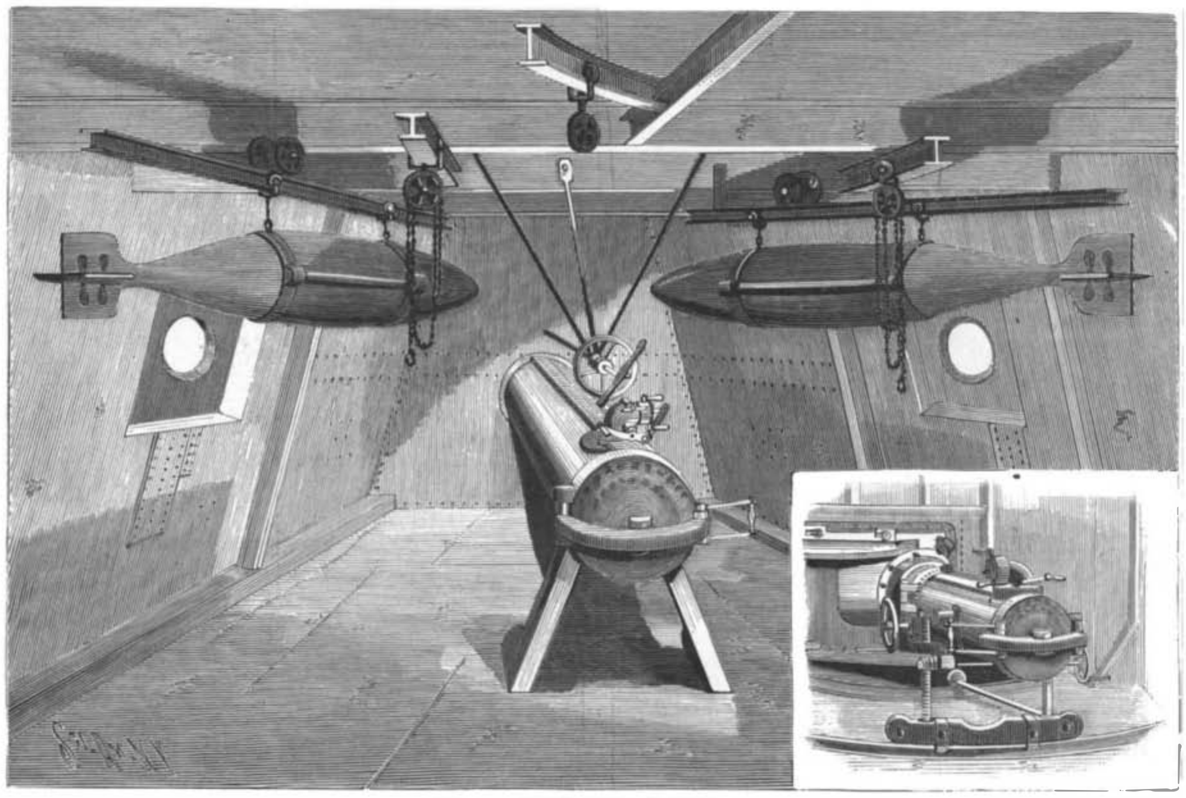
THE UNITED STATES FIRST CLASS BATTLESHIP INDIANA.

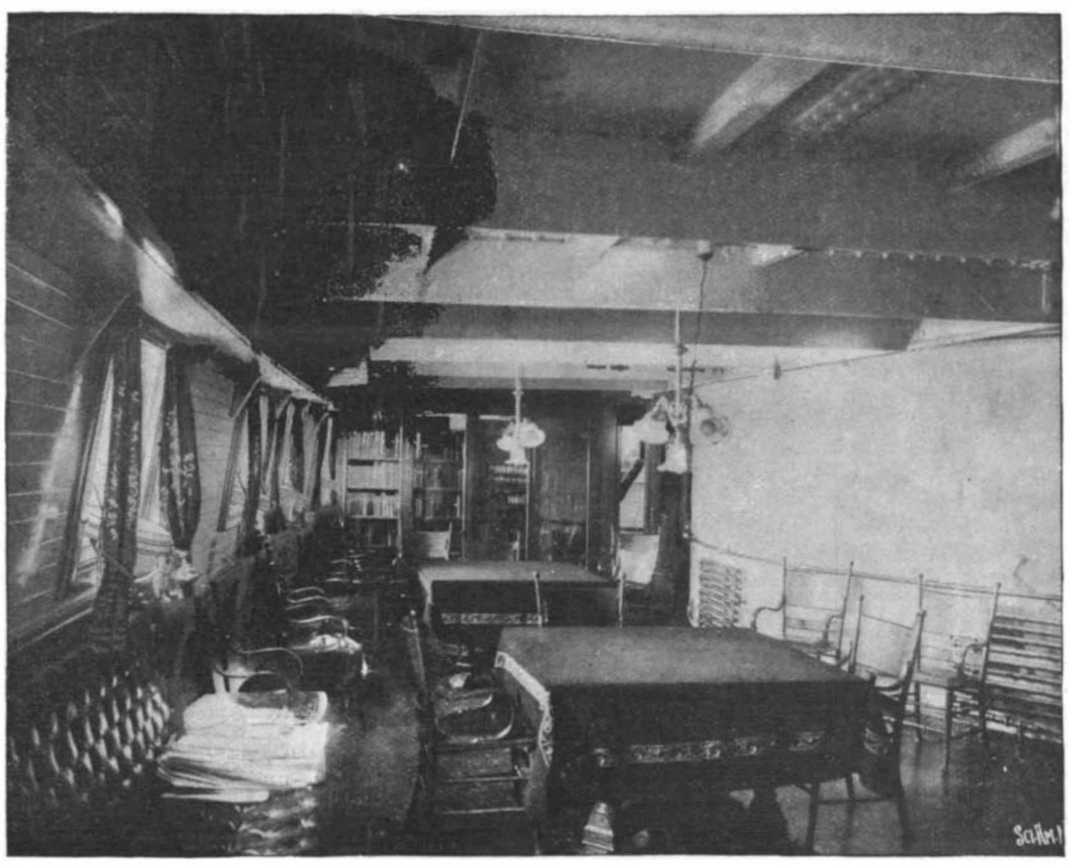
A visitor on approaching the battleship Indiana by water, as she lies at anchor in a roadstead, is first of all impressed with the power of destruction which is suggested by the gleam of the many pairs of long and powerful guns with which she fairly bristles. They are her distinguishing feature, and mark the Indiana as the most powerful fighting machine in the world to-day. Not only is she able to give the hardest blows, but she could stand more hammering than any other ship. There are faster battleships, and bigger, but none that could hit so hard or endure so long.

Together with the Massachusetts and the Oregon, she was built for the defense of the maritime cities and harbors. The trio might aptly be termed the watch dogs of the coast.

Looking at her massive form, it is difficult to realize that she has greater bulk below than above water. The floor of the outer shell of the hull lies 24 feet below the water line, and is some 348 feet long, and 69¼ feet broad at its widest part. Within the outer shell, and 3½ feet distant from it, is an inner shell, each being watertight, and forming a complete ship's hull in itself. The space between the two is divided up laterally by the plate frames (answering to the wooden ribs of the old three-deckers), which are riveted to both shells. These lateral spaces are again subdivided by a series of plate frames, or girders, which run the length of the ship, being riveted to the cross girders at the intersection, and also to the inner and outer "skin" of the ship. This arrangement cuts the space into small compartments, or "cells," each separate and watertight. The double bottom constitutes the below water armor or protection of the ship against the torpedo, for while the explosion of these deadly weapons might break in the outer skin, the inner skin would possibly remain intact, and the flooding would be confined to the cells in the neighborhood of the explosion. If the inner skin should be broken, the inflow of water would be localized by the athwartship and longitudinal watertight bulkhead, which extend above the water line.



BOW TORPEDO ROOM. BROADSIDE TORPEDO.



WARDROOM MESS.

The double skin rises to within 4½ feet of the water line, where it forms a shelf, upon which is carried a wall of Harvey steel armor 8½ feet high, 18 inches in thickness, and extending amidships for two-thirds of the length of the ship. At each end of the side walls is a transverse wall of steel, slightly thinner, but of the same height. The roof of this great rectangular fort is formed of 2¾ inches of steel, and down below its safe shelter are placed "the vitals," that is, the engines, boilers, and stores of shot and shell. Forward and aft beyond the 18 inch side belt, the steel deck is extended in a gradual curve to meet the bow and stern. This steel deck is known as the berth deck, and some eight feet above it is the main deck, which extends flush throughout the ship, and finishes the hull proper. The line of this deck may easily be traced in the first of the illustrations on the front page. Between the top edge of the 18 inch belt and the main deck the protection consists of 5 inches of steel, backed by some 10 feet of coal, which will together keep out all the rapid fire shells, and such of the heavier shells as are fired from long ranges, or strike obliquely to the armor—as many of them will.

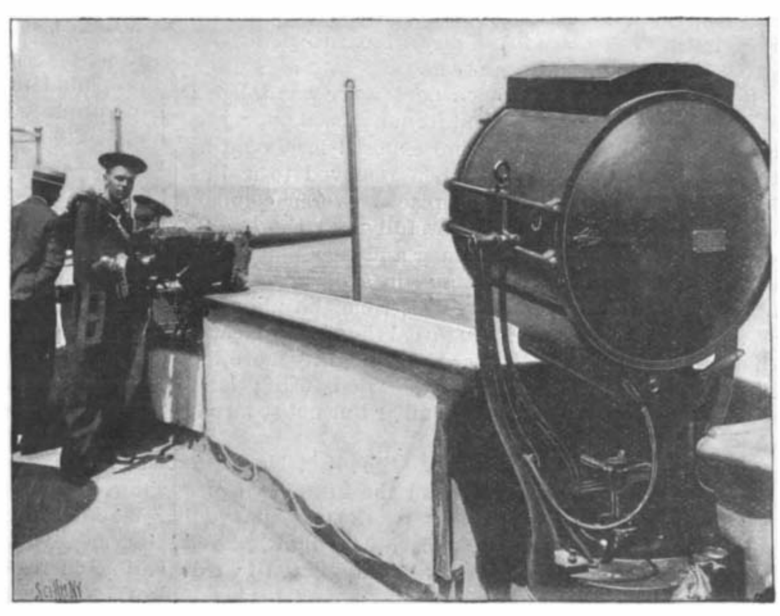
If we walk along the main deck to the starboard bow and look back, we get the view shown in the second illustration on the front page. The most striking objects are the muzzles of the two forward 13 inch guns, which show their black mouths protruding 23 feet through the portholes of the revolving turrets. The turret is formed of a solid circular wall of steel 17 inches thick, which revolves upon a circular track, located just below and within the top edge of a circular steel fort or barbette 17 inches thick, which is built up from the 18 inch armor belt below. It will thus be seen that from the top of the turret down to 4½ feet below the water line there is a continuous wall of steel 17 and 18 inches thick for the protection of the gun crew, the turning machinery, and the powder and shell. In the uncertainties of war it is not likely that one shot in thirty that struck this turret would effect an entrance; and experience shows that not one-fourth of that number would probably score a hit in half a day's fighting, if the battle of the Yalu is anything of a guide. Just over the muzzle of the starboard gun is seen the turret sighting hood with its two horizontal and two vertical slots, or peep-holes, from which the gunner watches the enemy, and, by means of convenient levers, trains and fires the guns.

Peering over the main turret are seen the four forward eight-inch rifles, placed in pairs in two turrets, one on each side of the ship. The turrets are of eight-inch steel and revolve within barbettes of 10-inch steel, the offset in the outer wall, seen clearly in the illustration, showing the top edge of the barbette. Armored ammunition tubes pass from the barbettes down to the 2¾-inch steel deck before mentioned, for the passage of the powder and shell. Upon the main deck, and under and slightly to the rear of each eight-inch turret is a six-inch gun, which is capable of broadside and dead ahead fire.

If we take our stand at the stern and look forward we see the same arrangement of turrets and guns; so that, with the exception of the pilot house, conning-tower, and mast, the after half of the ship above the main deck is a duplicate of the forward half.

To the rear of the forward 13-inch turret, and forming the base of the military mast, is the conning-tower, which is plated with 12 inches of steel. Here the commander will take up his position when going into battle, and through the narrow horizontal slots (to be seen just above the sighting-hood of the forward turret) he will watch the enemy. Inside the tower is an elaborate arrangement of telephone electric apparatus, and speaking tubes, by which he can communicate with the engine rooms, the various gun stations, and the steering room, at the after end of the ship. This latter is situated for protection below the water line. When the ship goes into action, one man, snugly ensconced within this little steel cage, can lay his hand upon any part of the ship, controlling her speed, turning her right or left at will, and concentrating her guns at will upon any weak spot in the enemy. Above the conning-tower is the pilot house, from which the navigation of the ship is carried on except in the actual time of battle.

Upon the roof of the pilot house, one on each side of the mast, are two 100,000 c. p. search lights, and on the small platform, just above them, are the two controllers, by means of which the beam of light may be raised or lowered and made to sweep the full circle of the ship. On the same platform is a range-finder, by which the distance of the enemy can be very accurately determined. A similar pair of search lights and a range-finder are located on the over deck, above the after end of the bridge deck. Our illustration shows the after port search light and one of the 6 pounder guns. If



A 100,000 CANDLE POWER SEARCH LIGHT.

SCIENTIFIC AMERICAN

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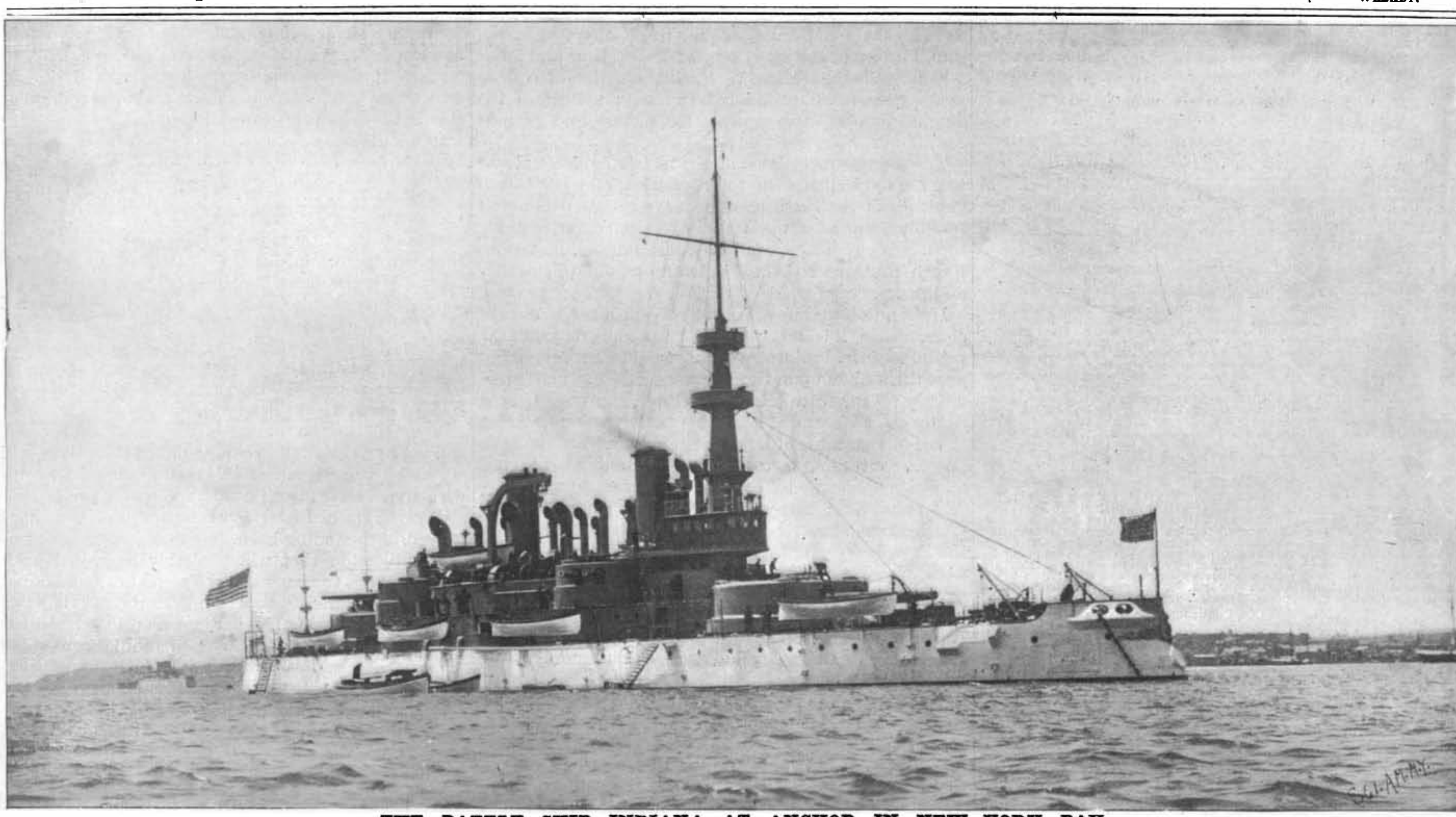
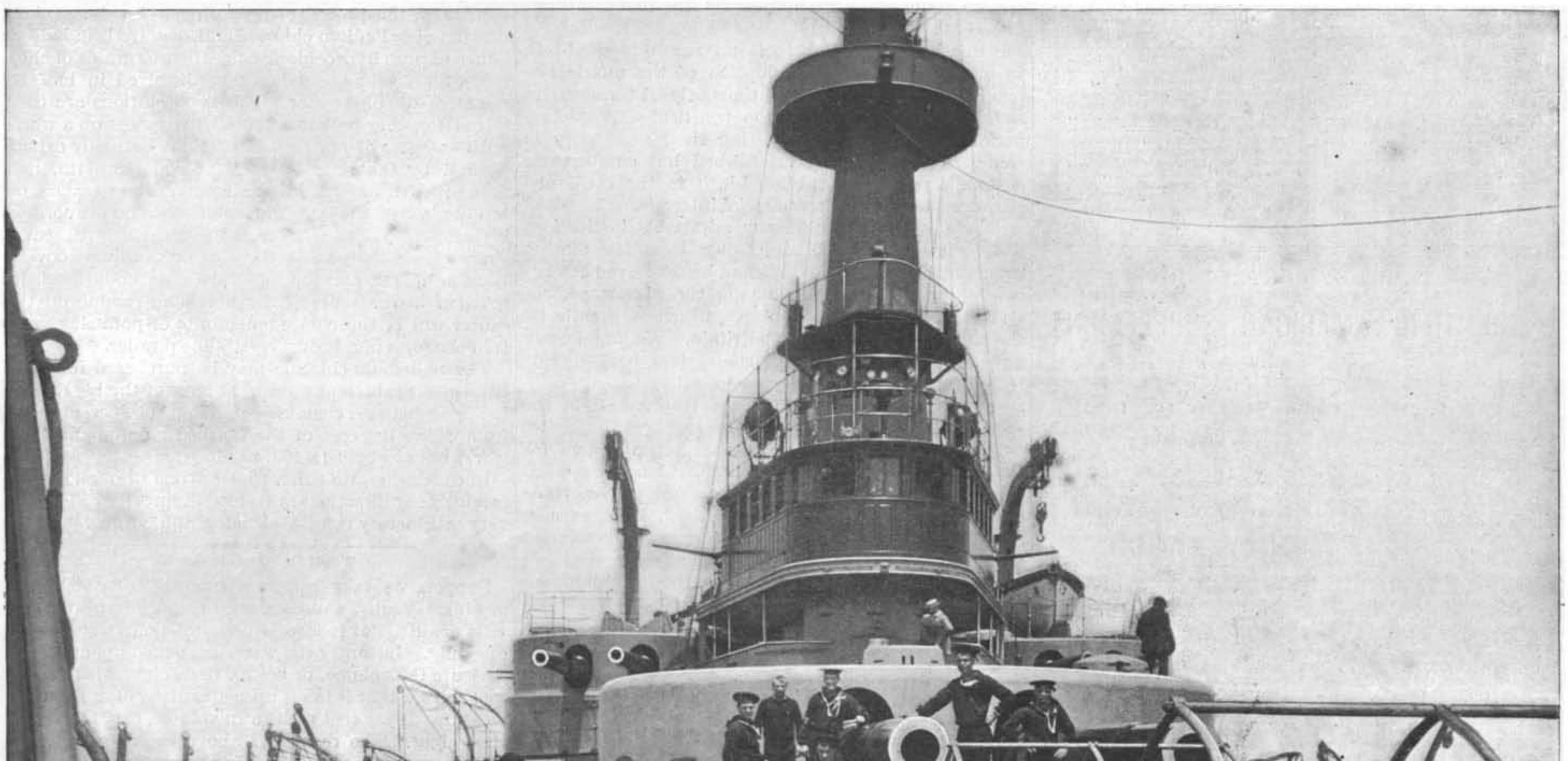


THE BATTLE SHIP INDIANA AT ANCHOR IN NEW YORK BAY.

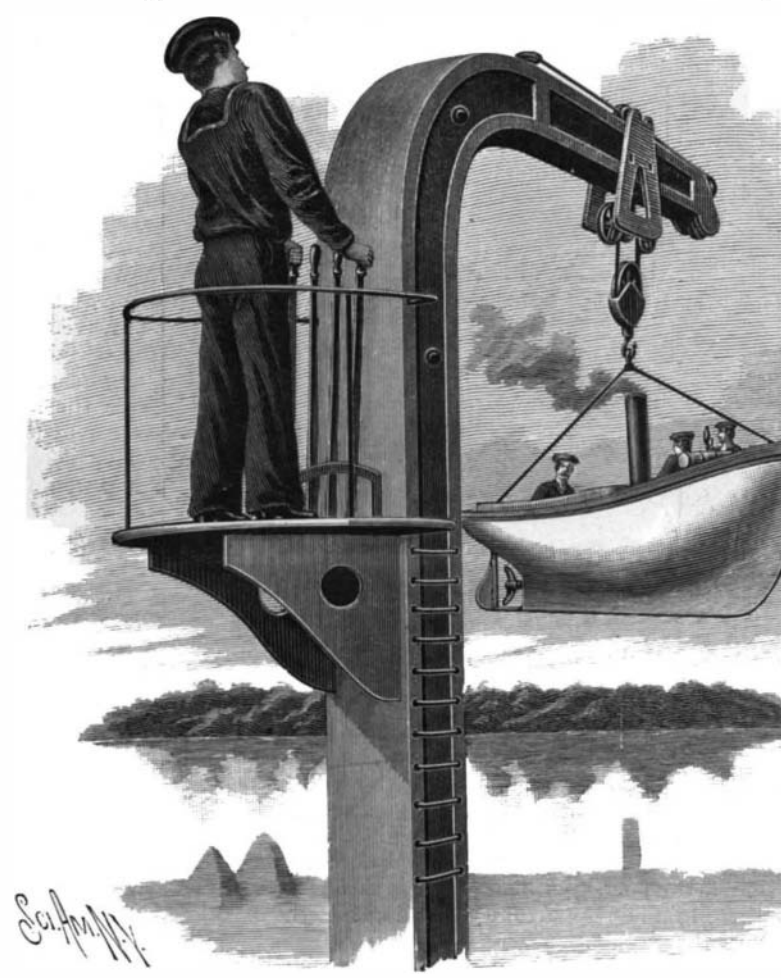


THE INDIANA—FORWARD TURRET, LOOKING AFT FROM THE BOW.—[See page 156.]

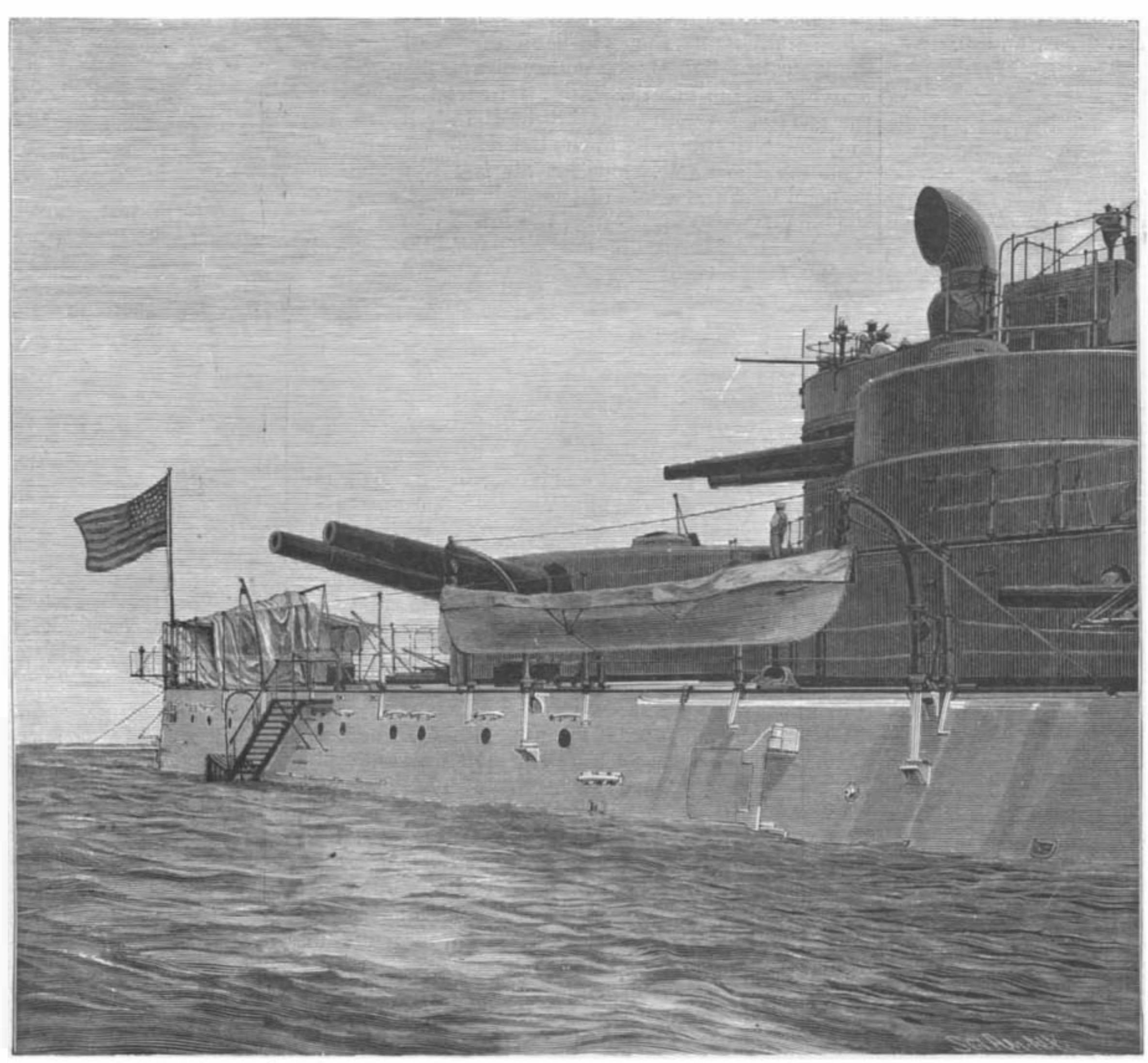
the visitor descends to the berth deck and walks to the extreme forward end of the ship, he will find himself in the bow torpedo room. Immediately in front of him he will see the fixed launching tube, which is built into the framework of the ship, parallel to its axis, and is inclined slightly downward to the water. Its outer end is closed with a cover plate shown on the front page view above the water line at the bow. Suspended from the ceiling are the 18 inch Whitehead torpedoes. When they are to be fired they are picked up by the chain hoists, run along the overhead tracks and lowered into the tube. The breech is then closed, and the torpedo is discharged, either by compressed air or by a small powder charge.

The torpedo, which weighs 835 pounds, contains three compartments. In the first is the charge of guncotton, which is fired by contact; the second is charged with air at 1,300 pounds to the square inch pressure; and the third contains the little compressed air engines, which work the screw propellers. It is provided with horizontal rudders, by which it can be made to run at any desired depth. The shock of discharging the torpedo starts the engines, and they will drive it for 400 yards at 30 knots, or for 800 yards at 27 knots, an hour. There is another fixed torpedo tube at the stern, and on each broadside there are two movable tubes—as shown in the smaller cut—which are fitted to the side of the ship with a ball and socket joint, and are capable of be'ng trained on an object in the same way as the guns. The space between the main turrets is occupied by the superstructure deck and the bridge deck, upon the latter of which are stowed the lifeboats, gigs and steam pinnaces. On each side of the ship a powerful steam crane is provided, with sufficient reach to enable it to pick up a boat from the water, lift it 35 feet into the air, swing it round, and lower it into position on the bridge deck. It is operated by a man who stands on a platform attached to the crane, where, by means of levers, he can control the various motions of lifting and turning. Last thing to be provided in planning the Indiana was the living quarters of the officers and crew. In general, the officers' quarters are found aft of the after turret and on the berth deck. Our illustration shows the officers' wardroom mess, which the landsman would term a dining saloon. At the far end of this room will be seen a select library of scientific works. The extreme after end of the ship is occupied by the captain of the ship. The living quarters of the crew are forward upon the berth deck and upon the main deck within the superstructure.

Our illustrations were made from photographs obtained through the courtesy of Capt. Robert Evans, and Lieut. Frederick L. Chapin.



THE STEAM LAUNCH HOISTING CRANE.



THE STARBOARD QUARTERS, SHOWING THE 13 INCH, 8 INCH AND 6 INCH GUNS.

Sea Mosses.

BY EUGENIA PRUDEN.

One of the pleasantest seashore occupations is the collecting and mounting of sea weeds, the "ocean's flowers." The process is very simple and easily accomplished, if one goes at it rightly and can have the patience to be particular to the extreme of preciseness.

The paraphernalia or outfit necessary for the collector is, first of all, suitable clothing for himself, as, in this work, one must not be afraid of wettings. The finest specimens are always sure to be out-side one's reach from dry land. It seems as if the waves had a special spite against such seekers, and they are always on the lookout for every possible chance to give a ducking.

A small meshed net attached to a long light pole, and a pail of some kind, are all the implements that are really necessary for collecting. The scientist would add some bottles containing alcohol for preserving specimens for microscopic study; also he would carry in his pail some large-mouthed bottles for keeping the different species separate. The amateur who knows not one kind from another should pick up all he comes to and decide upon the keeping after floating each one by itself.

The best time for collecting is at half flood. When the tide is flowing, mosses are more plentiful. The favorite place for collecting is below the low water mark. Rocky shores, small pools, especially if they are rocky, old wharves and piers are usually good collecting grounds. Now and then one can find some very good specimens on the beach; still, this is uncertain, it being only occasionally that they are washed ashore.

As far as possible, use nothing but sea water with mosses. Should it be impossible to obtain this in sufficient quantity, then make the water salt by artificial means. When collecting, put the mosses in the water, keeping them there until mounted. Experience has shown that the delicate varieties cannot be dried successfully, to soak out and mount at leisure. The larger, coarser ones, like rock weeds and devil's apron, it does no harm to dry and soak out at will; at best these can only be pressed and mounted like flowers. Another very necessary point to be observed is that the floating and mounting should be done as soon as possible after collecting. Leaving them in soak over one night only has frequently been sufficient to extract all their brilliancy of coloring, and in some cases has rotted them down completely.

A moderately thick, unglazed paper is best for mounting, although any kind may be used if not too thin. Many procure cards from the photographer which are very good.

In mounting, have at hand two dishes with plenty of water; one of ordinary size, in which the plants may be floated and washed, while the other should be large enough to take in easily the card to be used. When the moss is transferred to dish number two, place the card underneath, letting it rest on the palm of the left hand. Take an ordinary hat pin in the right hand and gently work the moss into its natural position of growth, just as one would arrange a plant for pressing. At the same time that this working out and arranging process is going on, the left hand should be busy manipulating the card by various tips and turns, so that when it is finally drawn from the water the moss adheres in lifelike form. All the details are difficult to give in words. Experience and practice are the best teachers.

After the moss is in place and the card is taken out, incline it slightly that the water may run off entirely before being put in press. The driers used in pressing should be of some absorbent paper, like the pads used by the botanist, or the ordinary blotting paper. The cards are laid on this paper, with moss uppermost, then covered with any thin white cloth from which all dressing has been previously removed, then another layer of paper, and so on to the end. On the top of all place a board weighted down with stones, the amount of pressure being governed by the quality of moss, the coarser varieties requiring more than the finer, more delicate ones.

The majority of specimens will adhere to the paper naturally; still there are some that will require an extra fastening of mucilage. The driers should be changed twice a day until the cards are dry, which in some cases will be accomplished in one day, while again in others it will require several.

A poorly mounted specimen is worse than nothing, while, on the other hand, one well done makes a picture such as no painter's brush could ever hope to excel in delicacy of tone and coloring. — The Outlook.

Steel Rails for New South Wales.

The government of New South Wales, as will be seen by an advertisement in another column, is desirous of making a contract for the manufacture, in that colony, of 150,000 tons of steel rails, with fish plates, bolts, etc. Any one wishing to undertake the business must state the prices per ton for the manufacture and delivery, each tender to be accompanied by a deposit of $25,000, and the delivery of the rails to be at the rate of fifteen thousand tons per annum, but the manufacture must be entirely in the colony, out of iron mined there, and with native coal, coke, or other fuel. The delivery of the rails is to commence eighteen months after signing contract, and be spread over a period of ten years.

A Smokeproof Fireman's Cap.

That a woman has been successful in inventing a cap for use by firemen in going through rooms filled with smoke, should be encouraging news to women inventors generally. According to the Syracuse Standard, it appears that Mrs. John H. Miller has invented such a cap, described as follows:

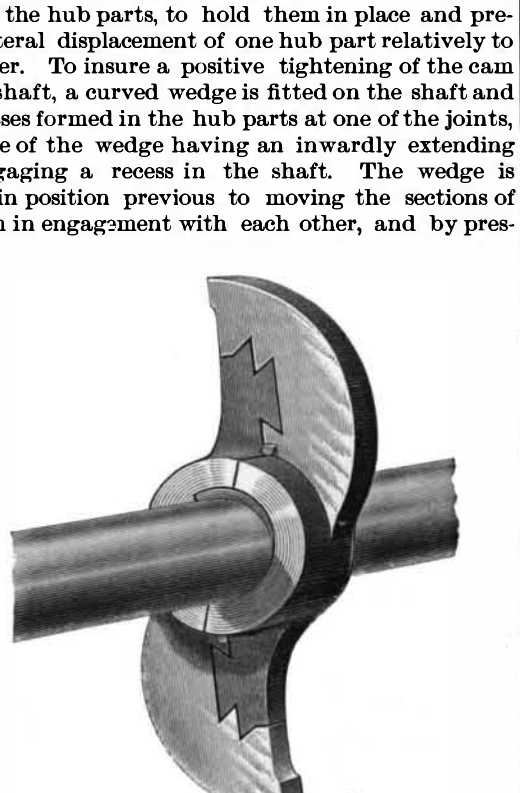
The cap is made of fine strips of asbestos conformed to the shape of the head. It is held fast in place by a rubber band, making it airtight. Its weight is only sixteen ounces, and it is so constructed as to enable a person to carry it on the arm without inconvenience. There is a strip of mica before the eyes; so no inconvenience is suffered in this respect. A silk sponge, through which no smoke can enter, but which permits the ingress of air in plentiful quantities, fills an aperture for the mouth, and when properly adjusted the cap is so simple that its efficacy is apparent at a glance.

When it is understood that firemen are unable to remain in a smoking building longer than three or four minutes at a time, an invention of this character, which enables a man to grope about in a stifling atmosphere for an hour, certainly reduces chances of losing life through suffocation to a minimum.

A practical trial of the cap was given in Syracuse which worked perfectly. Mr. Miller, the husband of the inventor, put on the cap and entered a smokehouse so densely filled with smoke that it was impossible to go near the door without protection, and there remained 35 minutes, with no possible chance of getting air from the outside. A fireman connected with No. 1's company entered the smokehouse without the contrivance, and remained eight seconds before coming into the fresh air, half suffocated and gasping for breath.

A SECTIONAL CAM.

A cam especially adapted for use in stamping mills, and which may be readily removed for repairs or replaced by a new one without disturbing the cam shaft and the other cams, is shown in the accompanying illustration, and has been patented by George W. Ravenscroft and Nils L. Magnusson, Mogollon, New Mexico. It has a two part hub, fitted on the cam shaft and fastened against lateral movement by two keys driven radially into the hub parts at their joint, and the hub parts have cam wings extending in opposite directions, with the usual curved cam surfaces to engage and disengage the arms of the stamp rods. In the rear edges of the wings are dovetailed grooves engaged by dovetailed arms extending from the hub parts. The two parts of the cam are readily moved into engagement with one another by moving them toward each other from opposite sides of the cam shaft, and the keys are then inserted at the joint of the hub parts, to hold them in place and prevent lateral displacement of one hub part relatively to the other. To insure a positive tightening of the cam on the shaft, a curved wedge is fitted on the shaft and in recesses formed in the hub parts at one of the joints, the base of the wedge having an inwardly extending lug engaging a recess in the shaft. The wedge is placed in position previous to moving the sections of the cam in engagement with each other, and by pressure against the working surfaces of the cams the wedge and the cam sections are made tight on the shaft in proportion to the pressure exerted. Communications relative to this invention may be addressed to Thomas F. Cooney, of Cooney, New Mexico.



RAVENSCROFT AND MAGNUSSON'S SECTIONAL CAM.

Death of Sir Robert Grove.

The Right Hon. Sir William Robert Grove, D.C.L., LL.D., F.R.S., died in London on August 2. He was born in Wales in 1811. He was educated at Oxford and became a lawyer. Being temporarily prevented by ill health from following his profession he turned his attention to electricity, and in 1839 invented the powerful voltaic battery which bears his name, and the gas battery.

A NEW LIGHT FOR PHOTOGRAPHERS.

BY C. F. TOWNSEND, F.C.S.

Four hundred candle power for 10 cubic feet of gas burnt per hour, costing one farthing! Noiseless, powerful yet soft, absolutely steady! What more can a photographer or anybody else desire in the way of gas lighting? My attention was called to the new lamp by a brilliant illumination appearing through the doorway of the workshop at King's College, where, like a good photographer, I was devoting my spare time to the mysteries of cabinet making. The light seemed too bright for incandescent gas light, and yet not cold and ghost-like enough for the electric arc; so my picture frames were neglected, and I proceeded to the engineering shops whence the light was coming. Here I saw a number of what appeared to be large incandescent gas mantles, mounted on cylindrical copper tubes screwed into the ordinary gas pendants. The brilliancy of the light, however, showed that something unusual was at work, for the large machine shop was as bright as day. In a few minutes I was introduced to M. Caton, the inventor, who was superintending the experimental installation. With the greatest courtesy and much enthusiasm, M. Caton explained the principles on which his invention, "La Lampe Caton," was based, and invited me to call on him in Leadenhall Street, where I had an opportunity of going into the question more thoroughly.

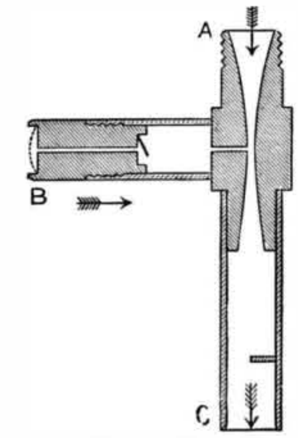


Fig. 1.—THE ASPIRATOR.

Before describing the new lamp further, a few words about the principle on which the incandescent gas light works will make the account of the light more intelligible. A Bunsen or other similar burner, in which a mixture of air and gas is burned, is non-luminous. To produce luminosity it is necessary to have solid particles of some kind in the flame. A candle is luminous, because one zone of the flame contains solid particles of carbon, which are raised to a white or yellow incandescence by the intense heat. The hotter the flame, the greater will be the quantity of light given off by the incandescent body. In the ordinary incandescent burner, the mantle, composed of a fine network of infusible substances similar to lime, takes the place of the carbon particles of the ordinary candle or luminous gas flame. The actual flame that plays on the mantle is non-luminous, the light being emitted by the incandescent material in the mantle. Now, if instead of allowing the gas to burn with a mixture of the air it can drag in through the air holes in the burner, and the air surrounding the flame, sufficient air is forced into the flame to burn the whole of the gas without calling on the outside air to supply any, the intense local heat of the blowpipe flame is obtained. That is the principle of M. Caton's lamp: the mantle is kept at an intense heat by a blowpipe flame.

The secret of success in the new burner is that the gas and air are mixed perfectly before reaching the flame, and consequently the combustion is perfect. Another most important point is that the gas and air travel at the same rate, so that there is no noise or flickering.

This desirable end is attained by causing the air and gas to pass through a spiral tube, or series of tubes, whence they issue thoroughly mixed. It is essential to success that the tubes should be cut to a particular pitch or angle, which the inventor has determined. To a lanternist this mixture of gas and air before reaching the burner will seem dangerous in case of lighting back, but the mixing tubes are safeguarded by wire gauze. Even without this the inventor declares that the quantity of air and gas actually mixed at one time is too small to cause an explosion. In cases where the burner has been damaged accidentally, a slight puff has followed and the gas has been blown out; nothing more.

The air necessary for combustion is supplied by a small injector, worked by water pressure. For a large installation a metal one would be required, but where only a few lamps were used a glass one, such as is commonly used in chemical laboratories, would be sufficient. The cost of the metal injector would be £1 perhaps, and that of the glass one a few shillings. To this must be added the cost of a few feet of iron or compo piping, as the case may be—a comparatively small item. The cost of the water power required is insignificant. For five 400 candle lamps, eight gallons of water per hour at the ordinary high pressure of town services would be ample. Water is charged by meter at 6d. per 1,000 gallons, so that the water for a light of 2,000 candles would only cost 1d. for twenty-four hours.

The temperature of the flame is 1,800° Centigrade (3,270° F.), so that no chimney can be used with the lamp. Paradoxical as it may appear, the heat produced is less than that given off by burning the same quantity of gas in any other way. Although the local heat is intense, the total quantity given out is comparatively small, because so much of the energy of the flame is converted into light. M. Caton wishes it to be clearly understood that he only claims the lamp, and is willing to use any mantle on the market. Purchasers, therefore, need have no fear of infringing existing patents. The price of the lamps has not been fixed at present, but it will probably not exceed 2s., to which must be added the cost of the mantle. Lamps of all sizes are made, to give light from 25 to 400 candles; the small lamps having the same efficiency as the large ones.

What struck me as the great advantage of the lamp from a photographic point of view was its remarkable diffusiveness. There were no heavy shadows anywhere. Even right under the lamp no appreciable shadow of the pipe could be seen. The light seemed to proceed from the lamp horizontally, to be diffused softly and evenly by the walls. The inventor took me behind a heavy piece of machinery, where with almost any other lamp would have been deep shadow, and it was like being in diffused daylight. Reading was perfectly easy, and colors could be distinguished quite as well as in daylight.—The Photogram.

NOTE.—The two accompanying illustrations show the principle of the water pressure injector. Fig. 1 is a sectional view. The water falling vertically through the small opening draws the air inward through the side duct and carries it into the bottle. Fig. 2 shows the whole apparatus, the pressure of the column of water passing out at the bottom of the bottle, and the flexible tube is the pressure exerted on the air in the bottle above the water, which is used to give a gentle air blast with the gas to the burner.—EDS.

A Lighthouse with no Lantern.

The most extraordinary of all lighthouses is to be found in the Hebrides, Scotland, on Armish Rock, Stornoway Bay—a rock which is separated from the Island of Lewis by a channel over 500 feet wide. On this rock a conical beacon is erected, and on its summit a lantern is fixed, from which, night after night, shines a light which is seen by the fishermen far and wide. Yet there is no burning lamp in the lantern and no attendant ever goes to it, for the simple reason that there is no lamp to attend to, no wick to trim, and no oil well to replenish.

The way in which this peculiar lighthouse is illuminated is this, says the Marine Record: "On the island of Lewis, 500 feet or so away, is a lighthouse, and from a window in the tower, a stream of light is projected on a mirror in the lantern on the summit of Armish Rock. These rays are reflected to an arrangement of prisms, and by their action are converged to a focus outside the lantern, from where they diverge in the necessary direction." The consequence is that, to all intents and purposes, a lighthouse exists which has neither lamp nor lighthouse keeper, and yet which give as serviceable a light—taking into account the requirements of this locality—as if an elaborate and costly lighthouse, with lamps, service room, bed room, living room, store room, oil room, water tanks, and all other accessories were erected on the summit of the rock.

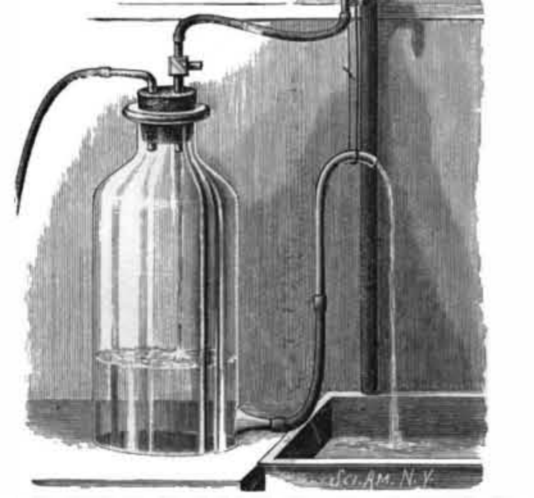


Fig. 2.—ASPIRATOR ARRANGED FOR PRODUCING A BLAST.

Dr. John Haldane, lecturer on Physiology at Oxford University, is one whose labors would appear to deserve more than passing recognition. In his experiments to discover a means of preventing the loss of life among miners, resulting from underground explosions, he actually inhaled carbon monoxide for seventy-one minutes, with the result that vital energy was nearly extinguished, and life would have flown had not oxygen been speedily administered.