SCIENTIFIC AMERICAN

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

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

Vol. LV.—No. 4.
[NEW SERIES.]

NEW YORK, JULY 24, 1886.

[Price 10 Cents.
$3.00 per Year.]

PROPULSION OF THE SECOR YACHT EUREKA BY THE EXPLOSION OF PETROLEUM VAPOR.

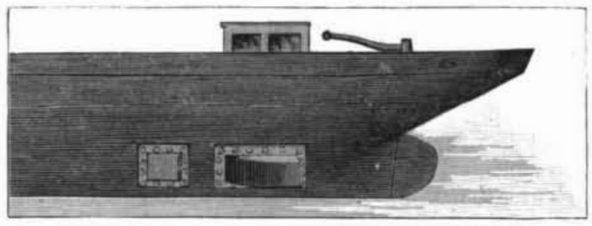
With the best marine boilers, and with the most approved forms of engine, shaft, and propeller, it is only possible in our present system of ship propulsion to utilize about five per cent of the energy developed by the combustion of the fuel. This fact has remained, for many years, a constant challenge to the inventive genius of the world. Yet it is a challenge which has seldom been taken up, for there are many difficulties in the path of the naval architect and engineer. We have to-day very little certain knowledge of the various elements which influence propulsion. We have attained, it is true, quite remarkable speeds, but they are the result rather of a lavish expenditure of energy than of skill in the adjustment of the several controlling factors. It is not, perhaps, too much to say that we have succeeded in spite of ever present difficulties, rather than by overcoming them.

There have been, however, a number of thoughtful efforts made from time to time to decrease this discrepancy between the energy stored in the fuel and effective work accomplished. As the loss sustained in the present system is generally regarded as inherent, these efforts have for the most part turned toward an attempt at direct propulsion. Many of our readers, doubtless, remember the Waterwitch and the Rival, which attracted considerable attention several years ago. Both of these vessels obtained some simplification of parts by the omission of shaft and propeller. They substituted a centrifugal pump, and effected propulsion by the large volumes of water discharged toward the rear.

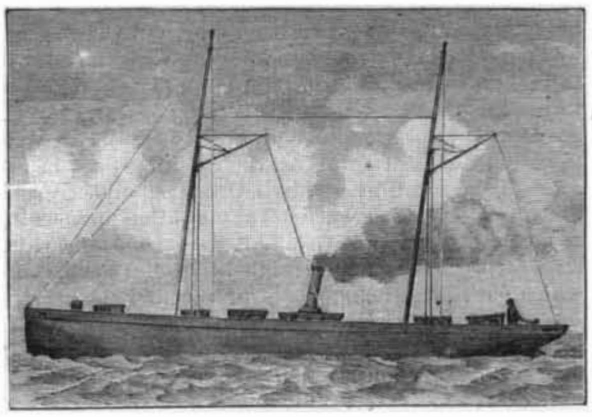
Somewhat later, Dr. Fleischer's hydromotor attempted the same thing in a modified form. In this the volume of water discharged was much smaller, but its velocity greater. The centrifugal pump in this case was replaced by the direct action of steam on the water in two cylindrical reservoirs. The little vessel supplied with the hydromotor met with a fair degree of success, attaining a speed of 9 knots an hour, and losing but 11 per cent in effecting the discharge of the water. It raised quite sanguine hopes that the new system would in time become so far perfected that it would pass into everyday use, and permit a marked economy in both fuel and first cost, as well as in the space occupied by the machinery. But for some reason all of these vessels remained mere experiments, and never became the types for any successors.

Working on the same general plan, but with a different agent, there have also been brought forward a number of propositions for pneumatic propulsion, in which jets of air are caused to impinge directly on the water, but as yet no practical success has been gained. The direct action of steam has been tried in the same manner, but so far has proved a failure.

Though the attempt to solve the problem of direct propulsion has thus rather discouraging precedents, it has, nevertheless, been recently renewed by Messrs. Samuel & John Secor, of Brooklyn, who have devised a new system, which they are now putting to the test of actual practice in their specially constructed yacht, the Eureka. Incited by the admitted loss of ninety odd per cent in the transformation of the energy stored in the fuel into motion of the vessel, both father and son, for a number of years, have given careful attention to the subject of propulsion. It was, perhaps, two or three years ago, that their joint meditations began to assume the shapes now materialized in their nearly completed experiment. Their motor is simply a modified form of gas engine, in which the gases, resulting from the explosion of a mixture of air and petroleum vapor, are made to impinge directly upon the water, through suitable portholes beneath the surface.



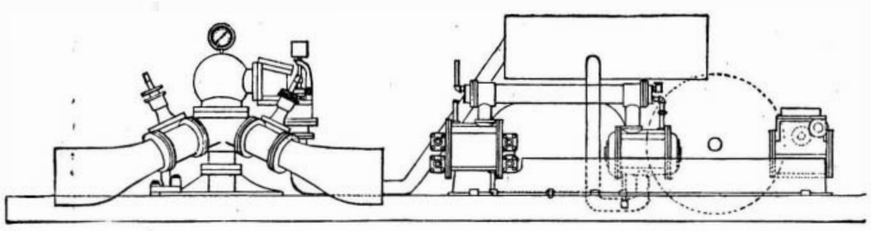
OUTSIDE VIEW OF THE EXPLODING PORTS.



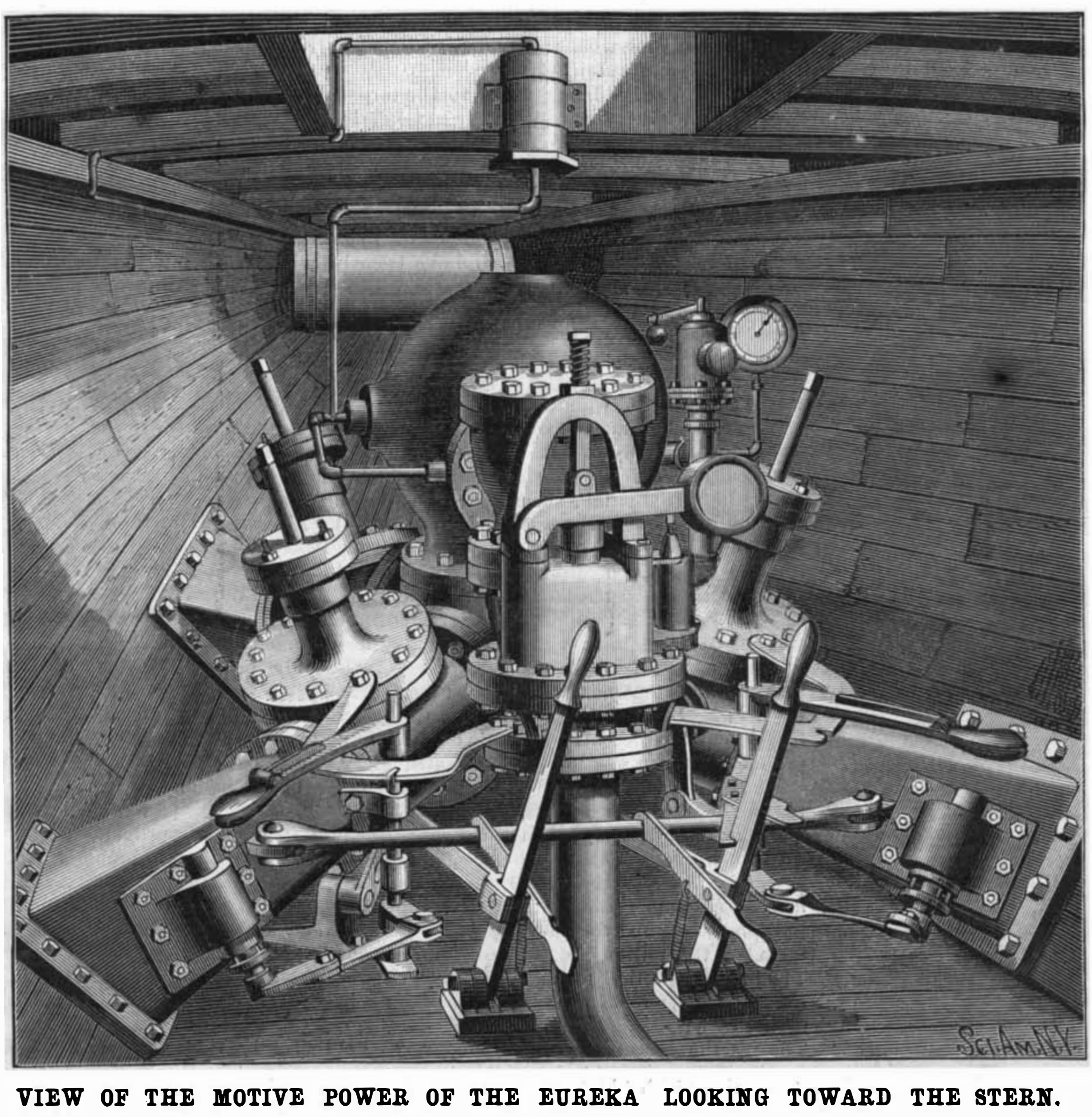
THE EUREKA.

The Eureka was launched last November from Poillon's shipyard, in Brooklyn. She is an odd-looking little racer, built very much after the model of a sharp wedge, and capable, to all appearances, of cleaving the water with but little expenditure of power. She has a total length on deck of 100 ft., an extreme width of 12 ft., and a depth of 6½ ft. Her draught is 4½ ft. aft and 2 ft. forward, but more ballast will probably be added, and the water line raised several inches all around. Her displacement is approximately 60 tons. Beyond the extremely narrow beam and pointed bow, the Eureka differs little in her external appearance from less revolutionary craft. An attenuated smokestack, leaning backward at a rakish angle, gives, however, the impression of meager motive power.

In the interior, the construction and machinery are decidedly more unique. A transverse bulkhead divides the vessel about amidships. An upright steel boiler of 25 horse power is located immediately back of the bulkhead. A Norwalk air compressor stands a short distance to the rear of the boiler, and furnishes the compressed air necessary for the exploding chamber. In this form of compressor the air is first condensed to a pressure of 20 pounds in a 14×16 inch cylinder, and then to any desired pressure up to 200 pounds in a second cylinder, 10×16 inches. The ordinary working pressure will be about 50 pounds. A steel reservoir, 6 ft. long by 2 ft. in diameter, is placed directly above the compressor, and has been tested up to a pressure of 200 pounds. The compressor also operates an Excelsior dynamo, having a capacity of twenty-five 16½ candle power lamps. From eighteen to twenty Edison incandescent lamps will be used to illuminate the vessel, but the main function of the electric current is to fire the mixture of air and petroleum in the exploding chamber.



SECTIONAL ELEVATION OF THE MACHINERY.



VIEW OF THE MOTIVE POWER OF THE EUREKA LOOKING TOWARD THE STERN.

The motor proper is placed in the rear of the compressor, at sufficient distance to allow room for the controlling levers and for the engineer in charge. The general arrangement and appearance of the machinery are shown in our illustration. It represents the motor as seen when looking toward the stern of the vessel. The motor is made entirely of cast steel, and consists, in the first place, of the spherical exploding chamber shown in the center of the engraving. This is (*Continued on page 52.*)

PROPULSION OF THE SECOR YACHT EUREKA BY THE EXPLOSION OF PETROLEUM VAPOR.

(*Continued from first page.*)

of 20 in. internal diameter, and is 2 in. thick. It is guaranteed by the makers, the Pittsburg Cast Steel Company, to withstand a pressure of 5,000 pounds. It has been tested up to 1,000 pounds. The exploding chamber communicates beneath with four radial port-holes or chutes, protruding through the hull and open to the outside water. Two of the ports extend toward the stern, and two toward the bow. These are each 2 ft. high at their open end and 1 ft. wide, giving an area of impact of 2 square feet.

The rear ports terminate in line with the keel, as shown in our outside view, thus giving the escaping gases direct action upon the wall of water at the rear of the vessel, when it is desired to drive her ahead. In our view of the motor, only one of these ports is shown, the other one being hidden by the rest of the machinery. The forward ports, used in backing or in stopping the vessel suddenly, terminate obliquely. The escaping gas is, however, made to impinge upon the water in line with the keel by means of the doors located at the open ends of the ports.

Four levers, placed within easy reach of the engineer, and shown in the foreground of our engraving, operate as many valves controlling the communication between the exploding chamber and the several portholes. The vertical levers control the valves in the stern ports, and, as shown, may be operated quite independently of each other. The horizontal levers, similarly independent, operate the valves of the forward ports, and at the same time the doors at the outer ends of the ports. The pipe shown in the foreground leads from the compressed air reservoir to an auxiliary chamber in front of the main exploding chamber.

The petroleum used in producing the explosion is stored in the copper reservoir shown in the very stern of the vessel. It has a capacity of three-fourths of a barrel, and will probably suffice for a twenty-four hours' run. The reservoir is surrounded by a water jacket in communication with the outside. By this precaution, risks of accident from fire, leakage, or explosion are avoided. The reservoir connects by means of a pipe with the small can placed immediately above the motor.

From this can the petroleum, as shown, passes through a tube in the exploding chamber, by which it becomes heated about to the boiling point, when the motor has once started up. The oil tube is then brought into the passageway in front of the exploding chamber, and terminates in an injector. This passageway communicates with the auxiliary chamber containing compressed air. The mixture of petroleum and air introduced into the exploding chamber by the injector impinges upon a small coil of platinum wire heated to a white heat by the electric current, and is at once exploded. Suitable valves cut off the communication with the air compressor and oil can during the explosion, so as to prevent the resulting gases from rushing back into either of the reservoirs. The motor is also so arranged that no explosion can take place, unless at least one of the valves leading to the portholes be open. The best proportions of air and petroleum to form the explosive mixture have not been determined.

It will thus be seen that the motor is simply a gas engine, in which the piston is replaced by a wall of water. This being the case, no lubricants are necessary on the interior of the chamber, and the temperature need not be reduced by the customary water jacket. No thermometric observations have yet been made, but Mr. John Secor states that the probable temperature during an explosion is 2,000° Fah. The absence of moving parts makes this high temperature possible, and permits a greater efficiency than in the usual form of gas engine, where a large amount of energy is dissipated by the water jacket. The safety valve attached to the motor is set at 500 pounds. The ordinary working pressure will be about 100, though this can be increased at pleasure. There will probably be about eighty explosions per minute.

Such being the construction of the motive power of the Eureka, the question of her speed and economy remains to be proved. That she will move with comparatively little agitation of the water, when once under headway, has been demonstrated by a preliminary trial at the dock. When the motor was first started, the only results of the explosion were seen in the bubbling of the water at her stern; but as the machinery became heated, and the explosions more numerous and violent, the vessel moved forward with fairly smooth motion, and the gas came to the surface of the water in fine bubbles some distance from the stern. Considerable difficulty has been experienced in the vibrations produced when the first explosions take place and before the boat is under headway. But these have been greatly reduced, and it is not too much to hope that they can be entirely avoided when the mechanism is perfected.

Everything about the boat has been built in a most substantial manner, and in the design of all her machinery the safety factor has been made unusually large. The Messrs. Secor hope to make a more extended trial trip down the bay about the 1st of July. It is hardly to be expected that they will attain a speed comparable with that of ordinary steam yachts, as it is the first trip of the Eureka, but they have already much to encourage them in believing that they will make the vessel eventually a success.

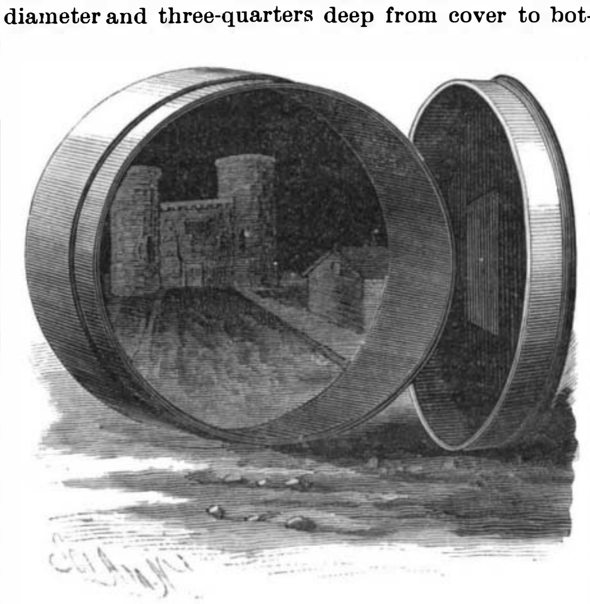
Each piece of mechanism has been thoroughly tested separately, and all designs have been first submitted to competent mechanical experts before they were executed. Although one professional gentleman expressed his confident opinion that the only result of the experiment would be a hydraulic display in the shape of a fountain, and that the boat would not move an inch, the large majority of persons qualified to pronounce upon the merits of the system have assured the inventors that their plan is entirely feasible, and can be made a commercial success when the details have been worked out more perfectly. There is at present very little ground upon which to calculate the probable economy of the vessel.

The junior inventor states that he believes it will be possible to run from New York to Newport and back on a dollar's worth of oil. The experience of the next few months will probably decide these questions, and will prove, it is much to be hoped, an important epoch in the history of direct propulsion.

PHOTOGRAPHIC NOTES.

PINHOLE CAMERA.

We illustrate in the cut a camera for photography in which the *ne plus ultra* of simplicity may fairly be said to be attained. It is a little tin box two inches in diameter and three-quarters deep from cover to bottom.



PINHOLE CAMERA.

A hole was punched in the center of the cover, and over this a piece of foil was secured by varnish. The foil was taken from a button card. Small mother-of-pearl buttons are generally mounted on pieces of pasteboard with this foil under them. Through the foil, where it extended across the hole in the box cover, a hole was made with a No. 10 needle. The needle was pressed through until its point could just be felt by the finger held against the opposite side of the foil. This made an aperture one-sixtieth inch in diameter. The interior of the box was blackened. A piece of Eastman's "A" bromide paper, cut circular, so as to fit in the box, was placed in it against the bottom, and the cover put on. This, of course, was done in the absence of actinic light. Then, with an exposure of four minutes, at a distance of about ten feet from the object, the negative shown in the sketch was taken. It was developed with oxalate developer. Castor oil or vaseline was used to make it transparent, so as to adapt it for printing from. The subject of the negative was the old armory at Summit Hill, Mt. Jefferson, Pa.

As nothing special, neither paper, glass negative, nor developer, was used, this process of pinhole photography deserves special mention. It might often be of considerable use in emergencies that sometimes will present themselves to the photographer.

The special novelty that presents itself is the use of paper instead of glass for the negative, as paper can be cut to fit any size or shape of box. The brand of paper employed is slow paper; it would be interesting to try a quicker paper, that would reduce the necessary time of exposure.

Theater Fires.

In the twenty-one principal theater fires of modern times, from the destruction of the Schouwburg Theater in Amsterdam, in 1772, to the burning of the Ring Theater in Vienna, in 1881, a total of 6,548 victims are chronicled. Among the more appalling disasters may be given the Capo d'Istria Theater, with a loss of 1,000, in 1794; the Canton Theater, with a loss of 1,670, on May 25, 1845; and the Ring Theater in Vienna, with a loss of 1,100, on December 8, 1881. The Brooklyn fire on December 5, 1876, caused a loss of nearly 400.

A New Way of Making Ready for Printing.

The making ready of cuts and electrotypes for printing very frequently presents considerable difficulties, which are still increased where the block has been obtained through one of the photo-mechanical and photo-chemical processes. The ordinary way of underlaying with paper, cutting away, and scraping off does not answer as well as might be desired. Hence there have been strong endeavors to find a different and more satisfactory manner of securing the desired results.

An article in the French trade journal *L'Imprimerie* speaks of a novel and certainly noteworthy way of proceeding.

After mentioning the difficulty of making ready the electros, the article goes on to describe the innovation, asking the workmen not to shrug their shoulders, but rather to give the directions a fair trial.

First a few remarks as to the packing upon the cylinder. A stout cardboard, but perfectly smooth, answers best; over this is drawn a layer of white muslin, which has been run through the calendering machine, and over which is placed a sheet of calendered paper. A hard and dry packing is absolutely necessary for the printing from photo-engravings with half tints.

In the making ready proper, the following steps are taken: The first impression is made upon the sheet of paper stretched over the muslin, pasting a few bits of tissue paper in the deep parts of the photo-engraving. After that a second thinner sheet is pasted over the first impression, run through, and proceed with the making ready upon this.

During the time, a quantity of English red has been ground together with an equal quantity of glue.

To be serviceable, the substance must not give off color when used, nor dry with a luster. It must have a dull appearance; and where one layer is placed over the other, the lower layers must neither soften nor absorb the upper ones.

Should there not be taken a sufficiency of glue, or too much of it, the covered parts will get too stiff or not flexible enough. The mixture should always remain fluid enough to run easily from the brush.

For the work there should always be on hand a set of paint brushes of various sizes.

Next, let a commencement be made with a laying on in large spaces, which have not shown up upon the second impression sheet, proceeding to those less prominent and continuing until the requisite strength is reached. Care should be taken to have every layer of the paint dry before the succeeding one is added. Before turning to printing, let a thin sheet be pasted over the entire make-up.

It is self-evident that a few strokes of the brush will not take nearly as much time as the cutting out and pasting formerly resorted to.

Should there have been placed too much paint in some part, the defect can be easily remedied by rubbing, done with a piece of *ossa sepia* or cuttlefish bone. Delicate graduations are obtained even more easily by such a manipulation than by resorting merely to the painting.

The making ready which we have described deserves to find favor. When the first difficulties arising in the handling of the brush are surmounted, the proceeding spoken of will be preferred to all others. There is certainly no better one for the making ready of photo-engravings.—*Lith. and Printer.*

Hot Water Artesian Well at Pesth.

The deepest artesian well in the world is that now being bored at Pesth, for the purpose of supplying the public baths and other establishments with hot water. A depth of 951 meters (3,120 feet) has already been reached, and it furnishes 176,000 gallons daily, at a temperature of 158° Fah. The municipality have recently voted a large subvention in order that the boring may be continued to a greater depth, not only to obtain a larger volume of water, but at a temperature of 176° Fah.

Earthquake Waves.

The chief effect of an earthquake on the ocean is the raising of a great sea wave, sometimes very large, *e. g.*, 60 feet high at Lisbon (1761), 80 feet at Callao (1724), 210 feet at Lupatka (1737). These waves are often more destructive on land than the actual shocks; the influx is usually preceded by an outflow, which, in fact, acts as a warning. One of the most remarkable effects is the distance to which these waves are propagated as "great waves," *e. g.*, right across the Pacific. Thus most large earthquakes on the east or west coast of the Pacific produce waves which are recorded on the opposite coast about twenty-four hours after.

As to prediction of earthquakes, nothing certain is yet known. In many cases there are noticeable changes in springs and wells preceding earthquakes. One useful warning is, however, obviously possible, viz., the report of an actual earthquake on one side of the Pacific could be at once telegraphed to the other side, thus giving twenty-four hours' warning of the probable advent of a great sea wave.