## THE MARINE GASOLINE ENGINE AND GAS ENGINE BOAT.

The gasoline gas engine, both from a theoretical and practical standpoint, is the most efficient of prime motors. This is particularly true of the "Union" and "Pacific" engines, built by the Globe Gas Engine Company, for the reason that in their engines the hot gases of the exhaust, usually wasted, are used to heat the air drawn through the vaporizer and into the cylinder. As heat is the essence of the power, the smaller the amount that is wasted, the greater the economy.

In the operation of the gas engine, as compared with the steam engine, there is an additional economy involved in the fact that no fuel is used except when running, and, while running, the expense for fuel is in proportion to the work the engine is doing.

We have already had occasion to describe and illustrate gas and gasoline engines of the Globe Gas Engine Company, of Philadelphia. Our present article is devoted to a special department of their business, a department which is of growing importance—gas engine boats—of which this company and its Western connection, the Union Gas Engine Company, of San Francisco, have constructed a great many, which are operated with perfect satisfaction to their owners on the waters of the two American seaboards. Our illustrations show different types of these boats, and also give views of two sizes of the engines. The latter are gasoline engines of the compression type, but which possess several very distinctive features, some of which we can only allude to. Thus, much of their success is due to the atomizer, by which the gasoline is finely divided and mixed with the air previous to ignition.

Another important feature is the igniting device. For this purpose an electric spark is used, produced by breaking an electric circuit containing a spark coil. The current is supplied by a few salammoniac cells. The spark is produced in the interior of the engine, so that no external flame or spark appears.

The usual mode of producing the ignition in a gas engine has been to employ either an open flame which, at the proper time, was drawn into the engine cylinder, or a tube heated by an external flame or blow pipe has been employed for the purpose. Both of these methods involved the employment of a constantly exposed flame. For marine purposes, the absence of any flame whatever is certainly an important feature. The external heat of the combustion tube is also a perpetual annoyance, as the tube burns out after a comparatively short period of running.

For marine purposes, the engines supplied may be of the single cylinder or double cylinder type. They are usually placed in the center of the boat, resting on a solid bed, and from them the propeller shaft runs aft. Forward, in the bow, is a gasoline tank. Immediately aft of the engine is a lever, by means of which the motion of the propeller can be reversed, the engine, like all gas engines, rotating always in the same direction. The reversing gear operates without shock. For the marine engines a twofold governing device is applied. This cuts off or readmits the gasoline as required by the circumstances, so as to regulate the motive power, while it also, by opening or closing the exhaust valve, operates to prevent wasteful cushioning. The air applied to the combustion is automatically heated by the exhaust. This heating effects considerable economy and comes into operation after the engine has made a few revolutions.

Returning now to the complete boat with its engine, it will be seen that we have illustrated different examples. Fig. 1 shows a small type of vessel without any cabin, in which can be clearly seen the general disposition of the interior. Fig. 2 is an interesting example, being the police patrol boat used on the Schuylkill River, Philadelphia, as it flows by Fairmount Park. The boat is thirty and a half feet long, six and a half feet wide and is driven by a Union gas engine of ten and a half indicated horse power. This little vessel can develop a speed of ten miles an hour, and ran 10,000 miles in one season without any repairs. One and a quarter gallons of gasoline per hour are sufficient to drive it.

Fig. 4 is a Western boat built for use on the Pacific coast. It is a flat bottom stern wheeler, 40 feet long, 10 feet wide and has a Union engine. The boat attains a speed of very nearly ten miles an hour. No belts are used in transmitting the power to the wheel.

Fig. 5 shows the launch Canvas Back, the property of Mr. A. N. Stanton, of Bridgeport, Conn., which has been used among the Norwalk Islands on Long Island Sound. Originally it was a steam launch. The owner then put in another form of engine, but not being satisfied, changed to the Globe Company's Union engine, and since then has had perfect satisfaction. The boat is 42 feet long, 9 feet beam and with an engine of 25 indicated horse power can make nine and a half to ten miles per hour.

Our illustration of the engines represents views of the double and single cylinder "Union" engines, which show the train of reversing gears and the general disposition of parts. Below nine horse power the marine engines are single cylinder, while the double cylinders range from nine to seventy-five horse power. The larger engine shown is 75 indicated horse power, built for the Kimball Lumber Company, and is in a lumber vessel 105 feet long, 22 feet beam, and is the largest gasoline marine engine in America.

One very valuable feature in connection with their use on board of boats is their governor. This operates to prevent racing, should the screw by any motion of the boat be thrown out of water. It is believed that in the production of an absolutely fireless power-propelled boat an important advance has been made, the "Union" gas engine being absolutely non-explosive, and in its operation having no possibility of setting a boat on fire.

## Irrigation by Wind.

It is interesting to observe the progressive development of an original crude invention, and to study the added improvements which have led to its increased usefulness.

The bicycle is a convenient instance of the development of a crude idea, because its origin and its improvement are modern, and also because improvements in its construction are yet being made so rapidly that the bicycle of two years ago, or even of one year ago, seems antiquated compared with the bicycle of to-day, and it seems yet capable of improvements which may lead to startling results.

In 1816, in France, the bicycle may be said to have been born. It consisted of two wheels of equal size, one before the other, connected by a bar on which was a seat. The rider propelled himself by pushing on the ground with his toes. Apparently this was an unpromising invention, but it contained the germ of the idea which has made possible a bicycle on which 413 miles have been traversed within twenty-four hours, and on which messages have been carried from Chicago to New York, over 1,000 miles, in one hundred and eight hours.

In 1862, forty-six years after the first crude invention, the pedal, or the wrench axle, or the crank applied to a bicycle, was patented in this country, and not until then did the bicycle appear to have a promising future. Expert artisans experimented with it in all possible ways. Many improvements were made; only the fittest survived. The hand propeller, the foot propeller, the unicycle, the bicycle, the tricycle, the ice cycle, the celeripede, the velocipede, and all possible forms were tested and were accepted or were rejected, and the first crude construction has been so much improved that the original inventor, if he were now living, would be amazed to see the possibilities which were latent in his crude invention. Such rapid and effective improvement in construction would not have been possible in any other age. It was made possible by the improvements which have also been made in other arts, and the facilities which now exist for the rapid development of other crude inventions are much greater now than ever before. Given a clearly defined need for a new implement, and a crude invention of the implement, there are now ready to rapidly perfect the invention expert artisans, with expensive appliances and with resources brought out by the wonderful development in other arts, such as the world never knew before.

And this brings us to our subject, "Irrigation by Wind Power in the West." There is there a vast, nearly level, plain, with not a wind break from the North Pole to the Gulf, with but little wood or coal, with considerable but not sufficient rainfall, with fertile soil and a necessity for elevating water for irrigation. Clearly, there is need there for a cheap, simple, effective invention for elevating water.

The State of Kansas has appropriated $30,000 for experiments in irrigation. Everywhere in Western Kansas may be seen windmills of primitive form, horizontal, vertical, or vertical geared. Holland has 12,000 windmills, which average eight horse power, used to drain the polders. The States of the plains will soon apparently have more than that number used to irrigate the prairies. Steam pumps, gas engines, hydraulic rams, and pumps driven by animal power, and all of the known devices for elevating water are now finding experimental tests in Kansas. It is probable that valuable data in regard to comparative cost and efficiency of these different motors will be obtained from these experimental tests.

The work of elevating water for irrigation is very old. Singularly, arid countries in ancient and in modern times have sustained dense populations. It might naturally be supposed that methods for elevating water having been used so long would now be little susceptible of improvement. It is, however, quite possible that an improvement is possible in this age which would not have been possible in other ages, or likely in other countries than the States of the plains.

A crude invention, which is called the "Jumbo" wind engine, appeared in Western Kansas about ten years ago, and is now coming into extensive use; its ease of construction, economy in cost, capacity, in power and simplicity, seem to recommend it to those who observe its work. It resembles the paddlewheel of a stern-wheel boat, with a shaft 12 or 14 feet long, with a diameter of 12 or 16 feet, with six or eight radial arms. The lower half of this horizontal wheel is shielded from the wind, so that the air acts only upon the upper vanes. A crank upon one end of the shaft connects with a pump. Its power can be indefinitely increased at any time by increasing its length, which can be done by any one who is handy with tools. It is said that a "Jumbo" giving 100 horse power in a 15 mile wind can be put up at cost of $500. The wind acts upon this sort of paddlewheel from all points of the compass except two. It seems to require no "governor," but simply pumps more during a storm. No tower is required, and it is placed so that the radial arms will be clear of the ground. In fact, in Kansas, where there are few trees and no hills, it is claimed that the wind currents have greater force at the surface than high in air.

Perhaps in this crude device for raising water for irrigation in a wind-swept country there is the germ of an idea which, when fully developed and perfected, may become widely useful. If so, it will be quickly improved, for it is watched by many eager and anxious eyes, and now the development of an implement requires days where formerly centuries were needed. The crude "Jumbo" of to-day may become the perfected irrigating machine of to-morrow in level and treeless sections of country.

One of these wind wheels, now running in Kansas, is 21 feet in diameter, 27 feet long, with eight fans. The largest water wheel in the world is an overshot wheel in the Isle of Man, and is 72 feet 6 inches in diameter, 6 feet in breadth, with a crank stroke of 10 feet. It gives 200 horse power. There may be many wind power Ferris wheels in the States of the plains, bringing fertility where is aridity.

Even in Louisiana, where there is a semi-tropical rainfall, the average exceeding 60 inches, it is found that the crops frequently suffer from drought, notwithstanding the heavy occasional rains and the proximity of all the lands to an unlimited supply of water. Irrigation will remedy all this, and with falling prices and greater necessity, irrigation will come to be adopted in those States where, while not as essential as in the States of the plains, it will be wondrously beneficial in maintaining the necessary supply of moisture for the growing plants, which under the semi-tropical skies now so frequently suffer.

The capacity of Western Louisiana and Eastern Texas for rice production is practically unlimited, provided the water supply there constantly present, but some 20 or 25 feet below the level of the prairies, be economically raised to the surface. Perhaps irrigation by wind may solve the problem in the South as well as in the West.—La. Planter.

## The Perception of Colors in Colored Light.

Experimenting on the perception of colors by light of various tints, Herr H. W. Vogel has fonnd some very interesting results, which have been communicated to the Berlin Physical Society. Using oil lamps provided with pure red, green and blue shutters, Herr Vogel observed that, when white light was rigorously excluded, all sense of the color of objects disappeared from the perception of the observers, who could distinguish nothing but shades of black and white upon the illuminated objects. It was further noted that a scale of colors illuminated by red light showed the red pigments as white or gray, which abruptly changed into yellow —not red—upon adding blue light. Hence a color appeared which was not contained in either of the sources of illumination. Red and yellow patches appeared to be of the same color, so that they could hardly be distinguished from one another; but the difference at once appeared upon the addition of green instead of blue light. The kind of sensation experienced also depends very much upon the intensity of the illumination, as is easily seen in and about the region of the spectrum near the G line of Fraunhofer. This region appears violet when of low luminosity; blue when it is stronger; and may even appear of a bluish-white with strong sunlight. So that the often-made assertion that with normal eyes a definite color sensation corresponds with a definite wave length is not tenable. Herr Vogel arrives at the conclusion that our judgment of the color of a pigment is guided by our perception of the absence of certain constituents. Thus a red tint is only recognized as such when light of other colors is used, and we perceive its inability to reflect these. The observations bear directly upon some phenomena of photography and photometry.

## New Process of Extracting Gold.

A new process of extracting gold from auriferous ores has been devised by Mr. C. Lorsen, and is described in the Technical World. He electrolyzes a solution of bromide of potassium, and thereby obtains an alkaline solution which contains hypobromide and bromate, which is capable of dissolving gold. The ore is treated with an excess of this solution by rotating cylinders. The solution is then filtered, the gold precipitated by passage over a mixture of iron and coal, and the solution, which now contains bromide of potassium mainly, is once more electrolyzed, and again used for extraction.

# SCIENTIFIC AMERICAN

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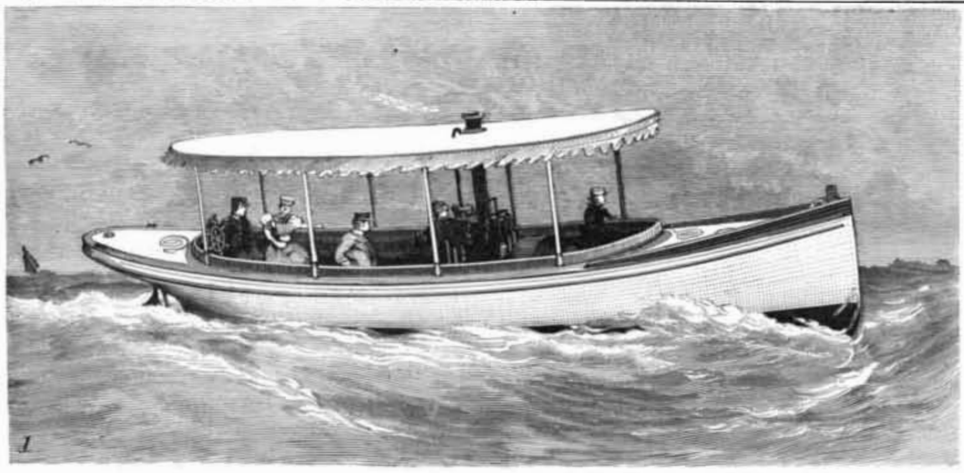
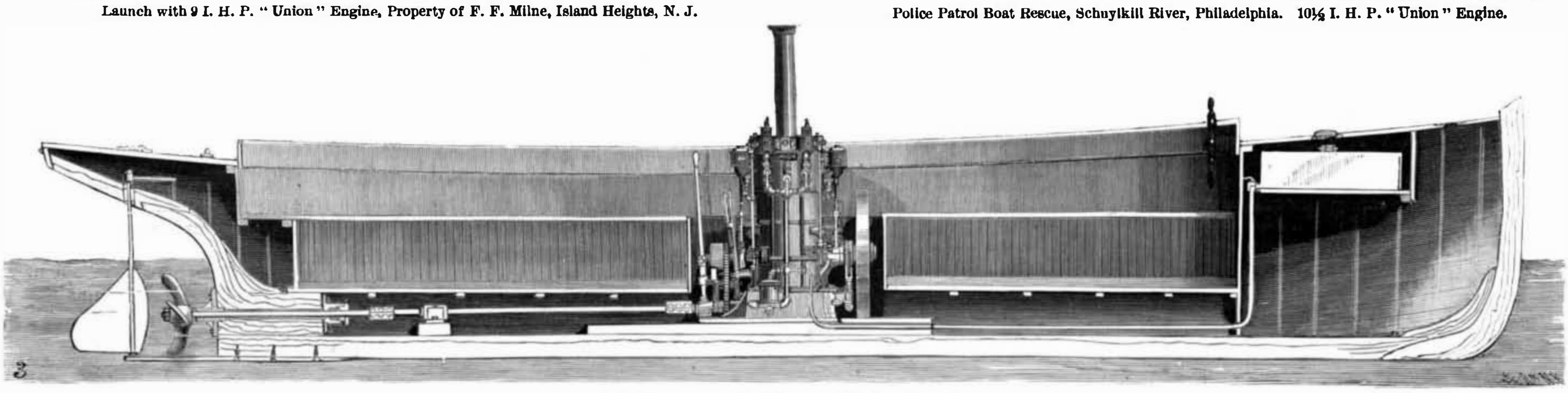
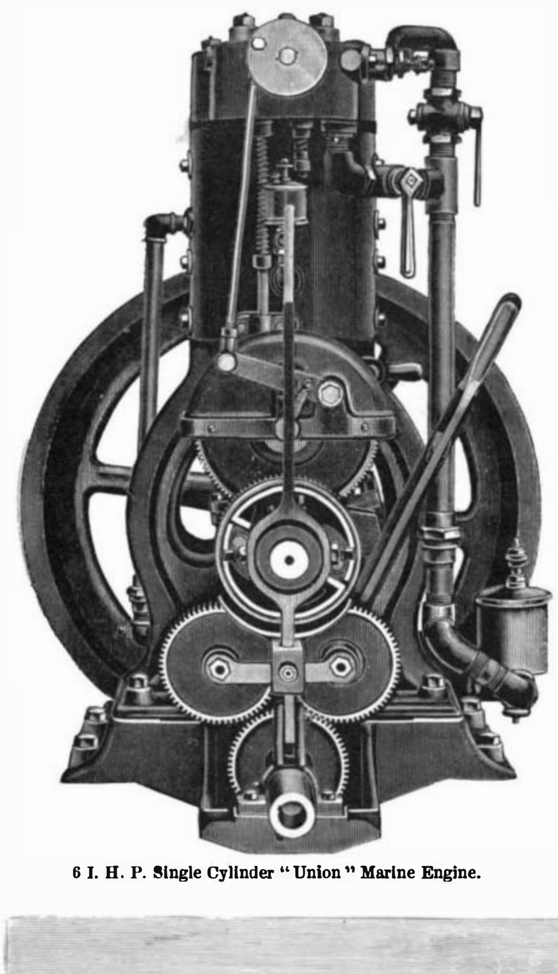


1 Launch with 9 I. H. P. "Union" Engine, Property of F. F. Milne, Island Heights, N. J.

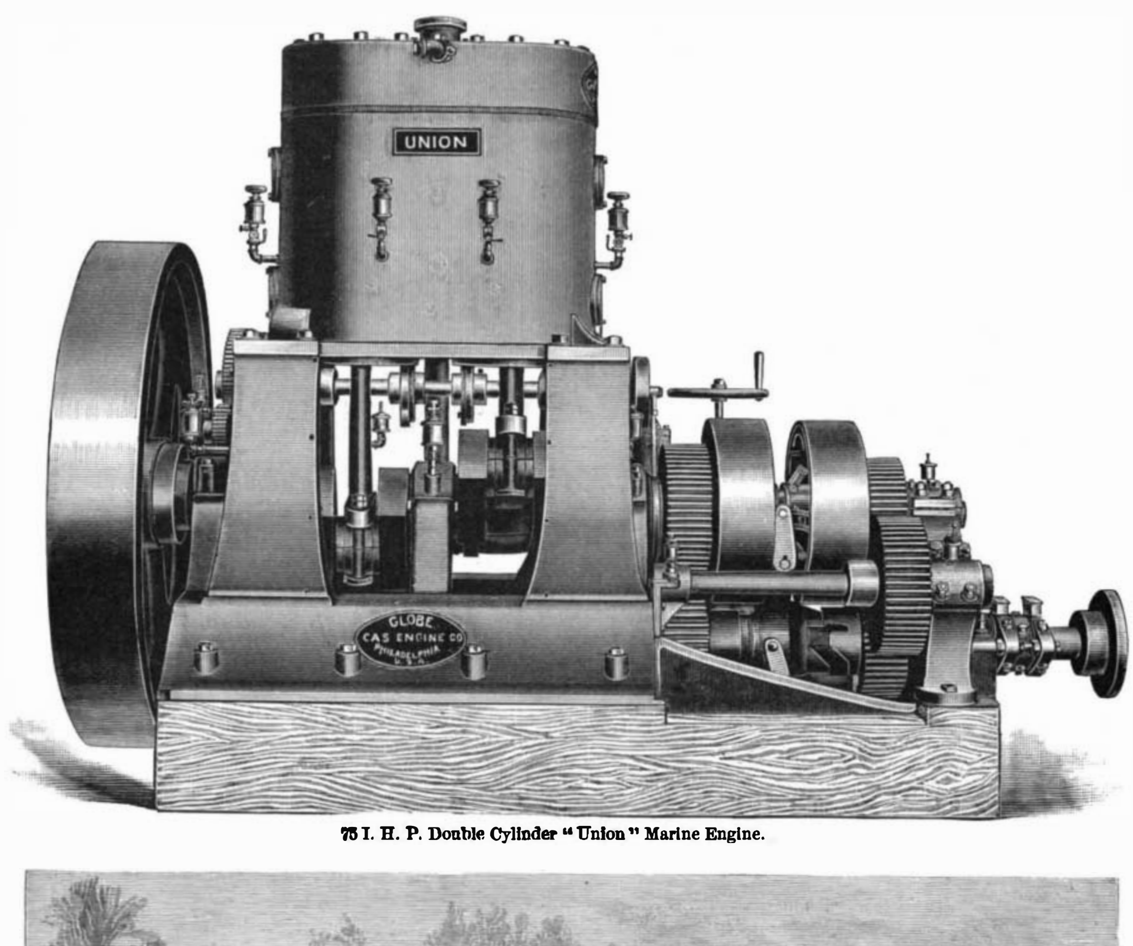
2 Police Patrol Boat Rescue, Schuylkill River, Philadelphia. 10½ I. H. P. "Union" Engine.



3 General Arrangement of Engine and Parts in Launch.



6 I. H. P. Single Cylinder "Union" Marine Engine.




75 I. H. P. Double Cylinder "Union" Marine Engine.

4 Stern Wheeler. 25 I. H. P. "Union" Engine.

5 Launch 42×9 ft., with 25 I. H. P. "Union" Engine, Property of A. N. Stanton, Bridgeport, Conn.

THE MARINE GASOLINE ENGINE AND GAS ENGINE BOAT.—[See page 311.]