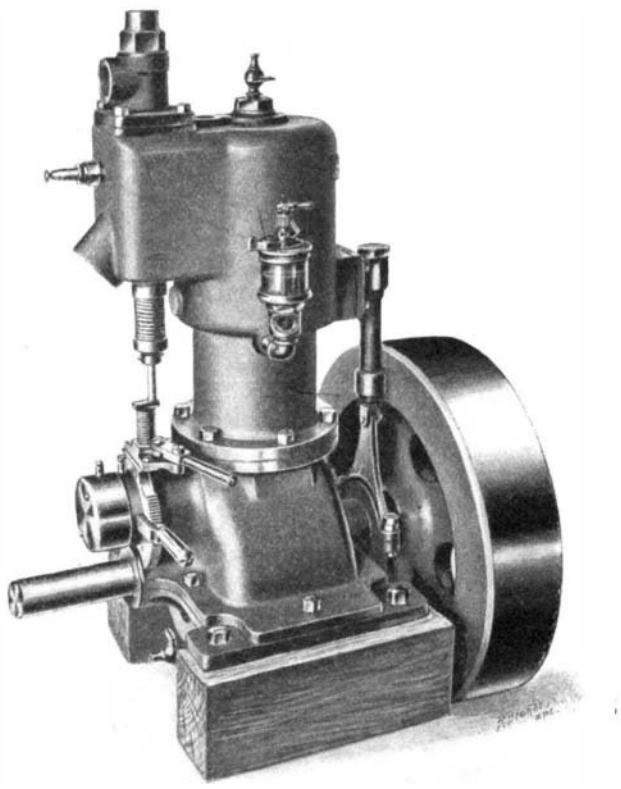
A SINGLE-CYLINDER, REVERSIBLE, FOUR-CYCLE GASOLINE ENGINE.

The engine shown in the accompanying cut is the invention of Mr. A. F. Law, of Bridgeport, Conn., and is manufactured by the Royal Equipment Company, of



A NOVEL, FOUR-CYCLE, REVERSIBLE, GASOLINE MOTOR.

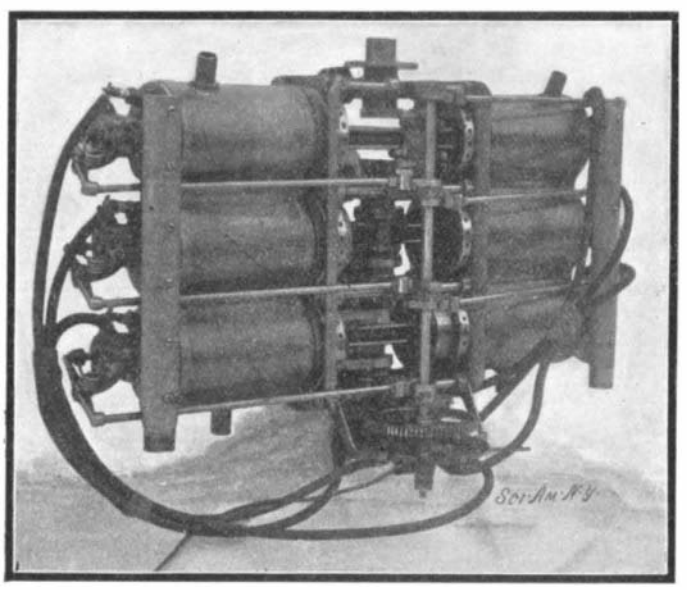
that city. It is of the usual four-cycle type, having a 4-inch bore by 5-inch stroke, and is adapted especially for marine purposes, where its use makes a reversible-blade propeller or other reversing gear unnecessary, except in cases where the boat must always be instantly reversible. The marine motor is rated at 3 horse-power at 600 R. P. M., and it can be made to develop 5 horse-power by running it at a higher speed. Its weight complete is 235 pounds. The plunger water pump seen beside the cylinder, in front, is driven by an eccentric beside the flywheel. Variable jump-spark ignition is used, the spark being advanced or retarded by moving vertically over its notched segment the lower of the two levers seen beside the base. The upper lever, which moves in a horizontal direction, shifts the small plunger that operates the exhaust valve, from the regular cam on the secondary, or half-speed, shaft to another cam beside it, which is set so as to open and close the valve at the proper time when the engine is running backward. To reverse, it is only necessary to cut off the ignition current when the motor is running with the spark advanced, throw over the reversing lever as soon as the motor slows down, and cut in the ignition current again. The spark, being advanced for running forward, will of course be retarded for running backward, and as soon as the motor starts to turn in the latter direction, the spark must be advanced in order to secure full power.

The motor can generally be reversed without stopping it, but, in the event that it does stop while being reversed, it can of course be at once started again by hand in the reverse direction. In other words, this four-cycle engine comprises all the advantages of engines of this type, with the reversible feature of the two-cycle engine added. The engine is well constructed throughout, has a hand-hole in the base for adjusting bearings, and is built up to a four-cylinder size, which, for automobile use, is rated at 20 horse-power.

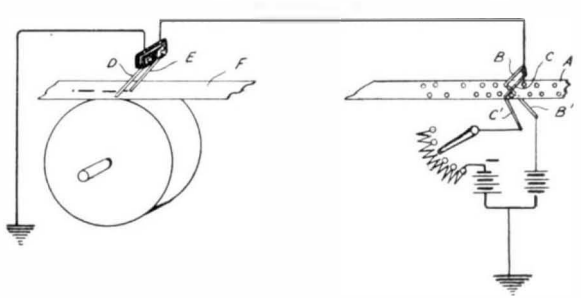
As stated in a paper recently read before the Russian Physico-Chemical Society, Mr. N. Awerkieff observed that in connection with the action of hydrochloric acid on metallic gold in the presence of formaldehyde, trioximethyl, methyl, ethyl, and amyl alcohol, as well as in that of phenol, chloroform, and several other organic bodies, a dissolution of the gold would take place. The solutions obtained in this way, on being vaporized, dried, and heated, would leave a residuum of metallic gold.

A NEW GASOLINE MOTOR FOR AIRSHIPS.

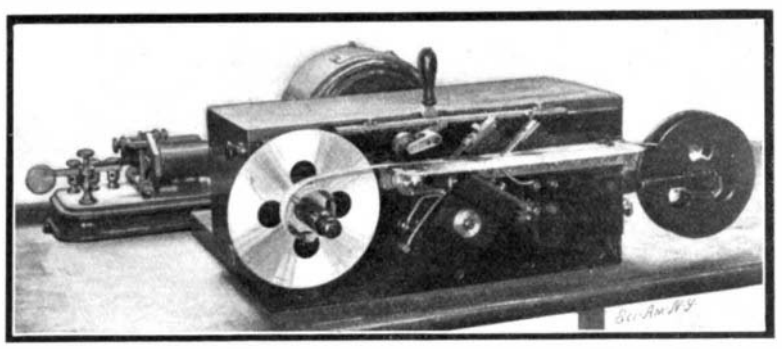
The six-cylinder motor shown herewith was designed and built by Mr. Charles E. Duryea, of the Duryea Power Company, Reading, Pa., for use on an airship. The cylinders have a 4½-inch bore and the pistons a 5½-inch stroke, and when turning at 900 R. P. M. the motor developed 40½ horse-power. Its weight stripped, as shown, but with complete equipment of two carbureters, battery, spark coil, water, and gasoline tanks, with a gallon of the respective liquids in each, was 232 pounds, or less than 5¾ pounds per horse-power. The three-throw crank shaft of 1¾-inch diameter is hand forged and has a ¾-inch hole bored in it to carry oil to the crank pins. These are 1¼-inch in diameter and are provided with a ¼-inch central hole for oiling. The wrist pins of the pistons are hollow and are plugged so as to prevent the oil going out at the bottom. Instead of setscrews to hold them in place, oil cups screw into the lug on the inside of the piston wall. These oil cups have an opening on the upper side for filling, and they can be filled when the piston is at the end of its stroke. The reciprocating motion causes the oil to feed properly. The cylinders of the motor are of cast iron, machined inside and outside. They are fitted with copper water jackets. At the base of each cylinder there is a slightly conical space on which the copper water jacket fits with a steel ring around it, which, when it is driven up on the cone, clamps the jacket to it, making a tight joint. The motor is a particularly light and compact one, and should fulfill well the purpose for which it was designed.



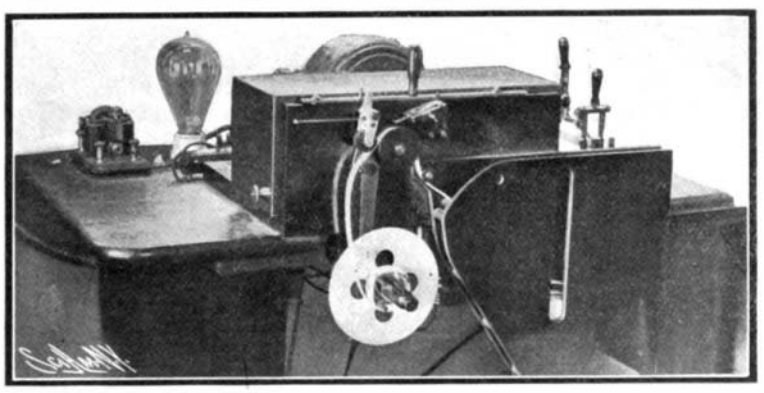
A 40½-H. P., WATER-COOLED, GASOLINE MOTOR FOR AN AIRSHIP.



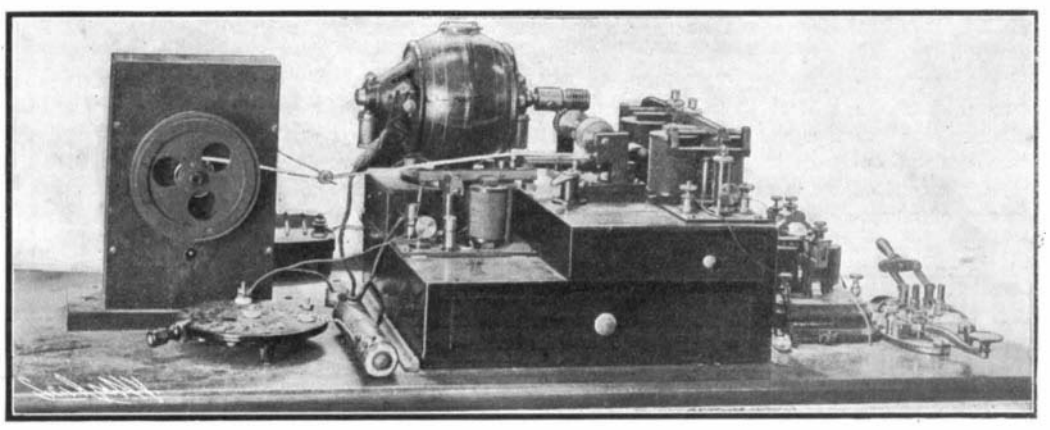
The Transmitter and the Receiver.



Message Ready for Transmission at a Speed of 1,000 Words a Minute



Recording the Message Electrolytically on a Chemically-Prepared Tape.



Machine for Perforating the Transmitting Tape.

A NEW SYSTEM OF RAPID TELEGRAPHY.

The difficulties which have hitherto blocked the path to the invention of a successful high-speed telegraph system are of an electrical, rather than a mechanical nature. Many transmitters and receivers have been devised, which are mechanically capable of operating at a high rate of speed; but which have utterly failed when used on any but short telegraph lines, because, owing to static capacity of the line, they are too rapid for the electric impulses. A telegraph line presents features and effects similar to those of a Leyden jar. Though these effects are too small to be noticeable in a short line, in a distance of several hundred miles they become so great as to seriously interfere with high-speed transmission of telegraphic signals. Dots and dashes, instead of being sharply defined, are prolonged until they are run together by the sluggishly flowing current, rendering the message unintelligible.

A system recently invented by Mr. Patrick B. Delany, of South Orange, N. J., is not in the least hindered by the static capacity of the line; but on the contrary utilizes the "static discharge" and is inoperative without it, so that, when used on short lines whose capacity is small, it is necessary to bring these lines up to the requisite capacity by the use of condensers. The system is designed to transmit and receive messages at the rate of one thousand words a minute over distances of one thousand miles, though a speed of eight thousand words a minute has been attained on a short experimental line. In the accompanying illustrations we show the three machines which are used in the operation of this system, namely, the perforator, the transmitter, and the recorder. Messages are sent by means of a perforated tape, which is prepared in the perforating machine. The tape is drawn at any desired speed through the perforating machine under a pair of steel punches. Each of these punches is operated by a magnet. The magnets are controlled by a Morse transmitting key, shown at the right in our illustration. A downward stroke of the key causes one of the punches to operate, and on release of the key the other punch operates. Thus each operation of a key, whether for a dot or a dash, serves to make two perforations, one near the upper edge, and the other near the lower edge of the tape. As shown in our illustration of the perforated tape, the primary and secondary perforations have an angular relation to each other, which is due to the fact that the tape is constantly running, and which varies with the interval of time between the downward stroke and release of the key. When a message has been perforated in the tape, the latter is passed through the transmitting machine. Here the primary perforations co-operate with suitable mechanism to send positive electric impulses through the line, while the secondary perforations permit the passage of negative electric impulses.

The accompanying diagram clearly shows the method of sending and receiving the message. The perforated tape, *A*, at the transmitting end passes between two primary contact fingers, *B* and *B'*, and two secondary contact fingers, *C* and *C'*. *B'* is connected with the positive pole of a battery whose