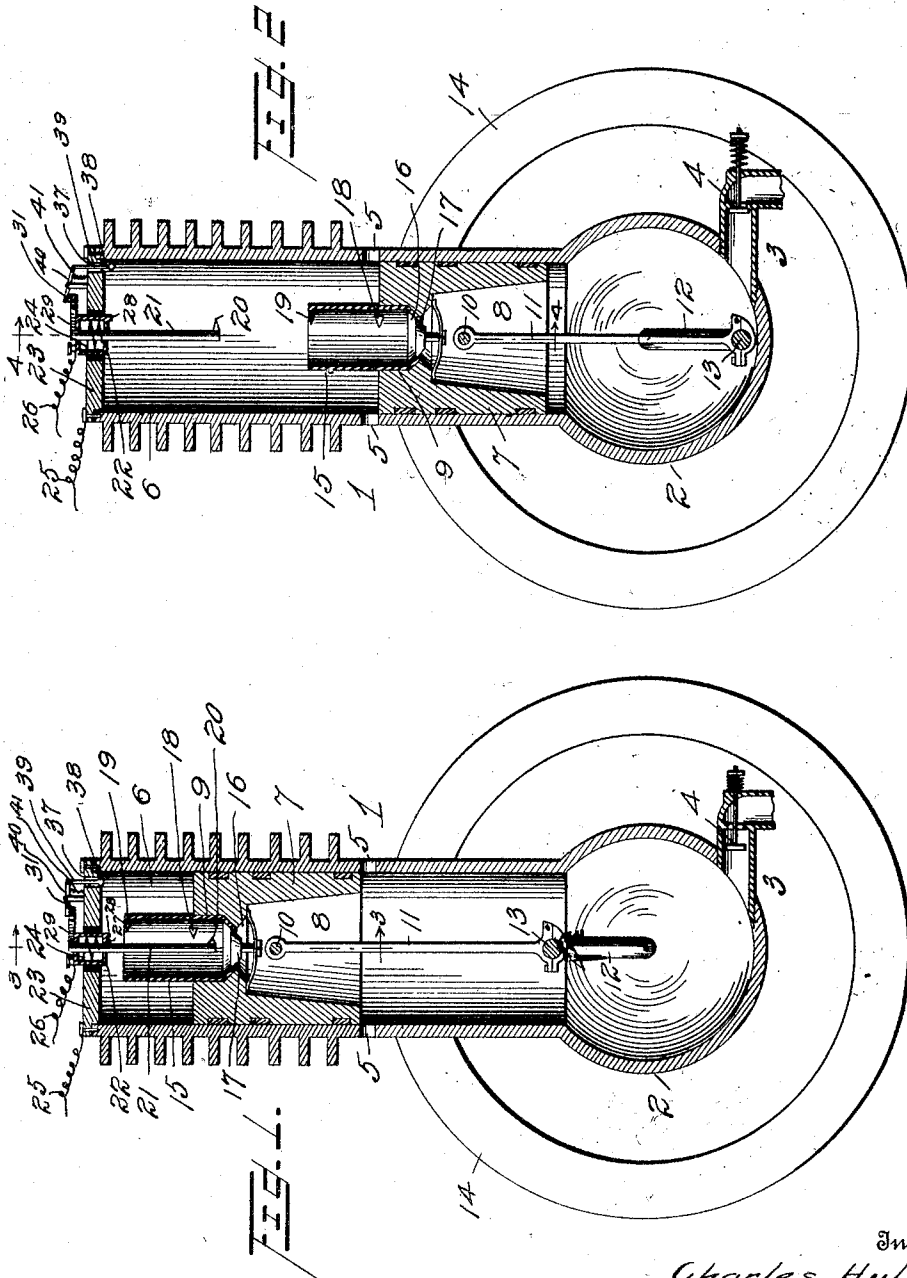


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 REVERSIBLE TWO-CYCLE ENGINE.
 APPLICATION FILED AUG. 8, 1911.

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Patented Sept. 10, 1912.

2 SHEETS—SHEET 1.



Inventor
 Charles Hull

Witnesses

W. B. Duffy
E. E. Hines

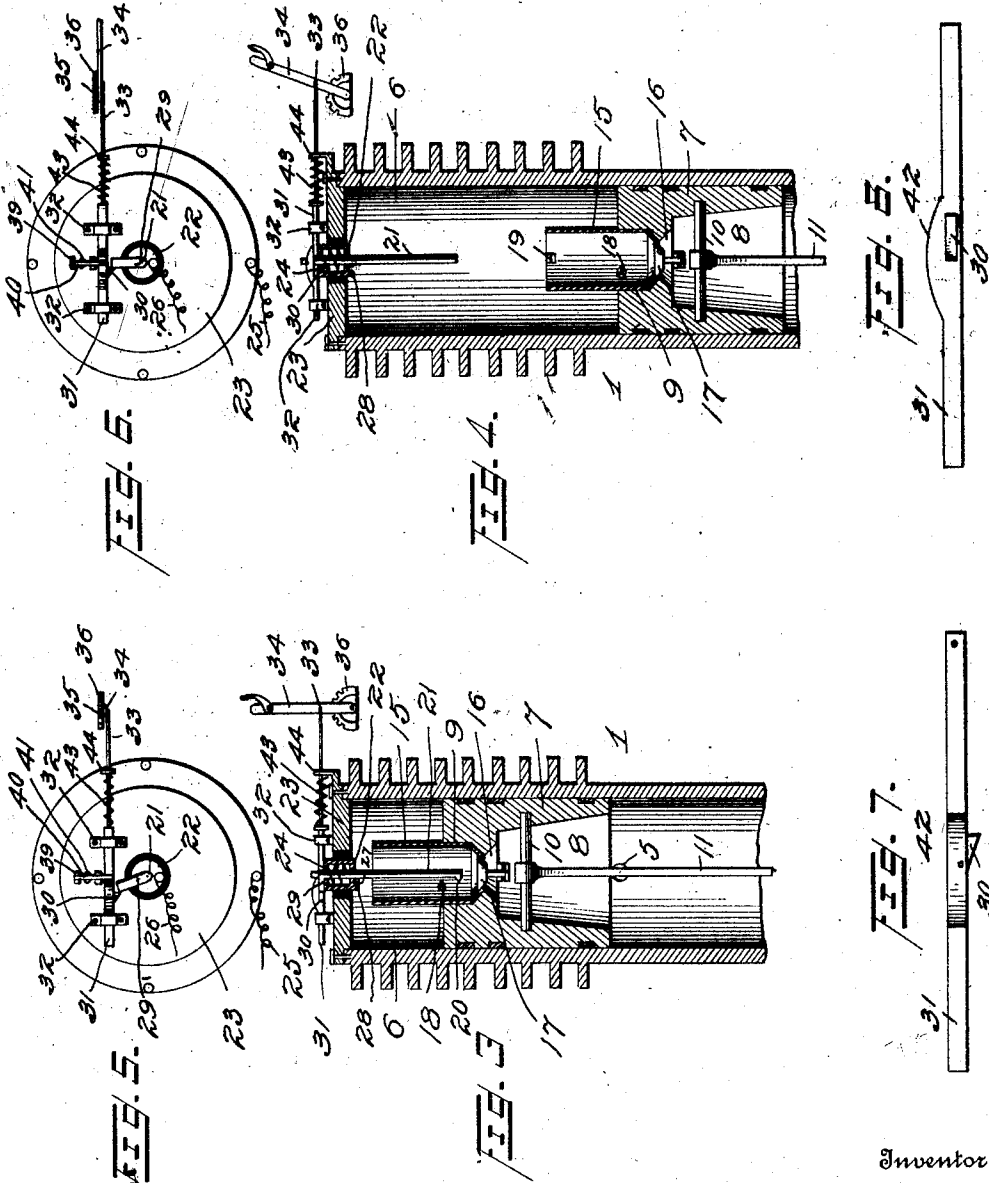
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UNITED STATES PATENT OFFICE.

CHARLES HULL, OF BLOOMVILLE, OHIO.

REVERSIBLE TWO-CYCLE ENGINE.

1,038,371.

Specification of Letters Patent.

Patented Sept. 10, 1912.

Application filed August 8, 1911. Serial No. 642,914.

To all whom it may concern:

Be it known that I, CHARLES HULL, a citizen of the United States, residing at Bloomville, in the county of Seneca and State of Ohio, have invented new and useful Improvements in Reversible Two-Cycle Engines, of which the following is a specification.

This invention relates to two-cycle internal combustion engines, and its object is to provide a simple, inexpensive, reliable and efficient construction of engine embodying means for reversing the same whenever it is desired or necessary to change the direction of motion.

The invention consists of the features of construction, combination and arrangement of parts, hereinafter described and claimed, reference being had to the accompanying drawings, in which:—

Figure 1 is a vertical section through the engine, as arranged to run in one direction, and showing the piston at the end of its compression stroke. Fig. 2 is a similar view of the engine with parts arranged for the reversing action, and showing the piston at the end of its working stroke. Figs. 3 and 4 are vertical sections on the lines 3—3 and 4—4 of Figs. 1 and 2. Figs. 5 and 6 are top plan views with the parts of the reversing mechanism arranged in normal and reversing positions. Figs. 7 and 8 are views showing details of construction of the reversing mechanism.

Referring to the drawings, 1 designates the engine cylinder, which may be either air or water cooled, and at the base of which is arranged the usual crank casing and compression chamber 2 provided with an admission port 3 controlled by a spring closed admission valve 4, through which port the explosive mixture is introduced into the crank casing on the upward movement of the piston, through the induced suction, for compression upon the subsequent downward movement of the piston. The cylinder is further provided with oppositely disposed exhaust ports 5 uncovered at the limit of downward movement of the piston for the discharge of the spent gases from the combustion chamber 6.

The piston 7 is provided in its bottom with a cavity 8 and in its top with a cavity 9. In the cavity 8 is disposed a pin 10 to which is pivotally connected the upper end

of the connecting rod 11, the lower end of which is similarly connected with the crank 12 of the engine shaft 13, journaled in and extending through the side walls of the crank casing and carrying a fly wheel 14, of sufficient weight to carry the piston from one stroke to the other.

The piston carries a tubular shield 15, of some suitable conducting material, which is fitted at its lower end within the cavity 9 and extends therefrom above the upper end of the piston. The cavities 8 and 9 are connected by an inlet port 16 controlled by a spring-closed valve 17, which is unseated upon the compression stroke of the piston for the passage of the fuel mixture to the combustion chamber 6 through the cavity 8, port 16 and shield 15, which serves the function of a baffle to prevent the discharge of the mixture through the exhaust ports at the beginning of the intake.

The shield 15 is provided upon the interior thereof with electrodes or ignition points 18 and 19, arranged at different elevations and out of vertical alinement with each other. These electrodes or ignition points are adapted to coöperate with the spark plug electrode or ignition point 20 for the production of a spark. The electrode, or point 20 is carried by a depending stem 21 journaled for a limited rotary movement in the plug body or casing 22, which is fitted in and insulated from the upper head 23 of the cylinder in any preferred manner. The stem 21 is normally arranged to dispose the sparking point in proper position to pass the sparking point 18 in the normal operation of the engine, but is adapted to be partially turned or rotated to bring said sparking point 20 into position for coöperation with the spark point 19, to advance the sparking action for reversing the engine. A spring 24 is suitably connected with the stem 21 and plug body 22 and is adapted to normally hold the stem in position for coöperation of the point 20 with the point 18, and to be placed under tension when the stem is turned to bring the point 20 into position for coöperation with the point 19, for subsequent restoration of the stem to its first-named or normal position. 25 and 26 designate the terminals of the spark circuit, which are respectively connected with the engine cylinder and plug body, and 27 designates a lug upon the stem to engage a shoulder 28 on

the plug body, whereby the rotary movement of the stem is limited and said stem maintained in normal position.

The stem carries an actuating arm 29 which is engaged by a pawl or dog 30 on a reversing slide 31 movable in guides 32 on the head 23, which slide is coupled by a connecting rod or link 33 with a reversing lever 34 provided with the usual spring actuated pawl 35 to engage a rack 36, whereby the lever may be secured in adjusted position. The head 23 is provided with a relief port 37 controlled by an inwardly opening valve 38, the stem 39 of which extends through the port and is connected with one end of an operating lever 40 on which acts a spring 41 normally holding the valve closed. The other end of the lever 40 is arranged to be engaged by a projection or cam surface 42 on the reversing slide 31, whereby the lever will be rocked to open the valve at a predetermined period in the reversing operation. The dog 30 is provided with the usual shoulder to engage the arm 29 and a beveled face to permit it to slide past the arm on the backward movement of the reversing slide 31, to bring the shoulder again into engagement with the arm after the stem has been adjusted to reversing position and returned to normal position again. A coiled spring 43 surrounds the rod or link 32 between the slide 31 and a suitable abutment 44 and operates to maintain the slide in its normal position.

In operation, the piston 7 on its upward stroke draws a charge of the mixture through the port 3 into the crank casing, which charge is compressed on the subsequent downward stroke of the piston and passes through the port 16 to the combustion chamber 6. Upon the upward movement of the piston the charge in the combustion chamber is compressed and ignited by the spark produced when the ignition point 18 passes the point 20. On its subsequent downward movement the piston finally uncovers the ports 5, through which the spent products exhaust to the atmosphere.

When it is desired to reverse the engine, the lever 34 is operated to draw the slide 31 forward, whereby the stem 21 is turned to bring the point 20 into position to cooperate with the point 19, so that an advanced explosion will be produced in the chamber 6 before the piston has completed the first half of its upward or compression stroke. The piston is thus impelled downward and a reverse motion imparted to the crank 12 to start the engine running in the opposite direction. At the limit of forward movement of the arm 29, said arm clears the dog 30, and is returned to normal position by the spring 22, thus resetting the sparking point 20 for cooperation with the sparking point 19 to maintain the normal operation of the

engine in its reverse driving action. As soon as the reversing explosion occurs, as above described, the cam surface 42, in the continued forward movement of the slide 31, engages and operates the lever 40 to open the relief valve 38, for the vent of a portion of the explosive mixture from the chamber 6 on the subsequent upward movement of the piston, thus reducing the power of the subsequent explosion and speed of the engine.

The vent valve may be held open to maintain the slow speed of the engine until an easy working reverse motion is obtained by holding the slide at the limit of its forward movement. When the engine is running smoothly on the reverse motion, the lever 34 is released and the spring 43 returns said lever and the slide back to normal position, thus closing the vent valve and restoring the normal order of arrangement of the parts. In such backward movement of the slide 31 the dog 30 rides over and again snaps into engagement with the arm 29, as will be readily understood. When it is again desired to cause the engine to run in the direction in which it was assumed to be running prior to the reversing operation, the reversing mechanism may be again operated, with the result of again advancing the explosion and reversing the direction of motion of the shaft, the operation being a repetition of that previously described.

It will thus be seen that my invention provides a two-cycle engine of simple construction which may be operated in either direction at will, and conveniently reversed to vary its direction of motion as occasion may require.

Having thus described my invention, what I claim as new is:

1. A two-cycle engine comprising a cylinder having an explosion chamber at its upper end, a compression chamber at its lower end provided with a valve controlled admission port and one or more exhaust ports at a point intermediate said explosion and compression chambers, a piston operating in the cylinder and controlling said ports, said piston having a valve controlled passage for the feed of the explosive charge from the compression chamber to the explosion chamber, spark points carried by the piston and arranged at different elevations and out of vertical alinement with each other, a spark plug having a rotary stem provided with a sparking point for cooperation with the first-named points, and means for adjusting said stem for cooperation with either of the first-named sparking points.

2. A two-cycle engine including a cylinder having an explosion chamber provided with a relief port, a spark plug having an adjustable spark point, a valve controlling said relief port, a piston provided with

spark points arranged at different elevations and out of vertical alinement with each other, and means for adjusting the said adjustable spark point for coöperation with either of the latter-named spark-points and opening the relief valve at prescribed intervals.

3. A two-cycle engine including a cylinder having an explosion chamber, an adjustable sparking device, a piston provided with spark points arranged at different elevations and out of vertical alinement with each other, and means for adjusting said adjustable sparking device for coöperation with each of said spark points.

4. A two-cycle engine including a cylinder having a crank casing provided with an admission port, an explosion chamber, and exhaust ports arranged at a point intermediate the crank casing and explosion chamber, a piston controlling the exhaust port and having a valved feed passage, a tubular shield extending upwardly from the piston in line with said passage, a pair of sparking points carried by the shield at different ele-

vations and out of vertical alinement with each other, and a sparking point within the explosion chamber adjustable to coöperate with either of the first-named sparking points.

5. A two-cycle engine comprising a cylinder having an explosion chamber provided with a relief port, a valve controlling said port, a piston provided with spark points arranged at different elevations and out of vertical alinement with each other, a spark plug provided with an automatically retracted, spark terminal adjustable to coöperate with either of said spark points, a movable member for adjusting said spark terminal, means for operating the same, and means controlled by the first-named means for opening the relief valve after adjustment of said adjustable spark terminal.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES HULL.

Witnesses:

S. R. HULL,
E. C. SNYDER.