J. C. ENGLISH.

GAS ENGINE.

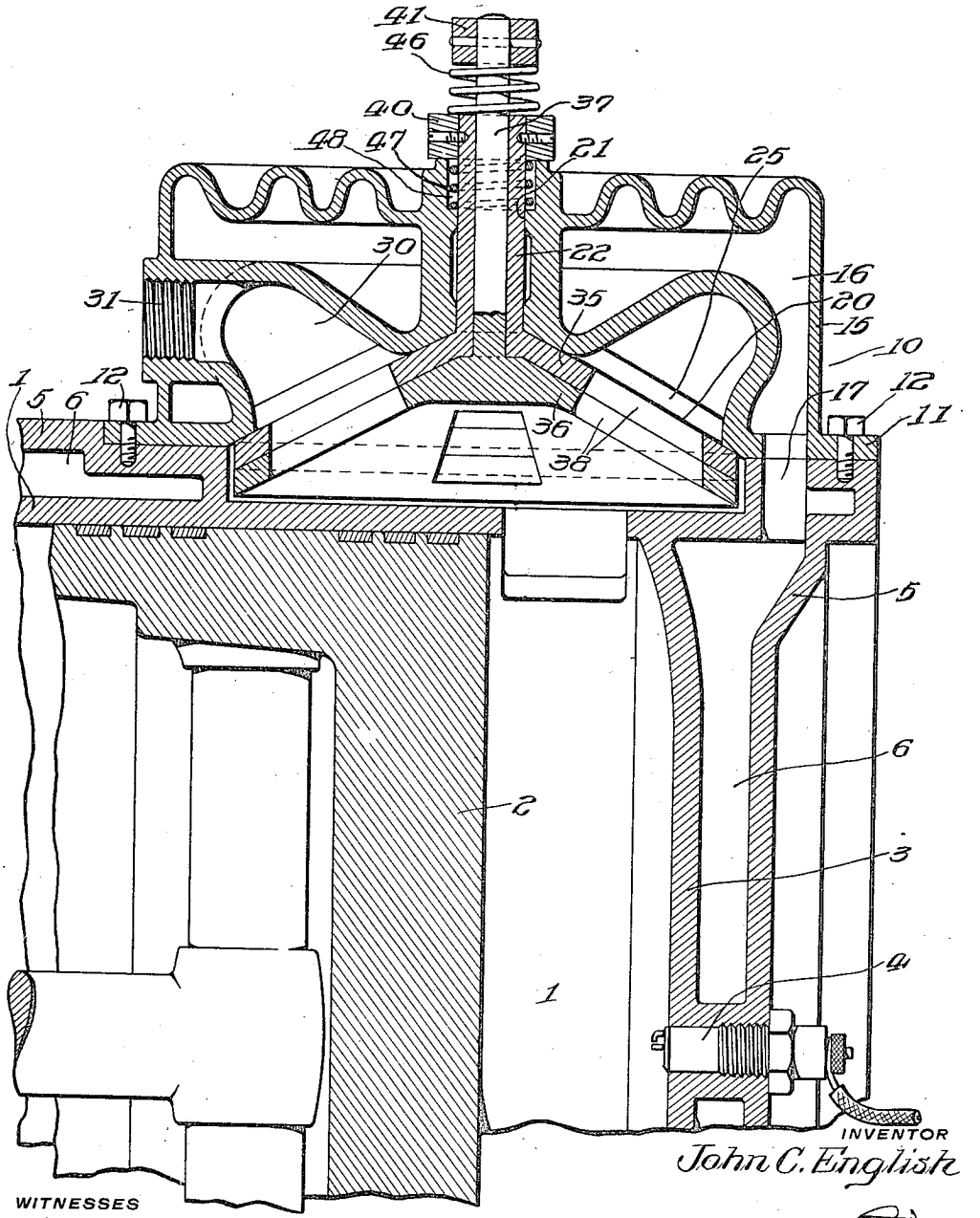
APPLICATION FILED NOV. 27, 1911.

1,159,482.

Patented Nov. 9, 1915.

3 SHEETS—SHEET 1.

Fig. 1.



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3 SHEETS—SHEET 2.

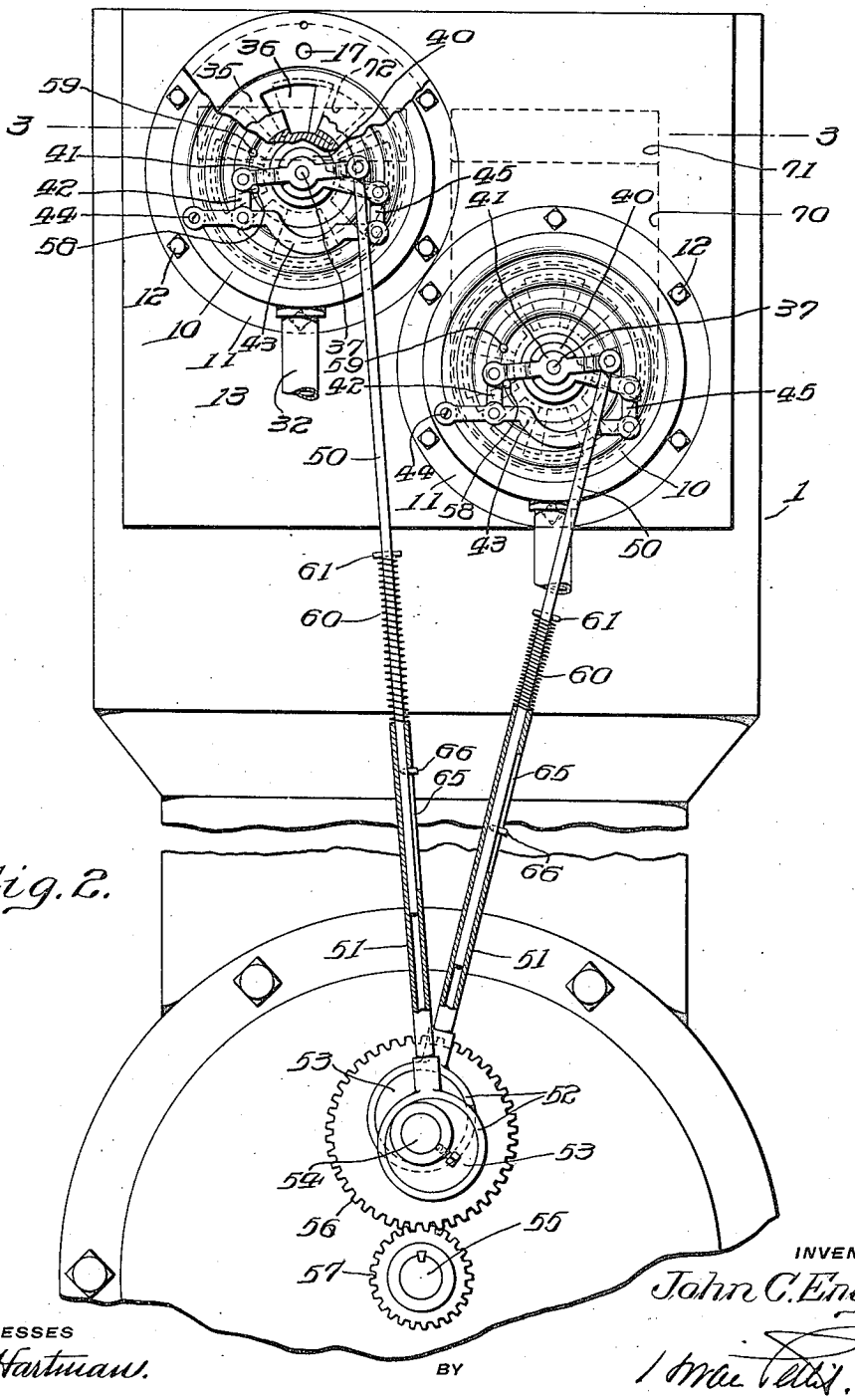

Fig. 2.

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3 SHEETS—SHEET 3.

Fig. 3.

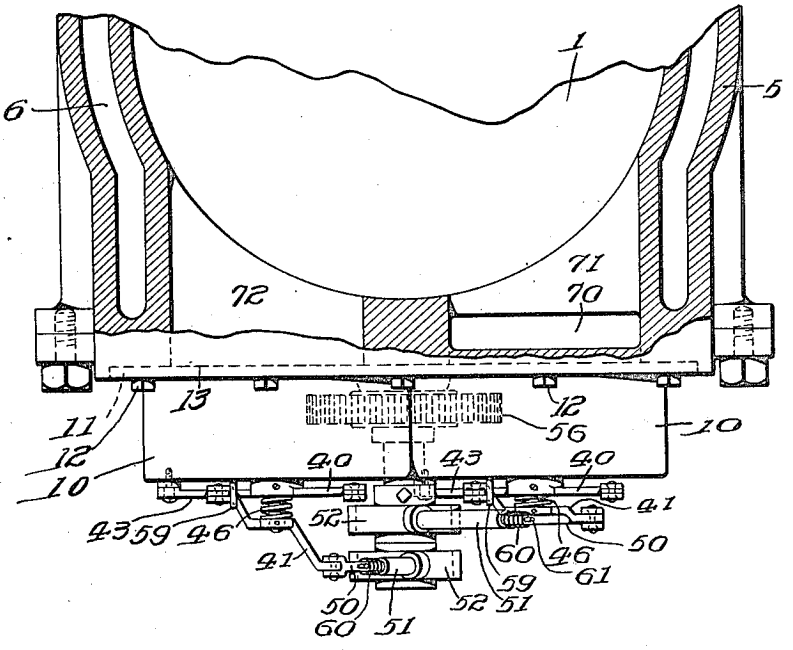
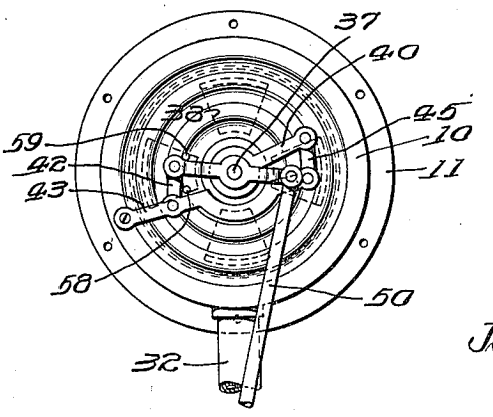


Fig. 4.



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GAS-ENGINE.

1,159,482. Specification of Letters Patent. Patented Nov. 9, 1915.

Application filed November 27, 1911. Serial No. 662,671.

To all whom it may concern:

Be it known that I, JOHN C. ENGLISH, a citizen of the United States, a resident of the city of Camden, county of Camden, and State of New Jersey, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification.

The main objects of this invention are to provide improved means for the distribution of an actuating fluid in motors actuated by an elastic fluid under pressure, and more specifically to provide in an internal combustion motor improved valves and valve actuating mechanism; and to provide other improvements as will appear hereinafter.

In the accompanying drawings, Figure 1 is a fragmentary longitudinal section of a four cycle gas engine constructed in accordance with this invention; Fig. 2 a fragmentary side elevation of the same; Fig. 3 a fragmentary top plan view or end elevation of the same partly in transverse section on line 3—3 of Fig. 2, and Fig. 4 a front elevation of certain portions of the same in a stage of operation different from that shown in the preceding figures of the drawings.

Referring to the drawings, one embodiment of this invention comprises a hollow cylinder 1 in which reciprocates in the usual manner a piston 2.

The head 3 of the cylinder 1 is provided with a spark plug 4 arranged to generate a spark to explode a combustible mixture of gases in the cylinder. The cylinder 1 is surrounded by a water jacket 5 providing a passage or compartment 6 for water or other fluid for cooling the cylinder.

For controlling the admission of a combustible mixture of gases into the cylinder, there is arranged upon one side of the cylinder adjacent to its inner end a substantially cylindrical valve case 10, one side of which is provided with a continuous flat annular flange 11, which is rigidly secured by means of cap screws 12 to a corresponding flat annular seat 13 provided therefor on the adjacent side of the cylinder 1. The valve case 10 is provided with a water jacket 15 providing a water compartment 16 which communicates with the water compartment 6 through a suitable opening 17 provided therefor through the walls of the cylinder 1 and valve case 10.

The central portion of the inner surface of the valve case 10 is in the form of a concave, conical valve seat 20, coaxially with which and extending outwardly through the case 10 is a cylindrical aperture 21, the cylindrical wall of which forms a bearing for a cylindrical hollow valve stem 22 extending snugly but rotatively through the aperture 21 and projecting outwardly from the case 10. The valve seat 20 is provided with a plurality of ports 25 (in this instance four) arranged radially with respect to the seat and communicating with an annular passage 30 provided therefor outside of the seat and in the case 10 and through which the valve ports communicate with a tubular inlet 31, which is adapted to be connected to a supply pipe 32 for conducting a combustible mixture of gases into the annular passage 30.

For quickly opening or closing the ports 25 in the conical valve seat 20, two coöperating conical disk valves 35 and 36 are provided. These valves are arranged coaxially with the conical valve seat 20, and one, 35, of these valves bears upon its convex conical side directly against the concave conical valve seat 20 and is integral with or rigidly secured to the inner end of the hollow valve stem 22. The other, 36, of these valves is arranged inside of and with its convex conical side in sliding contact with the conical concave inner side of the first mentioned valve, and integral or rigid with the inner end of a valve stem 37, which extends snugly but rotatively through the hollow valve stem 22 coaxially therewith and projects outwardly therefrom. Each of these valves 35 and 36 is provided with a plurality of ports 38 corresponding in number and arrangement with the ports 25 of the valve seat. The ports 38 of one valve are arranged to register with the ports 38 of the other valve when the valves are in position for this purpose, and the ports 38 of both valves are arranged to register with the ports 25 of the valve seat 20 when the valves are positioned for this purpose.

For oscillating the valves 35 and 36 quickly in opposite directions respectively to open and close the ports 25 of the valve seat 20, a lever 40 is adjustably secured to the outer end of the hollow valve stem 22, and a lever 41 is adjustably secured to the outer end of the other valve stem 37. The latter lever 41 projects in opposite directions from its valve stem 37 and one end of this lever is pivotally connected to one end

of a link 42, the other end of which is pivotally connected to a transmission lever 43 which is mounted to oscillate about a fixed pivot 44 extending through one end of the transmission lever in a direction parallel to the axis of oscillation of the valves 35 and 36. The other end of the transmission lever 43 is pivotally connected to one end of a link 45, the other end of which is pivotally connected to the free end of the lever 40.

The two valve levers 40 and 41 are thus connected so that when either one is oscillated in one direction, the other will be oscillated in the opposite direction, the arrangement being such that the valve lever 40 secured to the tubular valve stem 22 will always oscillate at a greater speed of rotation than the lever 41 secured to the other valve stem, the ratio of the two speeds being, in the case illustrated, about two and a half to one, and the valves 35 and 36 will oscillate accordingly.

For holding the two valves 35 and 36 always yieldingly and in sliding contact with each other to take up any wear and to prevent leakage between the valves, a compressed spiral spring 46, or other compressed yielding means, may be interposed around the valve stem 37 between the outer valve lever 41 and the inner valve lever 40.

For holding the outer valve 35 yieldingly but slidably against the valve seat 20 to take up any wear and to prevent leakage between the valve and the seat, a compressed spiral spring 47, or other compressed yielding means, may be interposed around the tubular valve stem 22 and between the inner valve lever 40 and the valve case 10 in an annular recess 48 provided therefor in the valve case.

For oscillating the valve levers 40 and 41, any suitable connection may be made between one of the valve levers and a moving part of the motor, but the connection is preferably made, as in this instance, between a moving part of the motor and the outer valve lever 41 which has the slower motion. The connection for oscillating the valve levers is also preferably such that an intermittent movement will be given to the valves so that the valves will not be moved under any excessive pressure and will not be performing any unnecessary work. In this instance, the free end of the outer valve lever 41 is connected to one end of a connecting rod 50, the other end of which fits snugly but slidably in one end of a tubular eccentric rod 51, the other end of which is rigidly connected to an eccentric strap 52, slidably mounted upon an eccentric 53 adjustably secured to an eccentric shaft 54 which is mounted to rotate upon a fixed axis. The eccentric shaft 54 may be, as in Fig. 2, parallel to the axis of oscillation of the valves 35 and 36, but in some instances, it is desirable to have the eccentric shaft arranged substantially at right angles to this position.

The eccentric shaft 54 is connected to the main driving or crank shaft 55 of the motor, as for instance, by a gear 56 fixed upon the eccentric shaft and engaging a pinion 57 fixed upon the main driving shaft, so as to give the eccentric shaft 54 one revolution to every two revolutions of the main driving shaft. The eccentric 53 is proportioned to give the proper amount of movement to the valves 35 and 36 to open and close the valve ports in about one-quarter of a revolution of the eccentric and to permit the valves to remain stationary during the remainder of each revolution of the eccentric.

Two fixed stops 58 and 59 are arranged upon opposite sides respectively of the valve lever 41 to limit its movement, and a normally compressed spiral spring 60 surrounds the connecting rod 50 between a stop 61 fixed upon the connecting rod and the free end of the tublar eccentric rod 51. The eccentric rod 51 is provided with a longitudinal slot 65 in which engages a pin 66 fixed upon the lower portion of connecting rod 50. The outer or upper end of the slot 65 is positioned to engage against the pin 66, at the proper moment, to actuate the valves and to remain in engagement for a predetermined period, in this instance for about a quarter of a revolution of the eccentric 53, which corresponds to a single oscillation of the valve lever 41 from one stop 58 to the other stop 59 and return, the pin 66 being held in engagement with the end of the slot 65 during this period by the force of the compressed spiral spring 60. During the remainder of each revolution of the eccentric 53, the valves are held closed by the force of the spring 60 which holds the valve lever 41 against the stops 58, and during this period the tubular eccentric rod 51 slides over the lower end of the connecting rod 50 compressing the spring 60, the slot 55 being long enough to permit of a full revolution of the eccentric 53 without bringing the lower or inner end of the slot into contact with the pin 66.

The ports 38 in the valve, and the stops 58 and 59 are arranged so that when the valve lever 41 is against the stop 58, the ports of the valve will not overlap each other, and one valve will act as a closure for the other valve. When the valves are in this position, a slight movement of the valves in opposite directions will begin to open the ports through the valves and the ports 25 through the valve seat, and when the valve lever 41 is against the stop 59, the ports 38 in one valve register with the ports 38 in the other valve, and the ports 38 of both valves register with the ports 25 in the valve seat, thus giving a full opening of

the valve ports into the cylinder 1 for the inlet of a combustible mixture of gases.

It is to be understood that duplicate distributing mechanisms may be used to control the inlet and the exhaust respectively of the motor, the eccentric of the exhaust being set in an angular relation to the eccentric of the inlet to secure the proper timing of the exhaust. In Fig. 2 of the drawings, the inlet and the exhaust mechanisms are both shown, for convenience of illustration, upon one side of the motor, but it is to be understood that the exhaust valves may be placed upon opposite sides of the motor from the inlet valves, if preferred. Where both inlet and exhaust valves are placed upon the same side of the motor, the exhaust valves may be conveniently arranged, as shown in Fig. 2, below the inlet valves, a suitable passage 70 being provided between the exhaust valves and an exhaust port 71 opening from the inner end of the cylinder 1. A suitable inlet port 72 is, in this case, arranged adjacent the exhaust port 71 and leading from the space inside of the valve 36 into the interior of the cylinder 1.

It is thought that the operation of this improved distributing mechanism will be clear from the foregoing description. It is to be understood that the construction is such that when the piston 2 is about to begin its intake stroke, the intake valves begin to open, the valves moving in opposite directions respectively, and continuing to open until the ports 38 of the intake valves register with the ports 25 of the valve seat. The valves then are automatically reversed in movement and continue to move in the reversed direction until the valve lever 41 comes in contact with the stop 58 to stop the movement of the valves temporarily, the valves being when thus stopped in position to close the intake ports. This closure of the intake ports takes place at about the beginning of the compression stroke, and the intake valves remain closed and stationary during the compression stroke, and during the greater part of the explosion and exhaust strokes. The exhaust valves are arranged to open slightly before the beginning of the exhaust stroke and remain open only substantially during the exhaust stroke. The valves may, however, be proportioned or adjusted to secure any desired timing of the various events of the distribution.

Although only a single form has been illustrated in which this invention may be embodied, the invention is not limited to the specific structure shown, but may be modified to meet various needs without departing from the spirit of the invention or the scope of the appended claims.

Having thus fully described this invention, I claim and desire to protect by Letters Patent of the United States:

1. In an internal combustion motor, the combination with a pair of coöperating coaxial conical disk valves arranged to control a port, of a pair of levers of different lengths in fixed relation with said valves, a third lever arranged to oscillate on a fixed pivot, links connecting said first mentioned levers and said third lever, and means operative to impart oscillatory motion to one of said first mentioned levers and to oscillate the other of said first mentioned levers through said third lever to operate said valves.

2. In an internal combustion motor, the combination with a pair of coaxial disk valves, of a pair of levers in fixed relation with said valves and of different lengths, a third lever connected with said first mentioned levers and arranged to oscillate on a fixed pivot, and reciprocating means operative to impart motion to one of said first mentioned levers whereby the other of said first mentioned levers will be moved to rotate said valves in opposed directions and at different speeds.

3. In an internal combustion motor, the combination of a pair of coaxial disk valves, a pair of levers of different lengths connected to a third lever and in fixed relation with said valves, reciprocating means operative to oscillate the shorter of said pair of levers and to move the longer of said pair of levers through said third lever to rotate said valves in opposite directions and at different speeds, and means operative to cause said valves to remain in relative stationary relation during a predetermined interval.

4. The combination in an engine comprising a port, of two valves operative to open or close said port, and means for reciprocating each of said valves, said last mentioned means comprising a pair of levers in fixed relation with said valves, a third lever operatively connected to said pair of levers, and means operative to reciprocate one of said pair of levers whereby said valves are caused to move in opposite directions to open or close said port.

In witness whereof, I have hereunto set my hand this 18th day of November A. D., 1911.

JOHN C. ENGLISH.

Witnesses:
A. I. GARDNER,
ALEXANDER PARK.