J. KELLY.

INTERNAL COMBUSTION ENGINE.

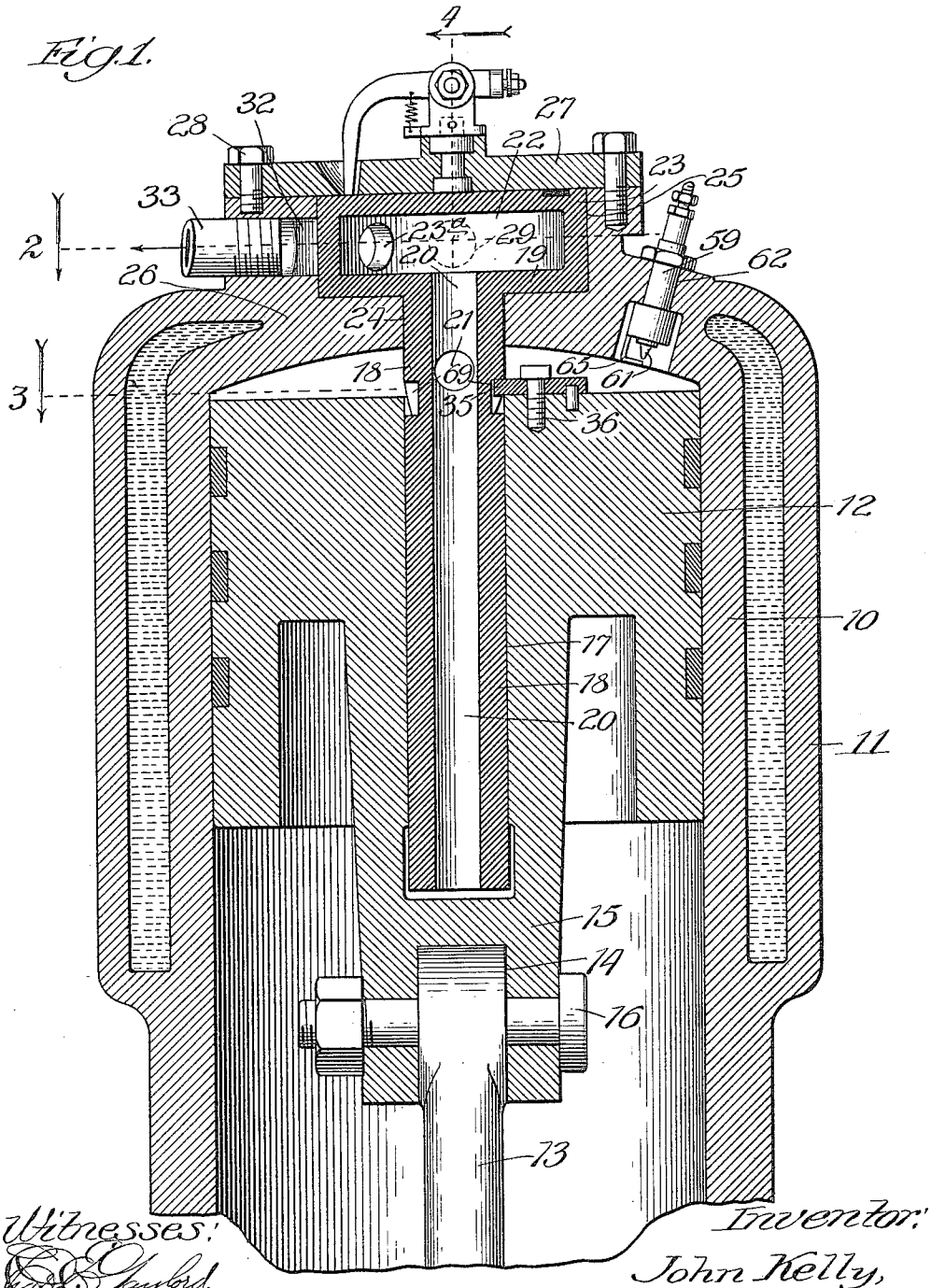
APPLICATION FILED JAN. 18, 1912.

1,045,560.

Patented Nov. 26, 1912.

3 SHEETS—SHEET 1.

Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 2.

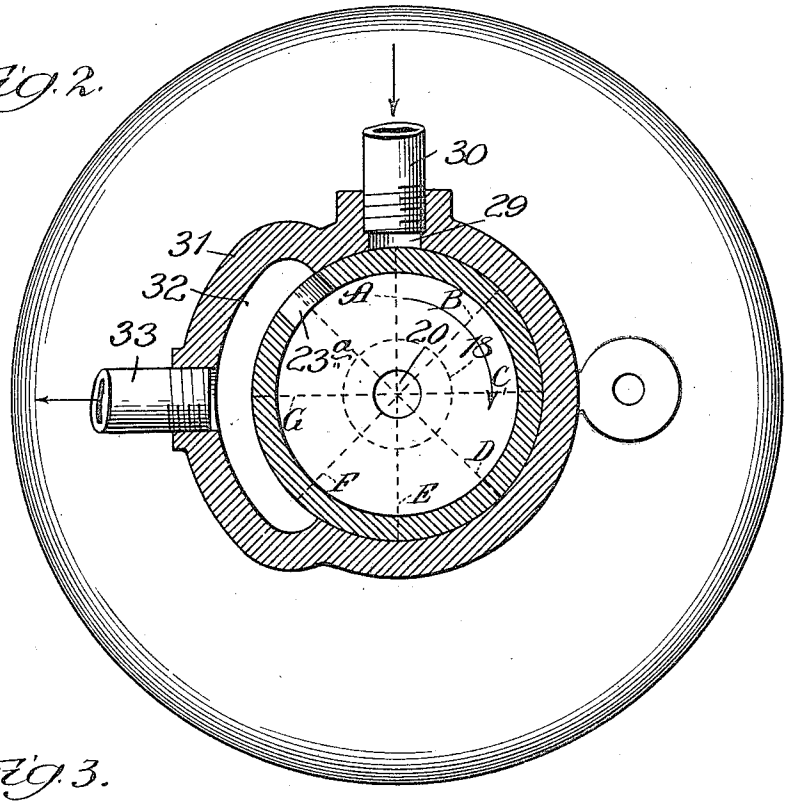
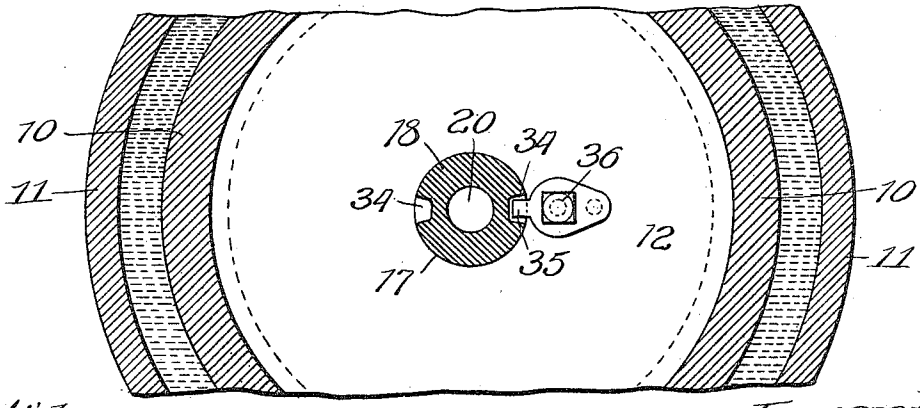


Fig. 3.



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3 SHEETS—SHEET 3.

Fig. 4.

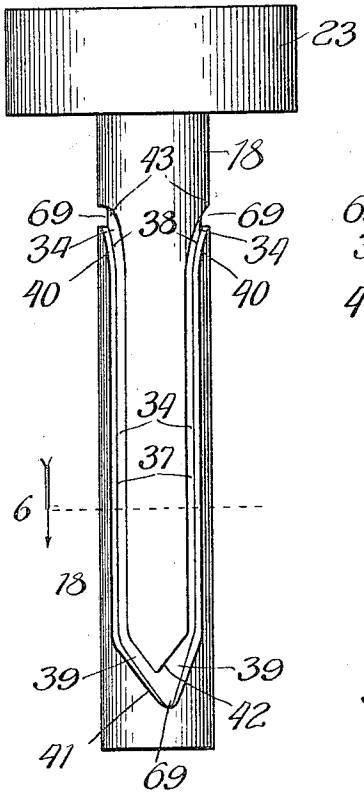


Fig. 5.

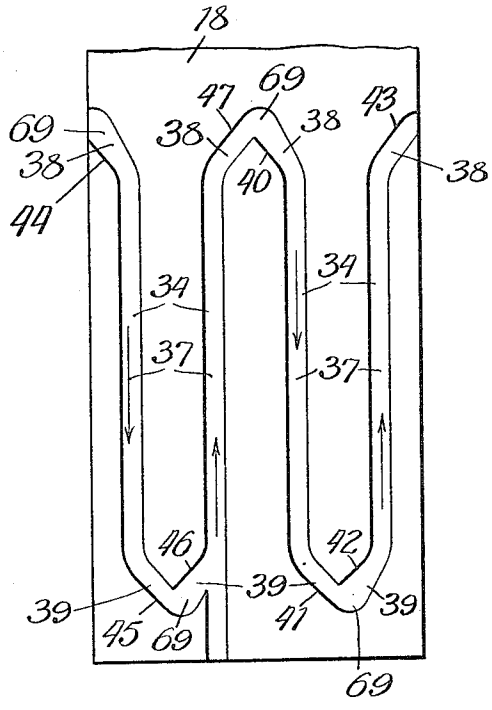
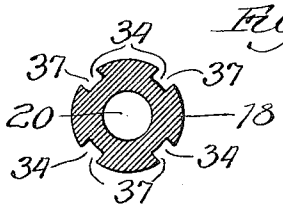


Fig. 6.



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UNITED STATES PATENT OFFICE.

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INTERNAL-COMBUSTION ENGINE.

1,045,560. Specification of Letters Patent. Patented Nov. 26, 1912.

Application filed January 18, 1912. Serial No. 671,808.

To all whom it may concern:

Be it known that I, JOHN KELLY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Internal-Combustion Engines, of which the following is a specification.

My object is to provide a novel and simple construction of valve-device and actuating means therefor for controlling, preferably both, the introduction of the explosive charges into the engine and the exhaust therefrom of the burned gases, which shall be positive in operation, not liable to become impaired, and shall dispense with the use of valve-springs, and the commonly employed cam-shaft mechanism and other devices necessary in prior constructions as usually provided, and to provide in connection therewith a simple and positively operating spark-timing device.

Referring to the accompanying drawings: Figure 1 is a view in vertical sectional elevation of the charging-end of a cylinder of an internal-combustion engine equipped with my improved valve-mechanism and a timing device; Figs. 2 and 3 are sections taken at the lines 2 and 3, respectively, on Fig. 1, and viewed in the directions of the arrows, Fig. 3 being partly broken. Fig. 4 is a view in elevation of the rotary valve of Fig. 1. Fig. 5 is a broken developed view of the stem of the valve of Fig. 4 showing the preferred form of the grooves therein for coöperation with the piston to actuate the valve; and Fig. 6, a section taken at the line 6 on Fig. 4 and viewed in the direction of the arrow.

In the drawings I have illustrated my improvements in connection with a cylinder of a 4-cycle, internal-combustion engine, but it will be understood that my invention is not limited to its embodiment in an engine of this type. A cylinder of the engine, the charging end-portion only of which is illustrated, is represented at 10 and is provided, as is commonly the practice, with a water-jacket 11. The piston of the cylinder is represented at 12 and is shown as connected with the connecting-rod 13 (a portion only of which is illustrated), in a manner to prevent axial turning of the piston in the cylinder, as by journaling the rod 13 in a recess 14 in an extension 15 on the piston as by a pin 16. The piston 12 contains a centrally-disposed bore 17 opening through its upper end, in which bore the stem 18 of a valve-device 19, is confined, the stem 18 preferably having journal fit in the bore 17 to permit the piston in its reciprocating movements to move freely with relation to said stem. The stem 18 contains a longitudinally-extending passage 20 which communicates between its ends, through an opening 21, with the interior of the cylinder 10 above the piston 12 therein, and opens at its upper end into a chamber 22 provided in the head 23 of the valve, a port 23^a in the head 23 opening therethrough into the chamber 22. The upper end of the stem 18 and the head 23 are journaled in openings 24 and 25, respectively, in the top 26 of the cylinder, the cylinder-top 26 being provided with a cap-plate 27, secured thereto, as by screws 28 and extending over the valve-head 23. The top 26 of the cylinder 10 contains a passage 29 which opposes the head 23 and communicates at one end with the opening 25 in which said head is journaled, a pipe 30, which, in practice, would lead from a carbureter (not shown), opening into the passage 29 at the other end of the latter. The cylinder-top 26 is provided with an enlargement 31 which contains an elongated arc-shaped recess 32 communicating with the opening 25 and opposing the valve-head 23, this recess, from which a pipe 33, extends, constituting the outlet for the burned-gases from the engine.

The valve 19, in the reciprocating movements of the piston, is adapted to be rotated thereby by progressive movements, to open the passage 29 to the chamber 22 and consequently to the interior of the cylinder above the piston therein, through the bore 20 and passage 21 for introducing the explosive charges into the cylinder for compression and firing, and to close the passage 29 and open the cylinder 10 above the piston to the exhaust passage 32 through the bore 20, passage 21, chamber 22 and port 23^a, a description of the preferred means for thus operating the valve 19 being as follows:—The stem 18 of the valve 19 is provided about its circumference with grooves 34, shown as four in number, which extend substantially longitudinally of the stem 18 and into which a finger 35, forming a striker, and secured to the top of the piston 12, as by a screw 36, extends. The grooves 34 in accordance with the illustrated em-

bodiment of my invention, and which are continuous about the stem 18 to form an endless channel in which the finger 35 operates, are formed of straight, longitudinally-extending sections 37 and deflected sections 38 and 39 at their upper and lower ends, respectively, and toward opposite ends of the stem 18, at which deflected sections adjacent ones of the grooves 34 intersect with each other as represented. The sections 38 and 39 of each groove 34 extend peripherally about the stem 18 in opposite directions as illustrated and afford cam-surfaces 40 to 47 inclusive with which the finger 35 successively engages in the reciprocations of the piston 12 for actuating the valve 19 as hereinafter described.

In assembling the valve 19 with the piston 12 the former is inserted into the bore 17, in the latter, the finger 35 entering a groove 68 opening into the adjacent one of the grooves 34.

The valve 19 in its movement rotates to the left in the drawings, the finger 35 in the reciprocatory movements of the piston 12 traveling in the grooves 34 in the directions indicated by the arrows in Fig. 9, and traveling in opposite directions in adjacent grooves 34, respectively.

Assuming that the piston 12 is in raised position (Fig. 1) in which case the finger 35 will extend into one of the grooves 34 at the uppermost end of the latter, and that the valve 19 is in such a position as to cause its port 23^a to be in the position illustrated in Figs. 1 and 5 in which it is in communication with the exhaust passage 32 and in which case the piston has finished its uppermost stroke to scavenge the cylinder 10, and the finger 35 extends into the groove-section 38 of which the cam-surface 40 constitutes a wall, downward movement of the piston will cause the finger 35 carried thereby to strike the cam-surface 40 and by the continued downward movement of the finger 35 against this cam, rotate the valve 19 substantially one-eighth of a revolution before the finger 35 engages with the straight section 37 of this groove. Thus turning the valve 19 will cause its port 23^a to be moved from the position illustrated in Fig. 5, to a position represented by the dotted line A in this figure in which it registers with the inlet 29 shortly after the piston 12 has started down on its suction-stroke, the suction in the cylinder produced by the downward movement of the piston sucking an explosive-charge from the carbureter through the pipe 30 into the cylinder 10 above the piston therein. As the piston 12 nears the limit of its suction-stroke, the finger 35 strikes the cam-surface 41 and turns the valve 19 to the left in Fig. 5 another one-eighth of a revolution in which the port 23^a will extend in the position represented by the dotted line B in Fig. 5, and as the piston 12 starts upward on its compression stroke the finger 35 striking the cam-surface 42 turns the valve 19 another one-eighth of a revolution to cause its port 23^a to extend in the position represented by the dotted line C in Fig. 5.

As the piston nears the end of its upward, compression-stroke the finger 35 strikes the cam-surface 43 and the valve 19 is again turned another one-eighth of a revolution to cause its port 23^a to extend in the position represented by the dotted line D in Fig. 5. The charge having been compressed in the cylinder 10 it is ready for firing, which may be accomplished by passing an electric current through the spark-plug represented at 59, secured in an opening 62 in the end of the cylinder and having the sparking terminals 61 and 65. The piston in its initial downward movement on the firing stroke causes the finger 35 to strike the cam-surface 44 which moves the valve 19 another one-eighth of a revolution thus bringing its port 23^a to a position represented by the dotted line E in Fig. 5, and when the piston nears the limit of its downward movement on the firing stroke the finger 35 strikes the cam-surface 45 and turns the valve 19 another one-eighth of a revolution which causes the port 23^a to be in the position represented by the dotted line F in Fig. 5, in which position of the valve the port 23^a is in communication with the exhaust passage 32 and burned gases under pressure escape from the cylinder 10 through the pipe 33. When the piston starts upwardly on the scavenging-stroke the finger 35 engages with the cam-surface 46 turning the valve 19 another one-eighth of a revolution to carry the port 23^a to the position represented by the dotted line G in Fig. 5, and as the piston nears the limit of its upward stroke the finger 35 engaging the cam-surface 47 turns the valve 19 to the position illustrated in Fig. 5, thus completing the cycle of operation. The next movement of the piston is downward on its suction stroke and the finger 35 by engaging with the cam-surface 40 causes the valve 19 to move to a position in which the exhaust 32 is closed to the cylinder and the inlet 29 opened thereto, the operations heretofore described continuing and the valve 19 making a complete rotation each time the engine performs a complete cycle of operations.

To provide for the proper positioning of the valve 19 at the ends of the complete strokes of the piston to insure the engagement of the finger 35 with the cam-surfaces 40 to 47, inclusive, in succession, I widen the grooves 34 at their ends as illustrated at 69, and thus the finger 35 in its final movements in opposite directions in striking against the cam-surfaces 41, 43, 45 and 47, will so move the valve 19 as to insure the engagement of

the finger 35 with the cam-surfaces 40, 42, 44 and 46 in succession and alternating with relation to the cam-surfaces 41, 43, 45 and 47.

The primary feature of my invention residing in the feature of producing rotation of the valve by the movement of the piston for effecting preferably both the introduction of the explosive charges into the engine and the exhaust therefrom of the burned gases, it will be manifest that the form of means for operating the valve may be varied as desired without departing from the spirit of my invention.

While I have illustrated and described my invention as embodied in a cylinder of an engine of the 4-cycle type in which embodiment the valve makes one complete rotation while the piston is making two complete reciprocations, I do not wish to be understood as intending to limit it to use under such conditions, or to its operation in the particular manner described as it may be used with other types of internal-combustion engines and its operation may be varied as rendered advisable, as will be manifest to those skilled in the art.

What I claim as new, and desire to secure by Letters Patent, is—

1. In an internal-combustion engine, the combination of a cylinder, a piston in said cylinder forming therewith a combustion-chamber, a ported valve-casing, a rotatable, hollow, valve journaled in said casing and extending through the end of said cylinder and into said combustion-chamber and piston, said valve containing ports communicating with said combustion-chamber and opening into said valve-casing, respectively, and means actuated by the movements of said piston for actuating said valve.

2. In an internal-combustion engine, the combination of a cylinder, a piston in said cylinder forming therewith a combustion-chamber, a ported valve-casing, a rotatable, hollow, valve journaled in said casing and extending through the end of said cylinder and into said combustion-chamber and piston, said valve containing ports communicating with said combustion-chamber and opening into said valve-casing, respectively, and means on said piston and valve operating when the piston is reciprocated to actuate said valve.

3. In an internal-combustion engine, the combination of a cylinder, a piston in said cylinder forming therewith a combustion-chamber, a ported valve-casing, a rotatable, hollow, valve comprising a chambered head journaled in said casing and a hollow stem extending through the end of said cylinder and into said combustion-chamber and piston, said stem communicating at its interior with the chamber in said head, said head and stem containing ports opening into said casing and into said combustion-chamber, respectively, and means actuated by the movements of said piston, for actuating said valve.

4. In an internal-combustion engine, the combination of a cylinder, a piston in said cylinder forming therewith a combustion-chamber, a ported valve-casing, a rotatable, hollow, valve comprising a chambered head journaled in said casing and a hollow stem extending through the end of said cylinder and into said combustion-chamber and piston, said stem communicating at its interior with the chamber in said head, said head and stem containing ports opening into said casing and into said combustion-chamber, respectively, and means operatively engaging with said stem and actuated by the movements of said piston, for actuating said valve.

5. In an internal-combustion engine, the combination with its cylinder and piston therein, of a rotary valve-device comprising a chambered head and a chambered stem journaled in and extending through the end of the cylinder, the chambers of said head and stem communicating with each other, said stem extending into said piston, the chamber of said valve-head containing a port adapted, when the valve is actuated, to be brought into registration, successively, with the source of supply of explosive-charges and with the exhaust, a port in said valve-stem communicating with the interior of said cylinder, and means, timed with the actuation of said piston, for actuating said valve-device.

6. In an internal-combustion engine, the combination with its cylinder and piston therein, of a rotary valve-device comprising a chambered head and a chambered stem journaled in and extending through the end of the cylinder, the chambers of said stem and head communicating with each other, and said stem extending into said piston, the chamber of said valve-head containing a port adapted, when the valve is actuated, to be brought into registration, successively, with the source of supply of explosive-charges and with the exhaust, and the chamber in said valve-stem communicating with the interior of said cylinder, and means actuated by the movements of said piston for actuating said valve.

JOHN KELLY.

In presence of—
A. U. THORIEN,
R. A. SCHAEFER.