T. J. SHANAHAN.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED AUG. 19, 1908.

968,274. Patented Aug. 23, 1910.

2 SHEETS—SHEET 1.

Fig. 1.

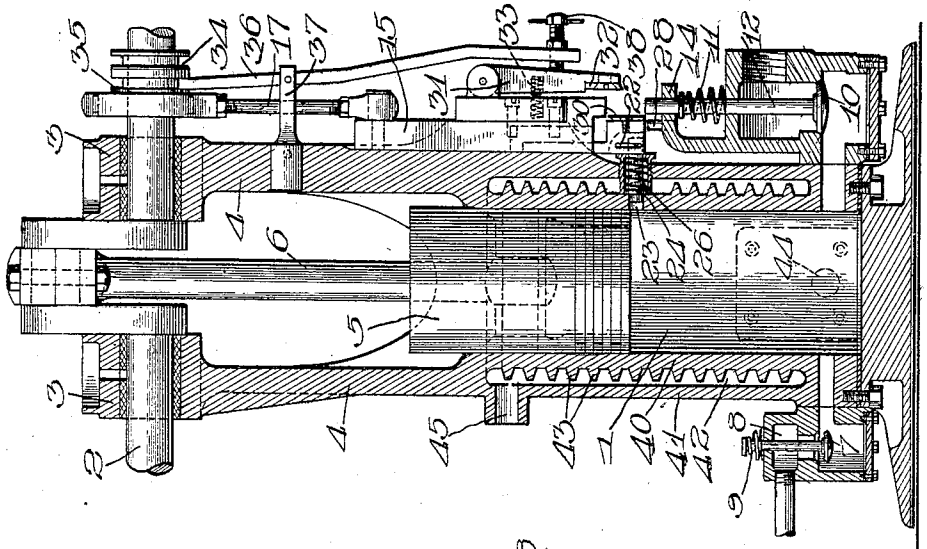


Fig. 2.

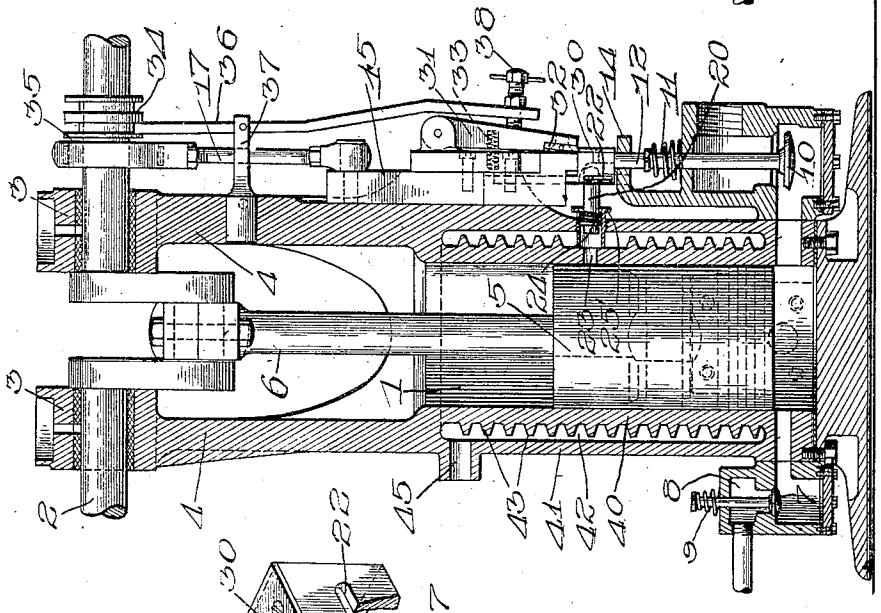
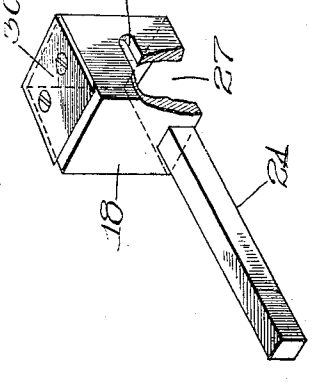


Fig. 7.



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2 SHEETS—SHEET 2.

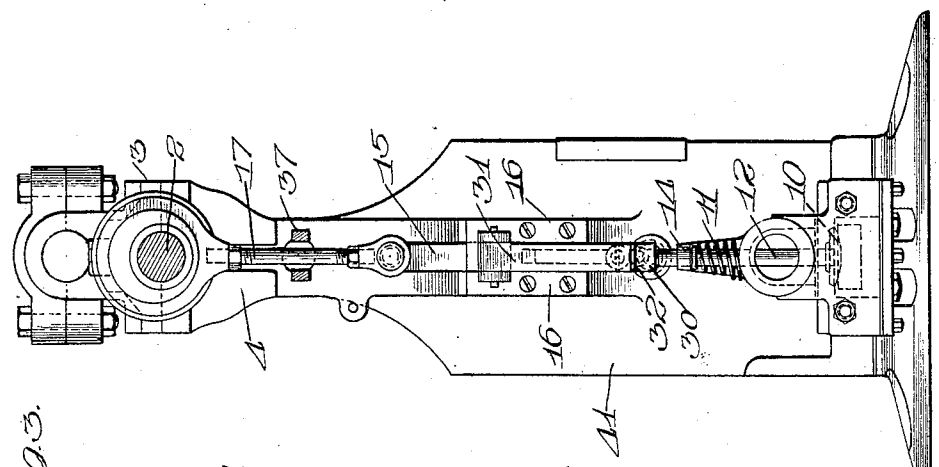


Fig. 3.

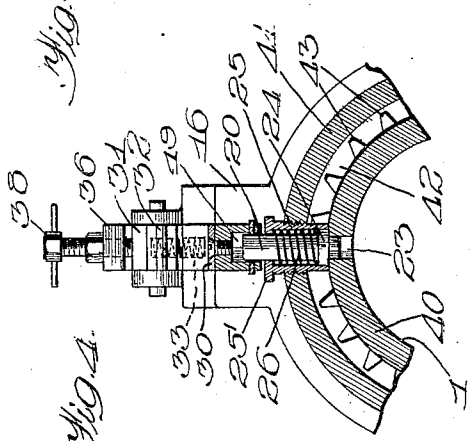


Fig. 4.

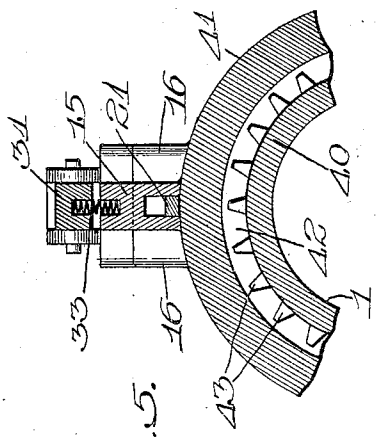
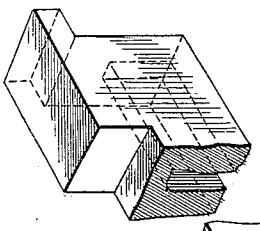


Fig. 5.



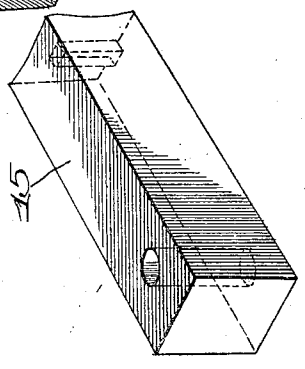


Fig. 6.

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UNITED STATES PATENT OFFICE.

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INTERNAL-COMBUSTION ENGINE.

968,274. Specification of Letters Patent. Patented Aug. 23, 1910.

Application filed August 19, 1908. Serial No. 449,322.

To all whom it may concern:

Be it known that I, TIMOTHY J. SHANAHAN, a citizen of the United States, residing at Elkhart, in the county of Elkhart and State of Indiana, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a description.

My invention relates to that class of devices known as internal combustion engines, and particularly to the mechanism for controlling the escape of the products of combustion, and the cooling of the cylinder walls.

The object of my invention is to produce a simple, convenient, durable, and reliable device of the kind described, avoiding as far as possible all complicated valve mechanism and mechanism for cooling the cylinder walls.

To this end my invention consists in the novel construction, arrangement, and combination of parts herein shown and described, and more particularly pointed out in the claims.

In the accompanying drawings, wherein like or similar reference characters indicate like or corresponding parts; Figure 1 is a vertical diametrical section of my improved internal combustion engine. Fig. 2 is a similar view showing the valve operating mechanism in a different position. Fig. 3 is a partial side elevation of my engine with parts removed and broken away to more clearly show the construction. Fig. 4 is a section taken substantially on line 4—4 of Fig. 1. Fig. 5 is a section taken substantially on line 5—5 of Fig. 1. Fig. 6 is a perspective detail of the reciprocating valve actuating slide of my engine. Fig. 7 is a perspective detail of the valve controlling block.

In the drawings my improvements are shown as forming parts of what is commonly known as a four cycle internal combustion engine or motor, or one in which a charge of combustible is drawn into the cylinder of the motor at each alternate rotation of the crank shaft.

As shown 1 is the cylinder of the motor, 2 the crank shaft supported in suitable bearing 3—3 connected to the cylinder 1, by the usual frame members 4—4. A piston 5 of the usual or any preferred form is fitted in the interior of the cylinder 1 and connected to the crank shaft by means of a suitable connecting rod 6 in substantially the usual manner.

Any desired form of valve mechanism may be provided to control the admission of the combustible to the cylinder and the exhaust of the spent gases from the cylinder. In the form shown the admission valve 7 consists merely of a check valve of suitable form preferably provided with a spring 9 or other suitable means to normally hold the valve closed. The valve 7 is positioned in a passage 8 between the source of supply of the combustible and the cylinder of the motor and adapted to be automatically operated by the reduction of the pressure within the cylinder to less than the pressure upon the supply of the combustble, thus simultaneously opening the valve 7 and injecting a charge of the combustible into the combustion space in the cylinder at each suction or admission stroke of the piston.

In the form shown the exhaust valve 10 is similarly constructed except that it is provided with a spring 11 considerably stronger than the spring 9 of the admission valve and the stem 12 of the valve is extended and provided with a guide 14 or other suitable means to assist in directing its movements and position.

Suitable means are provided to mechanically operate the valve 10 to permit of the escape of the spent gases after each explosion, and retain the valve open a sufficient time to permit of the free escape of all spent gases from the cylinder. As shown a slide 15 is provided upon the frame of my device arranged to move longitudinally between suitable guides or ways 16—16 of any suitable form. The slide 15 is connected by a rod 17 or equivalent means to an eccentric or other suitable mechanism upon the crank shaft 2 adapted to reciprocate the slide one complete stroke at each rotation of the crank shaft 2 preferably moving the slide isochronously with the piston 5. A portion of the slide 15 adjacent the end of the stem 12 is preferably in axial alinement with the stem 12 and slightly spaced therefrom when the slide is at the limit of its movement toward the stem, so that normally the slide reciprocates in a direction to open the valve against the pressure of the spring 11 but without at any time coming into actual contact with the valve stem.

Any suitable means may be provided to coöperate with the slide 15 to operate the valve. In the form shown a distance piece or member 18 is provided normally out of the path of the slide 15 adapted to be moved transversely into the space between the end of the slide and the stem 12 so that the movement of the slide will cause a corresponding movement of the valve 10. The member 18 may be of any suitable form or size and provided with any desired means for controlling its movements and position. As shown the member 18 is merely a rectangular block provided with a recess 19 at one side adapted to receive the end of a plunger 20 to control its transverse position, and with a stem or shank 21 to prevent its turning and to control its position laterally. A suitable recess is provided at the back of the slide 15 adapted to receive the shank 21 and loosely hold the member against the movements above described.

Any desired means may be provided to control the transverse position of the block 18. As shown the plunger 20 is provided at one end with projecting trunnions upon its opposite sides adapted to engage slots 22—22 formed in the opposite walls of the recess 19 to pivotally connect the member 18 transversely of the plunger. The opposite end of the plunger 20 is fitted to a suitable opening 23 in the wall of the cylinder 1, so that the pressure within the cylinder may act upon the exposed end of the plunger and tend to force the same outward when the piston 2 has reached a position in its travel to expose the opening 23 to the pressure of the motive fluid in the cylinder.

Suitable means are preferably provided to resiliently maintain the plunger 20 at the inner limit of its movement and to limit its travel. As shown, a collar 24 is provided upon the plunger adapted to engage the cylinder wall and limit the inward movement of the plunger.

A socket 25 of suitable size to receive the collar 24 and having a cap 25′ with an opening therethrough fitting the plunger 20 at a point between the collar 24 and the point of attachment of the member 18 is secured to the cylinder walls in any suitable manner, as for example, by threading the exterior of the socket and forming the opening in the cylinder wall to coöperate with the threaded portion of the socket to securely hold the same in position. A spring 26 or equivalent means is preferably positioned in the socket 25 between the cap 25′ and the collar 24 with one end bearing against the collar 24 and the other against the cap 25′ tending to resiliently force the collar 24 against its seat upon the cylinder wall and the plunger 20 to the inner limit of its movement.

In operation the first movement of the piston crank toward the crank shaft draws a charge of the combustible into the cylinder, which is compressed by the return movement of the piston and ignited by any suitable mechanism (not shown) when the piston reaches the limit of its movement from the crank shaft, the pressure produced by the explosion supplying the power to again move the piston toward the crank shaft. When the piston has reached a point where the end of the plunger 20 is exposed to the pressure within the cylinder the plunger moves outward positioning the member 18 between the reciprocating slide 15 and the end of the valve stem 12 so that as the slide 15 moves toward the valve stem 12, that is, away from the crank shaft, the valve 10 is opened permitting the spent gases to escape from the cylinder as the piston again moves away from the crank shaft.

In the form shown, to insure the full opening of the valve 10 and prevent the member 18 from moving out of its position between the valve stem 12 and the slide 15 before the completion of the stroke of the piston, thus imprisoning a portion of the gases within the cylinder, a recess 27 is provided in the member 18 next the cylinder, and a pin 28 or equivalent means is rigidly attached to a stationary portion of the mechanism, as for example, the guide 14, in position to enter the recess, so that when the member 18 is forced outward to operate the valve as above described the recess 27 will be positioned in line with the pin 28 and as soon as the member 18 is moved to open the valve, the pin 28 enters the recess and prevents the member from moving from its position between the slide 15 and valve stem 12 until the slide 15 has completed its stroke and returned to nearly the end of its travel toward the crank shaft again, that is, to the point farthest from the valve stem, where the member 18 is again free to return to its normal position, out of the path of the slide 15.

When it is desired to automatically control the speed of the motor the usual or any suitable form of governing mechanism may be provided to control the operation of the valve 10 or other suitable portions of the mechanism to control the number or force of the explosions in the cylinder. The preferred arrangement however is to hold the valve 10 permanently open when the crank shaft is rotating above its normal speed so that the pressure upon the interior and exterior of the cylinder may be equalized through the exhaust opening and when so equalized no fresh charge of combustible will be drawn into the cylinder until the speed has fallen below normal and the valve 10 is released. Any suitable means may be provided for this purpose. In the form shown a plate 30 is rigidly attached to the outer face of the member 18 with the end

adjacent the slide 15 beveled toward the member 18 to form a notch. An arm 31 is pivotally mounted upon the ways 16 with a plate 32 upon its free end having a beveled portion adapted to coöperate with the beveled portion of the plate 30 to interlock therewith and prevent the disengagement of the arm from the member 18 at all times except when the slide 15 engages the member 18 and moves it longitudinally out of engagement with the arm 31. A spring 33 is provided to normally hold the arm 31 away from the block and out of engaging position.

Any suitable means may be provided to force the free end of the arm 31 downward to engage the member 18 when the speed of the engine reaches the desired limit. In the form shown a collar 34 provided with a groove 35 is mounted upon the crank shaft 2 and adapted to be moved longitudinally thereof by suitable mechanism of the usual or any preferred construction (not shown) controlled by the speed at which the crank shaft is rotated. A lever 36 is pivotally mounted upon a projecting bracket 37 upon the frame 4 with one end engaging the groove 35 of the collar 34 and the opposite end adapted to press against the lever 31 and thus force its free end inward, so that a movement of the collar 34 longitudinally of the shaft will force the end of the lever 31 into a position to engage the plate 30 upon the member 18 as shown in Fig. 2. A screw 38 or other suitable means is preferably provided in the end of the lever 36 to engage the arm 31 so that the relative movements of the collar 34 and arm 31 may be adjusted to vary the normal speed of the motor within certain limits. When the above described movement occurs it is obvious that the valve 10 will be held open until the movement of the collar 34 upon the crank shaft 2 releases the arm 31 when the next movement of the slide 15 forces the member 18 out of engagement with the arm thus permitting the member 18 and valve 10 to move to their normal position the slide 15 and associated parts operating as heretofore described.

Suitable means are preferably provided for maintaining the cylinder 1 at a proper temperature. As shown the cylinder consists of an inner wall 40 and an outer wall 41 suitably spaced from each other, rigidly and continuously connected near the end of the cylinder to form an annular chamber 42 about the cylinder. In the preferred construction, a plurality of projections, fingers or spines 43 are formed upon and integral with, the inner wall 40, projecting into the chamber 42 to increase the radiating surface of the wall 40 and to dissipate the heat therefrom.

In the preferred construction suitable means of the usual or any preferred construction are provided (not shown) for circulating a cooling medium such as air, or water through the chamber 42 to carry away the heat from the projections 43. As shown the cooling fluid is introduced into the chamber 42 at an opening 44 near the lower end of the cylinder and permitted to escape at an opening 45 near the opposite end of the cylinder.

In the foregoing specification only the preferred form of my invention is shown and described, and it is obvious that various immaterial modifications may be made in my improvement without departing from the spirit of my invention, hence I do not wish to be understood as limiting myself to the exact form and construction shown.

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

1. In an internal combustion engine, the combination with the cylinder, piston and main shaft thereof, of a member reciprocated from the main shaft of the engine, a valve and stem, a transversely moving plunger operated by the pressure within the cylinder, a filling block adapted to be moved by said plunger into position between the reciprocating member and the valve stem, a governor controlled member for engaging said filling member, and spring means normally tending to retract said plunger.

2. In an internal combustion engine, the combination with the cylinder, piston and main shaft thereof, of a member reciprocated from the main shaft of the engine, a valve and stem, a transversely moving plunger operated by the pressure within the cylinder, a filling block adapted to be moved by said plunger into position between the reciprocating member and the valve stem, and a governor controlled member for engaging said filling member, said filling member having an extension which is slidably mounted in a groove formed in the reciprocating member.

3. In an internal combustion engine, the combination with a cylinder, a piston, a connecting rod and crank shaft, of a spring actuated exhaust valve, a slidably mounted reciprocatory member actuated from the crank shaft of the engine, a plunger actuated by the pressure in the engine cylinder, when the piston reaches its outward limit of movement, a filling member carried by said plunger and adapted to be moved toward said reciprocatory member and the stem of the exhaust valve, and a fixed member carried by the engine frame which engages said filling member to hold it in this latter position until the reciprocatory member is retracted to a predetermined degree.

4. In an internal combustion engine, the combination with a cylinder, a piston, a connecting rod and crank shaft, of a spring ac-

tuated exhaust valve, a slidably mounted reciprocatory member actuated from the crank shaft of the engine, a plunger actuated by the pressure in the engine cylinder, when the piston reaches its outward limit of movement, a filling member carried by said plunger and adapted to be moved toward said reciprocatory member and the stem of the exhaust valve, a fixed member carried by the engine frame which engages said filling member to hold it in this latter position until the reciprocatory member is retracted to a predetermined degree, and governor controlled means for engaging said filling member to hold it in position between the reciprocatory member and the exhaust valve stem.

In testimony whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

TIMOTHY J. SHANAHAN.

Witnesses:
L. A. DENNERT,
SIDNEY SWIGERT.