H. P. TIPPETT.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED DEC. 18, 1911.

1,234,969.

Patented July 31, 1917.

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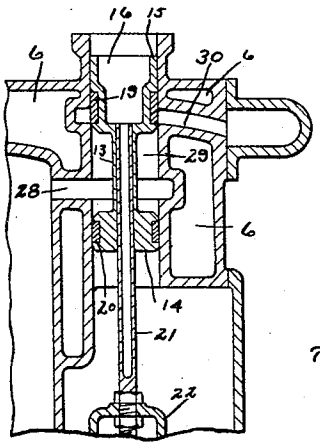

Fig. 2.

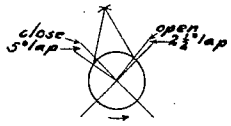

Fig. 9.

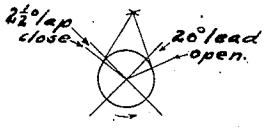

Fig. 10.

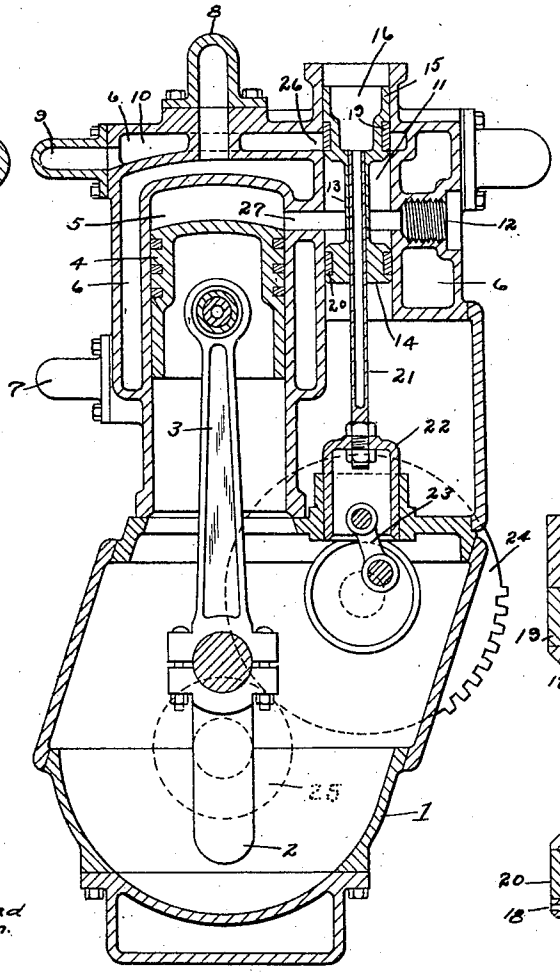

Fig. 1

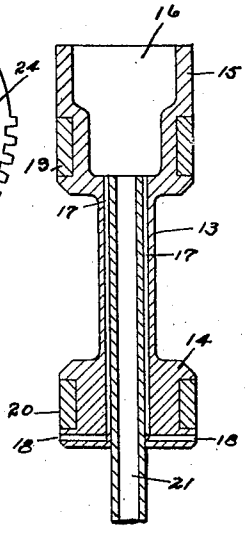

Fig. 3.

Witnesses

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2 SHEETS—SHEET 2.

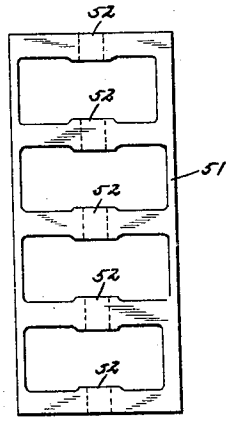

Fig. 5

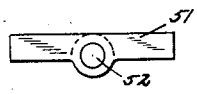

Fig. 6

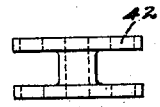

Fig. 7.

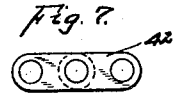

Fig. 8.

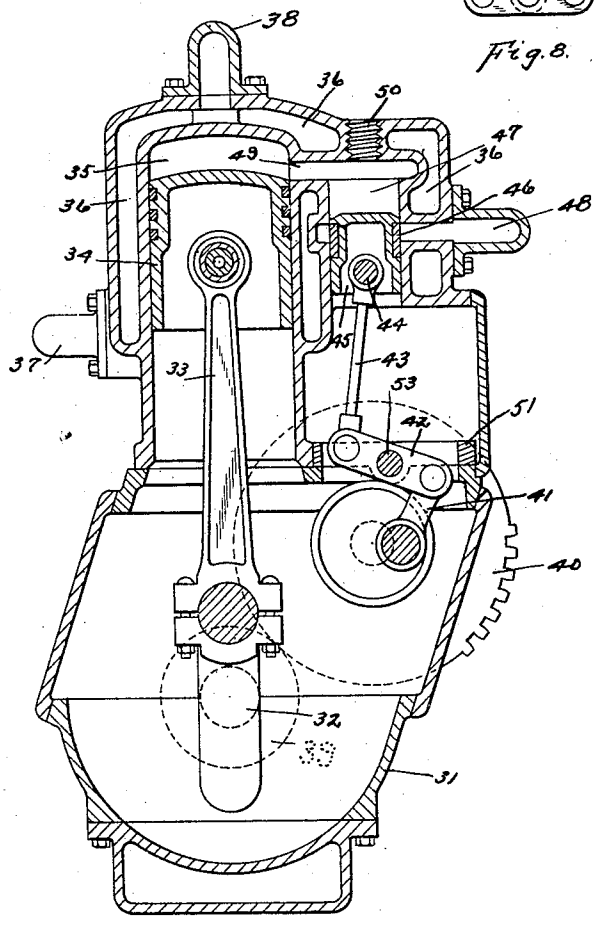

Fig. 4.

Witnesses

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UNITED STATES PATENT OFFICE.

HAROLD P. TIPPETT, OF COLUMBUS, OHIO.

INTERNAL-COMBUSTION ENGINE.

1,234,969. Specification of Letters Patent. Patented July 31, 1917.

Application filed December 18, 1911. Serial No. 666,605.

To all whom it may concern:

Be it known that I, HAROLD P. TIPPETT, a citizen of the United States, residing at Columbus, in the county of Franklin and State of Ohio, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

My invention relates to internal combustion engines and it is particularly designed as an improvement in the valve structure of internal combustion engines of such a nature that the one well-known weak point hitherto common to all engines of this type, will be entirely done away with. One of the many difficulties with internal combustion engines has been the utilization of puppet valves and consequent uncertainty of action at comparatively high rates of speed.

In the first place, the puppet valves are extremely liable to warping and distortion and this results inevitably from several causes. In order to obtain the highest efficiency of an engine, it is necessary that the controlling valves for the inlet and outlet passages be as large as possible, so as not to restrict the passage of the gases. This provision of comparatively large valves is, however, subject to one vital consideration and that is that increasing the size of the valve, necessarily increases the difficulty of maintaining the valves comparatively cool by induction. On the other hand, when the valve is made comparatively small, it is more readily cooled, but at the same time, it is subject to the ever present danger due to the "wire drawing" effect caused by the decreased size of passage for the gases and the consequent increase of the average pressure thereof.

In addition to these draw-backs common to the ordinary puppet valve, they are further liable to warping and distortion because of their pounding both under the pressure of their springs and under the jarring actions of the cams and driving mechanism therefor. As a matter of fact, the whole engine is continually subjected to weakening jars due to these puppet valves and this jarring action is particularly deleterious to the continued and faithful operation of the valves. In order to appreciate this, it may be noted that the ordinary two inch valve must be continually subjected to the pressure of a sixty pound spring and when this spring is overcome, there is bound to result a return hammering pressure of a very appreciable force. The unequal pressures to which the controlling cams are subjected and which are in turn transmitted to the gear mechanism of the engine must necessarily vary with great rapidity comprising a number of blows in the neighborhood of sixty pounds pressure, more or less, dependent upon the friction.

My invention aims to provide an improvement in gas engines of such a type that the inlet and outlet passages for the gases need not be restricted in size and in which the valves controlling the same are in turn controlled and operated by positively operable means directly under the control of the piston. In the production of an operative and efficient structure of the type noted, it is extremely essential that the valves be subjected to no pressure upon their sides from the gases within the cylinder, or from the products of combustion. The prime draw-back in other structures attempting to produce a positively driven valve, has hitherto been the danger and liability that the packing rings upon the sides thereof will be destroyed by contact with these gases. Therefore, my invention primarily resides in the provision of positively driven valves in the nature of small sized pistons which are so operated as to preclude the passage of the same over the ports of the cylinders, thereby maintaining the packing rings entirely out of direct contact with the heated gases. In effecting this result, my valves at all times present their ends to the compression and explosive forces and operate under substantially identical conditions with the main pistons of the engine.

I find it extremely desirable and in fact practically essential in the utilization of my improved type of valve, to cause the same to open and close the inlet and exhaust ports on that portion of the valve shaft travel forming a convex arc.

My improvement may be embodied in various forms, but I desirably utilize one of the two distinct types shown in the drawings, that is, plain piston valves and double or balanced piston valves. In the use of balanced piston valves, a practically direct drive may be effective, whereas in the use of the plain valves and in order to secure opening upon the convex arc of travel of the valve shaft, it is necessary to interpose a lever element.

In the further description of my invention, it will be apparent that I have provided a structure of engine wherein the controlling valves are of such a form and may be so located as to be subjected to a maximum inductive effect of the cooling water in the water jackets utilized. This inductive effect is practically independent of the size of the valves.

The preferred embodiments of my invention are shown in the accompanying drawings, in which similar characters of reference designate corresponding parts, and in which—

Figure 1 is a vertical transverse section of my improved engine showing the application of a double or balanced valve thereto as an inlet valve,

Fig. 2 is a section in detail of the valve chamber and double or balanced valve controlling the exhaust,

Fig. 3 is a detail view of the double or balanced valve utilized by me,

Fig. 4 is a vertical transverse section of an internal combustion engine with my plain valve applied thereto and controlling the inlet, it being understood that the exhaust valve is substantially identical,

Fig. 5 is a detail view of a casting desirably utilized by me and forming a shaft support for an intermediate leverage link enabling me to cause the valve to open on the convex arc as hitherto described,

Fig. 6 is an end elevation of the structure shown in Fig. 5,

Fig. 7 is a plan of the intermediate leverage element detached.

Fig. 8 is a side elevation of the element shown in Fig. 7,

Fig. 9 is a diagrammatic view showing the path of travel of the valve shaft and showing the approximate time of the period of opening with relation to the valve shaft travel and upon the convex arc of such travel, and,

Fig. 10 is a diagrammatic view showing the path of travel of the exhaust valve shaft and the period in the travel circle during which the exhaust port is open, likewise upon the convex arc of such travel circle.

In the preferred embodiment of my invention, the engine is shown as comprised of a casing 1, crank shaft 2, piston rod 3, piston 4 and cylinder 5. The cylinder 5 is desirably surrounded by a water jacket 6 having an inlet at 7 and an outlet at 8 and at its upper end is preferably constructed with supplemental inlet passages 9 and 10 for the fuel and leading across and around the outlet 8 to a tubular valve chamber 11.

The valve chamber structure 11 is desirably apertured as at 12 for the insertion of a spark plug (not shown).

The valves for controlling the inlet and exhaust are substantially identical as shown in Figs. 1 and 2 and will therefore be described simultaneously. They each comprise a formation 13 of a cylindrical nature and having at its extremity enlarged pistons 14 and 15. The upper piston 15 is desirably recessed or socketed as at 16 for the continual reception of a lubricant which is fed therefrom down through the formation 13 by ports 17 to radial ports 18 in the piston 14. The pistons 14 and 15 are each provided with annular channels for the reception of packing rings 19 and 20 and the entire piston or valve structure is mounted upon the tubular rod 21 which is in turn connected to a casting 22 driven by a crank 23 ultimately controlled by a two to one gearing as at 24 and 25, the latter being mounted upon the crank shaft 2.

In this construction of my invention, it will be apparent that the gas is fed in through the passages 9 and 10 and when the valve or balanced piston moves upwardly, passes through the port 26 and into the inlet port 27. In this passage between these two last named ports, the piston is balanced by the effect of the fuel, so that the positive drive of the piston valve is rendered comparatively easy because of its freedom from pressure from within the cylinder and in no particular direction. When the gases are exhausting they pass from the port 28 into the valve chamber 29 and through the exhaust ports 30, being at all times actively exchanging heat with the walls within which they come in contact. The operation is substantially the same in the effect had upon the double or balanced piston valve for the exhaust and it need only be noted that the sides of the cylindrical members upon the piston valve, are never in alinement with the ports 27 and 28 of the cylinder and consequently are never subjected to the direct effect of the heated gases. The gases passing through the port 26 are not such as to materially injure the valve by destroying the packing thereof as they are comparatively cool and under no pressure, being drawn through the ports by suction of the piston. In addition, these gases are vaporized in their passage across the upper end of the cylinder. The force of compression and explosion within the cylinders is only effective upon the opposing faces of the double or balanced piston valve and can therefore have no deleterious effect upon the packing rings thereof.

The modified form of my invention is shown in Figs. 4, 5, 6, 7 and 8 and resides primarily in the valve structure and the structure of chamber therefor. The engine desirably comprises a casing 31, a crank shaft 32, a piston rod 33, a piston 34, a cylinder 35 with a water jacket 36 and with inlet and outlet passages for the water jacket shown at 37 and 38.

The crank shaft 32 is desirably provided with a gear 39 operating a complemental gear 40 driving a crank arm 41 pivotally connected at its outer extremity to a lever arm 42. This lever arm 42 is shown best in Figs. 7 and 8 and is desirably constructed for pivotal connection of the lever arm 41 as described and for the pivotal connection of the piston or valve stem 43, which is in turn pivoted as at 44 to the plain piston 45 with an annular packing ring 46 carried upon its side in a channel provided therefor. The valve or piston 45 operates in a valve chamber 47 having a fuel inlet 48 and a fuel admission port 49. There is also provided a threaded aperture 50 for the reception of a spark plug, not shown. The exhaust valve and the chamber therefor, is substantially identical with the inlet valve and its chamber.

In this structure described, it will be understood that the interposition of the intermediate lever 42 serves to permit the valve or piston to uncover its supply port upon the convex arc of its driving shaft and thereby attain the comparatively lengthy opening desired. The forces of compression and explosion have direct access to the piston or valve 45, but are at no time directed against the packing rings in the side of the same.

In the efficient support of the intermediate lever mentioned, I desirably utilize a casting 51 affording a plurality of bearings 52 for a shaft 53.

It will be observed that I have provided an extremely simple structure wherein the valves are positively driven and open upon the convex arc of travel of their driving shafts, being at all times removed from direct contact of their packing rings and sides with the explosive and compression forces.

What I claim is—

In an internal combustion engine, the combination with a cylinder having inlet and exhaust ports located in the upper side wall thereof, of a vertically disposed inlet valve spaced from said cylinder, said valve comprising oppositely arranged pistons adapted to simultaneously reciprocate vertically, a valve chamber for said inlet valve having an inlet port at one end thereof and an outlet port below said inlet port adapted to register with the inlet port of the cylinder between the oppositely disposed pistons of the inlet valve, an exhaust valve vertically disposed and spaced from the cylinder, said exhaust valve comprising oppositely arranged pistons adapted to simultaneously reciprocate vertically, a valve chamber for said exhaust valve having an outlet port at the upper end thereof and another port communicating with the exhaust port of the cylinder located below the said outlet port and between the oppositely disposed pistons of the exhaust valve, and a guide connected to each of said inlet and exhaust valves for vertically alining the aforesaid valves.

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

HAROLD P. TIPPETT.

Witnesses:

WALTER E. L. BOCK,

A. L. PHELPS.