Jan. 18, 1938. J. W. JENKINS 2,106,099

PISTON VALVE ENGINE

Filed May 18, 1934 3 Sheets-Sheet 1

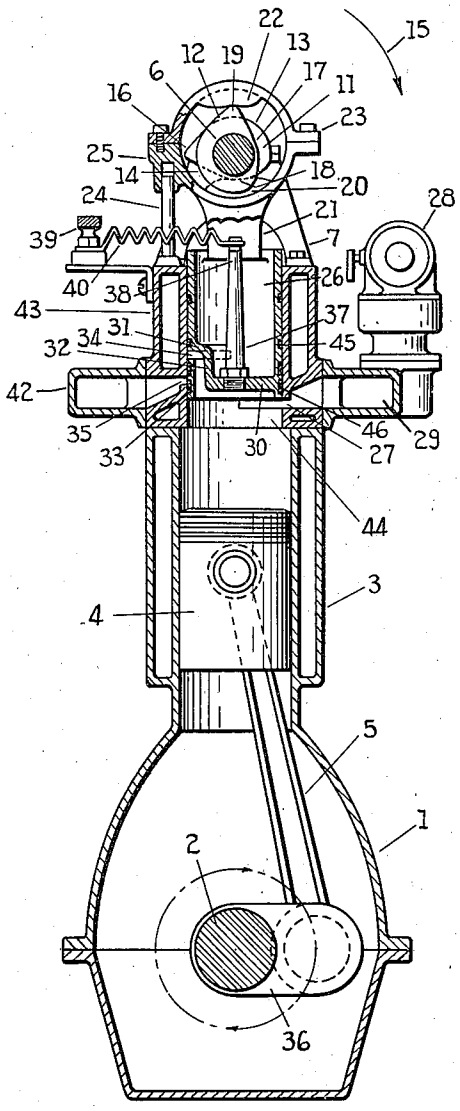


FIG. 1

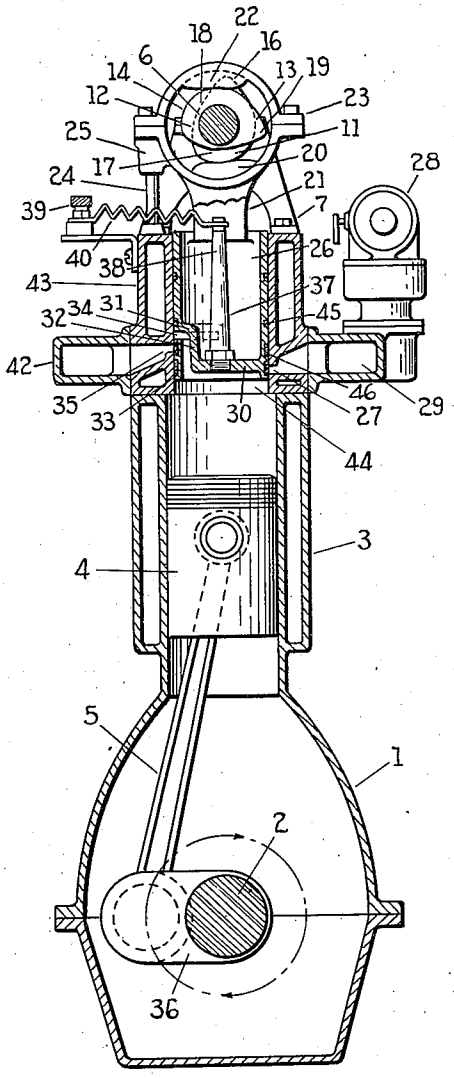


FIG. 2

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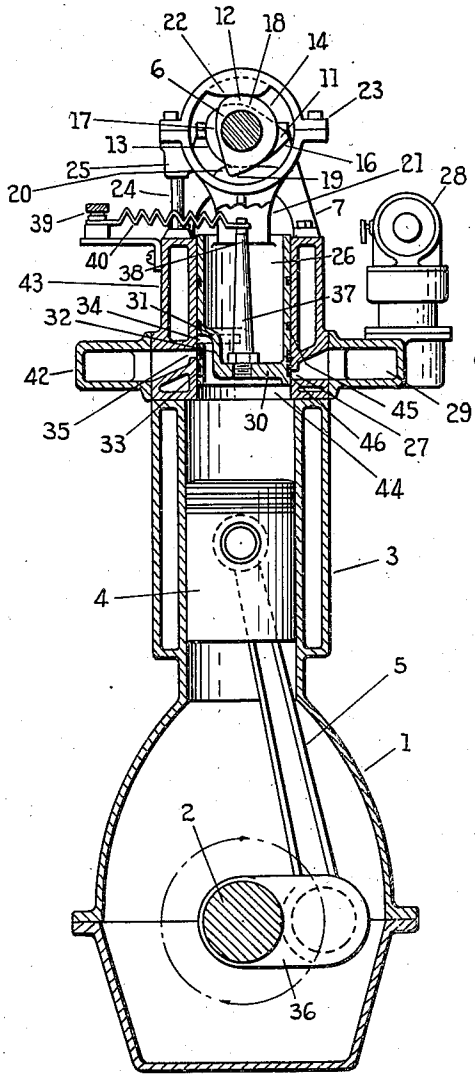


FIG. 3

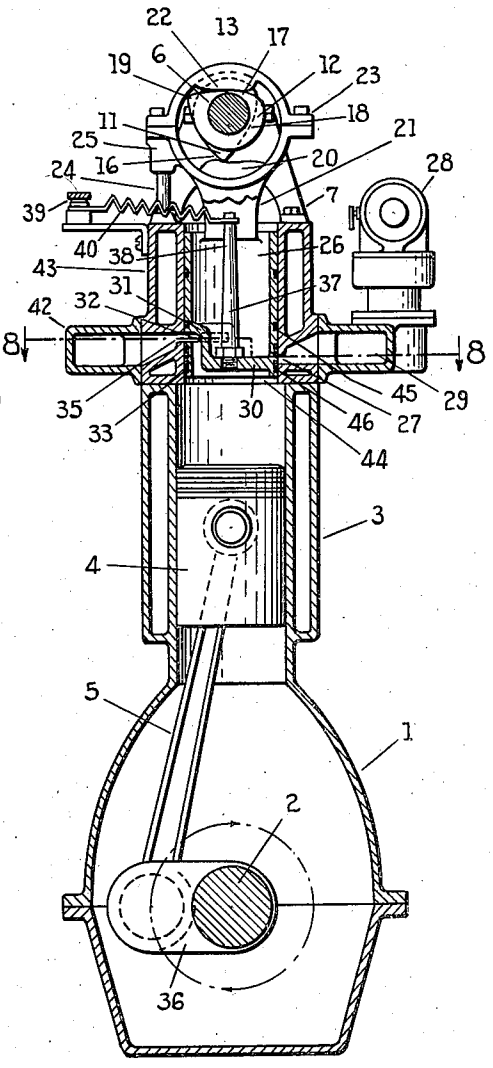


FIG. 4

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PISTON VALVE ENGINE

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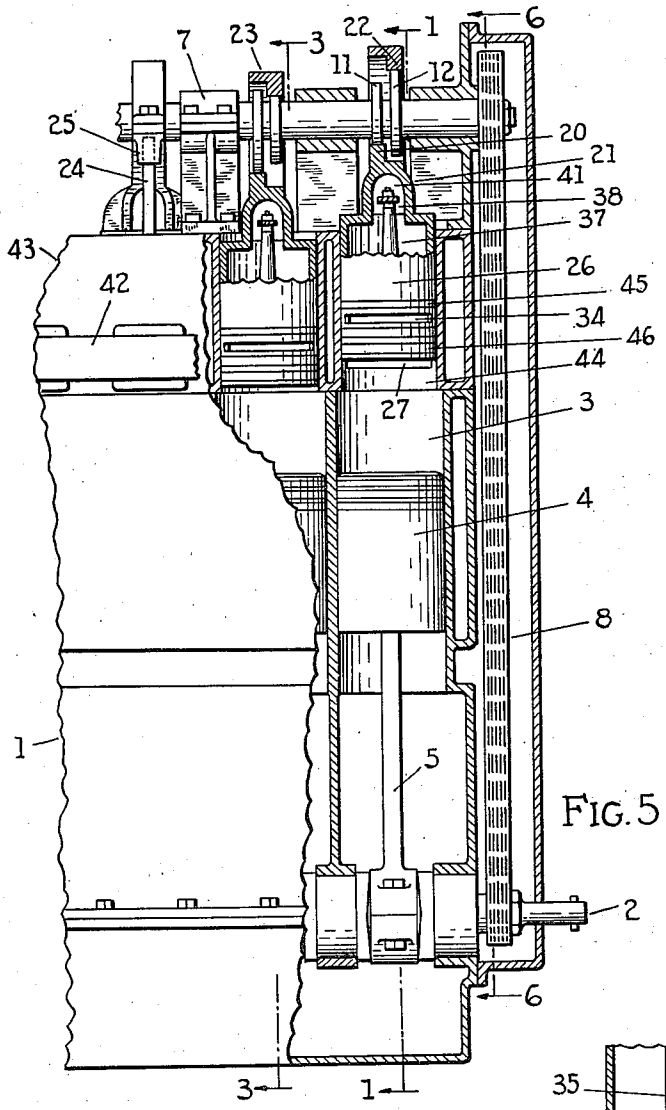


FIG. 5

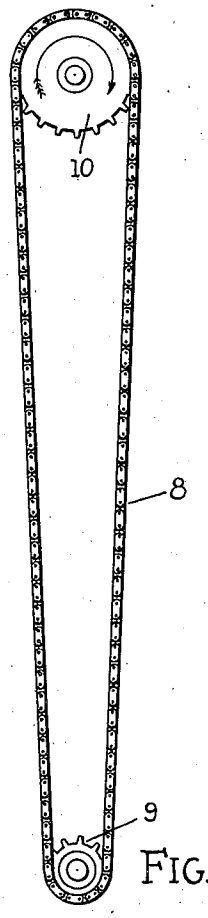


FIG. 6

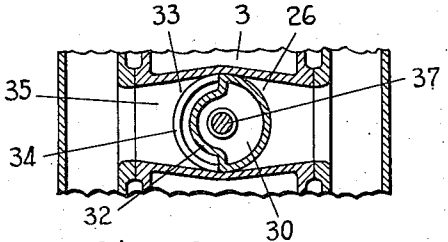


FIG. 8

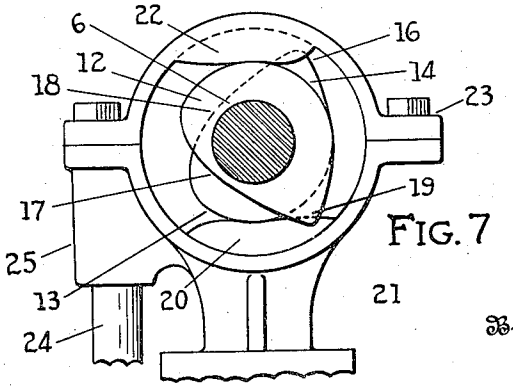


FIG. 7

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UNITED STATES PATENT OFFICE

2,106,099

PISTON VALVE ENGINE

John W. Jenkins, Indianapolis, Ind.

Application May 18, 1934, Serial No. 726,273

1 Claim. (Cl. 123—78)

The invention relates to explosive engines and more particularly to explosive engines having inlet and outlet ports opened and closed by a sliding element.

It is an object of the invention to provide in combination with an explosive engine having a ported cylinder closed at one end and open at the other, a piston-like valve element which serves to close and open the cylinder ports in proper time and which serves as a removable closure for the closed end of such cylinder.

It is a primary object of the invention to provide in combination with an explosive engine having a ported cylinder with a closed end and an open end, a slidable valve element which serves as a closure for the closed end of said cylinder, and to provide means for actuating said element to a more retrograde position during the intake stroke than in the compression and power stroke, and correspondingly increasing the cubical size of the combustion chamber of the engine during the intake stroke, for entering correspondingly larger fuel charges within the cylinder.

It is an important object of the invention to provide for operating such slide element, two substantially equal and co-axially related peripheral cams secured side by side to a shaft in complementary relation to each other, each of said cams having a true circular face portion, each having a depressed face portion angularly spaced from the other about the shaft, each having a protruding face portion angularly spaced about the shaft, the diametrical vertical distance across said cams considered together from any peripheral point of one cam to the most distant peripheral point of the other being equal at all peripheral points of either cam; and a cam follower secured to said elements and having a cam seat between said valve element and said shaft, said seat following the peripheral face of one cam, and another cam seat on the other side of said shaft following the peripheral face of the other cam, said cams operating to hold said valve element in fixed position through said follower substantially during the nominal compression and power strokes of the engine, and operating to move said valve element to cover the exhausst port and open the inlet port of the engine during the nominal intake stroke thereof, and operating to move said valve element to cover the intake port and uncover the exhaust port during the nominal exhaust stroke of the engine.

It is a further object to carry the valve for the ignition spark plug in operating position with said element, and to provide a threaded hole therethrough for engaging such plug; and to provide a flexible and stretchable conductor between the terminal connection of such plug, and a relatively fixed terminal, said conductor yielding to the movements of said valve element.

The above and other objects are attained by the structure illustrated in the accompanying drawings in which:

Figure 1 is a cross-sectional view of the invention taken in the proximity of line 1—1 of Fig. 5; and in which the engine parts are shown in intake position;

Fig. 2 is a view similar to Fig. 1 showing the engine parts in compression position;

Fig. 3 is a sectional view taken in the proximity of line 3—3 of Fig. 5 and shows the engine parts in power stroke position;

Fig. 4 is a view similar to Fig. 3, showing the engine parts in exhaust stroke position;

Fig. 5 is a partial fragmentary side view of the engine partly in section;

Fig. 6 illustrates the gearing through which the valve element cams are operated from the engine crank shaft;

Fig. 7 is a detailed sectional fragmentary view of the engine cam and follower mechanism; and,

Fig. 8 is a cross sectional view taken in the proximity of line 8—8 of Fig. 4.

The example of the invention herein described is embodied in a vertical explosive engine.

Similar characters of reference designate similar parts throughout the several views. Referring to Figure 1, the numeral 1 designates the engine crank case in which the crank shaft 2 is journaled. The cylinder 3 in this example of the invention is integrally merged at its inner end with said crank case, the piston 4 being slidably disposed therein, and being associated with said crank shaft through the usual connecting rod 5.

Beyond the other or outer end of said cylinder the cam shaft 6 is journaled substantially at right angles to the longitudinal center line of said cylinder, by the bearings 7 best shown in Fig. 5. Still referring to Fig. 5 and also Fig. 6 it will be understood that said cam shaft is rotated by the crank shaft 2 through the sprocket chain 8, said chain meshing with the crank shaft carried sprocket 9 and the cam shaft sprocket 10, said sprockets being of suitable ratio to gear the cam shaft down to half the speed of the crank shaft, as will be understood by those familiar with four-cycle explosive engines.

At the intersection of the cam shaft 6 with the longitudinal center line of the cylinder 3 the cams

11 and 12 are formed side by side on said cam shaft. Said cams have continuous peripheral cam faces, and the cam 11 has a true circular face portion 13, in rotary advance of the similar circular face portion 14 of the cam 12, as rotated in the direction indicated by the arrow 15 of Figure 1. The protruded face portion 16 of the cam 11 immediately follows the true circular portion 13 thereof, but the depressed face portion 17 of the cam 12 immediately follows the true circular portion thereof; and the true circular portion 13 of the cam 11 immediately follows the depressed portion 18 thereof, while the true circular portion 14 of the cam 12 immediately follows the protruding portion 19 thereof, by which features said cams may be said to be in overlapping complementary arrangement as considered in Figure 1; and it is further pointed out that the vertical height measured from the lowest point on either cam to the highest point on the other cam, is the same in any rotated position of said cams.

On the cylinder side of the cam 11 the cam seat 20 of the cam follower 21 rides said cam, said seat being substantially horizontal in this example of the invention, and the seat 22 of said follower rides the cam 12 on the other side of the cam shaft 6 from the seat 20, said seats being substantially parallel, the head 23 of said follower encircling said cam shaft. Follower guide pins 24 extend from the cylinder 3 parallel to the longitudinal center line thereof, said guides engaging the slides 25 of said cam follower, by which feature it will be understood that rotation of said cams against said cam seats will move the follower 21 on said guides, the movements of said follower being co-directional with the movements of the piston 4; and said seats being substantially parallel, and said cams together being the same distance across, it will be obvious that all positions of said follower are positively determined in both directions by said cams.

In the outer end of the cylinder 3 the piston-like valve element 26 is slidably disposed, the outer end of said element being integrally connected to the cam follower 21, by which arrangement said valve element is operated in alternate, retrograde and return movements in said cylinder.

Beyond the path of the piston 4 from the crank shaft 2, the inlet port 27 is formed through the cylinder wall structure, said port communicating with the carbureter 28 through the inlet manifold 29, and serving to close and open said port in required sequence as will be understood.

The valve element 26 is of somewhat inverted cup character, a web being formed across the lower end of same, and consisting of two floor portions 30 and 31, the floor portion 30, merging with the inlet-port closing side of said valve element and the floor portion 31 being offset outwardly from the portion 30 and being united therewith by a more vertical wall 32, which with the more adjacent wall portion 33 of said element forms a channel on the inner side of said web, which communicates with the port 34 formed through the wall portion 33, said port being adjacent to the inner surface of the floor portion 31.

On the opposite side of the cylinder 3, from the inlet port 27, said cylinder forms the exhaust port 35 through its wall structure, said exhaust port being more outwardly positioned in said cylinder than said inlet port, and being suitably located to register with the port 34 of the valve element 26 when said valve element is slid by the cams 11 and 12, through the follower 21 to the end of its return movement, and when said inlet port is covered by said valve element.

In Figure 1, which illustrates the intake stroke of the engine, the valve element 26 is shown in its most outer position, the inlet port 27, being entirely uncovered by said valve element and the exhaust port 35 being covered by the wall portion 33 of said element, said element being confined to position upwardly by confinement of the cam seat 22 against the most protruded point of the cam 12, and downwardly by confinement of the valve seat 22 against the most depressed point of the cam 11, and said element being thus precisively positioned against movement in either direction other than as determined by the rotation of said cams..

In Figure 1, the piston 4 being in downward travel, is shown at approximately halfway through the intake movement, the crank arms 36 of the crank shaft 2, being in approximately horizontal position. As said piston and crank move to their most downward position (not illustrated), or approximately the end of the intake stroke, the cams 11 and 12 are rotated by the crank shaft 2, through the sprocket chain 8, bringing the circular portion of the cam 11 in engagement with the seat 20, and the circular portion of the cam 12 in engagement with the seat 22 and the valve element 26 being correspondingly lowered into inlet port-closing position, it being understood that at all intermediate points, said seats follow said cams with precision and without any so-called lost motion or back-lash.

As the crank arms 36 rotate further to approximately horizontal position on the other side of the crank shaft as illustrated in Fig. 2 the piston 4 is correspondingly moved outwardly through approximately half its compression movement, the circular portions of said cams running in engagement with said seats respectively, and thus maintaining the port-closing position of the valve element while the piston approximately reaches the end of its compression movement, at which time the compressed charge is ignited by the spark plug 37, which is threaded through the web floor 30 of the valve element 26, the ignition current being supplied and regulated by any suitable engine current source and timing means (not shown).

The spark plug 37 is sufficiently tall to support its terminal connection 38 higher than the upper edge of the valve element 26, by which feature it is convenient to connect said terminal connection with the fixed terminal 39, by the flexible and stretchable conductor 40 through the vacancy or wrench hole 41 of said valve element, said conductor yielding to the movements of said spark plug with said valve element.

Fig. 3 illustrates the power stroke position of the engine parts during which stroke the travel of the piston 4 and crank shaft 2 is the same as during the intake stroke illustrated in Figure 1, the cams rotating through the position indicated by Fig. 7. The cam seats 20 and 22, however, continue to engage the circular portions of the cams 11 and 12, respectively, to approximately the end of the power stroke, or approximately when the piston again reaches the end of its return stroke at about which time the depressed portion 17 of the cam 12 is rotated into contact with the cam seat 22 and the protruded portion 16 of the cam 11 is rotated into contact with the seat 20, causing the valve element 26 to move inwardly until the valve element port 34 registers with the cylinder exhaust port 35 initiating

the exhaust stroke, best illustrated in Fig. 4, the exhaust fumes passing through the ports 34 and 35 into the exhaust manifold 42, and as the piston again approximately reaches its most retrograde position, the cams are rotated to position preliminary to inlet stroke position as best illustrated in Figure 1.

A number of cylinders may be embodied in an engine as will be obvious from Fig. 5, each cylinder being provided with a valve element, cam follower, set of cams, etc. as above described.

In this example of the invention the upper end of the cylinder consists of a removable extension 43 which is bolted or otherwise secured to the cylinder proper, and the cylinder bore is reduced in diameter through said extension, although it is understood that the cylinder may be an integral part throughout its length, and have the same bore diameter throughout its length, under which conditions the valve element and piston are of the same diameter.

It will be observed that the valve element 26 is in higher position during the intake stroke illustrated in Figure 1, than in the compression and power strokes as illustrated in Fig. 2, and Fig. 3, respectively, by reason of which the combustion chamber port 44 of the cylinder 3 is of greater cubical size during the intake stroke, thus increasing the intake capacity of the cylinder without decreasing the compression pressure carried out in the compression stroke.

It is understood that during the compression and power stroke of the engine the pressure per square inch within the cylinder is exerted against the valve element 26 and that said valve element is held in place against such pressure by the cam 11; and that in the intake or suction stroke of the engine the suction pull exerted on said valve element is resisted by the cam 12.

Referring to Figures 1 to 5, the piston rings 45 and 46 are provided in the corresponding grooves of the valve element 26, the upper ones 45, of said rings being of a standard width, but the lower rings 46 being of greater vertical width than the corresponding dimension of the ports 27 and 35, by which feature said lower rings are adapted to slide over said ports without expanding into same and disabling the engine, it being understood that the rings which pass over said ports are of greater vertical width than the corresponding width of the ports.

While the description and drawings illustrate in a general way a certain manner of carrying the invention into effect, it is obvious that many modifications may be made in the various details without departing from the scope of the appended claim, it being understood that the invention is not restricted to the particular example herein shown.

The invention claimed is:

A gas engine comprising a cylinder having an open upper end and inlet and exhaust ports, a sliding valve within the open end of the cylinder and closing the same and controlling the inlet and exhaust ports, a rigid member carried by the valve and extending beyond the cylinder, said rigid member being smaller in cross section than said valve member and having an outer end provided with a transverse opening, said opening having cam contacting surfaces and cam clearing surfaces, a driven shaft passing through said opening, cams carried by the shaft and engaging said cam contacting surfaces to impart proper movement to the valve, a means extending rigidly from the cylinder, said means slidably engaging said enlarged outer end of said central member at a sufficient distance from the cylinder and sliding valve to prevent overheating at such engagement and to facilitate the convenience of lubrication, repair and other attention of same independently of the cylinder and valve proper, said means preventing rotation of said valve by the friction of said cams against said cam contacting surfaces.

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