May 17, 1938. J. FORKOIS ET AL 2,117,551

VALVE MECHANISM

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Fig. 1

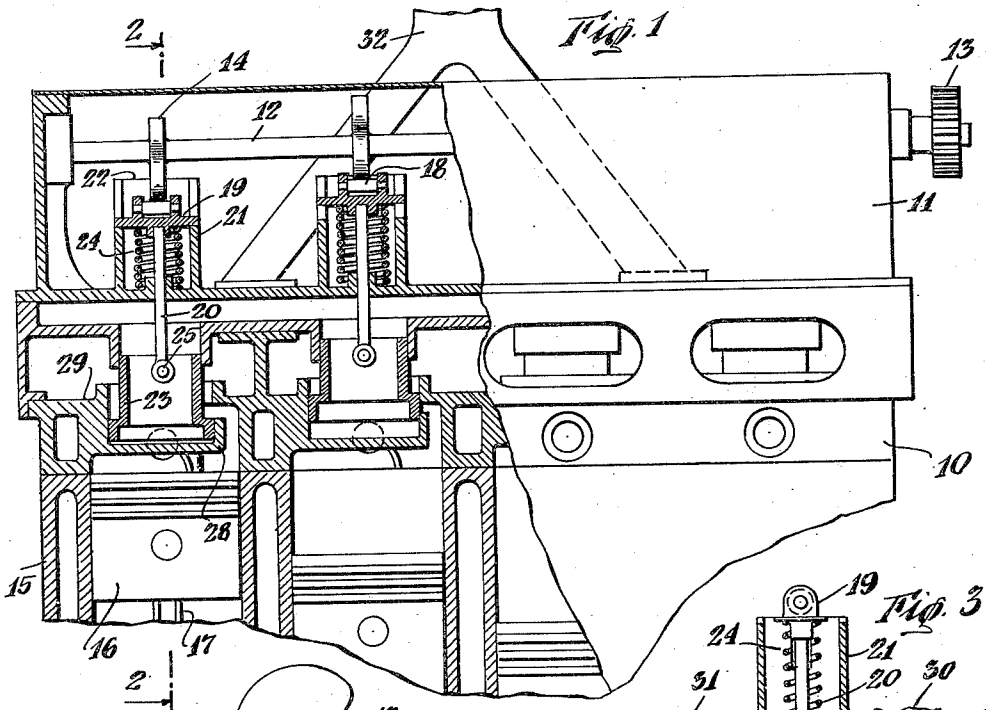


Fig. 2

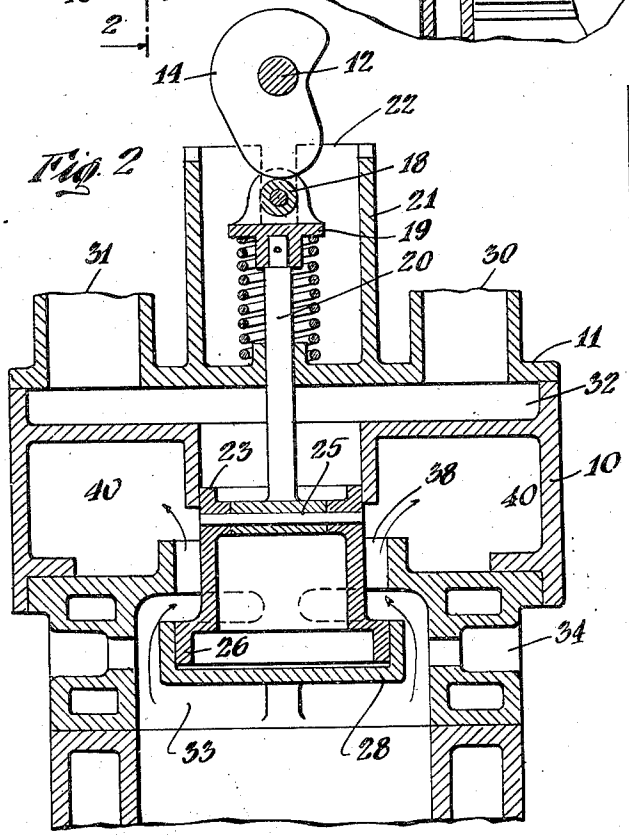


Fig. 3

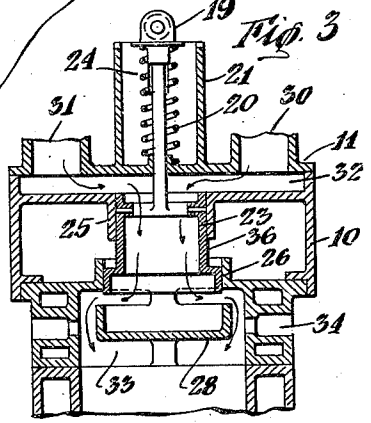
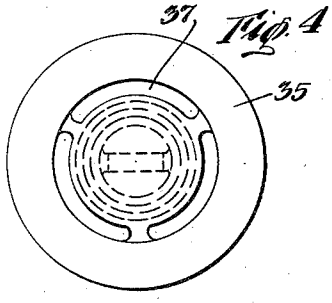


Fig. 4



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VALVE MECHANISM

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4 Claims. (Cl. 123—75)

This invention relates to improvements in internal combustion engines, particularly in the valve mechanism of such engines, and it is the principal object of our invention to provide a valve mechanism in which one valve performs the functions of intake and exhaust for one cylinder in an engine operating on the four-cycle principle; whereas in the ordinary type of four-cycle internal combustion engine two poppet valves are necessary for this purpose, one performing the function of intake and the other of exhaust.

Another object of our invention is the provision of a valve mechanism for internal combustion engines including engines of the Diesel type eliminating the use of lifters and rock rods, and reducing the number of moving parts to a minimum.

A further object of our invention is the provision of a valve mechanism for internal combustion engines, the operation of which is practically noiseless and smooth, which avoids the necessity of frequent grinding of the valves and the frequent replacing of the same.

A still further object of our invention is the provision of a valve mechanism for internal combustion engines which is comparatively simple and inexpensive in its construction, requires no adjustments, but is nevertheless durable and highly efficient in operation.

Our valve mechanism can also be used with engines having any number of cylinders and may be used with advantage with two-cycle engines with suitable alterations to suit the special construction.

These and other objects and advantages of our invention will become more fully known as the description thereof proceeds, and will then be specifically defined in the appended claims.

In the accompanying drawing, forming a material part of this disclosure:

Fig. 1 is a vertical, fragmentary front elevation of a cylinder block equipped with a valve mechanism constructed according to our invention, partly in section and the front wall broken away to illustrate the interior arrangement.

Fig. 2 is a section on line 2—2 of Figure 1 with the piston at the exhaust stroke.

Fig. 3 is a sectional view, similar to Figure 2 on a somewhat smaller scale with the piston at the intake stroke.

Fig. 4 is a bottom plan view of the combustion chamber, Figure 3.

As illustrated, the cylinder block 15 of a four-cycle internal combustion engine carries at its top a cover 11 suitably secured to a cylinderhead superstructure 10 containing exhaust chambers 40. In the end walls of this housing a cam shaft 12 is journaled, which is adapted to be driven in clockwise direction from the crank shaft of the engine at half velocity ratio to the engines, by means of for instance a chain over the sprocket wheel 13.

The shaft 12 carries a plurality of cams 14 set in proper timed relation with the engine crank shaft. It will be clear that while we have here illustrated a four cylinder internal combustion engine, the mechanism with appropriate changes in its construction may just as well be adapted to engines having any number of cylinders.

In the cylinders 15 the pistons 16 reciprocate by means of their rods 17 connected to the crank shaft of the engine in the usual well known manner.

As shown in Figures 1 and 2, the cams 14 engage rollers 18, held between suitable brackets 19 at the upper end of stems 20 in housings 21, open at the top, as at 22, to allow the sleeve or hollow gas chamber 23, to which the stem is connected, to reciprocate in vertical direction and held in elevated position against the cam 14 by means of a spring 24 about the stem. The sleeve 23 to which the inner end of stem 20 is connected by means of the pins 25 has an integral lower widened part 26 engaging in a housing 28 formed with cylinder head 29 of the engine block and which housing 28 depends into the combustion chamber 33. The cover 11 has attached thereto the inlet pipes 30, 31 for the gas mixture coming from the carbureter through the manifold 32. The lower widened part 26 permits the separation of the valve chamber 28 into two separate and distinct passages, one for the exhaust, and the other for the intake, and provides a means for effecting a continuous separation of intake and exhaust while permitting the use of only one communicating port to the combustion chamber and cylinder. This widened part 26 furthermore, provides a means for opening and closing the communicating port to the cylinder in synchronization with the cycles of the piston operations and the alternation of the intake and exhaust gases through the port.

The inlet pipes 30, 31 for the gas mixture coming from the carbureter communicate with the cylinder during the intake stroke of the piston through the interior of the chamber 23 and through the plurality of concentrically arranged arcuate ports 37 formed by the housing 28 and

the cylinder head 29. This course of the intake charge is indicated by the arrows in Figure 3. Compression by the piston takes place as usual in combustion chamber 33 and ignition of the charge by means of spark plugs located in the sockets 34. During compression and explosion of the mixture in the cylinder, the chamber 33 assumes an intermediate position as indicated in Figure 1, closing off communication of the cylinder to both intake and exhaust ports and chambers. On the scavenging stroke of the piston, the exhaust gases will escape through the ports or channels 38 into the exhaust chambers 40 in communication with the atmosphere as indicated in Figure 2.

In operation, when the cam 14 is about to compress the spring 24, as indicated in Figure 3, the wall of the chamber 23, which is in constant engagement with the upper portion of the housing 28, and the lower widened part 26 of chamber 23, will close the ports 38 to the exhaust chambers, and the intake mixture from the carbureter will enter through ports 30, 31, chamber 32 and the open top of sleeve or chamber 23 into chamber 28, and escape therefrom as indicated by the arrows in Figure 3, through the communicating port in the housing 28 into the cylinder to be compressed and ignited therein, while the communicating port to the cylinder is closed by the lower part of the chamber 23 in its intermediate position. During the exhaust stroke of the piston, the exhaust gases will escape through the channels 38, formed by the upper portion of housing 28 and the wall of the gas chamber 23 and which are now left open by the enlarged portion of sleeve 23 as shown in Figure 2, by means of which they were closed during the intake stroke, into exhaust chambers 40 which are in communication with the atmosphere. The entire operation, as will be clear, is continuous.

By advancing the cam shaft approximately 90° in a clockwise direction without disturbing the setting of the crankshaft and then reversing the direction of the crankshaft and camshaft simultaneously in a counter clockwise direction, the engine will operate in a reverse direction.

By a suitable method of by-passing and cross-connecting the intake and exhaust manifolds, the intake ports and chambers will become the exhaust ports and chambers and vice versa. It will therefore be obvious that what has been described as an annular exhaust port could be used for an intake port and that the interior of the valve or hollow gas chamber which has been described as the passage for the intake could be used as a passage for the exhaust depending on the position of the cam and the operation desired.

It will be understood that we have described and shown the preferred form of our invention as one example only of the many possible ways to practically construct the same, and that we may make such changes in its general arrangement and in the construction of the minor details thereof as come within the scope of the appended claims without departure from the spirit of our invention and the principles involved.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:

1. A valve mechanism for an internal combustion engine comprising a plurality of cylinders each with cam controlled valve units, each valve unit provided with a valve chamber having a single port for intake and exhaust to and from the cylinders, and within said valve chamber a vertically reciprocating hollow gas chamber open at the top and bottom, a stem attached to said gas chamber and controlled by said cam, a widened lower part formed integrally with said gas chamber, a chamber dependent into the combustion chamber of the engine adapted to receive said widened part on said hollow gas chamber and forming with the wall of said gas chamber an annular passage constituting the exhaust passage of the engine when said reciprocating gas chamber is in its lowermost position, said gas chamber in its elevated position closing the exhaust ports during the intake stroke and leaving said ports free during the exhaust stroke, and means to supply air or gas mixture to the interior of said gas chamber.

2. In an internal combustion engine with air or air fuel mixture inlets, the combination of its cylinders and pistons reciprocating therein, with a valve unit for each cylinder, each unit comprising a valve chamber having a single port having intake and exhaust to and from the cylinders, a hollow, vertically reciprocating gas chamber within said valve chamber in communication with the inlet for the air or air-fuel mixture, a lower widened end formed integrally with said gas chamber, and a chamber dependent within the combustion chamber of the engine and adapted to receive the widened end of said gas chamber, exhaust passages in communication with the atmosphere, and in communication with channels formed by the upper portion of said dependent chamber and the wall of said gas chamber, the upper part of the gas chamber wall in constant engagement with the inner wall of said valve chamber, the wall of said gas chamber closing the exhaust ports during the intake stroke of the engine with said gas chamber disengaged from the dependent chamber, and opening the same for communication with said channels for the exhaust during the exhaust stroke of the engine with the gas chamber in engagement with the dependent chamber, a spring controlled stem attached to said gas chamber, and a cam controlling said stem and the movements of said gas chamber, and means to supply air or gas mixture to the interior of said gas chamber.

3. A valve mechanism for internal combustion engines comprising a housing having a port having intake and exhaust to and from the cylinders, a hollow gas chamber vertically reciprocating in said housing, the inner wall of said housing in constant engagement with the upper part of said gas chamber, an intake manifold in communication with the interior of said gas chamber, a widened lower part on said gas chamber formed integrally therewith, a chamber formed to depend within the combustion chamber of the engine into which said gas chamber engages, exhaust chambers in communication with annular passages formed by the wall of the dependent chamber and the wall of said gas chamber, said widened part of said gas chamber closing the ports of the exhaust chambers during the intake stroke, a combustion chamber having one communicating port only through which both, intake and exhaust gases alternately pass, a spring controlled stem on said gas chamber, a roller on said stem, and a cam engaging said roller to compress the spring in one of its positions to engage the widened part of said gas chamber with said dependent chamber during the exhaust stroke with the walls of said gas chamber opening the exhaust ports, and in the other position

of the cam to permit an expansion of said spring to raise said gas chamber during the intake stroke and to close the exhaust ports, and means to supply air or gas mixture to the interior of said gas chamber.

4. In an internal combustion engine provided with a plurality of cylinders, pistons reciprocating in said cylinders, a head for each of said cylinders having a down draft air or air-fuel mixture inlet, a valve unit for each cylinder within said head, each valve unit comprising a hollow, unenclosed, vertically reciprocating gas chamber in communication with the inlet for said down draft air or air-fuel mixture, a lower widened part formed integrally with said gas chamber, and a chamber dependent within the combustion chamber of the engine adapted to receive said widened part, and forming with the wall of said gas chamber an annular passage constituting the intake passages of the engine when the said reciprocating gas chamber is in its lowermost position, said gas chamber in its elevated position closing the intake ports during the exhaust stroke of the piston, and leaving said ports free during the intake stroke, the exhaust gases passing out to the atmosphere through the interior of said gas chamber.

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