April 21, 1931. A. C. PETERSON 1,801,367

FOUR-CYCLE BALANCED VALVE ENGINE

Filed March 14, 1928 2 Sheets-Sheet 1

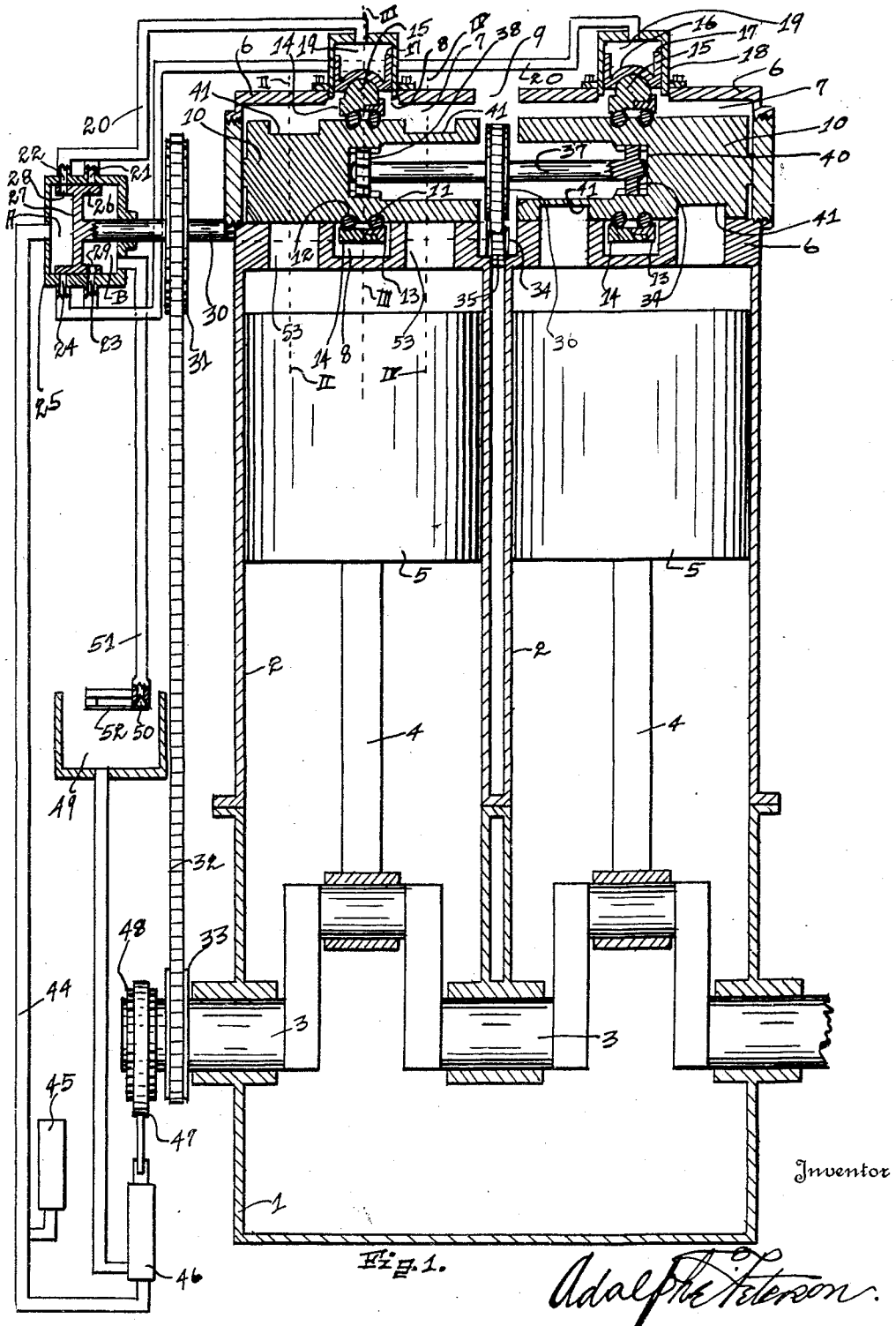


Fig. 1.

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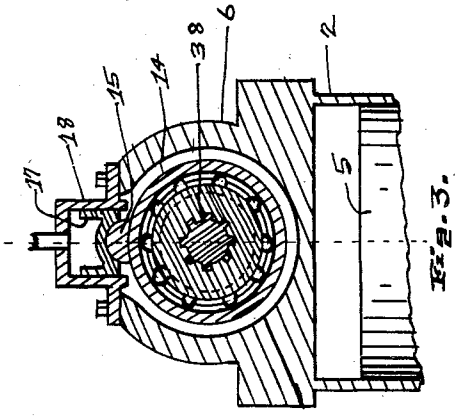


Fig. 3.

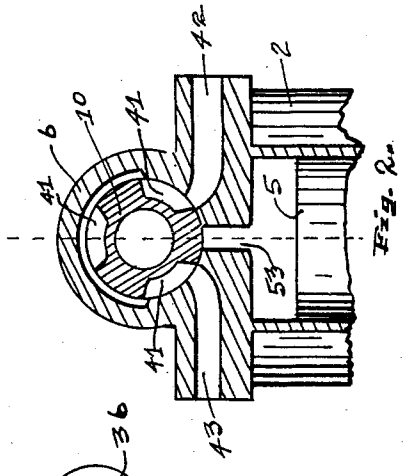


Fig. 2.

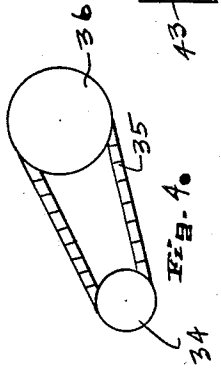


Fig. 4.

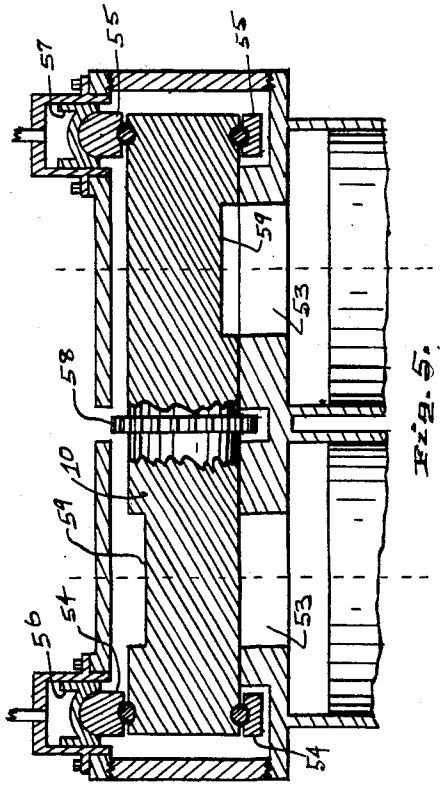


Fig. 5.

Inventor

Adolph C. Peterson

Patented Apr. 21, 1931

1,801,367

UNITED STATES PATENT OFFICE

ADOLPHE C. PETERSON, OF MINNEAPOLIS, MINNESOTA

FOUR-CYCLE BALANCED-VALVE ENGINE

Application filed March 14, 1928. Serial No. 261,682.

My invention relates to internal combustion engines and particularly to a form of four cycle engine having certain balanced valve features wherefore it is called four cycle balanced valve engine.

The principal objects of my invention are to provide an internal combustion engine utilizing a rotary valve which engine shall be simple in construction, durable in use, and cheap in manufacture and which shall have the advantages inherent in a rotary valve while obviating certain of the difficulties of such rotary valve engines. A particular object is to provide a form of rotary valve which shall under all conditions of operation, as for instance under all pressures be closely seated upon its valve seat without thereby presenting difficulty in use or unreasonable wear. An object is to provide a rotary valve means which shall have a special pressure applying means which seats it properly upon its seat during rotation. An object is to provide a rotary valve means which shall be constantly adjusted to its seat so that always a close union and gas tight union is provided under rotation. An object is to provide a rotary valve means which has a particular pressure distributing means for varying the pressure for seating of the valve according to the pressure in the engine cylinder to which the valve is related. An object is to provide a particular form of pressure distributing means for balancing valves upon their seats. In general the object is to provide an improved valved engine particularly of the four cycle internal combustion engine variety, it being noted that the valve means may be applied to two cycle engines or any form of engine.

In the accompanying drawings which illustrate my invention like characters refer to like parts throughout the several views. The principal devices and combinations of devices comprising my invention are as hereinafter described and as defined in the claims.

Referring to the drawings:

Figure 1 is a view chiefly in vertical section through the axis of the crank shaft of an engine embodying my invention, some parts being shown in full side elevation.

Figure 2 is a view chiefly in vertical section at right angles to the section of Figure 1 on the line II—II of Figure 1.

Figure 3 is a view chiefly in vertical section at right angles to the section of Figure 1 on the line III—III of Figure 1.

Figure 4 is a view in side elevation showing diagrammatically the sprocket chain 35 and its relation to its sprockets.

A section on the line IV—IV of Figure 1 would be substantially the same as that of Figure 2, with exception that in the one section, that on line IV—IV, the clutch shaft 37 would appear and in the other it would not. The Fig. 2 shows the relation of the valve passages 41 to ports 42 and 43 particularly and is not intended to show the relation of the shafts.

Referring again to the drawings, the numeral 1 indicates a crank case, 2 the engine cylinders, 3 the crank shaft, 4 the connecting rods, 5 the engine pistons, 6 the cylinder head of a four cycle two cylinder engine embodying my invention. The cylinder head 6 has a valve space 7 horizontally bored through it above each cylinder 2, these valve spaces being bored on the same axis horizontally. The valve spaces 7 are bored so that their lower half is substantially one half or a little less of a true circle the diameter of the valves hereinafter described. The space of each valve space 7 above its lower half is bored or formed somewhat larger in its diameter for the purpose hereinafter described. Each valve space 7 has at its central portion an enlarged space 8 surrounding the valve space transversely of the latter and formed in the cylinder head. There is also an open space 9 between the two portions of the cylinder head wherein the valve spaces are bored for the accommodation of the sprocket wheel hereinafter described.

Each valve space 7 accommodates one cylindrical valve 10 related to its cylinder 2. Each cylindrical valve, 10 is substantially as long axially as its cylinder 2 related to it is wide in its diameter. Each valve 10 at its central portion, that is mid-way of its length is machined as shown so that it forms the central bearing of two rows of ball bearings 11, 12, respectively. The two rows of ball

bearings, 11, 12, of each valve have related exterior races formed of two parts 13, 14 one of which is screwed into the other as shown to form a complete race for the double row ball bearing constituted by the balls 11, 12, and parts 13, 14. The exterior race 13, 14 has formed integrally with one of its parts or secured thereto a semi-spherical bearing 15 which is socketed in a counterpart semi-spherical part 16, the latter formed integrally in a so-called pressure-piston 17. Each valve 10 has its ball bearing and semi-spherical bearing 15 and pressure piston 17. The two pressure pistons 17 are respectively reciprocable within pressure-cylinders 18, each of which is formed integrally with or secured to its related part of the cylinder head 6.

The two pressure pistons 17 each forms with its related pressure cylinder 18 a completely enclosed space 19 which has no communication exteriorly of it except through a related conduit 20. The two conduits 20 form independent communication of its space 19 with two ports 21, and 22 respectively, as to the one space 19 and with two ports 23, 24 respectively as to the other space 19. Thus the enclosed space of each pressure cylinder 18 has communication only with its related two ports. The ports are formed in a distributor casing 25 which is divided into two chambers, A and B, respectively, by a rotatable cylindrical distributor valve 26. The distributor valve 26 on one side of the central wall 27 whereby it divides the casing has one distributor port 28 and on the other side in its cylindrical wall has one distributor port 29. The ports 28, 29 are located at substantially diametrical opposite portions of the distributor valve 26 but they need not be of the same length, their length being according to the timing and particularly according to the need for pressure distribution as hereinafter described.

The distributor valve 26 is secured to and rotates with a sprocket shaft 30 which is rotatably mounted on a horizontal axis nearly on the level of the cylinder head 6. The The sprocket shaft 30 has secured thereto a sprocket wheel 31 whereby it is turned by a chain 32 and sprocket wheel 33 upon the crank shaft 3. The sprocket shaft 30 has at its opposite end a sprocket wheel 34 whereby through the chain 35 it drives a sprocket wheel 36 which latter is formed integrally with a so-called clutch-shaft 37. The clutch shaft 37 has its sprocket wheel 36 and at its ends spur clutches 38, 39 formed integrally therewith. The spur-clutches 38, 39 respectively are located one in each valve 10 in an interior bore. The end of the clutch shaft 37 in each valve 10 abuts against the interior transverse wall 40 of the valve as shown whereby the clutch shaft 37 is maintained in its location longitudinally. The spur-clutches 38, 39 coact with counter interior spur gear clutches in the related valve 10 whereby the clutch shaft is clutched with the valves 10 so that the valves 10 are rotated with the clutch shaft 37 but so that the clutch shaft may have some universal jointed action relatively to the valves 10.

The relation of the sprocket wheels described is such that the distributor valve 26 is revolved at one half the speed of the crank shaft 3 and so that the clutch shaft and valves 10 are revolved at one sixth the speed of the crank shaft 3. Each valve 10 is related to one cylinder and has on each side of its central portion three depressions or gas passages 41 each of which is of such a length circumferentially of the valve as to provide the inlet and exhaust communication hereinafter described. The three solid portions of the valve 10 between the gas passages 41 are of such length that they close the cylinder ports during the compression and exhaust strokes which occur during each of those periods when the solid portions pass over the cylinder ports.

The cylinder head has formed in the transverse plane of each set of depressions an exhaust port 42 and an inlet port 43, thus each cylinder 2 has two inlet and two exhaust ports, one pair, an inlet and an exhaust port in the transverse plane of its related gas passages 41 of the related valve 10. The cross sectional area of the inlet and exhaust ports is such that they are relatively long in the direction of the axis of the valve 10 at the point of contact with the valve 10. The inlet ports may have an inlet manifold attached from which gas is drawn from a related carburetor but the manifold and carburetor is not shown for the sake of simplicity in the drawing and as they are not other than as commonly used.

The chamber A of the distributor casing may receive an oil as lubricating oil, preferably of good flowing quality, or any liquid from a conduit 44 which in turn may receive liquid from a receiver 45 and from an oil or liquid pump 46. The pump 46 is driven by eccentric rod 47 and eccentric 48 the latter driven by crank shaft 3. The pump 46 is adapted to deliver liquid under a pressure of say five hundred pounds, more or less depending on the construction and on the relative size of the parts. Preferably a large pressure of more than five hundred pounds say seven or eight hundred pounds may be used in order that the pressure parts may be smaller.

The pump 46 receives liquid from the tank 49 which latter contains a surplus of liquid and also receives liquid as it overflows through a spring controlled valve 50 from conduit 51 from chamber B of the distributor casing. The spring 52 is such as to prevent release of liquid from chamber B except when the pressure of liquid in chamber B exceeds say fifty or one hundred pounds. The two

pressure pistons 17 should be so fitted or have such leather or other packing that there may be substantially no leakage or very little leakage past the pressure pistons. Any means of delivering lubrication to the valves 10 may be provided, it being contemplated that any pressure means for positively delivering lubrication thereto will be provided as commonly done in such rotary valve engines.

In the use of my engine the crank shaft is given initial rotation in any way and when so rotated the liquid is delivered under pressure to the chamber A and under rotation the inlet ports will receive carburetted air or gas, or air. As the distributor valve 26 rotates, first one conduit 20 will be connected with chamber A and then the other, and conduits 20 will alternately be connected with chamber A and also will be alternately connected with chamber B. Thus spaces 19 will be alternately connected with chambers A and B. The connection with chamber A will be during the compression and expansion strokes of the related working cylinder and thus during the time that the valve 10 closes the related inlet and exhaust ports of the cylinder 2. The connection with chamber B will be during the exhaust and inlet strokes and thereby there will be only the low pressure of say fifty or one hundred pounds in the pressure cylinder related to the valve 10 during that period when there is low pressure in the related cylinder 2. Thus there will be the high pressure of say five hundred or more pounds, or eight hundred pounds as necessary during the working and compression strokes when the pressure in the cylinder 2 is great. The ports of the distributor valve may be of such form that the pressure is gradually released into the related pressure cylinder during the compression stroke of the related cylinder 2 whereby the pressure of the pressure piston 17 upon its valve 10 will be gradually increased according to the increase of the pressure in the cylinder 2. The pressure pistons 17 have substantially no movement except that necessary to make up for the closer contact of the valve 10 or the exudation of the lubricating fluid under the greater pressure. But it is to be noted that the device should be so constructed and proportioned that the pressure of the pressure piston is always balanced except for a certain amount of pressure by the pressure in the cylinder 2, that is the increase of pressure in the cylinder balances the increase of the pressure in the pressure cylinder 18 whereby the pressure of contact of the valve 10 with its seat does not increase except to a minor extent during the compression and working strokes. The pressure is thus alternated upon its valve 10 by the distributor valve 26 and the pressure is taken by the double row ball bearing so that no great increase of the friction occurs, and so likewise no great increase of the friction between the valve 10 and its seat occurs because the increased pressure is somewhat balanced.

My device may be used for two cycle engines or other than internal combustion engines and it may be constructed in various forms. While I have shown particular devices and combinations of devices in the illustration of my invention I contemplate that other detailed devices and combinations of devices may be used in the realization of my invention without departing from the spirit and intent of my invention.

What I claim is:—

1. In an engine, a cylinder and cooperating piston, a port in the cylinder wall, a valve rotatable adjacent to the wall of the port and adapted to effect periodic opening and closing of the port, a bearing part, in combination with a fluid pressure chamber and related piston movable relative to the fluid pressure chamber, a ball and socket joint between the piston and the bearing part holding the valve in conjunction with the wall of the port, and means whereby fluid under pressure is delivered to the fluid pressure chamber.

2. In an engine, a cylinder and cooperating piston, a port in the cylinder wall, a valve rotatable adjacent to the wall of the port and adapted to effect periodic opening and closing of the port, a bearing part, in combination with a fluid pressure chamber and related piston movable relative to the fluid pressure chamber, a ball and socket joint between the piston and the bearing part holding the valve in conjunction with the wall of the port, and means whereby pressure of fluid in the fluid pressure chamber is high during periods of high pressure in the cylinder and is low during periods of low pressure in the cylinder.

3. In an engine, a cylinder and cooperating piston, a port in the cylinder wall, a valve rotatable adjacent to the wall of the port and adapted to effect periodic opening and closing of the port, rolling bearing members in contact with a race on the valve and an exterior race on the rolling bearing members, in combination with a fluid pressure chamber and related piston movable relative to the fluid pressure chamber, and adapted to impart pressure of the piston of the fluid pressure chamber by the exterior race to the valve, and means whereby pressure is maintained in the fluid pressure chamber.

4. In an engine, a cylinder and cooperating piston, a port in the cylinder wall, a valve rotatable adjacent to the wall of the port and adapted to effect periodic opening and closing of the port, rolling bearing members in contact with a race on the valve and an exterior race on the rolling bearing members, in combination with a fluid pressure chamber and related pressure piston movable relative to the fluid pressure chamber, and adapted to impart pressure of the pressure piston to the

valve through the exterior race and means whereby pressure of fluid in the fluid pressure chamber is high during periods of high pressure in the cylinder and is low during periods of low pressure in the cylinder.

5. A plurality of cylinders and cooperating pistons, each cylinder having a port, a rotatable valve on its seat related to each cylinder and its port, rolling bearing members in contact with a race related severally to each valve and an exterior race related to each valve's rolling bearing members, pressure means imparting pressure to each exterior race and to the valve on its seat, and valve driving means having universal driving connection with each valve.

In witness whereof I have hereunto set my hand this 28th day of August, 1927.

ADOLPHE C. PETERSON.