Jan. 12, 1954 H. E. ADKINS 2,665,670

HYDRAULIC VALVE LIFTER

Filed Oct. 2, 1950 2 Sheets-Sheet 1

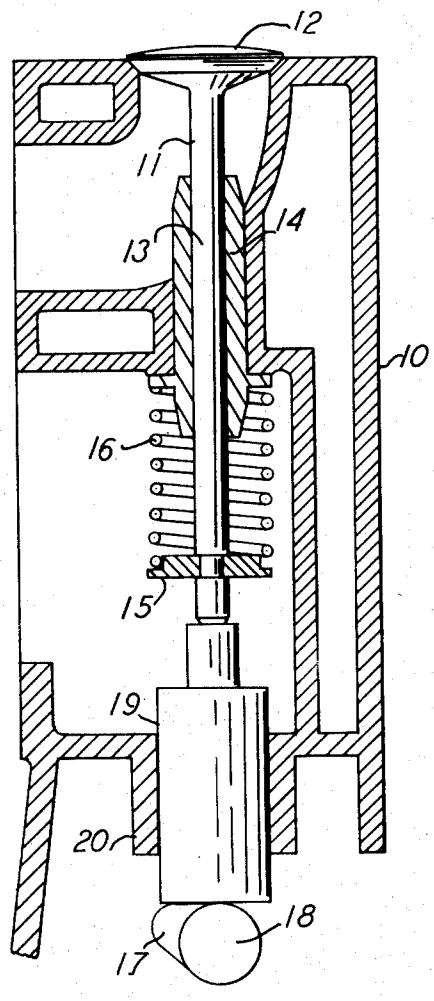



FIG. 1.

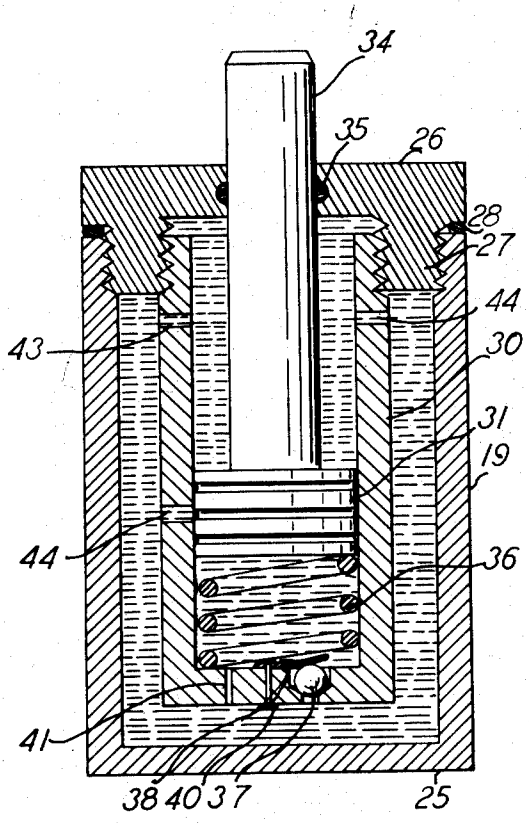



FIG. 2.

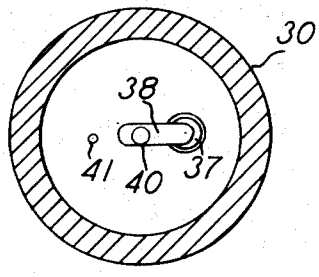



FIG. 3.

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Jan. 12, 1954 H. E. ADKINS 2,665,670

HYDRAULIC VALVE LIFTER

Filed Oct. 2, 1950 2 Sheets-Sheet 2

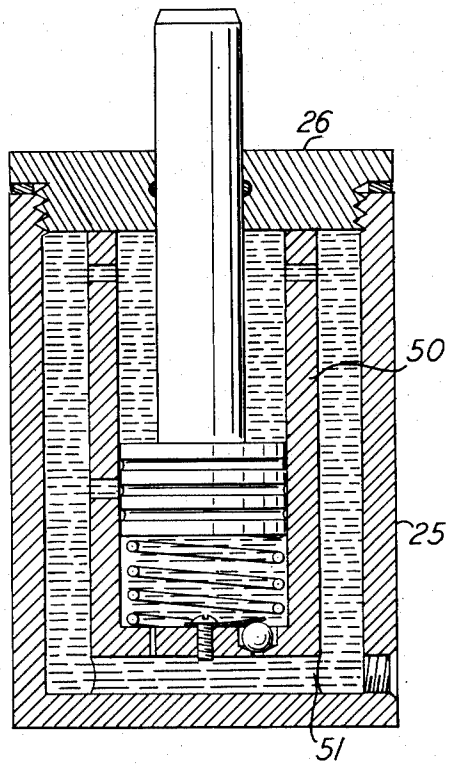



FIG. 4.

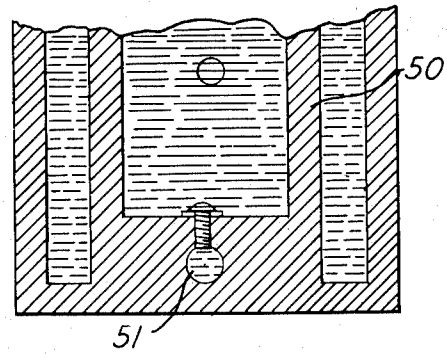



FIG. 5.

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## HYDRAULIC VALVE LIFTER

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2 Claims. (Cl. 123—90)

1

This invention relates generally to a valve mechanism for internal combustion engines and is directed to a part of the mechanism commonly known as a valve lifter. This piece of mechanism for an internal combustion engine valve operating system operates as a silencer by eliminating clearance. In other words, the adaptation of the invention is in connection with internal combustion valve tappets and has for one of its objects the securing of zero clearance in valve tappets.

In addition to the foregoing an object is to produce a smooth, quiet operating mechanism and one which is very efficient and practical.

In general, the invention relates to that type of valve lifter involving a cylindrical hydraulic mechanism, comprising a cylinder having a piston therein and having hydraulic fluid whereby the parts are at all times kept fully extended. As is well known in the art, this form of valve lifter is incorporated between the cam on the cam shaft and the operating stem of the valve to be operated. The general purpose of the arrangement is, among other things, to provide a device which, in addition to the purposes mentioned above, has a cushioning effect when it is operated by the cam shaft, or in other words, it is a device which is capable of taking up some of the shock which results from the high speed operation of the cam which engages one end of the valve lifter. Also, the device is fully self-adjusting.

While one of the principal objects of the invention is to provide zero clearance in the valve tappet mechanism the invention has the additional object of providing for temperature compensation in that the lifter mechanism is automatically expansible or contractible in response to temperature changes to always remain sufficiently expanded so as to always take up any clearance in the system and to provide, as pointed out above, zero clearance. This, of course, results in a device wherein any lost motion is eliminated and also there is no backlash in the system.

The lifter is adaptable to any type of internal combustion engines, automotive, industrial, aircraft or diesel.

The valve lifter of my invention involves certain improvements over known prior art devices. My invention, as pointed out above, involves a piston operating in a cylinder and in my invention hydraulic fluid is provided both below and above the piston and it is operable to provide a complete hydraulic fluid circuit from one side of the piston to the other by way of a chamber

2

around the cylinder mechanism. This arrangement eliminates the necessity of having any sort of a compressible chamber or sack incorporated in the system in order to provide for accommodating excess hydraulic fluid in one of the chambers.

Accordingly, it is an object of the invention to provide a hydraulic valve lifter of the type described involving a piston operating in a cylinder wherein there is a chamber provided on the outside of the cylinder and passageways whereby hydraulic fluid can be communicated from one side of the piston to the other on the outside of the cylinder.

Another object of the invention is to provide a valve lifter as in the foregoing, wherein a check valve is provided in the piston chamber below the piston providing for communication of hydraulic fluid to the chamber below the piston. This object also embodies the conception of having an orifice channel additionally providing communication to the chamber below the piston.

Another object of the invention is to provide a hydraulic valve lifter as in the foregoing wherein means are provided for communication of hydraulic fluid from one side of the piston to the other on the outside of the cylinder, the arrangement having a spring within the cylinder and normally urging the piston outwardly.

My invention is in the form of a completely sealed unit; no fluids flow in or out of the unit and no servicing of the unit is required. The lifter is installed simply by inserting it in place of existing mechanism and it is thereafter completely self-adjusting to give zero clearance and to provide a quiet, smooth running motor. The achievement of the foregoing purposes is among the objectives of the invention.

Another object is to provide a simple lifter, having few moving parts and therefore cheap to build and having fewer parts subject to wear.

Further objects and numerous of the advantages of my invention will become apparent from the following detailed description and annexed drawings wherein Fig. 1 is a sectional view of a part of an internal combustion engine cylinder block and tappet valve and the valve lifter of my invention incorporated therein.

Fig. 2 is a cross sectional view of a preferred form of the hydraulic valve lifter of my invention.

Fig. 3 is a sectional view of Fig. 2.

Fig. 4 is a cross sectional view of a slightly modified form of the hydraulic valve lifter.

Fig. 5 is a partial sectional view of Fig. 4.

Referring now more particularly to Fig. 1 of the drawings numeral 10 designates the cylinder block of an internal combustion engine and 11 represents a valve having a valve head 12 controlling a port opening to a cylinder of the engine. The valve is mounted in the usual manner with its stem 13 projecting slidably through a sleeve bushing 14 secured in the cylinder block 10. At the end remote from the valve head, the valve stem carries a washer 15 between which and the cylinder block 10 is a compression spring 16, the purpose of which is to urge the valve toward seated position. The valve is opened against the action of the spring 16 at proper intervals by means of a cam 17 provided on a cam shaft 18 and acting through the valve lifter generally designated 19. The valve lifter is guided for longitudinal reciprocatory movement in a bore 20 formed in a portion of the cylinder block 10.

Referring now more particularly to Fig. 2 of the drawings the valve lifter is designated generally at 19. It comprises a cylindrical casing 25, the upper end of which is closed by a cap 26 having a downwardly extending screw threaded flange 27 as shown which engages the upper end of casing 25 in screw threaded relationship. The cap 26 has an annular shoulder as shown and compressed between this shoulder and the upper end of casing 25 is a compressible sealing ring or gasket 28 to make the parts fluid-tight. The downwardly extending flange 27 is also internally screw-threaded and engaging in screw-threaded relationship with the flange is a cylindrical sleeve member 30 forming a cylinder in which a piston 31 operates. The piston 31 may have the usual oil grooves as shown to provide fluid tightness. The lower end of the cylinder 30 is spaced from the bottom of casing 25 and there is a space as shown between the side walls of the cylinder 30 and casing 25. The piston 31 has a stem 34 which extends through the opening in the cap 26 which is sealed by a sealing ring or gasket 35 as shown.

Interposed between the lower end of piston 31 and the end of cylinder 30 is a coil spring 36 which is of relatively less strength than the valve tappet spring 16 previously described. In the lower end of the cylinder 30 is a ball check valve as shown at 37 which seats downwardly to close off a channel providing communication between the interior of cylinder 30 and the space around the cylinder. The ball check valve 37 is normally urged in closing direction by a flexible leaf spring 38 attached to the bottom of cylinder 31 by a screw or pin 40. The bottom of the cylinder 30 also has a small orifice channel 41 therein, providing for a restricted communication between the chamber below piston 31 and the space around cylinder 30.

Near the upper end of the cylinder 30 are orifice channels 43 and 44 which provide communication between the interior of cylinder 30 above the piston 31 and the space around the cylinder. Also in the side wall of cylinder 31 is an orifice channel 44 which under certain circumstances provides for communication between the chamber below piston 31 and the space around cylinder 30.

The valve lifter is positioned in the manner described in connection with Fig. 1. From the foregoing structural description those skilled in the art will observe that the valve lifter provides a hydraulic member which is always effective to be fully extended so as to take up the clearance between the cam and the end of the valve operating stem and to maintain the clearance at zero. The operation of the valve lifter is such that as can be seen, due to the cushioning properties provided by the hydraulic fluid, the shock imparted to the mechanism by operation of the cam 17 is taken up by the hydraulic lifter. On the downstroke of the lifter mechanism the pressure below the piston 31 maintains the check valve 37 in closed position, although during the downward stroke the orifice 41 provides for a slow bleed of hydraulic fluid out of the chamber below piston 31. On the upstroke the check valve 37 may open and admit some hydraulic fluid to the space below the piston 31. Whenever the piston 31 moves as a result of hydraulic fluid flowing into or out of the chamber below piston 31 the amount of fluid above the piston is variable by being forced into or out of the chamber around the cylinder 30. In other words, as can be observed, the arrangement provides for a complete hydraulic circuit, that that is, a closed cycle, between opposite sides of the piston whereby, for instance, upon upward movement of piston 31 hydraulic fluid is forced through channels 43 and 44 into the chamber around the cylinder 30 and it can then proceed into the chamber below the piston 31 through the check valve 37, or in the case of the downstroke wherein the flow is in the reverse direction, hydraulic fluid may be forced out of the chamber below piston 31 through orifice 41 and thence back into the chamber above piston 31 through the channels 43 and 44. From the foregoing, it can be seen that the lifter provides for a cushioning effect by reason of the piston being able to cause flow in the hydraulic circuit or closed cycle. The coil spring 36 provides a part of the cushioning effect and as can be seen the chambers on the outside of cylinder 30 and above the piston 31 provide a reserve supply of hydraulic fluid which may be forced into or out of the chamber below piston 31. As will be observed by those skilled in the art the operation of hydraulic fluid being forced into or out of the reserve chamber does not require that this chamber be itself an expansible one inasmuch as has been explained the circuit is a closed circuit, the fluid being caused to flow from one side of the piston 31 to the other. The lifter automatically adjusts itself in response to temperature changes to always provide zero clearance by forcing fluid out of the chamber below the piston or allowing fluid to enter it as the parts expand or contract.

The port 44 forms a relief port for the chamber below the piston 31. If the pressure below the piston becomes sufficient that the piston begins to uncover this port, fluid will be released through this port to relieve the pressure below the piston.

Referring now to Fig. 4 of the drawings, the arrangement is similar to that of Fig. 2, similar parts having similar reference numerals. However, in Fig. 4 the cylinder is formed as a secondary internal bore within the casing 25 and communication between the cylinder 50 and the interior of casing 35 is provided by a transverse port or channel 51 as shown. The bottom of the cylinder 50 being above the lower or bottom part of the space around the cylinder 50. In this form of the invention the casing 25 is closed by a screw threaded cap 26 similar to that of the previous form of the invention.

From the foregoing those skilled in the art will

observe that I have provided a very effective and useful form of hydraulic valve lifter having novel characteristics and features whereby the desired results are achieved in a very simple and effective manner. The arrangement is particularly effective in that, as explained, it provides for a complete fluid circuit, that is, a closed cycle, between opposite sides of the piston wherein chambers having flexible or expansible side walls are not required and the desired results of providing zero tappet clearance are secured.

The foregoing disclosure is representative of preferred forms of my invention and it is intended that variations, modifications and alterations such as may be made and practiced by those skilled in the art shall come within the spirit and scope of the claims appended hereto.

I claim:

1. A zero lash self-adjusting hydraulic tappet comprising a first elongated cylindrical barrel closed at the bottom, a second cylindrical barrel of similar shape to the first barrel of less length and smaller diameter to provide a fluid chamber therebetween, said first barrel being internally threaded at the top thereof and said second barrel being externally threaded at the top thereof, a circular cover member having a depending annular portion having an external thread and an internal thread to mate with the first cylinder internal thread and the second cylinder internal thread respectively to thereby support the first and second barrels in a unitary rigid fluid tight assembly, a piston slidably supported in a substantially fluid tight fit in said second barrel, a stem affixed to said piston and projecting out of the said cover member, means for resiliently urging said piston away from the bottom of the second barrel, a ball check valve in the bottom of the second barrel communicating inwardly into the second barrel from the first barrel, a small bleeder aperture through the bottom of the second barrel, fluid substantially filling the space between the first and second barrels and fluid filling the space between the piston and the bottom of the second barrel and between the piston and the top of the second barrel, and a fluid passage penetrating the lateral wall of the second barrel near the top thereof, whereby said tappet is automatically self-adjusting to zero lash in a valve lifter train and said bleeder aperture compensates for valve stem length lengthening in operation.

2. A zero lash self-adjusting hermetically sealed hydraulic tappet comprising: a first elongated cylindrical barrel having a closed end and an open end; a second cylindrical barrel of less length and smaller diameter than the first barrel and having an open and a closed end; a circular cover member having a central opening therethrough and affixed to the end of the first barrel, said second barrel open end being likewise affixed to the cover member in symmetrical internal relation to the first barrel; a piston slidably supported in a substantially fluid-tight fit in said second barrel, a stem affixed to said piston and projecting out of the cover member through the central opening therein, means for resiliently urging said piston away from the bottom of the second barrel; a check valve in the bottom of the second barrel communicating inwardly into the second barrel from the first barrel, a small bleeder aperture through the bottom of the second barrel, fluid substantially filling the space between the first and second barrels, and fluid filling the space between the piston and the bottom of the second barrel, and between the piston and the top of the second barrel, and a fluid passage penetrating the lateral wall of the second barrel near the top thereof, whereby said tappet is automatically self-adjusting to zero lash in a valve lifter train and said bleeder aperture compensates for valve stem lengthening in operation.

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