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SELF-CONTAINED TYPE HYDRAULIC VALVE LIFTER

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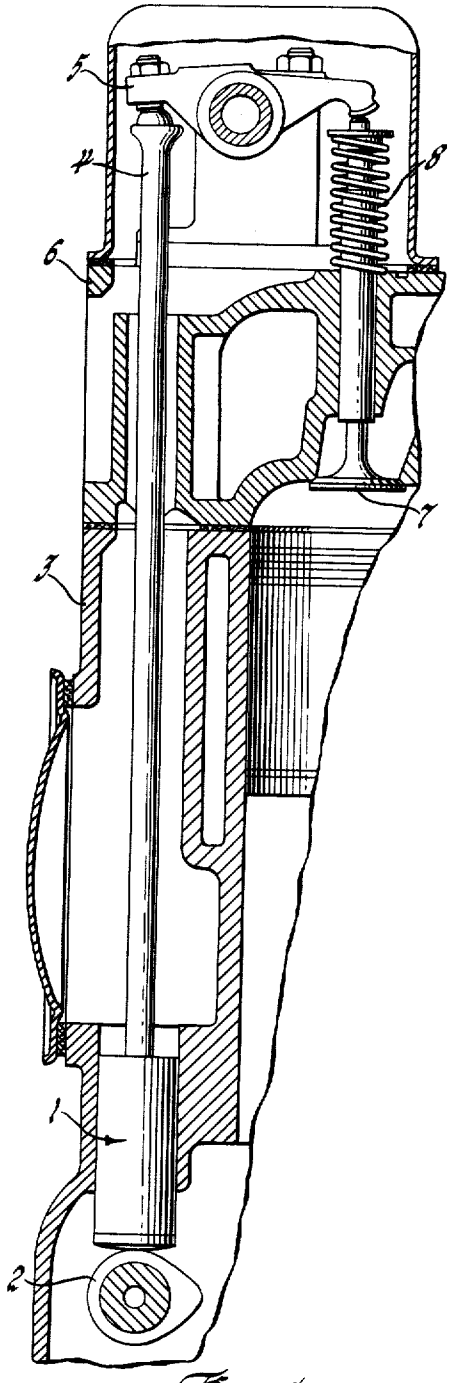


Fig. 1

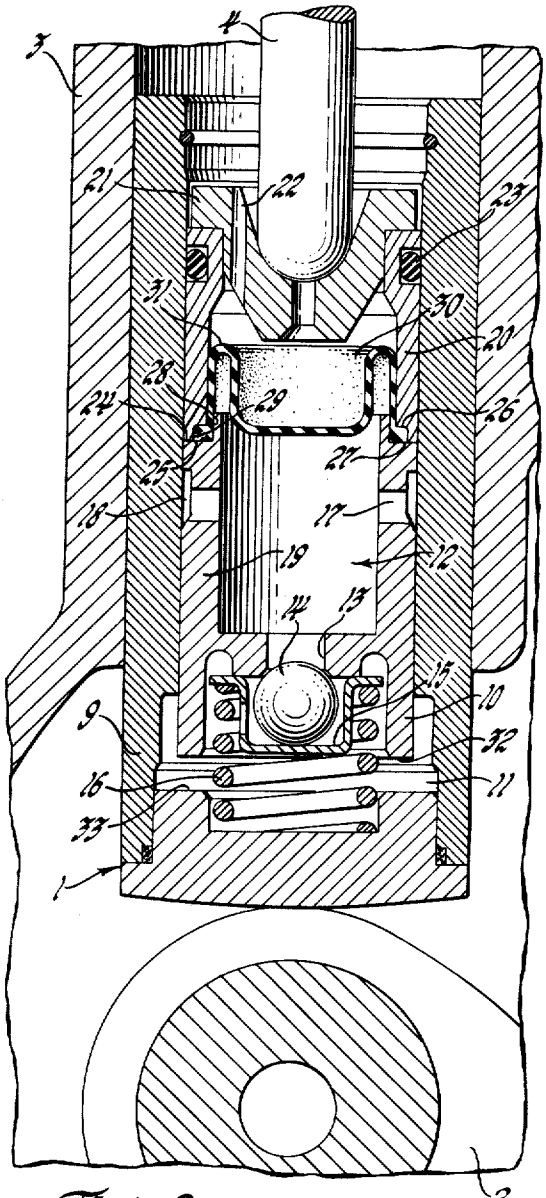


Fig. 2

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SELF-CONTAINED TYPE HYDRAULIC VALVE LIFTER

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This invention relates to hydraulic valve lifters for internal combustion engines, and particularly to lifters of this type which contain their own supply of hydraulic fluid, as distinguished from those which are fed from an external source such as the engine lubricating oil system.

The lifter of this invention, like conventional practice, comprises telescoping cylinder and plunger members between which axial thrust is transmitted by fluid in a "cushion" chamber, and a reservoir is provided in the inner of the two members for receiving leakage fluid from and supplying replenishment fluid to the cushion chamber in maintaining the proper length adjustment of the lifter. The unique feature of the lifter lies in the provision of a flexible diaphragm or partition which confines the fluid in the reservoir both against escape by leakage externally of the lifter, and against admixture with air during operation. A further advantage of the diaphragm arrangement is that the fluid pressure in the reservoir is maintained at substantially atmospheric pressure at all times, so that changes in adjusted length of the lifter do not materially affect its operating performance.

A better understanding of the means for carrying out the invention will be had from the following description of a preferred embodiment thereof, having reference to the drawing wherein:

Figure 1 is a transverse view partly in section and partly in elevation through the valve operating gear of an internal combustion engine incorporating the lifter of this invention.

Figure 2 is an enlarged fragmentary sectional view, similar to Figure 1, showing the internal parts of the lifter.

The lifter designated generally by the numeral 1 is shown arranged for reciprocation by the usual camshaft 2 in the engine crankcase 3. Lift movements of the lifter are transmitted by a push rod 4 to a valve rocker 5 mounted on the cylinder head 6, the rocker, in turn, effecting opening of an engine poppet valve 7 having its usual return spring 8.

The lifter has inner and outer cup shaped cylinder and plunger members 10 and 9, respectively, in nestably slidable relation. Between the closed ends thereof is a cushion chamber 11 in which hydraulic fluid acts to transmit thrust from the cylinder 9 to the plunger 10 during each lift stroke of the cam 2. The plunger 10 is hollow, forming a reservoir 12 which is connected by a passage 13 through the closed end of the plunger to the cushion chamber 11. A check valve in the form of a ball 14 is loosely retained opposite the end of this passage by a cage 15 so that fluid may flow into the chamber from the reservoir, but not in the reverse direction. 16 indicates a spring which biases the plunger outwardly of the cylinder and serves also to position the cage 15 on the plunger. The plunger 10 is cup shaped as shown, and its side walls are pierced by one or more transverse passages or ports 17 which

connect with an annular groove 18 encircling the plunger. Leakage of hydraulic fluid from the chamber, which occurs between the slidably fitted surfaces of the plunger and cylinder during each lift stroke of the cam 2, is collected by this groove 18 and returned to the reservoir via the ports 17. On each return stroke of the cam and during its subsequent dwell period, such fluid as has leaked from the cushion chamber during the previous lift stroke is replenished by fluid flowing past the ball 14 into the cushion chamber 11.

The plunger is formed in two longitudinally adjacent sections, these being the lower cup shaped section 19 containing the ports 17 and groove 18, and an upper generally cylindrical section 20. Resting on the upper end of the upper section 20 and extending thereinto is a plunger thrust transmitting member 21, forming a seat for the push rod 4. A vent passage 22 extends longitudinally through this seat member 21, adjacent one side of the push rod, for maintaining atmospheric pressure within the upper plunger section 20. Formed in the outer wall of the upper section 20 is an annular groove in which is seated an O-ring gasket or packing 23 which serves as means to prevent hydraulic fluid leaking out of the cylinder 9 rather than being returned to the reservoir via the groove 18 and ports 17.

The opposing ends of the upper and lower plunger sections are relieved as shown to provide co-abutting surfaces 24 and 25, respectively, adjacent the bore of the lifter cylinder 9, and axially spaced surfaces 26 and 27, together with radially spaced surfaces 28 and 29. The surfaces 26—29 serve to receive and sealingly clamp outer marginal extremities of an imperforate flexible diaphragm 30 which forms a partition between the hydraulic fluid in the reservoir and the air space above it within the upper plunger section 20. As shown, this partition has an annular fold 31, the outer wall of which lies against the inner wall surface of the upper plunger section 20. As a result, the central portion of the partition telescopes freely within the aforementioned outer wall portion in moving inwardly and outwardly of the plunger with change in quantity of hydraulic fluid in the reservoir 12.

In assembling the lifter, all air is excluded from the reservoir, chamber 11 and ports 17, etc., before clamping the partition 30 between the two plunger sections. This is desirable in order to insure quick response of the plunger to cam lifting movements of the cylinder in operation. No leakage of air into the reservoir therefore occurs through the upper end of the plunger, by reason of the seal afforded by the partition 30. Likewise, no hydraulic fluid leakage from the cushion chamber 11 may occur between the upper plunger section 20 and the cylinder bore by reason of the O-ring 23. The partition 30 has freedom to flex upwardly with increased hydraulic fluid content in the reservoir sufficiently to accommodate a fully "leaked down" condition of the plunger when its lower end 32 abuts the closed end 33 of the cylinder. Since atmospheric pressure only is applied to the upper surface of the partition at all relative positions of the plunger, substantially constant atmospheric pressure is maintained in the reservoir 12. As the result of maintaining such a constant reservoir pressure, neither the rate of leakage around the plunger during the lift stroke nor the rate of fluid flow into the cushion chamber from the reservoir is materially affected by change in relative heights of the plunger and cylinder.

While only a single preferred embodiment of the invention has been disclosed, it is appreciated that numerous minor changes in the construction and arrangement of the parts may be made without departing from the spirit and scope of the invention as defined in the following claims.

I claim:

1. In a hydraulic valve lifter, a cylinder with a closed end, a hollow plunger defining a fluid reservoir with side walls slidably fitting the cylinder and an end wall cooperating with said cylinder closed end to define a chamber for fluid in thrust transmitting reation between the cylinder and plunger, said plunger end wall having a one-way passage therethrough for fluid flow from the reservoir to the chamber, said plunger side walls having a port extending therethrough intermediate their ends for returning to the reservoir fluid escaping externally of the plunger from said chamber, means sealing the cylinder to the plunger side walls above said port, and a flexible imperforate wall sealingly secured to the plunger side walls above said port and defining the upper limits of said reservoir.

2. The invention of claim 1, wherein said imperforate wall has freedom to flex toward and away from said plunger end wall in maintaining substantially atmospheric pressure in the reservoir.

3. The invention of claim 2, together with a plunger thrust transmitting member seated by the plunger side walls and spaced above said imperforate wall, said thrust transmitting member having an opening extending longitudinally therethrough providing an atmospheric vent for the interior of the plunger above said imperforate wall.

4. In a hydraulic valve lifter having a cylinder closed at one end to form an oil cushion chamber and slidably receiving a plunger, a reservoir in the plunger for receiving fluid escaping between the plunger and cylinder from the chamber and for supplying fluid to the chamber, said plunger having a one-way valved passage in its inner end connecting the reservoir for fluid flow to the chamber and having a transverse passage in its side for returning said escaping fluid to the reservoir, a fluid sealing gasket between the cylinder and the plunger above said transverse passage, and a flexible diaphragm within the plunger above said transverse passage and defining the upper limits of said reservoir, said diaphragm being imperforate and having freedom to flex upwardly in maintaining substantially atmospheric pressure in the reservoir as the quantity of fluid therein increases with decrease in fluid quantity in said chamber.

5. The invention of claim 4, wherein said plunger comprises a lower cup-shaped section and an upper cylindrical section, said plunger sections having their opposing ends in abutting engagement adjacent the cylinder bore and in radially and axially clamping engagement inwardly thereof with the lateral extremities of said diaphragm, said diaphragm having an annular fold with the outer wall of said fold receiving its lateral support from the side walls of one of said sections.

6. In a hydraulic valve lifter having nestably slidable cup shaped members defining a fluid cushion chamber between their respective closed ends and a fluid reservoir within the inner member; passage means interconnecting the chamber and reservoir accommodating substantially unrestricted fluid flow from the reservoir to the chamber and restricted fluid flow from the chamber to the reservoir; a body of fluid filling said chamber, passage means and reservoir; a seal between the members preventing fluid flow from the chamber other than via said passage means; and a freely yieldable imperforate partition sealing the reservoir defining surfaces of the inner member against fluid flow outwardly of the lifter; said partition being exposed outwardly of the inner member to atmospheric pressure and being in direct surface engagement with the fluid in the inner member; whereby the fluid in the reservoir is prevented from admixture with air and is maintained at atmospheric pressure irrespective of its change in volume with change in volume of the cushion chamber.

7. In a hydraulic lash adjuster having telescoping members defining a variable volume chamber for fluid in endwise thrust transmitting relation therebetween and a variable volume reservoir for fluid entering and escaping from said chamber; passage means accommodating unrestricted fluid flow from the reservoir to the chamber and restricted fluid flow from the chamber to the reservoir; a body of fliud filling said chamber, passage means and reservoir; means sealing the members together against fluid escaping from the chamber other than to the reservoir; and a freely yieldable imperforate partition sealing against fluid flow from the reservoir other than via said passage means; said partition being in direct surface engagement on one side with the fluid in the reservoir and exposed on its opposite side to atmospheric pressure, whereby the fluid in the reservoir is prevented from admixture with air and is maintained at substantially atmospheric pressure.

8. The invention of claim 7, wherein the inner of said telescoping members comprises longitudinally adjacent sections having their opposing ends formed with co-abutting surfaces and radially and axiallly spaced surfaces located radially inward of said co-abutting surfaces, said partition having its peripheral portions sealingly clamped between said radially and axially spaced surfaces.

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