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HORIZONTAL VALVE LIFTER

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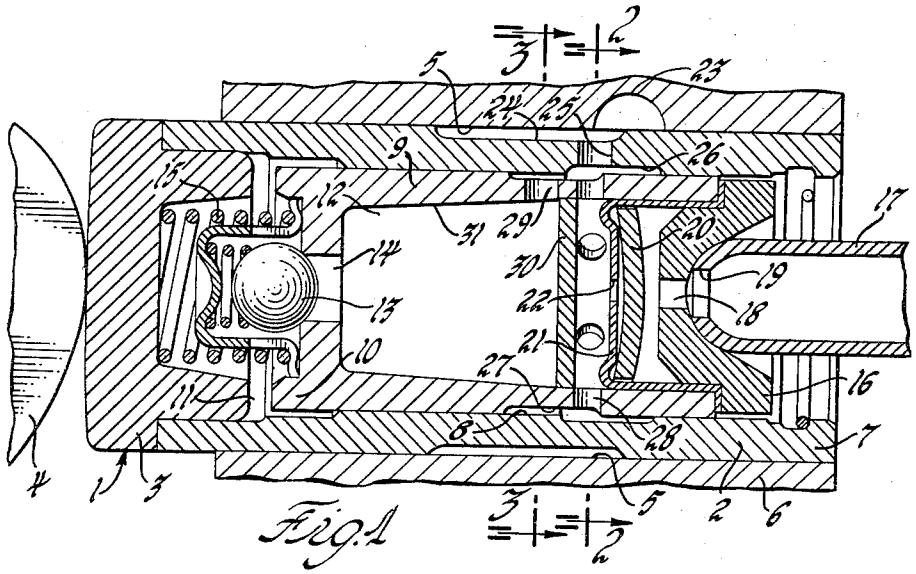


Fig. 1

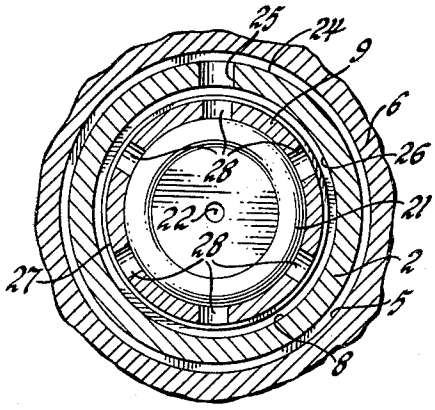


Fig. 2

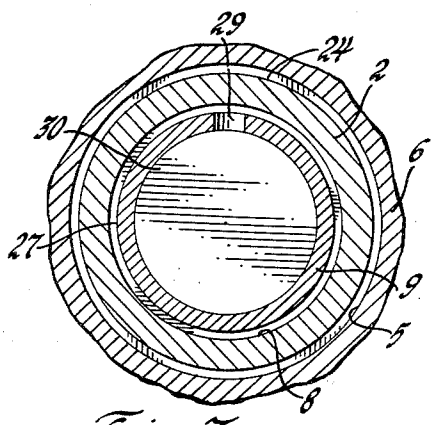


Fig. 3

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HORIZONTAL VALVE LIFTER

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This invention relates to externally fed hydraulic valve lifters and the like in the form of a dash pot device wherein the plunger is hollow and serves as a reservoir chamber for the externally fed fluid, and particularly to such devices which operate in a substantially horizontal direction.

In operation of such hydraulic valve lifters in horizontal or nearly horizontal inclined position, once the reservoir chamber and the pressure chamber or dash pot below the plunger is filled with hydraulic fluid (usually oil from the engine pressure lubricating system) any loss of fluid is more than made up to keep the reservoir chamber filled so that it, in turn, can replenish the necessary "leak-down" or escape of fluid from the pressure chamber past the plunger. At the end of each operating cycle (comprising one lift stroke, followed by return of the plunger cylinder to its initial position) such elongation of the lifter as is then necessary to take up all endwise clearance or lash in the valve operating linkage takes place in preparation for the next lift stroke. This hydraulic take-up occurs relatively slowly in comparison to the speed with which the parts move during the lift stroke, hence the noise which would attend the taking up of such last during the lift stroke is eliminated. However, during an engine shut-down when the oil supply pressure to the lifter is cut off it frequently happens that the oil in the reservoir chamber leaks out and is replaced by air, and during restarting of the engine the lifter is unable to function quietly until this air has been purged from the various chambers and passages within the lifter to enable it to again take up the lash before each lift stroke.

The problem of such "leak out" of oil from the reservoir chamber during engine shut-downs is particularly aggravated in the case of lifters which have a second outlet from the reservoir chamber through which oil is conducted to another part of the engine, as via the valve operating push rod to lubricate the rocker which transmits the lift motion finally to the engine valve or other part to be actuated by the lifter. During an engine shut down such an outlet from the reservoir chamber acts in conjunction with the lifter inlet or feed port to vent the reservoir chamber.

While previous proposals for solving this problem have been made, as by damming or baffling the reservoir chamber against reverse flow of oil out its inlet the United States Patent 2,938,508 to Papenguth, and by providing a positively closeable check valve to block such reverse flow in United States Patent 2,962,012 to Howson, I have discovered that satisfactory results can be obtained in a simpler and more economical manner. I preferably form the inlet to the reservoir chamber as a side port in the wall of the plunger, which port communicates with a suitable port in the side wall of the lifter cylinder by way of an annular groove on the outer cylindrical periphery of the plunger or the bore of the cylinder, or both. Furthermore, since there are conventionally a plurality of side inlet ports provided in the walls of the plunger to accommodate sufficient flow to both maintain the needed oil make-up requirements of the lifter and to insure adequate oil delivery through the outlet to the rocker or other engine part to be lubricated, my invention may be advantageously carried out by using only one of these plunger inlet ports to supply the lifter make-up oil requirements and baffling or partitioning the interior of the plunger so as to prevent

any of the remaining inlet ports or the lubricating oil outlet port from venting the reservoir chamber served by such single inlet port. Thus, the lifter make-up inlet port may be located in a plane spaced nearer the pressure chamber of the lifter from the plane of the remaining inlet ports through which oil enters the plunger for engine lubricating purposes, and the partition in the form of an imperforate plate or disc may be pressed into the plunger from the open end thereof to a position intermediate these two planes.

Also by tapering the side walls of the reservoir chamber within the plunger inwardly of its axis and toward the pressure chamber end of the plunger from the section thereof containing the single oil inlet port, any air which should enter the reservoir chamber will tend to be led away from the check valve controlled passage through which it is desired only make-up oil may flow into the pressure chamber from the reservoir chamber.

These and other objects and advantages of my invention will be more clearly understood from the following description of a single preferred embodiment thereof selected for purposes of illustration, having reference to the drawing, wherein:

FIGURE 1 is a fragmentary sectional view through the valve lifter guide bore of an internal combustion engine, showing my improved valve lifter installed in operative relation between the usual driving cam and driven push rod.

FIGURE 2 is a transverse sectional view taken substantially along the line 2—2 of FIGURE 1.

FIGURE 3 is a transverse sectional view taken substantially along the line 3—3 of FIGURE 1.

Referring now in detail to the drawing, a hydraulic valve lifter is designated generally by the numeral 1 and includes a rather conventional, generally cup-shaped dash pot or cylinder member formed of a tube 2 closed at one end by a foot piece 3. Shown also is the conventional engine driven cam 4 operatively engaging the foot piece 3. The outer periphery of the tube is slidably guided in the lifter bore 5 of the engine crankcase or other fixed part 6 of the engine. The cylinder is open at its opposite end 7, and slidably fitting the bore 8 of the tube 2 is a generally cup-shaped or hollow plunger 9. Two cup-shaped members are thus slidably interfitted in nesting relation, and the end wall 10 of the plunger and the cylinder end wall or foot piece 3 form between them a dash pot or pressure chamber 11. The internal side walls and end wall 10 of the plunger define a reservoir chamber 12 for storage of fluid required to replenish the pressure chamber 11 for that which escapes therefrom by leakage past the plunger in operation. Means providing a connection between these two chambers for accommodating fluid flow from the reservoir chamber into the pressure chamber, while restricting fluid flow therebetween in the opposite direction, is illustrated in the form of an oil check valve 13 controlling the passage 14 in the end wall of the plunger. Fluid may thus be trapped in the pressure chamber for transmitting thrust from the lifter cylinder to the plunger 9 when moveme t of the lifter cylinder is effected by the cam 4. The plunger return spring 15 acts in compression to bias the plunger outwardly of the lifter cylinder at all times, thereby tending to maintain the pressure chamber volume at a maximum at all times. Mounted on the open end of the plunger is a conventional push rod seat member 16 for a push rod 17 which transmits the cam induced plunger motion to the engine valve or other engine part to be actuated by the cam. In the particular construction shown, connecting axial passages 18 and 19 are provided in the push rod seat and push rod for conducting the lifter fluid used (oil) to the valve operating rocker or other

parts (not shown) of the engine, and a flow control valve 20 and retainer 21 therefor having a central aperture 22 serve to meter such flow through the push rod, as more fully disclosed in the aforementioned Papenguth patent.

Suitable external fluid supply means for the lifter is provided, including a gallery 23 which may be connected to the engine lubricating pump (not shown), this gallery being open to the lifter bore 5 in the engine. Passage means for connecting this external fluid supply to the plunger reservoir 12 will now be described. The lifter cylinder is provided with an annular external groove 24 of sufficient width to have continuous registry with the gallery 23 and this groove is connected via a port 25 with an internal groove 26 in the bore 8 of the cylinder. The plunger, in turn, has an external groove 27 of sufficient width for maintaining continuous registry with the cylinder internal groove 26 throughout the range of relative sliding movement of the plunger and cylinder members. Adjacent one side extremity of this plunger groove 27 are provided a plurality of side ports 28 in the plunger, through which engine lubricating oil may enter the interior of the plunger below the control valve retainer 21 and pass through the aperture 22 thereof and the passages 18 and 19 in the push rod seat and push rod.

As indicated in FIGURE 2 these ports 28 are all located in a single plane as represented by section 2—2 of FIGURE 1. Spaced inwardly of the cylinder and plunger, i.e., toward the pressure chamber 11, from these ports 28 is a single inlet port 29 which also extends through the side wall of the plunger to connect the grooves 26 and 27 with the reservoir chamber 12. Intermediate this single port 29 and the ports 28 is an imperforate partition 30 in the form of a disc having a press fit with the internal side walls of the plunger. Between this disc 30 and the check valve controlled passage 14 of the plunger, the internal side wall surfaces defining the reservoir chamber are tapered as shown at 31.

During operation of the valve lifter with the engine running, oil from the gallery 23 is delivered into the plunger on each side of the partition 30, that received therein via the single port 29 being available for make-up of oil required by the pressure chamber 11 during operation, and that which is received on the opposite side of the partition 30 being available for lubrication of the valve rocker or other engine parts via the hollow push rod 17. Upon shutting down the engine with consequent stoppage of engine oil supply pressure to the gallery 23, the partition 30 operates to prevent any of the ports 28 or the outlet via the aperture 22 and passages 18 and 19 from venting the reservoir chamber 12 inwardly of the plunger. As a result, even should the plunger have rotated in the cylinder to a position such that the single port 29 is opposite the lowermost side of the cylinder, the oil in the reservoir chamber will not leak out to any appreciable extent during a prolonged engine shut-down. Accordingly, upon restarting the engine there is little or no air contained in the reservoir chamber 12 that must

be purged before quiet operation of the lifter begins. To the extent that any air has so entered the reservoir chamber, it is readily directed by the taper 31 away from the check valve passage 14 and toward the port 29, through which it is permitted to escape this port when rotation of the plunger again positions this port 29 opposite the uppermost side of the lifter cylinder as shown.

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 horizontally operable hydraulic valve lifter, slidably interfitting cylinder and hollow plunger members defining a pressure chamber opposite one end of the plunger member and a reservoir chamber interiorly of the plunger member, passage means interconnecting said chambers including means operative to restrict fluid flow from the pressure chamber to the reservoir chamber relative to flow in the opposite direction, said plunger member having an outlet for fluid flow other than from the reservoir chamber to the pressure chamber, an imperforate partition in the plunger member, said partition being spaced from said outlet and separating said reservoir chamber therefrom, inlet fluid passage means connecting the exterior of the lifter to the interior of the plunger member between said partition and outlet, including a port in the cylinder member, a port in the plunger member and groove means on one of said members connecting said ports, an inlet passage consisting of a single side port in the plunger member connecting said groove means to the interior of the plunger between said partition and said first named passage means, whereby venting of the reservoir chamber via either said outlet or first named plunger port to permit drainage of fluid from the reservoir chamber via said single plunger port is precluded by said partition.

2. The invention of claim 1, together with means slidably guiding the cylinder member for reciprocation in a generally horizontal direction, and wherein the plunger member has its reservoir chamber defining surfaces diverging from each other in the direction away from the end of the plunger member adjacent said pressure chamber, whereby any air entering the reservoir chamber with the fluid and tending to rise therein by gravity is deflected by said surfaces toward the opposite end of the plunger.

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