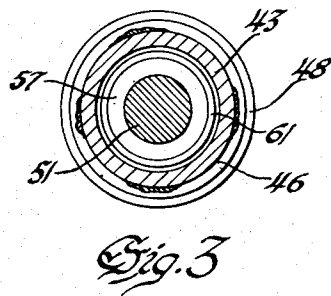
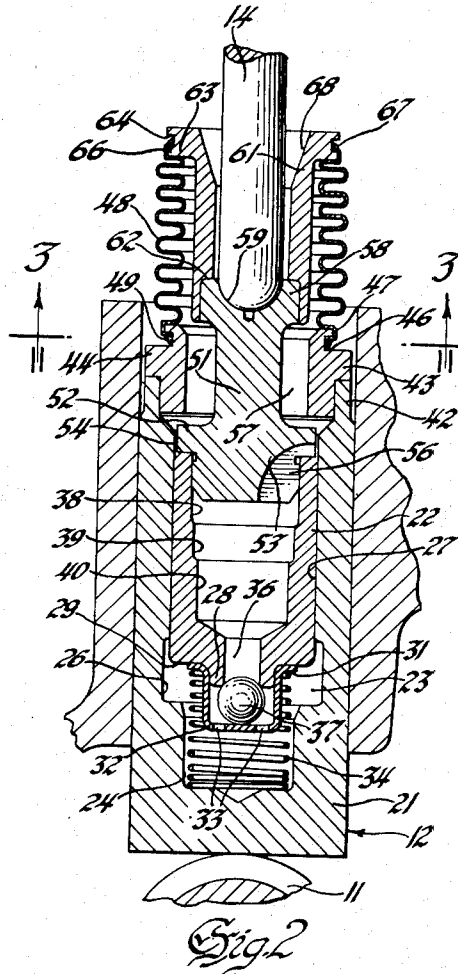
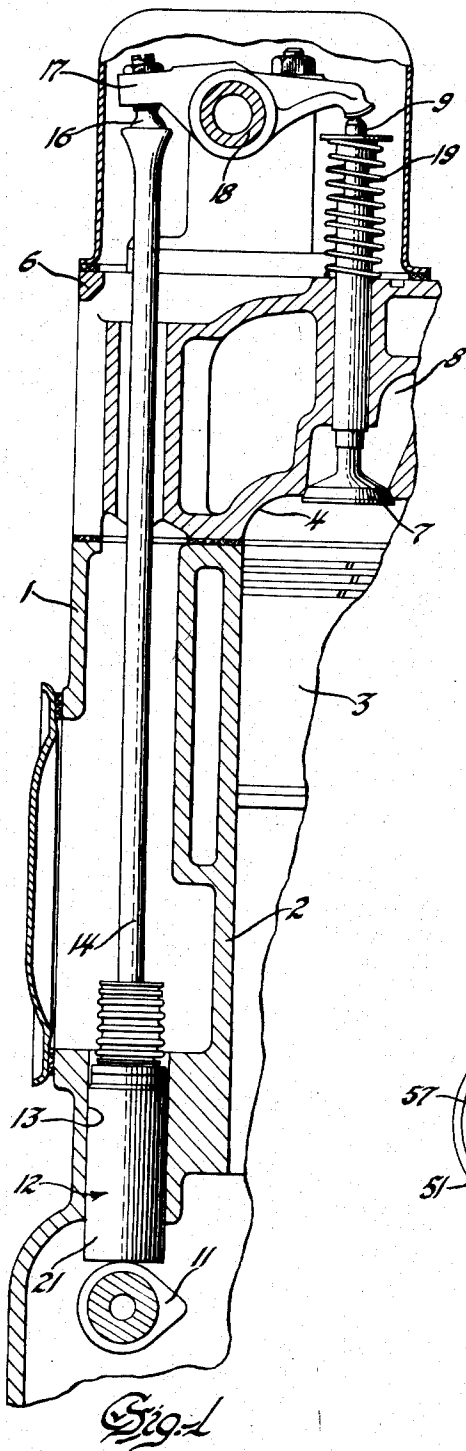


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HYDRAULIC VALVE LIFTER

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HYDRAULIC VALVE LIFTER

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1

This invention relates to hydraulic valve lifters for automatically taking up excess lash in the valve trains of internal combustion engines and the like, and particularly to such lifters of the "self-contained type" in which the hydraulic fluid is sealed within the assembly with no provision for its replenishment from any external source during operation.

The principal object of the invention is to provide an improved construction for lifters of the aforementioned type having the lifter plunger sealed to its operating cylinder by an expansible bellows located externally of both the cylinder and piston and in embracing relation with the lower end of the push rod or valve stem driven by the piston, the bellows being connected to the cylinder and a seat member for the push rod by novel means having advantages which both reduce the cost of construction and initial assembly, and enable the bellows unit to be formed as a subassembly unit removable as such from the remainder of the lifter for service replacement.

Further objects and advantages of my invention will be readily apparent from the following description of a preferred embodiment thereof, having reference to the drawing wherein:

Figure 1 is a sectional view of a portion of an internal combustion engine having a valve operating train incorporating my lifter.

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

Figure 3 is a sectional view through the lifter, taken on line 3—3 of Figure 2.

Referring now in detail to the drawing, there is shown in Figure 1 an engine cylinder block and crankcase structure designated generally by the numeral 1 in which is located a working cylinder 2 having the usual piston 3. Closing the upper end of the cylinder 2 and forming a combustion chamber 4 above the piston is a cylinder head 6. At 7 is a poppet valve controlling communication between a cylinder head port 8 and the combustion chamber 4 and having a stem 9 slidably mounted for reciprocation in the cylinder head. In conventional manner, reciprocal movements of the valve 7 are effected by rotation of a cam 11 which is suitably supported in the crankcase 1 and driven in timed relation with movements of the piston 3. Completing the valve operating train, I have shown my lifter 12 operatively engaging the cam 11 and slidably supported for reciprocation in a lifter bore 13 formed in the crankcase 1. Upward movements of the lifter are transmitted by the usual push rod 14 to an adjusting screw 16 fixed in one end of the rocker 17, which latter is arranged to oscillate about an axis represented by the rocker shaft 18 suitably supported on the cylinder head 6, the other end of the rocker being in driving engagement with the upper end of the valve stem 9. A valve return spring 19 having one end secured to the valve

2

stem and its other end seated against the cylinder head is also shown, and serves to maintain the valve in closed position as illustrated in Figure 1.

As shown in Figure 2 the lifter 12 comprises telescoping cup shaped cylinder and piston members 21 and 22 arranged in nesting relation. Between the closed end of the lifter cylinder 21 and the adjacent end of the lifter piston 22 is a fluid pressure chamber 23 which is normally maintained filled with fluid for transmitting thrust from the cylinder to the piston during opening movements of the engine valve 7. This pressure chamber 23 includes a lower well portion 24 which opens upwardly into an enlarged diameter portion 26 of preferably greater diameter than the bore 27 of the cylinder and extending upwardly beyond the lower end of the piston outer periphery. The lower end of the piston has an extension 28 of reduced diameter forming a shoulder 29 at its juncture with the main body of the piston. Loosely journaled on the extension 28 and having an external flange 31 rotatively seated against the shoulder 29 is a cup shaped cage member 32 whose end wall is provided with one or more apertures 33 which provide communication between the interior of the cage member and the portion of the chamber 23 externally thereof. Seated in the bottom of the well 24 and loosely centered by the side walls thereof is a lifter piston biasing spring 34 whose upper end loosely embraces the cage member 32 and maintains its flange 31 seated against the shoulder 29 of the lifter piston. Extending through the bottom wall of the lifter piston and its extension 28 is a fluid supply passage 36, through which fluid may pass from the interior of the piston to the pressure chamber 23. A check valve accommodating such fluid flow but preventing flow of fluid in the reverse or upward direction through the passage 36 is also provided in the form of a ball 37 which is of larger diameter than the passage 36. The seat for this ball 37 is formed by the lower end of the extension 28 immediately surrounding the passage 36, and when the ball is in engagement with this seat and the cage flange 31 is in abutment with the piston shoulder 29 only a predetermined small clearance (on the order of .004-.008) exists between the ball and the bottom wall of the cage member. The internal surface of the piston side walls are preferably formed as a series of decreasing diameter portions 38, 39, and 40, as shown, which arrangement lends strength to the lifter piston lower side and end walls while yielding the largest internal volume for purposes of fluid storage.

The cylinder side walls terminate at their upper end with an annular section 42 of reduced external diameter and increased internal diameter. Pressed into this annular portion 42 is a collar member 43 having a flange 44 intermediate its

3

ends which abuts against the upper end face of the cylinder portion 42 and has its external periphery flush with the outer annular surface of the portion 42. The internal diameter of the collar member 43 is substantially less than that of the cylinder bore 27 so as to overhang the latter as shown. Between its upper end and the flange 44 the external periphery of the collar member is relieved by an annular groove 45 to form a narrow flange 47 which defines the upper outer end collar member, and crimped around this flange 47 is the lower end of an expansible bellows 48. A fluid tight joint is secured between the bellows 48 and collar member 43 as by soldering or welding the two parts together as at 49 within the groove 46.

Forming a seat for the lower end of the push rod 14 is a member 51 having a flange 52 which rests on the upper edge of the piston side walls and a lower end portion 53 having a slip fit in the piston bore 38. The external diameter of the flange 52 is made somewhat less than the bore diameter of the lifter cylinder to provide an annular space 54 therebetween. To provide continuous communication between this space 54 and the interior of the lifter piston below the push rod seat member 51 a radial slot 56 is provided extending from the lower face of the end portion 53 to the lower outer periphery of the flange 52. Above the flange 52 the seat member is of reduced transverse section to provide an annular space 57 between it and the collar member 43, and the upper end of the seat member is formed with an enlarged head portion 58 whose upper face is recessed as at 59 to socketably receive the lower end of the push rod 14.

Press fitted onto the external periphery of the head portion 58 is the lower counterbored end of a sleeve member 61 whose internal diameter above the head portion 58 loosely embraces the push rod 14. A shoulder 62 formed at the juncture of the internal diameter and the lower end counterbore of this sleeve member 61 abuts the upper end face surrounding the recess 59 in the valve seat head 58. The upper end of the sleeve member 61 has an external flange 63 whose outer periphery is circumferentially grooved as at 64, and the upper end of the bellows member 48 is sealed to this flange by crimping the bellows material around the lower side wall 66 of the groove 64 and welding or soldering as at 67. The internal diameter of the sleeve member 61 may be enlarged or flared at its upper end as shown at 68 for the purpose of directing the engine lubricating oil draining down the outside of the push rod into the sleeve for lubricating the recess 59 and the abutting lower end of the push rod. The bellows member 48 has its internal diameter larger than the outer periphery of the sleeve member 61 below the flange 63 to prevent sliding friction between these parts during lifter operation and to permit the bellows member being filled or partially filled with hydraulic fluid at assembly.

In operation, lifting movements of the lifter cylinder 21 in response to rotation of the cam 11 are transmitted to the lifter piston 22 through the medium of the hydraulic fluid which is trapped within the pressure chamber 23 upon closure of the piston passage 36 resulting from the ball check valve 37 moving to its seated position at the lower end of this passage in response to increased fluid pressure in the chamber 23. Continued upward movement of the lifter cylinder is then accompanied by upward movement of

4

the lifter piston which, in turn, transmits this movement through the push rod seat member 51 to the push rod 14, causing the rocker 17 to rotate on its shaft 18 and open the engine valve 7 against its return spring 19. The spring 19 serves both to close the engine valve and to return the lifter to its initial position after each lift stroke of the cam. Any wear or thermal contraction of the parts which would tend to create an endwise clearance between the upper end of the engine valve stem and the cam when the engine valve is in closed position is taken up by the lifter spring 34 urging the lifter piston out of its cylinder and the lifter cylinder against the operating face of the cam. In order that the lifter may also accommodate any lengthening of the valve train resulting from thermal expansion of the parts as the engine heats up in operation, a certain amount of fluid leakage past the lifter piston from the pressure chamber 23 during each lift stroke is provided for in the fit between the lifter piston and the cylinder bore 27. This leakage fluid is returned to the interior of the lifter piston via the slot 56 in the push rod seat 51. As the volume of the pressure chamber is restored by the action of the lifter spring 34 in urging the piston outwardly of its cylinder after each lifting stroke the resultant pressure drop in the chamber 23 permits the ball check valve to leave its seat to the extent permitted by the cage member 32 and sufficient fluid then flows downwardly through the passage 36 to replenish this leakage from the chamber 23. At the start of the next lift stroke of the lifter cylinder the fluid pressure in the chamber again rises, causing the ball check valve to again seat itself and the operating cycle to be repeated.

Above the flange 52, the annular space 57 between the push rod seat member and the collar member as well as the annular space between the bellows member and the sleeve member, provide additional storage capacity for the hydraulic fluid. Leakage of this fluid to the exterior of the lifter assembly is prevented by the press fit of the collar member 43 in the cylinder and the press fit of the sleeve member on the head 58 of the push rod seat. In their normal positions, as shown in Figure 2, the flange 52 of the push rod seat is spaced below the lower end of the collar member 43 so that there is ample communication between the annular space 57 and the upper end of the slot 56.

The means described for securing the bellows to the lifter cylinder and push rod seat enables this seat member 51 together with the sleeve member 61, bellows 48 and collar member 44 to be pre-assembled as a unit for convenient initial installation and replacement in service. Also, the collar member 43 being pressed into the upper end of the lifter cylinder and having an internal diameter exceeding that of the push rod seat flange 52 takes the place of the conventional snap-ring or other stop means for limiting outward movement of the piston and push rod seat when the lifter assembly is removed from the engine.

Having thus described a preferred structural embodiment illustrating the principles and advantages of my invention, minor modifications will readily suggest themselves to persons skilled in the art. Such modifications, however, shall not depart from the spirit and scope of the invention as defined by the following claims.

I claim:

1. In a hydraulic lifter having cup-shaped piston and cylinder members in slidably nested re-

lation and forming a fluid pressure chamber between their end walls, the interior of the piston forming a reservoir for fluid to be introduced to said chamber, an annular collar member having a press fit in the cylinder member above the piston member, an annular seat member carried by the piston member and having a portion extending through and defining an annular space within said collar member in communication with said reservoir, a sleeve member having a press fit on the upper end of said seat member, and an expansible bellows surrounding said sleeve member, said bellows having its upper and lower ends sealed to the sleeve and collar members, respectively, and its lower end open to said annular space.

2. In a hydraulic lifter having a cylinder with oppositely closed and open ends and a piston reciprocally mounted in the cylinder, means above the piston forming a reservoir for fluid to be introduced to the closed end of the cylinder, said means including an annular collar having a press fit in the open end of the cylinder and a seat member having a portion abutting the piston and engageable with the underside of said collar member to limit movement of piston outwardly of the cylinder, a sleeve extending above said seat member having its lower end press fitted thereto, and an expansible bellows loosely surrounding said sleeve and forming a sealed connection between the upper end of said sleeve and said collar member.

3. In a hydraulic lifter having a cylinder with a bore open at one end and a piston slidably fitting said bore, said cylinder being provided at the open end of said bore with a pressed-on collar member having a diameter less than the cylinder bore diameter, a seat member carried by the piston having a portion extending within said collar member for engagement with a lifter driven member, said portion and collar member defining an annular space open to said bore end, and means forming a fluid tight connection between said collar and seat members consisting of a rigid sleeve and an expansible bellows in concentric relation, said sleeve and bellows having their upper ends sealed to each other and their lower ends sealed respectively to said collar and seat members.

4. In a fluid sealing and driven stem seating device adapted for assembly as a unit to a hydraulic lifter of the type having slidably interfitted cylinder and piston members with correspondingly presenting open ends, said device including an annular collar member having a lower end portion adapted to be press fitted to the open end of the cylinder, a seat member having a portion extending concentrically of said collar member and terminating at its lower end with a portion adapted to rest on the piston, a sleeve forming an upward extension of said seat member, said sleeve having its lower end press fitted onto said seat member, and an expansible bellows surrounding said sleeve having its upper end sealed to the upper end of said sleeve and its lower end sealed to said collar member, said first named seat member portion and said collar member defining an annular space for passage of fluid between the open end of the cylinder and the interior of the bellows.

5. In a device for transmitting thrust to and from a piston of a hydraulic lifter and forming a fluid tight joint between said piston and the lifter cylinder, an annular collar member having a cylindrical surface adapted to effect a press fit

with an opposing cylindrical surface of the lifter cylinder, a second member adapted to seat on the lifter piston and reciprocate therewith in the cylinder, said second member having a portion of reduced cross-section extending outwardly of the cylinder in radially spaced relation with the internal periphery of said collar member and defining an annular space open at its lower end to the lifter cylinder, a sleeve having one end press fitted on the outwardly extended end of said second member, and an expansible bellows interiorly open to the upper end of said annular space and sealingly interconnecting the collar member and the opposite end of said sleeve.

6. In a hydraulic valve lifter having upwardly presenting cup shaped piston and cylinder members in sliding engagement with each other, an annular seat member having a flange abutting the open end of the piston member and a portion depending from said flange having a slip fit with the internal periphery of the piston, said flange terminating radially in spaced relation to the bore of the cylinder to provide for passage of fluid therebetween, said seat member having a passage formed therein interconnecting the outer periphery of said flange and the interior of the piston below said seat member, said seat member having a reduced diameter portion extending above said flange and an enlargement at the upper end of said reduced portion, said enlargement being formed with an upwardly presenting recess forming a seat for the lower end of a valve actuating rod, a sleeve extending above said seat having a counterbore in its lower end press fitted to the outer periphery of said enlargement, the bore of said sleeve above said counterbore being of sufficient diameter to accommodate free flow of oil draining down the external periphery of the valve rod to said seat, said sleeve being provided with an external flange adjacent its upper end, said sleeve flange having its external periphery relieved by a circumferential groove, said cylinder member terminating at its open end in an annular section of reduced external and increased internal diameters, an annular collar member having a flange abutting the end face of said section and a depending portion press fitted to the internal periphery of said section, said collar member having an internal diameter less than the diameter of said seat member flange and larger than the outside diameter of said sleeve, whereby said collar member constitutes a stop limiting movement of the piston and seat member outwardly of the piston while accommodating their movement inwardly of the cylinder with the sleeve, said collar member having a circumferential groove in its external periphery above the flange thereof, and an annular expansible bellows having its internal diameter spaced concentrically from the external periphery of the sleeve, said bellows having its upper end crimped into said groove in the seat member flange and its lower end crimped in said groove in the collar member.

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