Oct. 20, 1964 L. J. VAN SLOOTEN 3,153,404

HYDRAULIC LASH ADJUSTER

Filed Dec. 30, 1963

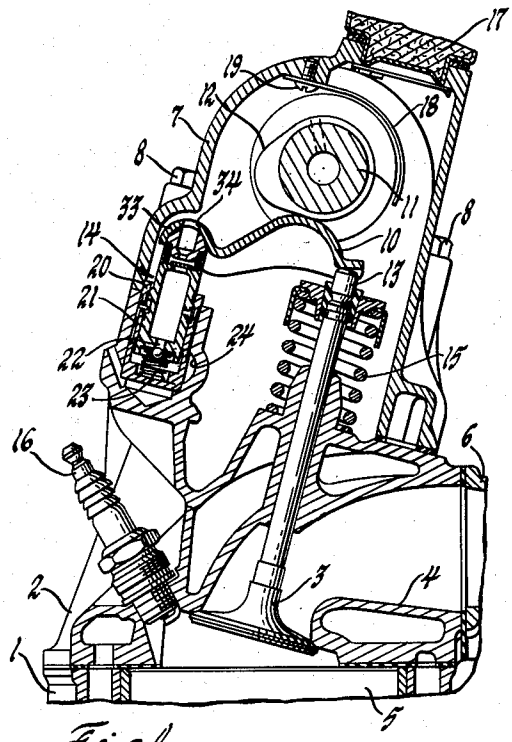


Fig. 1

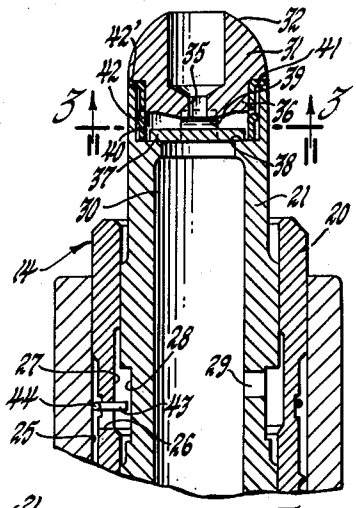


Fig. 2

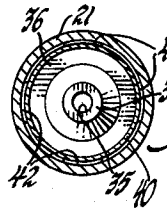


Fig. 3

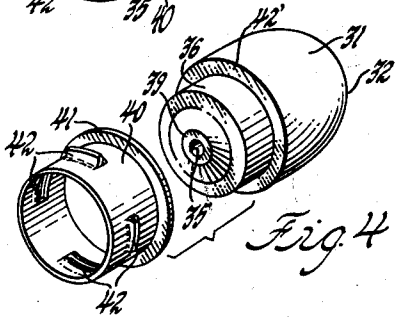


Fig. 4

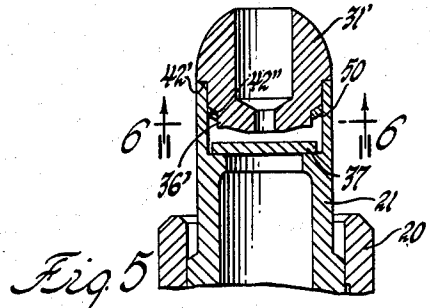


Fig. 5

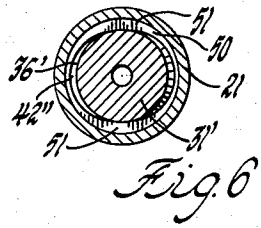


Fig. 6

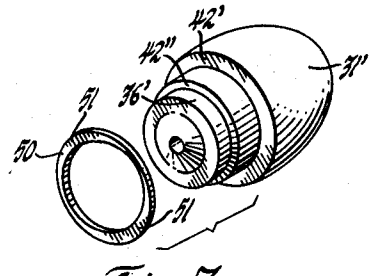


Fig. 7

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HYDRAULIC LASH ADJUSTER

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The invention relates to hydraulic lash adjusters such as are used, for example, in internal combustion engines for taking up clearance between the thrust transmitting parts in the valve train.

It is conventional practice to employ such a hydraulic lash adjuster in the form of a tappet or lifter between the valve operating cam and the poppet valve, or between such cam and the push rod which transmits opening movement to the valve through a rocker arm. The prior U.S. Patent 2,818,050 to Papenguth shows a hydraulic valve lifter of the latter type having the usual cup-shaped outer body port and slidably interfitting cup-shaped plunger. The plunger carries an apertured thrust member which closes its upper end and transmits the thrust to a hollow push rod. The engine lubricating oil, which enters the lifter through registering side ports in the body and plunger and thence through a check valved passage in the lower end of the plunger to serve as the plunger supporting fluid, is also permitted to flow through the aperture in the thrust member and the push rod for lubricating the valve rocker, such flow being metered by a control valve within the upper end of the plunger. These lifters, which are assembled for shipment and installation as unit assemblies, may be conveniently retained in assembled condition by means of a snap ring seated in the open outer end of the body and overlying the thrust member.

For those installations, however, where the over-all length of the lifter body, plunger and thrust member must be minimized there is insufficient room for extending the open end of the body part to locate any such snap ring or other retainer outwardly thereof from the thrust member. Such a limitation on over-all length, for example, may be presented in the case of the Papenguth type lifter employed as a hydraulic lash take-up device at the fulcrum for the rocker in the poppet valve operating train of an overhead cam engine. In the interest of minimizing engine height—an important element in obtaining a low vehicle profile—the rocker bears directly on the thrust member carried by the plunger of the lash adjuster, and the open end of the body which forms the dash pot terminates well below this end of the plunger so as not to interfere with oscillation of the rocker arm. It is desirable in such arrangements to provide for oil flow through the thrust member for lubrication of the rocker bearing and cam engaging surfaces, and to meter this flow with a control valve within the plunger in the manner of the aforementioned Papenguth patent. The present invention is accordingly directed to providing a unique and advantageous, yet low-cost, means for retaining the thrust member in place on the plunger and limiting the outward movement of the plunger from the body prior to installation of the lash adjuster in the engine.

This is accomplished in accordance with the invention by press fitting, onto the portion of the thrust member which extends into the plunger above the control valve, a retainer member which embraces said portion and has outer peripheral sections which are resiliently deflected by the inner side walls of the plunger during insertion of the thrust member; and by employing a bail-like member which extends about the girth of the lash adjuster body and has a projecting end extending through the oil feed port in the side wall of the body and into an external

groove on the plunger which registers with this body side port.

The invention will be more clearly understood from the following description of two preferred embodiments thereof, selected for illustration, having reference to the drawing wherein:

FIGURE 1 is a transverse cross-sectional view of a portion of an internal combustion engine and showing my improved lash adjuster in its installed operating position therein.

FIGURE 2 is an enlarged fragmentary view of the lash adjuster shown in FIGURE 1.

FIGURE 3 is a sectional view taken substantially on the line 3—3 of FIGURE 2.

FIGURE 4 is an exploded view in perspective of the plunger thrust member and its retainer member.

FIGURE 5 is a view similar to FIGURE 2, but showing a modification of the means for retaining the plunger thrust member.

FIGURE 6 is a sectional view taken substantially along the line 6—6 of FIGURE 5.

FIGURE 7 is an exploded view in perspective of the plunger thrust member and its modified retainer member.

Referring now in detail to the drawing, and first to FIGURE 1, there are shown portions of an internal combustion engine including a cylinder block 1, on which is mounted a cylinder head 2 fitted with a conventional poppet valve 3 for controlling a port 4 connecting the engine cylinder 5 with the manifold 6. A rocker cover 7 is shown secured to the cylinder head by bolts or studs 8, and journaled in this cover, above a valve rocker 10, is a cam shaft 11 which is suitably driven by the engine crankshaft (not shown). The rocker 10 is in the form of an arm which bears intermediate its ends against a cam 12 on the cam shaft, and has its ends resting on the upper end of the valve stem 13 and fulcruming on the hydraulic lash adjuster designated generally by the numeral 14. Also shown are the conventional coil return spring 15 for the poppet valve, a spark plug 16, an engine oil vent cap 17, and an oil deflecting shield 18 secured by a bolt 19 to the rocker cover to prevent engine oil being thrown directly against the vent cap by the cam lobe.

The lash adjuster 14 comprises an upwardly presenting, generally cup-shaped body 20 which is seated in a pocket provided therefor in the cylinder head at one side of the poppet valve. This body forms a dash pot for an upwardly presenting, generally cup-shaped plunger 21 whose lower end has a check valve controlled passage 22 therein for admitting and trapping hydraulic fluid (engine oil) in the lower end of the body to support the plunger under thrust loads imposed during opening of the engine poppet valve by the cam and rocker. The usual plunger return spring 23, between the lower ends of the plunger and body, serves to advance the plunger outwardly of the body when such thrust loads are relieved by the rocker returning to the base circle of the cam 12 to allow the poppet valve to close. Oil which serves as the hydraulic fluid is delivered, as a part of the engine lubricating system, to the pocket via an oil gallery 24 adjacent thereto in the cylinder head. This gallery communicates with an external annular groove 25, best shown in FIGURE 2, in the body. A transverse port 26 extends through one side wall of the body to an internal annular groove 27 therein which, in turn, is in constant registry with an external annular groove 28 on the plunger 21, and a transverse port 29 in the plunger connects this latter groove with the reservoir chamber 30 formed by the plunger above its check valve passage 22. During engine operation, oil is constantly fed under pressure via the gallery 24 and connecting grooves 25, 28 and ports 26, 29 to the reservoir 30, from which sufficient oil is admitted past the check valve to

maintain that portion of the body below the plunger filled at all times.

The upper end of the plunger, it will be noted, extends a substantial distance outwardly of the body 20 and carries a thrust member 31 having a part-spherical upper end surface 32 which socketably receives the concave-shaped end 33 of the rocker. This concave-shaped end of the rocker has a central aperture 34 therein (FIGURE 1) to allow passage of oil from the plunger reservoir 30 to lubricate the rocker surfaces engaging the cam 12 and the valve stem 13, and to connect this rocker aperture 34 with the plunger reservoir 30 is a passage 35 extending centrally through the thrust member 31. The thrust member has a portion 36 extending into the open upper end of the plunger, and disposed between this portion and the reservoir 30 is a control valve 37 for metering oil flow through the passage 35. This particular metering valve illustrated is in the form of a plate-like member which has freedom for limited movement between an internal shoulder 38 on the plunger and the lower end face 39 of the thrust member portion 36. By reason of this face 39 having a part-cylindrical curvature where it is intersected by the passage 35, the plate-like metering valve 37 variably restricts (but does not entirely block) delivery of oil through the passage 35.

Since the plunger with its thrust member 31 must extend a substantial distance above the upper end of the lash adjuster body 20 in order to avoid any interference of this body with oscillation of the rocker 8, novel means must be provided for retaining the lash adjuster parts in assembled relation. To this end, as best shown in FIGURES 2, 3 and 4, an annular retainer member 40 serves to secure the thrust member on the plunger and a bail-like member 44 limits outward displacement of the plunger from the body. The retainer member 40 is shown in the form of a sleeve which may be made of sheet metal of sufficient stiffness and resilience for the function now to be described. It is shown with an external flange 41 at its upper end, and it is of sufficient length that its lower end terminates just short of abutment with the shoulder 38 in the plunger. The flange 41 extends between the upper end of the plunger and the thrust member shoulder 42' formed by its reduced portion 36, and the side walls of the sleeve have a plurality of lanced-out peripheral sections 42 which are deflected by the internal surfaces of the plunger during insertion of the thrust member into the open end of the plunger. As will be appreciated, these lanced-out portions or tab-like projections 42 may initially extend perpendicularly to the longitudinal axis of the plunger, but when installed therein with the thrust member 31 they assume an angle to such axis that they tend to forcibly engage the inner peripheral surfaces of the plunger in opposing withdrawal of the thrust member. The installation is best effected by press fitting the retainer member onto the portion 36 of the thrust member and then forcing this subassembly into the open end of the plunger.

The plunger retainer member 44 is in the form of a bail-like wire which embraces the body within its external groove 25, and has an inturned portion 43 at one end which extends through the body port 26 and terminates within the plunger external groove 28. It will be evident that when the lash adjuster is removed from the engine this inturned portion 43 will limit outward movement of the plunger by engagement therewith of the lower end of the plunger groove 28.

FIGURES 5, 6 and 7 show a modified form of the thrust member retainer, this being initially in the form of a flat sheet metal, resilient washer 50 whose outer periphery is circular and whose inner periphery is elliptical. The ellipse defined by the internal periphery has a minor diameter enabling it to effect a press fit on the reduced portion 36' of the thrust member 31', and a major diameter which is slightly greater than the diameter of the thrust member portion 36'. Because of its relative weakness to flexure about the major axis of the ellipse as compared to that about the minor axis thereof, the retainer member 50 assumes a part-cylindrical shape when pressed onto the thrust member portion 36; i.e., the wider sections 51 of the member adjacent its minor axis are inclined slightly toward a thrust member shoulder 42'', which is preferably made conical as shown. The diameter of the external periphery of the member 50 is such as to initially have a merely snug sliding fit with the internal surfaces of the plunger open end, however when the member 50 is pressed onto the thrust member portion 36' the said inclined peripheral sections of the member 50 adjacent its major axis are somewhat expanded from their initial circular configuration, as well as inclined to the longitudinal axis of the plunger. Then, upon forcing the thrust member portion 36' with its pressed-on member 50 into the plunger until its shoulder 42' abuts the outer end of the plunger, these outer peripheral sections 51 of the member 50 are further deflected by the internal surfaces of the plunger to an acute angle, as shown in FIGURE 5, whereby they opposingly engage those surfaces in resisting withdrawal of the thrust member from the plunger. The same bail-like member 40 described above may be used with this modified form of thrust member retainer.

While only two embodiments of the invention have been disclosed it is appreciated that minor changes in the parts and their arrangement may be made without departing from the spirit and scope of the invention defined in the following claims.

I claim:

1. In a hydraulic lash adjuster, a dash pot, a hollow plunger therein into which fluid is fed for both admission to the dash pot inwardly of the plunger and for delivery out the opposite end of the plunger, said plunger opposite end being open, means for metering said fluid delivery including a plunger thrust member having a portion extending into said open end, and retaining means embracing said portion with a press fit and having outer peripheral sections resiliently deflected by the inner peripheral surfaces of the plunger during insertion into said open end with said thrust member, said deflected sections being at an acute angle with the longitudinal axis of the plunger for imparting wedging engagement with said surfaces in opposition to withdrawal of the thrust member from the plunger.

2. The invention of claim 1, wherein said metering means also includes a passage in said thrust member connecting the interior of the plunger to the exterior of the lash adjuster and a member adjacent the inner end of said passage and movable relative thereto within the plunger, and wherein said thrust member has a portion in operative endwise abutment with the plunger for limiting the extent of insertion of said first named portion into said open end of the plunger.

3. The invention of claim 2, wherein said retaining means consists of a sleeve with lanced-out tabs extending angularly from the sides thereof to form said peripheral sections.

4. The invention of claim 2, wherein said retaining means consists of a washer-like member having a generally elliptical internal periphery and circular external periphery, whereby the external periphery portions adjacent the major axis of the ellipse form said outer peripheral sections.

5. In a hydraulic lash adjuster comprising a generally cup-shaped body forming a dash pot, a hollow plunger therein and extending outwardly of the open end thereof, a thrust member carried by the extended end of the plunger and having a portion extending into said extended end, retaining means for said thrust member and plunger including a member embracing said thrust member portion with a press fit and having outer peripheral sections resiliently deflected by the inner peripheral surfaces of the plunger during insertion of the thrust member portion therein, said deflected sections being at an angle with

the longitudinal axis of the plunger for imparting wedging engagement with said surfaces in opposition to withdrawal of the thrust member from the plunger, said body and plunger each having an external groove extending thereabout intermediate its respective ends and a port extending transversely thereof and communicating with said groove and the groove and port of the other of said body and plunger, and a member embracing the body within its said groove and having an end extending through its said port and terminating within said plunger groove.

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