Sept. 20, 1955 C. A. CHAYNE ET AL 2,718,219

HYDRAULIC LASH ADJUSTER

Filed Jan. 20, 1955 3 Sheets-Sheet 1

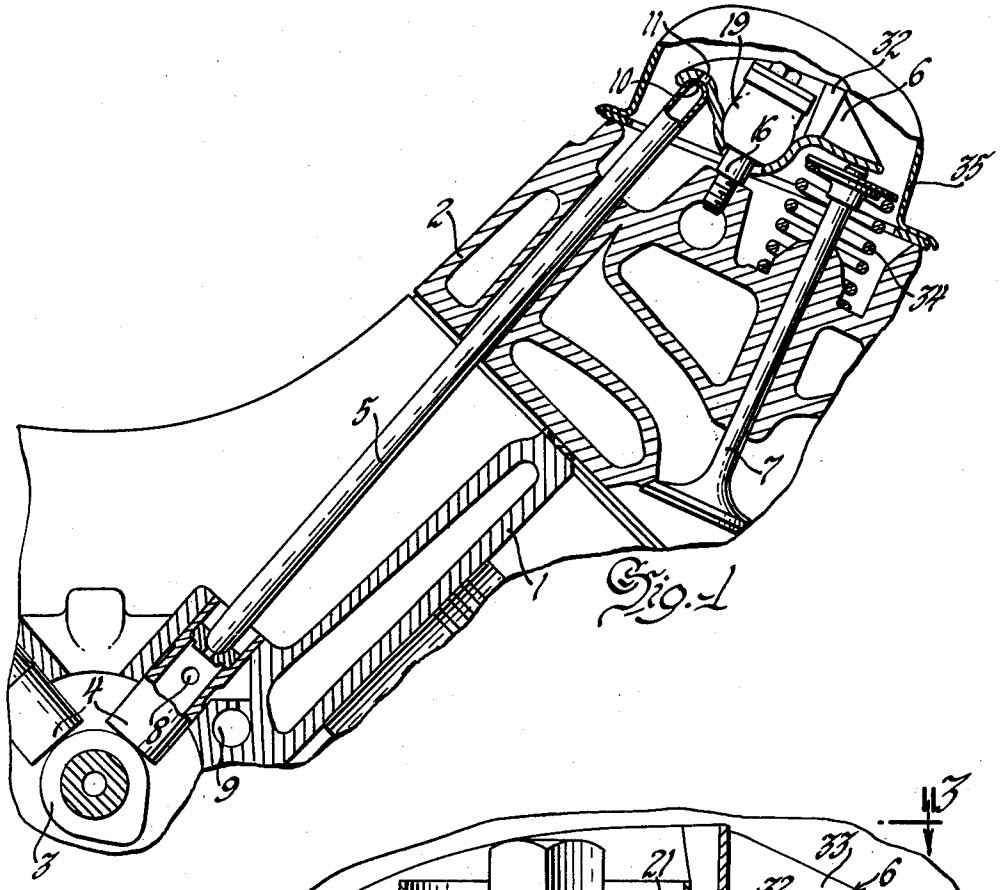


Fig. 1

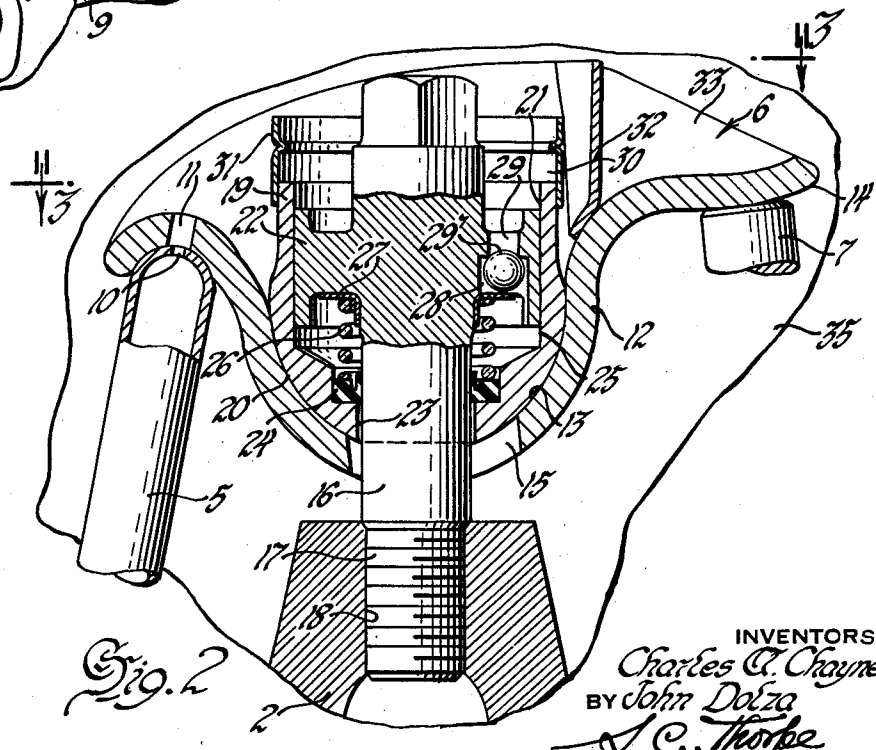


Fig. 2

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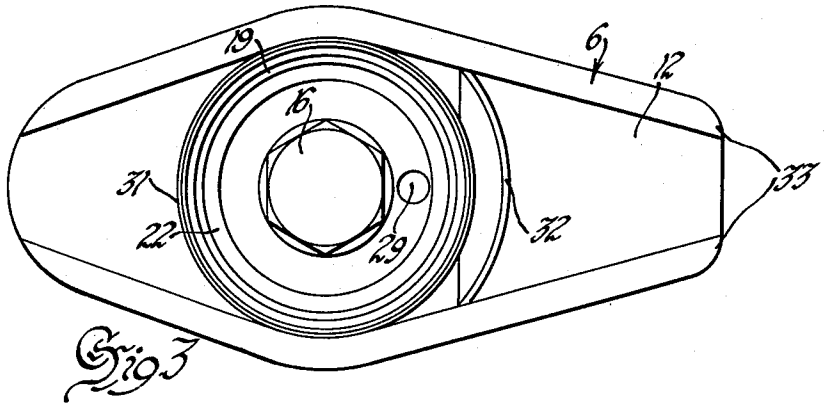


Fig. 3

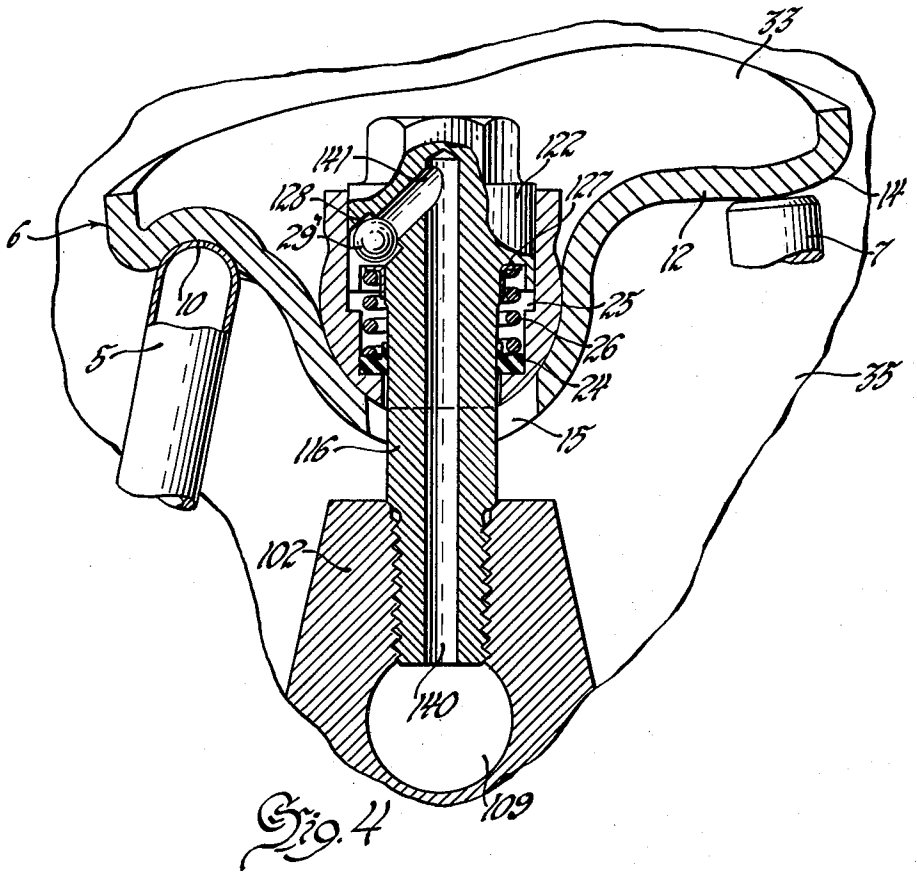


Fig. 4

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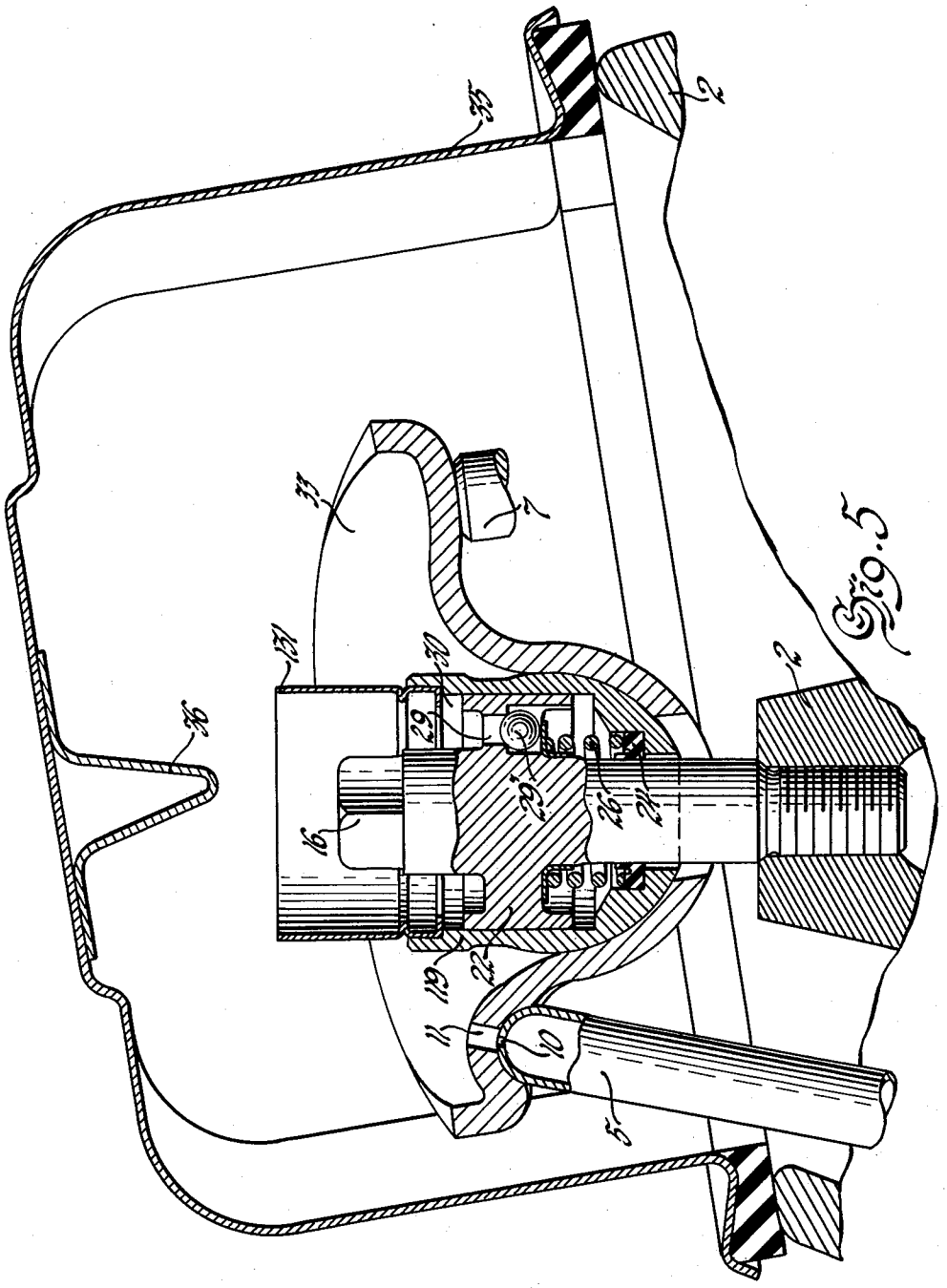


Fig. 5

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HYDRAULIC LASH ADJUSTER

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12 Claims. (Cl. 123—90)

This invention relates to poppet valve operating mechanisms for internal combustion engines and the like utilizing rockers for transmitting valve opening and closing movements to and from the valve, and particularly to a mounting for such a rocker which automatically adjusts its fulcrum to compensate for wear and other factors tending to affect the lash or operating clearance between the rocker and other parts drivingly associated with it.

One of the principal objects of the invention is to improve such mechanisms by arranging the rocker to be journaled by one of two telescopically slidable members which between them form an oil cushion or pressure chamber on the thrust or opposite side of the rocker from the engine, with the other of the cushion chamber forming members having a stud-like portion extending through the rocker and being fixedly supported by the engine frame structure.

Additional objects of the invention are to provide such a rocker journaling lash adjuster wherein the journaling member has an upwardly open cup in which a plunger carried by the stud is slidable, together with novel means for conducting engine oil to the cushion chamber.

The means by which these and other objects of the invention are attained will be more clearly apparent from the following description, having reference to the drawings wherein:

Figure 1 is a transverse view through a portion of a V-type internal combustion engine incorporating a rocker hydraulic lash adjuster mechanism in accordance with the invention.

Figure 2 is an enlarged cross sectional view of the lash adjuster mechanism and certain of its associated engine parts as shown in Figure 1.

Figure 3 is a view in plan as taken from line 3—3 of Figure 2.

Figure 4 is a view similar to Figure 2 but showing a modified form of the invention as regards the manner of conducting the engine lubricating oil to the cushion chamber of the lash adjuster.

Figure 5 is a view similar to Figure 2 and additionally illustrating the use of an oil deflector attached to the engine rocker cover for directing the oil into the lash adjuster reservoir, the latter being arranged somewhat differently from that of Figure 2 to take advantage of less restricted space requirements between the rocker and the rocker cover.

Referring in detail first to Figures 1 and 2 of the drawings, there is shown an engine frame member including a crankcase 1 of conventional V-type having a cylinder head for each bank, one of which is indicated at 2. An engine driven cam 3 drives the tappets 4, each of which is connected by a push rod 5 and a valve rocker 6 to actuate a poppet valve 7. As shown, the rocker 6 is of generally upwardly presenting channel-like configuration and has its respective ends overlying the upper ends of the push rod 5 and the stem of the valve 7, each of which protrudes above the cylinder head 2. The channel-like shape of the rocker enables it to conduct engine lubricating oil fed to it through the push rod and tappet which are made hollow for this purpose, the tappet being slidably mounted in the crankcase and having openings 8 in its side walls communicating with a crankcase oil pressure gallery 9. The upper end of each push rod has a port 10, best shown in Figure 2, registering with a port 11 extending through the end of the rocker. Intermediate its push rod end and the stem of the valve 6 the rocker has its bottom wall 12 spherically depressed to form a bearing surface 13 to which oil tends to flow from the port 11. Excess oil is normally supplied through the push rod in the manner stated so as to overflow the valve end of the rocker and effect lubrication of its valve actuating space 14.

Centrally of the rocker bearing surface 13 is an aperture 15 through which extends a stud 16 whose lower end is fixedly anchored as by threads 17 in a hole 18 provided therefor in the cylinder head 2. The rocker aperture 15 has ample clearance about the stud 16 to accommodate rocking motion of the rocker which motion is journaled by an upwardly presenting cup-shaped cylinder member 19 whose bottom and side walls have their external surfaces joining each other to form a ball end 20 socketed in the bearing surface 13. The internal side wall surfaces of the member 19 define a cylindrical bore 21 of substantially larger cross section than the stud 16, and slidably fitted in this bore is a plunger 22 integral or otherwise rigid with the stud. The end wall of the member 19 is centrally apertured at 23 for passage of the stud, and slidably sealing this aperture to the external periphery of the stud is an annular body 24 of synthetic rubber which is supported by the end wall of the member 19. Between this seal 24 and the plunger 22 is an oil cushion chamber 25 which is also defined by the lower end of the bore 21 and the portion of the stud external surface extending through the aperture 23 above the seal 24. Within the chamber 25 and surrounding the stud is a coil compression spring 26 whose lower end seats on the seal body 24 and reacts at its upper end against the plunger 22 to urge the cup-shaped member 19 and the rocker toward the cylinder head. At its upper end the spring 26 seats against a washer 27 which underlies a counterbore 28 at the chamber end of a passage 29 which connects the opposite ends of the plunger 22. Loosely disposed in the counterbore 28 is a ball check valve 29' which is movable under oil pressure within the chamber to close the passage 29 by seating on the intersection of such passage with the bottom of the counterbore. The ball 29' is limited in its movement in the opening direction outwardly of the counterbore by the washer 27, there being sufficient freedom for travel of the ball between its seat and the washer to permit relatively free flow of oil into the chamber through the passage 29 when the ball is in engagement with the washer 27. The bore 21 extends a distance above the plunger to form a reservoir 30 for oil to maintain the chamber 25 filled at all times, and forming an extension of the upper end of the side walls of the member 19 is a pressed on sheet metal sleeve 31 which serves to enlarge the oil storage capacity of the reservoir 30. With the rocker occupying a substantially tilted position in a V-type engine as indicated in Figure 1, the maintenance of a sufficient head of oil in this reservoir is further ensured by a baffle 32 extending generally transversely between the channel side walls 33 of the rocker and upwardly from the bottom wall 12 thereof so as to dam up the oil in the rocker to a height enabling it to overflow into the sleeve 31 on the valve side.

In operation, with each lift stroke of the cam 3 its motion is transmitted through the tappet 4, push rod 5 and rocker 6 to open the valve against its return spring 34. The resultant upward thrust of the rocker is taken by the cup-shaped member 19 which, in turn, transmits the thrust through the oil in the cushion chamber 25 to the plunger 22 which is fixedly anchored by its stud 16 to the cylinder head. The pressure thus exerted on the oil in

the chamber 25 results in some leakage of oil therefrom between the plunger and the cylinder bore 21, into the reservoir 30, the check valve 29' being of course held closed by the chamber oil pressure. Due to such leakage there is a small amount of movement of the cup-shaped member and of the rocker upwardly of the stud toward the plunger, in opposition to the relatively light spring 26. Such leakage, or "leakdown" as it is called, continues until the cam has rotated sufficiently to permit the engine valve 7 to return to its fully seated position shown, after which all thrust on the body of oil in the cushion chamber 25 is relieved. Because the engine valve will reach its seated position before the tappet 4 fully returns to the base circle of the cam 3, continued rotation of the cam at this point in the cycle tends to create an operating clearance, or "lash," in the valve operating linkage, which is largely the result of the aforementioned leakdown occurring during the time the engine valve was off its seat. This lash, however, is taken up by the lash adjuster spring 26 maintaining the ball end 20 socketed in the spherical bearing surface 13 of the rocker while urging the rocker downwardly of the stud toward the cylinder head. As the pressure within the cushion chamber during this time is insufficient to hold the check valve 29 in its seated position shown, oil from the reservoir 30 may flow into the chamber through the passage 29 to replenish that which escaped during the previous "leakdown," ready for the start of the next engine valve operating cycle.

The rapid oscillation of the rocker causes the oil entering the space between the channel forming side walls 33 of the rocker via the registering push rod and rocker ports 10, 11 to be thrown about within the enclosure formed by the rocker cover 35. Particularly at high operating speeds a certain proportion of this oil will be deflected from the rocker cover 35 into the upper end of the sleeve 31, and such oil as tends to build up around the lash adjuster cup member 19 and between the channel forming side walls 33 of the rocker will tend to overflow into the sleeve 31, being assisted in this respect by the damming action of the baffle 32.

Where sufficient space between the rocker and the top of the rocker cover 35 permits, the upper wall of the rocker cover may be provided with a fixed deflector 36 as shown in Figure 5. This deflector is located so as to depend from the cover toward the open end of the reservoir 30, and in accordance with the construction shown in Figure 5 the storage capacity of this reservoir is enlarged by a somewhat longer sheet metal sleeve 131 which is pressed into the upper end of the lash adjuster cylinder 119. With the addition of this oil deflector 36 and the longer extension sleeve 131 we have found that the oil baffle 32 previously described may be omitted. The construction of the lash adjuster is otherwise unchanged, and its operation is likewise the same as that of Figure 2 with the only exception that the oil entering through the push rod and rocker ports 10, 11 is more positively directed into the lash adjuster reservoir.

In the modified form of the invention shown in Figure 4 the oil feed to the lash adjuster cushion chamber 25 is by way of drilled passages 140 and 141 formed in the stud 116 and its plunger portion 122. As shown, the passage 140 extends axially of the stud from an oil pressure gallery 109 provided in the cylinder head 102 and connects at its upper end interiorly of the plunger portion with the drilled passage 141. The chamber end of the passage 141 is defined by a counterbore 128 which laterally guides the ball check valve 29' in its opening and closing movements. The spring 26 is seated at its upper end by a washer 127 which underlies the chamber entrance to the counterbore 128 and serves to limit opening travel of the check valve 29' in a manner similar to that of the washer 27. The operation of the rocker and its lash adjuster is the same in all essential respects to that previously described in connection with Figures 2 and 5 except that by reason of the relatively short path of oil flow from the pressure gallery 109 to the cushion chamber 25 and the fact that the gallery 109 is at all times supplied with oil under pressure during engine operation, there is no necessity for providing an oil reservoir above the check valve 29' since the demands of the oil cushion chamber for replenishment after each "leakdown" can be readily met with oil under pressure from the engine lubricating system. For purposes of lubricating the upper end of the push rod and its bearing surface on the rocker the same hollow push rod 5 and hollow tappet 4 are used with their separate oil gallery supply as described in the preceding forms. Since the oil leaking past the plunger 122 from the cushion chamber 25 is allowed to flow into the space between the channel forming side walls 33 of the rocker, from where it may overflow the valve end of the rocker and lubricate the valve stem bearing surface 14, only the port 10 at the upper end of the push rod is retained with no registering port 11 in the rocker as was employed in the previous forms.

It is appreciated that various minor changes in the construction and arrangement of the parts will readily suggest themselves to those skilled in the art without departing from the spirit and scope of the invention as hereinafter defined.

We claim:

1. In combination, a rocker for transmitting motion between oppositely reciprocating elements, said rocker having an opening extending therethrough in the thrust direction, rocker supporting means including a movable member journaling the rocker about one end of said opening, a fixed member extending through said opening and carrying a plunger in telescopic slidable engagement with said movable member, a support for said fixed member on the opposite side of the rocker from said plunger, said movable member and plunger defining a fluid pressure chamber on the opposite side of the rocker from said support, means for introducing fluid into said chamber and restricting its return therefrom, and a resilient member biasing the movable member toward the rocker from said plunger.

2. The invention defined in claim 1, wherein said last named means includes a passage extending longitudinally through one of said reciprocating elements, registering ports in the coengaging ends of the rocker and said one element, a source of oil under pressure in communication with the opposite end of said passage, a reservoir within said movable member, means for directing oil into said reservoir from said rocker port, and a check valve controlled passage connecting said reservoir and chamber.

3. The invention defined in claim 1, wherein said last named means includes a source of oil under pressure within said support, a passageway in said fixed member connecting at one end with said source and at the other end with said chamber, and a check valve controlling oil flow through said passage and movable to its closed position in response to chamber pressure.

4. In combination with a poppet valve actuatable rocker having an opening extending therethrough in the thrust direction and a fixed support for the valve, a hydraulic lash adjuster including a cylinder member and a plunger, said cylinder member having a bore and being provided adjacent one end of said bore with an external surface journaling the rocker for oscillatory movement, said plunger having a close sliding fit in said bore and a reduced diameter portion extending through said opening and fixed to said support on the opposite side of the rocker from the cylinder member, sealing means interconnecting the cylinder member and said plunger reduced diameter portion opposite said one of the bore, said sealing means being spaced axially from the plunger and defining the rocker adjacent end of an oil pressure chamber, a compression spring acting between said sealing means and plunger to maintain said cylinder surface in journaling contact with the rocker and urge the rocker toward said support, and means for introducing fluid into the chamber and restricting its return therefrom.

5. The invention defined in claim 4, wherein said last named means includes a hollow push rod drivingly connected at one end to the rocker and in fluid receiving communication at its other end with a source of oil under pressure, registering ports in the drivingly connected portions of the rocker and said one end of the push rod, an upwardly open reservoir in the cylinder member above the plunger, means for directing oil into said reservoir from said rocker port, and a check valve controlled passage extending through the plunger and connecting said reservoir and chamber.

6. The invention defined in claim 4, wherein said last named means includes a source of oil under pressure within said support, a first passageway extending longitudinally through said plunger reduced portion from said source, a second passage in said plunger interconnecting said first passageway and said chamber, and a check valve at the chamber end of said second passage and movable to close the same in response to chamber pressure.

7. In a journaling and lash take-up device for a rocker of a poppet valve operating linkage, a generally cup-shaped member having its external end wall and adjacent side wall surfaces spherically curved and having its internal side wall surfaces defining a bore, said member having an opening in its end wall aligned with said bore, a plunger axially spaced from said end wall having a close sliding fit in said bore and a stud portion of reduced diameter extending through said opening adapted to be fixedly secured adjacent its extended end, an annular seal abutting said end wall and slidably embracing the stud portion, a spring thrustably interposed between the seal and plunger, and a check valve controlled passage extending end-wise through the plunger accommodating one-way flow of fluid into the space between the plunger and said end wall.

8. In combination, a rocker of generally upwardly presenting channel-like shape having its bottom wall spherically depressed intermediate the ends to socketably receive a ball ended rocker journaling member, oppositely reciprocating elements terminating in end abutting engagement with the under surface of said bottom wall adjacent the respective ends of the rocker, one of said elements being hollow and having its interior communicating with a source of oil under pressure at a distance longitudinally thereof from the rocker, said rocker bottom wall and the rocker abutting end of said hollow element having registering ports through which the oil may enter the space between the channel side walls of the rocker, a fixed support below the rocker, a lash adjuster including a member of generally upwardly presenting cup-shape having side walls defining a cylinder bore and terminating with an externally ball-shaped end wall journaling said spherically depressed rocker bottom wall, a plunger having a close sliding fit in said bore and cooperating with said end wall in defining an oil pressure chamber, a coil compression spring in said chamber reacting against the plunger and urging said end wall toward the support, a washer seating the plunger end of said spring, said plunger having an aperture connecting said chamber with said bore above the plunger and a counterbore defining the chamber end of said aperture, a ball check valve movable in said counterbore to close said aperture in response to chamber pressure, said valve being limited in its movement outwardly of the counterbore by said washer, said plunger having a reduced diameter stud portion extending through said chamber and fixed to said support, said end wall and rocker bottom wall being apertured for passage of said stud portion, and means sealing the aperture in said end wall against escape of oil along said stud portion from the chamber.

9. The combination defined in claim 8, together with a deflector fixed to said support and depending toward the open end of said cup-shaped member, said deflector being positioned to intercept oil cast under pressure from said rocker port and direct it into said bore.

10. The combination defined in claim 8, together with an annular sleeve pressed onto the outer periphery of said cup-shaped member and extending above the open end thereof to enlarge the oil storage capacity of the lash adjuster above the plunger, and a baffle fixed to the rocker internally of its channel forming walls on the side of said lash adjuster most remote from said ports to dam up the oil within the rocker channel to a height sufficient to overflow into said sleeve.

11. In combination, a rocker of generally upwardly presenting channel-like shape having its bottom wall spherically depressed intermediate the ends to socketably receive a ball ended rocker journaling member, oppositely reciprocating elements terminating in end abutting engagement with the under surface of said bottom wall adjacent the respective ends of the rocker, a fixed support below the rocker having an oil gallery supplied with oil under pressure, a lash adjuster including a member of generally upwardly presenting cup-shape having side walls defining a cylinder bore and terminating with an externally ball-shaped end wall journalling said spherically depressed rocker bottom wall, a plunger having a close sliding fit in said bore and cooperating with said end wall in defining an oil pressure chamber, a coil compression spring in said chamber reacting against said plunger and urging said end wall toward the support, a washer seating the plunger end of said spring, said plunger having an oil passage extending internally thereof from said chamber and a counterbore defining the chamber entrance to said passage, a check valve loosely disposed in said counterbore and movable inwardly thereof into blocking relation with said passage under pressure from within the chamber, said valve being limited in its movement outwardly of the counterbore by said washer, said plunger having a reduced diameter stud portion extending through said chamber and fixed to said support, said stud portion being provided with a passage connecting said oil gallery to said first named passage above the check valve, said end wall and rocker bottom wall being apertured for passage of said stud portion, and means sealing said end wall aperture to said stud portion whereby sbstantially all leakage from said chamber occurs between the sliding surfaces of said plunger and cylinder bore from which it overflows into the space between the channel side walls of the rocker.

12. In a hydraulic lash adjusting device for a rocker of the type fulcrumed on a stud extending therethrough in the thrust direction, a cylinder member having a bore and an external surface at one end adapted to journal the rocker for pivotal movement about its fulcrum axis, a stud having a plunger portion fitting said bore and slidably guiding said cylinder member for axial movement along the stud, said cylinder member having an opening in its rocker journaling end for passage of the stud and having walls defining a chamber between said opening and said plunger portion, said opening and the adjacent periphery of the stud having a close sliding fit, means for introducing fluid into said chamber and restricting its return therefrom, and resilient means biasing the cylinder member axially of the stud in the direction to enlarge said chamber.

References Cited in the file of this patent

UNITED STATES PATENTS

1,937,932	Woolman	Dec. 5, 1933
2,075,597	Zahodiakin	Mar. 30, 1937
2,158,222	Dayton	May 16, 1939
2,669,981	Leach	Feb. 23, 1954

FOREIGN PATENTS

436,744	Great Britain	Oct. 17, 1935
608,871	Germany	Sept. 7, 1933