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SELF-CONTAINED HYDRAULIC LASH ADJUSTER

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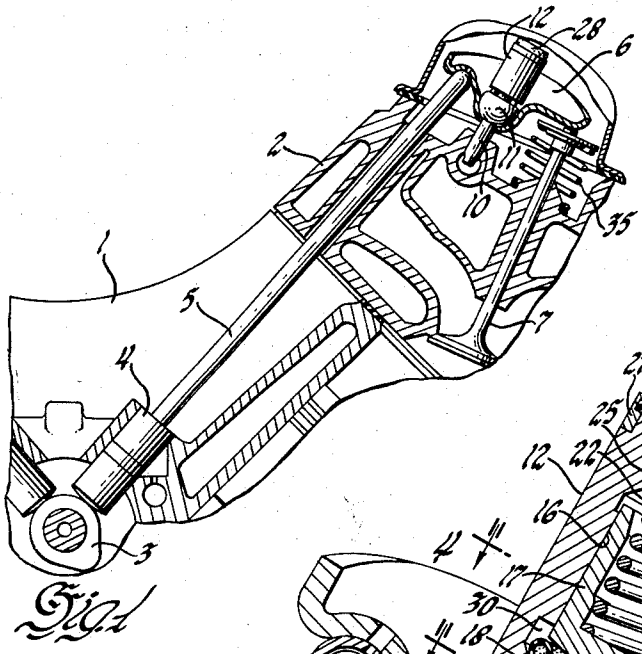


Fig. 1

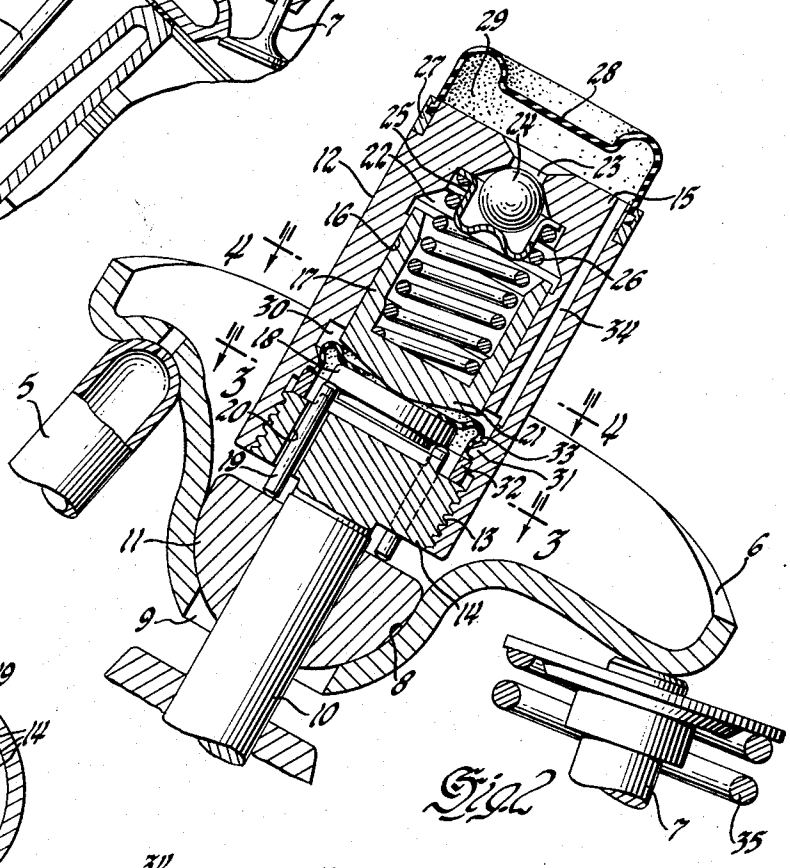


Fig. 2

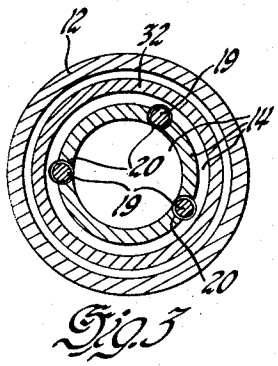


Fig. 3

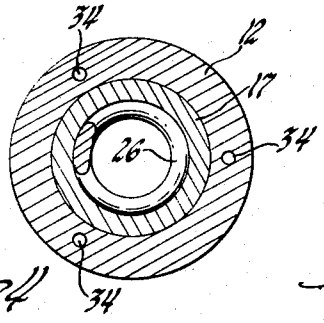


Fig. 4

INVENTOR.
Lee T. Mekkes
BY
J. C. Thorpe
ATTORNEY

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SELF-CONTAINED HYDRAULIC LASH ADJUSTER

Lee T. Mekkes, Grandville, Mich., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application January 13, 1958, Serial No. 708,513

6 Claims. (Cl. 123—90)

This invention relates to poppet valve operating mechanisms for internal combustion engines and the like using rockers for transmitting valve opening and closing movements to and from the valve, and particularly to a sealed hydraulic 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.

The mechanism in accordance with the present invention constitutes an improvement over that of the application of Morris V. Dadd, Serial No. 695,723, filed November 12, 1957. As in said prior application, a fixed stud extends through the rocker and slidably guides a rocker bearing whose thrust is supported hydraulically by a plunger in a dashpot fixed to the stud and having but a single leakdown path. Whereas in the aforesaid Dadd application the fluid in the dashpot was supplied from an external source such as the engine lubricating system, I have provided novel reservoir and sealing means to eliminate the need for such external supply, while still retaining all the advantages of the other structural parts of the prior device.

The novel means for carrying out these improvements will be more clearly understood from the following description, having reference to the drawing 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.

Figures 3 and 4 are sectional views through the dashpot assembly, taken substantially on lines 3—3 and 4—4 respectively of Figure 2.

Referring now in detail to the drawing, there is shown an engine frame including a crankcase 1 of a conventional V-type having a cylinder head 2 for each bank. An engine driven cam 3 drives the tappets 4, each of which is connected to 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.

As most clearly shown in Figure 2, the rocker has its bottom wall spherically depressed to form a bearing surface 8 which surrounds an opening 9. Rigidly secured as by press fit in a hole provided therefor in the cylinder head 2 is a stud 10 which extends through the rocker opening 9 with sufficient lateral clearance to accommodate full rocking movements of the rocker in operation. Slidably embracing this stud is a ring-like bearing member 11 whose outer and lower periphery conforms to and journals the rocker bearing surface 8. Rigidly secured to and extending above the stud is a cylinder 12 of downwardly presenting generally cup shape. Attachment of the cylinder 12 to the upper end of the stud is illustrated in the form of a threaded connection 13 to a head 14 of the stud. It will be appreciated, however, that other means of such attachment may be used, and

that the head 14 may instead be an integral part of the cylinder 12. In the arrangement shown, the upper or closed end wall 15 of the cylinder 12 cooperates with the cylinder bore 16 to form a dashpot for a slidably fitted plunger 17. The slidable fit of this plunger in the cylinder bore requires a slight clearance therebetween which clearance defines a restricted leakage path for fluid to escape past the plunger.

Means are provided for transmitting thrust from the rocker bearing 11 to the plunger in a manner which minimizes side loading and resultant tendencies of the plunger to bind in the cylinder bore 16. A platform member, in the form of a circular imperforate plate 18 within the cylinder below the plunger, rests on a plurality of circumferentially spaced legs 19 extending loosely through drilled bores 20 in the head 14. These legs 19 are in the form of simple pins, non-integral with the platform member 18, and rest at their lower ends on the upper surface of the rocker bearing 11. Abutment between the platform member 18 and the lower end of the plunger 17 is confined closely to the plunger axis as by conically shaping the bottom surface 21 of the plunger.

Means are provided for introducing and trapping a body of oil or other hydraulic fluid in the cushion chamber 22 between the plunger and closed end 15 of the dashpot cylinder. For this purpose, the cylinder end wall 15 is provided with an inlet port 23, below which is a check valve in the form of a ball 24. This ball is movable a sufficient distance away from the end wall 15 to open the port to the chamber 22, and is retained in operative position for closing the port by a perforated cage member 25. A spring 26 operates to hold the cage 25 in place against the cylinder end wall 15 and also to bias the plunger outwardly of the cylinder into abutment with the platform member 18. Sealed to the upper end of the cylinder 12 by suitable means such as the clamping ring 27 is a cover member 28 in the form of a diaphragm of flexible rubber-like material whose inner surface is spaced from the cylinder end wall 15 and cooperates therewith in defining a fluid supply reservior 29 opposite the chamber inlet 23. Adjacent and opposite the lower end of the plunger 17, the cylinder is provided with an internal groove 30. Below this groove is a shoulder 31, and between this shoulder and the head 14 is a ring 32 which has a press fit in the cylinder and to which is bonded or otherwise sealingly secured a second diaphragm 33 of rubber-like material. This diaphragm is preferably provided with an opening in its central portion to accommodate direct abutment therethrough of the plunger end 21 with the platform member 18, and the inner marginal extremities of this diaphragm overlie and are sealingly bonded to the platform member 18. This lower diaphragm 33 thus cooperates with the groove 30 and the plunger in defining a reservoir for collecting the fluid which leaks past the plunger from the pressure chamber 22. Prior to threadedly assembling the dashpot cylinder to the stud, sufficient fluid is introduced into the reservoir 29, groove 30, passages 34 and chamber 22 to completely fill the same. This is most conveniently accomplished with the cylinder and plunger assembly submerged in a tank of such fluid, during which the lower diaphragm is installed by pressing its clamping ring into place in the cylinder. Such complete filling is desired in order to exclude all air from the interior of the device between the two diaphragms, thereby insuring dependable thrust transmission by the fluid in the cushion chamber 22 during operation.

During 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 engine valve 7 against its re-

turn spring **35**. The resultant upward thrust of the rocker against its bearing **11** is transmitted by the pins **20** and platform member **18** to the plunger **17**. Resultant upward movement of the plunger is resisted by a rapid buildup of fluid pressure in the cushion chamber **22**, causing the ball check valve **24** to close. The slidable fit of the plunger in the cylinder bore **16**, however, accommodates a slight leakage of fluid from the cushion chamber downwardly past the plunger into the reservoir **30**. After completion of the cam lift stroke and the tappet has returned to the base circle of the cam **3**, the check valve **24** opens and the plunger spring **26** effects a re-expansion and refilling of the cushion chamber **22** to compensate for such foreshortening thereof as occurred during the lift stroke. The extent of such previous foreshortening is, of course, primarily that resulting from fluid leakage, or "leakdown," past the plunger. However, the re-expansion of the cushion chamber additionally compensates for such minute wear as occurs on the abutting thrust surfaces of the various parts in the valve train, as well as any change in their combined operative lengths resulting from thermal expansion and contraction of the parts. As this re-expansion of the cushion chamber **22** occurs, the fluid pressure therein decreases sufficiently to allow the ball check valve to open so that fluid from the upper reservoir **29** may flow into the cushion chamber **22**.

The fluid in the upper and lower reservoirs and pasages **34** is maintained at substantially atmospheric pressure, irrespective of change in the volume of the cushion chamber **22**, by flexure of the upper diaphragm relative to the cylinder closed end **15**. Such constant pressure is desired in maintaining both a uniform "leak-down per cycle" (fluid leakage past the plunger during the cam lift stroke) and a uniform "recovery" (extent of refilling of the cushion chamber during the expansion stroke), for all adjusted positions of the plunger in the bore at any particular operating speed. The diaphragm **33** follows the adjusting movements of the plunger and platform member **18** in maintaining the rocker bearing seated in the rocker, while sealing against escape of plunger leakage fluid out of the lower end of the cylinder, this fluid being returned to the upper reservoir via the passages **34**. Upon start of the next lift stroke of the engine cam, the cycle is repeated.

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 claimed.

I claim:

1. In combination with a rocker for transmitting motion between oppositely reciprocating elements, rocker supporting means including means journaling the rocker about its rocking axis and movable normal to said axis with change in rocker thrust, a fixed member guiding said rocker thrust movements of said journaling means, means rigid with said member and defining a bore on the thrust side of the rocker, a plunger slidably fitting said bore and biased into thrust receiving relation with said journaling means, a fluid chamber at the end of said bore most remote from the rocker, said chamber having an inlet, a check valve for said inlet accommodating fluid flow into said chamber and preventing fluid flow out of the chamber, and means sealing said bore against the escape therefrom of fluid leaking past the plunger from the chamber, said last means cooperating with the plunger in defining a reservoir, said reservoir having an outlet in sole fluid communication with said chamber inlet.

2. In combination with a rocker for transmitting motion between oppositely reciprocating elements, rocker supporting means including a bearing journaling the rocker for oscillation about its fulcrum axis, a fixed member supporting and guiding said bearing for linear movement in response to rocker thrust, means rigid with said member and defining a bore on the opposite side of said bearing from the rocker, a plunger slidably fitting said bore and biased into thrust receiving relation with said bearing, a fluid chamber at the end of said bore most remote from said bearing, said chamber having an inlet, a check valve for said inlet accommodating fluid flow into said chamber and preventing fluid flow out of the chamber, and means sealing said bore against the escape therefrom of fluid leaking past the plunger from the chamber, said last means cooperating with the plunger in defining a reservoir, said reservoir having an outlet in sole fluid communication with said chamber inlet.

3. Supporting and journaling means for a rocker of the stud mounted type which has an opening extending therethrough in the thrust direction, comprising a fixed stud adapted to extend through the rocker opening, a rocker bearing telescopically embracing the stud and guided for axial movement thereby, a generally cup-shaped cylinder facing and rigidly secured to the stud on the opposite side of the bearing from the rocker, a plunger slidably fitting the cylinder, thrust transmitting means extending between the bearing and plunger including an imperforate platform member within the cylinder, and means opposing rocker thrust induced movements of the plunger including a first body of fluid in the cylinder, a second body of fluid externally of the cylinder and passage means for interchange of fluid between said bodies, said passage means including a restricted leakage path for fluid flow past the plunger to said second body from said first body, means sealing said platform member to the cylinder opposite the exit end of said leakage path, and a one-way valve accommodating fluid flow from said second body to said first body and preventing reverse flow.

4. Supporting and journaling means for a rocker of the stud mounted type which has an opening extending therethrough in the thrust direction, comprising a fixed stud adapted to extend through the rocker opening, a generally cup-shaped cylinder aligned with and facing one end of the stud, a head rigidly interconnecting the adjacent ends of the stud and cylinder, said head having a plurality of circumferentially spaced bores extending therethrough, pins slidably supported in said bores, a rocker bearing slidably embracing the stud and abutting one of the ends of each pin, a platform member abutting the other ends of said pins, a plunger slidably fitting said cylinder and having a centrally extended end abutting the platform member, said cylinder and the other end of the plunger defining an oil pressure chamber, a spring acting between the plunger and the cylinder tending to enlarge said chamber, a chamber inlet port and a check valve operative to close said port against escape of oil from the chamber whereby movement of the plunger in response to thrust from the bearing is accommodated only in accordance with the rate of oil leakage between the plunger and the cylinder, an axially flexible diaphragm sealingly connecting the platform member to the cylinder and defining a collecting reservoir for said leakage fluid, a cover member secured to the cylinder and defining a supply reservoir for fluid at said inlet and passage means interconnecting said reservoirs.

5. In combination, a rocker for transmitting motion between oppositely reciprocating parts, said rocker having an opening extending therethrough in the thrust direction, rocker supporting means including a generally ring shaped bearing journaling the rocker adjacent one end of said opening, a fixed stud slidably embraced by said bearing and extending through said rocker opening, an inverted generally cup-shaped cylinder facing the end of the stud above the bearing, a head rigidly interconnecting the adjacent ends of the stud and cylinder, a plunger in the cylinder, thrust transmitting means extending through said head between the bearing and plunger, a plunger return spring biasing the plunger away from the closed end of the cylinder, an oil inlet in the closed end of the cylinder, a check valve controlling said inlet and closable against

escape of oil therethrough from the closed end of the cylinder, a cover member secured to the upper end of the cylinder and defining an oil reservoir opposite said inlet, axially flexible imperforate diaphragm means sealed to the cylinder and interposed between the plunger and said thrust transmitting means, and a fluid passageway connecting the plunger side of said diaphragm means to said reservoir for the return to the latter of fluid leakage past the plunger from said closed end of the cylinder.

6. The invention of claim 5, wherein said cover member is axially expansible with sufficient freedom to maintain substantially constant fluid pressure in said reservoir.

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