Sept. 8, 1964 C. R. KILGORE 3,147,745

FULCRUM ADJUSTER

Filed Sept. 24, 1962

Fig-1

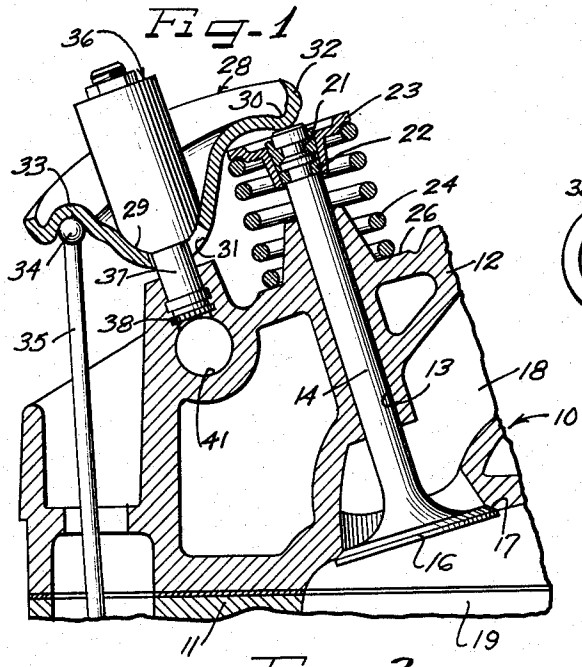


Fig-2

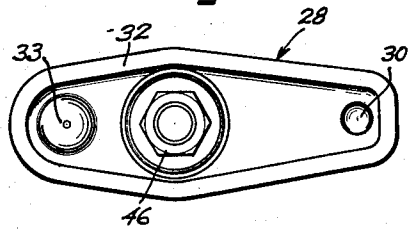


Fig-3

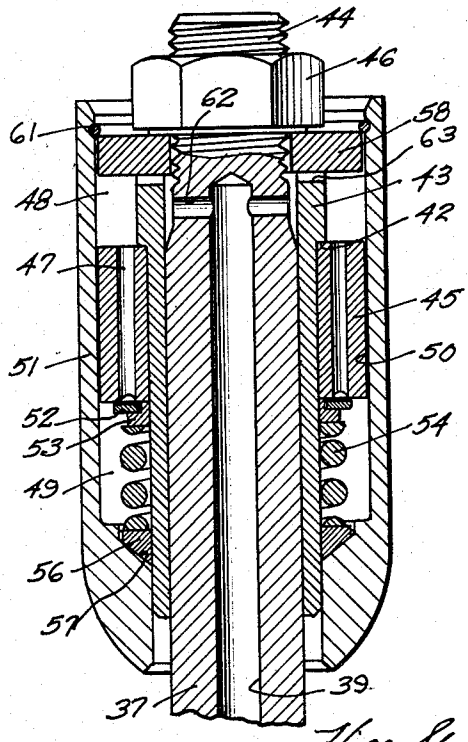
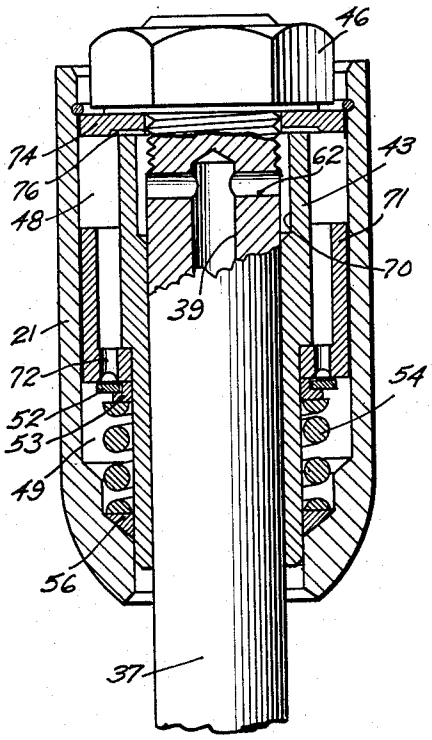


Fig-4



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FULCRUM ADJUSTER

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The present invention relates to an improved fulcrum adjuster or lash adjuster for engine valve linkages. Specifically, the invention relates to an improved oil operated mechanism which prevents excessive and objectionable lash in the operation of engine valves. In some respects, the present invention is an improvement in the type of fulcrum adjuster described in my previous United States Patent No. 2,873,730, which issued on February 17, 1959. In the fulcrum adjuster of the previous patent, the adjuster is mounted on an engine to pivotally support the rocker arm of a valve-in-head engine valve linkage and operates under the pressure of engine oil to hold the rocker arm in lash preventing engagement with the push rod and the valve stem to take up the looseness or slack which may occur in the linkage.

The fulcrum adjuster of the present invention, like that of the previous patent, utilizes a unitary lightweight lash preventing device which operates to pivotally support a stamped, pressed, brazed or otherwise fabricated metal rocker arm. The rocker arm may be operated by an overhead camshaft, or by a pushrod, depending on the type of engine. The rocker arm may have a fragmental spherical depressed portion serving as a bearing surface to receive a fragmental spherical bearing surface of the lash preventing mechanism, whereby the rocker arm is supported. The rocker arm may have an opening through the depressed portion for the passage of a mounting stud or post projecting upwardly from the engine and serving to support the lash adjusting unit. Through this stud or post there is an oil passageway which communicates with a pressurized oil supply from the engine to deliver pressurized oil to the lash adjusting unit.

While the fulcrum adjuster of my previous patent was highly satisfactory in operation where the adjuster was installed in a substantially vertical plane, it was found that when the axis of the adjuster had to be located at angles greater than about 30° from the vertical, air would become trapped in the upper area of the pressure chamber of the adjuster. To purge this air, it was found necessary to provide special passages resulting in increased production costs. It was also found that close machining tolerances were necessary to keep the sleeve in perfect alignment with the reaction barrel member so that the central plunger would not bind during operation.

The present invention provides an improved lash adjuster which simplifies the design of comparable lash adjusters heretofore used. Among the features of the new lash adjuster are the location of the leakdown annulus which, in the new form of the invention, is located between the sleeve and the barrel. This construction allows entrapped air to escape readily when the unit is installed at an angle deviating substantially from the vertical. Another feature resides in providing a simple snap ring to retain the inner components of the unit. Heretofore it was necessary to stake the reaction member and this sometimes damaged the reaction member and caused the inner parts to stick. The new unit has also been designed for a minimum of stock removal to form the component parts, thereby decreasing the cost of manufacture. Furthermore, the overall height of the new unit is considerably less than previous lash adjusters, so that the rocker arm cover height can be less.

One of the objects of the present invention is to provide an improved lash adjuster assembly which provides for venting of air which may become trapped in the pressure chamber when the adjuster is installed at a substantial angle.

Another object of the invention is to provide an improved fulcrum adjuster which can be assembled more readily and more economically than comparable fulcrum adjusters heretofore employed.

A further object of the invention is to provide an improved fulcrum adjuster which has a reduced response time.

Other objects and features of the present invention will be apparent to those skilled in the art from the following description of the attached sheet of drawings in which:

FIGURE 1 is a vertical sectional view taken through a valve assembly employing a fulcrum adjuster of the present invention;

FIGURE 2 is a plan view of the top of the rocker arm assembly;

FIGURE 3 is an enlarged vertical sectional view of the fulcrum adjuster assembly; and

FIGURE 4 is an enlarged view, partly in cross-section and partly in elevation, of a modified form of the present invention.

As shown on the drawings:

In FIGURE 1, reference numeral 10 indicates generally an internal combustion engine including a cylinder block 11 having a cylinder head 12. A valve guide 13 is formed in the cylinder head 12 and receives a stem 14 of a poppet valve 16 in sliding relation therealong. The valve 16 has the usual seating face 17 to control the flow of gases between a valve port 18 and a combustion chamber 19.

The upper end of the valve stem 14 has grooves 21 formed therein, and conventional valve locks 22 are provided with beads which seat within the groove 21. A valve lock retainer 23 tightly engages the valve locks 22 and serves to bottom a valve spring 24 extending between the retainer 23 and a shoulder 26 formed in the engine head 12.

The rocker arm may take the form of a stamped sheet metal arm 28 having a depressed fragmental spherical socket portion 29 with an aperture 31 through the bottom of the socket. The rocker arm 28 is provided with an upturned peripheral flange 32. At one end of the rocker arm 28 and at one side of the socket 29, the rocker arm is provided with an inverted socket 33 for the rounded end 34 of a push rod 35. On the opposite side of the socket 29, and on the opposite side of the rocker arm, the rocker arm is depressed as indicated at numeral 30 to provide a rounded surface for engaging and rocking on the end of the valve stem 14.

The fulcrum adjuster of the present invention has been identified generally in FIGURE 1 by reference numeral 36. It is supported in its operating position to pivotally carry the rocker arm 28 on a post 37 having a knurled end portion 38 which is pressed into a suitable passage formed in the cylinder head 12 without the necessity of using a threaded fit. The particular design of the fulcrum adjuster, as will be apparent from succeeding portions of this description, makes it unnecessary to provide for releasable engagement between the post 37 and the engine block.

As indicated in FIGURE 3, the post 37 is provided with an axially extending bore 39 which communicates with an oil chamber 41 supplied with pressurized oil from the oil pump of the engine.

As seen in FIGURE 3, the post 37 is slidably received within a sleeve type bushing 43 and has a threaded end portion 44 engaged by a nut 46. The bushing 43 has a shoulder 42 which locates a sleeve 45 therealong. The sleeve 45 is provided with a plurality of axially extend-

ing passages 47 which provide for fluid flow between an oil reservoir chamber 48 located above the sleeve 45 and a high pressure oil chamber 49 located below the sleeve 45. The outer diameter of the sleeve 45 is made smaller than the inner diameter of the reaction barrel 51 which confines all the operating mechanism of the fulcrum adjuster so that a leakdown path 50 is provided in the space between the outer diameter of the sleeve 45 and the inner diameter of the barrel 51.

Flow of oil through the passages 47 is controlled by means of a washer type valve 52 which is received on an annular valve guide 53 having a shoulder arranged to hold the valve element 52 with a slight clearance between the valve 52 and the ends of the passages 47. A coiled spring 54 acts against the valve guide 53 to hold the guide 53 against the base of the sleeve 45. The opposite end of the spring 54 is bottomed against a dynamic seal 56 which engages the outer periphery of the bushing 43 and is received along an inclined seating face 57 formed in the barrel 51.

A washer 58 also rides on the upper end of the bushing 43, and the diameter of the washer 58 is less than the inner diameter of the barrel 51, thereby providing an air venting space for the interior of the fulcrum adjuster. The washer 58 as well as the other elements of the fulcrum adjuster are retained within the barrel 51 by the provision of a snap ring 61 located in a suitable groove cut in the inner face of the barrel 51.

When oil is first introduced into the fulcrum adjuster following installation, it enters through the axially extending bore 39 and then through a plurality of radially extending bores 62 emanating from the axially extending bore 39. The oil then flows through slots 63 formed in the bushing 43 into the oil reservoir 48, into the passages 47, and ultimately into the pressure chamber 49.

When the engine valve stem 14 is being pushed downward by the rising pushrod 35, the pressure within the pressure chamber 49 increases rapidly above the pressure in the reservoir chamber 48. This pressure differential causes the valve 52 to snap shut almost instantaneously. A very small controlled quantity of oil is permitted to escape through the leakdown path 50 into the reservoir during the remainder of the valve open cycle. The quantity of bleed off oil is not sufficient to permit the parts to collapse during engine operation. When the engine valve closes, the spring 54 expands to take up any unnecessary clearance in the valve train. Simultaneously, the pressure in the pressure chamber 49 drops below reservoir and oil system pressure, valve 52 opens a volume of makeup oil sufficient to fill the pressure chamber surges in. If the length of the valve train grew during the cycle, the amount of oil issuing back into the pressure chamber is slightly less than the volume which escaped during valve opening. If the valve train shrank, the replacement volume is greater.

In all multicylinder engines, one or more valves remain open when the engine is not running. The fulcrum adjusters for these valve trains are thus under a continuous pressure from the engine valve spring 24 and are forced to collapse, i.e., oil is transferred from the pressure chamber 49 to the reservoir chamber 48 until the spring 54 bottoms. If the engine is shut down for a prolonged period, all of the oil from the engine's oil passages returns to the crankcase. When the engine is started, several seconds elapse before pressurized oil reaches the adjusters. The reservoir subsequently supplies the necessary makeup oil during those first few cycles of operation before pressurized oil reaches the adjuster.

The configuration shown in FIGURE 4 is substantially similar to that shown in FIGURE 3, except for certain structural modifications, the mechanism of operation being the same for both embodiments. The embodiment of FIGURE 4 employs a sleeve 71 consisting of a cup-shaped element having a plurality of passages 72 extending therethrough. The sleeve 71 was designed to increase the reservoir volume and to decrease the amount of machining required on the bushing 43. In this embodiment, the bushing 43 is not provided with slots 63 as in FIGURE 3 but a washer 74 is provided with spaced recesses 76 to accommodate the flow of oil from the axial bore 39 of the post 37 into the reservoir chamber 48. The inside diameter of the bushing 43 is relieved as indicated at 70 to accommodate a post 37 of uniform diameter.

From the foregoing, it will be seen that the fulcrum adjuster of the present invention provides a simplified structure which is considerably easier to manufacture than previously designed devices of this type. Furthermore, by positioning the leakdown annulus between the sleeve and the reactant barrel, entrapped air can readily escape even when the unit is tilted at a substantial angle from the vertical. This vented air is conveniently removed through the provision of the simple washer arrangement described. Furthermore, with the construction of the present invention, fabrication is considerably simplified because all of the inner components of the unit are retained by a simple snap ring. In addition, the parts involved are easier to machine, thereby further increasing the economy of manufacture.

It should be evident that various modifications can be made to the described embodiments without departing from the scope of the present invention.

I claim as my invention:

1. A fulcrum adjuster comprising a barrel having an an axial passage extending therethrough, an axially bored post extending through said axial passage, a sleeve received between said post and said barrel and defining with said barrel both an oil reservoir and an oil pressure chamber, said sleeve having port means therein providing for fluid communication between said reservoir and said pressure chamber, said sleeve being spaced from the internal wall of said barrel to provide a fluid leakdown path between said reservoir and said pressure chamber.

2. A fulcrum adjuster comprising a barrel having an an axial passage extending therethrough, an axially bored post extending through said axial passage, a sleeve received between said post and said barrel and defining with said barrel both an oil reservoir and an oil pressure chamber, said sleeve having port means therein providing for fluid communication between said reservoir and said pressure chamber, said sleeve being spaced from the internal wall of said barrel to provide a fluid leakdown path between said reservoir and said pressure chamber, and a washer received about said post and fitting loosely in said barrel to provide an air venting space for said oil reservoir.

3. A fulcrum adjuster comprising a barrel having an axial passage extending therethrough, an axially bored post extending through said axial passage, a sleeve received between said post and said barrel, an annular seal member disposed about said sleeve in engagement with said barrel, said sleeve having a plurality of axial passages therein and being of lesser diameter than the inner diameter of said barrel, thereby providing an oil leakdown passage space therealong, a valve member arranged to close off said passages, and a spring extending between said seal and said valve member.

4. A fulcrum adjuster comprising a barrel having an axial passage extending therethrough, an axially bored post extending through said axial passage, a sleeve received between said post and said barrel, an annular seal member disposed about said sleeve in engagement with said barrel, said sleeve having a plurality of axial passages therein and being of lesser diameter than the inner diameter of said barrel, thereby providing an oil leakdown passage space therealong, a valve member arranged to close off said passages, a spring extending between said seal and said valve member, and a washer disposed about said post, said washer fitting loosely in the top of said barrel to provide an air vent therefor.

5. A fulcrum adjuster comprising a barrel having an axial passage extending therethrough, an axially bored post extending through said axial passage, a bushing disposed between said post and said barrel, a sleeve carried by said bushing, said bushing having a shoulder for locating said sleeve therealong, an annular seal member disposed about said bushing in engagement with said barrel, said sleeve having a plurality of axial passages therein and being of lesser diameter than the inner diameter of said barrel, thereby providing an oil leakdown space therealong, a valve member arranged to close off said passages, and a spring extending between said seal and said valve member.

6. A fulcrum adjuster comprising a barrel having an axial passage extending therethrough, an axially bored post extending through said axial passage, a bushing disposed between said post and said barrel, a sleeve carried by said bushing, said bushing having a shoulder for locating said sleeve therealong, an annular seal member disposed about said sleeve in engagement with said barrel, said sleeve having a plurality of axial passages therein and being of lesser diameter than the inner diameter of said barrel, thereby providing an oil leakdown space therealong, a valve member arranged to close off said passages, a spring extending between said seal and said valve member, and a washer on the end of said bushing opposite from said seal member, said washer fitting loosely in said barrel to provide an air venting space therefor.

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