Oct. 8, 1957 A. C. SAMPIETRO 2,808,818

SELF-CONTAINED AUTOMATIC LASH ADJUSTER

Filed June 27, 1955 2 Sheets-Sheet 1

Fig. 1

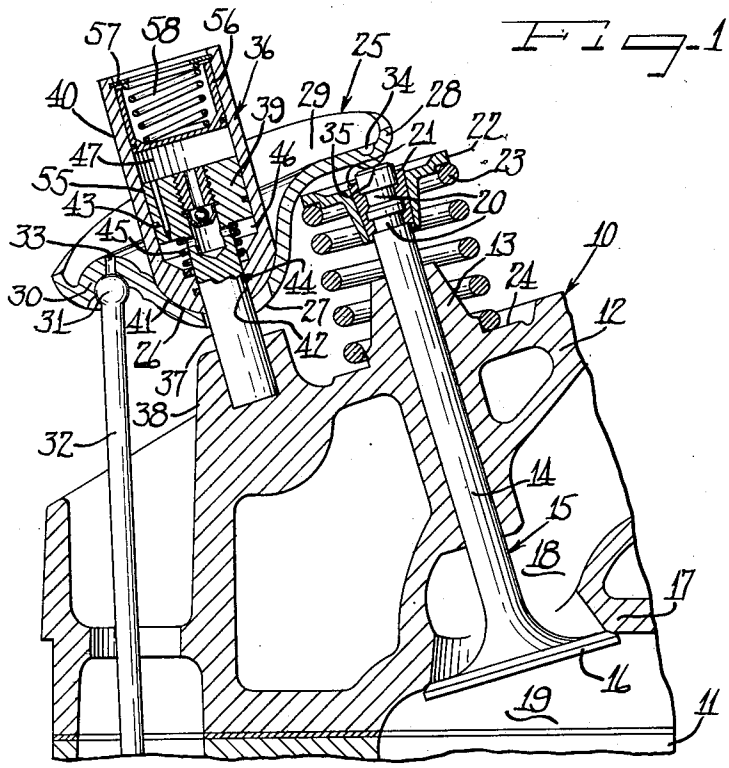


Fig. 2

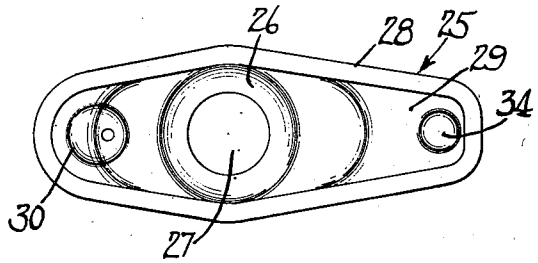
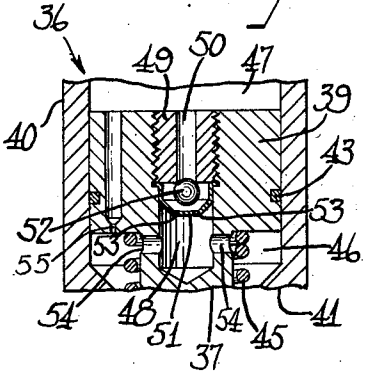


Fig. 3



Inventor

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Fig. 4

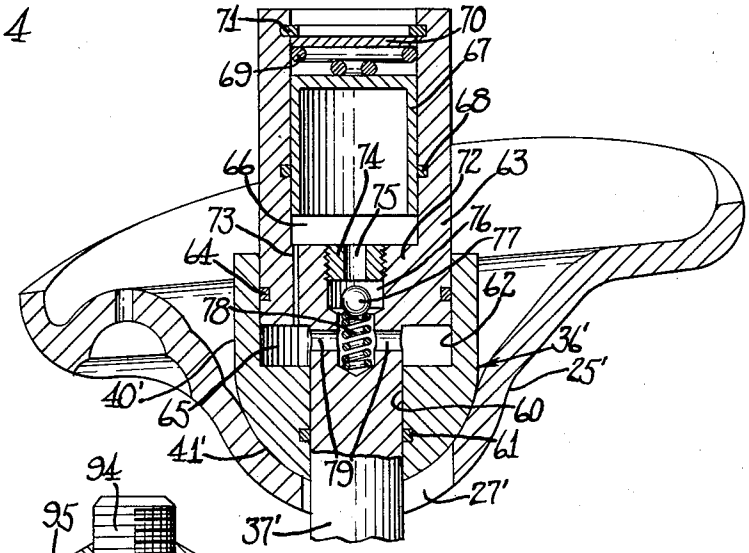
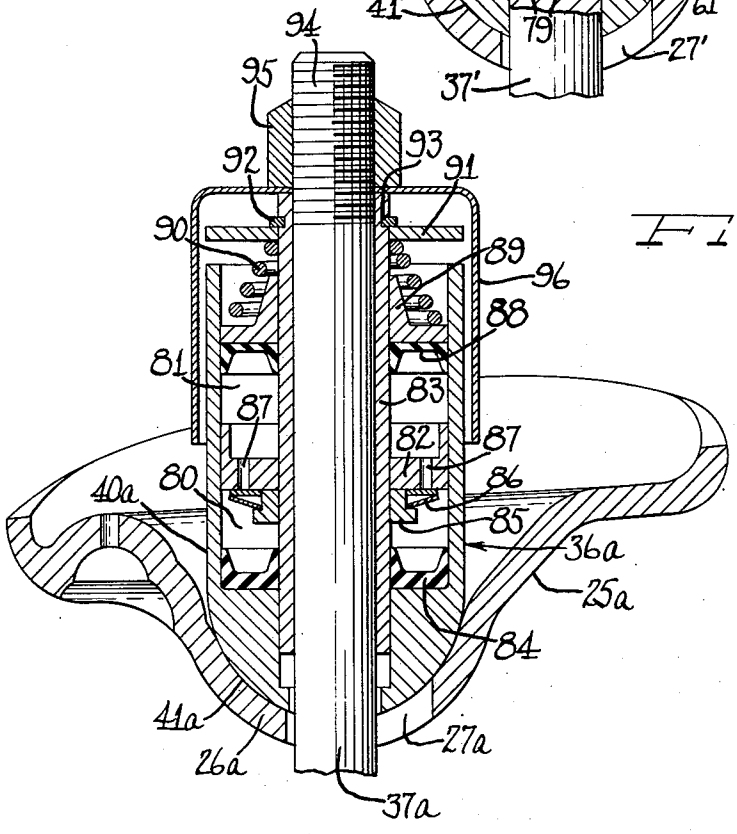


Fig. 5



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SELF-CONTAINED AUTOMATIC LASH ADJUSTER

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Application June 27, 1955, Serial No. 518,201

18 Claims. (Cl. 123—90)

The present invention relates to a lash adjuster which will automatically compensate for slack in engine valve linkage and more particularly to a lash adjuster having self-contained therein hydraulic fluid under pressure for taking up the slack and which does not add to the reciprocating weight or inertia of the linkage.

It is an object of this invention to provide an automatic lash adjuster which has self-contained therein hydraulic fluid under pressure and which thereby dispenses with the need for the use of connections to an oil gallery or the like. In this regard it should be noted that some valve in head engines do not have a supply of oil or oil gallery in proximity to the valve linkage and that therefore this invention is particularly useful with such engine structures.

Another object of this invention is to provide an automatic lash adjuster which is economical to manufacture and assemble and which may be readily applied to the post on which a rocker arm is pivotally mounted.

Yet another object of this invention is to provide an automatic lash adjuster which can have self-contained therein a hydraulic fluid such for illustration as a heavy viscous fluid that is relatively stable despite temperature variables. Excellent results may be attained by the use of a fluid such for example as "Silicone," which is methyl-poly-siloxane.

In accordance with the general features of this invention, there is provided in a valve gear including a push rod, a rocker arm actuated by the rod, a spring loaded engine valve actuated by the arm, the improvement of a mounting for the rocker arm accommodating rocking thereof by the push rod and the spring loaded valve, a lash adjuster on the mounting effective to hold the rocker arm in contact with the push rod and valve without interfering with proper seating of the valve and including a restricted orifice, the lash adjuster having self-contained therein hydraulic fluid, and means for effecting flow of such fluid through the restricted orifice in the adjuster in response to slack conditions developed in the valve gear.

Another feature of this invention relates to the provision in the aforesaid adjuster means for affording a bleed for the fluid in addition to its flow through the main orifice in response to slack conditions of the valve gear.

Yet another feature of this invention relates to the provision in the aforesaid valve adjuster of a simple spring urged piston for impelling the contained hydraulic fluid toward the rocker arm to hold the adjuster in hydraulically cushioned cooperation with the rocker arm.

Other objects and features of this invention will more fully appear from the following detailed description taken in connection with the accompanying drawings, which illustrate several embodiments thereof, and in which:

Figure 1 is a transverse cross-sectional view, with parts in elevation, of a valve in head internal combustion engine equipped with an automatic lash adjuster embodying the features of this invention;

Figure 2 is a plan view of the rocker arm with the adjuster omitted;

Figure 3 is a fragmentary cross-sectional view corresponding to a portion of Fig. 1 showing the valve means and the bleed passage and showing the valve ball in closing cooperation with the valve orifice;

Figure 4 is a fragmentary cross-sectional view similar to Fig. 1 but illustrating a modification of the invention; and

Figure 5 is a fragmentary cross-sectional view similar to Fig. 1 but illustrating still a third form of the invention.

As shown in the drawings:

In Fig. 1 there is illustrated in fragmentary manner a valve in head type of engine to which any one of the several forms of my valve adjuster may be adapted. The internal combustion engine **10** includes a cylinder block **11** and a cylinder head **12**. The head **12** has a guide **13** receiving in slidable relation therein the stem **14** of a poppet valve **15**. The head **16** of the valve **15** cooperates with a seat **17** in the engine head **12** to control the flow between the valve port **18** in the head **12** and the combustion chamber **19**. The upper end of the valve stem has grooves **20** therearound and the conventional split valve locks **21** have beads seated in these grooves. A valve spring retainer **22** is fixedly held on the upper end of the valve stem by the locks **21** and a valve spring **23** surrounding the valve stem has one end bottomed in the retainer **22** and the other end bottomed on a shoulder **24** of the engine head **12** surrounding the guide **13**. The valve spring **23** is compressed to hold the valve head **16** against its seat **17**. A stamped sheet metal rocker arm **25** has a depressed fragmental spherical socket portion **26** in the bottom thereof with an aperture **27** through the bottom of the socket.

The rocker arm **25** as indicated in Fig. 2 is surrounded by an upturned peripheral flange **28** to provide a centrally bowl-shaped interior **29**. On one side of the socket **26** in the arm, the bottom of the bowl is raised to provide an inverted socket **30** for the rounded end **31** of the push rod **32**. The push rod **31** can rock in the socket **30** and an oil aperture **33** is provided through the socket **30** to lubricate the end **31** of the push rod.

On the opposite side of the socket **26** the bowl-shaped bottom portion **29** of the rocker arm **25** is depressed at **34** to provide a rounded exterior for rocking on the end **35** of the valve stem **14**.

In accordance with the features of this invention, the rocker arm **25** is held in cooperation with the valve stem **14** and the push rod **32** by an automatic lash adjuster designated generally by the reference character **36**. The (Fig. 1) lash adjuster **36** is associated with a mounting stem **37** suitably secured to a boss **38** on the engine head **12**. This mounting stem **37** includes an enlarged head **39** which may be integrally formed therewith and in reality comprises a part of the lash adjuster **36**.

The head **39** of the stem **37** is snugly disposed within the interior of a hollow cylindrical member **40** having a lower rounded or semi-spherical end **41** disposed in the socket **26** of the rocker arm **25**. In this manner the rocker arm **25** is universally socketed on the lower rounded end **41** of the member **40**.

It will also be noted that the rounded end **41** of member **40** has an aperture **42** through which the stem **37** extends in close cooperation therewith. Rubber O rings **43** and **44** may be disposed between the head **39** and member **40** and between the stem **37** and the rounded end **41** respectively. A spring **45** under compression is disposed in the lower end of member **40** between the head **39** and the rounded end **41**. Thus this spring **45** is disposed in a lower fluid chamber **46** in member **40** which chamber is separated from the upper fluid chamber **47** by the head **39**.

Referring now to Fig. 3, it will be perceived that the head **39** has a central bore **48** which extends into the

stem 37 and the upper end of which is closed by a plug 49 having a central orifice or passageway 50. This plug 49 only extends partway through the thickness of head 39 so that a portion of the bore 48 is utilized as a valve receiving area.

Disposed at the bottom of the plug 49 is a cup-like ball cage 51 resiliently snapped into snug engagement with the wall of the bore 48 directly below the plug 49. This cage is slightly larger than a ball valve 52 adapted to close off the flow of fluid through the orifice 50. The cage below the ball 52 has spaced apertures 53 through which fluid can flow.

As shown in Fig. 3, the ball when in its uppermost position closes off the lower end of the orifice or passageway 50 so as to shut off the flow of fluid from lower chamber 46 to upper chamber 47 in member 40. In this respect it should be observed that the stem 37 has diametrically opposed apertures 54 at right angles to the bore 48 so that the bore 48 is in communication with the lower chamber 46.

In addition, the head 39 of stem 37 is provided with a restricted passageway or bleed 55 through which fluid can flow between chambers 47 and 46.

Now referring back to Fig. 1, it will be perceived that the upper end of the hollow member 40 has disposed therein a spring urged closure in the form of a hollow piston 56 which when in its uppermost position abuts a stop ring 57 in the upper part of member 40. The lower or head end of the piston 56 defines the top of the chamber 47 and is resiliently held in engagement with the viscous fluid in chamber 47 by the compression spring 58. Springs 58 and 45 together have a force less than that exerted by the engine valve spring 23 so as to not interfere with the closing of the valve head 16.

Access to the interior of the hollow member 40 may be easily attained by removing the snap retainer ring 57 whereupon the spring 58 and the piston 56 may be removed from the upper part of the member 40. This permits the introduction of fluid such as hydraulic fluid in the upper chamber 47. As noted before, it is contemplated that a heavy relatively temperature stable fluid should be used. Excellent results have been attained by the use of "Silicone."

According to this invention, the rocker arm 25 universally moves as required about the rounded end 41 of the lash adjuster. Pressure in the upper chamber or reservoir 47 caused by the spring 58 insures filling of the lower chamber 46 forming a fluid lock. Then, too, spring 45 in the lower chamber 46 also insures that the rocker arm 25 will be maintained in proper cooperation with valve stem 14 and push rod 32.

The ball check valve 52 can open to cause extension when the ball check valve 52 is closed, retraction can take place by leak down through orifice or passageway 55. The retraction may be otherwise obtained by omitting the middle O ring seal 43 or by the provision of a nick (not shown) in the sealing surface of the ball 52.

The upper chamber or reservoir, generally speaking, has three main purposes. One is to store a supply of fluid, to feed the lower chamber 46 when necessary, and to accept the return of fluid at the time of retraction. The lower chamber 46 defines a "lock" and has the principal function of holding position. It will be appreciated that adjustments may be easily made by changing the pressure exerted by the lower spring 45.

In Figure 4, there is disclosed a slightly different form of lash adjuster 36' associated with the upper end of the fixedly mounted stud or stem 37' for coaction with a socket in the rocker arm 25'.

In this form of the invention, as well as in the form shown in Figure 5 to be hereinafter described, the rocker arm coacts with the valve linkage and push rod in the same manner as in the first form. Also, the lash adjuster, which has self-contained therein hydraulic fluid under pressure, coacts with the rocker arm to hold it in yieldable cooperation with the upper ends of the valve stem and the push rod as in the preferred form. For simplicity purposes, the valve linkage push rod and engine parts are not shown in Figures 4 and 5, such parts being fully illustrated, however, in Figure 1. The principal difference between the two modifications and the form shown in Figure 1 resides in the construction of the lash adjuster.

Referring again to Figure 4, it will be perceived that the stud or stem 37' projects through the enlarged aperture 27' of the rocker arm 25' so as to permit pivoting of the rocker arm and extends through the central bore 60 of a hollow cylindrical or tubular member 40'. This member 40' has a rounded or semi-spherical end 41' socketed in the rocker arm and about which the rocker arm universally pivots. A suitable O ring 61 is disposed between the wall of bore 60 and the stem 37'.

The upper end of the tubular member 40' has an enlarged cylindrical recess 62 in which is snugly fitted an enlarged head 63 integral with the upper end of stem 37'. An O ring 64 is disposed between the head 63 and the wall of member 40'. A lower or oil "lock" chamber 65 is located between the underside of the head 63 and the lower portion of the tubular member 40'.

The upper portion of the head 63 is hollowed out to form an upper or oil pressure chamber 66 in which is disposed a spring urged piston 67 between which on the wall of the head is an O ring 68. A compression spring 69 bears on the upper end of the piston 67 and against a washer 70 held in place by a snap ring 71 in the upper hollowed end of the head 63.

The lower end of the head 63 comprises a barrier wall 72 separating the two chambers 65 and 66. This wall 72 is also provided with a bleed down passage 73.

The middle of wall 72 is apertured to receive a screw plug 74 defining a restricted orifice 75 leading into a ball valve receiving chamber 76 in which is located a ball 77.

Coacting with the lower portion on the ball 77 is a compression spring 78 tending to urge the ball upwardly into seated position on the lower end of orifice 75. Lateral openings 79 are formed in the stud 37' and establish a communication between the lower chamber 65 and the valve ball chamber 76.

It will be appreciated that the chambers 65 and 66 may be filled with any suitable fluid although excellent results may be obtained by the use of a heavy viscous fluid such as silicone as previously described. Such a fluid has a relatively flat viscosity curve with changes in temperature.

Needless to say, the spring 69 of necessity must exert a pressure on the piston 67 and the fluid which is not enough to overcome that of the engine valve spring such as spring 23 described in Figure 1, but enough to insure that the semi-spherical fulcrum end 41' of the lash adjuster 36' is maintaining rocker arm 25' in proper coaction with the valve stem and the push rod.

The ball valve controlled passage 75 and the leakdown bleed cooperate to insure respectively proper filling of chamber 65 and retraction of the hydraulic lash adjuster.

It is also contemplated that adequate hydraulic seals will be obtained by the O rings 61 and 64 and that there will be little or no leakage for extended periods of operation.

The upper chamber or reservoir has three purposes: first, it has sufficient volume and spring actuation to keep the mechanism functioning after a substantial amount of fluid is lost; second, it accepts return fluid when the mechanism is over-extended and must retract; and third, because it is pressurized for filling reasons, it also is the takeup means for overcoming slack in the valve train and in the lower chamber or "lock" 65.

It will be appreciated that otherwise the operation of this modified lash adjuster 36' is quite similar to that of the first described form 36.

In the modification shown in Figure 5, the rocker arm 25*a*, like the previously described rocker arms, is cooperable with the valve linkage and push rod and has an enlarged aperture 27*a* in its semi-spherical socket 26*a* through which extends the stem 37*a* secured in any suitable manner to the engine block.

As in the other forms, the lash adjuster 36*a* includes a cylindrical hollow or tubular upstanding member 40*a* provided with a rounded or semi-spherical lower end 41*a* which defines a universal fulcrum bearing against and on which the rocker arm 25*a* moves as in the previous forms.

The tubular member 40*a* is hollowed out to define lower and upper fluid or oil receiving chambers 80 and 81 separated by an intermediate barrier member 82 which is secured by a press fit to a sleeve 83 on the stem 37*a*.

In the bottom of the lower chamber 80 is a rubber sealing ring 84 of cupped or U-shaped cross section, the legs of which bear against the sleeve and the wall of the tubular member 40*a*. This U-shaped rubber ring comprises a high pressure sealing cup.

The sleeve 83 carries a spring retaining collar 85 which, in turn, carries a one-way spring disk valve of the so-called "Belleville" type 86 which will permit a one-way flow of fluid from the upper chamber 81 to the lower chamber 80 through apertures 87 in the intermediate barrier 82. While this barrier has a pressed fit on the sleeve 83 so as to be movable therewith, it is loosely fitted in the tubular member 40*a* so as to allow "leak-down" of fluid between the barrier and the tubular member.

The one-way valve 86 is such as to enable a rapid filling of the high pressure or lower chamber 80 from the upper or loading chamber 81. This upper chamber 81 has a sealing ring or cup 88 in sealing position at the upper end of chamber 81 between sleeve 83 and the wall of tubular member 40*a*.

The rubber ring or cup 88 bears against a boss-like annular member 89 between sleeve 83 and the wall of tubular member 40*a* and which is encircled by a frusto-conical loading or compression spring 90. The lower end of the spring 90 bears against the flange of boss member 89 and the upper end bears against an annular adjustment plate 91 on the sleeve in abutting relation with a snap ring 92 engaged in a groove 93 in the sleeve.

The upper end of stem 37*a* is threaded at 94 for receiving a nut 95 which holds a cup-like dust cap 96 against the upper end of sleeve 83. This cap is telescoped over the upper portion of the tubular member 40*a*.

It will be noted that by removing the nut 95 the dust cap 96 and the parts in the upper portion of tubular member 40*a*, the chambers 81 and 80 may be filled with suitable fluid such as oil or the like. Thus, the lash adjuster self contains its own hydraulic fluid.

The loading spring 90, as in the previous forms of the invention, has a downward force less than that exterted by the engine valve spring, such as the spring 23 in Figure 1, so as not to interfere with the proper closing of the engine valve. However, it always exerts sufficient pressure through the hydraulic fluid to take up slack or lash as in the previous forms. In other words, as in the previous forms the upper chamber 81 of oil constitutes a loading chamber and the lower chamber 80 of oil constitutes a "lock" which insures tight frictional bearing of the semi-spherical end of tubular member 40*a* in the socket of the rocker arm 25*a*.

It is believed that the operation of this third form of the invention will be otherwise apparent from the descriptions of the operation of the first two described forms.

I claim as my invention:

1. In a valve gear including a push rod, a rocker arm actuated by the rod, a spring loaded engine valve actuated by the arm, the improvement of a mounting for the rocker arm accommodating rocking thereof by the push rod and the spring loaded valve, a lash adjuster on said

mounting including means effective to hold the rocker arm in contact with the push rod and valve without interfering with proper seating of the valve and including a restricted orifice, said lash adjuster having self-contained therein hydraulic fluid, and means for effecting flow of such fluid through said restricted orifice in the adjuster in response to slack conditions developed in the valve gear.

2. In a valve gear including a push rod, a rocker arm actuated by the rod, a spring loaded engine valve actuated by the arm, the improvement of a mounting for the rocker arm accommodating rocking thereof by the push rod and the spring loaded valve, a lash adjuster on said mounting including means effective to hold the rocker arm in contact with the push rod and valve without interfering with proper seating of the valve and including a restricted orifice, said lash adjuster having self-contained hydraulic fluid, means for effecting flow of such fluid through said restricted orifice in the adjuster in response to slack conditions developed in the valve gear, and means for affording a bleed for the fluid in addition to the aforesaid flow through said orifice.

3. In a valve gear including a push rod, a rocker arm actuated by the rod, a spring loaded engine valve actuated by the arm, the improvement of a mounting for the rocker arm accommodating rocking thereof by the push rod and the spring loaded valve, a lash adjuster on said mounting including means effective to hold the rocker arm in contact with the push rod and valve without interfering with proper seating of the valve and including a restricted orifice, said lash adjuster having self-contained therein hydraulic fluid, and means for effecting flow of such fluid through said restricted orifice in the adjuster in response to slack conditions developed in the valve gear, said mounting including a fixedly supported stem projecting upwardly from its support through an aperture in the rocker arm and said lash adjuster being associated with the upper portion of said stem and socketed in said rocker arm for universal movement of said arm relative to said adjuster.

4. In a valve gear including a push rod, a rocker arm actuated by the rod, a spring loaded engine valve actuated by the arm, the improvement of a mounting for the rocker arm accommodating rocking thereof by the push rod and the spring loaded valve, a lash adjuster on said mounting including means effective to hold the rocker arm in contact with the push rod and valve without interfering with proper seating of the valve and including a restricted orifice, said lash adjuster having self-contained hydraulic fluid, means for effecting flow of such fluid through said restricted orifice in the adjuster in response to slack conditions developed in the valve gear, and means for affording a bleed for the fluid in addition to its aforesaid flow through said orifice in response to other conditions in the adjuster, said mounting including a fixedly supported stem projecting upwardly from its support through an aperture in the rocker arm and said lash adjuster being associated with the upper portion of said stem and socketed in said rocker arm for universal movement of said arm relative thereto.

5. In a valve gear including a push rod, a rocker arm actuated by the rod, a spring loaded engine valve actuated by the arm, the improvement of a mounting for the rocker arm accommodating rocking thereof by the push rod and the spring loaded valve, a lash adjuster on said mounting including means effective to hold the rocker arm in contact with the push rod and valve without interfering with proper seating of the valve and including a restricted orifice, said lash adjuster having self-contained therein hydraulic fluid, means for effecting flow of such fluid through a restricted orifice in the adjuster in response to slack conditions developed in the valve gear, and means for affording a bleed for the fluid in addition to its aforesaid flow through said orifice in response to other conditions in the adjuster, said flow effecting means

including a spring urged piston for impelling the fluid toward the rocker arm to hold the adjuster in cooperation with the rocker arm.

6. In a valve gear including a push rod, an apertured rocker arm actuated by the rod, a spring loaded engine valve actuated by the arm, the improvement of a mounting for the rocker arm accommodating rocking thereof by the push rod and the spring loaded valve, a lash adjuster on said mounting having self-contained hydraulic fluid and effective to hold the rocker arm in contact with the push rod and valve without interfering with proper seating of the valve, said adjuster including a cupped hollow member having an apertured rounded end on which said rocker arm is universally socketed, said mounting including a stem in said cup member projecting through the aperture in said rounded end thereof and downwardly through a larger aperture in the portion of said rocker arm socketed on said end and being fixedly supported therebelow, said stem having a head in said hollow member dividing it into upper and lower chambers in which said hydraulic fluid under pressure is enclosed, and check valve means at said head for controlling the flow of hydraulic fluid between the chambers in response to lash condition in the valve gear.

7. In a valve gear including a push rod, an apertured rocker arm actuated by the rod, a spring loaded engine valve actuated by the arm, the improvement of a mounting for the rocker arm accommodating rocking thereof by the push rod and the spring loaded valve, a lash adjuster on said mounting having self-contained therein hydraulic fluid and effective to hold the rocker arm in contact with the push rod and valve without interfering with proper seating of the valve, said adjuster including a cupped hollow member having an apertured rounded bottom end on which said rocker arm is universally socketed, said mounting including a stem in said cupped member projecting through the aperture in said rounded end thereof and downwardly through a larger aperture in the portion of said rocker arm socketed on said end and being fixedly supported therebelow, said stem having a head in said hollow member dividing it into upper and lower chambers in which said hydraulic fluid is enclosed under pressure, check valve means at said head for controlling the flow of fluid between the chambers in response to lash condition in the valve gear, and a spring urged piston in said chambers for applying pressure through the fluid to said rounded end of said cupped member for maintaining it in hydraulically cushioned bearing against said rocker arm.

8. In a valve gear including a push rod, an apertured rocker arm actuated by the rod, a spring loaded engine valve actuated by the arm, the improvement of a mounting for the rocker arm accommodating rocking thereof by the push rod and the spring loaded valve, a lash adjuster on said mounting having self-contained therein hydraulic fluid and effective to hold the rocker arm in contact with the push rod and valve without interfering with proper seating of the valve, said adjuster including a cupped hollow member having an apertured rounded bottom end on which said rocker arm is universally socketed, said mounting including a stem in said cupped member projecting through the aperture in said rounded end thereof and downwardly through a larger aperture in the portion of said rocker arm socketed on said end and being fixedly supported therebelow, said stem having on its upper portion restrictive orifice means for regulating flow of hydraulic fluid in said adjuster and in and against said bottom end of said cupped member and means in said adjuster for applying pressure against said fluid in a direction toward the rocker arm.

9. In a valve gear including a push rod, an apertured rocker arm actuated by the rod, a spring loaded engine valve actuated by the arm, the improvement of a mounting for the rocker arm accommodating rocking thereof by the push rod and the spring loaded valve, a lash adjuster on said mounting having self-contained therein hydraulic fluid and effective to hold the rocker arm in contact with the push rod and valve without interfering with proper seating of the valve, said adjuster including a cupped hollow member having an apertured rounded bottom end on which said rocker arm is universally socketed, said mounting including a stem in said cupped member projecting through the aperture in said rounded end thereof and downwardly through an aperture in the portion of said rocker arm socketed on said end and being fixedly supported therebelow, said stem having on its upper portion restrictive orifice means for regulating flow of hydraulic fluid in said adjuster and in and against said bottom end of said cupped member and means in said adjuster for applying pressure against said fluid in a direction toward the rocker arm, said latter means including a spring urged piston exerting at all times a pressure through the fluid in a direction to maintain the rocker arm socketed on said rounded end but which pressure is less than the spring loading of said engine valve.

10. In a valve gear including a push rod, a rocker arm actuated by the rod, a spring loaded engine valve actuated by the arm, the improvement of a mounting for the rocker arm accommodating rocking thereof by the push rod and the spring loaded valve, a lash adjuster on said mounting including means effective to hold the rocker arm in contact with the push rod and valve without interfering with proper seating of the valve and including a restricted orifice, said lash adjuster having self-contained therein hydraulic fluid, and means for effecting flow of such fluid through said restricted orifice in the adjuster in response to slack conditions developed in the valve gear, said latter means including a spring urged piston at all times exerting pressure on the fluid in a direction to urge same toward the rocker arm mounting.

11. A lash adjuster for a rocker-operated valve of the type having a fulcrum part and a stud part comprising means forming axially opposite motive surfaces on a movable member connected to one of said parts, means confining a body of liquid in which said movable member is submerged and forming fluid chambers on opposite sides of said member for confining a volume of static fluid adjacent each corresponding motive surface, whereupon movement of said member will unbalance the hydraulic equilibrium in said chambers, means forming a first enlarged passageway between said chambers and having a normally closed check valve therein for intermittently transferring fluid between said chambers as a function of the movement of said member, means forming a second restricted passageway between said chambers for continuously transferring fluid at a restricted rate of flow between said chambers as a function of the pressure differential between said chambers, and continuously biased movable wall means for one of said chambers to adjust the volume of said chambers and to transmit a slack-eliminating force between the parts through said fluid.

12. A lash adjuster as defined in claim 11, said fulcrum part comprising a cup-shaped member having a cylindrical recess formed therein, said stud part having a piston head forming said movable member and dividing said cylindrical recess into said fluid chambers, and a spring-biased wall means forming said movable wall means and closing the end of said cylindrical recess.

13. A lash adjuster as defined in claim 11, said fulcrum part comprising a cup-shaped member having a first cylindrical recess formed therein, said stud part comprising a piston having a second cylindrical recess formed therein, said piston received in said first cylindrical recess and forming together with said fulcrum part a first one of said fluid chambers, and said biased wall means closing said second cylindrical recess to form the other of said fluid chambers.

14. A lash adjuster as defined in claim 11, said fulcrum part comprising a cup-shaped member having a

cylindrical recess, said stud part extending through said cylindrical recess and having a piston portion extending radially outwardly thereof for dividing said cylindrical recess into said fluid chambers, and said movable wall means having a biasing spring engaged against said stud part and against said wall means and being disposed to close the end of said cylindrical recess in said fulcrum part.

15. The method of automatically adjusting lash in a rocker-operated valve which includes the steps of confining a static body of fluid on axially opposite motive surfaces of a relatively movable part of a stud and fulcrum assembly, hydraulically balancing said part to a state of equilibrium at rest, unbalancing the fluid load on one of said motive surfaces in response to movement of said part, substantially instantaneously balancing said part by intermittently transferring fluid between said surfaces as a function of the load induced displacement of said part, continuously balancing said part over an appreciable interval of time in a selected direction in response to an hydraulic unbalance between the parts extending through a slack condition, and applying a predetermined continuous biasing force between said parts through the fluid.

16. The method of adjusting lash in a rocker-operated valve which includes the steps of submerging a movable piston between a relatively movable fulcrum part and a stud part in a static body of fluid to provide chambers of fluid on opposite sides of the piston, intermittently transferring liquid from one chamber to the other chamber under load to maintain the chambers in fluid equilibrium in response to relative load-induced movements of the piston, continuously transferring a restricted flow of liquid from one chamber to the other chamber to maintain the chambers in fluid equilibrium under slack conditions, and continuously transmitting a minimum bias between the parts through the liquid to take up the slack between the parts and to maintain wholly liquid the fluid in said chambers.

17. In a lash adjuster for a rocker-operated valve, fulcrum means having an external fulcrum surface, means including said fulcrum means having a first recess, a stud extending through said fulcrum surface, means including said stud forming together with said fulcrum means a first fluid chamber in said first recess, means including said stud forming a second recess, spring-biased movable wall means in said second recess forming together with means including said stud a second fluid chamber, means forming a check valve-controlled passage between said first and second chambers to accommodate fluid flow in response to relative movement of said stud and said fulcrum means under load conditions, and means forming a restricted passage between said first and second chambers to accommodate fluid flow in response to relative movement of said stud and fulcrum means under slack conditions, said spring-biased movable wall means providing a continuous bias to keep the rocker and valve in contact with one another and acting through the fluid.

18. In a lash adjuster for a rocker-operated valve, a relatively movable stud part and fulcrum part, one of said parts having a piston formed with axially spaced pressure faces, self-contained hydraulic adjustment means for said parts comprising means including said parts confining said piston in a body of liquid thereby forming a fluid chamber on opposite sides of said piston, means forming a first passage to substantially instantaneously transfer fluid between said chambers in response to a load-induced relative movement of said piston, a check valve in control of said first passage to maintain said fluid chambers in fluid equilibrium as a function of said movement, means forming a second passage and having a restriction formed therein to continuously transfer fluid at a restricted rate of flow between said chambers, thereby tending to maintain said chambers in fluid equilibrium when the parts are under slack conditions, movable wall means for one of said chambers, and continuous biasing means engaged between said movable wall means and one of said parts to transmit a minimum slack-eliminating force between the parts through said liquid.

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