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Cornell

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[54] **HYDRAULIC LASH ADJUSTER OIL METERING MEANS**

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[73] Assignee: **Johnson Products, Inc.,** Muskegon, Mich.

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[52] **U.S. Cl.**..... **123/90.36,** 123/90.43, 123/90.46, 184/6.9

[51] **Int. Cl.** **F01l 1/24,** F01l 1/18, F01m 9/10

[58] **Field of Search** 123/90.35, 90, 36, 90.43, 123/90.46; 184/6.9

[56] **References Cited**

UNITED STATES PATENTS

3,153,404	10/1964	Van Swoten	123/90.43
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[57] **ABSTRACT**

Lubricating oil through the lash adjuster body is directed first into a reservoir formed by a plunger reciprocating within the lash adjuster body and then through a central passageway formed in the closure element which element forms the pivot for the rocker arm. A plate is positioned in the plunger cavity intermediate the reservoir and lower end of the closure element, the latter having a groove extending radially from the central passageway to the clearance between the plunger wall and closure element. The plate is urged by the oil pressure in the reservoir against the lower end of the closure element forming with the groove a restricted passageway which meters the oil flow to the lubricating arm. The plate is also a check valve during engine start up to prevent the ingestion of air into the plunger.

3 Claims, 7 Drawing Figures

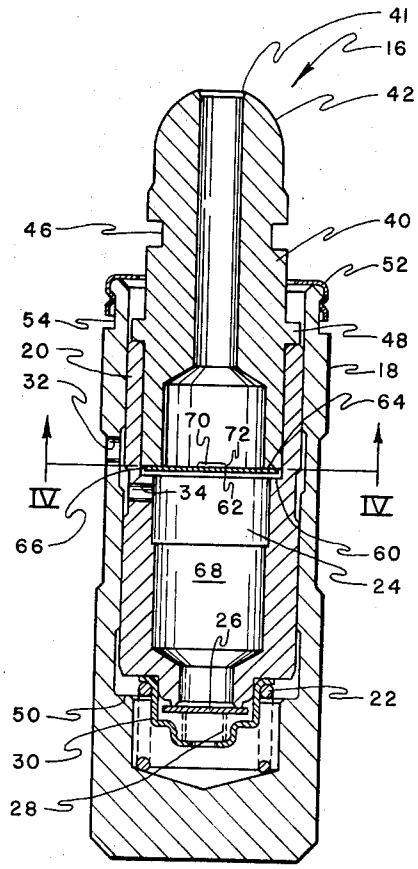


FIG. 1

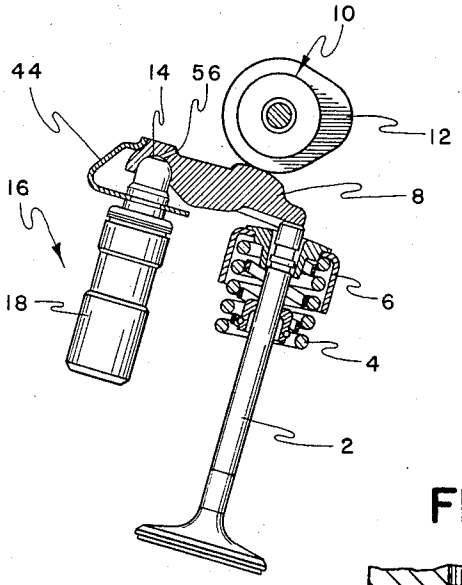


FIG. 2

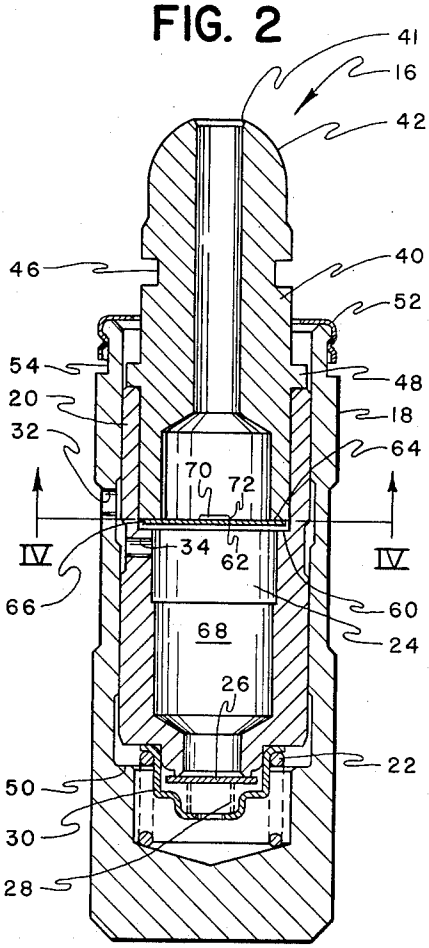


FIG. 6

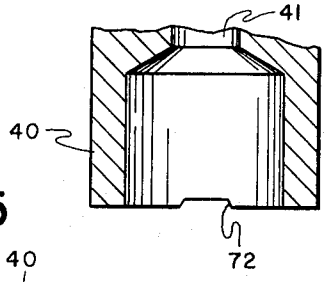
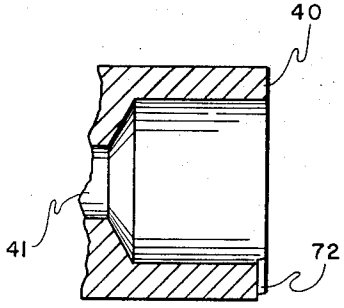


FIG. 5



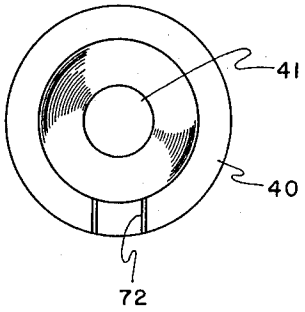


FIG. 7

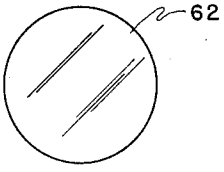


FIG. 3

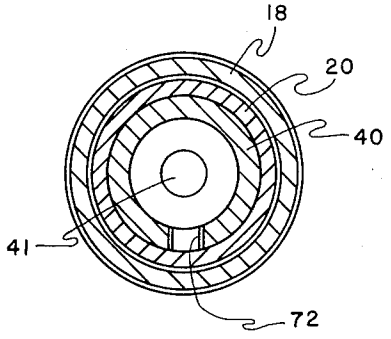


FIG. 4

HYDRAULIC LASH ADJUSTER OIL METERING MEANS

BACKGROUND OF THE INVENTION

This invention relates to hydraulic lash adjusters, and more particularly to a unique means for lubricating oil flow through the adjuster.

In certain overhead camshaft engines, cams bear against rocker arms which open and close the engine valves. Each rocker arm assembly is pivoted on a hydraulic lash adjuster which takes up slack in the valve train due to any expansion of the parts as the engine heats up.

It is desirable in certain environments to meter lubricating oil to the camlobe and the cam follower arm contact pad. Conventional means for doing this call for an external cam oiling system or extensive drilling of the camshaft for the internal oil supply. This is not only time consuming and costly, but provides but another source of trouble in the overall operation of the engine. An alternative lubricating means is to utilize the hydraulic lash adjuster as a source of lubricating oil thereby simplifying the overall construction of the engine by eliminating the external cam oiling system or the extensive drilling of the camshaft for the internal oil supply. One very successful approach is illustrated and described in U.S. Pat. No. 3,587,539 entitled HYDRAULIC LASH ADJUSTER issued June 28, 1971. This approach utilizes a pin means within a passageway formed in the nose of the plunger. While such approaches work quite well, there is a continual need in this art for improved hydraulic lash adjuster oil metering means which is more economical than present known proposals and yet effectively performs a positive metering function. Yet another drawback with many of the present known adjusters is the ingestion of air into the oil reservoir during engine start up.

SUMMARY OF THE INVENTION

In a conventional hydraulic lash adjuster, an open ended plunger reciprocates within the adjuster body with the plunger cavity and body being closed by a closure element which forms the pivot for the rocker arm. Oil is directed into the adjuster body through an oil inlet which leads into a reservoir formed by the plunger cavity from whence it is directed up to the rocker arm through a central passageway formed in the closure element.

In accordance with the invention, the lower end of the closure element extends within the body and is spaced above a shoulder formed on the plunger. A plate means is positioned intermediate a portion of the lower end of the closure element and the plunger shoulder, the diameter of which is less than the inner diameter of the adjacent wall thereby providing a clearance for oil flow around the plate. The plate is urged against the lower end portion of the closure element by the oil pressure in the reservoir and forms a restricted passageway with a groove in the end portion of the closure element extending from the passageway at least to the clearance between the plate and adjacent wall. The restricted passageway meters the flow of oil through the adjuster. In another aspect of my invention, the plate means provides a check to prevent ingestion of air into the plunger during engine start and run up. Until the engine oil pressure is great enough to move the plate means off the plunger seat, the plate means is a check valve preventing back flow.

As a result of my invention, an extremely simplified meter lubricating means is provided by a plate which is extremely simple and inexpensive to manufacture. A minimum number of elements are required which furthermore do not require high tolerance machining since the functional operation is simple and straight forward. A simple straight machined or coined groove on the lower end of the closure element through one of its walls fixes the meter rate. Existing lash adjuster constructions could be utilized to provide metering in accordance with my invention without requiring any extensive or expensive modification.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic representation of an overhead cam valve train having a hydraulic lash adjuster according to the invention;

FIG. 2 is an enlarged sectional view of the lash adjuster shown in FIG. 1;

FIG. 3 is a plan view of the meter plate utilized in accordance with the invention;

FIG. 4 is a cross-sectional view of the lash adjuster of the invention taken along line IV—IV of FIG. 2;

FIGS. 5 and 6 are enlarged sectional views of the inner end of the closure element; and

FIG. 7 is a bottom end view of the closure element.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now in detail to FIGS. 1 and 2, a valve 2 having a spring 4 and retainer 6, is actuated by rocker arm 8 through a camshaft 10 and cam 12. The rocker arm 8 pivots about a solid or closed socket 14 on lash adjuster 16. The lash adjuster, which automatically adjusts for lash, contains a body 18 with a plunger 20. Plunger 20 is biased in the upward position against the closed socket 14 of rocker arm 8 through a spring 22. Plunger 20 has an internal cavity 24 which opens into a bottom compression chamber through check valve plate 26. A spring 28 biases valve plate 26 against the bottom of plunger 20. A valve retainer 30, which holds the check valve assembly in place, is held against the bottom of plunger 20 by spring 22.

Lubricating oil enters cavity 24 through ports 32 and 34. As is conventional in hydraulic valve assemblies, the oil passes through cavity 24 through the bottom portion of plunger 20 into the bottom compression chamber.

The open upper ends of lash adjuster body 18 and plunger 20 are closed by a closure element 40. The lower portion of closure element 40 extends down within cavity 24 of plunger 20 while the upper end includes a spherical nose portion 42 which forms a fulcrum for rocker arm 8. Nose 42 is seated in seat 14 of rocker arm 8 and retained there by a spring 44 which clips into an annular groove 46 formed in closure element 40 beneath nose 42. Closure element 40 includes an annular shoulder 48 projecting beyond its outer side wall for limiting the downward movement of closure element 40 relative to plunger 20. The reciprocal motion of plunger 20 is limited at the lower extremity by shoulder 50 and at the upper extremity by a retainer 52 positioned in an annular groove 54 formed in the upper end of adjuster body 18. Shoulder 48 acts as a stop in

both the upper and lower travel of closure element **40** by engaging either the upper end of plunger **20** or retainer ring **52.**

It is desirable to lubricate the closed socket **14** as it rotates on the upper spherical head or nose **42.** Once oil reaches socket **14** through the lash adjuster body, the oil is directed through a passageway **56** formed in rocker arm **8** to direct a stream of engine oil to camshaft **10** and cam **12.**

Plunger **20** includes an inner shoulder **60** which acts as a stop for a meter plate **62** positioned intermediate the lower end **64** of closure element **40** and shoulder **60.** Meter plate **62** is preferably a very thin flat disc having a diameter less than the inner wall diameter of plunger **20** above shoulder **60** so that when plate **62** is positioned above shoulder **60,** an annular clearance **66** permits free flow of lubricating oil from the lower portion of cavity **24** below plate **62** up and around the plate. The lower portion of cavity **24** below plate **62** defines an oil reservoir **68** which is constantly supplied with lubricating oil through ports **32** and **34.** When closure element **40** is in its lowermost position with shoulder **48** in abutment against the upper end of plunger **20,** the lower end **64** of closure element **40** is spaced above shoulder **60** a distance greater than the thickness of plate **62.** This permits plate **62** to be positioned off seat **60** so that oil flow from the reservoir around plate **62** is possible. Plate **62** is preferably light enough so that the oil pressure in reservoir **68** urges plate **62** axially away from seat **60** into flush abutting engagement with the lower end **64** of closure element **40.** The oil flow around plate **62** is directed to the center bore **41** by a passageway **70** formed by the upper flat face of plate **62** and a radial slot **72** formed in the lower end of closure element **40.**

It will be appreciated that when the engine is not running, plate **62** will come to rest by its own weight on seat **60** since there is no counteracting oil reservoir pressure. The plate acts as a check valve in this position to prevent the ingesting of air into the plunger reservoir **68** during the period of engine start up before engine oil pressure has been established. Once the engine oil pressure is established, plate **62** is urged up against closure element **40** to establish oil flow to the rocker arm.

To recapitulate, during engine operation, oil flows into reservoir **68** through ports **32** and **34.** The oil pressure in reservoir **68** urges plate **62** up against the lower end of closure element **40.** The oil flow is then directed past shoulder **60** around plate **62** through clearance **66** from whence it is directed through passageway **70** into bore **41** on up through nose **42** into passageway **56** for lubrication of socket **14** and cam **12.**

Where it is desired to meter the rate of flow through the lash adjuster, the cross-sectional dimensions of slot **70** is selected so that it forms a restricted passageway limiting the flow therethrough to a prescribed amount over a given prescribed length of time. Thus, an extremely simplified flow passageway and meter means is provided by a single slot or groove formed in the lower edge of the closure element and a plate which is extremely economical to produce.

It will be appreciated that more than one slot could be utilized as an alternative way of increasing the flow rate. In certain instances, the groove or slot could be formed in the plate rather than the end of the closure element. It is preferred however that it be formed in the closure element since this plate can then be installed during assembly with either side facing up or down. Blockage or clogging of flow passageway **70** is prevented by the normal circumferential movement of plate **62** during the normal operation of the lash adjuster.

Although but one embodiment has been shown and described in detail, it will be obvious to those having ordinary skill in this art that the details of construction of this particular embodiment may be modified in a great many ways without departing from the unique concepts presented. It is therefore intended that the invention is limited only by the scope of the appended claims rather than by particular details of construction shown, except as specifically stated in the claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In a hydraulic lash adjuster for an internal combustion engine having a body with an open upper end, a plunger reciprocal within said body, said plunger having a central cavity defining an oil reservoir; oil inlet means communicating with said reservoir; a closure element in said open end of said body forming a fulcrum for a rocker arm; flow passageway means from said reservoir to said rocker arm for lubricating said fulcrum and rocker arm; and means for metering the flow of oil through said flow passageway means; the improvement comprising: said flow passageway means comprising a bore through said closure element communicating between the upper and lower end of said closure element; a plate means in the form of a thin flat disc positioned in a space formed between said plunger and closure element below said lower end portion of said closure element and above said reservoir and urged by the oil pressure in said reservoir against said lower end portion of said closure element; said plate means having at least a portion of its diameter less than the diameter of the adjacent wall of the plunger to permit oil flow from said reservoir around the outer circumference of said plate means when said plate is urged against said end portion and a slot means formed in said lower end portion of said closure element and extending radially from said bore to essentially the annular interface formed between said plunger and closure element, the interior of said plunger including a shoulder forming a seat which limits the downward movement of said plate means, the slotted lower end of said closure element extending downwardly into said plunger and spaced above said seat a distance greater than the thickness of said plate means, said slot and plate means forming a restricted flow passageway from said reservoir to the bore of said closure element; said restricted flow passageway metering the rate of oil flow through said adjuster to said rocker arm.

2. A hydraulic lash adjuster according to claim **1** wherein said closure element includes an annular shoulder above said plunger having a diameter greater than the bore of said plunger whereby said shoulder limits the downward movement of said closure element in said plunger.

3. A hydraulic lash adjuster according to claim **1** wherein said plate means is positioned on said seat during engine start up and acts as a check valve prior to engine oil pressure being established to prevent air ingestion into said reservoir during engine start up.

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