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HYDRAULIC LIFTER

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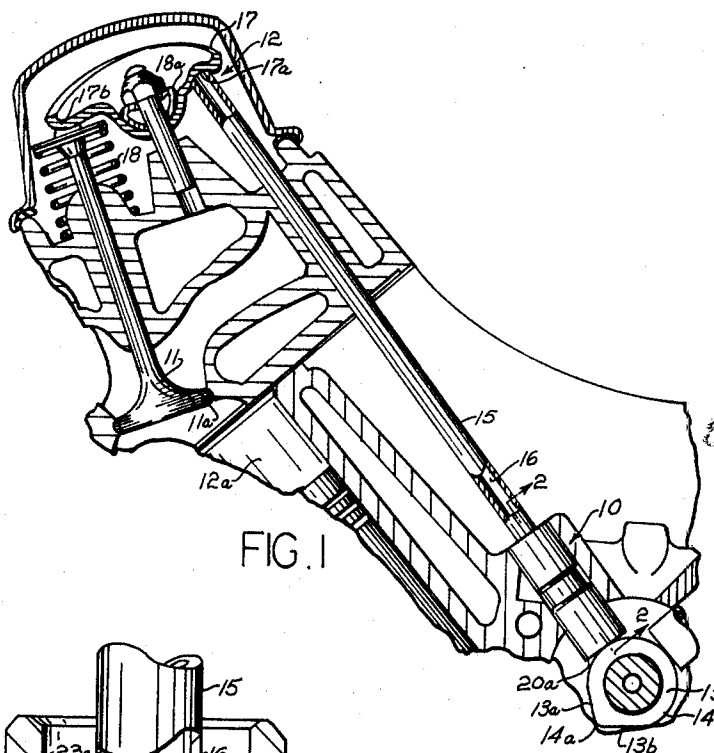


FIG. 1

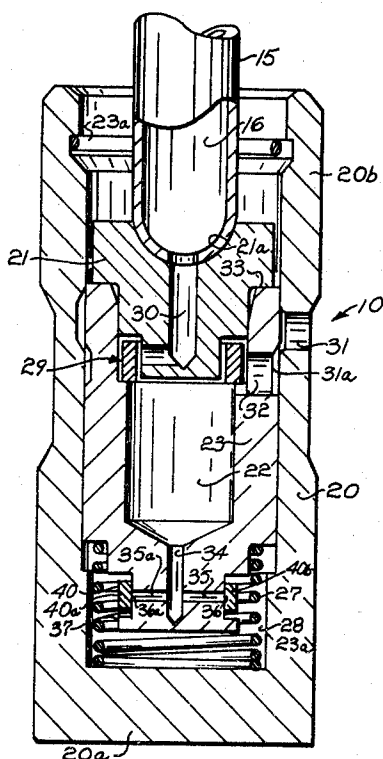


FIG. 2

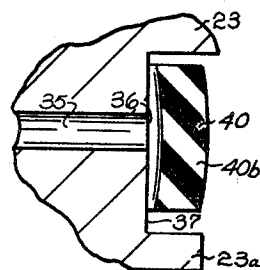


FIG. 3

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1

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HYDRAULIC LIFTER

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2 Claims

ABSTRACT OF THE DISCLOSURE

A check valve is provided in a hydraulic lifter. The hydraulic valve lifter includes a body member having a plunger member therein. The check valve cooperates with the lower portion of the plunger member to control the flow of fluid from a fluid reservoir defined at least in part by the plunger member to a pressure chamber disposed between the lower portion of the plunger member and the body member. The check valve means comprises a resilient member which encircles the lower portion of the plunger member and yields in response to the application of fluid pressure thereon to control the flow of fluid from the fluid reservoir into the pressure chamber.

The present invention relates to a hydraulic valve lifter having a body member and a plunger member and particularly relates to a check valve means in a hydraulic valve lifter which operates to control the flow of fluid from a fluid reservoir through a passage in the plunger member and into a chamber defined by portions of the plunger member and the body member.

Hydraulic valve lifters have been provided with a check valve means to control the flow of fluid to a pressure chamber defined by portions of the plunger member and body member of the lifter. However, known check valve means require an accurately machined check valve seat so as to effect proper sealing between the valve member and the check valve seat. Moreover, the known check valve means are relatively costly and complicated, generally including a metal valve member, a spring, and a spring retainer.

The principal object of the present invention is to provide a new and improved hydraulic valve lifter having a check valve means of a simple, practical and reliable construction and one which eliminates the need for accurate machining of a check valve seal.

Another object of the present invention is to provide a new and improved hydraulic valve lifter having a check valve member for controlling fluid flow from the fluid reservoir in the lifter to the pressure chamber defined by the plunger member and body member and which is made of a resilient material and deforms upon the application of fluid pressure thereon to control the flow of fluid to the pressure chamber.

A still further object of the present invention is the provision of a new and improved hydraulic valve lifter having a check valve means comprising an annular yieldable ring member encircling the lower portion of the plunger member, and wherein the ring member is operable upon the application of fluid pressure thereon to control the flow of fluid from the fluid reservoir to the pressure chamber.

Another object of the present invention is to provide a new and improved hydraulic valve lifter having a check valve movable substantially perpendicular to the reciprocating motion of the lifter to control the flow of hydraulic fluid into the pressure chamber defined by the plunger and body member of the lifter.

Still another important object of the present invention is the provision of a new and improved hydraulic valve lifter having a plunger member with a fluid passageway

2

therein communicating the reservoir of the lifter with a pressure chamber and wherein an annular resilient check valve member encircles a portion of the plunger member and is operable to control the flow of fluid through the fluid passageway.

A further object of the present invention is to provide a new and improved hydraulic valve lifter having a check valve member composed of an elastic, rubber, or a similar resilient material and which comprises a band which encircles the plunger member of the lifter and seals a fluid passageway therein and which deforms in response to fluid pressure in the passageway to provide for flow of fluid through the passageway.

Further objects and advantages of the present invention will be apparent to those skilled in the art to which the present invention relates from the following detailed description of a preferred embodiment thereof made with reference to the accompanying drawings in which:

FIG. 1 is a view of a hydraulic valve lifter embodying the present invention and showing the related assemblies in the engine block;

FIG. 2 is a cross-sectional view illustrating the present invention taken approximately along the section line 2—2 of FIG. 1; and

FIG. 3 is an enlarged fragmentary sectional view of a part of the hydraulic valve lifter of FIG. 2.

The present invention provides an improved hydraulic valve lifter and particularly an improved check valve means for controlling the flow of hydraulic fluid to a pressure chamber located within the hydraulic valve lifter. The valve lifter is suitable for use in different engine environments having either an overhead or regular cam shaft. By way of example, a hydraulic lifter 10 is illustrated in FIG. 1 in association with a V-type internal combustion engine.

The hydraulic valve lifter 10, as illustrated in FIG. 1, controls the movement of an engine valve member 11. The valve member 11 controls the flow of gases into and from the combustion chamber 12a of a cylinder of the engine. The valve member 11 is moved between open and closed positions with respect to a valve seat 11a by a valve gear, generally designated 12.

The valve gear 12 is actuated by a cam 13 which engages the hydraulic lifter 10. The cam 13 consists of a circular portion 14 and a raised portion 14a. A bottom portion of the lifter 10 engages the cam 13 and the cam 13 imparts reciprocating motion to the lifter 10 during rotation thereof. The cam 13 rotates in a clockwise direction and an upward motion is imparted to the lifter 10 as the ramp 13a of the cam 13 engages and moves relative to the lifter 10. An upward motion of the lifter 10 effects opening of the valve member 11. When the ramp 13b of the cam 13 engages and moves relative to the lifter 10, a downward movement of the lifter 10 is effected and the valve member 11 moves to engage the valve seat 11a.

The valve gear 12 consists generally of a push rod 15 interposed between the lifter 10 and a rocker arm 17. Movement of the push rod 15 by the lifter 10 causes the rocker arm 17 to pivot about bearing 18a and effects opening or closing of the valve 11. The push rod 15 has a tubular inner passageway 16 which allows lubricant to flow therethrough from the valve lifter 10 to the bearing 18a of the rocker arm 17. When the rocker arm 17 is raised by an upward movement of the push rod 15 acting upon a shoulder 17a, the rocker arm 17 pivots about the bearing 18a and a shoulder 17b of the rocker arm 17 exerts a downward force to open the valve 11. The spring 18 biases the shoulder 17b upwardly so that when the ramp 13b engages the lifter 10, the spring 18 effects an upward movement on shoulder 17b to engage valve 11 with the valve seat 11a and causes the rocker

arm 17 to pivot and thereby causes the push rod 15 and lifter 10 to move downwardly.

The hydraulic valve lifter 10, as illustrated in FIG. 2, comprises a cup-shaped body member 20. The cup-shaped body member 20 has a closed end 20a which is engaged by the cam 13, as shown in FIG. 1. Disposed within the hollow body member 20 are a plunger member 23 and a push rod socket member 21. The push rod 15 is seated within the push rod socket member 21 on a push rod seat 21a. A snap ring 23a is disposed in an annular groove in the side 20b of the hollow body member 20 to hold the parts of the lifter within the body member 20.

The plunger member 23 is designed to abut with the socket member 21 at the shoulder 33 and a plunger return spring 27 biases the plunger 23 into engagement with the socket 21 during normal operation of the hydraulic valve lifter 10. Therefore, an upward movement of the plunger member 23 causes an upward movement of the socket member 21. This upward movement of the socket member causes the push rod 15, which engages the push rod seat 21a of the socket member 21, to move upwardly. The upward movement of the push rod 15 effects opening of valve 11 as described hereinabove.

The socket member 21 has a fluid passageway 30 disposed therein. The fluid passageway 30 communicates a fluid reservoir 22 with the passageway 16 in the push rod 15 to allow for flow of lubricating fluid from the reservoir 22 through the passageway 30 and up through the push rod 15. Disposed between the socket member 21 and the plunger member 23 is a metering means 29. The metering means 29 is operable to meter the flow of hydraulic fluid from the reservoir 22 into the fluid passageway 30. The metering means 29 may take different forms but for illustrative purposes is shown as a metering means described in the copending application, Ser. No. 674,287, assigned to the assignee of the present application.

The plunger member 23 defines at least in part, the fluid reservoir 22 which contains hydraulic fluid during operation of the lifter 10. Hydraulic fluid is pumped into a passageway 31 on the side 20b of the body member 20 by some suitable means not illustrated, such as a pump. The passageway 31 communicates with an annular passageway 31a on the inner surface of the body member 20 which in turn communicates with the passageway 32 disposed within the plunger 23 to allow flow of hydraulic fluid through the passageways to the fluid reservoir 22. Therefore, during normal operation, the reservoir 22 is filled with hydraulic fluid.

The fluid reservoir 22 communicates with a pressure chamber 28, disposed between the lower portion of the plunger member 23 and the body member 20. This communication is provided by fluid passageways 34, 35 and 35a. The fluid passageway 34 is interposed between the fluid reservoir 22 and the inner ends of passageways 35 and 35a. The passageways 35, 35a, are substantially radially disposed within the lower portion of the plunger member 23 and have respective openings 36, 36a disposed on the annular peripheral surface 37 of the plunger member 23 to allow hydraulic fluid to flow into the pressure chamber 28.

The flow of hydraulic fluid from the reservoir 22 to the pressure chamber 28 is controlled by a check valve means which includes a check valve member 40. The check valve member 40 is disposed on the peripheral surface 37 of the lower portion of the plunger member 23 and cooperates with the openings 36, 36a of the respective fluid passageways 35, 35a. The check valve member 40 is yieldable upon the application of fluid pressure thereon to control the flow of fluid from the reservoir 22 to the pressure chamber 28 by opening and closing the openings 36, 36a.

The check valve member 40 comprises an annular band of resilient material which encircles the lower portion of the plunger member 23. The normal internal transverse

dimension of the band member 40 when the band 40 is not in tension is less than the transverse dimension of the surface 37 of the plunger member 23. The band member 40 may be stretched to a larger dimension and thus positioned on the plunger member 23 and specifically on the surface 37 thereof.

When the band 40 is located on the plunger member 23, as shown in FIG. 2, the band 40 blocks openings 36, 36a to prevent fluid flow from the reservoir 22 to the chamber 28. Moreover, the band 40 is in tension and maintained on the plunger member 23 due to the natural tendency of the band 40 to return to its normal condition. The tension in the band 40 may be considered as biasing the band member 40 to its closed position blocking fluid flow through the openings 36, 36a.

The band member 40 maintains its position closing openings 36, 36a until fluid pressure in the reservoir 22 acting on the band member 40 overcomes the tension in the band member 40, which biases the band member 40 to its closed position, as well as the pressure in the chamber 28 acting on the band member. When this occurs the pressure in passageways 35, 35a acts to move adjacent, respective portions 40a, 40b of the band member 40 radially of the plunger member 23 and in a direction substantially perpendicular to the direction of reciprocating movement of the lifter 10. This movement of the portions 40a, 40b is effected due to the deformable or yieldable nature of the resilient band 40.

The band member 40 is in effect deformed by the fluid pressure acting thereon. This deformation of the band member 40 is illustrated in FIG. 3. As shown in FIG. 3 the pressure in passageway 35 causes the band portion 40b to be disposed outwardly of the opening 36 and fluid may flow from reservoir 22 to chamber 28. The plunger member 23 is provided with a projecting shoulder 23a to prevent the band member 40 from sliding relative to the surface 37 of the plunger 23 to an extent to render the band 40 inoperable to close the openings 36, 36a.

When the pressure differential between reservoir 22 and chamber 28 becomes less than the inherent resilient force tending to return the band member 40 to its normal condition, the band member 40 returns to the condition shown in FIG. 2 and closes openings 36, 36a and blocks fluid flow therethrough.

When the hollow body member 20 is moving in a downward direction, the band member 40 tends to open and allow lubricant to flow from the reservoir 20 through passageways 34, 35, 35a and into the pressure chamber 28. The band member or check valve 40 opens when the chamber 28 enlarges due to a downward movement of the valve lifter. The enlargement of chamber 28 is effected by the plunger spring 27 which biases the plunger 23 away from the bottom portion 20a of the body member 20. During a downward motion of the lifter 10, the operation thereof is such that the spring 27 effects enlargement of the pressure chamber 28 as is well known. As a result the pressure in chamber 28 reduces and the check valve member 40 has unbalanced forces acting thereon.

When the pressure acting on the check valve member 40 from the reservoir 22 is sufficiently greater than the pressure in chamber 28 to overcome the force of the pressure in the pressure chamber 28 and the inherent resilient forces in the check valve member 40 itself, the valve member 40 moves radially outwardly of the plunger member, as described above. This provides for fluid flow from reservoir 22 into chamber 28. When the body member 20 moves upwardly the fluid pressure in the chamber 28 is increased. The pressure increase in chamber 28 tends to push the check valve member 40 against the surface 37 of the plunger member to seal the openings 36, 36a, thus sealing the pressure chamber 28 from the reservoir 22.

When the check valve member 40 closes openings 36, 36a due to an upward movement of the body member

5

20, the hydraulic fluid in the pressure chamber 28 is essentially sealed therein. The hydraulic fluid sealed within the pressure chamber 28 is substantially incompressible and therefore, when the hollow body member 20 is raised by the cam 13 the fluid within the pressure chamber 28 will exert an upward force and cause the plunger member 23 to move in an upwardly direction thus opening the valve 11 as described hereinabove. During each valve opening stroke a small amount of lubricant trapped in the pressure chamber 28 escapes or leaks around the plunger through a small space disposed between the body member 20 and the plunger member 23. This leakage is termed "leak-down" and is necessary in order to insure that the valve 11 can be fully seated on the subsequent return stroke which occurs with a continued rotation of the cam 13. Were it not for this "leak-down" during each lifting stroke and any of the parts of valve train lengthened due to an increase in temperature, such greater length would hold the engine valve 19 slightly off its seat 19a.

The check valve member 40 in the present embodiment is constructed of a resilient material which is deformable upon the application of fluid pressure thereon. This resilient material could be rubber, elastic, or some other suitable material. Because the check valve member 40 is formed of a resilient material which is deformable, the lifter construction and manufacture may be simplified. It should be apparent that the natural resilience of the check valve member 40 permits the elimination of a biasing spring and spring retainer. Moreover, the member 40 can deform to imperfections on the plunger surface 37 and a tight seal may be obtained without the necessity of an accurate machining of the surface 37.

Although the preferred embodiment of the present invention has been described above in considerable detail, certain changes, modifications, and adaptations may be made therein and it is desired to cover all such changes and modifications.

Having described my invention, I claim:

1. A hydraulic valve lifter comprising a body member, a plunger member located in said body member and de-

6

fining at least in part a fluid reservoir, portions of said plunger and body members defining a fluid pressure chamber therebetween, a fluid passageway in the sidewall of said plunger member providing fluid communication between said fluid reservoir and said fluid pressure chamber, and an annular resilient check valve member encircling said plunger member at said passageway and normally blocking fluid flow through the passageway, said check valve member having at least a portion thereof movable substantially radially outward of said plunger member to permit fluid flow from said reservoir into said pressure chamber through said passageways when the fluid pressure in the reservoir is greater than the pressure in the pressure chamber, and said resilient check valve member having a normal internal transverse dimension smaller than the transverse dimension of said portion of said plunger member and is in tension when disposed thereon.

2. A hydraulic valve lifter as defined in claim 1 wherein said plunger member has an annular shoulder thereon which operates to maintain said check valve member on said portion of said plunger member.

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