This invention has to do with a hydraulic device for taking up lash in valve operating gear such as is used on internal combustion engines and the like. The device is preferably embodied in a valve tappet and is of self-contained construction so that, once filled with oil, it will operate for an indefinite period without requiring attention. It is very simple and is adapted for manufacture at low cost.

Details of the invention and its advantages will be pointed out in the course of the following description.

In the drawings:

Figure 1 is a longitudinal section through the preferred form of the device with cooperating parts of overhead valve operating gear shown fragmentarily.

Figure 2 is a section on line 2—2 of Figure 1.

Figure 3 is a view similar to Figure 1 showing a modified form of the device applied to the valve gear of an L-head engine.

Figure 4 is a partial longitudinal section through a modified form of the device.

Figure 5 is a fragmentary view showing a modified form of seal for the device.

In Figure 1 is shown the application of the invention to the valve operating mechanism of an overhead valve engine. Here 10 indicates one of the cams on the engine camshaft. 12 indicates the valve tappet in which the invention is embodied. 14 indicates the valve push rod engaging the tappet, and 16 indicates a portion of the usual valve rocker arm which has a ball and socket engagement with the upper end of the push rod as indicated at 18. The other end of the rocker arm, 16, not shown, engages the stem of the usual spring pressed poppet valve in the usual manner. The valve tappet 12 is guided for reciprocating movement in a cylindrical opening in the engine block in the usual manner but this has not been illustrated.

Valve tappet 12 consists of a cast iron, generally cylindrical, member 20, the lower end of which is lightened by the provision of openings 22 through the side walls connected by transverse passages 24. The bottom 26 of the member 20 is engaged by the cam 10 as shown and is preferably hardened, as by chilling, to resist wear.

There is slidably mounted within the cylindrical recess 27 in the member 20 a plunger 28 having a central bore 30 communicating adjacent its upper end with a transverse bore 32. The lower end of the plunger 28 is reduced in diameter, as shown, providing an annular shoulder 34 engaged by an outwardly extending flange on a cup-shaped member 36 which is pressed on the lower end of the plunger. The bottom of the cup 36 is spaced from the lower end of the plunger 28 and is provided with an aperture, preferably elongated, as indicated at 38 in Figure 2. Member 36 may be a stamping and aperture 30 may be formed by punching. Resting on the bottom of the cup is a disc valve 40 slightly smaller in diameter than the length of the slot 38.

Surrounding the cup 36 is coil spring 42 which yieldingly tends to urge the plunger 28 away from the cylindrical member 20. With the parts assembled as shown, spring 42 is slightly under compression but as it is of less strength than the poppet valve spring (not shown) it is unable to open the engine valve and simply serves to take up slack in the valve operating mechanism when the poppet valve is seated.

The parts of the tappet 12, so far described, are assembled, filled with oil, and then, while immersed in oil, the seal indicated at 44 is applied. The seal comprises a molded rubber sleeve 46 to the opposite ends of which are secured ferrules 48 and 50; the former being a press fit on the plunger and the latter a press fit on the reduced upper end of member 20. In the assembly of the parts, the last operation consists of pressing the ferrule 50 into the position shown while the parts are immersed in oil. By this means the chamber between the plunger and the closed end of the cylinder, the passages in the plunger and the annular reservoir formed by the rubber sleeve and the plunger are completely filled with oil and remain so during the life of the tappet.

Sleeve 44 is shown distended in Figure 1 and this is the shape it assumes when the tappet 12 is assembled in the engine and is under compression. However, when the tappet is removed from the engine and is relieved of compression the sleeve 46 assumes its normal conical shape as shown in Figure 4.

The operation of the device will be apparent to those skilled in the art. When the tappet rests on the base circle of the cam and the engine valve is seated, spring 42 takes up any slack which may have developed in the system, urging the plunger 28 upwardly and thus causing oil to flow downwardly past valve 40 into the space beneath the plunger. When the cam 10 forces tappet 12 upwardly, valve 40 is closed by the pressure on the oil beneath plunger 28 and the engine valve is opened in the usual manner. Should the parts
have expanded as a result of heating, the engine valve spring, in seating the engine valve, will exert pressure through the rocker arm and push rod on plunger 28 and force it downwardly in its cylinder, closing valve 40 and causing any excess oil beneath the plunger to be forced upwardly through the slight clearance between plunger 28 and its cylinder. The described actions will be repeated during the operation of the valve there-by taking up any clearance in the valve operating mechanism or permitting its expansion as the case may be.

The described construction consists of a minimum number of parts. The plunger 28, valve retainer 36, and valve 40 may be made of hardened steel, although, if desired, they might be made of some non-oxidizing metal. Spring 42 may be made of the usual spring steel wire but, if preferred, stainless steel may be employed. The sleeve 44 is preferably of oil resistant synthetic rubber.

The parts are so proportioned that should the tappet become empty of oil, as by leakage through the seal the sleeve 44, the tappet may still be operated by engagement of the bottom of the cylindrical recess 27 with the valve retainer 36.

The construction shown in Figure 3 is distinguished from that shown in Figure 1 principally in that the body 26 of the tappet is made of two parts, the bottom part 60 consisting of a disc of cast iron having a chilled lower face and a reduced upper portion on which is pressed cylinder 62 having a flange 64 engaging the reduced portion of the disc 60. With this construction the parts 62 and 64 may be made on screw machines out of suitable steel stock. In this construction also the tappet is shown applied to an L-head engine; 66 indicating the stem of one of the poppet valves, the lower end of which is provided with a flat face engaging the flat face on the upper end of the plunger 28. In the construction shown in Figure 1 the lower end of the push rod is provided with a socket 15 having a spherical surface engaging the spherical surface on the upper end of the plunger 28.

The modification shown in Figure 4 is the same as the previously described except that the body of the tappet, consisting of a cast iron cylindrical member 68 having its lower end closed and its lower surface hardened for engagement with the cam, is lightened by the provision of apertures 70 and within it is fitted cylinder 72 having a closed lower end. This simplifies the design of the casting as compared with that of Figure 1. Part 72 may be readily manufactured on screw machines. In this figure the plunger and seal are shown in the positions which they assume when removed from the engine.

In Figure 5 there is shown a modification of the seal. Here the sleeve 46 consists of a section of a tube of uniform diameter which is expanded at its lower end to fit over reduced upper end of the cylinder. Both the reduced upper end of the binder and the upper end of the plunger 28 are provided with grooves into which portions of the rubber sleeve 46 are pressed by steel rings 70 which may be split after the fashion of piston rings so as to provide the desired spring action to effect a liquid-tight seal.

Many modifications will readily occur to those skilled in the art. Thus the rubber sleeves 46 or 46' might be replaced by flexible metallic bellows.

I claim:

1. In a lash take-up device for valve gear and the like, the combination of a cylinder having one end closed, a plunger reciprocably mounted in said cylinder with one end extending outwardly of said cylinder for engagement with said valve gear, said plunger having a cross-section uniform throughout substantially its entire length providing engagement with the cylinder throughout a major portion of the depth of said cylinder, a reduced end of uniform cross-section at its other end and intersecting longitudinal and transverse passages for communication between the interior of said device and an elongated aperture of said plunger beyond said cylinder, a cylindrically shaped valve cage fitted on said reduced end, said cage having a flange engaging the shoulder formed at the junction of the body of the plunger and said reduced end and an elongated aperture in the bottom of said cage, a disk valve in said cage adapted to close said longitudinal passage when forced upwardly by pressure of the fluid beneath the plunger, said reduced end limiting the upward travel of said disk valve in said cage, said cage adapted to transmit force between said plunger and the bottom of said cylinder in the absence of fluid, said reduced end serving to reinforce a portion of the tubular wall of said cage, a cylindrically coiled spring surrounding said cage and engaging said flange and said elongated aperture of said cage, said spring yieldingly urging the plunger outwardly and a flexible annular seal encircling the plunger and secured at its opposite ends to the plunger outwardly of said transverse passage and to said cylinder, said seal comprising a flexible sleeve and metal bands engaging the ends of the sleeve and holding the sleeve in fluid-tight relation to the plunger and cylinder.

2. In a lash take-up device for valve gear and the like, the combination of a substantially cylindrical member having a bottom portion adapted to be engaged by an operating element and a mid-portion having a circumferentially spaced reduced cross section connected to said bottom portion by ribs extending downwardly from the portions adjacent the reduced cross section of said mid-portion said member being provided with a false bottom portion and a cylindrical bore extending outwardly from said false bottom, a plunger reciprocably mounted in said cylinder with one end extending outwardly of said cylinder for engagement with said valve gear, said plunger having a cross-section uniform throughout substantially its entire length providing engagement with the cylinder through a major portion of the depth of said cylinder, a reduced end of uniform cross-section at its other end and intersecting longitudinal and transverse passages for communication between the interior of said device and the exterior of said plunger beyond said cylinder, a cylindrically shaped valve cage fitted on said reduced end, said cage having a flange engaging the shoulder formed at the junction of the body of the plunger and said reduced end and an elongated aperture of said cage, a disk valve in said cage adapted to close said longitudinal passage when forced upwardly by pressure of the fluid beneath the plunger, said reduced end limiting the upward travel of said disk valve in said cage, said cage adapted to transmit force between said plunger and the bottom of said cylinder in the absence of fluid, said reduced end serving to reinforce a portion of the tubular wall of said cage, a cylindrically coiled spring surrounding said cage and engaging said flange and said elongated aperture of said cage, said spring yieldingly urging the plunger outwardly and a flexible annular seal encircling the plunger and secured at its opposite ends to the plunger outwardly of said transverse passage and to said cylinder, said seal comprising a flexible sleeve and metal bands engaging the ends of the sleeve and holding the sleeve in fluid-tight relation to the plunger and cylinder.
2,547,798

5

ing said flange and the bottom of said cylinder yieldingly urging the plunger outwardly and a flexible annular seal encircling the plunger and secured at its opposite ends to the plunger outwardly of said transverse passage and to said cylinder, said seal comprising a flexible sleeve and metallic bands encircling the ends of the sleeve and holding the sleeve in fluid-tight relation to the plunger and cylinder.

3. In a lash take-up device for valve gear and the like the combination of a cylinder having one end closed, a plunger reciprocating in the cylinder, said plunger having a longitudinal passage therein communicating with the space between the plunger and the closed end of the cylinder, said plunger having a reduced end, a cup-shaped valve cage fitted on said reduced end engaging the shoulder formed at the junction of the body of the plunger and said reduced end, the end of said cage being spaced from the end of the plunger, a disk valve in said cage adapted to close said longitudinal passage when forced upwardly by pressure of the fluid beneath the plunger, a coil spring surrounding said cage and yieldingly urging the plunger upwardly, said reduced end limiting the upward travel of said disk valve in said cage, said cage adapted to transmit force between said plunger and the bottom of said cylinder in the absence of fluid, and said reduced end serving to reinforce a portion of the tubular wall of said cage.

CLYDE W. TRUXELL, Jr.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,900,518</td>
<td>Pearson et al.</td>
<td>Mar. 7, 1933</td>
</tr>
<tr>
<td>2,109,459</td>
<td>Best</td>
<td>Mar. 1, 1938</td>
</tr>
<tr>
<td>2,109,815</td>
<td>Best</td>
<td>Mar. 1, 1938</td>
</tr>
<tr>
<td>2,116,749</td>
<td>Daisley</td>
<td>May 10, 1938</td>
</tr>
<tr>
<td>2,152,404</td>
<td>Dostal</td>
<td>Mar. 28, 1939</td>
</tr>
<tr>
<td>2,153,097</td>
<td>Moorhouse</td>
<td>Apr. 4, 1939</td>
</tr>
<tr>
<td>2,187,608</td>
<td>Baxter</td>
<td>Jan. 16, 1940</td>
</tr>
<tr>
<td>2,205,982</td>
<td>Bashbough</td>
<td>June 11, 1940</td>
</tr>
<tr>
<td>2,213,195</td>
<td>Banker</td>
<td>Sept. 3, 1940</td>
</tr>
<tr>
<td>2,278,985</td>
<td>Arola</td>
<td>Apr. 7, 1942</td>
</tr>
<tr>
<td>2,324,006</td>
<td>Lenz et al.</td>
<td>July 13, 1943</td>
</tr>
<tr>
<td>2,386,317</td>
<td>Jenny et al.</td>
<td>Oct. 9, 1945</td>
</tr>
</tbody>
</table>