April 30, 1957 W. P. LOWTHER 2,790,430

HYDRAULIC VALVE LIFTER

Filed April 17, 1953

Fig. 1

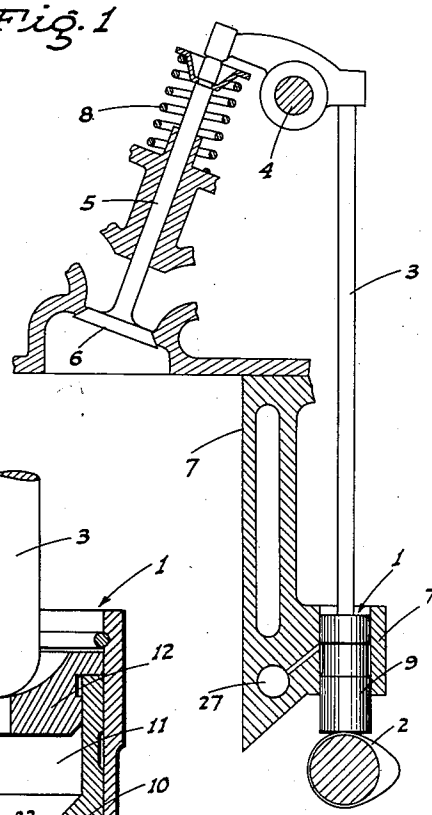


Fig. 2

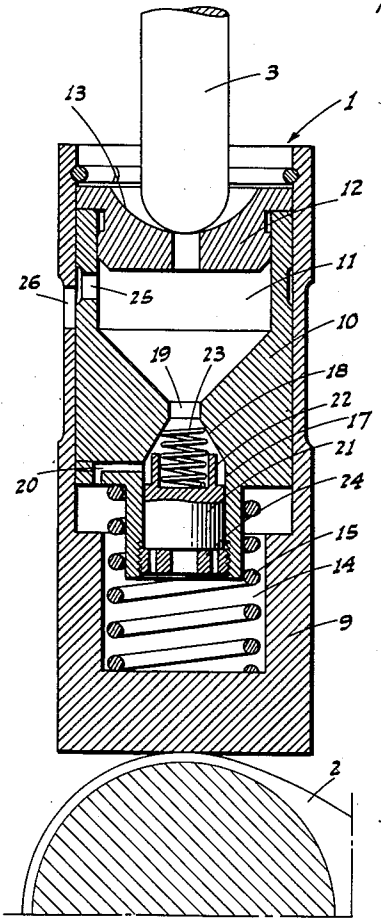


Fig. 3

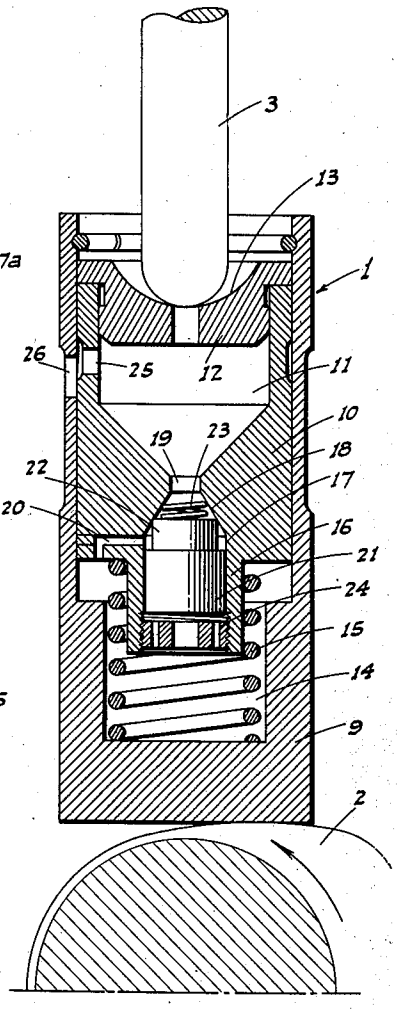


Fig. 4

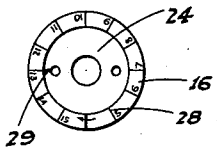
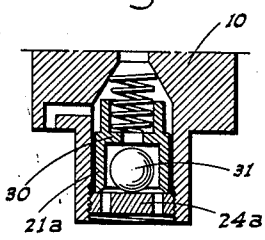


Fig. 5



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HYDRAULIC VALVE LIFTER

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2 Claims. (Cl. 123—90)

This invention relates to hydraulic valve lifters such as are used in connection with or as a part of the valve operating mechanisms of certain internal combustion engines, one such lifter being interposed between each cam and the push rod of the corresponding valve operating mechanism.

The principal object of the present invention is to provide a lifter of this character so constructed that clearance between the parts of the valve operating mechanism is provided for, so that the valve may close properly, regardless of expansion of the valve stem or push rod of the mechanism due to heat. At the same time, the lifter is arranged so that constant metal-to-metal contact is always maintained between the valve stem and rocker arm; between the rocker arm and push rod; between the push rod and lifter; and between the lifter and cam, so that silence of operation is maintained without any clicking or loose-tappet noises being had regardless of contraction or expansion of the parts.

The valves will thus always close with the necessary full contact with their valve seats, and burning of the valves and their seats with the resultant non-tight seating is prevented, and the necessity for frequent valve grinding or replacement is avoided.

A further object of the invention is to construct the lifter so that the amount of actual operating clearance may be varied as the particular engine or operating conditions may require for the most efficient operation.

These objects are accomplished by means of such structure and relative arrangement of parts as will fully appear by a perusal of the following specification and claims.

In the drawings:

Fig. 1 is an elevation of the hydraulic valve lifter, shown in connection with a typical overhead poppet valve and its operating mechanism.

Fig. 2 is an enlarged sectional elevation of the lifter in its normal or slack position.

Fig. 3 is a similar view of the lifter showing the position of the parts in their valve lifting position.

Fig. 4 is a bottom plan view of the plunger neck and plug therein.

Fig. 5 is a fragmentary sectional elevation of the plunger, showing a modified form of valve mounted therein.

Referring now more particularly to the characters of reference on the drawings, the lifter 1 as here shown is interposed between the rotary actuating cam 2 and the push rod 3, being disposed axially of the latter. The push rod actuates a rocker arm 4 which in turn engages the stem 5 of a valve 6 of the engine 7; a spring 8 on the stem 5 acting to close the valve, and—through the rocker arm and push rod—to hold the lifter down against the cam 2.

The lifter comprises a cylindrical barrel 9 closed on its lower end for cam engagement, and initially open at its upper end. This barrel is slidably mounted in a boss

7a on the engine above cam 2. Slidable in the barrel is a plunger 10 having a reservoir 11 for hydraulic fluid formed therein. A cap 12 on the plunger over the reservoir is cupped, as at 13, and supports the lower end of the push rod 3 therein.

The plunger has a close sliding fit in the barrel and terminates some distance above the lower end of the cylinder to leave a fluid chamber 14 therebetween. A compression spring 15 of less effectiveness or lighter than spring 8 is disposed in said chamber between the lower end of the plunger and said closed end of the barrel, and acts to yieldably push the plunger against the push rod.

The plunger includes a relatively small centrally disposed neck or extension 16 depending some distance into the spring 15. This neck is provided from its lower end upwardly a certain distance with a straight bore merging into a taper valve-seat portion 18 terminating in a passage 19 leading to reservoir 11. A relatively small passage 20 leads from the under side of the plunger 10 to the bore 17 at its upper end.

A valve body 21 is slidable in bore 17 and is formed at its upper end with a reduced-size valve element 22 to engage the valve seat 18; a light compression spring 23 between the wall of seat 18 and the valve element tending to force the same downwardly to hold said element clear of the valve seat. Downward movement of the valve member is limited by a vertically adjustable centrally orificed plug 24 screwed into the lower end of the neck 16.

The reservoir 11 and chamber 14 are filled with hydraulic fluid; the reservoir having a side port 25 substantially matching a port 26 in the barrel 9. Said port 26 in turn is adapted to communicate with a source of fluid under pressure in the usual passage 27 in the engine; the fluid also of course keeping the various parts lubricated. It should be noted that plug 24 is constructed so as to have a tight fit, avoiding the need of a lock nut.

In operation, when the cam 2 is turned so that the lifter is idle or at the lowest point in its movement, as shown in Figs. 1 and 2, the valve 6 is of course fully closed.

The valve body 21 is open and in its lowest position, being pressed down by spring 23 against plug 24, and the latter being always set so that body 21 can move a predetermined distance to a fully closed position. Spring 15 holds plunger 10 firmly against the push rod 3, and chamber 14 is completely filled with fluid, since passage 20 is open at this time to reservoir 11, from which fluid flows by pressure into chamber 14 through passage 19, taper bore 18, and passage 20.

As soon as cam 2 turns sufficiently to start its lifting action, such action is imparted to barrel 9 directly. Since spring 15 is weaker than valve spring 8, said spring 15 is compressed; plunger 10 remaining stationary. Some of the fluid in the chamber 14 is thus displaced and forced through passage 20 and into the reservoir 11, while at the same time such fluid presses against valve body 21, forcing the same upwardly to a closed position against the resistance of spring 23, and thus shutting off the flow of fluid through passage 20 and into the reservoir 11 above. This limits the distance the barrel 9 may move relative to the plunger, since the remaining fluid in the chamber 14 is confined therein and thereafter cannot escape.

The extent of upward movement of the barrel alone depends on the amount of lift permitted the valve body 21 from its initially open to its closed position. This distance is determined by the initial setting of plug 24, which is adjusted, before the lifter is installed, according

to the particular operating clearance desired for the engine valve mechanism.

In order to adjust the plug to the desired position to give a predetermined clearance, the under side of neck is calibrated, as at **28**, in Fig. 4, to read against a starting mark **29** on the plug **24**; the symbols on the calibrations indicating clearances in thousandths of an inch, or referring to a clearance chart provided separate from the lifter.

Upon further upward movement of the barrel **9**—as imparted thereto by cam rotation—the plunger **10** moves as a unit therewith, since the fluid is non-compressible, and the valve **6** is opened its normal distance.

When the cam drops away from the lifter and the valve **6** closes, pressure is removed from the fluid in chamber **14**, and spring **23** acts to open the valve **21**. At the same time, spring **15** acts to relatively raise the plunger in the barrel **9**. Fluid from reservoir **11** now drains back into chamber **14** through passages **19**, **18**, and **20** to maintain the chamber completely filled.

When the valve stem **5** or push rod **3** expand and elongate due to heat, the plunger **10** is depressed into the barrel **9**, fluid being accordingly displaced from chamber **14** when passage **20** is open to the reservoir **11**, without affecting the relative movement of the barrel and plunger had with initial cam lifting action, as previously described. If, on the other hand, the fluid expands, the excess can escape into reservoir **11**.

With either cold or hot engine conditions, therefore, the same clearance for the valve mechanism is obtained, and full valve closing is assured, without any actual noise-creating spacing between any part being necessary at any time.

For high speed engines in which the plunger must be loaded faster, the valve shown in Fig. 5 may be used. In this case, the spring-pressed valve member **21***a* is tubular, with an orificed cross wall **30** intermediate its ends. A ball valve **31** is disposed in the member **21***a* between the wall **30** and the adjustable plug **24***a* on which the ball rests; the ball when raised by fluid pressure from below closing the wall orifice. This arrangement not only provides for a faster loading of the plunger **10**, but facilitates the initial filling of the chamber **14** with fluid, since it permits of the ready escape of air from the chamber as the latter is filled.

From the foregoing description it will be readily seen that there has been produced such a device as will substantially fulfill the objects of the invention, as set forth herein.

While this specification sets forth in detail the present and preferred construction of the device, still in practice such deviations from such detail may be resorted to as do not form a departure from the spirit of the invention, as defined by the appended claims.

Having thus described the invention, the following is claimed as new and useful, and upon which Letters Patent are desired:

1. A hydraulic valve lifter for interposition between a rotary cam and the operating mechanism of an engine valve, said mechanism including a spring to close the valve; said lifter comprising an upstanding barrel closed at its lower end to rest on the cam and adapted to be mounted for longitudinal movement, a hollow plunger slidably mounted in the barrel and leaving a fluid chamber in said barrel below the plunger, the latter forming a fluid reservoir and being arranged at its upper end to support the push rod of the valve operating mechanism, a compression spring in the chamber between the plunger and barrel to urge the latter upwardly and being lighter than the spring of the valve mechanism, means forming a relatively small passage between the reservoir and chamber, and including a valve seat portion facing downwardly, a valve slidable in the passage to engage the seat and exposed at its lower end for chamber-fluid engagement, a spring normally pressing down on the valve to hold the same clear of the seat, means normally spaced from and limiting downward movement of the valve away from the seat, said movement limiting means being adjustable to vary the distance the valve may move away from its seat, and another passage in the plunger communicating at its lower end with the chamber and at its upper end with the first named passage below the point of seating engagement of the valve therewith.

2. A hydraulic valve lifter for interposition between a rotary cam and the operating mechanism of an engine valve, said mechanism including a spring to close the valve; said lifter comprising an upstanding barrel closed at its lower end to rest on the cam and adapted to be mounted for longitudinal movement, a hollow plunger slidably mounted in the barrel and leaving a fluid chamber in said barrel below the plunger, the latter forming a fluid reservoir and being arranged at its upper end to support the push rod of the valve operating mechanism, a compression spring in the chamber between the plunger and barrel to urge the latter upwardly and being lighter than the spring of the valve mechanism, means forming a relatively small passage between the reservoir and chamber, and including a valve seat portion facing downwardly, a valve slidable in the passage to engage the seat and exposed at its lower end for chamber-fluid engagement, a spring normally pressing down on the valve to hold the same clear of the seat, means normally spaced from and limiting downward movement of the valve away from the seat, the said last named valve being tubular with a passage therethrough in communication with the reservoir and chamber and formed with a downwardly facing valve seat intermediate its ends, and an additional valve confined in said passage below the valve seat thereof in clearance relation to the side wall of the passage and arranged for limited movement to and from the seat, and another passage in the plunger communicating at its lower end with the chamber and at its upper end with the first named passage below the point of seating engagement of the valve therewith.

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