

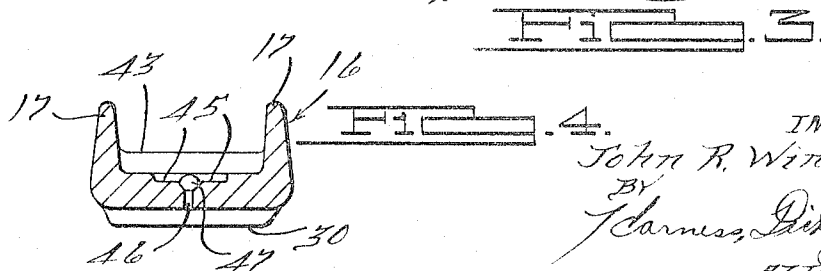
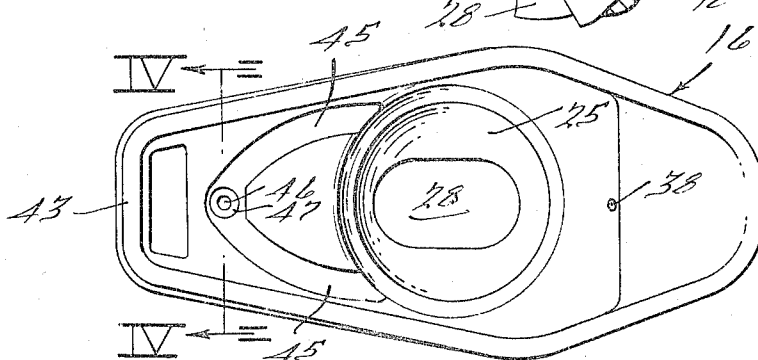
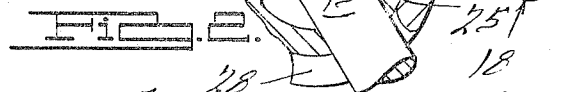
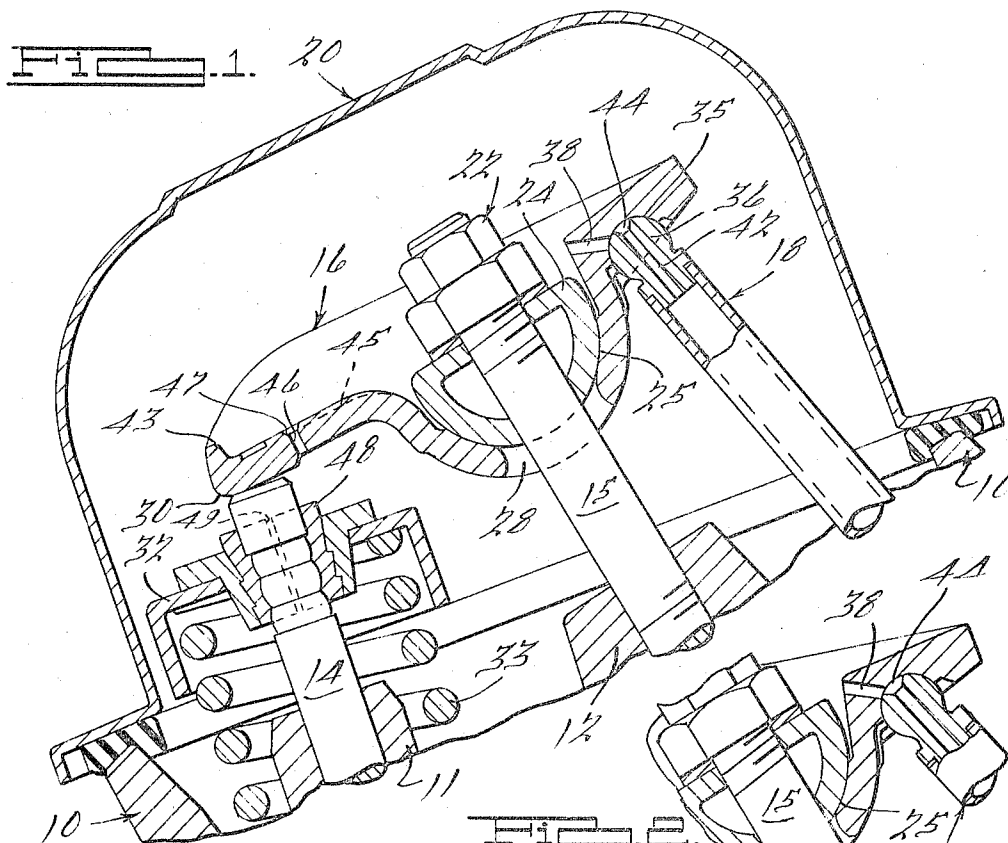
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J. R. WINTER, JR

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VALVE ACTUATING MECHANISM

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INVENTOR.

John R. Winter, Jr.

BY

By
T. Carness, Dickey & Pierie.

ATTORNEYS.

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3,289,657

VALVE ACTUATING MECHANISM

John R. Winter, Jr., 4276 S. Shore Drive, Pontiac, Mich.

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1 Claim. (Cl. 123-90)

The present invention relates to valve actuating mechanisms for internal combustion engines, and particularly to improved rocker arm-type mechanism for actuating overhead valves of the poppet type.

An important object of the invention is to provide improved controlled lubrication for rocker arms and their coacting parts, in engine valve actuating systems of the type wherein rocker arms are individually supported, rather than being mounted upon a common shaft. In such systems wherein it is not practical to deliver oil for lubrication of the overhead valve mechanism through a rocker arm shaft as is normal where rocker arms are mounted on a common shaft, it has been the practice to deliver such oil upwardly through the pushrods from the forced feed lubrication system of the engine. It is desirable to lubricate not only the rocker arm support bearing, but also the points of engagement between the pushrods and rocker arms, and between the rocker arms and valve stems. It is not desirable, however, to permit an excessive quantity of oil to reach the sides of the valve stems, because of the fact that such oil can then be sucked into the combustion chamber through the clearance between the stem and valve guide.

Arrangements heretofore used for lubricating rocker arms of the individually supported concave type, with oil supplied through the pushrods, have involved an over-supply of oil under excessive pressure, and which has been squirted into the space beneath the valve cover in such manner as to permit an excessive quantity of oil to reach the valve stems while at the same time starving points needing lubrication.

An object of the present invention is to achieve improved lubrication of the points requiring lubrication and to eliminate harmful overlubrication without increasing the cost or complexity of the parts and with a minimum change of existing designs and manufacturing methods.

Other objects, features and advantages of the present invention will become apparent from the subsequent description and the appended claims, taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a cross sectional view of an upper portion of an internal combustion engine showing my improved rocker arm and its supporting means in longitudinal section and with the parts in valve-open position;

FIGURE 2 is a fragmentary sectional view taken on the same plane as FIG. 1 but showing only the upper extremity of the pushrod and those parts of the rocker arm and its supporting means adjacent thereto, the parts being in valve-closed position;

FIGURE 3 is a top plan view of the rocker arm, and

FIGURE 4 is a cross sectional view taken substantially on the line IV-IV of FIGURE 3 and looking in the direction of the arrows.

Referring now to the drawing, reference character 10 designates a fragmentarily illustrated part of the upper portion of the head of a V-type internal combustion engine. The head includes valve guide portions 11 and supporting boss portions as 12. The parts 11 and 12 are normally integral with the head 10. Only the stem portion 14 of the valve is illustrated, the stem being slidable in the guide 11 during actuation of the valve. Boss 12

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carries an upstanding stud 15 which rockably supports the rocker arm 16. The rocker arm is actuated by a pushrod 18, of which only the upper portion is shown, while the rocker arm in turn actuates the valve stem 14.

It will be presumed that the pushrod 18 is actuatable in the conventional manner by a cam shaft (not shown) forming a part of the engine. One complete valve actuating assembly of the indicated variety is provided for each valve, and all of the valves forming a single cylinder bank are normally arranged in a row, with the valve actuating mechanism enclosed by a cover as 20 sealed to the head. It will also be noted that the cylinder; head and cover slant downwardly to the left, as the parts are shown in FIGURE 1, and this also will be recognized as typical of V-type engines, wherein the rocker arm must also be installed in a generally corresponding sloping position with the pushrod end of the arm higher than the valve-actuating end.

The stud 15 carries at its upper end a locknut assembly 22 beneath and retained by which is a downwardly convex hemispherical bearing member 24 which is radially pierced to fit upon the stud and the spherical bottom surface of which forms a bearing for a corresponding concave bearing socket portion 25 in the rocker arm. The rocker arm is hollow and may be formed of pressed steel, or cast, to the general shape indicated.

The parts thus far described will seem to be essentially conventional in their construction and arrangement.

The upwardly opening concave configuration of the rocker arm adapts it to retain a certain amount of lubricating oil which is delivered to the interior thereof, and the downwardly formed intermediate portion which defines the socket 25 is provided with an aperture 28, the size of which substantially exceeds the diameter of the stud 15, considered in the common plane of the stem 14, stud 15 and pushrod 18, so as to permit rocking of the rocker arm in such plane.

At its valve end the rocker arm is provided with a pad portion 30 which directly engages the upper end of the valve stem 14 to actuate the latter. The valve stem is shown as provided at its upper end with an abutment 32 for the valve spring 33. The spring operates in the normal manner to tend to close the valve and to constantly urge the valve stem and pad 30 upwardly, thereby also maintaining the ball and socket parts 24, 25 seated, due to the reaction at the pushrod end of the arm, the pushrod of course being supported from its lower end by the cam of the engine. The pushrod end of the arm is generally flat and extends angularly upwardly and to the right, as viewed in FIGURES 1 and 2, and its lower surface is provided with a hemispherical socket 35. The pushrod 18 is provided at its upper end with a ball portion 36 the radius of which corresponds to that of the socket 35, so that these parts fit rockably together with substantial accuracy throughout their interfitted areas. An aperture 38 extends angularly through the body of the arm at the pushrod end and provides oil-conductive communication between the socket 35 and the concave internal upper portion of the rocker arm. It will be noted that the ball portion 36 of the pushrod is formed as an axially drilled terminal fitting which is tightly secured and in sealed relationship to the pushrod. An oil passage 42 drilled in the ball 36 provides communication between the interior of the tubular pushrod and the upper extremity of the ball. At such upper extremity the oil hole 42 comprises an accurately sized terminal port portion 44. The size and positioning of port 44 and of the

lower or right-hand extremity of the oil hole 38 in the rocker arm are such that when the pushrod is up, in the valve-open position, as shown in FIGURE 1, the port 44 and passage 38 are disaligned, and no oil can then be delivered from the pushrod to passage 38, since the port 44 lies within and is sealed off by an unapertured portion of the socket 35. As the valve is allowed to close, under the influence of the valve spring, however, the rocker arm and pushrod rock to the relative positioning indicated in FIGURE 2, thereby allowing a predetermined amount of overlap between the port 44 and the socket end of passage 38. Oil, which is furnished under pressure through the pushrod, is then permitted to flow at a metered rate and for a predetermined interval through the passage 38 and into the interior of the rocker arm, where it provides lubrication for the ball and socket parts 24, 25 and also tends to establish a level within the hollow interior of the rocker arm. It is then conducted by means of depressed passages 45 formed on the floor of the valve end of the rocker arm to a hole 46 which extends downwardly through the floor to the bottom of the arm, adjacent to and on the higher side of the valve actuating pad 30. Oil passes downwardly through the hole 46, and being thus delivered to the high side of the valve stem flows under the pad sufficiently to effectively lubricate the engaging surface of the pad and the valve stem. It will be recognized that the oil tends to adhere to the bottom surface of the rocker arm due to surface tension or capillary action.

The spring retainer 32 and its securing portions 48 are not tightly sealed with respect to the valve stem and the limited amount of oil which finds its way through the hole 46 and past the retainer 32 effectively furnishes the limited amount of lubricant required between the stem 14 and valve guide 11. The passage through the spring retaining means is represented diagrammatically at 49 and is conveniently achieved without altering the conventional holding parts for fastening the retainer to the stem, which parts do not comprise a complete annular sealed assembly.

The metering means constituted by the orifice portions 44-38, previously described, is so proportioned as to provide a limited excess oil supply, over and above the total quantity required for lubricating all parts of the overhead valve mechanism, but the amount which is permitted to reach the valve stem is limited and controlled by the orifice 46, which is so restricted in size that it permits only enough oil to flow downwardly therethru to adequately lubricate the valve stem. The excess of oil which cannot pass through orifice 46 flows over the relatively low dam-like wall 43 at the extreme valve end of the arm. Due to the fact that this is the lowest end of the downwardly inclined valve end of the arm, and the fact that the oil discharged over dam 43 runs onto the low side of the stem, holding parts 48 and spring retainer 32, and all such parts are inclined downwardly, such excess oil is guided away from the stem by the retainer, and falls away from the stem at the low side of the skirt of the retainer. Excess oil which thus gets back to the top of the cylinder head may return to the crankcase through the normal oil return means (not shown) provided for such purpose in conventional overhead valve engine construction.

In order to properly guide the oil to the orifice 46 for the valve end, the orifice is provided with a funnel-like top 47 into which the ends of oil channels 45 discharge. It will be noted that two channels 45 are provided, their entrance ends being located so that one is near each of the two side walls 17 which impart to the arm its overall concavity and receptacle-like character. When installed upon a conventional V-type or laterally inclined automotive engine (which, as indicated, is the intended purpose of these arms) the arms extend transversely of the engine, and the engine also inclines downwardly toward its rear, as will be appreciated. Because of this arrangement, when the oil flow commences, the oil flowing from passage 38 quickly enters and flows downwardly through

that one of the channels 45 which is the lower of the two (the channel nearer the rear of the engine), and the oil therefore reaches the valve stem very quickly on start-up.

Previously known arrangements employing rocker arms of similar overall shape were so designed as to provide substantially continuous and unrestricted communication between the oil passage in the pushrod and a hole corresponding to the hole 38 in the arm. As a result, oil under very substantial pressure was squirted through the hole 38, splashed against the supporting means and the interior of the cover, and provided lubrication by means of the splashing and mist effect resulting from such jets. No hole at the valve end, corresponding to the hole 46, was provided in the arm, since the squirting and mist effect were relied upon to provide for lubrication of the parts. Such system, however, permitted relatively large quantities of oil to strike the stems 14. This was a cause of excessive oil consumption when the valve guides became worn as a result of substantial usage of the engine. One prior effort to overcome this difficulty involved placing shields of synthetic rubber on the valve stems inside the valve springs and overlapping the valve guides 14. Another past practice has been to incorporate pressure reducing means in the oil gallery at the cam shaft, thereby reducing the pressure of the entire supply for the overhead valve gear. This not only constituted a more costly and relatively inaccessible arrangement, but created the danger of starving the entire valve actuating mechanism in event of a defect or failure of such pressure reducing means. Furthermore where such a pressure control was provided in the main oil gallery, it was nevertheless considered necessary to deliver the oil to the rocker arms at a relatively high pressure in order to assure oil reaching all of the arms and to achieve sufficient lubrication by the splash effect, as noted above. In order to maintain constant communication between the hollow pushrod and the orifices corresponding to the orifice 38, in the prior known arms, a central deepened well portion was provided in the socket corresponding to the socket 35. Such upwardly concaved deepened well portion was out of contact with and spaced from the ball portion of the pushrod, so that such ball and socket parts would only bear against and wipingly interengage each other in an annular area surrounding the deepened well. The orifice corresponding to the orifice 38 terminated at its lower end in the well, so that the mouth of such orifice could never be sealed by the ball, and the well at all times overlapped the oil discharge port in the ball at the upper end of the pushrod, thereby providing constant oil communication, and continuous jetting of the oil from the aperture corresponding to the aperture 38, as indicated above. With my invention, by contrast, accurate individual oil control is achieved at each rocker arm by means of the limited and intermittent overlapping of the ports 44-38, and by the valve end metering means comprising the orifice 46 and overflow at the dam-wall 43. Further, by eliminating the deepened well in the pushrod socket in the arm, a much greater effective bearing surface is provided between the pushrod and rocker arm.

Due to the controlled metering effect obtainable by my invention as a result of the accurately predetermined overlap at port 44 and orifice 38, the oil is discharged from orifice 38 into the arm at reduced pressure. Instead of jetting and splashing, the oil flows into the arm smoothly, lubricates the arm support center bearing, and flows through the orifice 46 in accurately metered volume to provide controlled lubrication at the valve end.

While it will be apparent that the preferred embodiment of the invention disclosed is well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claim.

What is claimed is:

In combination with a rocker arm having a pushrod

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end having a valve end and having a hub portion located between said ends for rockably supporting the arm, said arm having a concavely recessed upper portion defining a receptacle for oil, means for introducing oil into the receptacle-defining upper portion of the arm from the pushrod end, a restricted orifice-defining portion extending downwardly through the arm in the valve end for conducting a limited quantity of oil from said receptacle-defining portion to the lower surface of the arm at the valve end, an oil escape-defining portion spaced from said orifice for diverting from the portion of the arm near said restricted orifice-defining portion oil which does not pass through said orifice, the receptacle-defining upper portion of the arm being of substantial width, the means for introducing oil thereinto comprising a passage extending through the pushrod end of the arm, and a pair of open-topped channels extending longitudinally of the valve end of the arm and having inlets located in the hub area and spaced apart substantially the full width of the interior

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of the receptacle-defining portion and extending to communication with said orifice.

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15 MARK NEWMAN, *Primary Examiner*.

KARL J. ALBRECHT, *Examiner*.

A. L. SMITH, *Assistant Examiner*.