July 28, 1964 E. A. THOMPSON 3,142,357

ROCKER ARM

Filed May 11, 1962

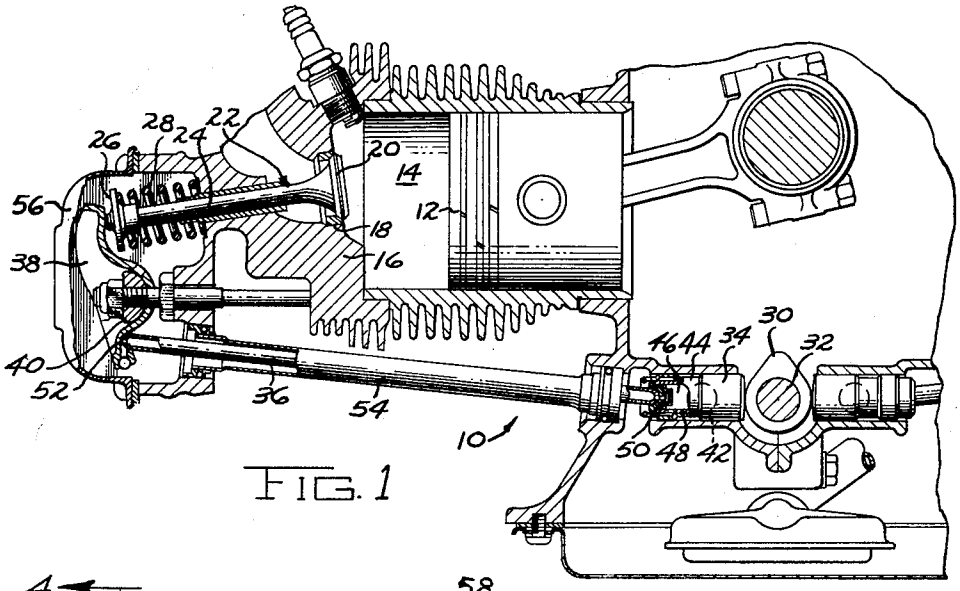


FIG. 1

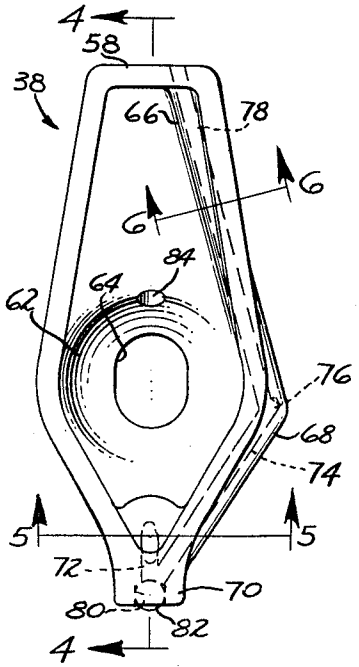


FIG. 2

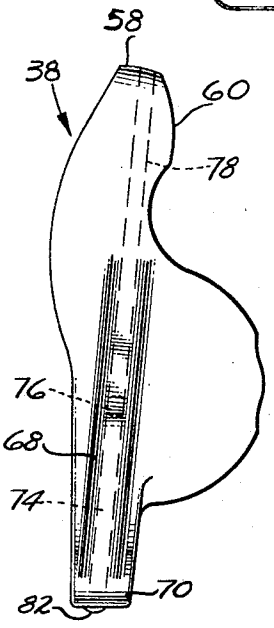


FIG. 3

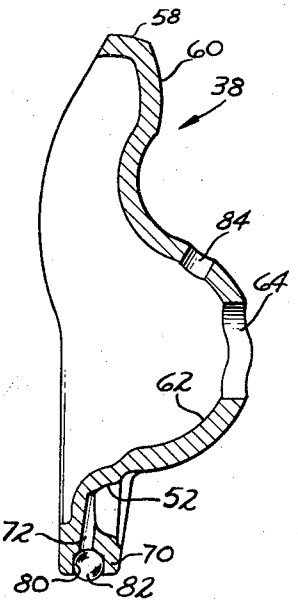


FIG. 4

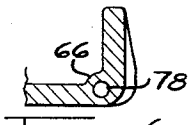


FIG. 6

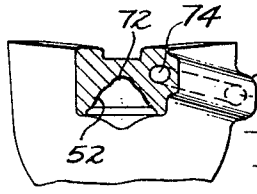


FIG. 5

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ROCKER ARM

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This invention relates to dished or trough-shaped rocker arms for the valve actuating gear of internal combustion engines, and more particularly to a lubricant distributing arrangement for use in engines of the type where the valve and rocker fulcrum are both located generally above the lubricant conducting hollow push rod.

One problem with such engines, notably horizontal piston engines where the valve and push rod are disposed in generally horizontal planes, involves lubricating the three bearing surfaces of the rocker arm. The first and lowest such surface, the push rod seat, is adequately lubricated by oil pressurized through the hollow push rod. The other two surfaces, however, the spherical fulcrum surface and the valve stem abutting surface, are disposed higher than the push rod seat and gravitational action on lubricant escaping from the push rod seat forces the lubricant to drain down and away from the other seats.

While it is known to provide oil passages in rocker arms for distributing lubricant to various wearing surfaces, the problem of conducting lubricant via the moving parts of the valve train itself is intensified in modern valve trains utilizing the desirably strong, lightweight and inexpensive dished or trough-shaped rocker arms which oscillate about individual semi-spherical fulcrums. The thin walls of such a rocker, curved to form high side walls around the fulcrum, preclude the straight drilled passages and the like heretofore proposed.

Accordingly, it is object of the present invention to provide in combination with a horizontal piston type internal combustion engine having a valve actuating train with a hollow lubricant conducting push rod, a rocker arm including an oil passage generally following the contours of the arm and extending throughout the longitudinal extent of the arm.

Another object of the present invention is to provide a cast rocker arm including a plurality of interconnecting drilled passages running from one point to another wherein a single plug or closure means suffices to interconnect the intersecting extremities of plural drilled passages as well as close such passages to the outside.

Further objects and advantages of the present invention will be apparent from the following detailed description, with reference to the accompanying drawings in which like reference characters refer to the same parts throughout the several views, and in which:

FIGURE 1 is a sectional elevational view of a horizontal piston engine employing the lubricant conducting rocker arm of this invention;

FIGURE 2 is a view of the rocker arm of this invention looking into the open trough-shaped side;

FIGURE 3 is a side view of the rocker arm;

FIGURE 4 is a sectional view on line 4—4 of FIGURE 2 showing the plug or closure means;

FIGURE 5 is a sectional view on line 5—5 of FIGURE 2 showing further details of the rocker arm; and

FIGURE 6 is a sectional view on line 6—6 of FIGURE 2 showing further details of the rocker of this invention.

Referring now in more particularity to the internal combustion engine 10 in FIGURE 1, a piston 12 is horizontally reciprocable in a cylinder 14, the head 16 of which includes an annular seat 18 for the head 20 of a valve 22. The stem 24 of the valve lies in a generally horizontal plane and includes at its outer end a retainer 26 for a spring 28 which provides a seating bias for the valve.

The valve is actuated against the spring bias by a linkage train deriving its motion from a rotary cam 30 on a camshaft 32. A cam follower or tappet 34 of the hydraulic type reciprocates in the engine 10 and transfers motion to a generally horizontally disposed push rod 36 which in turn serves to oscillate a rocker arm 38 about a fulcrum 40 fixed on the engine. The upper nose of the rocker arm abuts the end of the valve stem, all as is well known.

Lubricant for the various wearing surfaces of the valve actuating train is supplied from a pressurized source comprising an oil gallery 42 intersecting the tappet bore in the engine. From here it is picked up by an annular groove 44 around the wall of the cup-shaped body portion of the tappet 34 and admitted to the reservoir 46 in the plunger 48 of the tappet by holes in the body wall and plunger wall. A metering device 50 valves a predetermined amount of lubricant from the tappet reservoir to an aperture in the push rod seat of the tappet and thence into the hollow tubular push rod 36. The push rod conducts lubricant to the concave push rod seat 52 of the rocker arm 38. Excess lubricant then drains back to the crankcase through a tube 54 surrounding the push rod 36 after it is caught by a rocker arm cover 56 secured to the head of the engine 10. This system thus lubricates all of the wear points in the valve train except the rocker arm fulcrum surface and the valve stem abutment surface of the rocker arm, both of which lie above the point where lubricant is distributed at the rocker arm push rod abutment surface.

To properly lubricate these two upper surfaces, the rocker arm 38 of this invention takes the form of a dished or trough-shaped structure which may be fabricated by any suitable process, preferably casting in accordance with known foundry procedures. Such a structure is of somewhat elongate proportions having near one end the previously mentioned concave push rod seat 52 formed therein on the outside of the trough-shaped structure. Near the other end 58 of the arm is a convexly curved push rod abutment surface 60 also formed on the outside of the trough-shaped structure. Intermediate the ends of the arm, a semi-spherical fulcrum seat 62 adapted to matingly embrace the spherical fulcrum 40 on the engine is formed with an opening 64 therein through which a supporting stud for the spherical fulcrum may extend.

For the purpose of housing lubricant passages, ribs or bosses may be formed integral with the rocker arm. An internal rib 66 may extend from the end 58 of the arm toward the middle and merge with one side wall so as not to obstruct the open fulcrum seat 62. An external rib 68 may extend from the opposite end toward the middle and emerge from the side wall around the outside of the arm near the fulcrum center, then merge with the wall as the other rib 66 emerges on the other side. A boss 70 forming an end of the rocker structure near the push rod seat may be provided to receive the plug or closure means described below.

Means for conducting oil from the push rod seat 52 to the end 58 of the rocker arm may comprise an angled drilled passage. This passage may consist of a short hole 72 running between the push rod seat 52 and the end boss 70, a longer hole 74 following the rib 68 and running between the boss 70 and a point 76 intermediate the ends of the arm in one side wall approximately abreast of the fulcrum seat 62, and a long hole 78 following the ribs 66 and 68 and running between the point 76 and the end 58 of the arm. A short and wider bore 80 in the boss 70 may serve in the first place as a starting hole for drilling the two holes 72 and 74 while the hole 78 is being drilled from the other end of the arm.

The short bore 80 may serve in the second place as a

receiver for a plug or closure member 82. Such a plug may take the form of a ball which may be pressed into the bore 80 where it will be held with sufficient force to seal the hole. This isolates the intersecting ends of the holes 72 and 74 from the outside as well as interconnecting such intersecting ends to form an angled passage.

Thus, a channel in the wall of the trough-shaped rocker arm is provided which follows the desired contours of the arm and avoids interference with the open fulcrum surface. A further hole 84 may be provided through the rocker wall in the area of the fulcrum surface to allow lubricant flow therethrough.

In operation, with the rocker arm 38 seated on the individual spherical fulcrum 40 to transfer motion between the push rod 36 and the valve stem 24, the interior passage will connect at one end 72 with the hollow push rod. Oil pressurized from the source during engine operation through the push rod will lubricate the push rod abutment seat surface 52 and flow into the rocker arm passage. The passage, as can be understood, will deliver the lubricant out the end 58 of the oscillating arm 38 in the neighborhood of the valve stem abutment surface 60. Some oil will run down the rocker arm under influence of gravitational action, and some will be sprayed laterally against both the valve spring retainer 26 and the rocker arm cover 56. Some oil hitting the valve and its spring retainer will again find its way to the rocker arm and run down toward the fulcrum surface 62, some entering the fulcrum seating zone through the hole 84. With all three bearing surfaces of the rocker arm thus fully lubricated, excess oil may return to the crankcase through the tube 54 surrounding the push rod.

Thus, a contoured, trough-shaped rocker arm is provided which insures that all of its friction bearing surfaces are adequately lubricated with oil supplied to the lower end thereof by a hollow push rod.

While the above described embodiment constitutes a preferred mode of carrying out this invention, many other forms might be adopted within the scope of the actual invention, which is claimed as:

1. In a lubricating system for the valve actuating gear of an internal combustion engine of the type wherein a rocker arm pivoted on a fulcrum is positioned in a generally vertical plane and a valve stem is positioned above the fulcrum and wherein a hollow push rod conducts oil from a source of lubricant to the rocker arm, the improvement which comprises a unitary cast metal rocker arm including a trough-shaped part forming a spherical fulcrum bearing surface intermediate its ends inside the trough-shaped part, a concave push rod bearing surface on the rocker arm adjacent its lower end and outside the trough-shaped part, a convex valve stem bearing surface on the rocker arm adjacent its upper end and outside its trough-shaped part, the rocker arm having a hole through the trough-shaped part on the upper side of the fulcrum bearing surface, and means for positively conducting lubricant upwardly from the push rod bearing surface to the upper end of the rocker arm in the region above the valve stem bearing surface, said conducting means comprising a drilled passage having open ends, one end communicating directly with the push rod bearing surface, the other end opening free to the exterior of the rocker arm at a point above the valve stem bearing surface, and the passage following an angled path generally coincident with the trough-shaped part to circumvent the fulcrum bearing surface whereby the push rod bearing surface is lubricated directly by lubricant from the hollow push rod and the remaining bearing surfaces of the rocker arm are lubricated by the gravitational flow of lubricant delivered from the open end of the passage above the valve stem bearing surface.

2. In a lubricating system for the valve actuating gear of an internal combustion engine of the type wherein a rocker arm pivoted on a fulcrum is positioned in a generally vertical plane and a valve stem is positioned above the fulcrum and wherein a hollow push rod conducts oil from a source of lubricant to the rocker arm, the improvement which comprises a unitary cast metal rocker arm including a trough-shaped part forming a spherical fulcrum bearing surface intermediate its ends inside the trough-shaped part, a concave push rod bearing surface on the rocker arm adjacent its lower end and outside the trough-shaped part, a convex valve stem bearing surface on the rocker arm adjacent its upper end and outside its trough-shaped part, the rocker arm having a hole through the trough-shaped part on the upper side of the fulcrum bearing surface, and means for positively conducting lubricant upwardly from the push rod bearing surface to the upper end of the rocker arm in the region of the valve stem bearing surface, said conducting means comprising a drilled passage having open ends, one end communicating directly with the push rod bearing surface, the other end opening free to the exterior of the rocker arm in a generally upwardly pointing direction and the passage following an angled path generally coincident with the trough-shaped part to circumvent the fulcrum bearing surface and closure means sealing two interconnecting extremities of angled sections of the drilled passage both to connect them for lubricant flow and to seal them against leakage to the exterior of the rocker arm whereby the push rod bearing surface is lubricated directly by lubricant from the hollow push rod and the remaining bearing surfaces of the rocker arm are lubricated by lubricant sprayed out of the generally upwardly pointing open other end of the passage.

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