

[54] **ROCKER ARM ASSEMBLY INCLUDING FULCRUM MOUNTED LUBRICANT DEFLECTOR**

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[52] U.S. Cl. .... **123/90.35, 123/90.37, 123/90.41, 184/6.9**  
[51] Int. Cl. .... **F01m 9/10, F01l 1/18**  
[58] Field of Search ..... **123/90.36, 90.37, 90.42, 90.41, 123/90.35, 90 H, 90 HI, 195 C, 198 E; 184/6.9**

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[57] **ABSTRACT**

A rocker arm assembly for the operation of a valve in an internal combustion engine in which the rocker arm is pivotally mounted on a fulcrum supported by the cylinder head of the engine. A lubricant deflecting means mounted on the fulcrum is employed to deflect lubricant that flows through a push rod having a lubricant passage positioned therein and through an aperture in one end of the rocker arm onto the bearing means that pivotally supports the rocker arm on the fulcrum.

**8 Claims, 9 Drawing Figures**

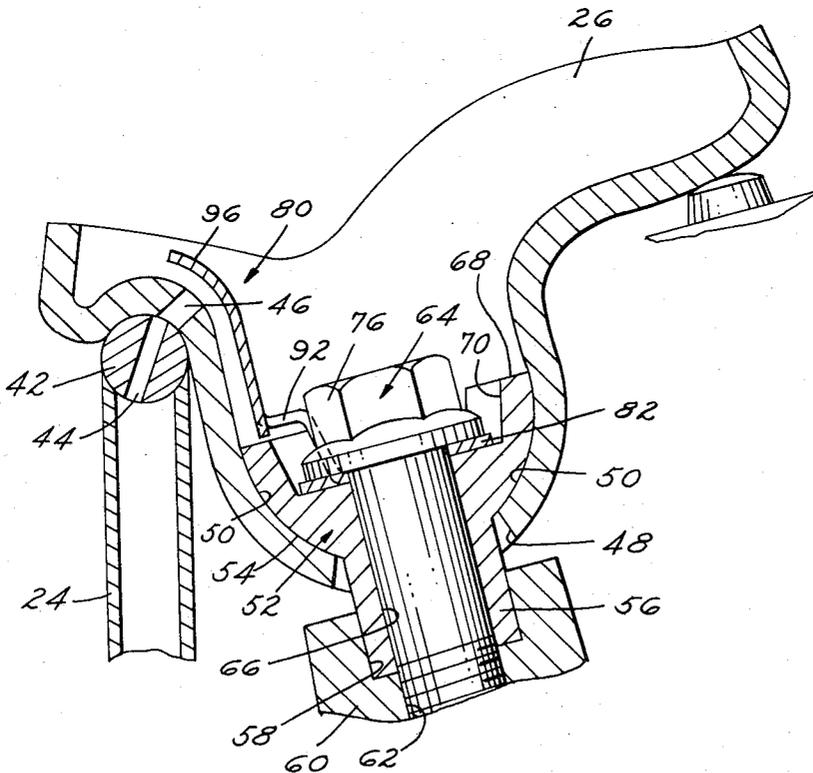


FIG. 1

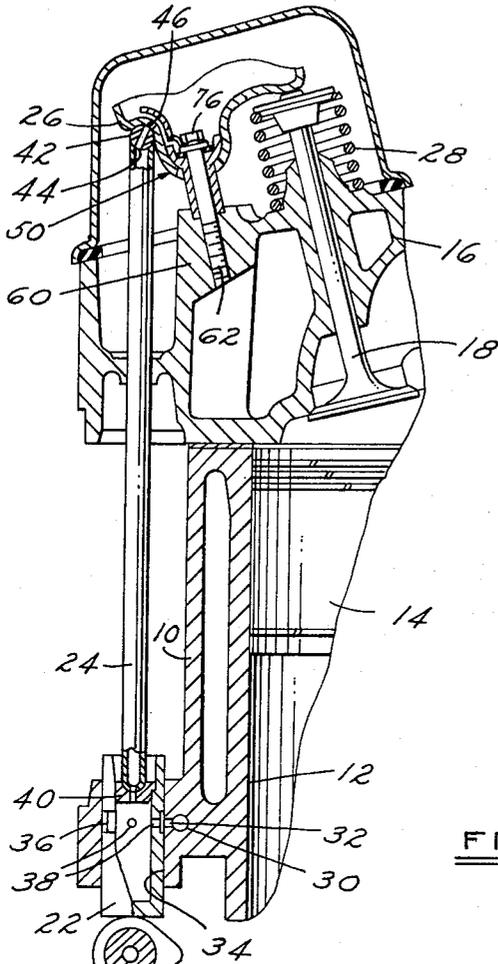
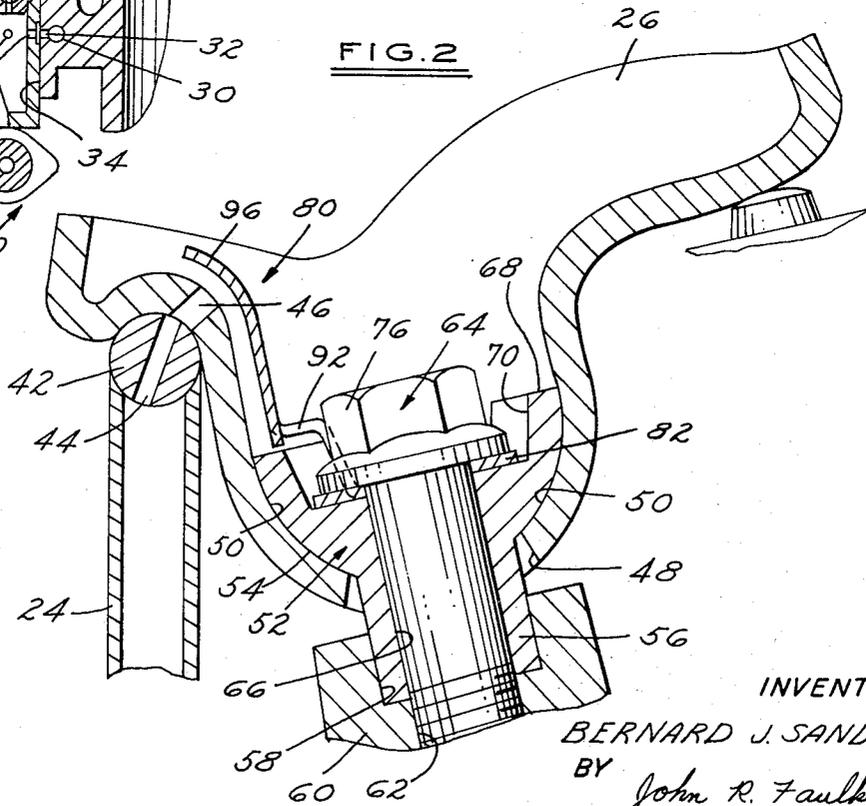


FIG. 2



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FIG. 3

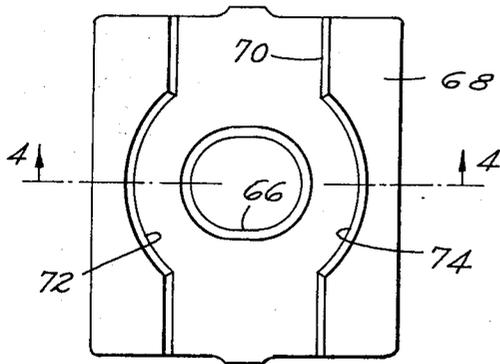


FIG. 4

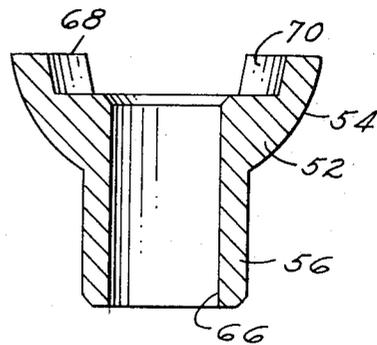


FIG. 5

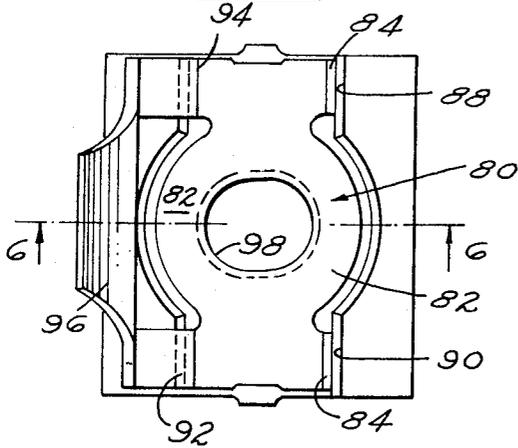


FIG. 6

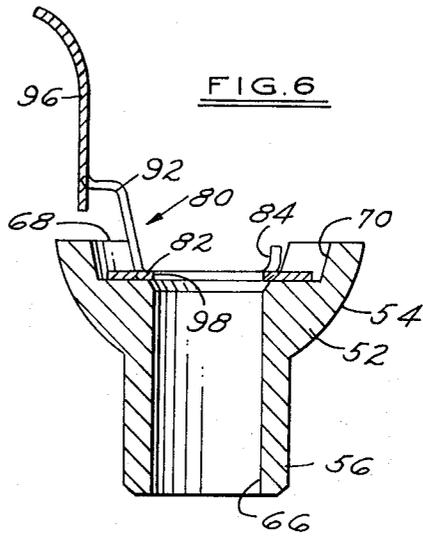


FIG. 7

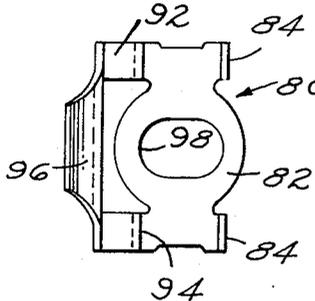


FIG. 8

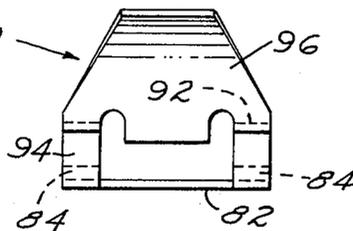
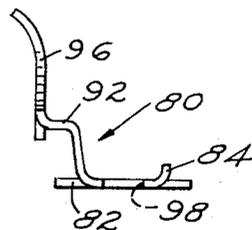


FIG. 9



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## ROCKER ARM ASSEMBLY INCLUDING FULCRUM MOUNTED LUBRICANT DEFLECTOR

### BACKGROUND OF THE INVENTION

This invention relates to an internal combustion engine having a valve operating rocker arm pivotally mounted upon the cylinder head of the engine, and, more particularly, to such an internal combustion engine including lubricant deflecting means that deflects lubricant flowing through a hollow push rod and a portion of the rocker arm onto the bearing means that pivotally supports the rocker arm on the cylinder head.

In modern day automotive vehicles, the rocker arms for operating the valves of the internal combustion engine are mounted on the cylinder head via pedestals which are cast into this cylinder head. These pedestals ordinarily carry studs or bolts which have affixed thereto a fulcrum or bearing means for pivotally mounting a stamped rocker arm which has one end thereof engageable with a valve of the internal combustion engine and the other end thereof engageable with a push rod or follower which is operated by the cam shaft of the engine. Lubricant for lubricating the mating surfaces of the end of the push rod and the complementary end of the rocker arm is applied under pressure through the push rod which has a lubricant passage means extending throughout the length thereof. In addition, the end of the rocker arm engaging the push rod has a passageway positioned therein so that lubricant under pressure is supplied to the fulcrum or bearing means that pivotally mounts the rocker arm on the cylinder head. It is vitally important that this bearing surface be properly lubricated, especially in high performance engines that operate at very high speeds.

It has been found that if the bearing surface between this fulcrum and the rocker arm does not receive adequate lubricant, the bearing surfaces positioned on the rocker arm and on the fulcrum rapidly overheat, thereby totally sealing out any lubricant available for these bearing surfaces and rapidly destroying them through heat, friction and galling action.

The present invention is designed to assure that adequate lubricant is provided for a bearing formed between a fulcrum bearing surface and a rocker arm bearing surface at all times during engine operation. This is accomplished by positioning an oil or lubricant deflecting means on the fulcrum between the stud or bolt that holds the fulcrum on the pedestal positioned in the cylinder head. This oil deflecting means has an upstanding body portion which conforms to the shape of one end of the rocker arm and terminates above the groove or oil passage in the rocker arm. It is situated so that at all times lubricant is deflected from the aperture or lubricant passage in the rocker arm into and onto the bearing surfaces formed on the rocker arm and the fulcrum.

Other oil deflecting or lubricant deflecting means are known in the prior art to accomplish this purpose. For example, in one of these structures an oil deflecting means in the form of a sheet metal web is spot welded to the top of the rocker arm cover. This structure has depending fingers that are designed to line up with the lubricant apertures or grooves in the rocker arms. This type of structure has a number of disadvantages. The rocker arm covers cannot be stacked during assembly or moving operations, thereby resulting in wasted space during the shipping of the rocker arm covers from their point of manufacture to the point of assembly of the engines. In addition, with this type of structure, wide tolerances are involved, particularly in the welding of these two sheet metal structures, i.e., the oil deflecting structure or strip and the rocker arm cover. As a result, the depending fingers or deflectors on the sheet metal strip do not always line up with the oil lubricant passages or grooves in the rocker arm. Moreover, during the handling of these rocker arm covers, in transportation of them, and in the assembling of them on the engine, the depending oil deflecting fingers or means may be deformed or bent out of alignment so they do not line up properly with respect to the lubricant passages in the rocker arms.

### SUMMARY OF THE INVENTION

The present invention is designed to overcome the disadvantages of known prior art structures and to provide a structure which will positively and at all times during engine operation assure that the bearing surfaces of the rocker arm and the fulcrum on which it is mounted receive adequate lubrication. In the invention, the rocker arm is pivotally mounted on a fulcrum by a bearing means which preferably is cylindrical in shape or configuration with the axis of the cylindrical surface being positioned substantially perpendicularly with respect to the pivotal movement of the rocker arm. One end of the rocker arm is positioned to engage a valve of the engine and the other end of the rocker arm is positioned in engagement with a hollow push rod which is operated by the camshaft of the internal combustion engine.

Lubricant under pressure is supplied to the hollow push rod and the end thereof that engages the rocker arm registers with an aperture or lubricant passage located in the rocker arm, thereby supplying lubricant under pressure at the upper surface or side of the rocker arm. The oil deflecting means of the present invention has a body portion which is positioned on the upper side of the bearing means which forms the fulcrum for the pivotal movement of the rocker arm under the impetus of the push rod. This oil deflecting means has an upstanding body portion which conforms to the general shape of the rocker arm in the area of the push rod and the lubricant passage or aperture in the rocker arm. It is located so that at all times lubricant which is forced through the lubricant passage or aperture in the rocker arm is deflected onto and into the bearing surface between the fulcrum and the rocker arm itself.

The structure described above assures adequate lubrication for these bearing surfaces at all times during engine operation and is particularly important in internal combustion engines which operate under high loads and at high speeds.

An object of the present invention is the provision of a means in an internal combustion engine to positively assure adequate lubrication for the bearing surfaces on a valve actuating rocker arm and a fulcrum which mounts this rocker arm for pivotal movement in a cylinder head.

A further object of the present invention is the provision of an oil or lubricant deflecting means mounted on a fulcrum for a rocker arm in an internal combustion engine which will deflect or direct lubricant directly onto the bearing surfaces of the rocker arm and the fulcrum.

Other objects and attendant advantages of the present invention may be readily realized when the specification is considered in connection with the attached drawings.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional view through a portion of an internal combustion engine valve train incorporating the present invention;

FIG. 2 is an enlarged view of a portion of the valve train shown in FIG. 1 and including the rocker arm and oil deflecting means of the present invention;

FIG. 3 is a top plan view of the fulcrum of the present invention which pivotally mounts the rocker arm;

FIG. 4 is a sectional view taken along the lines 4—4 of FIG. 3;

FIG. 5 is a top plan view of the fulcrum shown in FIG. 3 together with the oil or lubricant deflecting means of the present invention;

FIG. 6 is a side elevational view of the structure shown in FIG. 5;

FIG. 7 is a top plan view of the lubricant deflecting means of the present invention;

FIG. 8 is a side elevational view of the lubricant deflecting means of the present invention; and

FIG. 9 is an end elevational view of the lubricant deflecting means of the present invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings in which like reference numerals designate like parts throughout the several views thereof, there is shown in FIG. 1 an engine cylinder block 10 including a cylinder 12 having a power piston 14 located therein. A cylinder head 16 covers the upper end of the cylinder 12, and it has a poppet valve 18 slidably or reciprocally mounted therein. This valve is shown in its closed position. A rotary cam 20 is suitably journaled in the cylinder block 10, and this rotary cam forms a part of the camshaft of the engine. It is understood that there is a rotary cam 20 for each poppet valve 18 located in the cylinder head 16.

A reciprocable follower or tappet 22 rides on the rotary cam 20 and movement of the follower or tappet 22 is transmitted by a push rod 24 to one end of a rocker arm 26. The other end of the rocker arm 26 is positioned to engage the stem of the poppet valve 18, and a spring 28 is seated on the cylinder head 16 and is connected to the stem of the poppet valve 18 to bias it to the closed position as shown.

The lubrication system of the engine may include an oil gallery 30 in the cylinder block 10 from which oil is conducted by a feed passage 32 to the guide bore 34 of the tappet 22. The tappet 22 is of hollow construction and has an external groove 36 registering with the passage 32 and connected to the interior of the tappet by side ports 38. The push rod 24 is of tubular configuration and it engages at its lower end a centrally apertured seat 40 supported within the tappet 22 above the ports 38.

The rocker arm 26 may be a sheet metal stamping which opens upwardly to retain lubricant conducted to it from the tappet 22 by the push rod 24. The end of the push rod 24 engaging the rocker arm 26 may have a ball type bearing 42 welded to it which has a central groove 44 registering with an aperture or lubricant passage 46 positioned in the rocker arm 26. The rocker arm 26 has an opening 48 positioned therein intermediate the ends of the rocker arm 26 to accommodate the pivotal movement of the rocker arm. The rocker arm 26 is also provided at either side of the opening 48 with a bearing surface 50 which is preferably of cylindrical configuration, and a fulcrum 52 having a complementary cylindrical bearing surface 54 is positioned within the rocker arm 26 so that the bearing surface 54 engages the bearing surface 50 of the rocker arm 26. The fulcrum 52 may have a depending generally rectangular portion or sleeve 56 that is received within a complementary shaped depression 58 in a pedestal 60 which is formed integrally with the cylinder head 16. The pedestal 60 has a threaded bore 62 extending downwardly from the depression 58 to receive a fastening means which may be in the form of a threaded bolt 64.

The fulcrum 52, as shown specifically in FIGS. 1, 2, 3, and 4, has an axial opening 66 extending therethrough for the reception of the bolt 64. In addition, it has a generally planar upper surface 68 having a groove 70 positioned therein which extends in the direction generally parallel to the axis of the cylindrical bearing surface 54. This groove has radially extending portions 72 and 74 to receive the head 76 of the bolt 64.

The lubricant deflecting means 80 of the present invention has a generally planar body portion 82 which is generally complementary in shape to the groove 70 in the fulcrum 52, and this body portion is positioned in the groove 70 and underneath the head 76 of the bolt 64. The generally planar portion 82 of the lubricant deflecting means 80 has a pair of upstanding tabs or tangs 84 and 86 which engage shoulders 88 and 90 positioned on the fulcrum 52 for properly positioning the generally planar portion 82 within the groove 70 formed in the fulcrum 52. On the other side of the generally planar body portion 82 there is a pair of outstanding angular corner portions 92 and 94 that also serve as locating means for the generally planar body portion 82 within the groove 70 and further serve as supporting means for supporting an upstanding curved portion or tab 96 of the oil or lubricant deflecting means 80. This curved portion 96 conforms generally to the

interior configuration of the rocker arm 26 in the vicinity of the lubricant aperture or passage 46. The planar body portion 82 also has an aperture 98 positioned therein which is complementary in shape to the opening 66 in the fulcrum 52.

In operation, as the cam 20 is rotated, it moves the push rod 24 in a generally vertical direction as shown in FIG. 1 via the tappet 22. This in turn raises the end of the rocker arm 26 that is in contact with the ball bearing 42 of the push rod 24. Consequently, the rocker arm 26 is pivoted about the bearing surface 54 on the fulcrum 52 and the bearing surface 50 on the rocker arm 26 to open the poppet valve 18 against the bias of the spring 28. When the rotary cam 20 returns to the position shown in FIG. 1 the spring 28 closes the poppet valve 18 and pivots the rocker arm 26 back into position shown in FIG. 1 about the bearing surfaces 54 and 50.

It can be readily appreciated that under high engine speed conditions, this pivotal action occurs many times per minute. For example, if the engine is operating at 4,500 revolutions per minute, the poppet valve 18 will be opened and closed 4,500 times per minute, and the rocker arm 46 will be pivoted back and forth about the bearing surfaces 50 and 54 4,500 times per minute. As a result, it is vital that adequate lubrication be provided for the bearing surfaces 50 and 54. To that end, as previously described, oil under pressure is fed from the gallery 30 through the hollow tappet 22 and the hollow push rod 24 to the ball bearing 42. The lubricant then flows through the groove 44 in the ball bearing 42 and through the lubricant aperture or passage 46 in the rocker arm 26. This oil under pressure then encounters the upstanding curved portion or tab 96 on the lubricant deflecting means 80 and the engine lubricant is then forced down between the tab 96 and the body of the rocker arm 26 to lubricate the bearing surfaces 50 and 54.

It can be readily appreciated that in the absence of the lubricant deflecting means 82 the lubricant from the aperture or lubricant groove 46 may be projected over the rocker arm 26 onto the rocker arm cover shown in FIG. 1 and that the lubricant may not, therefore, reach the bearing surfaces 50 and 54.

Thus, the present invention provides an uncomplicated and positive means for assuring adequate lubrication of the bearing surfaces between a rocker arm and a fulcrum mounted on a cylinder head in an internal combustion engine. This assures adequate lubrication and long life for these bearing surfaces.

I claim:

1. In an internal combustion engine the combination comprising a cylinder head, a valve reciprocally mounted in said cylinder head, a rocker arm having one end positioned for operative engagement with said valve, a push rod reciprocally mounted in said cylinder head, said push rod engaging the other end of said rocker arm, a fulcrum mounted on said cylinder head intermediate the end of said rocker arm, said fulcrum including bearing means cooperating with said rocker arm for pivotally mounting said rocker arm on said fulcrum, said fulcrum having a fastening means mounted in said cylinder head, said bearing means including a generally cylindrical bearing surface having an axis positioned perpendicular to the direction of pivotal movement of said rocker arm, said bearing means having a groove positioned therein extending generally in the direction of the axis of said generally cylindrical bearing surface, said push rod and said end of said rocker arm including lubricant passage means for supplying lubricant to said bearing means, and lubricant deflecting means carried by said fulcrum, said lubricant deflecting means including means positioned adjacent said end of said rocker arm for deflecting lubricant from said end of said rocker arm onto said bearing means and a portion complementary in shape to said groove in said bearing means and positioned in said groove, said fastening means including means for affixing said portion in said groove.

2. The combination of claim 1 in which said lubricant deflecting means includes an upstanding lubricant deflecting tab formed integrally with said portion positioned in said groove, said tab positioned between said lubricant passage means and said bearing means.

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3. The combination of claim 2 in which said portion has locating means formed thereon positioned to locate said portion properly within said groove.

4. The combination of claim 3 in which said locating means comprise upstanding tabs positioned on opposite sides of said portion, said tabs being engageable with the walls of said groove.

5. The combination of claim 4 in which said upstanding lubricant deflecting tab is formed integrally with said tabs positioned on one side of said portion.

6. The combination of claim 5 in which said tabs positioned on one side of said portion includes means for offsetting said lubricant deflecting tab toward said lubricant passage means.

7. In an internal combustion engine the combination comprising a cylinder head, a valve reciprocally mounted in said cylinder head, a rocker arm having one end positioned for operative engagement with said valve, a push rod reciprocally mounted in said cylinder head, said push rod engaging the other end of said rocker arm, a fulcrum mounted on said cylinder head intermediate the end of said rocker arm, said fulcrum including bearing means cooperating with said rocker arm for pivotally mounting said rocker arm on said fulcrum, said bearing means including a bearing surface engaging a complementary surface on the side of said rocker arm opposite said valve and push rod and a generally planar surface opposite said bearing surface, said push rod and said end of said rocker arm including lubricant passage means for supplying lubricant to said bearing means, and lubricant deflecting

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means carried by said fulcrum, said lubricant deflecting means including means positioned adjacent said end of said rocker arm for deflecting lubricant from said end of said rocker arm onto said bearing means and a portion engaging said generally planar surface, and fastening means holding said portion of said lubricant deflecting means in engagement with said generally planar surface of said bearing means.

8. In an internal combustion engine the combination comprising a cylinder head, a valve reciprocally mounted in said cylinder head, a rocker arm having one end positioned for operative engagement with said valve, a push rod reciprocally mounted in said cylinder head, said push rod engaging the other end of said rocker arm, a fulcrum mounted on said cylinder head intermediate the end of said rocker arm, said fulcrum including bearing means cooperating with said rocker arm for pivotally mounting said rocker arm on said fulcrum, said push rod and said end of said rocker arm including lubricant passage means for supplying lubricant to said bearing means, and lubricant deflecting means carried by said fulcrum and including means positioned adjacent said end of said rocker arm for deflecting lubricant from said end of said rocker arm onto said bearing means, said lubricant deflecting means comprising a body portion affixed to said fulcrum and an upstanding curved lubricant deflecting tab formed integrally with said body portion and positioned between said lubricant passage means and said bearing means.

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