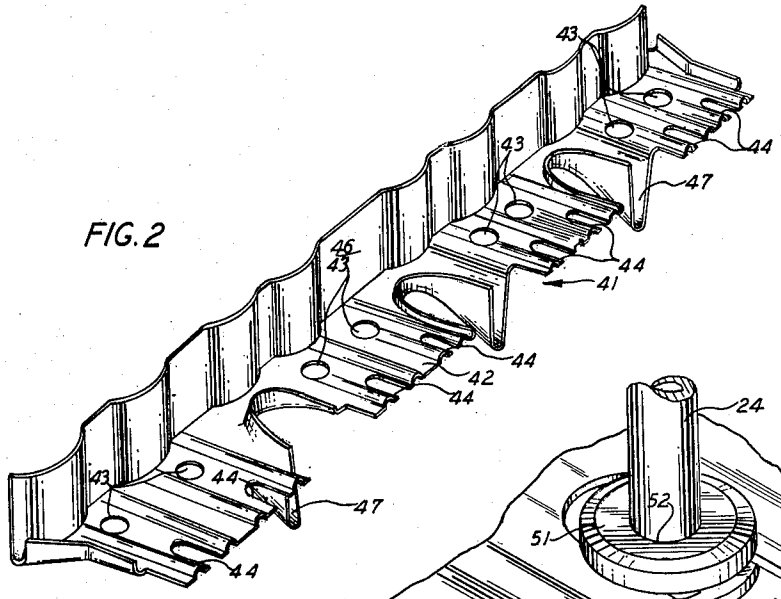
April 23, 1963 R. A. MOONEY, JR 3,086,507

PUSH ROD

Filed Sept. 26, 1961

FIG. 2



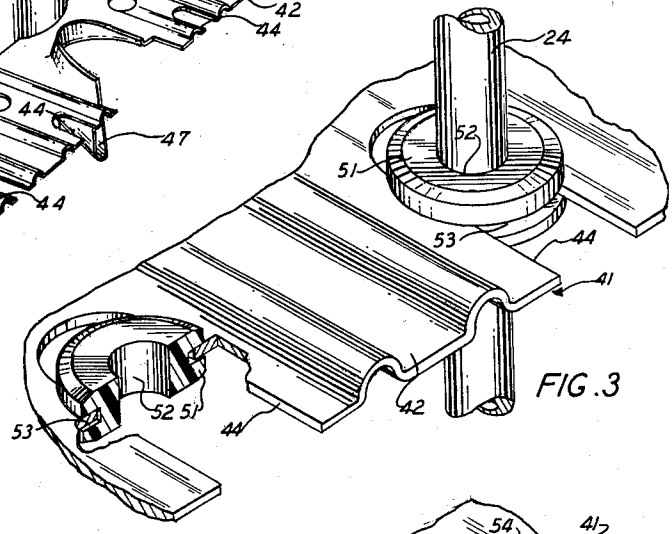


FIG. 3

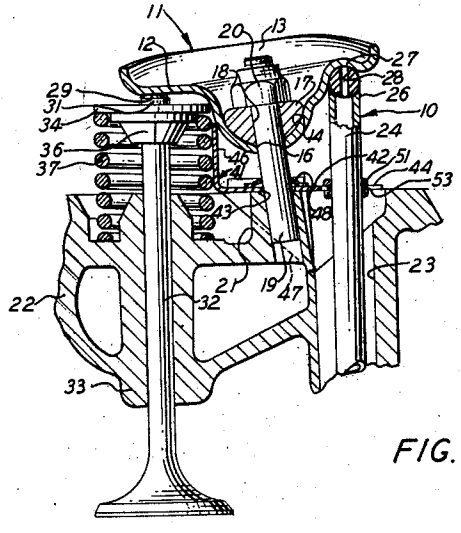


FIG. 1

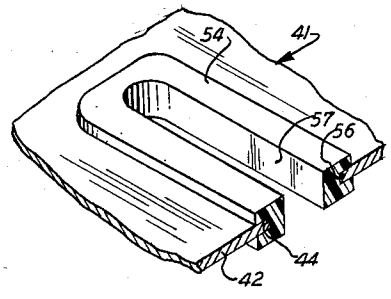


FIG. 4

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United States Patent Office 3,086,507 Patented Apr. 23, 1963

3,086,507

PUSH ROD

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Filed Sept. 26, 1961, Ser. No. 140,760
11 Claims. (Cl. 123—90)

This invention relates to the valve gear. In particular the invention relates to a push rod stabilizing means for an internal combustion engine embodying a valve gear arrangement wherein each rocker arm is pivotally mounted upon its own support.

In overhead valve engines it is common practice to support the rocker arm upon a rocker arm shaft which extends in a direction parallel to the longitudinal axis of the internal combustion engine. It is also common in overhead valve engines to provide an individual support for each rocker arm. In the latter instance the rocker arm is laterally unstable and must be stabilized in some manner.

A common method of push rod stabilization is to provide a slot in the cylinder head which restricts the lateral motion of the push rod. Designs of this type however require a polished and hardened push rod body to resist abrasion. Push rods of this type also add to the total engine noise.

Another method of push rod stabilization is by means of a bracket which is secured to the underside of the valve cover and extends downwardly into the interior of the rocker arm itself. This construction is shown in U.S. Letters Patent 2,818,843 issued in the name of M. H. Frank on January 7, 1958.

Still a further method of stabilization is the type which stabilizes a pair of adjacent push rods by means of a plate that is secured to the top of the engine frame. A construction of this type is disclosed in U.S. Letters Patent 2,963,012 issued in the name of Kolbe on December 6, 1960.

In an embodiment of this invention it is proposed to stabilize the push rod by guide means in the form of a stamped push rod guide mounted adjacent to the cylinder head. A bearing made from a moldable plastic of a thermoplastic or thermosetting type such as nylon, Teflon, acetal or phenolic resin is mounted in an opening in the push rod guide. The push rod extends through the bearing and is stabilized in a direction parallel to the longitudinal axis of the internal combustion engine. Movement of the push rod in a direction perpendicular to the longitudinal axis of the internal combustion engine, however, is permitted. In this construction a minimum of lubricant is required, the noise level is greatly diminished, and a push rod structure which requires a minimum amount of finish work is used.

It is also possible to embody the push rod guide in an oil baffle and trough construction. The bearing may either move in the slot in the guide or be installed in a substantially stationary position with the push rod moving relative to the bearing.

Other objects and advantages of this invention will become more apparent when considered in connection with the accompanying drawings, wherein:

FIGURE 1 is a transverse sectional view taken through an overhead valve engine that embodies the invention, and

FIGURE 2 is a perspective view of a combined oil baffle and push rod guide shown in FIGURE 1, and

FIGURE 3 is an enlarged fragmentary perspective view partly in section of the push rod guide and bearing means embodied in the structure shown in FIGURE 1, and

FIGURE 4 is an enlarged fragmentary perspective view of a portion of a push rod guide that embodies an alternate form of bearing.

Referring now to the drawings and in particular FIGURE 1, a portion of the internal combustion engine valve gear (overhead type) is indicated at **10**. The rocker arm is indicated generally at **11** and comprises a longitudinally extending web **12** and upstanding sides **13** (one of which is shown) integrally connected to the web **12**. A hemispherical bearing portion **14** is provided in the web **12** integral therewith and on the side of the web **12** to the upstanding sides **13**. A longitudinal extending slot **16** is provided in the hemispherical bearing portion **14**.

A hemispherical bearing **17** is nested in the bearing portion **14**. Bearing **17** is provided with a central bore **18** that is substantially axially aligned with the slot **16**. Stud **19** (threaded at the outer end) extends through the bore **18** in the bearing **17**, slot **16** of the rocker arm, and is press fitted or anchored in any well known manner in the rocker arm support boss **21** of the cylinder head **22**. An adjustable nut **20** secures the rocker arm **11** and bearing **17** upon the stud **19**.

Oscillatory movement is imparted to the rocker arm **11** through push rod **24**. Push rod **24** may be tubular in construction and may have an apertured ball tip end portion **26** that is received by a concave push rod engaging end **27** located in the rocker arm web **12**. The bore of the push rod **24** is conveniently open to a source of pressurized lubricant such as the hydraulic tappet. An opening **28** in the concave push rod engaging end **27** allows the flow of lubricant out of the push rod **24** onto the web **12**. The lubricant may then work its way between the bearing **17** and the bearing portion **14** of the rocker arm **11**.

Push rod **24** may extend through an enlarged opening **23** in the cylinder head **22**. Depending upon the type of internal combustion engine construction, the opening **23** may be in the cylinder head, the intake manifold, the cylinder block, or in a combination of two or more of the aforementioned elements. Opening **23** may be sufficiently large so as to permit the easy removal of the push rod **24** (and even the hydraulic tappet which is not shown) and the passing of the lubricant from the valve gear portion of the engine to the engine sump. In any event, the push rod **24** does not touch or engage any portion of the cylinder head, or part or parts comprising the opening **23**.

Rocker arm **11** is also provided with a poppet valve engaging end **29** that engages the end portion **31** of the poppet valve **32**. Poppet valve **32** is laterally stabilized by the valve guide **33** of the cylinder head **22**. Spring retaining means for poppet valve **32** comprises the usual spring retainer **34**, locking means **36** that engage the poppet valve stem, and valve spring **37**.

It is, of course, necessary to stabilize the rocker arm **11** in the direction that is parallel to the longitudinal axis of the engine. This is accomplished by the push rod stabilizing means indicated generally at **41**. Push rod stabilizing means **41** is shown in cross section in FIGURE 1, in perspective in FIGURE 2, and fragmentarily in FIGURE 3.

Push rod stabilizing means **41** comprises a stamped push rod guide **42** that is provided with a plurality of apertures **43** through which each stud **19** extends. Push rod guide **42** is further provided with a plurality of open end slots **44** located near the end of each of the push rods that engages the rocker arm. In the disclosed embodiment, push rod guide **42** is combined with an oil baffle **46** and an oil trough **47**. Upstanding oil baffle **46** may be integrally connected to the side of the push rod guide

42 adjacent the valve spring 37. Slots 44 are wider than the diameter of the push rod 24.

One or more oil troughs 47 may be provided in the push rod guide 42 for directing the oil from the valve gear to the opening 23. The attachment of the push rod guide 42 to the cylinder head 22 may be made by spring loaded nuts 48 which grip the stud 19.

To avoid metal-to-metal contact, a bearing 51 having a central bore 52 and an annular groove 53 is inserted in each of the open end slots 44 so that the sides of the slot 44 extend within the annular groove 53. Annular groove 53 may be made slightly smaller in diameter than the width of the open end slot 44 and larger in width than the thickness of the push rod guide 42. Central bore 52 may be figured dimensionally to snugly fit the push rod 24. This structure is shown in enlarged detail in FIGURE. 3.

Bearing 51 may be of a moldable plastic of either the thermoplastic or thermosetting type, particularly of the group having inherent lubricity and damping properties. Nylon is particularly adaptable to this application. Phenolic resin, Teflon and acetal, among other plastics, are also suited for this application. In the structure disclosed in FIGURES 1 and 3, oscillatory movement by the push rod 24 results in the bearing 51 sliding in the open end slot 44.

In FIGURE 4, an alternate form of a moldable plastic bearing is shown. A horseshoe shaped bearing 54 is provided with a peripheral groove 56 that allows the bearing 54 to be inserted snugly in the open end slot 44. In this arrangement the bearing 54 once inserted in the slot 44 is not intended to move. Push rod 24 simply rides inside the slot 57 of the bearing 54.

It is also possible to provide a push rod guide in which the bearing material is attached, for example, by dipping.

It is to be understood, therefore, that the invention is not to be limited to the exact construction shown and described but that various changes and modifications may be made without departing from the spirit and scope of the invention as defined in the appended claims.

What I claim is:

1. An internal combustion engine comprising a rocker arm support, a rocker arm pivoted upon said rocker arm support, said rocker arm having a push rod engaging end and a poppet valve engaging end, a poppet valve having an end portion engaged by said poppet valve engaging end of said rocker arm, a push rod having an end portion engaged by said push rod engaging end of said rocker arm, and push rod stabilizing means, said push rod stabilizing means comprising a longitudinal slot formed in a component of said engine, said push rod being reciprocally received in said longitudinal slot and freely movable in a first direction relative to said slot, and a plastic member interposed between said slot and said push rod for restricting motion of the push rod in a second direction while permitting free motion of said push rod in said first direction.

2. An internal combustion engine comprising a cylinder head, a rocker arm support adjacent to the cylinder head, a pivotally mounted rocker arm supported upon the rocker arm support, said rocker arm having a push rod engaging end and a poppet valve engaging end, a laterally stable poppet valve having an end portion engaging said poppet valve engaging end of the rocker arm, a push rod having an end portion engaging said push rod engaging end of the rocker arm and a push rod stabilizing means, said push rod stabilizing means comprising a moldable plastic member located near the end of the push rod which engages the rocker arm and being arranged to sharply restrict the motion of the push rod in a direction parallel to the longitudinal axis of the internal combustion engine, while permitting substantial movement in a direction perpendicular to the longitudinal axis of the internal combustion engine.

3. An internal combustion engine comprising a rocker arm support, a rocker arm pivoted upon said rocker arm support, said rocker arm having a push rod engaging end and a poppet valve engaging end, a poppet valve having an end portion engaged by said poppet valve engaging end of said rocker arm, a push rod having an end portion engaged by said push rod engaging end of said rocker arm, and push rod stabilizing means, said push rod stabilizing means comprising an open ended longitudinal slot formed in a component of said engine, said push rod being reciprocally received in said open ended longitudinal slot and freely movable in a first direction relative to said slot, and a plastic member interposed between said slot and said push rod for restricting the motion of the push rod in a second direction while permitting free motion of said push rod in said first direction.

4. In an internal combustion engine comprising a cylinder head, a rocker arm support mounted upon said cylinder head, a pivotally mounted rocker arm supported upon the rocker arm support, said rocker arm having a push rod engaging end and a poppet valve engaging end, a laterally stable poppet valve having an end portion engaging said poppet valve engaging end of the rocker arm, a push rod having an end portion engaging said push rod engaging end of the rocker arm and push rod stabilizing means, said push rod stabilizing means comprising a push rod guide adjacent to the cylinder head, said push rod guide having an open ended slot whose longitudinal axis is transverse to the longitudinal axis of the internal combustion engine, bearing means mounted in said slot, said bearing means being apertured to receive a portion of the push rod and laterally stabilize the push rod.

5. An internal combustion engine comprising a cylinder head, a plurality of rocker arm supports mounted upon said cylinder head, a plurality of pivotally mounted rocker arms, each of said rocker arms being supported upon a rocker arm support, each of said rocker arms having a push rod engaging end and a poppet valve engaging end, and a plurality of laterally stable poppet valves mounted in said cylinder head, each poppet valve having an end portion engaging the poppet valve engaging end of the rocker arm, a plurality of push rods, each of said push rods having an end portion engaging the push rod engaging end of a rocker arm and push rod stabilizing means, said push rod stabilizing means comprising a push rod guide mounted upon said cylinder head, said push rod guide having a plurality of open ended slots, each of said slots being located near the end of the push rod that engages the rocker arm, the longitudinal axis of each of said open ended slots being transverse to the longitudinal axis of the internal combustion engine, moldable plastic bearing means mounted in each of said slots, each of said bearing means being apertured to receive a portion of a push rod and stabilize the push rod in a direction parallel to the longitudinal axis of the internal combustion engine, while permitting substantial movement in a direction perpendicular to the longitudinal axis of the internal combustion engine.

6. An internal combustion engine comprising a cylinder head, a plurality of rocker arm supports mounted upon said cylinder head, a plurality of pivotally mounted rocker arms, each of said rocker arms being supported upon a rocker arm support, each of said rocker arms having a push rod engaging end and a poppet valve engaging end, and a plurality of laterally stable poppet valves mounted in said cylinder head, each poppet valve having an end portion engaging the poppet valve engaging end of the rocker arm, a plurality of push rods, each of said push rods having an end portion engaging the push rod engaging end of a rocker arm, and push rod stabilizing means, said push rod stabilizing means comprising a push rod guide mounted upon said cylinder head, said push rod guide having a plurality of open ended slots, each of said slots being located near the end of the push rod that engages the rocker arm, the longitudinal axis of said open ended slots being transverse to the longitudinal axis of

the internal combustion engine, moldable plastic bearing means mounted in each of said slots for movement along said slot, each of said bearing means being apertured to receive a portion of a push rod and stabilize the push rod in a direction parallel to the longitudinal axis of the internal combustion engine, said bearing means being movable by said push rod in a direction perpendicular to the longitudinal axis of the internal combustion engine.

7. An internal combustion engine comprising a cylinder head, a plurality of rocker arm supports mounted upon said cylinder head, a plurality of pivotally mounted rocker arms, each of said rocker arms being supported upon a rocker arm support, each of said rocker arms having a push rod engaging end and a poppet valve engaging end, and a plurality of laterally stable poppet valves mounted in said cylinder head, each poppet valve having an end portion engaging the poppet valve engaging end of the rocker arm, a plurality of push rods, each of said push rods having an end portion engaging the push rod engaging end of a rocker arm and push rod stabilizing means, said push rod stabilizing means comprising a push rod guide mounted upon said cylinder head, said push rod guide having a plurality of open ended slots, each of said slots being located near the end of the push rod that engages the rocker arm, the longitudinal axis of said open ended slots being transverse to the longitudinal axis of the internal combustion engine, moldable plastic bearing means secured in each of said slots against movement, said bearing means being apertured to receive a portion of the push rod and stabilize the push rod in a direction parallel to the longitudinal axis of the internal combustion engine, while permitting substantial movement in a direction perpendicular to the longitudinal axis of the internal combustion engine.

8. An internal combustion engine comprising a cylinder head having an opening adapted to communicate with the internal combustion engine lubricant sump, a plurality of rocker arm supports mounted upon said cylinder head, a plurality of pivotally mounted rocker arms, each of said rocker arms being supported upon a rocker arm support, each of said rocker arms having a push rod engaging end and a poppet valve engaging end, and a plurality of laterally stable poppet valves mounted in said cylinder head, each poppet valve having an end portion engaging the poppet valve engaging end of the rocker arm, a plurality of push rods, each of said push rods having an end portion engaging the push rod engaging end of a rocker arm and push rod stabilizing means, said push rod stabilizing means comprising a push rod guide mounted upon said cylinder head, and an upstanding baffle integrally connected to the push rod guide, said baffle shielding the poppet valve from wetting by the internal combustion engine lubricant, said push rod guide having a plurality of open ended slots located near the end of the push rod which engages the rocker arm, and at least one trough communicating with the opening in the cylinder head, the longitudinal axis of said open ended slots being transverse to the longitudinal axis of the internal combustion engine, a moldable plastic bearing mounted in each of said slots, each of said moldable plastic bearings having an opening to receive a portion of the push rod and stabilize the push rod in a direction parallel to the longitudinal axis of the internal combustion engine, while permitting substantial movement in a direction perpendicular to the longitudinal axis of the internal combustion engine.

9. An internal combustion engine comprising a rocker arm support, a rocker arm pivoted upon said rocker arm support, said rocker arm having a push rod engaging end and a poppet valve engaging end, a poppet valve having an end portion engaged by said poppet valve engaging end, a push rod having an end portion engaged by said push rod engaging end, and push rod stabilizing means, said push rod stabilizing means comprising a longitudinal slot formed in a component of said engine, molded plastic bearing means mounted in said slot for movement along the length of said slot, said plastic bearing means being apertured to reciprocally receive said push rod and stabilize the push rod in a direction normal to the length of said slot.

10. An internal combustion engine comprising a cylinder head, a rocker arm support mounted upon said cylinder head, a rocker arm pivotally mounted upon said rocker arm support, said rocker arm having a push rod engaging end and a poppet valve engaging end, a poppet valve reciprocally mounted in said cylinder head, said poppet valve having an end portion adapted to be engaged by the poppet valve engaging end of said rocker arm, a push rod reciprocally supported by said engine, said push rod having an end portion adapted to be engaged by the push rod engaging end of said rocker arm, and push rod stabilizing means, said push rod stabilizing means comprising a push rod guide mounted upon said cylinder head, an upstanding baffle integrally formed with said push rod guide for shielding the poppet valve from wetting by the lubricant of said engine, said push rod guide having a longitudinal slot encircling said push rod and limiting movement of said push rod in one direction while permitting free movement of said push rod in a direction normal to said one direction.

11. An internal combustion engine comprising a rocker arm support secured to the engine, a rocker arm pivoted upon said rocker arm support, said rocker arm having a push rod engaging end and a poppet valve engaging end, a poppet valve having an end portion engaged by said poppet valve engaging end of said rocker arm, an enlarged aperture formed in a portion of said engine, a push rod reciprocally supported in said aperture and having an end portion engaged by said push rod engaging end of said rocker arm, a hydraulic tappet in engagement with another end portion of said push rod, said aperture in the portion of the engine being sufficiently large to permit removal of said hydraulic tappet without necessitating removal of the portion of the engine, and push rod stabilizing means extending across said aperture, said push rod stabilizing means having a longitudinal slot encircling said push rod in limiting movement of said push rod in one direction while permitting free movement of said push rod in another direction.

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