United States Patent [19]

Loon

[11] **3,855,981**

[45] **Dec. 24, 1974**

[54] **ROCKER ARM**

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[73] Assignee: **Ford Motor Company,** Dearborn, Mich.

[22] Filed: **May 15, 1973**

[21] Appl. No.: **360,489**

[52] **U.S. Cl.**..... **123/90.27,** 123/90.34, 123/90.36, 123/90.44, 184/6.9

[51] **Int. Cl.** **F01l 1/02,** F01l 1/04

[58] **Field of Search**..... 123/90.36, 90.34, 90.27, 123/90.44; 184/6.9

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[57] **ABSTRACT**

A rocker arm for an internal combustion engine having overhead camshaft. The rocker arm includes an internal lubrication passage connecting the fulcrum socket and the cam pad. During engine operation oil is provided under pressure to the rocker arm from the fulcrum member and is discharged at the cam pad directly beneath the cam surface. The passage may include an oil reservoir beneath the cam pad which retains a predetermined quantity of oil when the engine is not in operation and which provides essentially instantaneous lubrication to the cam pad and cam surface upon start-up of the engine.

7 Claims, 4 Drawing Figures

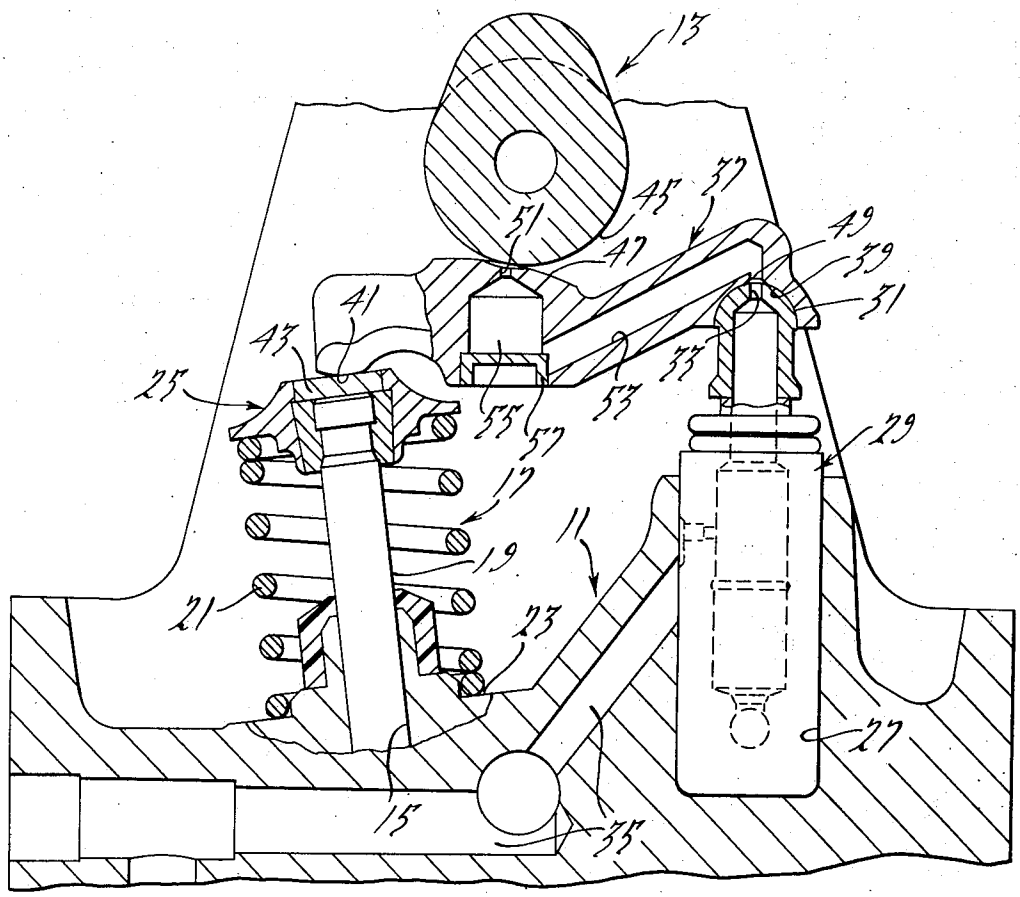
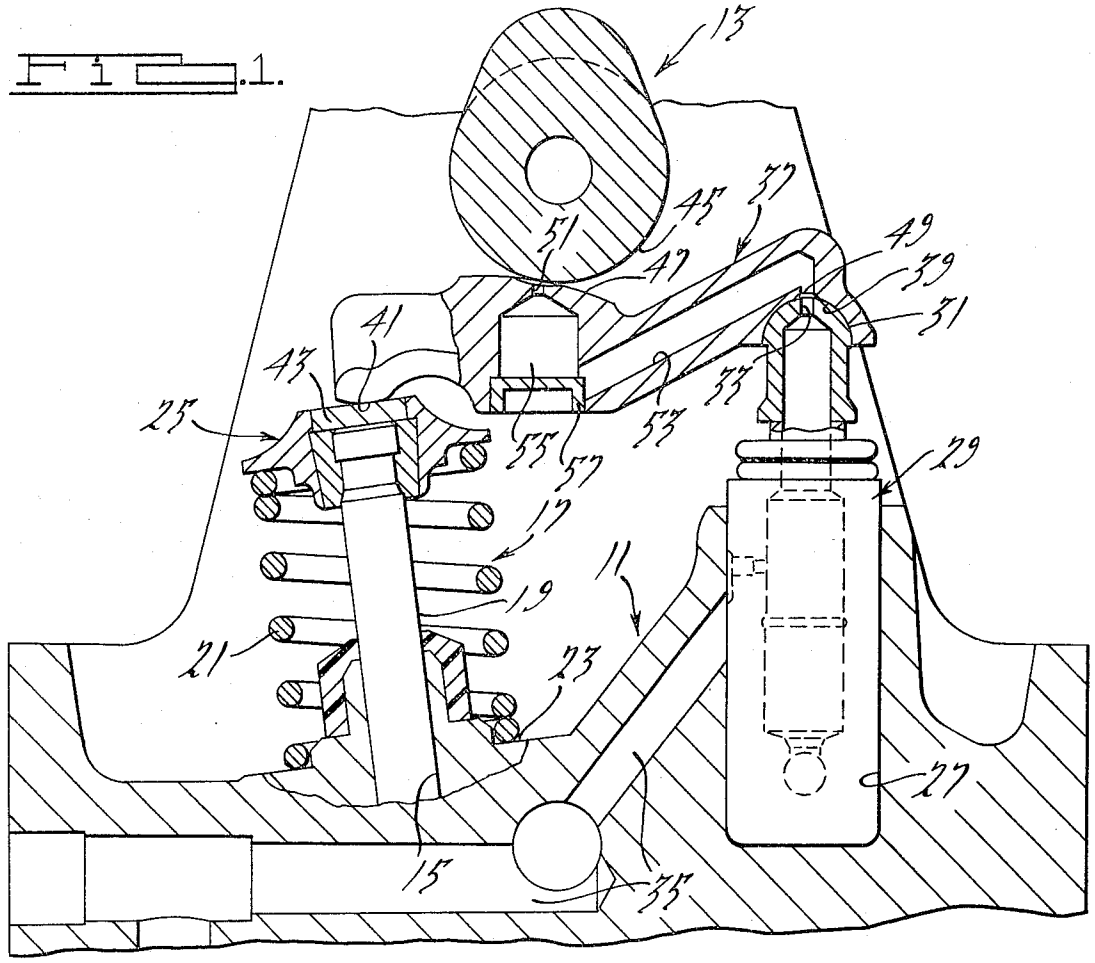


Fig. 1.



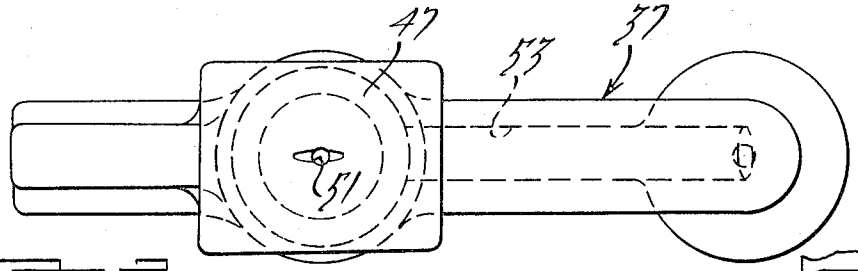
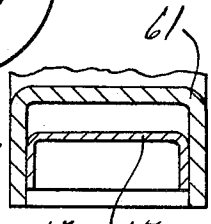


Fig. 2.

Fig. 4.



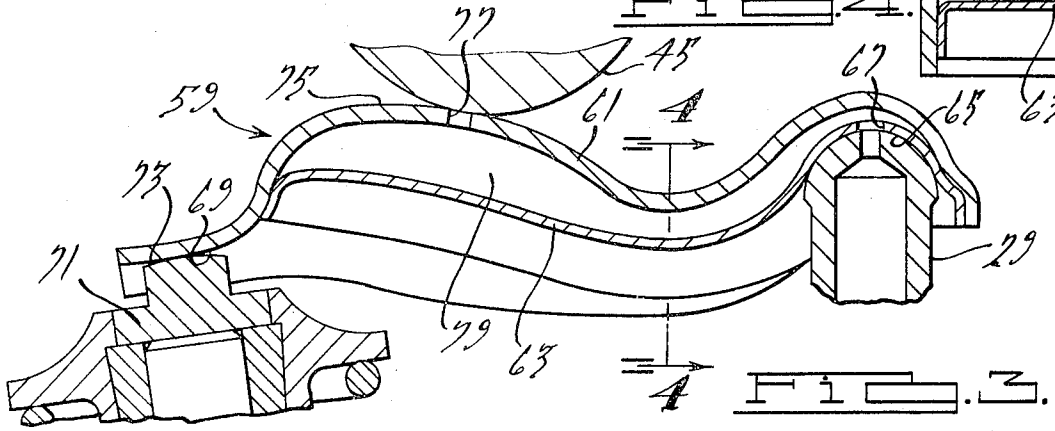


Fig. 3.

ROCKER ARM

BACKGROUND AND SUMMARY OF THE INVENTION

An internal combustion engine having an overhead camshaft generally incorporates a system to provide lubrication to the mating cam and rocker arm surfaces. In one such prior art system, oil is provided through the camshaft mounting supports to an axial passage formed within the camshaft and is discharged form ports opening on the cam surfaces. Another prior art lubrication system employs a rocker arm having an internal lubrication passage receiving oil from the rocker arm fulcrum member and discharging the oil from a jet against a cam surface prior to its engagement with the rocker arm pad.

This invention provides a cam lubrication system which receives lubricating oil from the rocker arm fulcrum member and which overcomes certain disadvantages associated with both the prior art systems identified previously. This invention provides a rocker arm and cam surface lubrication system which instantaneously supplies oil to the sliding surfaces upon initial engine start-up and which significantly reduces oil delivery delay often experienced in prior art systems. This invention also provides a lubrication system in which oil is provided to the cam and rocker arm interface during 360° of camshaft rotation. Furthermore, this invention provides a rocker arm incorporating a lubrication system which funtions identically for either direction of rotation of the camshaft. This invention also provides a rocker arm having an oil supply port that delivers oil at a location on the cam surface to most effectively carry away and dissipate heat generated by the mating surfaces. Finally, this invention provides a rocker arm construction which may be either cast or fabricated from stamped elements and which is economical to produce and reliable in operation.

A rocker arm constructed in accordance with this invention has a first end pivotally connected to a fulcrum member mounted to the cylinder head. The other end of the rocker arm is engageable with the protruding end of the valve stem or valve assembly. A camshaft is slidingly engageable with a cam pad formed on the rocker arm at a point between the two previously mentioned ends. An oil passage is formed in the rocker arm having an inlet receiving oil from the fulcrum member and an outlet on the cam pad immediately beneath the engaged portion of the cam surface. The passage within the rocker arm may include an enlarged reservoir positioned immediately beneath the outlet to the cam surface.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a cross sectional view with portions in elevation of a valve actuating mechanism including a rocker arm constructed in accordance with this invention.

FIG. **2** is an enlarged top view of the rocker arm.

FIG. **3** is a cross sectional view of an alternate embodiment of the invention.

FIG. **4** is a cross sectional view taken along the line 4—4 of FIG. **3**.

DETAILED DESCRIPTIONS OF PREFERRED EMBODIMENTS

Reference numeral **11** of the drawings refers to a portion of a cylinder head of an internal combustion engine having an overhead camshaft **13**. Reciprocably received within a bore **15** formed in the cylinder head is an intake or exhaust valve assembly **17** having a stem **19** protruding upwardly from the cylinder head. The valve assembly **17** includes a retainer assembly **25** which comprises a coiled compression spring **21** between itself and a seat **23** formed in the cylinder head surface. Spaced from bore **15** and coplanar therewith is a second bore **27** which receives the rocker arm fulcrum member or pivot support member **29**. The fulcrum member may be a threaded stud or a hydraulic lash adjuster as shown in FIG. **1**. The protruding end of the fulcrum member is a convex spherical surface **31** having an oil outlet port **33** formed therein. The oil outlet port is connected through the fulcrum member to a source of pressurized oil **35** within the cylinder head.

Bridging the end of the valve stem **19** and the end **31** of the fulcrum member **29** is a rocker arm **37**. The rocker arm has a concave spherical surface or socket **39** formed in the underside of one end corresponding in size to the spherical surface **19** of the fulcrum member. Formed on the underside of the other end of the rocker arm is a slightly convex surface or pad **41** that engages the upper element **43** of the valve assembly.

Mounted to the cylinder head **11** to rotate about an axis perpendicular to the plane formed by the axis of the valve stem **19** and the fulcrum member **29** is the camshaft **13**. The camshaft has a cam surface **45** which slidingly engages the pad **47** formed on the upper side of the rocker arm.

Communicating with the oil outlet port **33** of the fulcrum member **29** is an oil inlet **49** formed in the socket **39** of the rocker arm. An oil discharge port **51** is formed centrally within the cam pad **47** of the rocker arm immediately beneath the engaged portion of the cam surface **45**. Interconnecting the discharge port **51** with the inlet **49** is a passage **53**. Immediately beneath the discharge port and the cam pad and forming a portion of passage **53** is an enlarged reservoir **55**. A plug **57** closes the bottom of the reservoir. The inlet **49** is of sufficient height so that when the engine is not in operation the reservoir retains a substantial quantity of lubricating oil.

It may be seen from the drawings that the rocker arm **37** is a casting having the oil ports and passages formed by boring. An alternate embodiment is shown in FIGS. **3** and **4** of the drawings and comprises a functionally equivalent stamped version of the rocker arm. The stamped rocker arm **59** includes an outer member **61** and an inner member **63** welded in place within the enclosure of the outer member. The spherical socket **65** engaging the fulcrum member **29** is stamped into the inner member and includes a centrally located inlet port **67**. The valve stem engaging portion **69** comprises a channel which fits over a raised portion **73** of valve assembly element **71**. The cam pad **75** is a slightly convex portion of the upper surface of the outer member **61** as shown in FIG. **3**. An oil discharge port **77** is formed centrally in the cam pad along the line of engagement with the cam surface **45**. The volume between the inner member **63** and the outer member **61** defines a passage connecting the inlet **67** and the discharge port **77**, and further defines an oil reservoir **79** positioned immediately beneath the discharge port. Similarly to the rocker arm of FIG. **1**, the inlet **67** is positioned so that the reservoir **79** retains a substantial

portion of lubricating oil when the engine is not in operation.

In either embodiment, fulcrum member may be provided with a check valve (not shown) to prevent siphoning of oil from the interior of the rocker arm to the fulcrum member **29** and cylinder head passages **35.**

Upon initial starting of the engine, the oil in the reservoir **55** or **79** is instantaneously splashed or vibrated through discharge port **51** or **77,** respectively, onto the cam surface **45.** Thus, it may be seen that the cam and rocker arm engaging portions receive lubricating oil immediately without delay while the oil is pumped through the lubricating system through the pivot stud and into the cam lubricating passage. It may also be seen that lubricating oil is provided to the cam and rocker arm at times when it is most likely to be devoid of lubrication and when it is most susceptible to damage by scratching.

Modifications and alterations will occur to those skilled in the art which are included within the scope of the following claims.

I claim:

1. In an internal combustion engine having a cylinder head, a poppet valve assembly having a stem reciprocably mounted in said cylinder head, a camshaft rotatably mounted to said cylinder head, and a fulcrum member mounted to said cylinder head,

a rocker arm having a first end portion connected to said fulcrum member and a second end portion engageable with the end of said valve assembly,

said camshaft slidingly engaging said rocker arm at an area intermediate said end portions,

a passage formed in said rocker arm,

said passage having inlet means at said first end portion of said rocker arm,

said passage having outlet means formed in and located at the camshaft engaging area of said rocker arm,

said rocker arm receiving oil from said fulcrum member for discharge from said outlet directly against said camshaft.

2. In an internal combustion engine according to claim **1,**

said passage including an enlarged reservoir within said rocker arm.

3. In an internal combustion engine according to claim **2,**

said reservoir being positioned immediately upstream of said outlet means.

4. In an internal combustion engine having a cylinder head, a camshaft rotatably mounted above said cylinder head, a poppet valve assembly reciprocably mounted within the cylinder head, said valve assembly having an end portion protruding from said cylinder head, a fulcrum member having a portion received within said cylinder head and a portion protruding therefrom having a convex spherical end,

a rocker arm extending from the end said fulcrum member to said valve assembly, said rocker arm having a spherical socket at one end positionable over and corresponding to the convex spherical end of said fulcrum member,

an outlet port formed in said convex spherical end of said fulcurm member,

an inlet port formed in said spherical socket of said rocker arm, said inlet port being in communication with said outlet port,

said rocker arm having a first pad at its other end engageable with the end portion of said valve assembly,

a second pad formed on a surface of said rocker arm facing oppositely of said first pad, said second pad being intermediate said first pad and said spherical socket,

said camshaft including a cam surface slidably contacting a portion of said second pad,

a discharge port formed in said portion of said second pad contacting said cam surface,

passage means formed within said rocker arm interconnecting said inlet and discharge ports of said rocker arm.

5. In an internal combustion engine according to claim **4,**

said passage including a reservoir immediately beneath the discharge port of the rocker arm.

6. In an internal combustion engine according to claim **5,**

said passage including said reservoir having a configuration which precludes said reservoir from complete draining through said inlet port of the rocker arm when the engine is not in operation.

7. In an internal combustion engine according to claim **5,**

a portion of said reservoir being located below a horizontal line through the inlet port of the rocker arm to prevent drainage from said reservoir portion when the engine is not in operation.

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