

[54] **INTERNAL COMBUSTION ENGINE
WITH OVERHEAD VALVE
MECHANISM**

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[58] Field of Search.....123/90.38, 90.27, 90 L, 90 H,
123/193 H, 195 R, 195 C

[56] **References Cited**

UNITED STATES PATENTS

3,388,614 6/1968 De Castelet123/90.27
3,412,720 11/1968 Binder123/90.27

1,708,458	4/1929	Willgoos.....	123/90
1,752,055	3/1930	Angle	123/90
2,225,102	12/1940	Daub	123/90
3,002,507	10/1961	Bensinger et al.	123/90
3,352,293	11/1967	Hulten.....	123/90
3,422,806	1/1969	De Lorean.....	123/195 C
3,521,613	7/1970	Celli	123/195

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[57] **ABSTRACT**

An internal combustion engine in which overhead valves are operated by rocker arms pivotally mounted on lash adjusters, comprising a rocker cover secured by bolts to a cylinder head mounted on an engine block, bearing members integrally cast with the rocker cover on the inner wall of said rocker cover, a cam-shaft rotatably carried on said bearing members, manually controllable lash adjusters mounted on the cylinder head, wherein the valves are operated by moving the rocker arms on said lash adjusters through cam lobes provided on said camshaft. The rocker cover is provided with two openings one at one side and one at the forward end thereof covered by removable covers.

1 Claim, 3 Drawing Figures

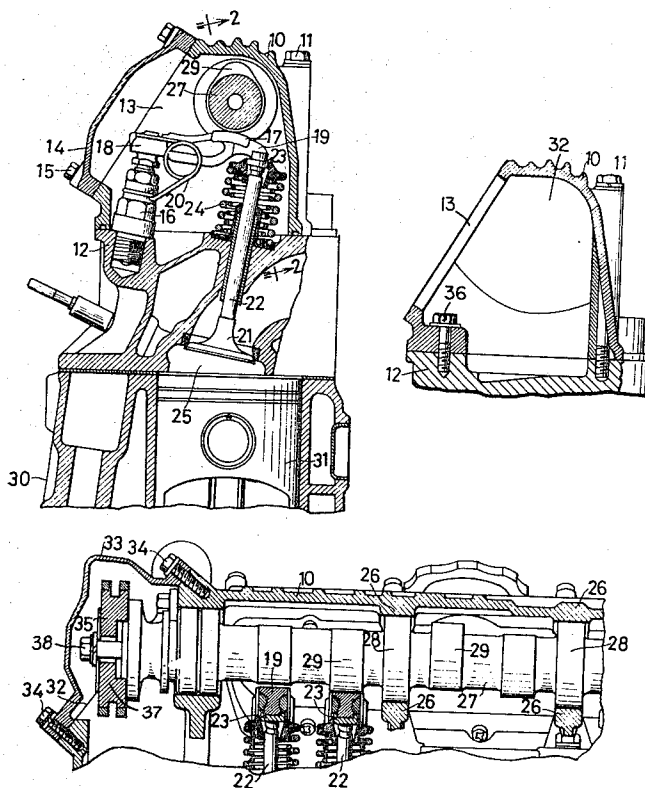


FIG. 1

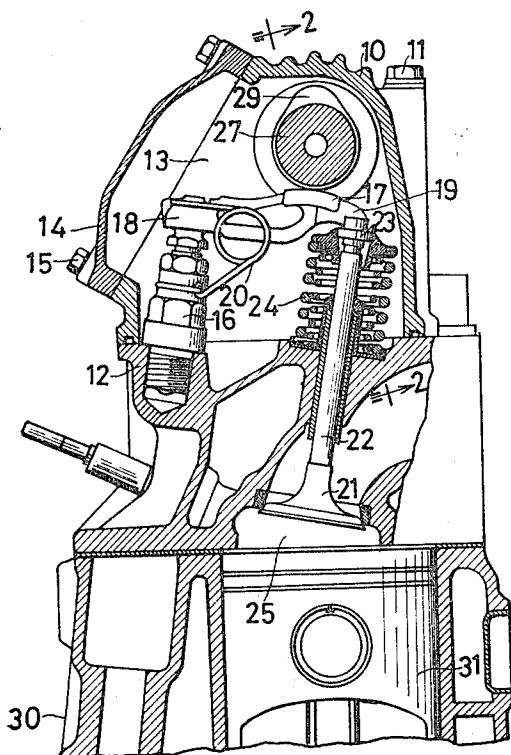


FIG. 3

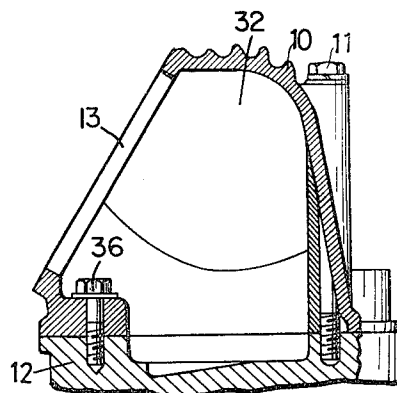
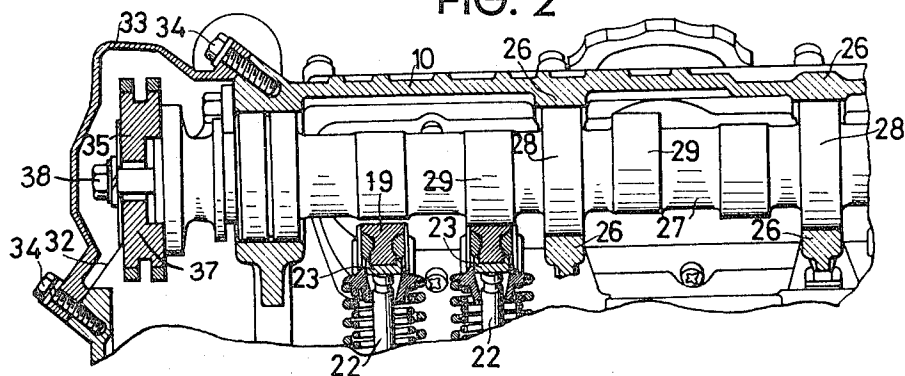


FIG. 2



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INTERNAL COMBUSTION ENGINE WITH OVERHEAD VALVE MECHANISM

FIELD OF THE INVENTION

The present invention relates to improvements in an internal combustion engine, and more particularly in a mechanism for operating valves with cam lobes mounted on a camshaft which is carried by a rocker cover on a cylinder head.

BACKGROUND OF THE INVENTION

Internal combustion engines, comprising a camshaft having a plurality of cam lobes rotatably supported in a rocker cover on an engine block, each of said cam lobes being in engagement with respective rocker arms which may be disengaged from the camshaft when the rocker cover is removed from the engine block, has been known prior to the present invention and disclosed in for example, U.S. Pat. No. 3,352,293.

Disadvantageously, these conventional internal combustion engines are of the construction that the entire rocker cover has to be removed from the engine block when the valve operation mechanism in the interior of the rocker cover is to be adjusted. Particularly in the invention disclosed in said U.S. Patent specification the lash adjusters pivotally supporting thereon the rocker arms are of the feature that the valve operating mechanism is hydraulically and automatically adjusted during operation of the engine. Also, in the invention the internal combustion engine is constructed such that the camshaft has an oil distribution means in the interior thereof for feeding the lubricating oil, an oil feeding passage provided on journal pedestals in the rocker cover is connected to said camshaft oil distribution means, and further there is provided a means to feed the lubricating oil into the oil distribution means of said camshaft.

SUMMARY OF THE INVENTION

An object of the present invention is to provide an internal combustion engine which has an opening on one side of the rocker cover, with a side cover securely fixed thereto with bolts, so that the cam clearances of manually controlled lash adjusters attached to the cylinder head can be adjusted, where any such adjustment is necessary, by not taking away the whole rocker cover from the cylinder head but merely removing the side cover from the rocker cover, said rocker cover also comprising an opening and cover at the forward end inclined at an angle to the axis of said camshaft for easy assembly and removal of the camshaft, camshaft sprocket and bolting means.

Another object of the present invention is to provide an internal combustion engine wherein bearing members are formed by integral casting with the rocker cover on the inner walls of the rocker cover and a journal of the camshaft is inserted through the bearing members whereby the camshaft may be secured into proper position in the interior of the rocker cover which, upon being removed from the cylinder head allows the camshaft together with the rocker cover to be removed from the upper part of the cylinder head so as to release the engagement with the rocker arms.

Still another object of the present invention is to provide an internal combustion engine in which the rocker cover is formed with an inclined opening in the front part and a front cover is detachably fitted with bolts over the inclined opening in such a manner that, when the front cover is removed, camshaft driving means attached to one end of the camshaft is exposed, and the chain and sprocket wheel can be fitted and also the timing of the camshaft driving means can be adjusted taking advantage of the inclined opening, with the camshaft being held in the rocker cover. It will also permit the assembly and removal of the camshaft without removing the rocker cover from the cylinder head.

A further object of the present invention is to provide an internal combustion engine wherein a rocker cover is of a box-type which provides high rigidity to the rocker cover proper and by which no adverse effects are resulted in the bearing

members formed on the inner walls of the rocker cover, even though the cylinder head is subjected to deformation, so that the axis of the camshaft is always kept in proper alignment so as to make the camshaft operate properly to thereby continue the constant movement of the rocker arms.

These and other objects and advantages of the present invention will become apparent from the following description on a preferred embodiment of the invention when taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an elevational view of an internal combustion engine incorporating an improved mechanism according to the present invention, portions thereof being broken away to clearly illustrate a relationship of a rocker cover, camshaft, rocker arm, lash adjusters, valves and piston;

FIG. 2 is a sectional view taken through line 2 — 2 of FIG. 1 looking in the direction of the arrows, particularly showing the camshaft arrangement supported on the rocker cover; and

FIG. 3 is a sectional view of the rocker cover fixedly secured to the cylinder head.

DETAIL OF THE INVENTION

Referring now to FIGS. 1 and 2, a rocker cover 10 is secured to a cylinder head 12 with a bolt 11. On one side of said cover 10 is provided with an opening 13, which is covered by a side cover 14 fixed to the rocker cover 10 with a bolt 15. Lash adjusters 16 of slotted type have its lower end threaded into the cylinder head 12. The upper ends of the lash adjusters 16 are each arranged in opposite relation to an end 18 of a rocker arm 17, said end 18 being connected to the upper end of the adjuster 16 through a wire spring 20. The other ends 19 of the rocker arm 17 are each located just above rocker guides 23 fixed at the upper ends of valve stems 22 of engine valves 21. Compression return springs 24 are each disposed around the valve stem 22 to normally, urge the valve stem 22 upwardly so that the rocker guide 23 fixed at its upper end is brought into contact with the other end 19 of the rocker arm 17 whereby the engine valve 21 closes a port 25. On the inner wall of the rocker cover 10, there are formed a plurality of bearing members 26 at predetermined intervals integrally cast with the rocker cover 10. A camshaft 27 is rotatably supported at its journals 28 by means of the bearing members 26 such that the camshaft 27 may rotate in the rocker cover 10. The camshaft 27 has on its periphery a plurality of axially-spaced cam lobes 29 between the adjoining journals 28, each of the cam lobes 29 is assembled in contact with the rocker arms 17 in order to actuate the valve mechanism. The cylinder head 12 is fixedly mounted on an engine block 30. Reference numeral 31 in the figure denotes a piston. Provided at an end of the rocker cover 10 is an inclination opening 32 which is closed by a front cover 33 secured thereto through a bolt 34. A camshaft driving means 35 is provided at one end of the camshaft 27. The rocker cover 10 is fixedly secured to the cylinder head 12, as shown in FIG. 3, from the outside with bolts 11 and internally with bolts 36.

In the form of construction of the internal combustion engine as hereinbefore described, the camshaft 27 is rotated by the camshaft driving means 35 whereupon each of the cam lobes 29 provided on the camshaft 27 depresses the respective rocker arms 17. Thus, the other ends 19 of the rocker arms 17 cause the valves 21 to move downwardly in the vertical direction against the force of the compression return springs 24 thereby opening the port 25 for suction and exhaustion. Subsequently the cam lobes 29 of the camshaft 27 continue to rotate with the result of releasing the rocker arms 17 from depression, whereupon the compression return springs 24 expands to move the valves 21 upwardly in the vertical direction to close the ports 25. It will be thus understood that rotation of the camshaft 27 causes repeatedly the suction and exhaustion in the engine. For the necessity of adjustment or disassembling the bolt 11 may be loosened and the rocker cover 10 be then

removed from the cylinder head 12 whereby the camshaft 27 can be disassembled in

When the internal combustion engine of the invention is to be assembled, the camshaft 27 as held in the rocker cover 10 is first fixed in relation to the cylinder head 12 with bolts 11 and 36, bolts 34 are loosened to detach the front cover 33 from the rocker cover 10, so that the camshaft driving means 35 is exposed through the inclined opening 32, and then both the chain to be engaged with the crankshaft and also the sprocket wheel 37 are inserted from above into the rocker cover, and finally bolt 38 is fastened securely to complete the assembling.

In the internal combustion engine with the conventional overhead valve mechanism, the camshaft is usually supported by attaching bearing members to separate adapter members of the cylinder head or camshaft, one bearing member being provided for each journal of the camshaft, and the rocker cover which is formed independently of the adapter members for the camshaft is fixed thereto by bolting. Accordingly, the conventional arrangement not only requires a very large number of bolts but also presents considerable limitation of the bolting points because of the relative positions of the various engine components. These factors have represented no small difficulties to the designing of internal combustion engines.

Although there have been developed internal combustion engines in which the bearing members are so fixed to the inner wall of the rocker cover as to support the camshaft, they lack any detachable side cover on the rocker cover as in the invention. Thus, for the adjustment of the cam clearances of lash adjusters built in the rocker cover, it has been necessary to take the trouble of detaching the rocker cover completely from the cylinder block. If this difficulty in adjusting is to be eliminated, some automatic cam-clearance adjusting means, e.g., hydraulically operated lash adjusters as invented by R. E. Hulten (U.S. Pat. No. 3,352,293) and A. Cell (U.S. Pat. No. 3,521,613) and which are known to be costly and yet relatively unstable in performance, have to be adopted. According to the invention, by contrast, manually controlled lash adjusters which are inexpensive and extremely stable in performance are used and their cam clearances are adjusted most conveniently because the side cover only needs to be removed

from the rocker cover, because the opening according to the invention offers direct access to the inside for the adjustment of the lash adjusters.

While the preferred embodiment has been described in detail, it will be understood that various changes and modifications may be made by those skilled in the art without departing from the scope and spirit of the following claims.

I claim

1. An internal combustion engine comprising in combination:
 - an engine block having a bank of aligned cylinders;
 - a cylinder head fixedly mounted on said engine block;
 - manually controlled lash adjusters, each having upper and lower ends, said lower ends being mounted on said cylinder head;
 - rocker arms, each having one end in operative engagement with the upper end of a lash adjuster;
 - valve means operatively connected to the other end of each rocker arm for actuation thereby and being movably supported in said cylinder head;
 - an elongated rocker cover means mounted on said cylinder head;
 - a plurality of bearing members formed on the inner wall of said rocker cover means;
 - an overhead mounted camshaft rotatably journaled in said bearing members and having a plurality of cams, each engaging one of said rocker arms for actuation thereof;
 - means for rotatably driving said camshaft;
 - said rocker cover means including an elongated opening formed on the lash adjuster side of said rocker cover means, said side opening providing access for adjustment of said manually controlled lash adjusters;
 - an additional opening formed at the forward end of said rocker cover means, inclined at an angle to the axis of said camshaft and overlaying said camshaft drive means, said inclined opening providing access for the assembly, adjustment and disassembly of said camshaft and said camshaft driving means; and
 - an inclined mounted cover removably mounted over said inclined opening.

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