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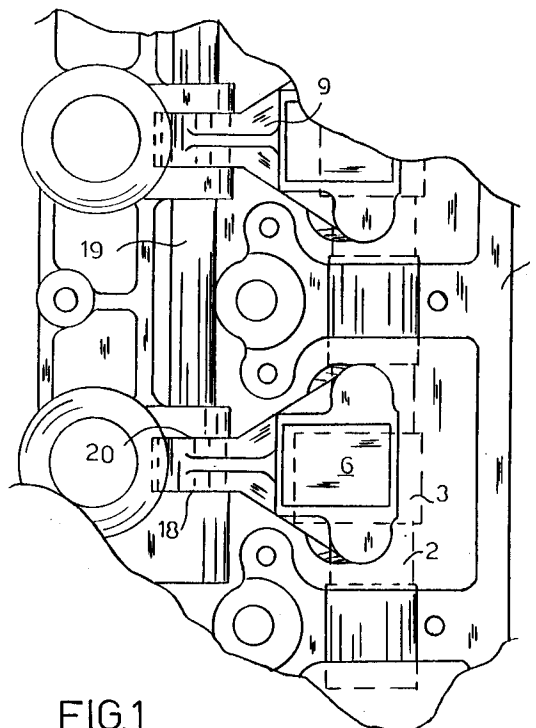
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**I-10128 Torino (IT)**(54) **Variable geometry distribution control for an internal combustion engine.**

(57) Internal combustion engine distribution valve control, provided with a variable profile camshaft (2) which can be moved along its longitudinal axis, and with valves (4) driven by means of a rocking lever (9), comprising a guide shoe (6) in contact with the surface of the cam (5) and connected, in a way that it can rotate, to a shaft (19) inserted into seats built in the cylinder head (1).

**FIG.1****EP 0 615 057 A1**

The present invention refers to a device for distribution valve control for an internal combustion engine, having at least two compliant valves per cylinder and a camshaft with variable profile cams.

The distribution controls using the variable profile cams, the so-called "splined" cams, are employed to optimize the efficiency, the consumption and the emission levels of the engine by varying, among other things, the lift and the opening times of the valves as a function of the revolution speed.

Using this type of cam, the contact line between tappet and cam lies on a plane which is never vertical to the axis of the tappet itself, as in traditional cam types, but which forms an angle which continually changes according to the position of the cam to the tappet.

Another problem linked to the use of "splined" cams is the rotatory force which is generated in the tappet by the cam during its rotation due to its particular profile, which must be countered to allow the tappet to work normally.

A further problem of the control in question concerns the fact that when the cam is moved longitudinally along its axis it creates a force in the tappet which tends to displace it sideways in the direction in which the cam is moving. This force, like the one before, must also be efficiently countered in order to obtain good working performance from all the distribution unit.

Application n° 67759-A/86, by the same applicant, shows a distribution control for an internal combustion engine with at least two compliant valves per cylinder driven by a single "splined" cam. The distribution control comprises, furthermore, a guide shoe in contact with the cam and a guide shoe seating provided with a cylindrical guide appendix, which is inserted into a seating in the cylinder head, in order to keep it in the required position thus countering the abovementioned forces.

One of the disadvantages of this type of solution is the fact that all the forces are unloaded on the cylindrical guide. It therefore must be of sizeable dimensions and furthermore needs to be manufactured very precisely in order to avoid the danger of seizure which would have disastrous consequences for the engine. Furthermore its dimensions increase the overall weight of the rocking lever and, as a consequence, limit the revolution speed of the engine.

Moreover, with said control it is necessary to carry out one further manufacturing operation on the cylinder head with the maximum precision. The aim of the present invention is to overcome said problems by realizing a command device which is both simple and light.

The abovementioned aim and others are reached by the device according to the invention

which refers to a distribution valve control for an internal combustion engine provided with at least one variable profile camshaft which can be moved along its longitudinal axis, and with at least two compliant valves per cylinder driven by means of a rocking lever and comprising a shoe guide in contact with the surface of the cam and a seating for the shoe guide characterized in that the rocking lever is connected to a shaft, inserted into seatings in the engine cylinder head and lying parallel to the cam shaft, in such a way that it can rotate relatively to it.

Further characteristics and advantages will become clear in the following description which, by way of example only, refers to the accompanying drawings in which:

- Figure 1 is a partial plan view of an internal combustion engine cylinder head provided with a control in accordance with the invention;
- Figure 2 is a partial sectional view of the control of figure 1;
- Figure 3 is a plan view of a rocking lever in accordance with the invention;
- Figure 4 is a bottom view of the rocking lever of figure 3;
- Figure 5 is a plan view of another embodiment of the rocking lever in accordance with the invention.

With reference to the figures, (1) indicates an internal combustion engine cylinder head provided with a camshaft (2) (phantom line in figure 1) of the type with variable profile cams (3) for the control of valves (4). The camshaft (2) is linked to a known device suitable to move it along its axis and which is of a predetermined size (not shown).

A rectangular shaped guide shoe (6) is placed in contact with the surface (5) of the cam (3), with a flat contact surface between shoe guide and cam (3) and a lower semicircular section projection (7) along the longer axis of the guide shoe. A substantially triangular plan rocking lever (9) is provided with a seating (10), also having a semicircular section, (phantom line), which can receive the projection (7) in a slidable manner.

This coupling allows the guide shoe to rotate along its longitudinal axis so that it can follow the subsequent inclination angles of the "splined" cam.

At the two ends of the rocking lever (9) which flank the seating (10) there are the seatings (12 and 13) of two hydraulic tappets commercially well known.

At the third end (15) of the rocking lever (9) which has a rectangular projection (16) there is a connection through bore which is parallel to the hypothetical axis connecting the seatings (12 and 13). Said bore (17) is used to connect the rocking lever (9), by means of a through shaft (19), to the

cylinder head (1) in suitable cast seatings (18), formed and machined in order to receive precisely the rectangular projection (16).

The rocking lever (9) is therefore free to rotate around the shaft (19), while both the rotary and lateral forces on it are completely unloaded onto the side walls (20) of the seatings (18) through the projection (16) and also onto the shaft (19) through walls (17) of the bore.

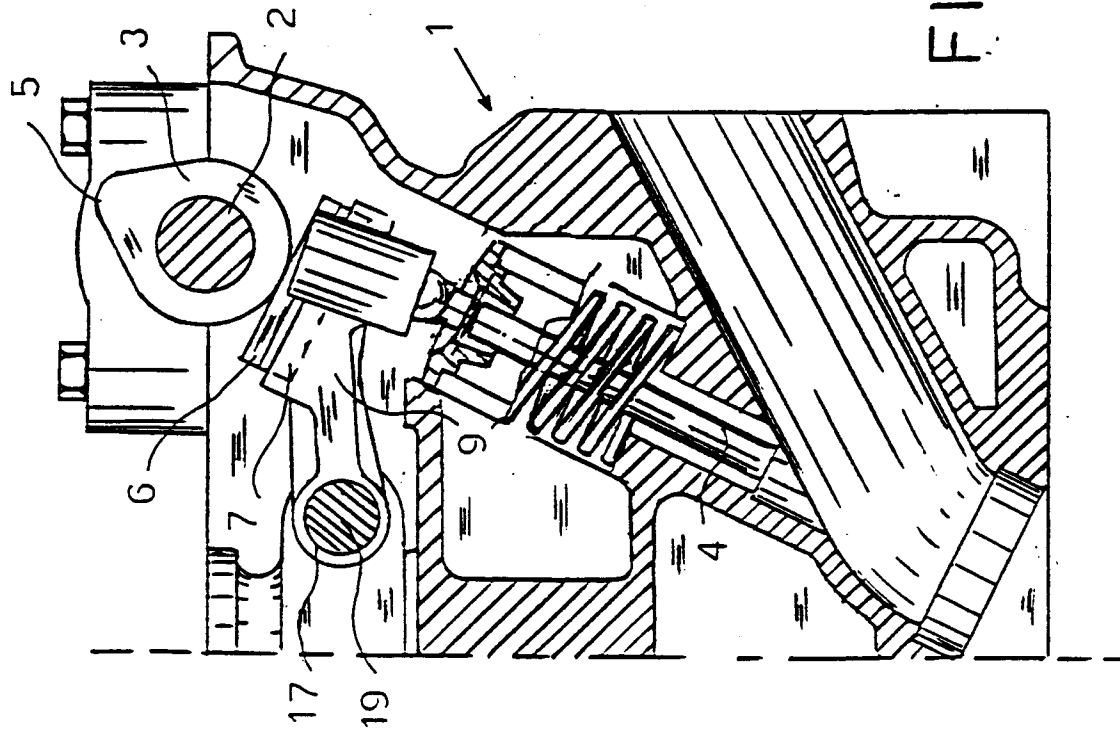
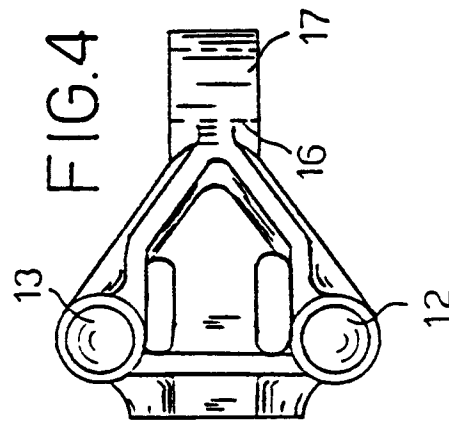
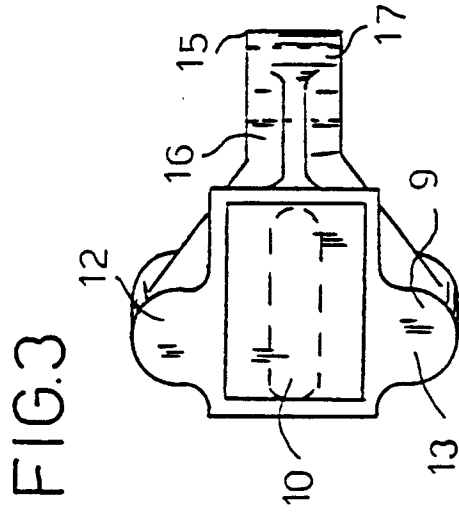
Such embodiment of the rocking lever is sufficiently light, robust, comprises an easy to manufacture seating on the cylinder head, and has extremely contained dimensions which allow an easier setup of the whole distribution system.

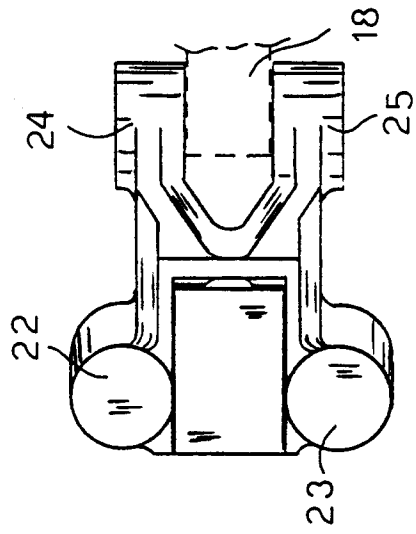
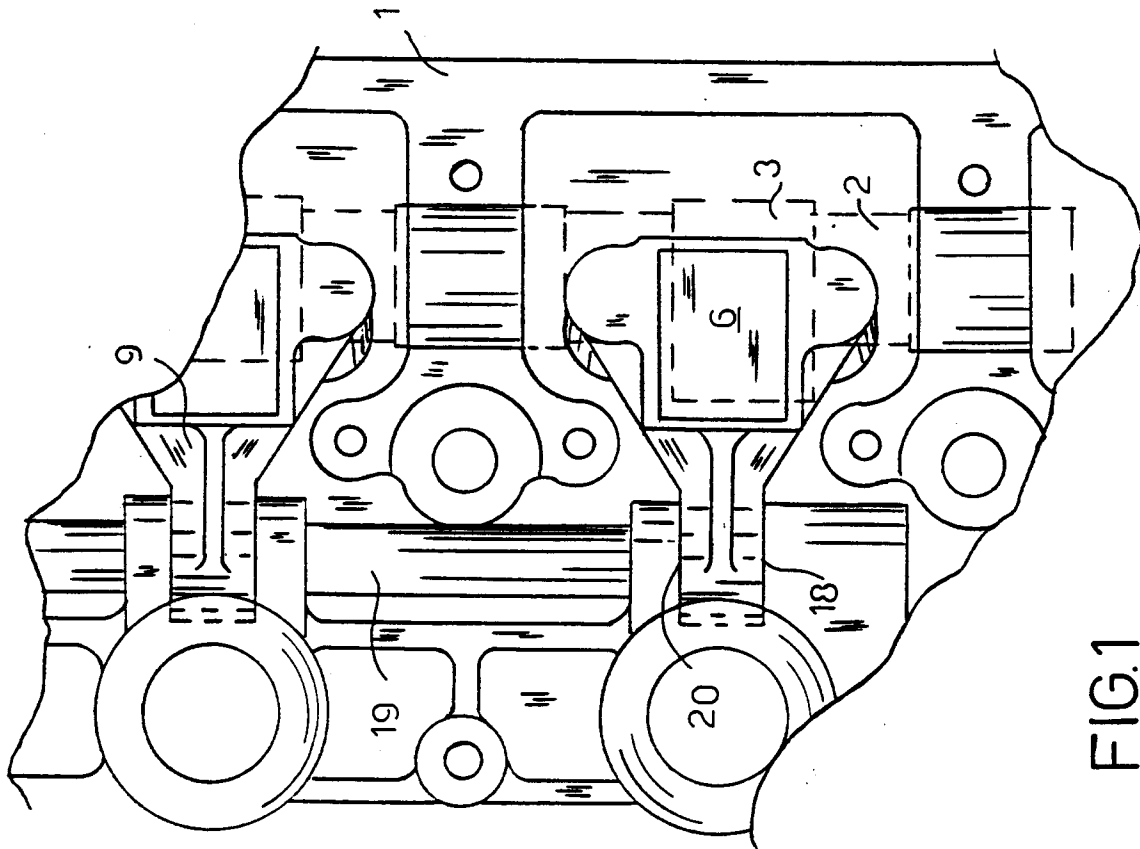
In another preferred embodiment of the invention, the rocking lever (9) is H shaped, the extremities of which H are occupied by two seatings for the hydraulic tappets (22 and 23), and by two through bores (24 and 25) (phantom line) for abutment on the cam shaft (19). In this case the seating (18) (phantom line), formed on the cylinder head, is inserted between the two through bores at the extremities of the H. This embodiment allows the rocking lever to support considerably greater loads and therefore it can conveniently be used in high performance engines. Obviously the above description may be modified in many ways and still remain within the boundaries of the invention.

## Claims

1. Distribution valve control for an internal combustion engine provided with at least one variable profile cam shaft (2), which can be moved along its longitudinal axis, and with at least two compliant valves (4) per cylinder driven by a rocking lever (9) comprising a shoe guide (6) in contact with the surface (5) of the cam and a seating (10) for the shoe guide characterized in that the rocking lever (9) is connected to the engine cylinder head (1) in such a way that it can rotate relatively to it, by means of a shaft (19) inserted in seatings formed on the cylinder head (1) itself and lying parallel to the cam shaft (2).
2. Distribution valve control according to claim 1 characterized in that the rocking lever (9) has a substantially triangular shape and that seatings for hydraulic tappets (12,13) are provided at two of its ends, while the third end consists of a rectangular projection (16) provided with a through bore (17) for the connection with the engine cylinder head (1).
3. Distribution valve control according to claim 1, characterized in that the rocking lever (9) is substantially H shaped and that two parallel

ends are provided with seatings for hydraulic tappets (22, 23), while the other two ends are rectangular and are provided with through bores (26, 27) for the connection with the engine cylinder head (1).







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## EUROPEAN SEARCH REPORT

Application Number  
EP 93 11 9186

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
X	DE-A-41 17 566 (AUDI AG) * the whole document *	1	F01L1/26 F01L1/34 F01L1/18
Y,D	EP-A-0 263 794 (FIAT AUTO SPA) * the whole document *	1,3	
Y	DE-A-37 08 675 (BAYERISCHE MOTOREN WERKE AG) * the whole document *	1,3	
A	FR-A-1 586 933 (CATERPILLAR TRACTOR CO) * figures 1-5 *	2,3	
A	AUTOMOTIVE ENGINEERING vol. 94, no. 5, May 1986, DALLAS, TEXAS, USA pages 83 - 84 DAVID SCOTT 'SIX VALVES GREATLY BOOST ENGINE OUTPUT' * page 83, right hand upper figure *	2,3	
A	PATENT ABSTRACTS OF JAPAN vol. 8, no. 220 (M-330)(1657) 6 October 1984 & JP-A-59 103 907 (HONDA GIKEN KOGYO KK) 15 June 1984 * abstract; figures 3,6-9 *	2	TECHNICAL FIELDS SEARCHED (Int.Cl.5) F01L
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 10 May 1994	Examiner Klinger, T
<b>CATEGORY OF CITED DOCUMENTS</b> X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			