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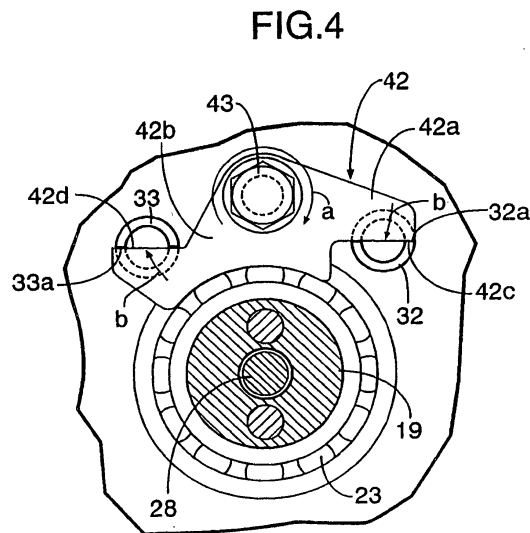
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(54)

WHIRL-STOP DEVICE FOR ROCKER ARM SHAFT IN VALVE MECHANISM OF INTERNAL COMBUSTION ENGINE

(57)

In a valve-operating device in an internal combustion engine, including two rocker arm shafts mounted in a cylinder head, and intake and exhaust cams and intake and exhaust valves which are connected to each other by rocker arms swingably carried on the rocker arm shafts, a detent plate (42) is fixed in a tightened manner to the cylinder head (3) between the two rocker arm shafts (32, 33) by a tightening bolt (43). Engage portions (42c, 42d) formed on front sides of first and second arms (42a, 42b) of the detent plate (42) in a direction (a) of tightening rotation of the tightening bolt are respectively brought into engagement with engaged portions (32a, 33a) formed on the two rocker arm shafts (32, 33). Thus, it is possible to reliably achieve the prevention of the rotation of the two rocker arm shafts.



Description

FIELD OF THE INVENTION

[0001] The present invention relates to a detent device for two rocker arm shafts on which rocker arms connecting intake and exhaust cams to intake and exhaust valves are swingably carried in a valve-operating device in an internal combustion engine.

BACKGROUND ART

[0002] In general, in a valve-operating device in an internal combustion engine of an SOHC type or the like, two rocker arm shafts are juxtaposed at a distance in a cylinder head of an engine body, and intake and exhaust cams and intake and exhaust valves are connected to each other by rocker arms swingably carried on the rocker arm shafts, so that the intake and exhaust valves are opened and closed with a predetermined timing by the rotation of the intake and exhaust cams (see Japanese Patent Application Laid-open No.2000-329002).

[0003] It should be noted here that in such valve-operating device, the two rocker arm shafts on a valve-operating camshaft are supported by press-fitting into rocker arm shaft bores defined in the cylinder head or by another means, but provided with a detent means for prevention of the rotation with respect to the cylinder head. For example, as shown in Fig. 5, a central portion of a set plate is screwed to the cylinder head between the two rocker arm shafts by a tightening bolt, and detent portions formed symmetrically on lower surfaces of ends of left and right arms of the set plate are put into abutment against notches of the two rocker arm shafts, so that the rotation of the two rocker arm shafts is prevented.

[0004] However, such conventional detent means for the rocker arm shafts suffers from the following problem: During tightening of a set plate by the tightening bolt, the set plate is rotated in a tightening direction and hence, it is inevitable that a slight gap $\underline{s}$ is created between the notch of one of the rocker arm shafts located on the rear side in the direction of tightening and rotating the set plate and the detent portion of the set plate, and during operation of the engine, a striking sound is generated by the free rotation of the rocker arm shafts due to such gap $\underline{s}$.

[0005] The following means are expected as a solution for such problem:

- (1) Separate detent set plates are mounted on the two rocker arm shafts; and
- (2) A detent O-ring is mounted between each of the rocker arm shafts and the rocker arm shaft bore.

[0006] The means (1) suffers from another problem: the number of parts is increased, resulting in an increase in cost, and moreover, a surplus space is occupied and

hence, the layout therefore is difficult. The means (2) also suffers from another problem: it is necessary to subject the rocker arm shafts to a surplus working or processing, and moreover, the number of parts is increased and further, a labor is taken for the assembling operation.

DISCLOSURE OF THE INVENTION

[0007] The present invention has been accomplished with such circumstances in view, and it is an object of the present invention to provide a new detent device for a rocker arm shaft in a valve-operating device in an internal combustion engine, wherein all of the above-described problems are solved.

[0008] To achieve the above object, according to the present invention, in a valve-operating device in an internal combustion engine in which two rocker arm shafts are juxtaposed at a distance in a cylinder head of an engine body, and rocker arms connecting intake and exhaust cams to intake and exhaust valves are swingably carried on the rocker arm shafts, so that the intake and exhaust valves are opened and closed with a predetermined timing by the rotation of the intake and exhaust cams,

an intermediate portion of a detent plate, from which a first arm and a second arm are extended integrally, is fixed in a tightened manner to the cylinder head at an intermediate portion of the two rocker arm shafts by a threaded member, and the first and second arms of the detent plate have engage portions provided thereon on a front side in a direction of tightening rotation of the threaded member, respectively, so that the engage portions are respectively brought into engagement with engaged portions formed in oppositely turned attitudes on the two rocker arm shafts to prevent the rotation of the rocker arm shafts. With such feature, the prevention of the rotation of the two rocker arm shafts can be achieved properly by the tightening and fixing of the detent plate to the cylinder head by the threaded member, thereby previously preventing the generation of a striking sound due to the free rotation of the two rocker arm shafts during operation of the engine.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

Fig. 1 is a vertical sectional view of essential portions of an internal combustion engine including a detent device for rocker arm shafts in valve-operating device according to the present invention; Fig. 2 is a sectional view taken along a line 2-2 in Fig. 1; Fig.3 is an enlarged sectional view taken along a line 3-3 in Fig. 1; Fig.4 is a sectional view taken along a line 4-4 in Fig. 1; and Fig. 5 is a sectional view similar to Fig. 4 but showing a conventional valve-operating device.

BEST MODE FOR CARRYING OUT THE INVENTION

[0010] The mode for carrying out the present invention will now be described by way of an embodiment shown in the accompanying drawings.

[0011] First, an embodiment of the present invention will be described with reference to Figs.1 to 4.

[0012] Referring to Figs. 1 and 2, an engine body E of an SOHC-type air-cooled 4-cycle internal combustion engine includes a cylinder block 1 having a cylinder bore 2 provided therein, a cylinder head 3 which is fixed to a deck surface of the cylinder block 1 and has a combustion chamber 4 defined therein to confront the cylinder bore 2, and a crankcase 5 fixed to a lower surface of the cylinder block 1. A valve-operating device V, which will be described hereinafter, is mounted in the cylinder head 3, and a head cover 6 is mounted on the cylinder head 3 to cover the valve-operating device V. A piston 8 is slidably received in the cylinder bore 2 with a cylinder sleeve 7 interposed therebetween, and is connected to a crankshaft which is not shown through a connecting rod 10.

[0013] This internal combustion engine is of a uni-flow type, and the cylinder 3 is provided with an intake port 11 which opens into one side of the cylinder head 3, and an exhaust port 12 which opens into the other side of the cylinder head. The intake port 11 and the exhaust port 12 are opposed to each other. An intake system In is connected to the intake port 11, and an exhaust system Ex is connected to the exhaust port 12. An intake valve 13 is mounted in the intake port 11 for opening and closing an intake valve bore permitting the intake port 11 and the combustion chamber 4 into communication with each other, and an exhaust valve 14 is mounted in the exhaust port 12 for opening and closing an exhaust valve bore permitting the exhaust port 12 and the combustion chamber 4 into communication with each other. The intake and exhaust valves 13 and 14 are retained as usual in their closed positions by valve springs 15 and 16, respectively. A spark plug 17 is threadedly mounted in a wall surface of the cylinder head 3 surrounding the combustion chamber 4 with its electrode facing into the combustion chamber 4.

[0014] A single valve-operating camshaft 19 is rotatably carried in a central portion of a valve-operating chamber defined above the cylinder head 3 with bearings 23 and 24 interposed therebetween. An intake cam 20 and an exhaust cam 21 are integrally formed at an axially intermediate portion of the valve-operating camshaft 19.

[0015] A timing transmitting chamber 25 is defined in one side (a left side in Figs. 2 and 3) of and astride the cylinder block 1 and the cylinder head 3, and a timing driven gear 26 is fixed at one end (a left end in Figs.2 and 3) of the valve-operating camshaft 19 within the timing transmitting chamber 25. The gear 26 is operated in operative association with a timing driving gear fixed on a crankshaft (not shown) through an endless timing

chain 27, so that the rotation of the crankshaft is transmitted at a reduction ratio of 1/2 to the valve-operating camshaft as usual. A bolt 28 passed through a sidewall of the cylinder head 3 is inserted through the hollow valve-operating camshaft 19, and a cover 29 is threadedly mounted to an end of the bolt 28 to cover an opening in the timing transmitting chamber 25 on the side of the cylinder head 3.

[0016] Intake-side and exhaust-side two rocker arm shaft bores 30 and 31 are provided in the cylinder head 3 to extend laterally above the valve-operating camshaft 19 in parallel to the valve-operating camshaft 19. The intake-side and exhaust-side two rocker arm shaft bores 30 and 31 are formed as blind bores which open into the timing transmitting chamber 25, as shown in Fig.3. In the present embodiment, the exhaust-side rocker arm shaft bore 31 is formed longer than the intake-side rocker arm shaft bore 30. Two, i.e., intake-side and exhaust-side hollow rocker arm shafts 32 and 33 are press-fitted into the two rocker arm shaft bores 30 and 31 from the sides of their openings. Intake-side and exhaust-side rocker arms 34 and 35 are swingably supported at their intermediate portions on the two rocker arm shafts 32 and 33 with their positions displaced from each other in axial directions of the rocker arm shafts 32 and 33, respectively. The intake-side rocker arm 34 is connected at its outer end to an upper end of the intake valve 13 through a tappet 37 and at its inner end to a cam face of the intake cam 20 on the valve-operating camshaft 19 through a roller 39 pivotably supported at such inner end. On the other hand, the exhaust-side rocker arm 35 is connected at its outer end to an upper end of the exhaust valve 14 through a tappet 38 and at its inner end to a cam face of the exhaust cam 21 on the valve-operating camshaft 19 through a roller 40 pivotably supported at such inner end. Therefore, the rotation of the valve-operating camshaft 19 causes the intake-side and exhaust-side rocker arms 34 and 35 to be swung about the rocker arm shafts 32 and 33, respectively, whereby the intake valve 13 and the exhaust valve 14 are opened and closed with a predetermined timing by cooperation with the valve springs 15 and 16 to conduct the operation of the internal combustion engine.

[0017] However, the two intake-side and exhaust-side rocker arm shafts 32 and 33 are provided with detent means, so that the rocker arm shafts 32 and 33 are prevented from being freely rotated within the rocker arm shaft bores 30 and 31, even if the valve-operating device V is operated. More specifically, as shown in Figs. 3 and 4, a detent plate 42 is fixed at its central portion in a tightened manner by a threaded member, namely, a tightening bolt 43 immediately above and in parallel to the valve-operating camshaft 19. The detent plate 42 is integrally formed with a first arm 42a extending toward the intake-side rocker arm shaft 32, and a second arm 42b extending toward the exhaust-side rocker arm shaft 33, and has a lower surface formed as an arcuate recessed surface substantially concentric with the valve-

operating camshaft 19. Flat engage portions 42c and 42d capable of being engaged with engaged portions 32a and 33a (which will be described hereinafter) of the two rocker arm shafts 32 and 33 are formed on the first and second arms 42a and 42b of the detent plate 42 at side faces of ends of the detent plate 42 on a front side in a direction of tightening rotation of the tightening bolt 43. As shown in Fig. 4, the engage portion 42c of the first arm 42a is formed in a downward turned attitude on the side face of the end, while the engage portion 42d of the second arm 42b is formed in an upward turned attitude on the side face of the end. The engaged portions 32a and 33a notched in a semi-circular shape are formed at one ends of the two rocker arm shafts 32 and 33 corresponding to the detent plate 42. As is shown in Fig. 4, when the tightening bolt 43 is rotated in the tightening direction (a direction indicated by an arrow a in Fig. 4) to fix the detent plate 42 in the tightened manner to the cylinder head 3 by the tightening bolt 43, the detent plate 42 is also rotated in the same direction (a direction indicated by an arrow b in Fig. 4), whereby the engage portions 42c and 42d at the opposite ends of the detent plate 42 are closely engaged with the engaged portions 32a and 33a of the two rocker arm shafts 32 and 33. In this manner, the two rocker arm shafts 32 and 33 are prevented reliably from being rotated by the rotated tightening of the threaded member, i.e., the tightening bolt 43 for the detent plate 42, whereby the generation of a striking sound due to the free rotation of the two rocker arm shafts 32 and 33 during operation of the engine can be prevented previously.

[0018] Although the embodiment of the present invention has been described, it will be understood that the present invention is not limited to the above-described embodiment, and various embodiments may be made within the scope of the invention. For example, the detent device for the rocker arm shafts according to the present invention has been described as being carried out in the SOHC-type internal combustion engine in the above-described embodiment, but it is of course that the detent device is applicable to another internal combustion engine including two rocker arm shafts.

Claims

1. In a valve-operating device in an internal combustion engine in which two rocker arm shafts (32, 33) are juxtaposed at a distance in a cylinder head (3) of an engine body (E), and rocker arms (34, 35) connecting intake and exhaust cams (21, 22) to intake and exhaust valves (13, 14) are swingably carried on said rocker arm shafts (32, 33), so that said intake and exhaust valves (13, 14) are opened and closed with a predetermined timing through said rocker arms (34, 35) by the rotation of said intake and exhaust cams (21, 22),
a detent device for the rocker arm shafts,

wherein an intermediate portion of a detent plate (42), from which a first arm (42a) and a second arm (42b) are extended integrally, is fixed in a tightened manner to the cylinder head (3) at intermediate portions of said two rocker arm shafts (32, 33) by a threaded member (43), and said first and second arms (42a, 42b) of said detent plate (42) have engage portions (42c, 42d) provided thereon on a front side in a direction of tightening rotation of said threaded member (43), respectively, so that said engage portions (42c, 42d) are respectively brought into engagement with engaged portions (32a, 33a) formed in oppositely turned attitudes on said two rocker arm shafts (32, 33) to prevent the rotation of said rocker arm shafts (32, 33).

FIG.1

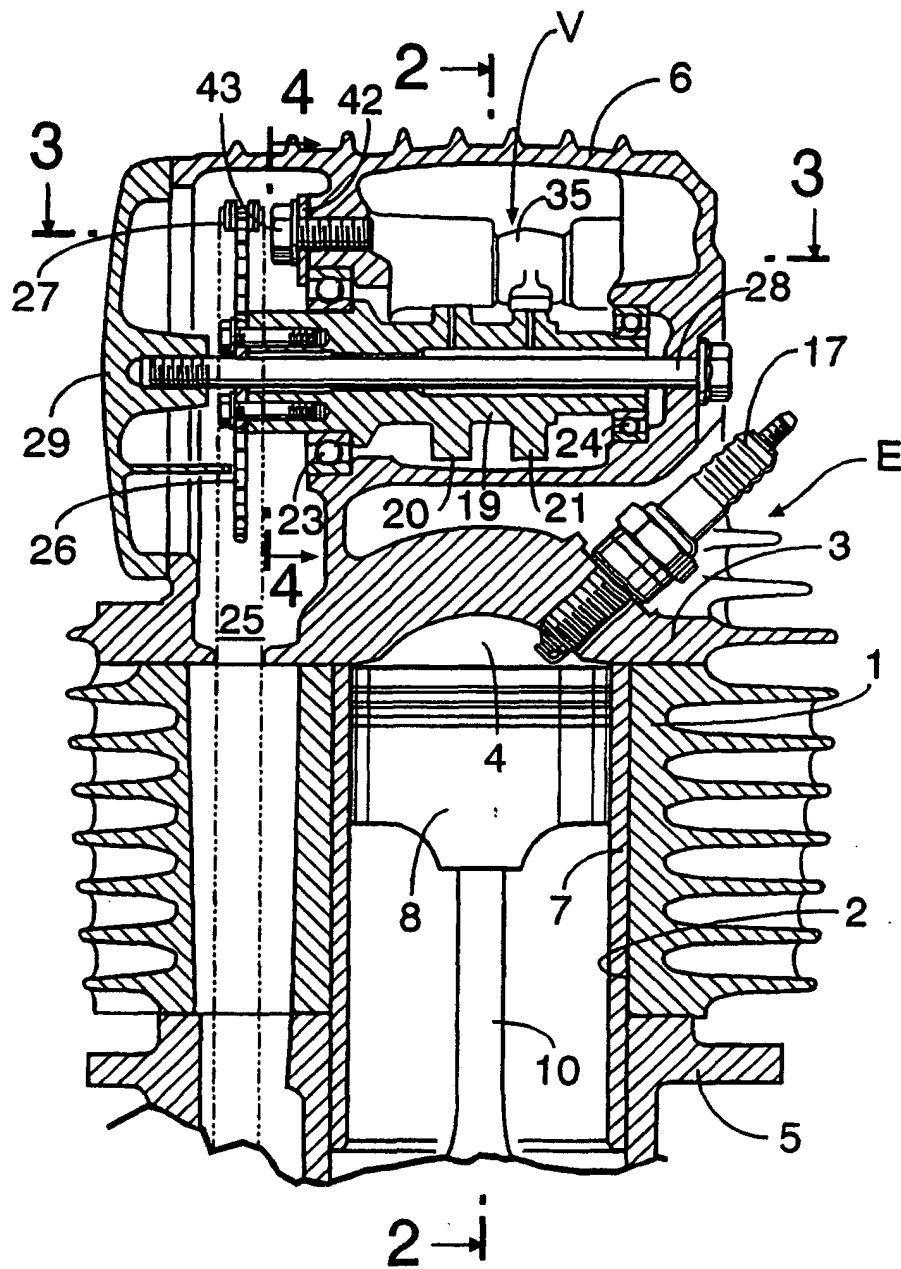


FIG.2

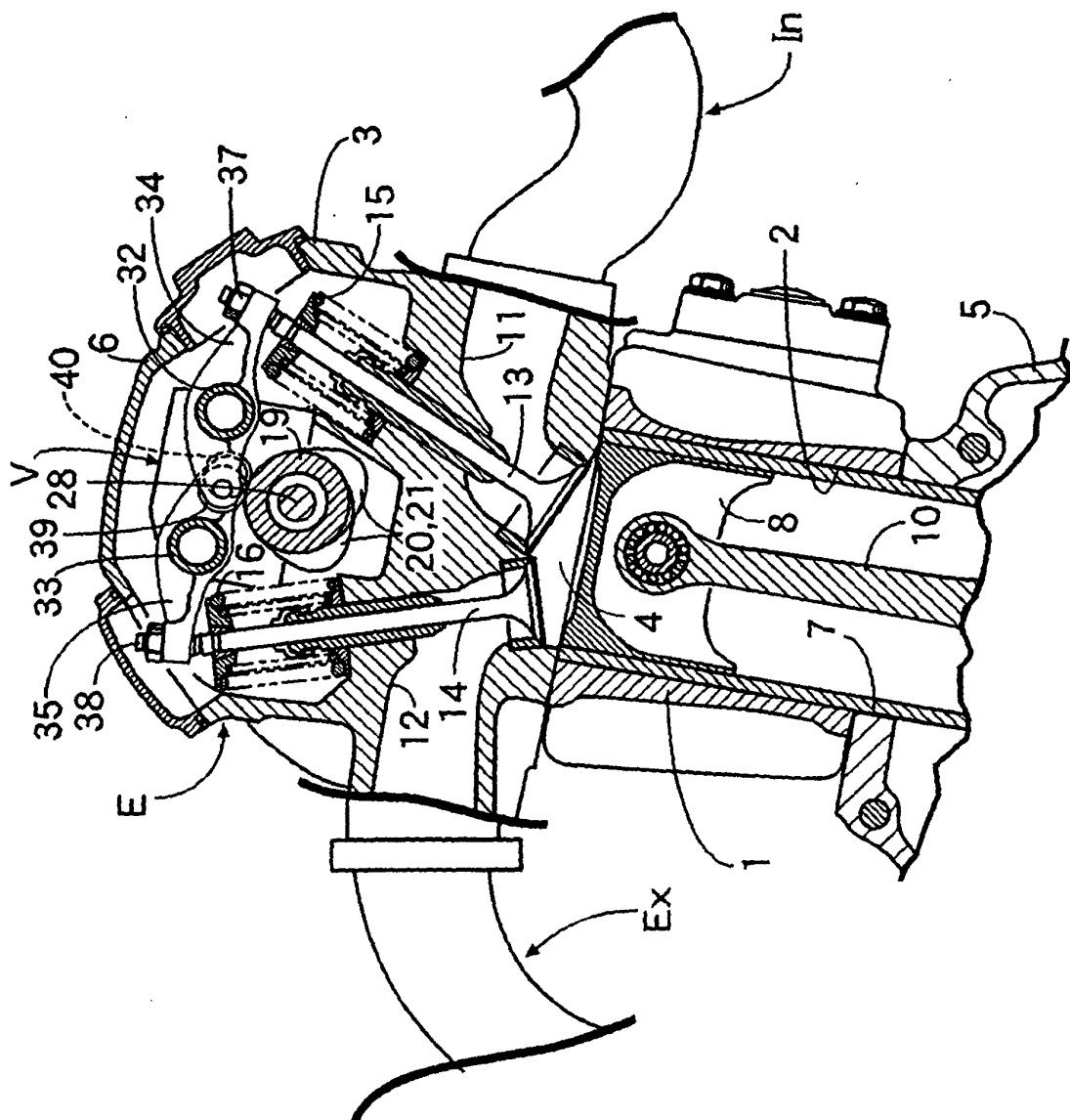


FIG.3

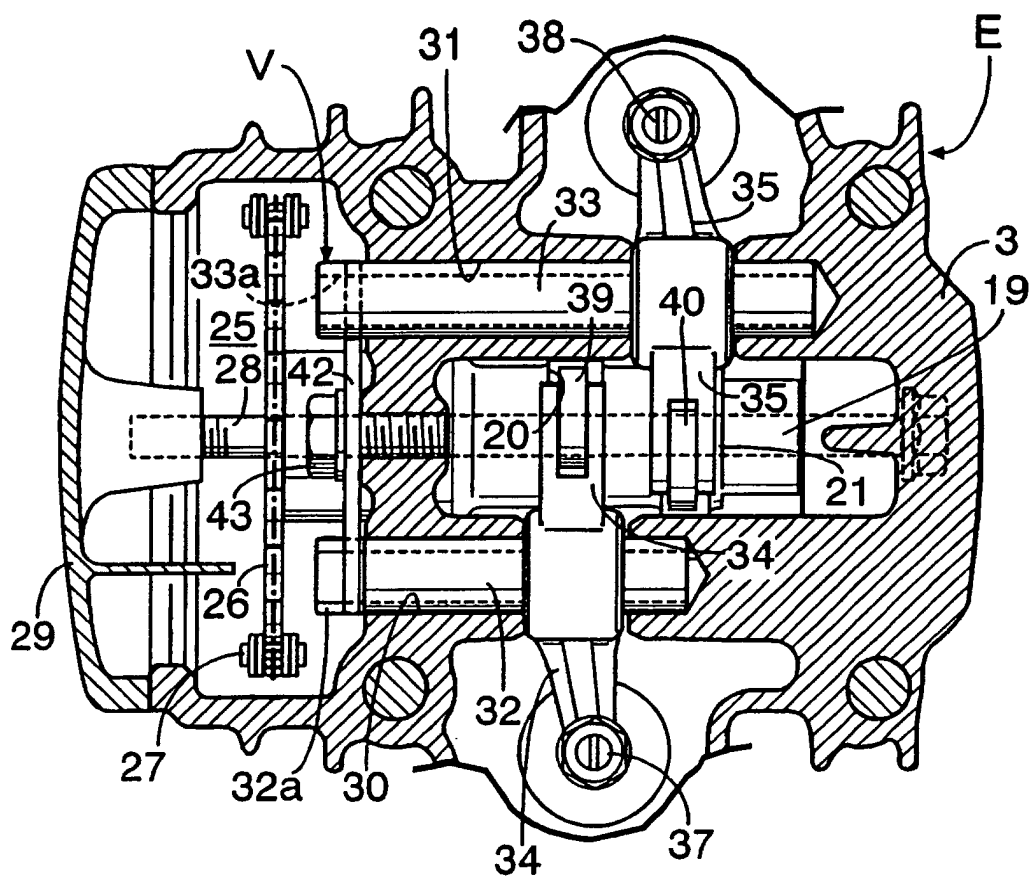


FIG.4

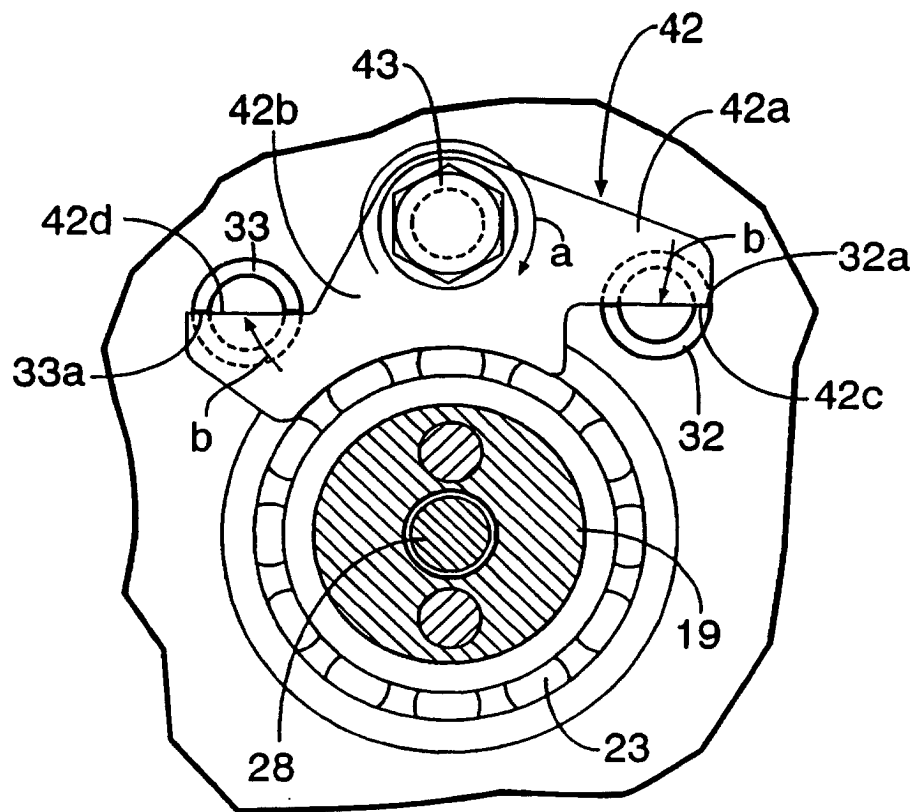
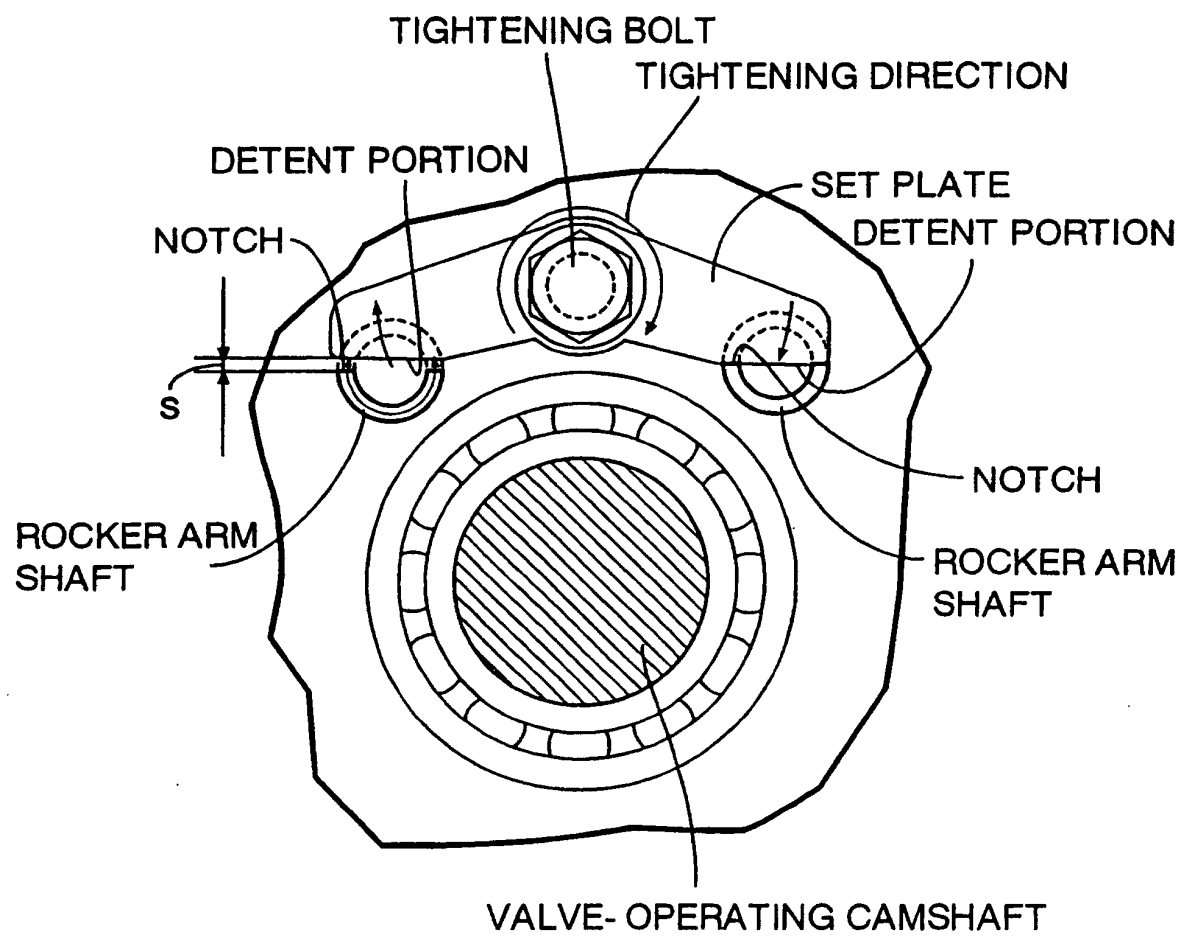


FIG.5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP02/08678

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl⁷ F01L1/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int.Cl⁷ F01L1/18, F02F1/24

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1926-1996 Toroku Jitsuyo Shinan Koho 1994-2002
 Kokai Jitsuyo Shinan Koho 1971-2002 Jitsuyo Shinan Toroku Koho 1996-2002

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 9-177511 A (Yamaha Motor Co., Ltd.), 08 July, 1997 (08.07.97), Par. Nos. [0028] to [0034]; Figs. 3, 5, 6, 8, 9 (Family: none)	1
A	JP 8-109810 A (Honda Motor Co., Ltd.), 30 April, 1996 (30.04.96), Par. Nos. [0018], [0019], [0043]; Figs. 8, 9 (Family: none)	1
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 31221/1976 (Laid-open No. 123215/1977) (Suzuki Motor Co., Ltd.), 19 September, 1977 (19.09.77), Page 2, line 11 to page 3, line 14; Fig. 2 (Family: none)	1

☐ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

* Special categories of cited documents:	"I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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