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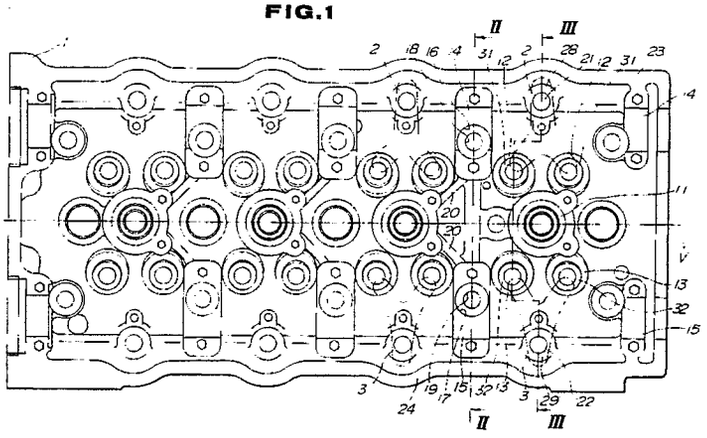
(54) Cylinder head of internal combustion engine.

(57) A cylinder head (1) of a DOHC internal combustion engine has a plurality of bearing sections which are located in the vicinity of each cylinder of the engine. Each of the bearing sections has a head bolt insertion-hole (16, 17) which vertically extends to pass through the bearing section and is connected with a head bolt hole (18, 19) located therebelow. Furthermore, Y-shaped rocker arms (2, 3) of the end pivot type are disposed on the cylinder head (1) so that each swinging end of the rocker arm (2, 3) for the intake valves (51) and that for the exhaust valves (52) are disposed opposite to each other. Therefore, an angle defined between the stems of the intake and exhaust valves can become small. This can make flatter the inclination of the upper surface of the combustion chamber, thereby contributing to setting the engine in a suitable compression ratio. Additionally, since the distance between the intake and exhaust camshafts (44, 45) can be suppressed relatively short, the lateral width of the cylinder head (1) becomes short.

FIG.1



BACKGROUND OF THE INVENTION

1. Field of the Invention

EP 0 416 600 A1

The present invention relates to improvements in a cylinder head structure with which an engine is improved with respect to its performances and size.

2. Description of the Prior Art

It is well known that an internal combustion engine uses a valve mechanism having double overhead camshafts (DOHC) which are provided to operate two intake valves and two exhaust valves for each cylinder of the engine. A cylinder head used for such a DOHC engine is disclosed, for example, in Japanese Patent Publication No. 1-22464. In this cylinder head, a rocker arm of the end pivot type is disposed between each of the camshafts and each of the intake and exhaust valves so that the intake and exhaust valves can be sufficiently lifted. Each pivot for supporting each rocker arm is disposed at a nearer position than the camshaft relative to a cylinder axis and is installed in a boss which is formed around a spark plug boss of each cylinder. Other configurations such as oil passages for supplying the oil to the pivots are located on the central part of the cylinder head.

However, with this structure since the length of the rocker arm enlarges an angle defined between an intake valve stem and an exhaust valve stem, the inclination of the upper surface of the pentroof type combustion chamber is increased. This causes the problem that maintaining a sufficient compression ratio becomes difficult. Additionally, since the distance between an intake valve camshaft and an exhaust valve camshaft is increased, the lateral width of the cylinder head becomes larger.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an improved cylinder head which provides a high performance engine which has a large lifting amount of intake and exhaust valves and a high compression ratio while being small in size.

A cylinder head of a double overhead camshaft internal combustion engine comprises a plurality of bearing sections disposed in the vicinity of each cylinder of the engine. The bearing sections support two camshafts of the engine. A head bolt is inserted through a first hole which vertically extends and passes through each bearing section. A second hole vertically extends and is connected and coaxial with the first hole. The second hole is located under the first hole and opens to outside of the cylinder head. The second hole receives the head bolt with which the cylinder head is fixedly secured to a cylinder block.

In this structure, since each of the bearing sections is formed to have the first hole under which the second hole is formed, the head bolt and bearing section can be disposed in the vicinity of each of the cylinders. In addition, if the rocker arm is formed in a Y-shape and operates two valves of the intake or exhaust system, a space for the pivot will be formed at a side section of the cylinder head.

With this structure, each swinging end of the rocker arm for the intake valve and that of the exhaust valve can be disposed opposite to each other so that the axis of the intake valve stem and the axis of the exhaust valve stem can form a small angle therebetween. Therefore, the upper surface of the combustion chamber of the pentroof type becomes flatter, so that the engine can have a high compression ratio while becoming small in size.

BRIEF DESCRIPTION OF THE DRAWING

Fig. 1 is a plan view of a first embodiment of a cylinder head according to the present invention;

Fig. 2 is a side cross-sectional view of the cylinder head taken in the direction of arrows substantially along the line II-II of Fig. 1;

Fig. 3 is a side cross-sectional view of the cylinder head taken in the direction of arrows substantially along the line III-III of Fig. 1;

Fig. 4 is a plan view of an intake port and a pivot installation hole of the cylinder head of Fig. 1;

Fig. 5 is a plan view of a second embodiment of a cylinder head according to the present invention; and

Fig. 6 is a side cross-sectional view of the cylinder head taken in the direction of arrows substantially along the line VI-VI of Fig. 5.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to Fig. 1, there is shown a first embodiment of a cylinder head 1 according to the present invention. The cylinder head 1 forms part of a four cylinder internal combustion engine having double overhead camshafts (DOHC). Two intake valves 51 and two exhaust valves 52 are provided for each cylinder (not shown) of the engine. The cylinder head 1 has a spark plug boss 11 located on the central part of each of the cylinders. The intake and exhaust valves 51, 52 are slidably installed respectively in valve bosses 12, 13 which are so located as to surround the spark plug boss 11. Bearing sections 14, 15 are formed on the

cylinder head 1 and located respectively in the vicinity of each cylinder or in such positions as to surround each cylinder. The bearing sections 14 support an intake valve camshaft 44 which operates the intake valves 51. Similarly the bearing sections 15 support an exhaust valve camshaft 45 which operates the exhaust valves 52. Each of the bearing sections 14, 15 and the spark plug boss 11 are interconnected with a rib 20 so that an engine rigidity is improved.

As shown in Fig. 2, each of the bearing sections 14, 15 has a head bolt insertion-hole 16, 17 which vertically extends through the bearing sections 14, 15. The head bolt insertion-hole 16, 17 is aligned and communicates with head bolt hole 18, 19 which vertically extends to be coaxial with the head bolt insertion-hole 16, 17, so that the aligned head bolt insertion-hole and head bolt hole pass through the cylinder head 1. Head bolts 7 for connecting the cylinder head 1 and a cylinder block 9 are installed in a state that the head of the head bolt 7 is mounted on the shoulder formed between the head bolt hole 18, 19 and the head bolt insertion-hole 16, 17. The threaded section of the head bolt 7 is screwed into the cylinder block 9. With this arrangement, the head bolts 7 can be disposed between the cylinders at predetermined intervals to fixedly secure the cylinder head 1 on the cylinder block 9 through a gasket (not shown), so that a good sealing is obtained between the cylinder block 9 and the cylinder head 1.

In order to operate the intake and exhaust valves 51, 52 in accordance with the rotation of the camshafts 44, 45, generally Y-shaped rocker arms 2, 3 are movably installed on the cylinder head 1. Thus, one end section of the rocker arm 2, 3 is bifurcated into two portions which are respectively brought into contact with the top ends (no numeral) of the intake and exhaust valves 51, 52. The other end of each rocker arm 2, 3 is pivotally supported by each pivot 41, 42 on the cylinder head 1.

As shown in Fig. 3, the pivot 41, 42 is disposed in each pivot installation hole 21, 22 which is formed in the boss section 28, 29. The boss section 28, 29 is disposed adjacent each side wall 23, 24 whose surface forms part of the peripheral surface of the cylinder head 1. The side walls 23, 24 are generally parallel with the axis of the camshaft 44, 45. There is shown an imaginary vertical plane V including an axis of the cylinder head in Fig. 1, 2 and 3. The pivot 41, 42 is located outside of the camshaft relative to the vertical plane V.

As shown in Figs. 3 and 4, the cylinder head 1 is formed with an intake port 4 of a siamese shape. The intake port 4 has one passage 4a at its upstream side and is branched into two passages 4b communicable with each cylinder so that intake air is guided into each cylinder with the two passages 4b of each intake port 4. The pivot installation hole 21 is formed between the two passages 4b of the intake port 4 with a predetermined depth. A hydraulic rash adjuster 46, 47 is inserted in each of the pivot installation holes 21, 22 so that the pivot 41, 42 is supported under a hydraulic power. The pivot installation holes 21, 22 are connected respectively with holes 30a, 30b through which remained air is discharged when the rash adjuster 46, 47 is inserted in each of the pivot installation holes 21, 22.

Each valve guide 31, 32 of a tube-shape is inserted into each hole (no numeral) which is formed at the valve boss 12, 13. For a combustion chamber C of the pentroof type shown in Fig. 3, valve seats 33, 34 are provided respectively at the ends of the intake and exhaust ports 4, 5. Numeral 35 indicates water jackets through which cooling water flows to cool the engine.

A pair of generally straight oil passages 25, 26 are formed in the cylinder head 1 to connect the pivot installation holes 21, 22 with each other. The hydraulic oil is supplied to each rash adjuster 46, 47 through the oil passage 25, 26 and lubricates a sliding surface of the pivot 41, 42. Each camshaft bracket 6 is fixedly secured on each of the bearing sections 14, 15 with two bolts in order to support each of the camshafts 44, 45. A pipe-shaped member 8 defining therein an oil passage is disposed on the camshaft bracket 6 so that the lubricating oil is sprayed over the sliding surfaces of the camshafts 44, 45 and of the stems of the intake and exhaust valves 51, 52.

The manner of operation of the thus arranged cylinder head will be discussed hereinafter.

In an assembly operation of the engine, the head bolt 7 and a tightening tool thereof are set over the head bolt hole 18, 19 through the head bolt insertion-hole 16, 17 which vertically passes through the cylinder head 1 and is formed through each bearing section 14, 15 before the cylinder head 1 and the cylinder block 9 are secured to each other with the head bolts 7.

In this structure, since the head bolt hole 18, 19 is formed located under the bearing section 14, 15, the head bolt 7 and the bearing section 14, 15 can be positioned in the vicinity of the cylinder.

Additionally, since the Y-shaped rocker arm is used in this arrangement in the above-mentioned structure, the boss 28, 29 for the pivot installation hole 21, 22 can be formed at a position far from the spark plug boss 11 as compared with the bearing sections 14, 15 and in the vicinity of the side wall 23, 24 of the cylinder head 1.

With this structure, since each swinging end of the rocker arm 2 for the intake valves 51 and that of the rocker arm 3 for the exhaust valves 52 can be disposed opposite to each other, the angle

defined between the stems of the intake and exhaust valves 51, 52 can become small without being restricted by the length of the rocker arm 2, 3. This can make flatter the inclination of the upper surface of the combustion chamber, thereby contributing to setting the compression ratio of the internal combustion engine at a high value. Additionally, since the distance between the intake and exhaust camshafts can be suppressed relatively short, the lateral width of the cylinder head becomes short.

Figs. 5 and 6 illustrate a second embodiment of the cylinder head 1 similar to the first embodiment. In this embodiment, each camshaft bracket 36, 37 is integrally formed in a beam shape and has each oil passage 38, 39 therein. With this structure, the lubricating oil is sprayed from the oil passage 38, 39 to the sliding surfaces of the camshafts 44, 45 and the stems of the valves 51, 52 through injection holes (not shown) which are formed in the camshaft brackets 36, 37.

Claims

1. A cylinder head of a double overhead camshaft internal combustion engine, comprising:
a plurality of bearing sections disposed in the vicinity of each cylinder of the engine, said bearing sections supporting two camshafts of the engine;
means defining a first hole through which a head bolt is inserted, said first hole vertically extending and passing through each bearing section; and
means defining a second hole which vertically extends and is connected and coaxial with said first hole, said second hole being located under said first hole and opening to outside of said cylinder head, said second hole receiving said head bolt with which said cylinder head is fixedly secured to a cylinder block.

2. A cylinder head as claimed in Claim 1, further comprising a Y-shaped rocker arm whose branched ends are contactable with top ends of intake valves and exhaust valves, and a pivot which is disposed adjacent the outer periphery of said cylinder head so that the other end of said rocker arm is pivotally supported at said pivot.

3. A cylinder head as claimed in Claim 1, further comprising two intake valves and two exhaust valves for each cylinder of the engine.

4. A cylinder head as claimed in Claim 1, wherein said first hole is a head bolt insertion-hole through which said head bolt fixedly secures said cylinder head with a cylinder block.

5. A cylinder head as claimed in Claim 1, further comprising means defining an intake port formed in a siamese shape, said intake port having one passage at upstream side and is branched into two passages so that intake air is guided into each cylinder with the two passages.

6. A cylinder head as claimed in Claim 1, wherein said cylinder head is secured to a cylinder block with said head bolt in a manner that said head bolt is screwed into the cylinder block through said second hole.

7. A cylinder head as claimed in Claim 1, further comprising means defining a generally straight oil passage through which lubricating oil is supplied to sliding surfaces of the camshaft and of stems of intake and exhaust valves.

8. A cylinder head as claimed in Claim 1, wherein said camshaft is rotatably supported between said bearing section and a camshaft bracket, said camshaft bracket being fixedly secured to the bearing section with two bolts.

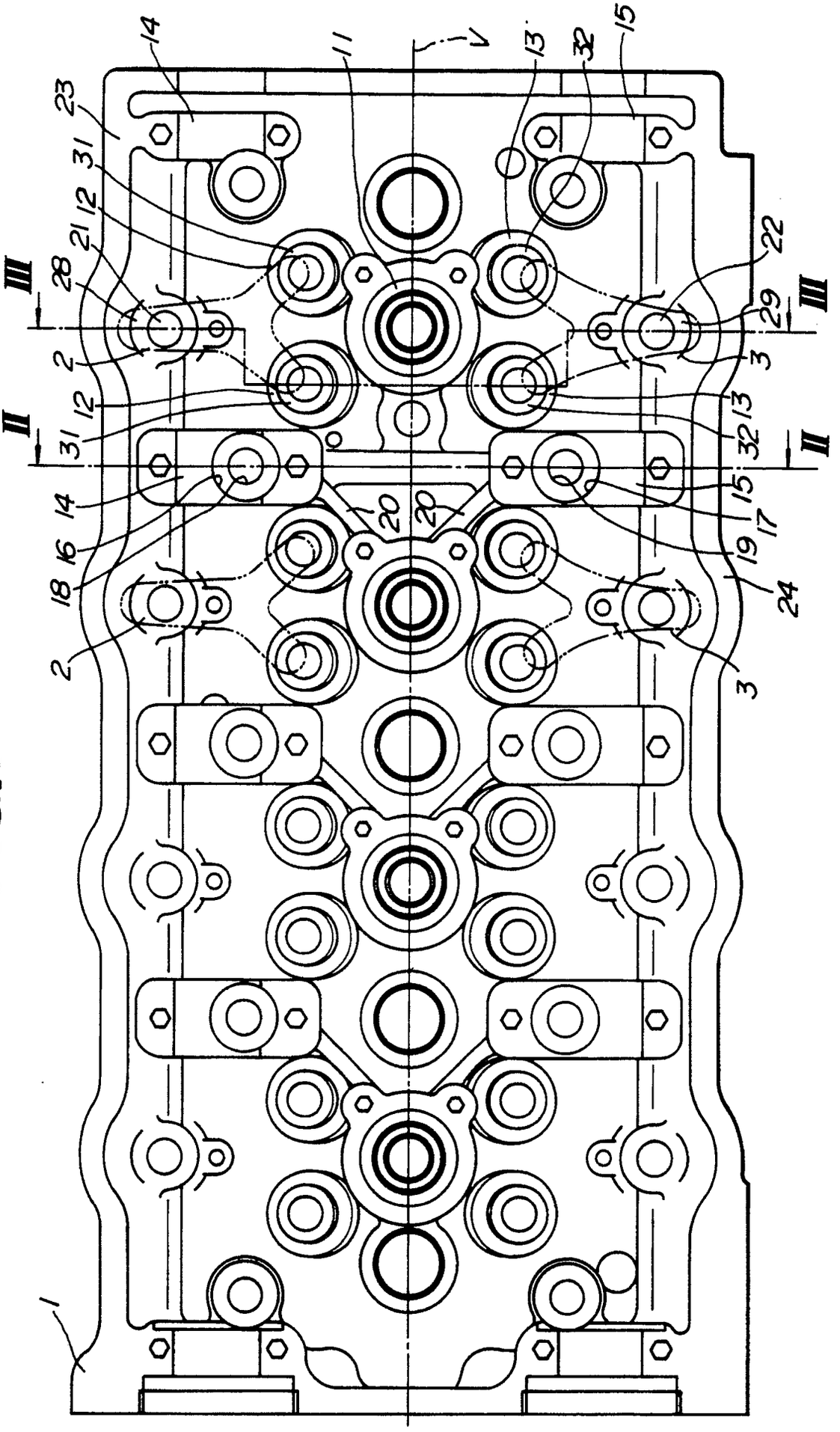
9. A cylinder head as claimed in Claim 8, wherein said camshaft bracket has an oil passage defined by a pipe thereon so that lubricating oil is sprayed over the sliding surfaces of said camshaft and of said intake and exhaust valves through said passage.

10. A cylinder head as claimed in Claim 9, wherein said camshaft bracket is integrally formed in a beam shape and has an oil passage therein.

11. A cylinder head of an internal combustion engine having a pair of camshafts, an intake valve and exhaust valve for each cylinder thereof, each valve being contactable with an end section of rocker arm, the other end section of the rocker arm being pivotally supported by a pivot which is located outside of said camshaft relative to a vertical plane containing an axis of said cylinder head, said cylinder head comprising:
a plurality of bearing sections disposed in the vicinity of each cylinder of the engine, said bearing sections supporting two camshafts of the engine;
means defining head bolt insertion-hole through which a head bolt is inserted, said head bolt insertion-hole vertically extending and passing through each bearing section; and
means defining a head bolt hole vertically extends and is connected and coaxial with said head bolt insertion-hole, said head bolt hole being located under said head bolt insertion-hole and opening to outside of said cylinder head, said head bolt hole receiving said head bolt.

12. A cylinder head of an internal combustion engine having two camshafts, and two engine valves for each cylinder thereof, said cylinder head comprising:
a rocker arm contacted with said engine valves at its first end to operate said engine valves;
a pivot swingingly supporting a second end of said rocker arm, said pivot being installed to said cylinder head;
means for located said pivot outside said camshaft relative to a vertical plane containing an axis of

said cylinder head;
a plurality of bearing sections disposed in the vicinity of each cylinder of the engine, said bearing sections supporting two camshafts of the engine;
means defining head bolt insertion-hole through which a head bolt is inserted, said head bolt insertion-hole vertically extending and passing through each bearing sections; and
means defining a head bolt hole which vertically extends and is connected and coaxial with said head bolt insertion-hole, said head bolt hole being located under said head bolt insertion-hole and opening to outside of said cylinder head, said head bolt hole receiving said head bolt hole.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V
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32
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23
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28
III
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FIG.1

FIG.2

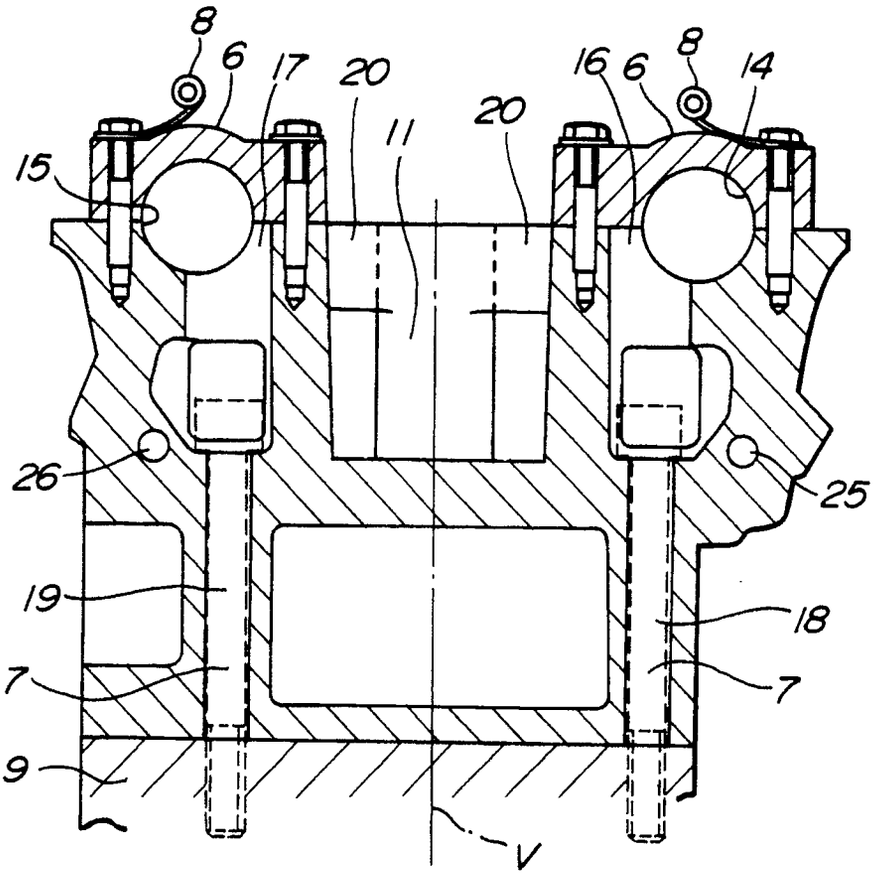
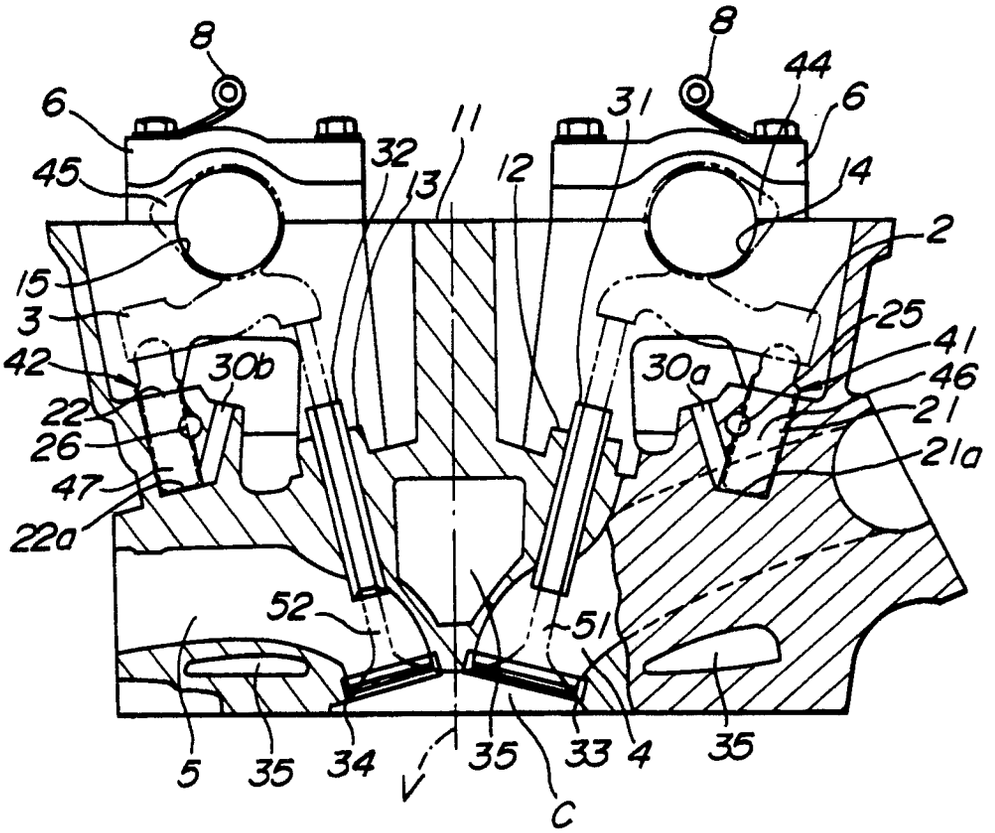


FIG. 3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45
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41
42
30b
30a
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22a
52
51
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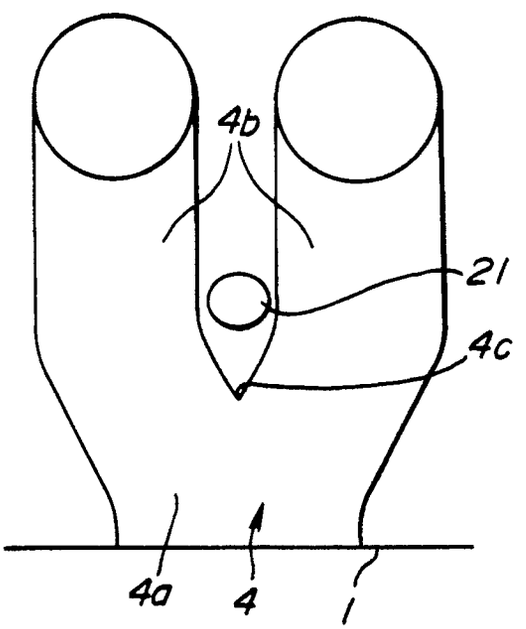
35
33
4
35
V
C

FIG. 4


4b
21
4c
4a
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1

FIG.5

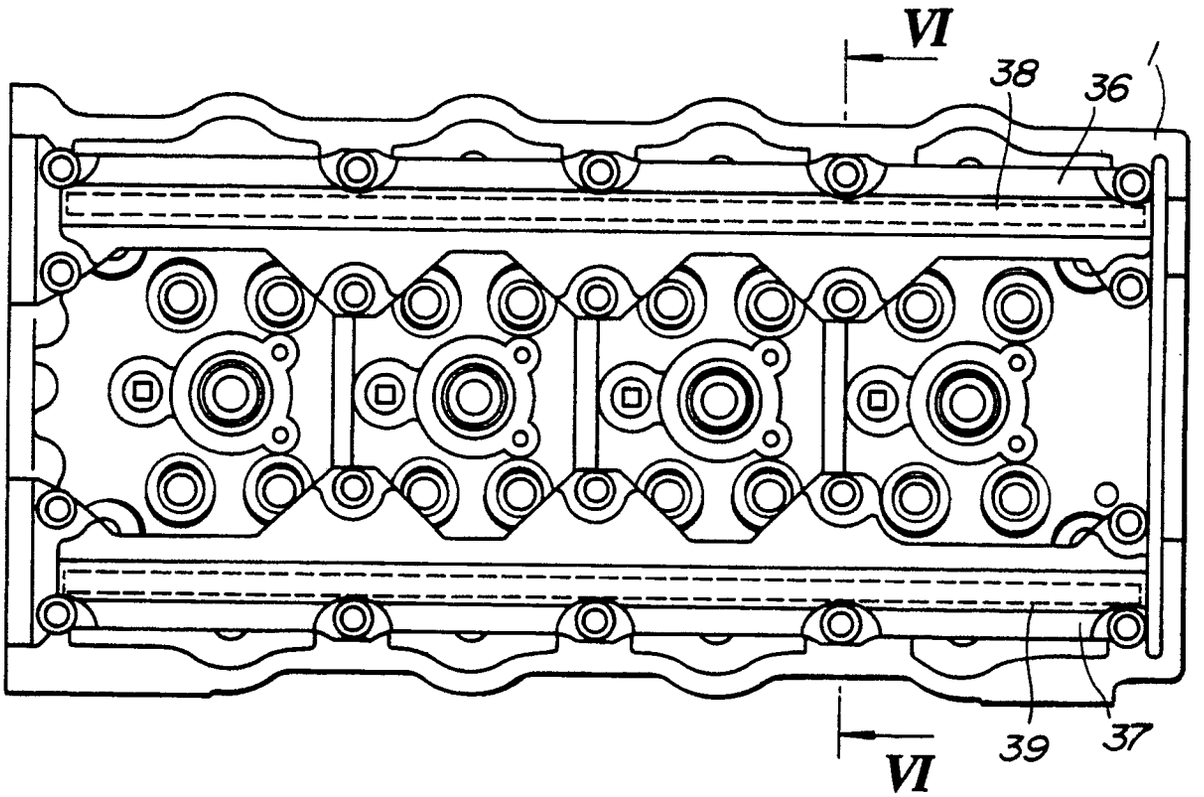
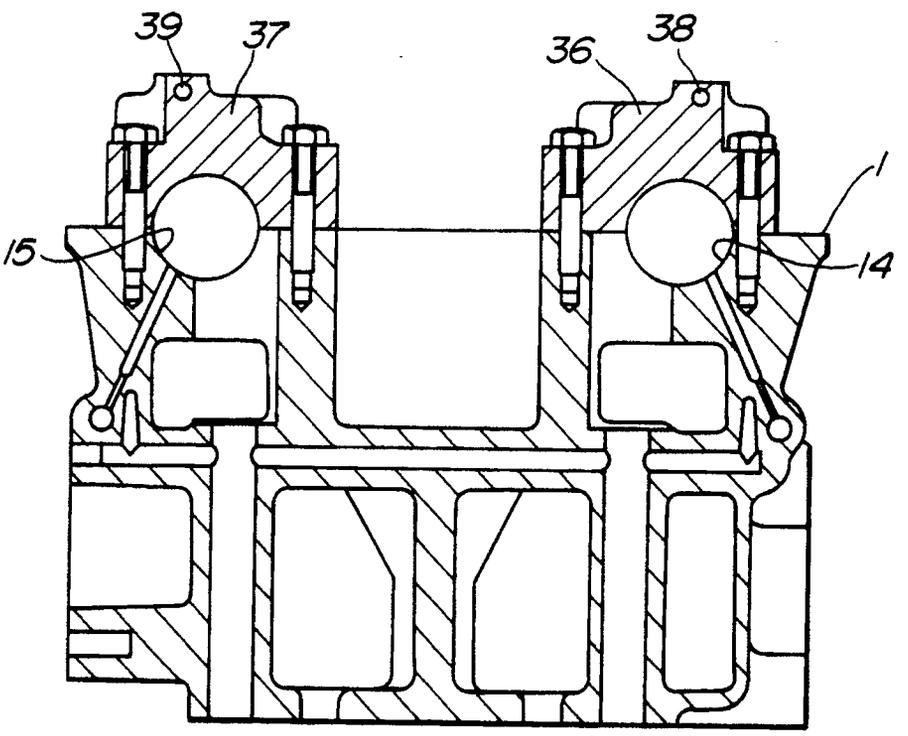


FIG.6



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EUROPEAN SEARCH REPORT

Application Number

EP 90 11 7130

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)
P,X	GB-A-2216187 (NISSAN) * the whole document * ---	1-12	F02F1/42 F01L1/26 F01L1/04
X	EP-A-323233 (HONDA) * column 4, line 30 - column 6, line 16; figure 11 * ---	1-10	
A	US-A-4641609 (MAZDA) * column 3, line 4 - column 4, line 52; figure 4 * ---	1	
A	DE-A-3545448 (BMW) * the whole document * -----	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

F02F
F01L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	23 OCTOBER 1990	WASSENAAR G.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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