(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 146 254**
A1

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **84307672.0**

(22) Date of filing: **07.11.84**

(51) Int. Cl.⁴: **F 02 F 1/38**, F 02 F 1/42, B 22 C 9/10

(30) Priority: **02.12.83 GB 8332318**

(43) Date of publication of application: **26.06.85 Bulletin 85/26**

(84) Designated Contracting States: **BE DE FR GB IT NL SE**

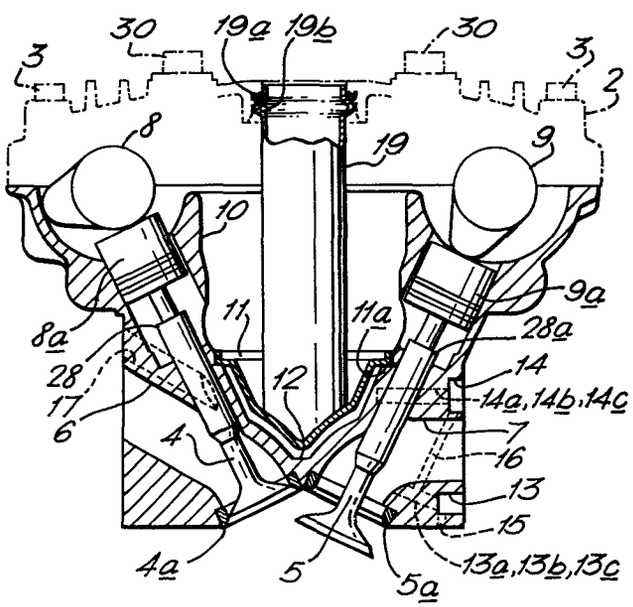
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(54) Cylinder head.

(57) A cylinder head has cooling passages 12 for cooling the inlet and exhaust valves 4, 5 formed by the bottom of a deep recess 10 cast into the head and a cup 11 seated for example on a ledge 11a in the recess and secured thereto around its periphery. The cooling passage 12 is communicated with by means of drillings 13a to 13c, 14a to 14c and 17. The cup 11 has an aperture for a sparking plug 18 which may have a protective tube 19. An advantage of the construction is that wide cooling passages can be achieved but without recourse to sand cores with their inherent disadvantages.



EP 0 146 254 A1

CYLINDER HEAD

This invention relates to cylinder heads for internal combustion engines.

To form liquid cooling passages in such heads, it is conventional to cast the cylinder head around sand cores which are destroyed when the casting has set to reveal the cooling passages.

However, the use of sand cores has well known disadvantages and it is known to avoid them by using as cooling passages drillings or channels cast into the combustion chamber face of the cylinder head. It has also been proposed (United States Patent Specification No 3 022 775) to form the cylinder head in multiple sections split about planes perpendicular to the cylinder axes, in order to provide cooling passages without recourse to sand coring.

It has also been proposed to provide a pair of separate closing members (for each cylinder) attached to the remainder of the head, to define the head water jacket, in order to make the fabrication of the remainder of the head easier (United Kingdom Patent Specification No. 579 664 and United States Patent Specification No. 2 990 819).

It has also been proposed to provide a flat closing disc in the region between inclined inlet and exhaust valves in a head having cooling channels and recesses shaped to be die cast without coring, the closing disc defining a region providing communication between the cooling channels. (United Kingdom Patent Specification No. 1 201 363).

The invention provides a cylinder head in which the inlet and exhaust valves for each cylinder are inclined relative to and on opposite sides of the plane of the cylinder axes, the head comprising a casting having a recess for each cylinder extending, from the face that is opposed to the combustion chamber face, between the inlet and exhaust valves to the region of the associated exhaust port or ports, and a closing member which is inserted into each recess and connected at its periphery to the surface of that recess to define a cooling passage, the closing member having an aperture for insertion of a sparking plug.

The Applicants have discovered that the cooling jacket defined by the closing member can provide a substantial amount of the head cooling for each cylinder, making extensive additional cooling channels and recesses unnecessary, while avoiding the need for sand cores.

Advantageously, the closing member is dished in shape and may be profiled to follow the contour of the adjacent surfaces of the recess, around the periphery that contacts the recess, and/or over its depth. The closing member may be a pressing. The arrangement is particularly suited to four valves per cylinder, and a suitable inclination between inlet and exhaust valves in 40^{o} to 60^{o}.

The sparking plug may be surrounded by a tube, in order to protect it from any oil in the head.

The inlet and exhaust ports may be defined by mould pieces, which are withdrawn from the casting when set: two such pieces may be provided for each port, to be withdrawn from opposite ends of the port, at least one of which may be withdrawn on a curved path.

The casting may be sand or die-cast, preferably pressure die-cast, and should not have undercuts, to facilitate manufacture.

Various drillings may be made in the finished castings, for example to communicate with the cooling passages defined by the casting and the closing member, and to accommodate the valve stems and valve guides.

A four valve per cylinder head for a spark ignition engine and its method of manufacture will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a section through a die for use in manufacture of the head casting, the section being normal to the length of the head (that is, normal to the crankshaft of the assembled engine) and through the plane of a pair of inlet and exhaust valves;

Figure 2 is a section through a fragment of the die shown in Figure 1, also normal to the length of the head but through the axis of the sparking plug;

Figure 3 is a section through a moulding box into which the die of Figures 1 and 2 is entered, the section being normal to the length of the head and through the plane of a pair of inlet and exhaust valves;

Figure 4 shows the die and moulding box of Figures 1 to 3 brought together for casting the head;

Figure 5 is a section through the assembled cylinder head, the section being normal to the length of the head and through the plane of a pair of valves;

Figure 6 is a section through a fragment of the cylinder head, the section being normal to the length of the head but through the axis of the sparking plug; and

Figure 7 is a section through the assembled head, the section being normal to the cylinder axes, and the metal cup and sparking plug being omitted for clarity.

Referring to figures 5 to 7 of the accompanying drawings, the cylinder head comprises a casting 1, the upper face of which is closed by a valve gear cover 2 secured by bolts 3. The head has two inlet valves 4 and two exhaust valves 5 per cylinder in inlet ports 6 and exhaust ports 7, respectively. The valves are driven by respective overhead camshafts 8, 9 via bucket tappets 8a, 9a.

The casting 1 has for each cylinder a recess 10 extending from its upper face to the region of the inlet and exhaust ports 6, 7. A closing member in the form of a metal cup 11 is inserted into the recess and is connected around its periphery to a ledge 11a on the surface of the recess 10, thereby defining a cooling passage 12 adjacent the valves 4, 5.

Cooling liquid passes through cooling passage 12 by means of cast-in recesses 13, 14 and by means of various drillings.

Thus, cooling liquid enters recess 13 (which is closed on the right hand side as seen in figures 5 to 7 by a plate which is not shown) from the block via inlet drillings 15. It passes to the lower part of the cooling passage 12 via drillings 13a, 13b and 13c, and also to recess 14 by means of drillings 16. Recess 14 is similarly closed on the right hand side by a plate which is not shown, and liquid passes to the upper part of cooling passage 12 via drillings 14a, 14b and 14c. Liquid flows right to left as seen in the drawings and leaves via wide drilling 17. If desired, additional outlet passages could be drilled from the lower part of the cooling passage beneath the drilling 17.

The cup 11 has an aperture for a sparking plug 18 which is protected from the oil in the valve gear region of the head by tube 19. The plug 18 is threaded into a boss 18a in the casting and the cup 11 seats against the top of the boss around the sparking plug. Threading the plug 18 into the boss secures the protective tube in position, and also assists in holding the cup 11 in position.

The valve gear cover 2 seals against a shoulder 19b on the tube via an O-ring 19a.

It will be understood that various operations have to be

performed on the casting 1 to complete the cylinder head. The drillings 13a to 13c, 14a to 14c, and 15 to 17 are made, and drillings are also made for receiving inlet valve guide 28 and exhaust valve guides 28a. The cup 11 is secured in position. Valve seats 4a and 5a are inserted, the valve guides 28, 28a, valves 4, 5, and tappets 8a, 9a are inserted, and then camshafts 8 and 9 are bolted onto the casting. Finally, tubes 19 are inserted and the sparking plugs 18 are threaded in position. The head is secured to a block by means of cylinder head attachment bolts 30 which may be bolted down on top of the valve gear cover 2, which also has additional bolts 3.

The casting 1 is designed without undercuts so that it can be cast easily. Thus, referring to figures 1 to 4, a moulding box 20 receives a die 21 which together form the outer periphery of the casting and its deep recess 10. The moulding has sliders 22, 23 which leave spaces for the valve springs (not shown) and mould pieces 24, 25 for the inlet ports and 26, 27 for the outlet ports. Mould pieces 24, 27 and sliders 22, 23 can be withdrawn in a straight line when the casting has set. Mould pieces 25, 26 are withdrawn on a curved path when the casting has set.

The casting is pressure die-cast, but could be gravity die-cast or cast in a sand mould. The material is aluminium alloy, but

other metals or alloys could be used if desired.

The cup 11 is secured in position by a press fit, but it could be secured in position by the wall above it being turned down onto the periphery of the cup (staking). Alternatively the cup 11 could be rivetted, or secured by adhesive such as epoxy adhesive. The cup 11 is an aluminium alloy pressing but other materials could be used.

The cup 11 could be integral with the tube 19, for example, the composite member could be a casting or a pressing.

Equally the sparking plug 18 need not play any part in securing the cup 11 in position. Thus, the cup 11 could engage the upstanding wall of the boss 18a instead of its top surface. The protective tube could also engage the upstanding wall of the boss 18a. This arrangement could also be achieved with an integral arrangement of cup 11 and tube 19.

Also, the use of cup 11 is not confined to engines with four valves per cylinder, and could be used with two valves or three valves per cylinder.

CLAIMS

1 A cylinder head in which the inlet and exhaust valves for each cylinder are inclined relative to and on opposite sides of the plane of the cylinder axes, the head comprising a casting having a recess for each cylinder extending, from the face that is opposed to the combustion chamber face, between the inlet and exhaust valves to the region of the associated exhaust port or ports, and a closing member which is inserted into each recess and connected at its periphery to the surface of that recess to define a cooling passage, the closing member having an aperture for insertion of a sparking plug.

2 A cylinder head as claimed in claim 1, wherein the closing member is dished in shape.

3 A cylinder head as claimed in claim 1 or claim 2, wherein the closing member is a pressing.

4 A cylinder head as claimed in any one of claims 1 to 3, wherein the angle between the inlet and exhaust valves lies between 40° and 60°.

5 A cylinder head as claimed in any one of claims 1 to 4, wherein there are four valves per cylinder and the sparking plug is positioned between the pairs of inlet and exhaust valves.

6 A cylinder head as claimed in any one of claims 1 to 5, wherein a boss is provided for each cylinder in which the sparking plug is positioned, and the closing member connects to the periphery of the boss.

7 A cylinder head as claimed in any one of claims 1 to 6, wherein the inlet and exhaust ports are defined by mould pieces.

8 A cylinder head as claimed in claim 7, wherein there are two mould pieces for each port shapes so that they can be withdrawn from the casting one from each end of the port.

9 A cylinder head as claimed in claim 7 or claim 8, wherein a port is so shaped that a mould piece can be withdrawn from the casting on a curved path.

10 A cylinder head as claimed in any one of claims 1 to 9, wherein at least one drilling communicates with each cooling passage.

11 A cylinder head substantially as hereinbefore described with reference to the accompanying drawings.

12 An internal combustion engine having a cylinder head as claimed in any one of claims 1 to 11.

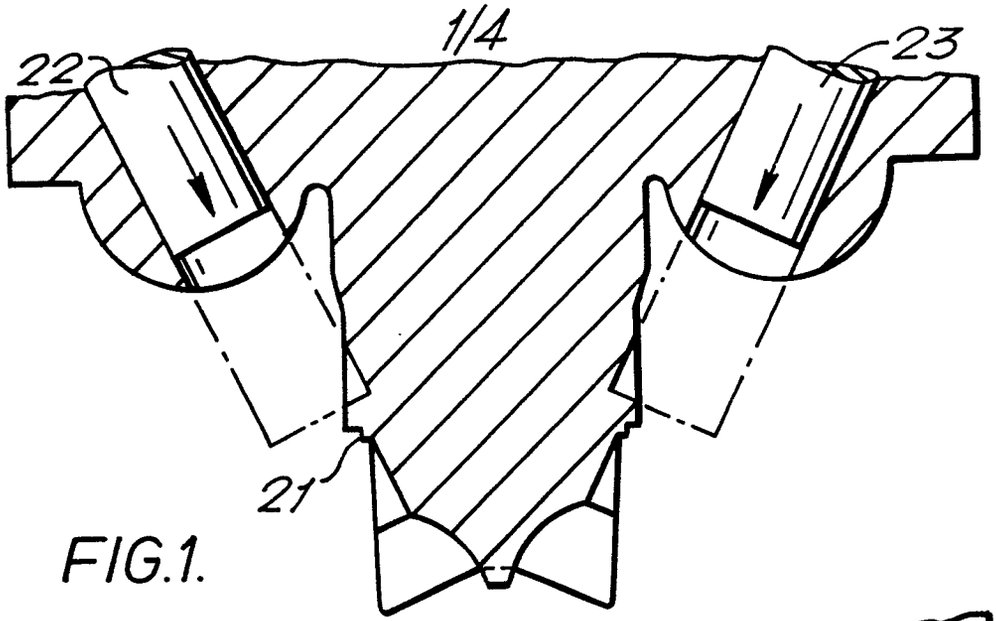


FIG.1.

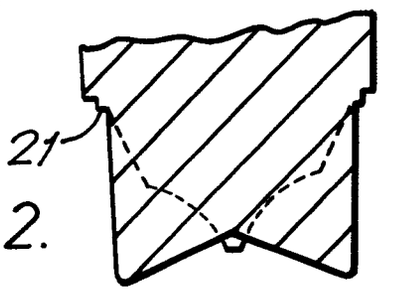
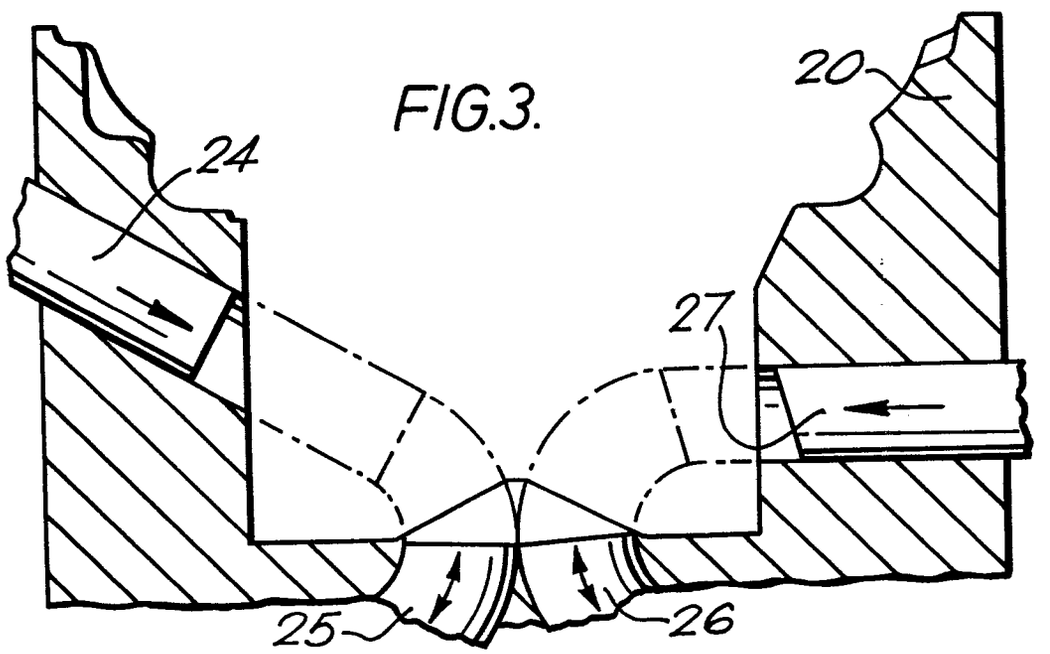


FIG.2.

FIG.3.



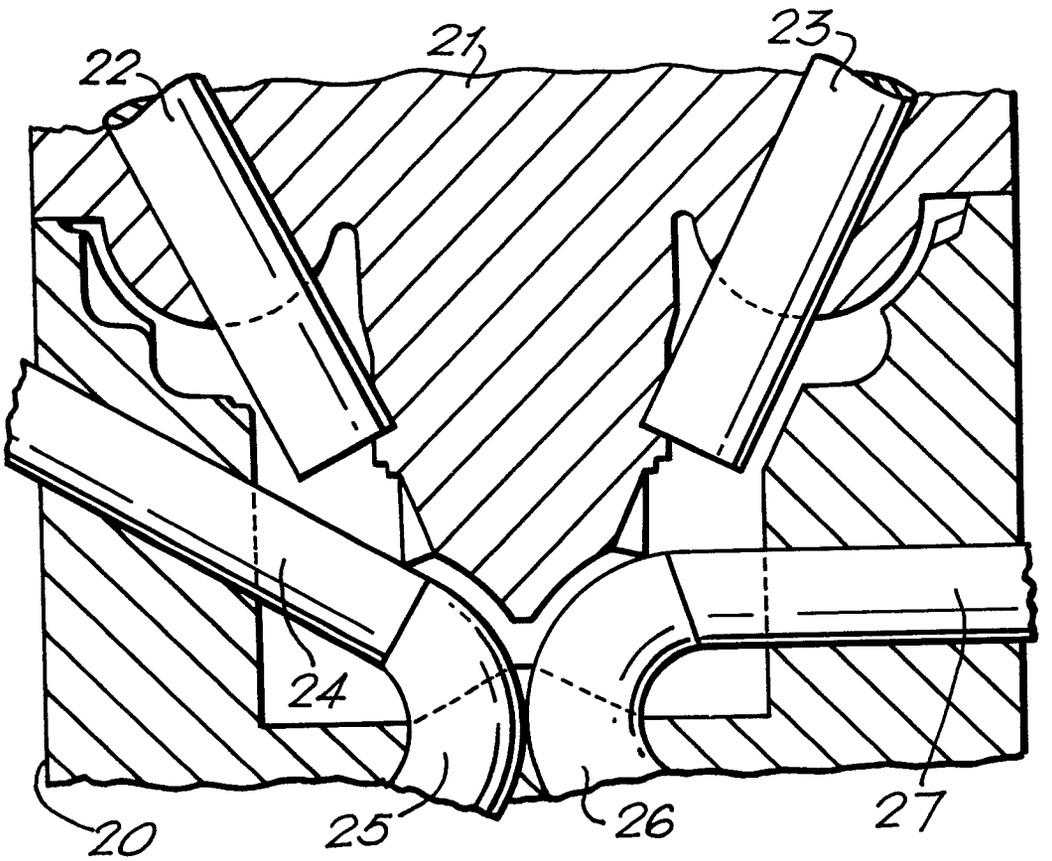


FIG.4.

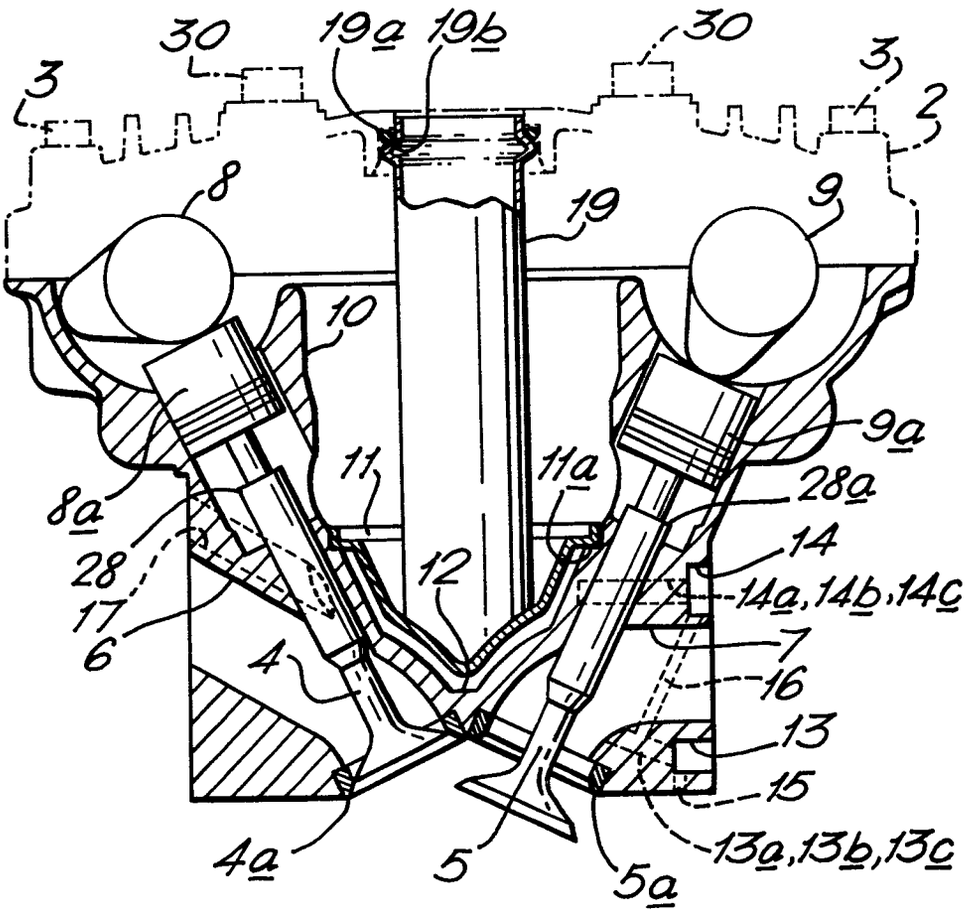

30
19a
19b
30
3
3
2
8
19
9
10
9a
11
11a
28a
8a
28
14
12
14a,14b,14c
17
6
4
7
16
13
15
4a
5
5a
13a,13b,13c

FIG.5.

FIG.6.

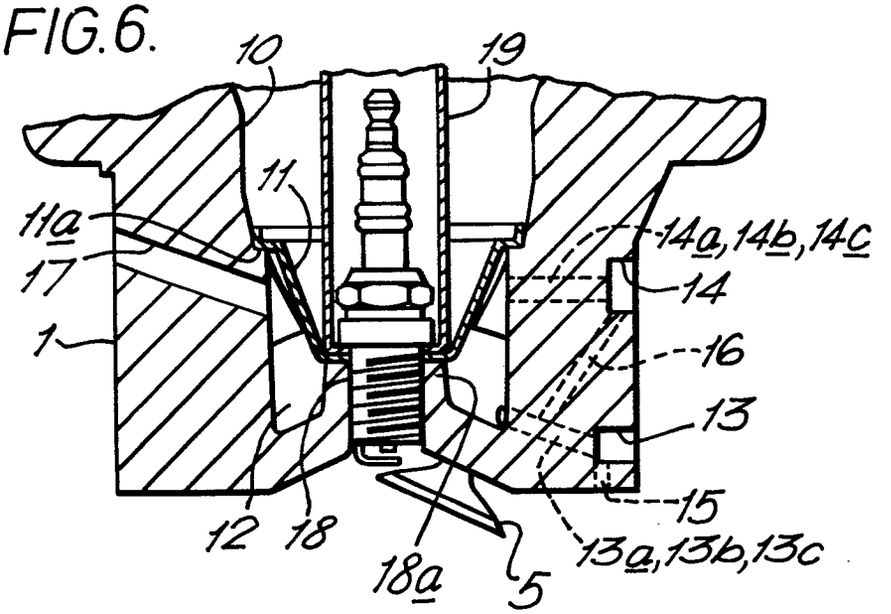
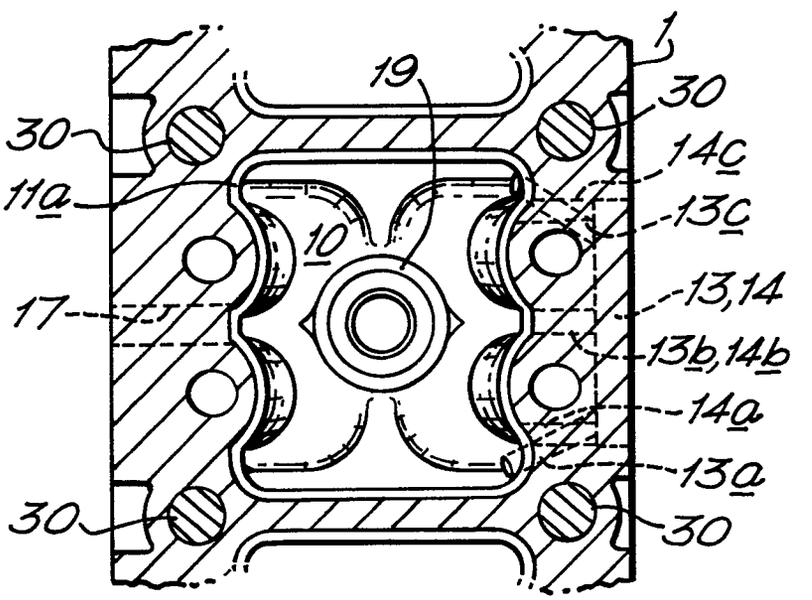

10
19
11
11a
17
1
14a,14b,14c
14
16
13
15
12
18
18a
5
13a,13b,13c

FIG.7.


1
19
30
14c
11a
13c
10
13,14
17
13b,14b
14a
13a
30
30

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Application number

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EUROPEAN SEARCH REPORT

EP 84 30 7672

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.4)
Y	US-A-3 144 013 (RENAULT) * Whole document * ---	1	F 02 F 1/38 F 02 F 1/42 B 22 C 9/10
Y	US-A-2 990 819 (GENERAL MOTORS) * Figure 1; column 2, lines 41-69 * ---	1	
A	DE-C- 395 316 (M. DEUBEL) * Figure 5; page 3, lines 5-26 * ---	1,2,6	
A	FR-A-2 226 231 (AEROPLANE & MOTOR ALUMINIUM CASTING Ltd.) * Page 6, lines 1-34 * ---	7,8	TECHNICAL FIELDS SEARCHED (Int. Cl.4) F 02 F B 22 C
A	CH-A- 277 073 (UNITED MACHINE TOOLS FACTORIES) * Page 2, lines 1 - 34 * ---	9	
A	AU-B- 24 869 (J. BRONOTTE) ---		
A,D	US-A-3 468 295 (RENAULT) --- -/-		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	06-03-1985	WASSENAAR G.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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0146254
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Page 2

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.4)
A,D	GB-A- 579 664 (F.DEHN)		

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

The present search report has been drawn up for all claims

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THE HAGUE	06-03-1985	WASSENAAR G.

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