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(71) Applicant : **FIAT AUTO S.p.A.**
Corso Giovanni Agnelli 200
I-10135 Torino (IT)

(72) Inventor : **Ferrazzi, Francesco**
Piazza Mattirolo 9
I-10149 Torino (IT)

(74) Representative : **Buzzi, Franco et al**
c/o Jacobacci-Casetta & Perani S.p.A. Via Alfieri, 17
I-10121 Torino (IT)

(54) **Cooling circuit of a cylinder head for internal combustion engine.**

(57) A head (1) for an internal combustion engine for motor vehicles has passages for the circulation of a coolant liquid. The passages comprise two longitudinal ducts (11, 12) extending a long the sides of the head and communicating with an inlet (13) situated at one end (1c) of the head. The longitudinal ducts communicate, through a series of transverse passages (17, 18, 19) arranged around the inlet and exhaust ducts (9, 10), with an intermediate circulation chamber (20) formed in correspondence with the tops of the combustion chambers (3), between the tubular projections (4, 5, 6) defining the seats for the inlet and exhaust valves and for the spark plugs of the engine, and communicating with an outlet (14) for the coolant liquid.

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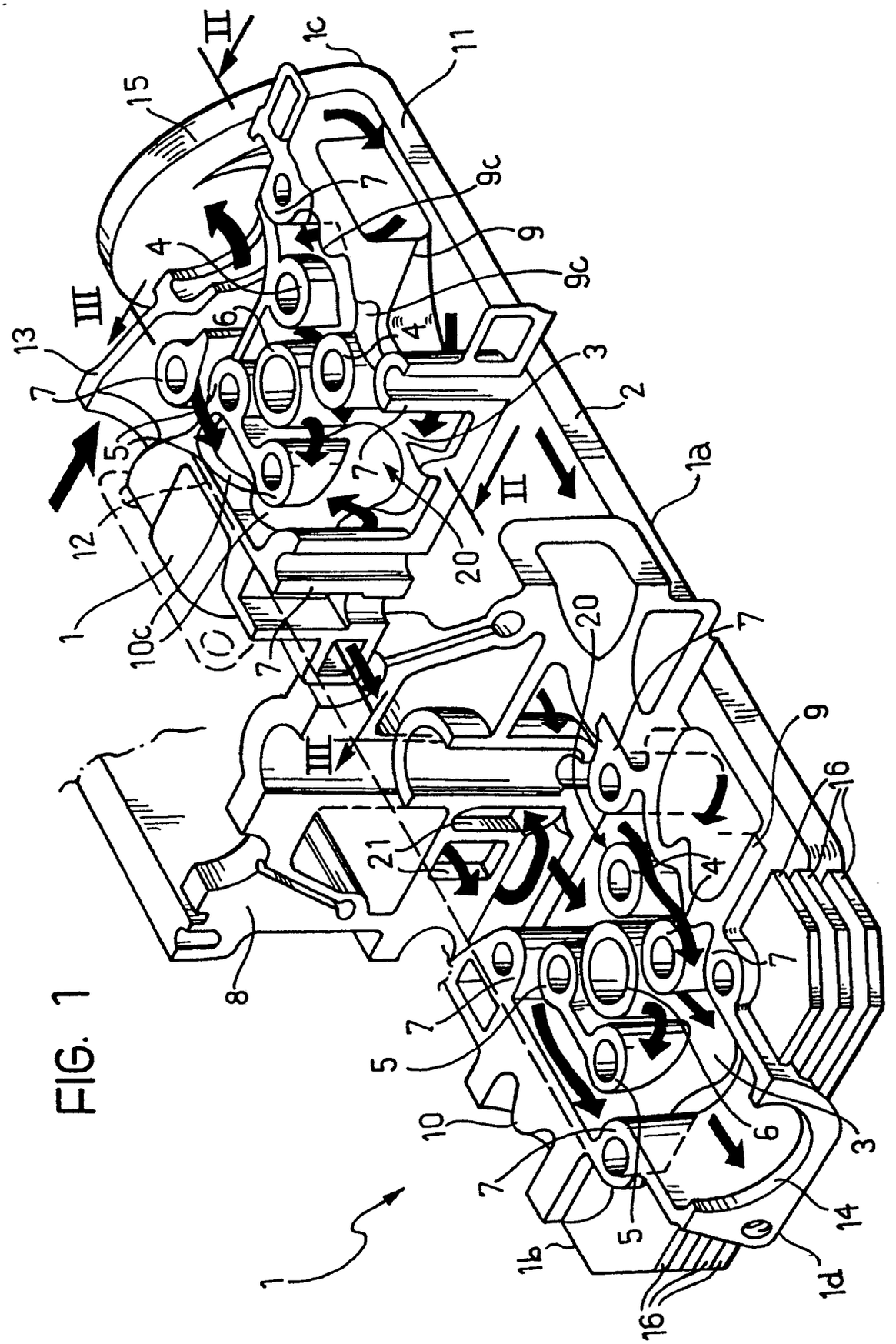


FIG. 1

A HEAD FOR AN INTERNAL COMBUSTION ENGINE FOR MOTOR VEHICLES

The present invention relates in general to heads for internal combustion engines for motor vehicles.

More particularly, the invention is concerned with a unitary head constituted by a body having a base wall which is intended to be applied to a cylinder block and defines the tops of combustion chambers from which sets of tubular projections project to define seats for inlet and exhaust valves and for spark plugs, as well as inlet and exhaust ducts which communicate with the valve seats and open into opposite sides of the head, ducts for the circulation of a coolant liquid communicating with an inlet and an outlet, and an upper chamber for containing the liquid.

In known heads of this type, the ducts for the circulation of the coolant liquid are normally constituted by holes which are intended to be put into communication with corresponding holes in the engine block to which the head is applied and which communicate with an outlet situated at one end of the head. The ducts do not enable the flow of coolant liquid to be directed to specific areas within the head and the cooling is therefore not very effective. This disadvantage is particularly critical in the case of heads for engines with four valves per cylinder, in which the cooling of the tubular projections defining the valve seats is generally ineffective and that of the tubular projections defining the seats for the spark plugs and the walls of the inlet and exhaust ducts is even more so.

The object of the present invention is to avoid this disadvantage and to provide a head of the type defined at the beginning which is formed so as to enable a homogeneous temperature distribution in operation by means of effective cooling by the coolant liquid, particularly in the regions of the tops of the combustion chambers and the respective tubular projections for valves and spark plugs and for the walls of the inlet and exhaust ducts.

According to the invention, this object is achieved by virtue of the fact that the inlet for the coolant liquid is situated at one end of the head and communicates with two longitudinal ducts extending along the sides of the head and beneath the inlet and exhaust ducts; the longitudinal ducts communicate through a series of transverse passages situated around the inlet and exhaust ducts with a longitudinal intermediate circulation chamber formed between the tops of the combustion chambers, the tubular projections for the valves and the spark plugs, the upper walls of the inlet and exhaust ducts, and the containment chamber; a pump for supplying the two longitudinal ducts is associated with the inlet, and the outlet for the coolant liquid is situated at the opposite end of the head from the inlet and is connected to the intermediate chamber.

In a preferred embodiment of the invention, the transverse ducts are formed beneath the exhaust and inlet ducts.

If the head is intended for application to engines having four valves per cylinder with each inlet and exhaust duct formed by two adjacent portions, the transverse passages conveniently include three passages for each exhaust duct, of which the central passage is situated between the two portions of the respective exhaust duct and each side passage is situated beside a respective portion of the exhaust duct, and at least two passages for each inlet duct situated beside respective portions of the inlet duct.

The invention will now be described in detail with reference to the appended drawings, provided purely by way of non-limiting example, in which:

Figure 1 is a partially-sectioned, schematic, partial perspective view of a head for an internal combustion engine according to the invention,

Figure 2 is a section taken on the line II-II of Figure 1, on an enlarged scale, and

Figure 3 is a section taken on the line III-III of Figure 1, on an enlarged scale.

With reference to the drawings, part of a head for a multi-cylinder internal combustion engine for motor vehicles is generally indicated 1. In the embodiment illustrated, the head 1 is intended for application to an engine with controlled ignition and with four valves, two inlet valves and two exhaust valves, for each cylinder.

The head 1 is constituted by a unitary body formed by a base wall 2 which is intended to be applied to the cylinder block and defines the top 3 of the combustion chamber of each cylinder. Two pairs of tubular projections 4, 5 defining the respective seats for the inlet valves and exhaust valves, and an intermediate tubular projection 6 interposed between the two pairs of projections 4, 5 and defining the seat for a spark plug project from each top 3.

The head 1 is also formed with bosses 7 for the insertion of the bolts for fixing it to the engine block and intermediate walls 8 (only one of which is visible in Figure 1) defining bearings for the rotation of a pair of camshafts.

The tubular projections 4 for the inlet valves communicate at their bases with respective inlet ducts 9 which open into the side 1a of the head 1, and the tubular projections 5 for the exhaust valves communicate with respective exhaust ducts 10 which open into the opposite side 1b of the head 1. The upper walls 9c, 10c of the inlet and exhaust ducts 9 and 10 project from the respective tops 3.

As shown in greater detail in Figures 2 and 3, each inlet duct 9 is formed by two adjacent portions 9a, 9b each of which is associated with a respective tubular projection 4. Similarly, each exhaust duct 10

is formed by two adjacent portions 10a, 10b associated with respective tubular projections 5.

The head 1 is formed with internal passages for the circulation of a coolant liquid. According to the invention, these passages comprise two longitudinal ducts 11, 12 extending along respective sides 1a, 1b of the head 1 and communicating at one end 1c thereof with an inlet 13.

A double-volute body 15 of a hydraulic pump is associated with the inlet 13 and is intended to be fitted to the end 1c of the head 1, whilst cooling fins 16 are formed at the other end 1d on opposite sides of an outlet for the coolant liquid.

The two longitudinal ducts 11, 12 communicate with the internal regions of the head 1 through a series of respective transverse passages arranged around the inlet ducts 9 and the exhaust ducts 10.

With reference in greater detail to Figure 3, three transverse passages are associated with the longitudinal duct 12 situated on the exhaust side 1b of the head 1 in correspondence with and beneath each exhaust duct 10. These three transverse passages comprise a central passage 17 situated between the portions 10a of the exhaust duct 10 and two side passages 18 one situated beside each of the portions 10a.

With reference in greater detail to Figure 2, two transverse passages are associated with the longitudinal duct 11 in correspondence with and beneath each inlet duct 10. These two transverse passages, indicated 19, are situated beside respective portions 9a of the exhaust duct 9.

The transverse passages 17, 18 and 19 communicate with the internal regions of the head 1 constituted, in particular, by an intermediate circulation chamber, generally indicated 20, formed between the tops of the combustion chambers 3, the corresponding tubular projections 4, 5 and 6, the upper walls 9c and 10c of the inlet ducts 9 and the exhaust ducts 10, and an upper chamber 21 for containing the coolant liquid. The intermediate chamber 20 is connected to the outlet 14 for the coolant liquid.

In operation, the coolant liquid supplied by the hydraulic pump to the inlet 13 is divided by the body 15 into two flows which flow through the longitudinal duct 11 and the longitudinal duct 12 respectively. The liquid passes over the inlet ducts 9 and the exhaust ducts 10 and enters the circulation chamber 20 through the transverse passages 19, 17 and 18 so as to pass over the tops 3 of the combustion chambers, the tubular projections 4, 5 and 6, and the upper walls 9c, 10c of the inlet ducts 9 and exhaust ducts 10. The liquid is then discharged from the head 1 through the outlet 14.

The paths described above are indicated by the arrows shown in the drawings.

Naturally, the details of construction and forms of embodiment may be varied widely with respect to those described and illustrated, without thereby departing from the scope of the present invention.

Claims

1. A head for an internal combustion engine for motor vehicles, constituted by a body (1) having a base wall (2) which is intended to be applied to a cylinder block and defines the tops (3) of combustion chambers from which sets of tubular projections (4, 5, 6) project to define seats for inlet and exhaust valves and for spark plugs, as well as inlet ducts (9) and exhaust ducts (10) which communicate with the valve seats (4, 5) and open into opposite sides (1a, 1b) of the head, a containment (21) for the coolant liquid,and ducts for the circulation of the coolant liquid communicating with an inlet (13) and an outlet (14), characterised in that the inlet (13) is situated at one end (1c) of the head (1) and communicates with two longitudinal ducts (11, 12) extending along the sides (1a, 1b) of the head (1) and beneath the inlet and exhaust ducts (9, 10) respectively; the longitudinal ducts (11, 12) communicate through a series of transverse passages (17, 18, 19) situated around the inlet and exhaust ducts (9, 10) with a longitudinal intermediate circulation chamber (20) formed between the tops (3) of the combustion chambers, the tubular projections (4, 5, 6) for the valves and the spark plugs, the upper walls (9c, 10c) of the inlet and exhaust ducts (9, 10), and the containment chamber (21); a pump (15) for supplying the two longitudinal ducts (11, 12) is associated with the inlet (13), and the outlet (14) for the coolant liquid is situated at the opposite end (1d) of the head (1) from the end (1c) at which the inlet (13) is situated and communicates with the intermediate chamber (20).

2. A head according to Claim 1, characterised in that the transverse passages (17, 18, 19) are formed beneath the inlet and exhaust ducts (9, 10).

3. A head according to Claim 1, for engines with four valves per cylinder in which each inlet and exhaust duct (9, 10) is formed by two adjacent portions (9a, 9b; 10a, 10b), characterised in that the transverse passages include three passages (17, 18) for each exhaust duct (10), of which the central passage (17) is arranged between the two portions (10a, 10b) of the respective exhaust duct (10) and each side passage (18) is situated beside a respective portion (10a, 10b) of the exhaust duct (10), and at least two passages (19) for each inlet duct (9) situated beside respective portions (9a, 9b) of the inlet duct (9).

4. A head according to any one of the preceding claims, characterised in that it is formed with cooling fins (16) arranged beside the outlet (14).

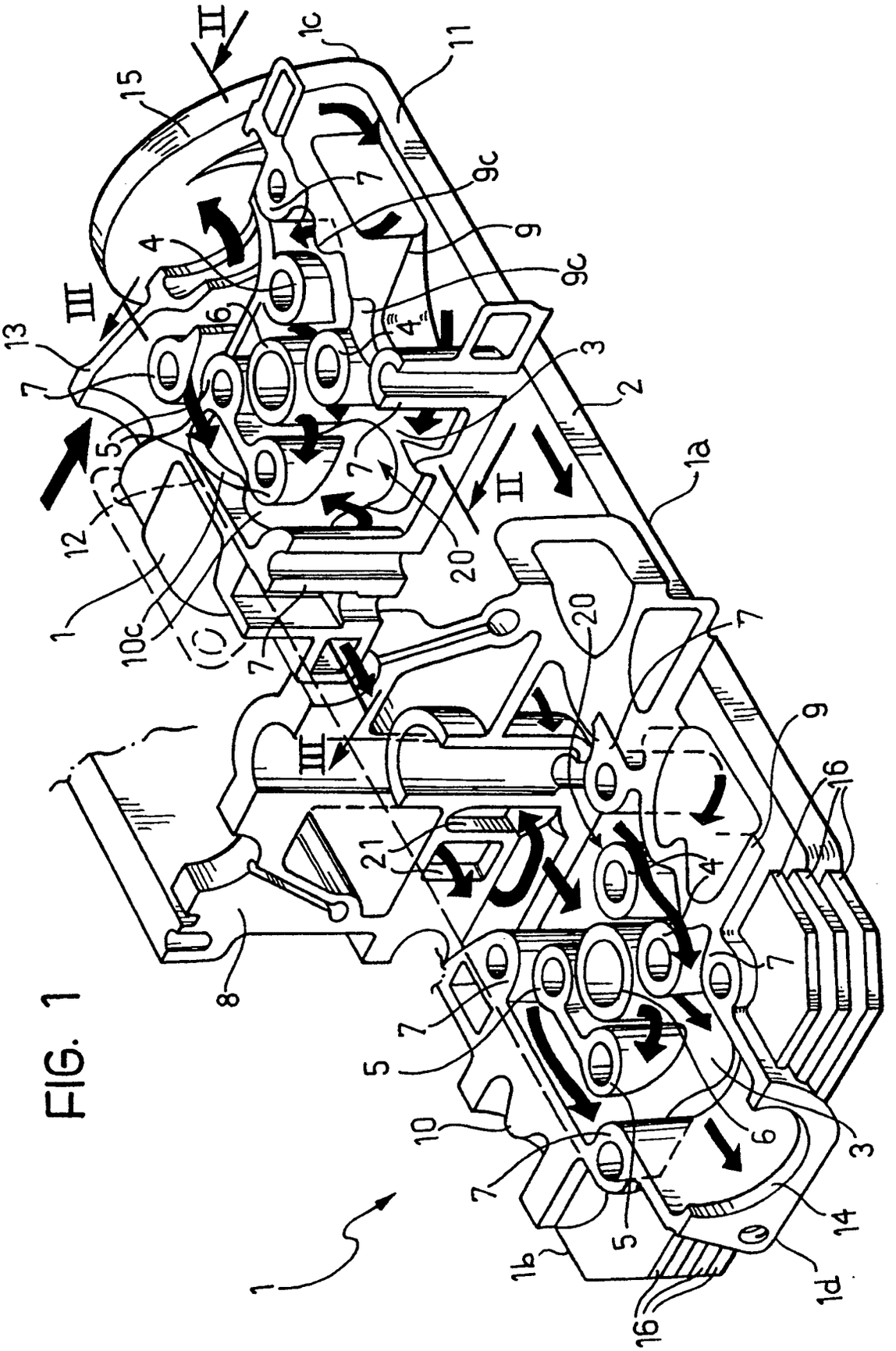


FIG. 1

FIG. 2

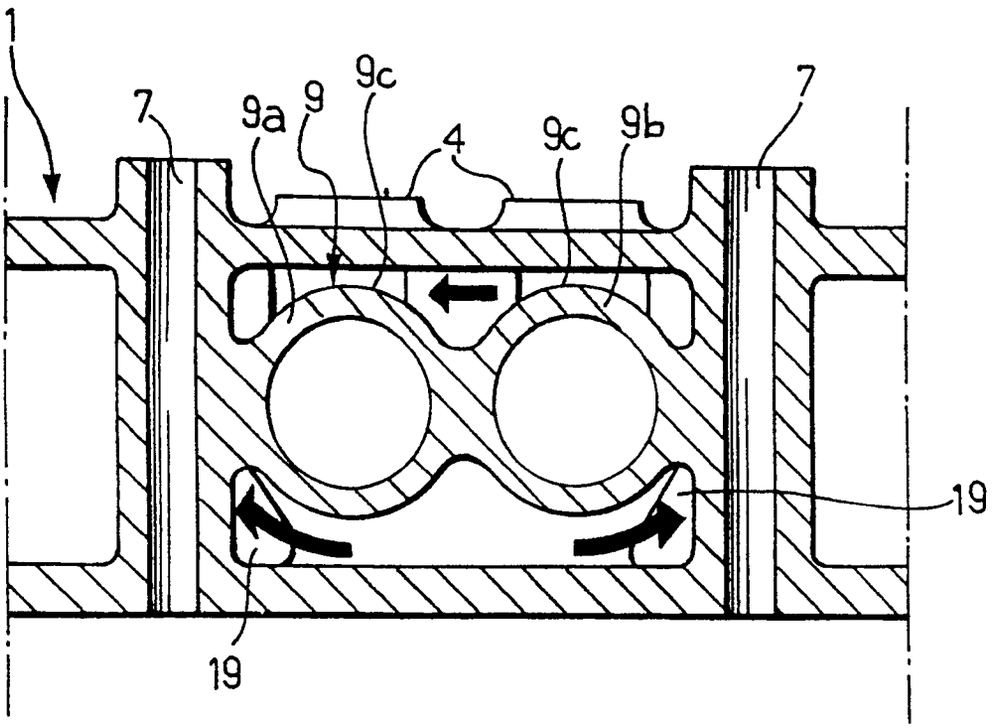
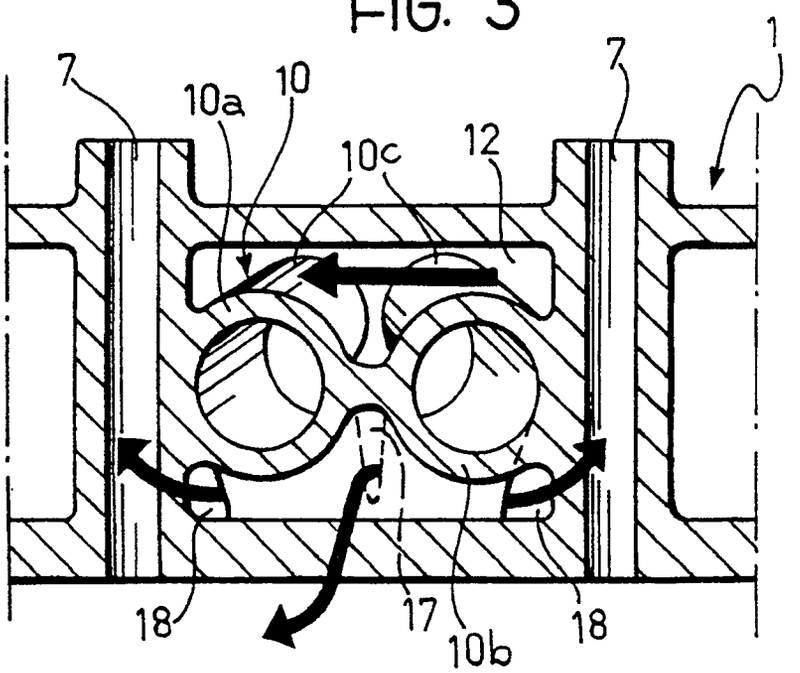


FIG. 3



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EUROPEAN SEARCH REPORT

Application Number

EP 91 83 0091

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)
A	FR-A-2390885 (FIAT) * page 2, line 19 - page 3, line 28; figure * ---	1	F02F1/38 F01P3/02
A	FR-A-2225628 (PERKINS ENGINES LIMITED) * page 2, line 5 - page 4, line 27; figures * ---	1	
A	US-A-2619078 (WITZKY) * column 2, line 21 - column 3, line 31; figures * ---	1	
A	DE-U-8621654.6 (PORSCHE) * page 4, line 16 - page 6, line 12; figures * -----	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5) F02F F01P

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	04 JUNE 1991	MOUTON J.M.M.P.

CATEGORY OF CITED DOCUMENTS

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