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(54) **Module for a cooling circuit and circuit comprising such a module**

(57) The present invention relates to a central module for a cooling circuit in a vehicle with an internal combustion engine.

Module (1) characterised in that it forms a hollow rigid body with a plurality of cavities, made up by assembly of three structural sub-modules (1', 1'' and 1'''), namely a first sub-module (1') comprising a hollow part (12) with a flow distribution chamber (12'), two portions of conduits (13, 13') of the sub-circuit (9) supplying the radiator (7') of the main unit heater (7), a portion of conduit (14) of the sub-circuit (10) supplying the radiator (8') of the secondary unit heater (8) and a portion of conduit (15) of the sub-circuit (11) supplying the heat exchanger

(6), a second sub-module (1'') comprising at least a part of the casing (16) of the heat exchanger (6), additional portions of conduits (17, 17') of the sub-circuit (11) supplying the latter and an additional portion of conduit (18) of the sub-circuit (9) supplying the radiator (7') and a third sub-module (1''') comprising the feed pump (5), end portions of conduit (19, 19' and 19'') respectively of the sub-circuit (9) supplying the radiator (7'), of the sub-circuit (11) supplying the heat exchanger (6) and of the sub-circuit (10) supplying the radiator (8') and portions of conduit (20 and 20') forming a part of the common segment of the portion of main circuit (3) extending upstream and downstream of the feed pump (5).

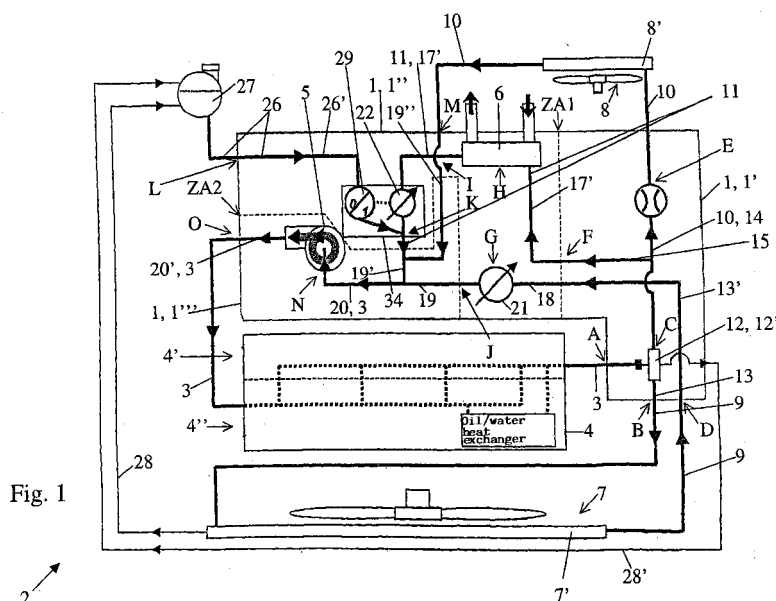


Fig. 1

2

7'

28'

Description

[0001] The present invention concerns the field of cooling circuits for thermal engines and relates to a central module, forming an integral structure before installation, for such a circuit.

[0002] Cooling circuits currently tend to comprise more and more sub-circuits for additional functionality, whereas the space available under the engine bonnet and in particular around the engine unit is limited.

[0003] The invention applies more particularly to a cooling circuit for vehicles with an internal combustion engine which comprises, in particular, a main portion of circulation circuit for cooling the cylinders and cylinder heads, a feed pump, a heat exchanger for exhaust gases, a radiator of a main unit heater dissipating the recovered heat in the surrounding medium, a radiator of a secondary unit heater dissipating the recovered heat in the vehicle body, the two unit heaters and the exchanger being installed in three respective circulation sub-circuits mutually set up in shunt or in parallel after the main portion of the circulation circuit and forming therewith a multi-branched circulation loop, said main portion incorporating in a single segment said feed pump connected, upstream, to said three sub-circuits and, downstream, to the cooling means for the cylinders and cylinder heads.

[0004] The object of the invention is to reduce the space required for such a circuit, the number of component parts to be installed and assembled in situ, as well as the duration of installation, the cost and the complexity of the cooling liquid circulation loops.

To this end, the idea behind the invention is to incorporate different portions of the circuit into a single prefabricated structure in the form of a central module for a cooling circuit of the above-mentioned type, said module being characterised in that it forms a rigid hollow body with a plurality of cavities, made up by the assembly of three structural sub-modules, namely a first sub-module comprising a hollow part with a flow distribution chamber, two portions of conduits of the sub-circuit supplying the radiator of the main unit heater, one portion of conduit of the sub-circuit supplying the radiator of the secondary unit heater and one portion of conduit of the sub-circuit supplying the heat exchanger, a second sub-module comprising at least a part of the casing of the heat exchanger, additional portions of conduits of the sub-circuit supplying this latter and an additional portion of conduit of the sub-circuit supplying the radiator of the main unit heater, and a third sub-circuit comprising the feed pump, end portions of conduit respectively of the sub-circuit supplying the radiator of the main unit heater, of the sub-circuit supplying the heat exchanger and of the sub-circuit supplying the radiator of the secondary unit heater and portions of conduit forming a part of the common segment of the portion of main circuit extending upstream and downstream of the feed pump, the first and the third modules being connected to the second

module in the region of two assembly zones situated at two opposite ends thereof, the assembly being achieved by fitting together mating portions of conduit of same sub-circuits which are part of different sub-modules, a first adjusting means being installed in the sub-circuit supplying the radiator of the main unit heater and a second adjusting means being installed in the sub-circuit supplying the heat exchanger for exhaust gas.

[0005] The invention will be understood better from the following description which relates to a preferred embodiment, given as a non-restrictive example and explained with reference to the accompanying diagrammatic drawings, in which:

Figure 1 is a symbolic representation of a cooling circuit partly consisting of a central module according to the invention;

Figure 2 is a hatched view, in the form of a rear side view, of a central module according to the invention;

Figure 3 is a hatched view in perspective of the module of Figure 1, the third sub-module having been removed;

Figures 4 to 8 are side views from different directions of the central module of Figures 1 and 2, the adjusting means of the sub-circuit supplying the heat exchanger and of the segment of the charging circuit having been removed, and

Figures 9 and 10 are side views from two different directions and on a different scale of the second sub-module forming part of the central module of Figure 2.

[0006] Referring to Figure 1 of the accompanying drawings, the invention applies to a cooling circuit 2 comprising in particular a main portion 3 of a circulation circuit for cooling the cylinders 4 and cylinder heads 4', a feed pump 5, a heat exchanger 6 for exhaust gas, a radiator 7' of a main unit heater 7 dissipating the recovered heat in the surrounding medium, a radiator 8' of a secondary unit heater 8 dissipating the recovered heat in the vehicle body, the two radiators of the unit heaters and the heat exchanger 6 being installed in three respective circulation sub-circuits 9, 10 and 11 mutually set up in shunt or in parallel after the main portion of the circulation circuit 3 and forming therewith a multi-branched circulation loop, said main portion 3 incorporating in a single segment said feed pump 5 connected, upstream, to said three sub-circuits 9, 10 and 11 and, downstream, to the cooling means for the cylinders and cylinder heads (illustrated by broken lines in the engine unit 4"), comprising a water/oil exchanger (labelled "module" in Figure 1).

[0007] In accordance with the invention, said module 1 forms a hollow, rigid body with a plurality of cavities,

made up of three structural sub-modules 1', 1" and 1'''.

[0008] A first sub-module 1' comprises a hollow part 12 with a flow distribution chamber 12', two portions of conduits 13, 13' of the sub-circuit 9 supplying the radiator 7' of the main unit heater 7, a portion of conduit 14 of the sub-circuit 10 supplying the radiator 8' of the secondary unit heater 8 and a portion of conduit 15 of the sub-circuit 11 supplying the heat exchanger 6.

[0009] A second sub-module 1" comprises at least a part of the casing 16 of the heat exchanger 6, additional portions of conduits 17, 17' of the sub-circuit 11 supplying the latter and an additional portion of conduit 18 of the sub-circuit 9 supplying the radiator 7' of the main unit heater 7.

[0010] A third sub-module 1''' comprises the feed pump 5, end portions of conduit 19, 19' and 19'' respectively of the sub-circuit 9 supplying the radiator 7' of the main unit heater 7, of the sub-circuit 11 supplying the heat exchanger 6 and of the sub-circuit 10 supplying the radiator 8' of the secondary unit heater 8 and portions of conduit 20 and 20' forming a part of the common segment of the main portion 3 of circuit extending upstream and downstream of the feed pump 5.

[0011] The first 1' and third 1''' modules are assembled with the second module 1" in the region of the two assembly zones ZA1 and ZA2 situated at two opposite ends thereof, assembly being achieved by fitting together mating portions of conduit of the same sub-circuits which are part of the various sub-modules 1', 1" and 1''', a primary adjusting means 21 being installed in the sub-circuit 9 supplying the radiator 7' of the main unit heater 7 and a second adjusting means 22 being installed in the sub-circuit 11 supplying the heat exchanger for exhaust gas 6.

[0012] In this way the central module 1 groups together relatively large portions of the main parts of the cooling circuit into a predefined and reproducible arrangement in accordance with the layout of said circuit, facilitating its installation, its connection and its maintenance and reducing its bulk (reduction of empty spaces between pipes, best use of available space).

[0013] For assembly of the first and third sub-modules 1' and 1''' with the second sub-module 1'', the latter comprises straight ends of portions of conduits, forming male parts, whereas said two other sub-modules 1' and 1''' have ends of portions of conduits which are flared or enlarged over a certain depth, allowing close fitting of the straight ends of the portions of the second sub-module 1'' (the presence of internal collars forming abutments).

[0014] The different fittings, forming connection zones for the sub-circuits concerned 9 and 11, will be locked together by cooperating assembly plates which receive fixing means (for example combinations of screws and nuts) and are sealed by compression joints, for example O-rings.

[0015] According to a preferred embodiment of the invention, which allows a good distribution of the bulk of

the module and is illustrated in Figures 2 to 8, the latter advantageously has an elongate structure with three-dimensional extension, extending after installation over at least two faces of the engine unit 4''. The sub-modules 1', 1" and 1''' are made of a thermoplastic material, the first 1' and the third 1''' sub-modules being formed by the vibration welding of two integrally moulded parts, the second sub-module 1" being formed all in one piece. As is also shown in Figures 2 to 8, the first 1' and the second 1" sub-modules consist essentially of two conduit structures set up side by side.

[0016] In order to facilitate its industrial production, the third sub-module 1''' has a joint face 23 going through the housing of the feed pump 5, one of the two halves thereof being formed all in one piece with a mounting and coupling flange 24 of a drive motor 25 for said pump 5.

[0017] According to another characteristic of the invention, the central module 1 can comprise, in addition, a portion of conduit 26' of a segment of circuit 26 for charging the feed pump 5 connected, externally to the module 1, to a degassing reservoir 27 into which open two parallel segments of the degassing circuits 28, 28', one 28 of which is fluidically connected to the radiator 7' of the main unit heater 7 and the other 28' of which is fluidically connected at the top of the hollow part 12 to the flow distribution chamber 12', said integrated portion of conduit 26' of the segment of charging circuit 26 incorporating an adjusting means 29 for the flow going through said segment 26 and the hollow part with the distribution chamber 12 comprising a housing 12'' for a temperature sensor.

[0018] Such a cooling circuit, illustrated schematically in fluid form, is known in particular from French patent application No. 02 08794 of 12 July 2002 in the name of the applicant.

[0019] To allow easy fluid connection of the central module 1, the interfaces of external connections of the portions of conduits forming parts, incorporated in said module 1, of the sub-circuits 9, 10 supplying the radiators 7', 8' of the two unit heaters 7, 8, of one of the segments of degassing circuits 28', of the segment of charging circuit 26 and of the part 20 of the portion of main circuit 3 extending upstream of the feed pump 5, are in the form of joining pieces 30 made all in one piece with the respective corresponding sub-module 1', 1'', 1''', the hollow part 12 with the distribution chamber 12' having an inlet opening 31 surrounded by a fixing flange 31' for a tight fitting to the outlet from the engine unit 4'' of the main portion of the circulation circuit 3 in the region of the cylinder heads 4'.

[0020] To facilitate the understanding of the correspondence between the symbolic Figure 1 and the other figures of the accompanying drawings, reference points A to O have been repeated in Figures 2 and 3.

[0021] Referring to Figure 3 of the accompanying drawings, the proportional or open and shut valve 22 corresponding to the adjusting means for sub-circuit 11

supplying the heat exchanger 6 consists of an added part, the body 22' of which forms part of said sub-circuit 11 and in the region of its inlet and outlet openings has respective fixing flanges 32, 32' for tight fitting to a flange 33 of the outlet opening of the casing 16 of the heat exchanger 6 and to the end portion of conduit 19' of the sub-circuit 11 supplying the heat exchanger 6 which is an integral part of the third sub-module 1'''. Said end portion of conduit 19' will of course be fitted with an adapted complementary fixing flange 19'''.

[0022] According to a particularly advantageous variation of the invention also illustrated in Figure 3 of the accompanying drawings, the adjusting means 22 for the flow in the sub-circuit 11 supplying the heat exchanger 6 and the adjusting means 29 for the flow in the segment of the charging circuit 26 for the feed pump 5 are in the form of a single valve device 34 with two inlets and one outlet, for example a linear valve, the flows coming from the above-mentioned sub-circuit 11 and segment of circuit 26 being combined in the region of the outlet opening of said double valve.

[0023] Such a linear valve with two shut-off valves is known in particular from French patent application No. 02 08632 of 9 July 2002 in the name of the applicant.

[0024] In addition the adjusting means 21, the actuator of which is installed in a protective box 21', could possibly correspond to a proportional control valve such as that known from French patent application No. 2 805 878 of 1 March 2000 in the name of the applicant, or French patent application No. 01 16314 of 17 December 2001 also in the name of the applicant.

[0025] In order to allow rapid heating of the circulation liquid under certain operating conditions of the engine, particularly when starting up, it can be provided that the loss of head in the sub-circuit 11 supplying or going through the heat exchanger 6 for exhaust gas is substantially equivalent to the loss of head in the sub-circuit 9 supplying or going through the radiator 7' of the main unit heater 7.

[0026] Referring to Figure 1, the present invention also relates to a cooling circuit for a vehicle with an internal combustion engine, characterised in that it comprises a central module 1, as described above, connected to the cooling means of the cylinders 4 and cylinder heads 4', to the radiators 7' and 8' of the main unit heater 7 and the secondary unit heater 8 and, if need be, to a degassing reservoir 27, via portions of tubing or adapted sleeves.

[0027] The management of the flow in this circuit 2 will be effected by controlling the adjusting means 21, 22 and 29.

[0028] Obviously the invention is not limited to the embodiment described and illustrated in the accompanying drawings. Modifications are still possible, in particular from the point of view of the formation of the various elements or by substitution of technical equivalents, without however departing from the scope of protection of the invention.

Claims

1. Central module for a cooling circuit of a vehicle with an internal combustion engine, said circuit comprising in particular a main portion of a circulation circuit for cooling the cylinders and cylinder heads, a feed pump, a heat exchanger for exhaust gas, a radiator of a main unit heater dissipating the recovered heat in the surrounding medium, a radiator of a secondary unit heater dissipating the recovered heat in the vehicle body, the two unit heaters and the exchanger being installed in three respective circulation sub-circuits, mutually set up in shunt or in parallel after the main portion of the circulation circuit and forming therewith a multi-branched circulation loop, said main portion incorporating in a single segment said feed pump connected, upstream, to said three sub-circuits and, downstream, to the cooling means for the cylinders and cylinder heads, the module (1) being **characterised in that** it forms a rigid, hollow body with a plurality of cavities, made up by the assembly of three structural sub-modules (1', 1'' and 1'''), namely a first sub-module (1') comprising a hollow part (12) with a flow distribution chamber (12'), two portions of conduits (13, 13') of the sub-circuit (9) supplying the radiator (7') of the main unit heater (7), a portion of conduit (14) of the sub-circuit (10) supplying the radiator (8') of the secondary unit heater (8) and a portion of conduit (15) of the sub-circuit (11) supplying the heat exchanger (6), a second sub-module (1'') comprising at least a part of the casing (16) of the heat exchanger (6), additional portions of conduit (17, 17') of the sub-circuit (11) supplying the latter and an additional portion of conduit (18) of the sub-circuit (9) supplying the radiator (7') of the main unit heater (7), and a third sub-module (1''') comprising the feed pump (5), end portions of conduit (19, 19' and 19'') respectively of the sub-circuit (9) supplying the radiator (7') of the main unit heater (7), of the sub-circuit (11) supplying the heat exchanger (6) and the sub-circuit (10) supplying the radiator (8') of the secondary unit heater (8) and portions of conduit (20 and 20') forming a part of the common segment of the portion of main circuit (3) extending upstream and downstream of the feed pump (5), the first (1') and the third (1''') modules being assembled with the second module (1'') in the region of two assembly zones (ZA1 and ZA2) situated at two opposite ends thereof, assembly being achieved by fitting together mating portions of conduit of same sub-circuits forming part of the various sub-modules (1', 1'' and 1'''), a first adjusting means (21) being installed in the sub-circuit (9) supplying the radiator (7') of the main unit heater (7) and a second adjusting means (22) being installed in the sub-circuit (11) supplying the heat exchanger for exhaust gas (6).

2. Module according to claim 1, **characterised in that** it has an elongate structure with a three-dimensional extension, extending after installation over at least two faces of the engine unit (4"), **in that** the two sub-modules (1', 1" and 1''') are made of thermoplastic material, the first (1') and the third (1''') sub-modules being formed by assembly by the vibration welding of two integrally moulded parts, the second sub-module (1'') being formed all in one piece, and **in that** the first (1') and second (1'') sub-modules consist essentially of two conduit structures set up side by side.

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3. Module according to claim 2, **characterised in that** the third sub-module (1''') has a joint plane (23) traversing the housing of the feed pump (5), one of the two halves thereof being formed all in one piece with a mounting and coupling flange (24) for a drive motor (25) for said feed pump (5).

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4. Module according to any one of claims 1 to 3, **characterised in that** it comprises, in addition, a portion of conduit (26') of a segment of circuit (26) for charging the feed pump (5) connected, externally to the module (1), to a degassing reservoir (27) into which open two parallel segments of the degassing circuits (28, 28'), one (28) of which is fluidically connected to the radiator (7') of the main unit heater (7) and the other (28') of which is fluidically connected at the top of the hollow part (12) to the flow distribution chamber (12'), said integrated portion of conduit (26') of the segment of charging circuit (26) incorporating an adjusting means (29) for the flow going through said segment (26) and the hollow part with the distribution chamber (12) comprising a housing (12'') for a temperature sensor.

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5. Module according to claim 4, **characterised in that** the interfaces of the external connections of the portions of conduits forming parts, incorporated in said module (1), of the sub-circuits (9, 10) supplying the radiators (7', 8') of the two unit heaters (7, 8), of one (28') of the segments of degassing circuits, of the segment (26) of charging circuit and of the part (20) of the portion of main circuit (3) extending upstream of the feed pump (5), are in the form of joining pieces (30) made all in one piece with the respective corresponding sub-module (1', 1'', 1'''), the hollow part (12) with the distribution chamber (12') having an inlet opening (31) surrounded by a fixing flange (31') for a tight fitting to the outlet from the engine unit (4") of the main portion of the circulation circuit (3) in the region of the cylinder heads (4').

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6. Module according to any one of claims 1 to 5, **characterised in that** the proportional or open and shut valve (22) corresponding to the adjusting means for the sub-circuit (11) supplying the heat exchanger (6) consists of an added part, the body (22') of which forms part of said sub-circuit (11) and in the region of its inlet and outlet openings has respective fixing flanges (32, 32') for tight fitting to a flange (33) of the outlet opening of the casing (16) of the heat exchanger (6) and to the end portion of conduit (19') of the sub-circuit (11) supplying the heat exchanger (6) which is an integral part of the third sub-module (1''').

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7. Module according to any one of claims 4 to 6, **characterised in that** the adjusting means (22) for the flow in the sub-circuit (11) supplying the heat exchanger (6) and the adjusting means (29) for the flow in the segment of the charging circuit (26) for the feed pump (5) are in the form of a single valve device (34) with two inlets and one outlet, for example a linear valve, the flows coming from the above-mentioned sub-circuit (11) and segment of circuit (26) being combined in the region of the outlet opening of said double valve.

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8. Module according to any one of claims 1 to 7, **characterised in that** the loss of head in the sub-circuit (11) supplying or going through the heat exchanger (6) for exhaust gas is substantially equivalent to the loss of head in the sub-circuit (9) supplying or going through the radiator (7') of the main unit heater (7).

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9. Cooling circuit for a vehicle with an internal combustion engine, **characterised in that** it comprises a central module (1) according to any one of the claims 1 to 8, connected to the cooling means of the cylinders (4) and cylinder heads (4'), to the radiators (7' and 8') of the main unit heater (7) and the secondary unit heater (8), and if need be, to a degassing reservoir (27), via portions of tubing or adapted sleeves.

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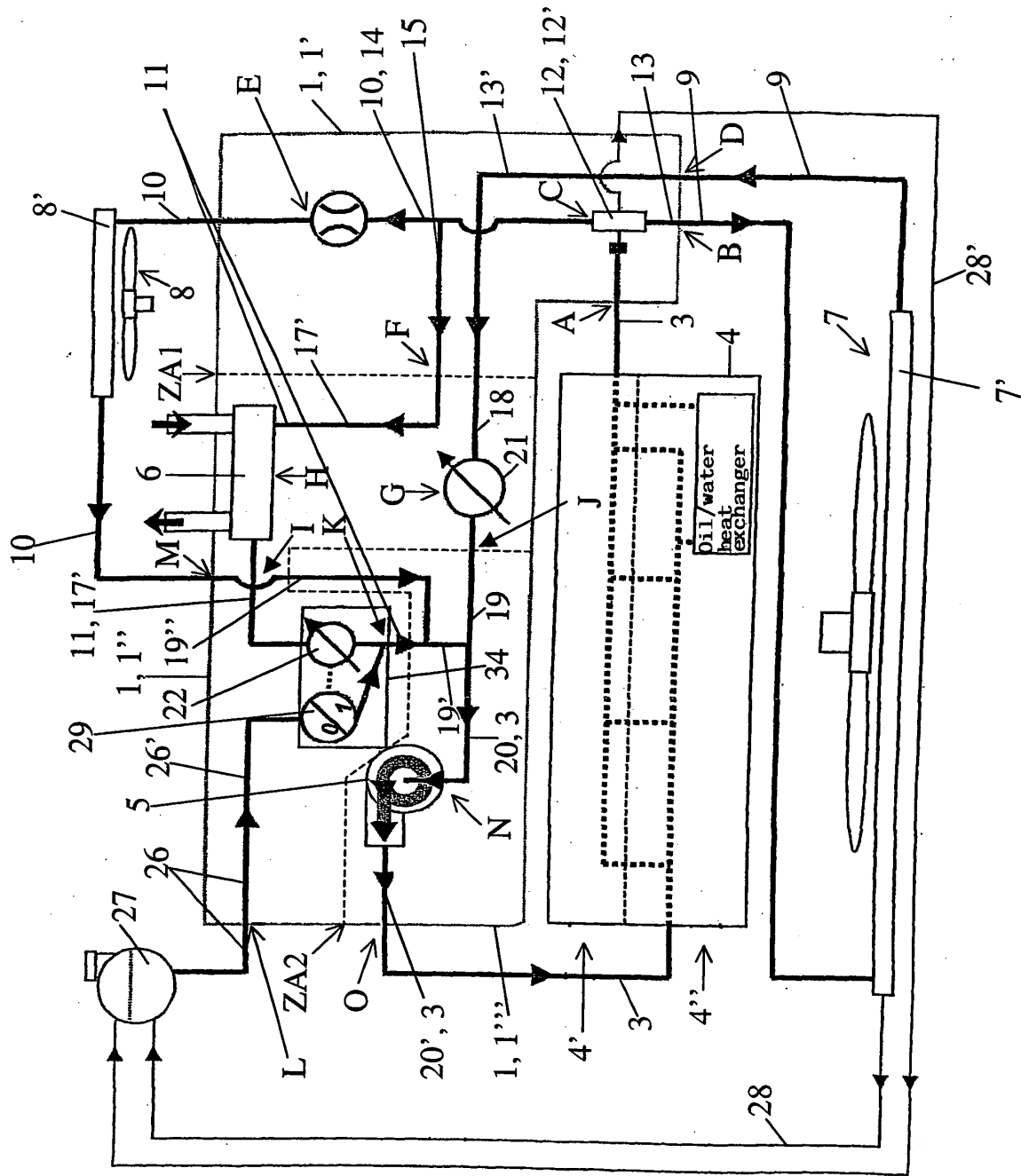
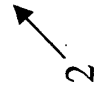


Fig. 1



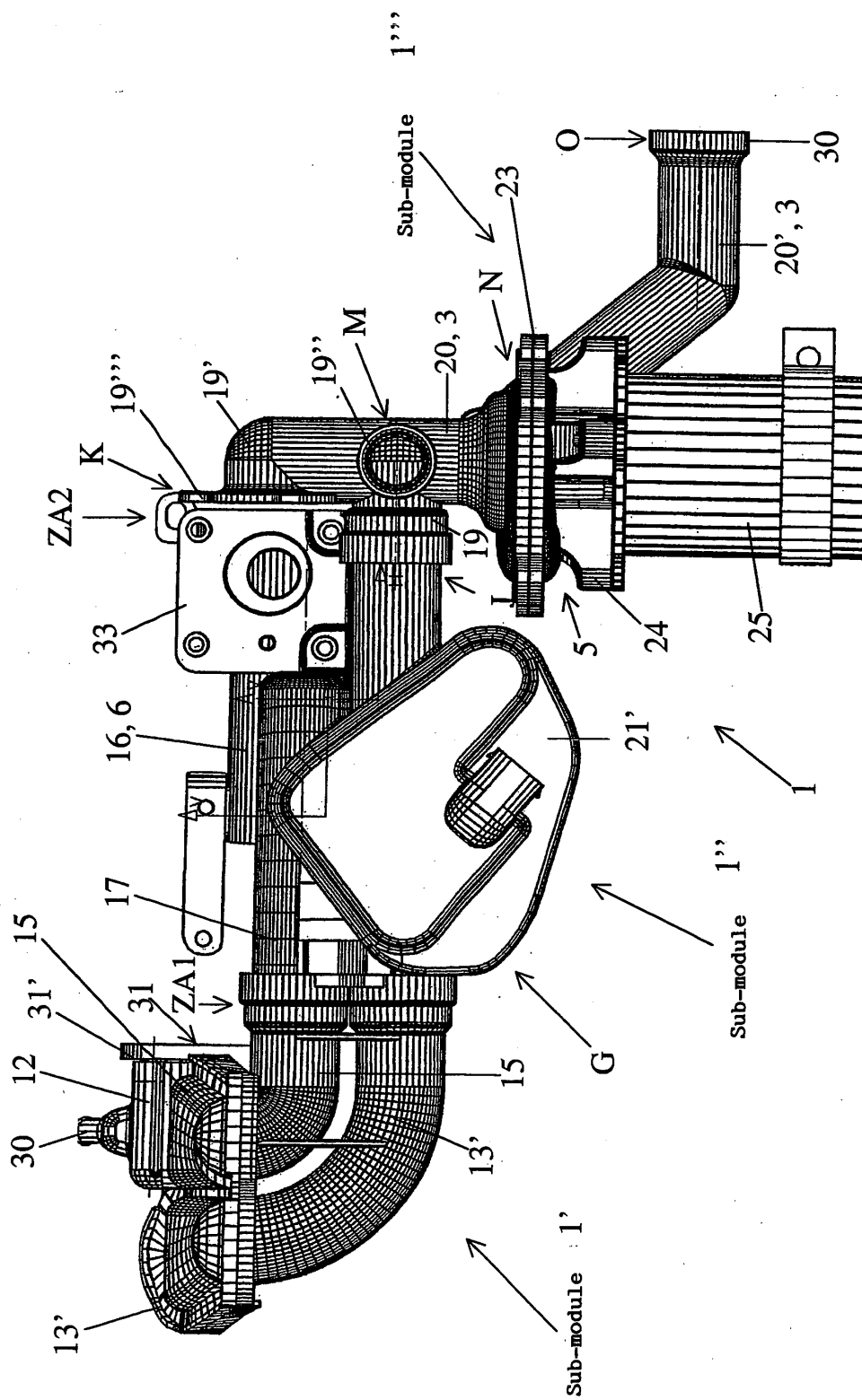


Fig. 2

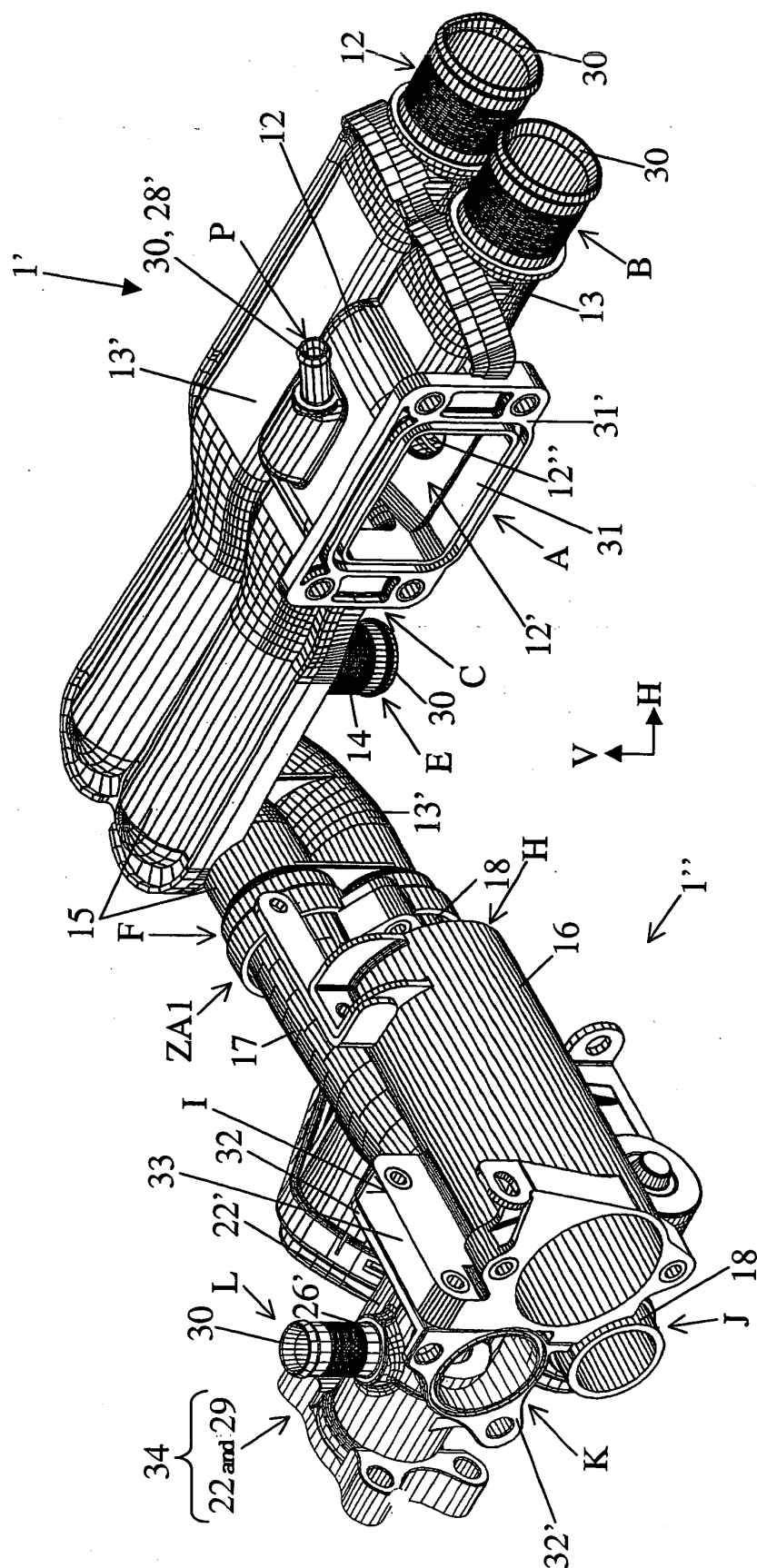
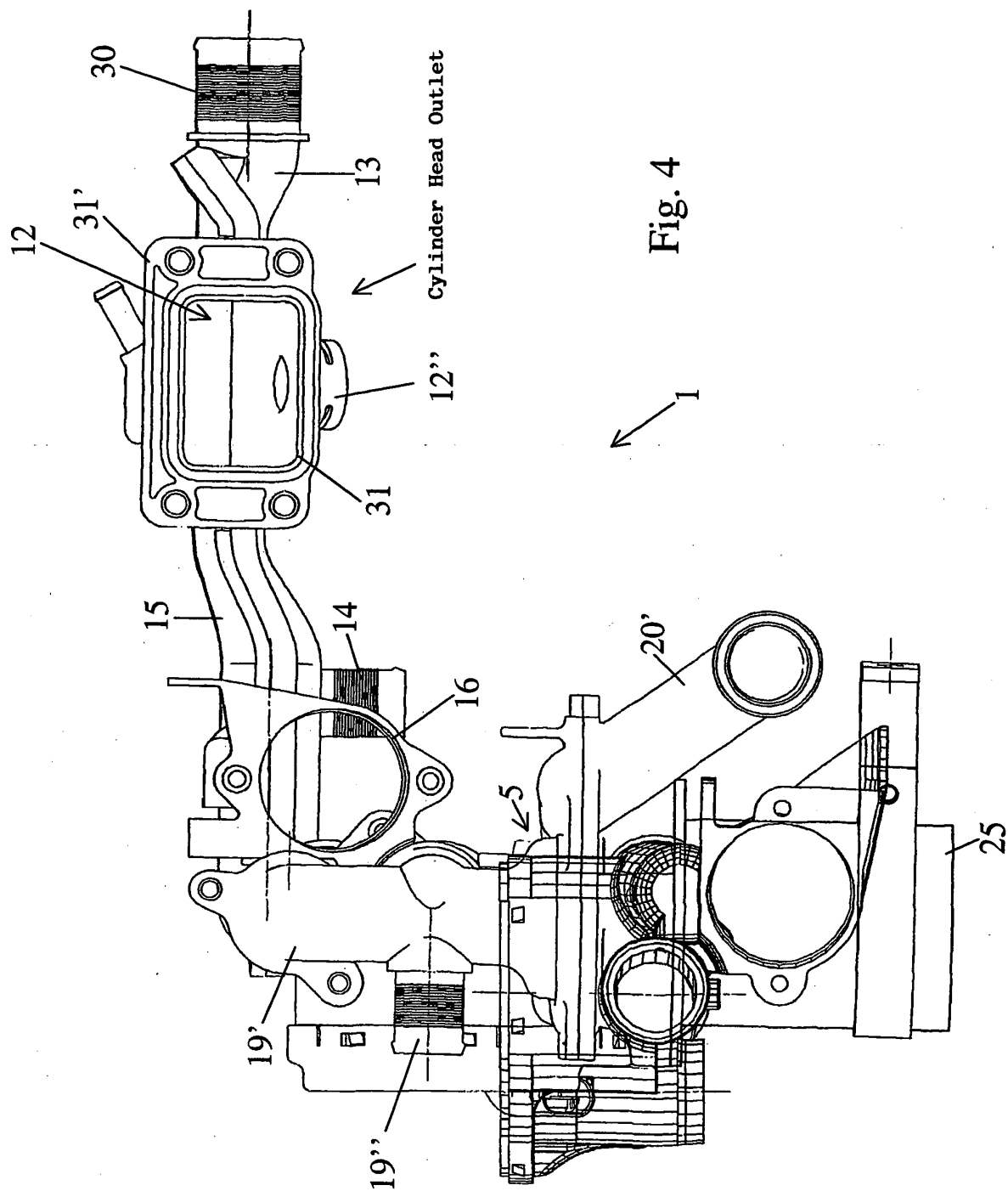


Fig. 3



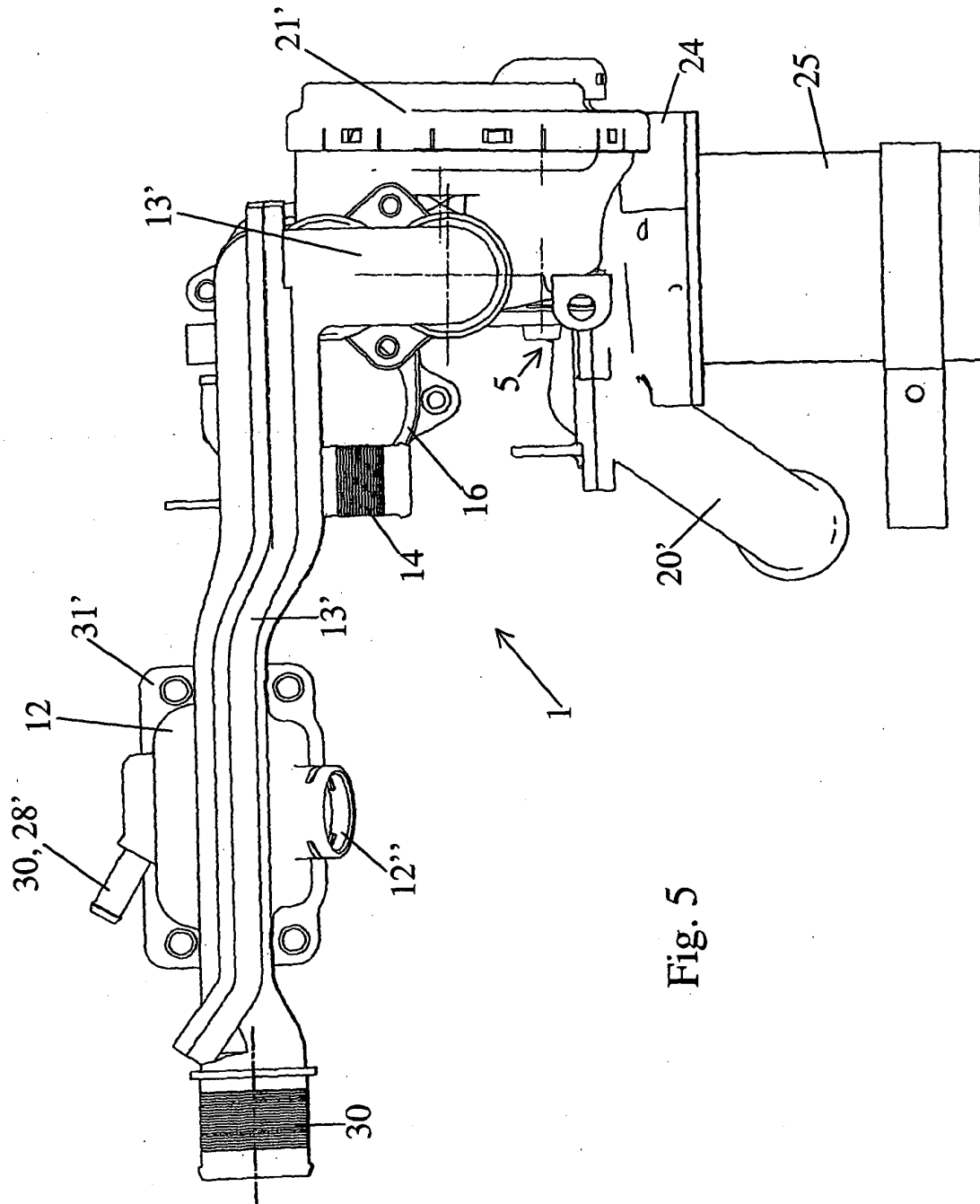


Fig. 5

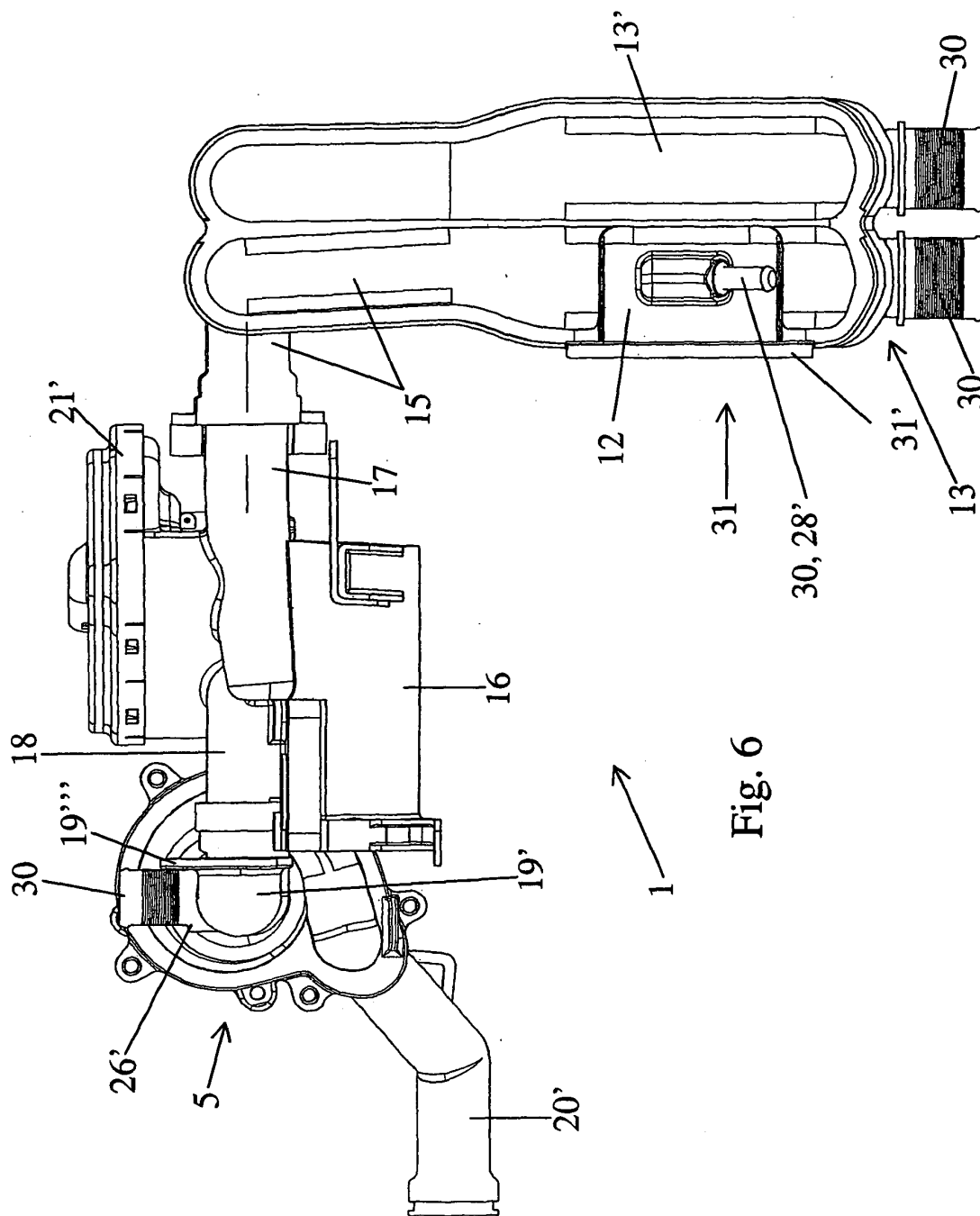


Fig. 6

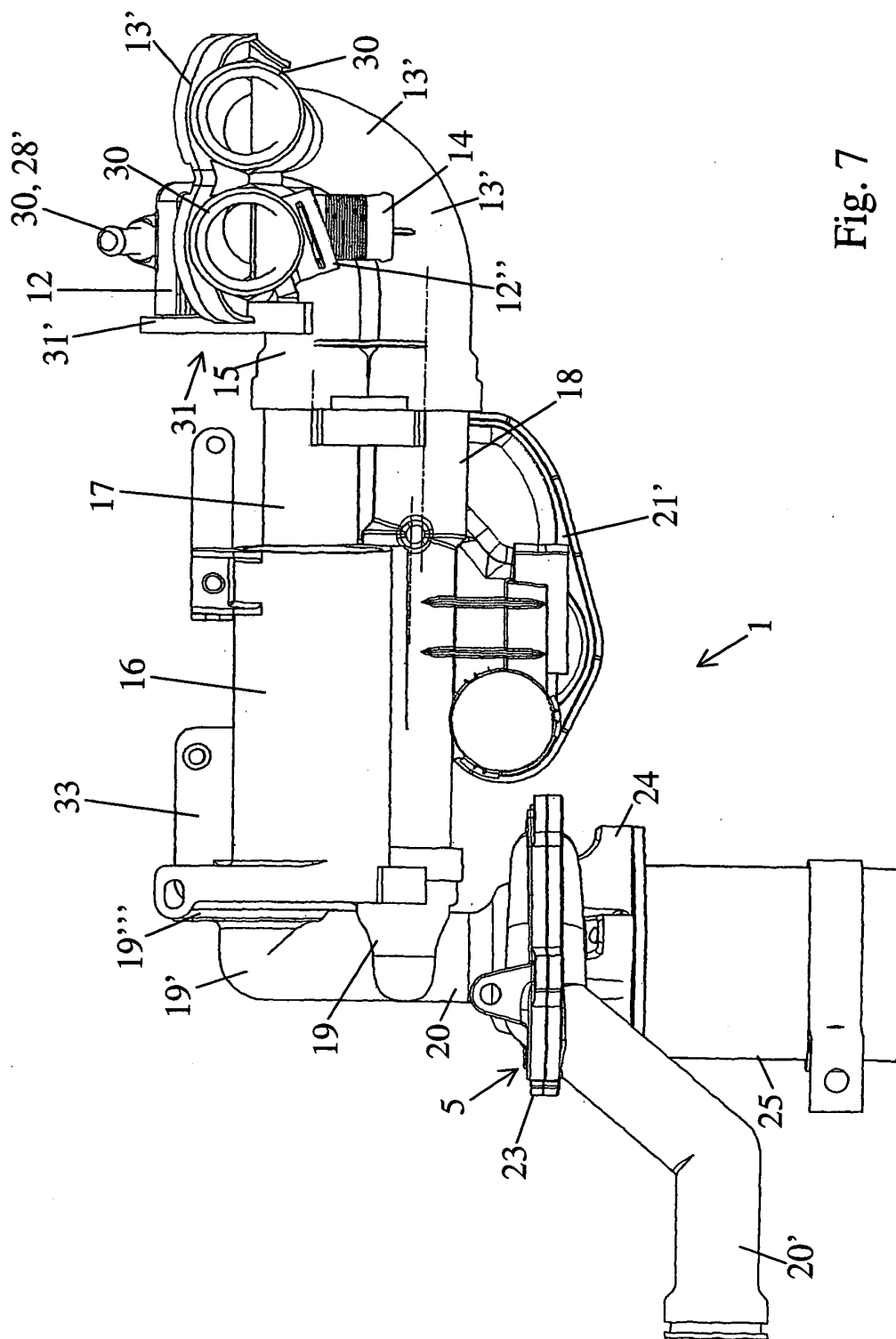


Fig. 7

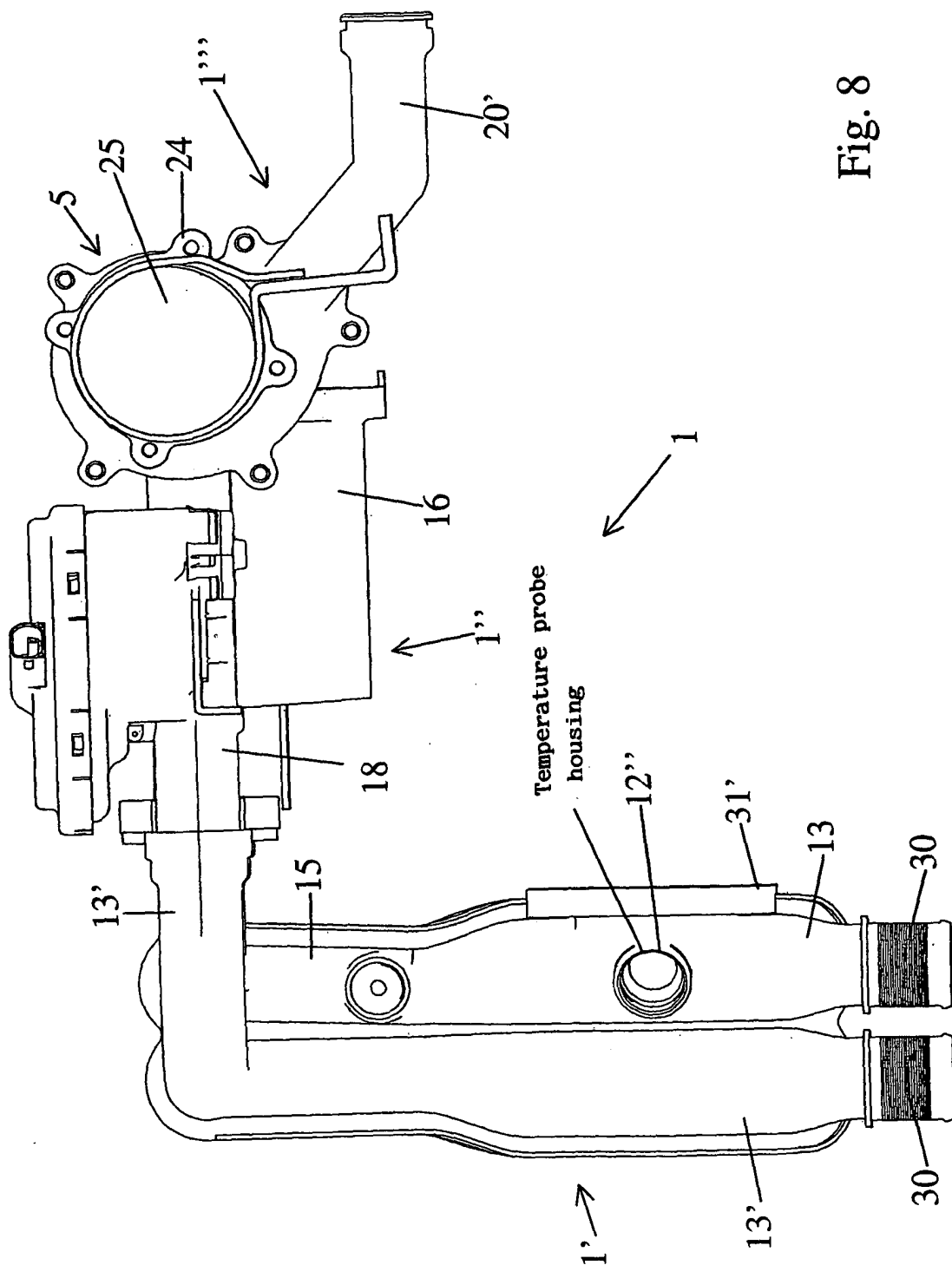


Fig. 8

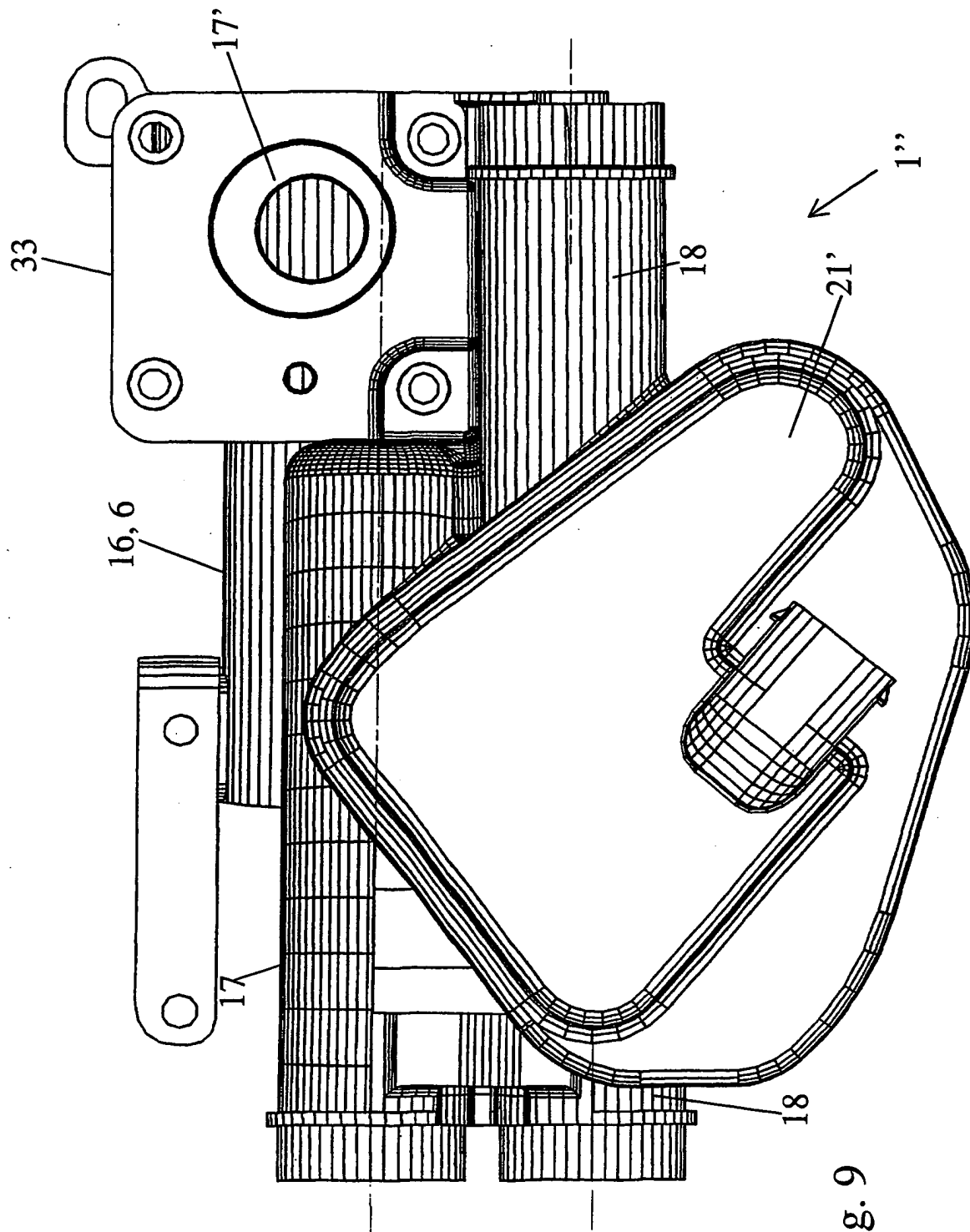


Fig. 9

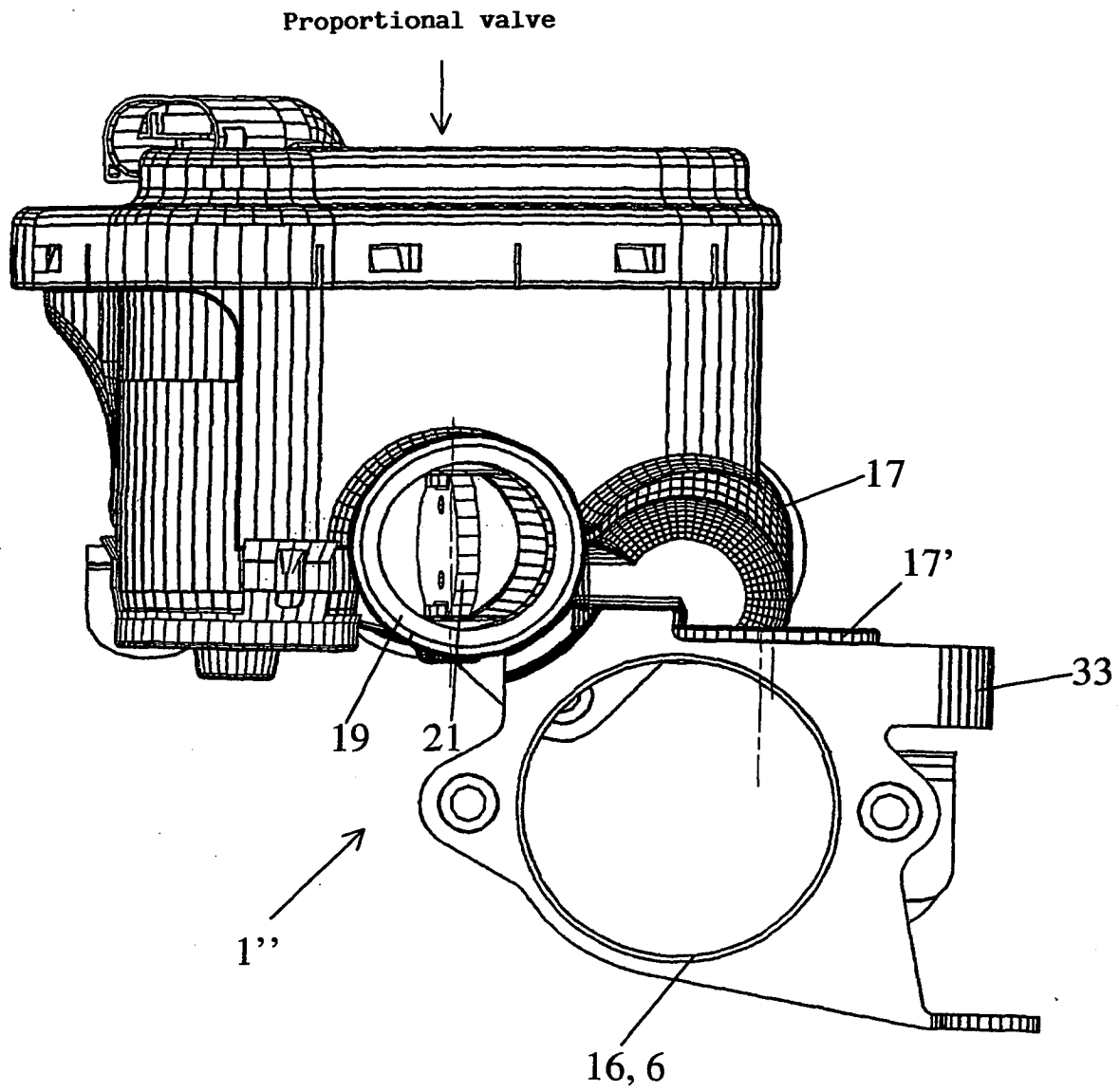


Fig. 10



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EUROPEAN SEARCH REPORT

Application Number
EP 03 01 5554

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.7)
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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 15 September 2003	Examiner Kooijman, F
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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