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

(57) The present invention relates to a cooling circuit module for vehicles with an internal-combustion engine.

Module characterised in that it is formed by assembly, in the region of a connection plane (P) or assembly zones, of two parts (11 and 12) made of thermoplastic material(s) sandwiched together, with at least partial nesting in end portions (6, 6'; 8, 8') of at least two conduit

segments juxtaposed to form at least one corresponding circulation line (3, 3') of the cooling circuit, at least one conduit portion (2; 2') containing a device (4, 4') for measuring or regulating the flow in the line (3; 3') concerned, and in that said module (24) incorporates at least the conduits forming the main circuit (15), conduit segments forming parts (20'', 21'') of the secondary circuits (20 and 21) and at least one part of the feed pump (17).

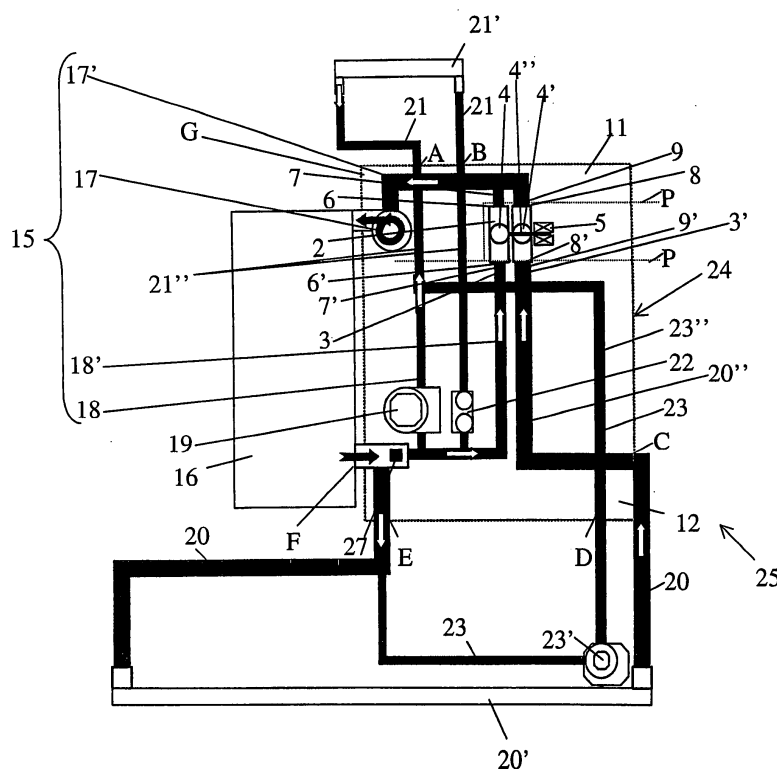


Fig. 1

Description

[0001] The present invention relates to the field of the design and production of multi-branch fluid circulation circuits and systems for regulating the flow of fluids in conduits or circulation lines, in particular of liquids in multi-branch hydraulic circuits with a plurality of regulating devices.

[0002] The present invention relates more particularly to a central cooling circuit module and a cooling system for an internal-combustion engine motor vehicle comprising such a module.

[0003] In the context of reducing the size of systems fitted to automotive vehicles, in particular under the engine bonnet, of simplifying construction, of promoting ease of assembly and of reducing and simplifying maintenance operations, there is a constant demand for a reduction in the number of components to be assembled to produce cooling circuits, for a reduction in the run of cooling liquid circulation lines and for a reduction in the size of such circuits.

[0004] It is also advantageous to have available a regulating means that allows a plurality of flows or outputs in the circuit branches or distinct lines to be adjusted with a single actuator that does not require fixing or special support and that can be removed without the need to disassemble the whole of the circuit or the structural unit incorporating it.

[0005] The object of the present invention in particular is to meet at least one and preferably all the requirements set out above.

[0006] To this end, it relates to a cooling circuit module for an internal-combustion engine motor vehicle, said circuit consisting substantially, on the one hand, of a main circuit forming a circulation loop on the cooling means for the cylinders and cylinder heads of the engine, incorporating a feed pump in a common circuit segment and comprising two parallel circuit segments, in series with the common segment, of which one traverses a water/oil heat exchanger and the other incorporates a regulating device and, on the other hand, of two secondary circuits extending in shunt from the above-mentioned main circuit, each incorporating a respective regulating device, one traversing the radiator of a main unit heater dissipating the recovered heat in the surrounding environment and the other traversing the radiator of a secondary unit heater used to heat the interior of the vehicle, the module being characterised in that it is formed by assembly, in the region of a connection plane or assembly zones, of two parts sandwiched together, with at least partial nesting in the end portions of at least two conduit segments juxtaposed to form at least one corresponding circulation line of the cooling circuit, at least one conduit portion containing a device for measuring or regulating the flow in the line concerned, and in that said module incorporates at least the conduits forming the main circuit, conduit segments forming parts of the secondary circuits, at least a part of

the feed pump, and the three regulating devices.

[0007] The invention also relates to a cooling circuit for vehicles with thermal engines, substantially consisting, on the one hand, of a main circuit forming a circulation loop on the cooling means for the engine cylinders and cylinder heads, incorporating a feed pump in a common circuit segment and comprising two parallel circuit segments, of which one traverses a water/oil heat exchanger, and the other incorporates a regulating device, on the other hand, of two secondary circuits extending in shunt from the main circuit, each incorporating a respective regulating device, one traversing the radiator of a main unit heater dissipating the recovered heat in the surrounding environment, and the other traversing the radiator of a secondary unit heater used to heat the interior of the vehicle, and finally, of a circuit in shunt for gas extraction and charging traversing a reservoir of cooling liquid, characterised in that it comprises a central structural module such as described above.

[0008] The invention will be better understood, with the help of the description below, which relates to preferred embodiments, given as non-restrictive examples and explained with reference to the accompanying diagrammatic drawings, in which:

Figure 1 is a diagrammatic fluidic illustration of an example of a cooling circuit comprising a module according to an embodiment of the invention;

Figures 2 to 4 are different views from different perspectives of a cooling module according to an advantageous variant of the invention, forming part of a circuit such as that illustrated in Figure 1;

Figure 5 is a partially cut away perspective view of the module in Figures 2 to 4;

Figures 6A and 6B (Fig. 6) are perspective views, from other directions, of the module in Figures 2 to 5 before assembly of the two constituent parts;

Figures 7 and 8 are exploded views of the module illustrated in Figures 2 to 6, and

Figures 9A and 9B are diagrammatic sections of a flap valve device according to the invention according to two embodiments, incorporated in a module according to the invention;

Figure 10 is a perspective view of a flap valve device according to the embodiment of the invention in Figure 9A;

Figures 11 to 14 are partial detailed and perspective views, on different scales, of the assembly zones of the two parts and of the flap valve device according to Figure 10, together forming the module illustrated in Figures 2 to 6.

[0009] Figure 1 shows symbolically and Figures 2 to 8 show in the form of an effective embodiment, a central module 24 for the cooling circuit 25 of a vehicle with an internal-combustion engine.

[0010] Said circuit 25 consists substantially, on the one hand, of a main circuit 15 forming a circulation loop on the means 16 of cooling the cylinders and cylinder heads of the engine, incorporating a feed pump 17 in a common circuit segment 17' and comprising two parallel circuit segments 18 and 18', in series with the common segment 17', of which one traverses a water/oil heat exchanger 19 (possibly associated with an oil filter 19') and the other incorporates a regulating device 22 and, on the other hand, of two secondary circuits 20 and 21 extending in shunt from the above-mentioned main circuit 15, each incorporating a respective regulating device 4, 4', with one traversing the radiator 20' of a main unit heater dissipating the recovered heat in the surrounding atmosphere and the other traversing the radiator 21' of a secondary unit heater used to heat the interior of the vehicle.

[0011] In accordance with the invention, said module 24 is characterised in that it is formed by assembly, in the region of a connection plane P or assembly zones, of two parts 11 and 12 made of thermoplastic material (s) sandwiched together, with at least partial nesting in end portions 6, 6'; 8, 8' of at least two conduit segments 7, 7'; 9, 9' juxtaposed to form at least one corresponding circulation line 3; 3' of the cooling circuit, at least one conduit portion 2; 2' containing a device 4, 4' to measure or regulate the flow in the line 3; 3' concerned, and in that said module 24 incorporates at least the conduits forming the main circuit 15, conduit segments forming parts 20'', 21'' of the secondary circuits 20 and 21, at least one part of the feed pump 17, and the three regulating devices 4, 4', 22.

[0012] Thus, the number of constituent parts forming the module 24, and therefore the circuit 25, is restricted, maintenance is facilitated (only the damaged part need be removed and changed) and no special fixing or particular assembly support is needed to assemble the regulating or measuring devices 4, 4'.

[0013] As shown in the above-mentioned figures, and also in Figures 1 and 11 to 14, the module 24 advantageously comprises at least two conduit portions 2, 2' assembled so as to each nest in the opposite end portions 6 and 6'; 8 and 8' of two conduit segment pairs 7 and 7'; 9 and 9' each of which forms by end to end association, in the region of the plane P or assembly zones, of its two segments, a corresponding circulation line 3; 3', each conduit portion 2, 2' comprising a device 4, 4' for regulating or measuring the flow, said portions being possibly formed together all in one piece.

[0014] Preferably, the conduit portion(s) 2, 2' are formed all in one piece with a part 5' at least of means 5 for control, actuation or checking of the measuring or regulating device(s) 4, 4' and/or a protection housing 5'' containing these means.

[0015] The conduit segments 7 and 9 may, as illustrated in the accompanying Figures 2 to 8, 9A and 11 to 14, be brought together in a single segment with a single end portion 6, 8, the form of which is adapted to receive in a close-fitting manner, the constituent nesting parts of the two conduit portions 2, 2' of the side concerned.

[0016] However, said conduit segments 7 and 19, together with the portions 6 and 8, may also be individualised and separated (Figure 9B).

[0017] The mechanical and fluidic assembly of the two parts 11 and 12 may also be achieved in the region of at least one other circuit segment, of which the constituent conduit is at least partially formed in the module.

[0018] Thus, as emerges from the accompanying drawings, two parts 21'' of the circuit segment 18, each of which is incorporated in one of the two parts 11 and 12, may be assembled by jointing or partial nesting in the region of end portions 28, 28' of suitable shape.

[0019] In addition, as illustrated in Figure 1 and partially in Figures 2 to 8, said module 24 will also comprise one of the conduit segments forming parts 23'' of a circuit in shunt 23 for gas extraction and charging of the pump 17, forming part of the cooling circuit and traversing a reservoir 23' of cooling liquid.

[0020] According to a preferred embodiment of the invention, emerging in particular from Figures 1 to 9 and 11 to 14 of the accompanying drawings, the conduit portions 2, 2' containing the regulating devices in the form of pivoting flaps 4, 4' forming part of a flap valve device 1, preferably with proportional control, used to regulate the circulation of liquid fluid in the circulation line portions 3, 3', the circulation flow in each line portion 3, 3' being controlled by a corresponding pivoting flap 4, 4', and the different flaps 4, 4' being rotationally engaged on the same support and control rod 4'', the rotating position of said rod 4'' round its longitudinal axis X being determined by an actuating means 5 offset in relation to said flaps.

[0021] In this embodiment, said flaps 4 and 4' are advantageously disposed in respective conduit portions 2, 2', connected to each other and to at least one part 5' of the housing 5'' containing said actuating means 5, each conduit portion 2; 2' being nested, in a sealed manner, at least partially in the end portions 6, 6'; 8, 8' opposite two conduit segments 7, 7'; 9, 9' forming by cooperation in axial juxtaposition, the portion of circulation line 3; 3' of which the traversing flow is controlled by the flap 4; 4' mounted in the conduit portion 2; 2' concerned.

[0022] Said device 1 is thus mounted in the circulation line portions 3 and 3' by simple nesting, as a connection insert, with no need for an additional support or fixing means.

[0023] Preferably, the different conduit portions 2, 2' and the part 5' of housing 5'' integral therewith are formed all in one piece, for example by injection moulding in a thermoplastic material.

[0024] As shown in Figures 9, 3, 6 and 11 to 14 of the accompanying drawings, the end portions 6, 6'; 7, 7' of

conduit segments 7, 7'; 9, 9' are provided with assembly means 10 that allow contiguous juxtaposition with axial gripping of the pairs 7 and 7'; 9 and 9' of opposed conduit segments intended to cooperate to each form a circulation line portion 3; 3', at least said end portions 6, 6'; 8, 8' of said conduit segments 7, 7'; 9, 9' being grouped adjacent to each other in the two structural units 11 and 12, each preferably all in one piece.

[0025] According to an advantageous characteristic of the invention, each end portion 6, 6'; 8, 8' of conduit segments 7, 7'; 9, 9' is provided with a mounting flange 10, preferably formed all in one piece with said end portion 6, 6'; 8, 8' concerned or with the structural unit 11 or 12 comprising said end portion, and comprising reception sites 10' for assembly means (for example screw-nut units) to connect said flange 10 with the mounting flange 10 of the end portion 6, 6'; 8, 8' juxtaposed to form, by contiguous association of their respective conduit segment 7, 7'; 9, 9', a corresponding circulation line portion 3, 3', the conduit portions 2, 2' forming inserted connection segments, providing a passage with no loss of charge between the conduit segments assembled respectively with each other 7, 7'; 9, 9'.

[0026] To guarantee rigid assembly and reliable retention of the conduit portions 2 and 2' in the end portions 6, 6'; 8, 8', provision may be made for the conduit portions 2, 2' to comprise on each of their constituent parts 2" intended to be nested in corresponding end portions 6, 6'; 7, 7' of the conduit segments 7, 7'; 9, 9' juxtaposed and assembled to form the line portions 3; 3', at least one external rib 13 and said end portions 6, 6'; 8, 8' of said conduit segments 7, 7'; 9, 9' have enlarged parts in relation to the common parts of said conduit segments 7, 7'; 9, 9', the depth or length of each end portion 6, 6'; 8, 8' being equal to the length of the corresponding constituent part 2" of the conduit portion 2, 2' intended to be nested in it, the transverse or sectional dimensions of each end portion 6, 6'; 8, 8' being substantially equal to, or even slightly less than, the peripheral dimensions of the external rib(s) 13 of the constituent part 2" of said nesting conduit portion 2, 2' concerned and the internal part of each conduit portion 2, 2' being identical to the common internal parts of the two conduit segments 7, 7'; 9, 9' in which it is intended to be partially nested with correspondence and continuity of passing parts.

[0027] Advantageously, each constituent part 2" of each conduit portion 2, 2' comprises two parallel external ribs 13 forming between them a reception groove 13' of an O-ring 13", some of said ribs 13 possibly extending over a plurality of constituent parts 2", the corresponding conduit segments 7'; 9' receiving these parts 2" then comprising a common end portion 6', 8' of which the cross-section is adapted to the shape and external dimensions of said ribs 13 extending over a plurality of constituent parts 2" (see in particular Figures 9 to 14).

[0028] To assist the relative positioning of the parts 11 and 12, permit gripping with high force between the end

portions 6 and 6'; 8 and 8' and reinforce immobilisation of the flap valve device 1 between these end portions, the external faces of the conduit portions 2, 2' are provided with substantially ring-shaped radial formations 14, extending substantially perpendicular to said faces and possibly all in one piece, providing stop surfaces 14' opposed to the end portions 6, 6'; 8, 8' of the conduit segments 7, 7'; 9, 9' juxtaposed to form the line portions 3; 3' and sandwiched, and if necessary gripped by pinching, between said pairs of end portions 6, 6'; 8, 8' facing each other and forming the different circulation line portions 3, 3'.

[0029] By joining and fusing the different radial formations 14, a body in the form of a small plate extending round the conduit portions 2 and 2' is obtained and produces the mutual connection of said portions and of the upper part 5' of the housing 5" containing the actuating means 5, by unifying them in a single structural part, obtained for example by injection moulding of a thermoplastic material.

[0030] According to a preferred variation of the invention, also illustrated in the above-mentioned figures, the device 1 will comprise two parallel conduit portions 2, 2', formed all in one piece, each with a determined passage cross-section, possibly different from each other, the flaps 4, 4' forming regulating devices and disposed in said two conduit portions 2, 2' having different angular orientations round the axis X of the control rod 4".

[0031] Practical production of the flaps 4, 4' of the control rod 4" and of the conduit portions 3, 3' forming part of the device 1 may for example correspond to one of those described in French Patent Application No. 00 02644 of 1 March 2000 (the longitudinal axes of the conduit portions 3, 3' not being aligned with each other in that case), in French Patent Application No. 01 15738 of 5 December 2001 or in French Patent Application No. 01 16314 of 17 December 2001, all in the name of the applicant.

[0032] Preferably, the flap valve device 1 comprises, on the one hand, the regulating device 4 of one 18' of the two parallel circuit segments 18, 18' of the main circuit 15 and, on the other hand, the regulating device 4' of the secondary circuit 21 traversing the radiator 21 of the secondary unit heater.

[0033] In accordance with a possible advantageous variation of the invention, illustrated in Figures 2 to 8 of the accompanying drawings, a first 11 of the two parts comprises the feed pump 17 and its flange 17" for mounting and fluidic connection on the engine block, certain parts of the conduits forming the main circuit 15, a portion of the secondary circuit 20 traversing the radiator 20', and also the end portions 6 and 8 of the segments 7 and 9.

[0034] The second 12 of the two parts in this case comprises the complementary parts of the conduits forming the main circuit 15, other secondary circuit portions 20, the parts 21" of the secondary circuit 21, the part 23" of the gas extraction and charging circuit 23,

and the end portions 6' and 8' of the segments 7' and 9'.

[0035] Thus, said two parts 11 and 12 are assembled solely in the region of the end portions 6, 6'; 8, 8' of the conduit segments 7, 7'; 9, 9' by end to end contact with interposition of the radial formations 14 of the flap valve device 1, thus defining a connection plane P perpendicular to the parallel circulation directions in the circulation line portions 3 and 3' forming part respectively of the parallel circuit segment 18 of the main circuit 15 and of the secondary circuit 20 traversing the radiator 20' and consisting by juxtaposed assembly of the conduit segments 7, 7'; 9, 9' receiving by partial nesting the corresponding constituent parts 2" of the conduit portions 2 and 2' of the flap valve device 1.

[0036] The resulting module 24 therefore has, as illustrated in the above-mentioned figures, an elongated structure that is not very wide or thick and extends, after assembly, along one side only of the engine.

[0037] The pump casing 17 is advantageously formed by assembly by vibration welding of two complementary parts made of a thermoplastic material and situated at the end of the part 11 opposed to the end portions 6 and 8.

[0038] The electric drive motor 26 of the pump 17 will preferably be mounted in continuity in the longitudinal direction of the module 24, after the casing of this pump 17.

[0039] As shown in Figures 2 to 8 of the accompanying drawings, and more particularly Figure 5, the part 12 may also be formed by assembly by vibration welding of two constituent parts made by injection moulding (the cutaway in Figure 5 shows one of the two parts, together with the connection plane).

[0040] In addition, the internal circuit of the water/oil heat exchanger 19, associated with an oil filter, and in the form of a module with said oil filter, will be connected to the circuit segment 18 by two inlet/outlet joining pieces while being incorporated in the general form of the module 24, and a temperature sensor 27 may be provided close to the passage interface of the means 16 of cooling the engine and cylinder heads towards the main circuit 15.

[0041] The regulation device 22 may consist of a flap valve with proportional control and of which the actuating motor 22' is mounted radially on the module 24.

[0042] This regulating device 22 may for example be produced in the form of a flap valve such as that described in the French patent applications referred to previously.

[0043] Finally, the invention also relates, as is shown in particular in Fig. 1 of the accompanying drawings, to a cooling circuit 25 for vehicles with thermal engines, substantially consisting, on the one hand, of a main circuit 15 forming a circulation loop on the means 16 of cooling the cylinders and cylinder heads of the engine, incorporating a feed pump 17 in a common circuit segment 17' and comprising two circuit segments 18 and 18' in parallel of which one 18 traverses a water/oil heat

exchanger 19 and the other 18' incorporates a regulating device 22, on the other hand, two secondary circuits 20 and 21 extending in shunt on the main circuit 15, each incorporating a respective regulating device 4, 4', one traversing the radiator of a main unit heater dissipating the heat recovered in the surrounding environment, and the other traversing the radiator 21' of a secondary unit heater used to heat the interior of the vehicle and, finally, a circuit in shunt for gas extraction and charging 23 traversing a reservoir 23' of cooling liquid, characterised in that it comprises a central structural module 24 as described above.

[0044] In Figures 1 to 8, the references A to H designate the interface points or zones (inlet/outlet openings) between the module 24 and the other components of the cooling circuit 25.

[0045] Of course, the invention is not restricted to the embodiments described and illustrated in the accompanying drawings. Modifications are possible, particularly from the point of view of the constitution of the various elements or by substitution of technical equivalents, without thereby departing from the scope of protection of the invention.

Claims

1. Module for a cooling circuit for vehicles with an internal-combustion engine, said circuit consisting substantially, on the one hand, of a main circuit forming a circulation loop on the cooling means for the cylinders and cylinder heads of the engine, incorporating a feed pump in a common circuit segment and comprising two parallel circuit segments, in series with the common segment, of which one traverses a water/oil heat exchanger and the other incorporates a regulating device and, on the other hand, of two secondary circuits extending in shunt from the above-mentioned main circuit, each incorporating a respective regulating device, one traversing the radiator of a main unit heater dissipating the recovered heat in the surrounding environment and the other traversing the radiator of a secondary unit heater used to heat the interior of the vehicle, the module being **characterised in that** it is formed by assembly, in the region of a connection plane (P) or assembly zones, of two parts (11 and 12) made of thermoplastic material(s) sandwiched together, with at least partial nesting in end portions (6, 6'; 8, 8') of at least two conduit segments (7, 7'; 9, 9') juxtaposed to form at least one corresponding circulation line (3; 3') of the cooling circuit, at least one conduit portion (2; 2') containing a device (4, 4') for measuring or regulating the flow in the line (3; 3') concerned, and **in that** said module (24) incorporates at least the conduits forming the main circuit (15), conduit segments forming parts (20, 21) of the secondary circuits (20 and 21), at least a part of

the feed pump (17), and the three regulating devices (4, 4', 22).

2. Module according to claim 1, **characterised in that** it comprises at least two conduit portions (2, 2') assembled so as to each nest in the opposite end portion (6 and 6'; 8 and 8') of two conduit segment pairs (7 and 7'; 9 and 9') each of which forms by end to end association, in the region of the plane (P) or assembly zones, of its two segments, a corresponding circulation line (3; 3'), each conduit portion (2, 2') comprising a device (4, 4') for regulating or measuring the flow, said portions possibly being formed together all in one piece. 5
3. Module according to any one of claims 1 and 2, **characterised in that** the conduit portion(s) (2, 2') are formed all in one piece with at least a part of means (5) for control or actuation of the measuring or regulating device(s) (4, 4') and/or a protection housing (5'') containing these means. 10
4. Module according to any one of claims 1 to 3, **characterised in that** it also comprises conduit segments forming parts (23'') of a circuit in shunt (23) for gas extraction and charging of the pump (17), forming part of the cooling circuit and traversing a reservoir (23') of cooling liquid. 15
5. Module according to any one of claims 1 to 4, **characterised in that** the conduit portions (2, 2') containing the regulating devices in the form of pivoting flaps (4, 4') forming part of a flap valve device (1), preferably with proportional control, used to regulate the circulation of liquid fluid in the circulation line portions (3, 3'), the circulation flow in each line portion (3, 3') being controlled by a corresponding pivoting flap (4, 4'), and the different flaps (4, 4') being rotationally engaged on the same support and control rod (4''), the rotating position of said rod (4'') round its longitudinal axis (X) being determined by an actuating means (5) offset in relation to said flaps. 20
6. Module according to claim 5, **characterised in that** said flaps (4 and 4') are disposed in respective conduit portions (2, 2'), made integral with each other and with at least one part (5') of the housing (5'') containing said actuating means (5), each conduit portion (2; 2') being nested, in a sealed manner, at least partially in the end portions (6, 6'; 8, 8') opposite two conduit segments (7, 7'; 9, 9') forming by cooperation in axial juxtaposition, the portion of circulation line (3; 3') of which the traversing flow is controlled by the flap (4; 4') mounted in the conduit portion (2; 2') concerned. 25
7. Device according to claim 5 or 6, **characterised in** 30

that the different conduit portions (2, 2') and the part (5') of the housing (5'') integral therewith are formed all in one piece, for example by injection moulding in a thermoplastic material.

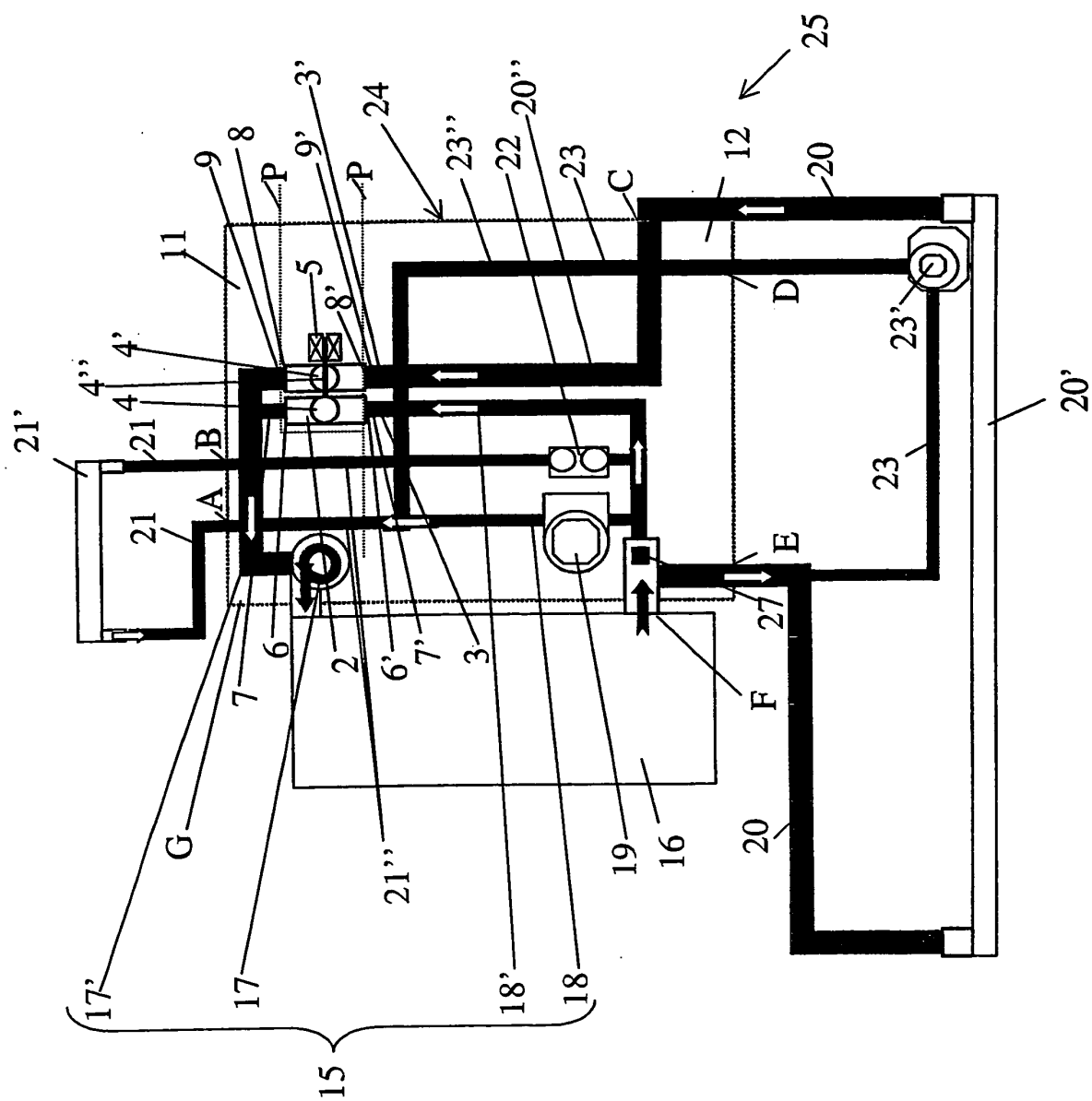
8. Device according to any one of claims 1 and 2, **characterised in that** the end portions (6, 6'; 7, 7') of the conduit segments (7, 7'; 9, 9') are provided with assembly means (10) that allow contiguous juxtaposition with axial gripping of the pairs (7 and 7'; 9 and 9') of opposed conduit segments intended to cooperate to each form a circulation line portion (3; 3'), at least said end portions (6, 6'; 8, 8') of said conduit segments (7, 7'; 9, 9') being grouped adjacent to each other in the two structural units (11 and 12), each preferably all in one piece. 35
9. Device according to any one of claims 1 to 8, **characterised in that** the conduit portions (2, 2') comprise on each of their constituent parts (2'') intended to be nested in corresponding end portions (6, 6'; 7, 7') of the conduit segments (7, 7'; 9, 9') juxtaposed and assembled to form the line portions (3; 3'), at least one external rib (13) and **in that** said end portions (6, 6'; 8, 8') of said conduit segments (7, 7'; 9, 9') have enlarged parts in relation to the common parts of said conduit segments (7, 7'; 9, 9'), the depth or length of each end portion (6, 6'; 8, 8') being equal to the length of the corresponding constituent part (2'') of the conduit portion (2, 2') intended to be nested in it, the transverse or cross-sectional dimensions of each end portion (6, 6'; 8, 8') being substantially equal to, or even slightly less than, the peripheral dimensions of the external rib(s) (13) of the constituent part (2'') of said nesting conduit portion (2, 2') concerned and the internal part of each conduit portion (2, 2') being identical to the common internal parts of the two conduit segments (7, 7'; 9, 9') in which it is intended to be partially nested with correspondence and continuity of passage parts. 40
10. Device according to claim 9, **characterised in that** each constituent part (2'') of each conduit portion (2, 2') comprises two parallel external ribs (13) forming between them a reception groove (13') of an O-ring (13''), some of said ribs (13) possibly extending over a plurality of constituent parts (2''), the corresponding conduit segments (7'; 9') receiving these parts (2'') then comprising a common end portion (6', 8') of which the cross-section is adapted to the shape and external dimensions of said ribs (13) extending over a plurality of constituent parts (2''). 45
11. Device according to any one of claims 1 to 10, **characterised in that** the conduit portions (2, 2') are provided on their external faces with substantially ring-shaped radial formations (14), extending substantially perpendicular to said faces and possibly to- 50

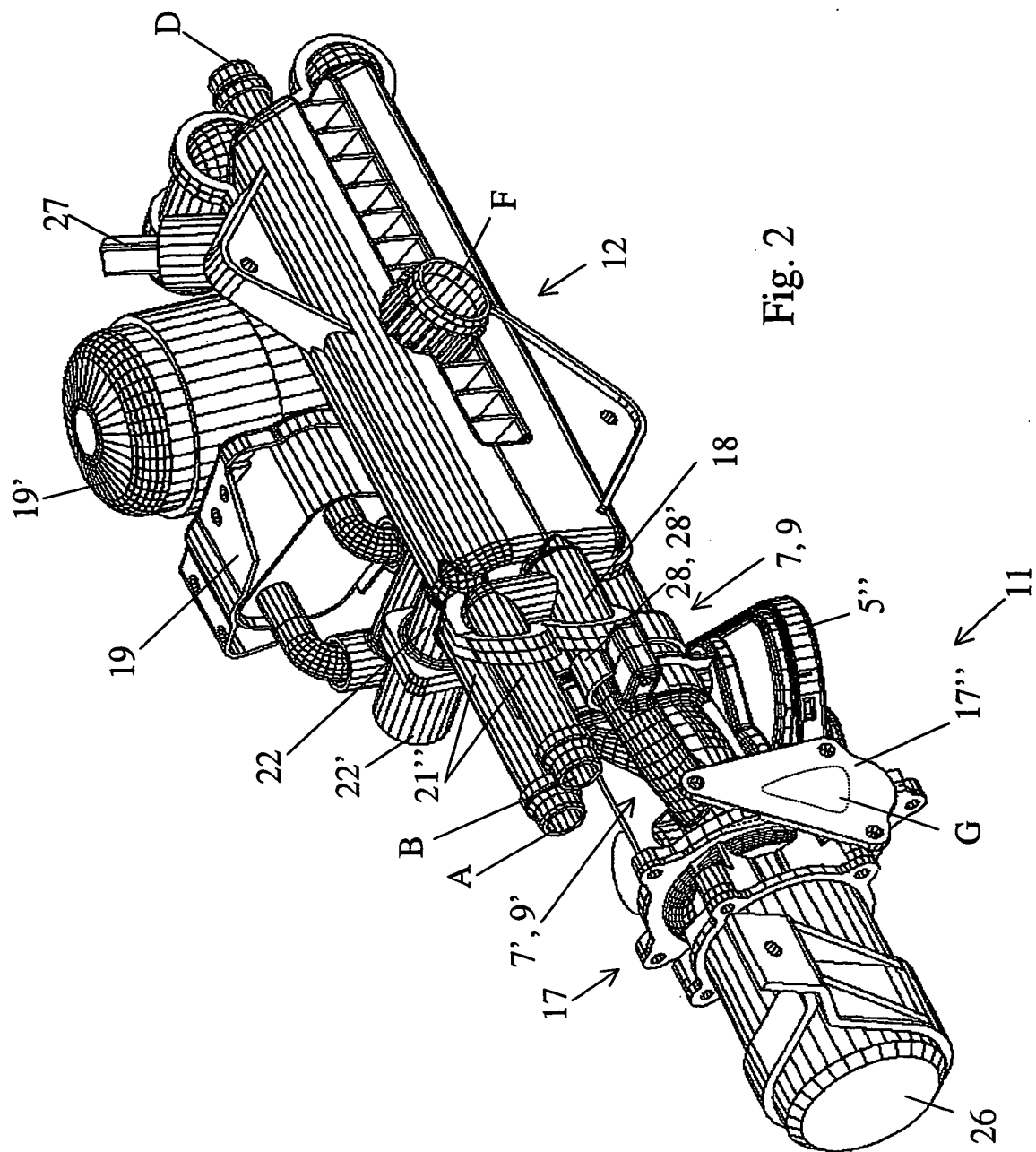
gether all in one piece, providing stop surfaces (14') opposed to the end portions (6, 6'; 8, 8') of the conduit segments (7, 7'; 9, 9') juxtaposed to form the line portions (3; 3') and sandwiched, and if necessary gripped by pinching, between said pairs of end portions (6, 6'; 8, 8') facing each other and forming the different circulation line portions (3, 3').

12. Device according to any one of claims 1 to 11, **characterised in that** each end portion (6, 6', 8, 8') of the conduit segments (7, 7'; 9, 9') is provided with a mounting flange (10), preferably formed all in one piece with said end portion (6, 6', 8, 8') concerned or with the structural unit (11 or 12) comprising said end portion, and comprising reception sites (10') for assembly means used to connect said flange (10) with the mounting flange (10) of the end portion (6, 6', 8, 8') juxtaposed to form, by contiguous association of their respective conduit segment (7, 7', 9, 9'), a corresponding circulation line portion (3, 3'), the conduit portions (2, 2') forming the inserted connection segments, providing a passage with no loss of charge between the conduit segments respectively assembled with each other (7, 7'; 9, 9').
13. Device according to any one of claims 1 to 12, **characterised in that** it comprises two parallel conduit portions (2, 2'), formed all in one piece, each with a determined passage cross-section, possibly different from each other, the flaps (4, 4') forming regulating devices and disposed in said two conduit portions (2, 2') having different angular orientations round the axis (X) of the control rod (4").
14. Module according to any one of claims 5 to 13, **characterised in that** the flap valve device (1) comprises, on the one hand, the regulating device (4) of one (18') of the two parallel circuit segments (18, 18') of the main circuit (15) and, on the other hand, the regulating device (4') of the secondary circuit (21) traversing the radiator (21) of the secondary unit heater.
15. Module according to any one of claims 4 to 14, **characterised in that** a first (11) of the two parts comprises the feed pump (17) and its flange (17") for mounting and fluidic connection on the engine block, certain parts of the conduits forming the main circuit (15), a portion of the secondary circuit (20) traversing the radiator (20'), and also the end portions (6 and 8) of the segments (7 and 9), and **in that** the second (12) of the two parts comprises the complementary parts of the conduits forming the main circuit (15), other secondary circuit portions (20), the parts (21") of the secondary circuit (21), the part (23") of the gas extraction and charging circuit (23), and the end portions (6' and 8') of the segments (7' and 9'), said two parts (11 and 12) being

assembled solely in the region of the end portions (6, 6'; 8, 8') of the conduit segments (7, 7'; 9, 9') by end to end contact with interposition of the radial formations (14) of the flap valve device (1), thus defining a connection plane (P) perpendicular to the parallel circulation directions in the circulation line portions (3 and 3') forming part respectively of the parallel circuit segment (18) of the main circuit (15) and of the secondary circuit (20) traversing the radiator (20') and consisting, by juxtaposed assembly, of the conduit segments (7, 7'; 9, 9') receiving by partial nesting the corresponding constituent parts (2") of the conduit portions (2 and 2') of the flap valve device (1).

16. Cooling circuit for internal-combustion engine vehicle, substantially consisting, on the one hand, of a main circuit forming a circulation loop on the cooling means for the engine cylinders and cylinder heads, incorporating a feed pump in a common circuit segment and comprising two parallel circuit segments, of which one traverses a water/oil heat exchanger, and the other incorporates a regulating device, on the other hand, of two secondary circuits extending in shunt on the main circuit, each incorporating a respective regulating device, one traversing the radiator of a main unit heater dissipating the recovered heat in the surrounding environment, and the other traversing the radiator of a secondary unit heater used to heat the interior of the vehicle, and finally, of a circuit in shunt for gas extraction and charging traversing a reservoir of cooling liquid, **characterised in that** it comprises a central structural module according to any one of claims 1 to 15.





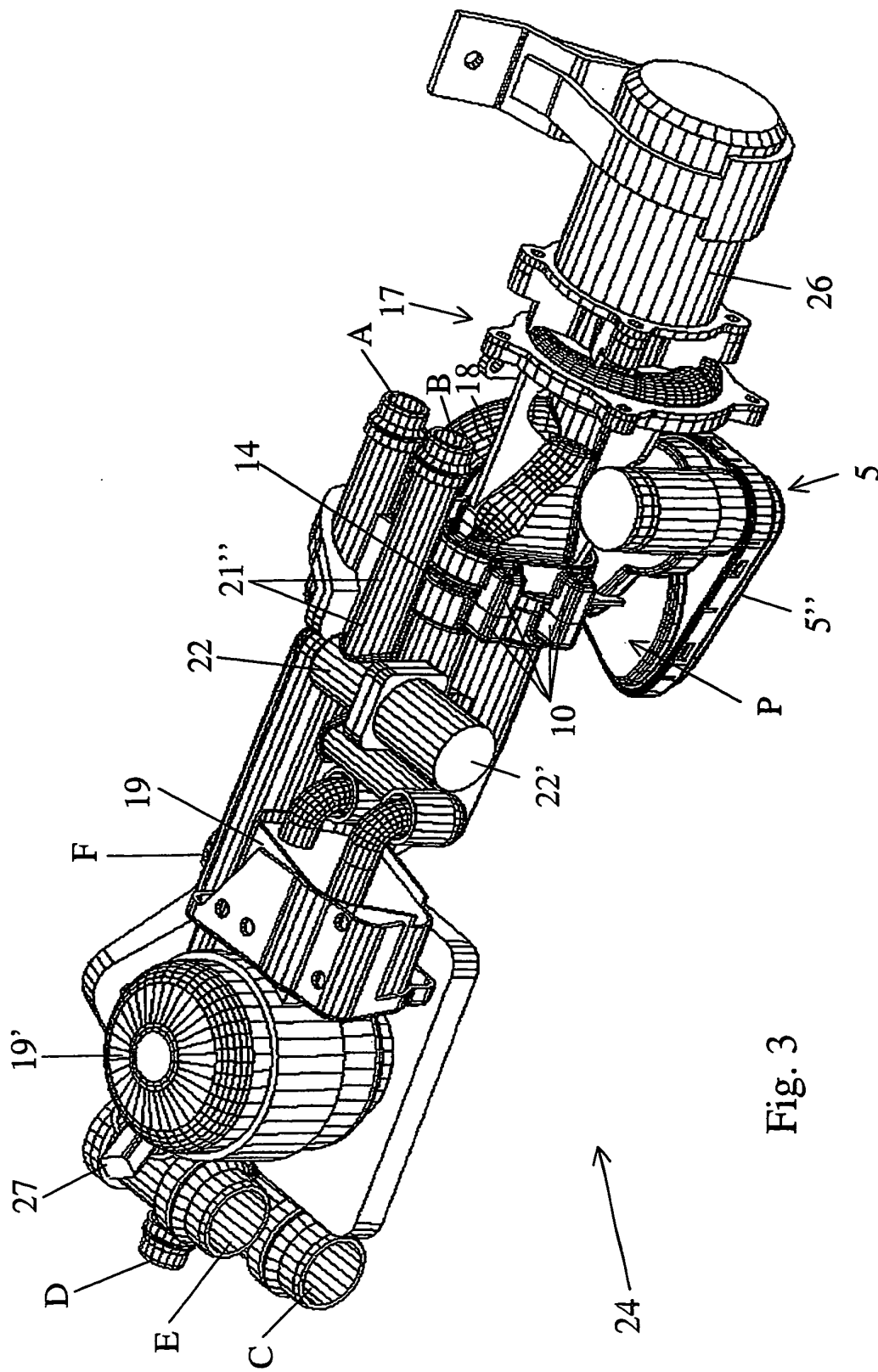


Fig. 3

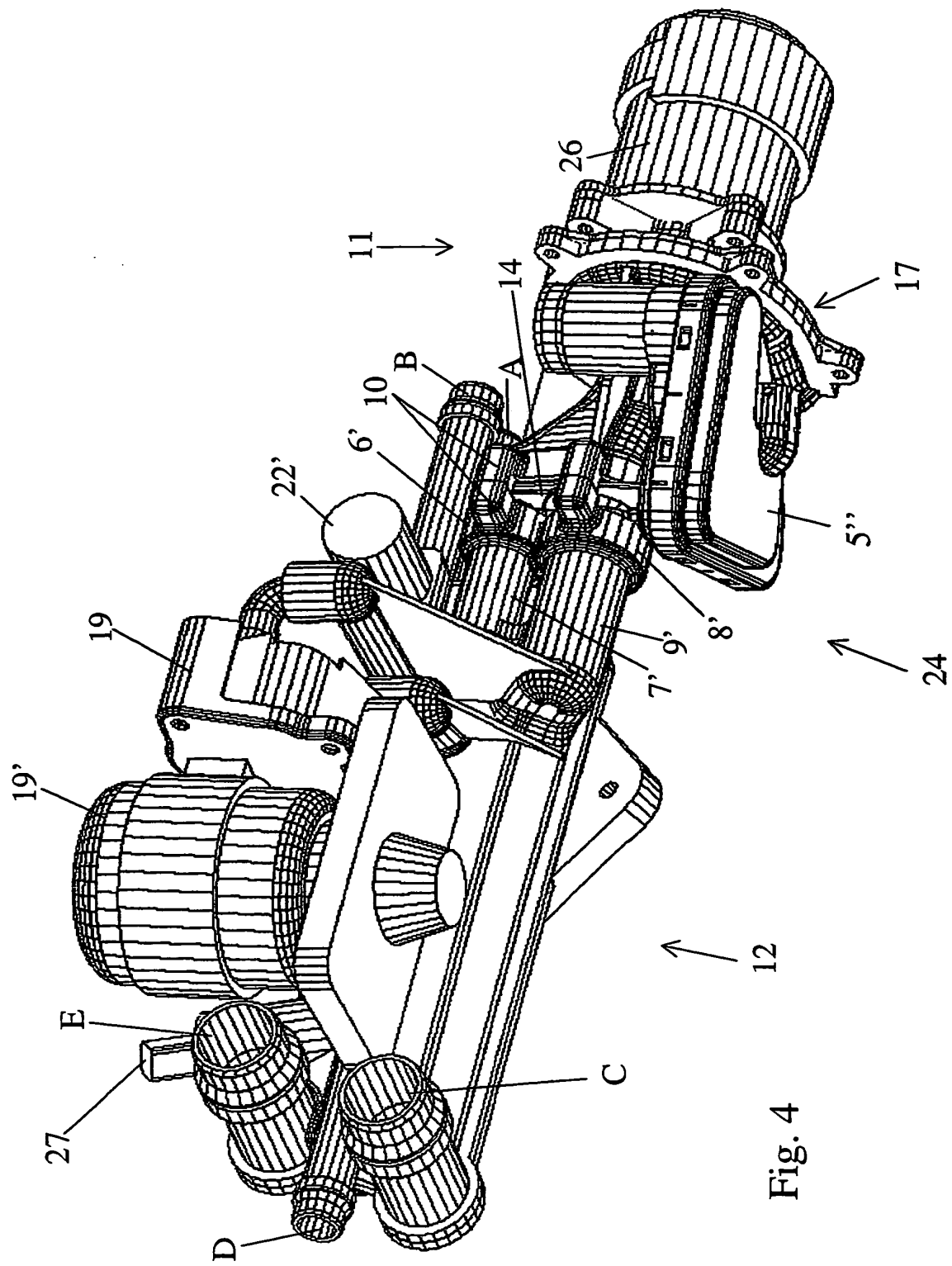


Fig. 4

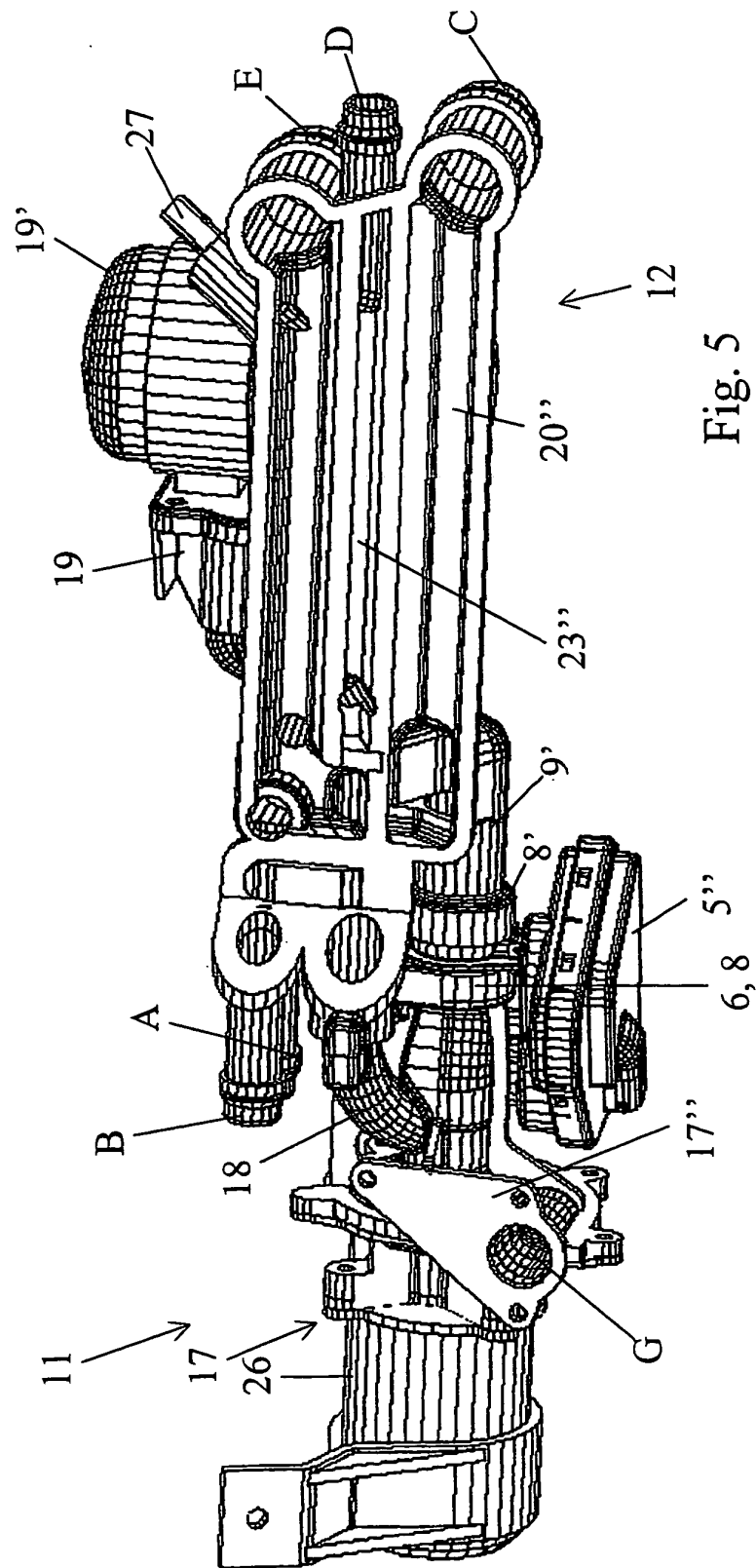


Fig. 5

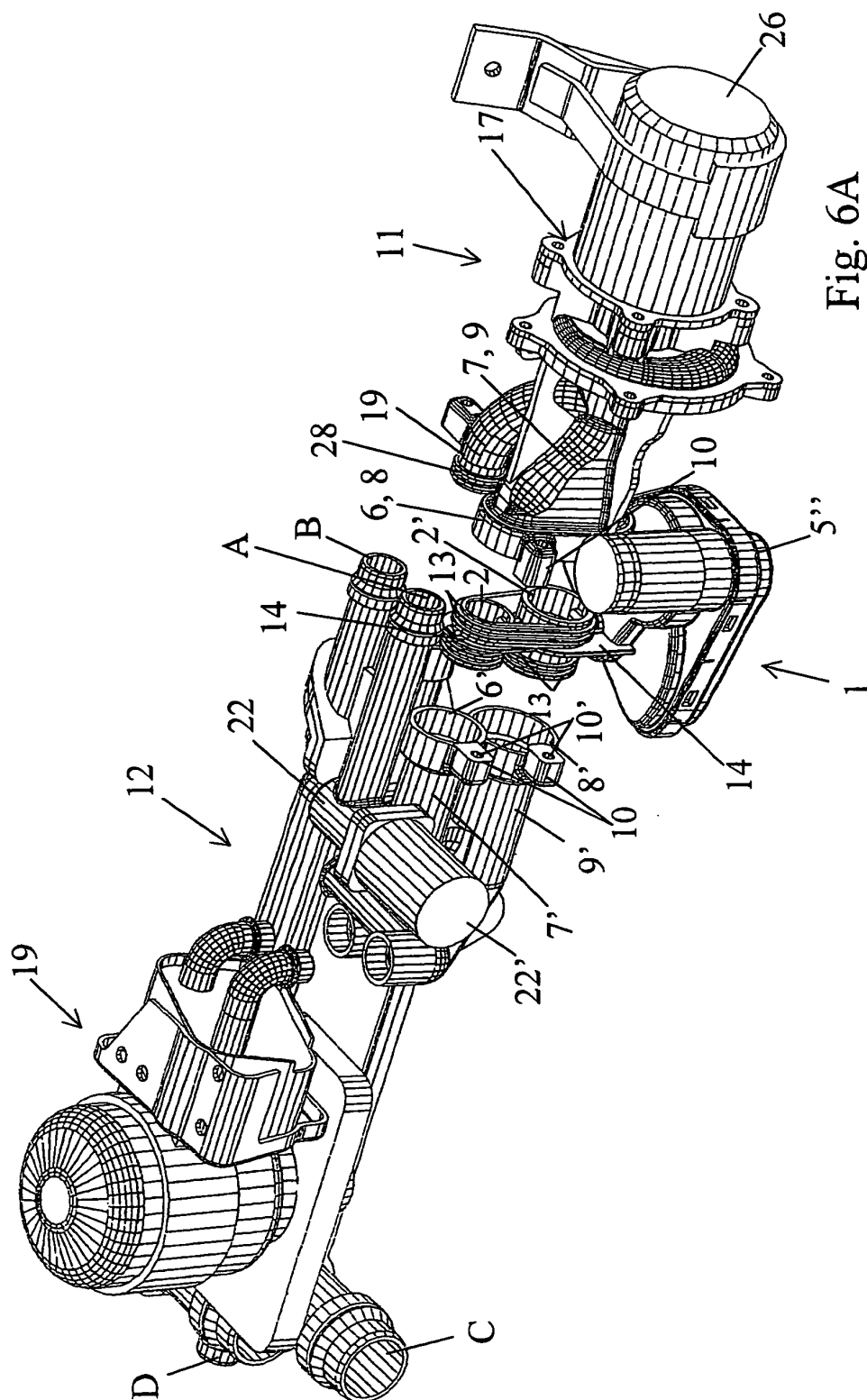


Fig. 6A

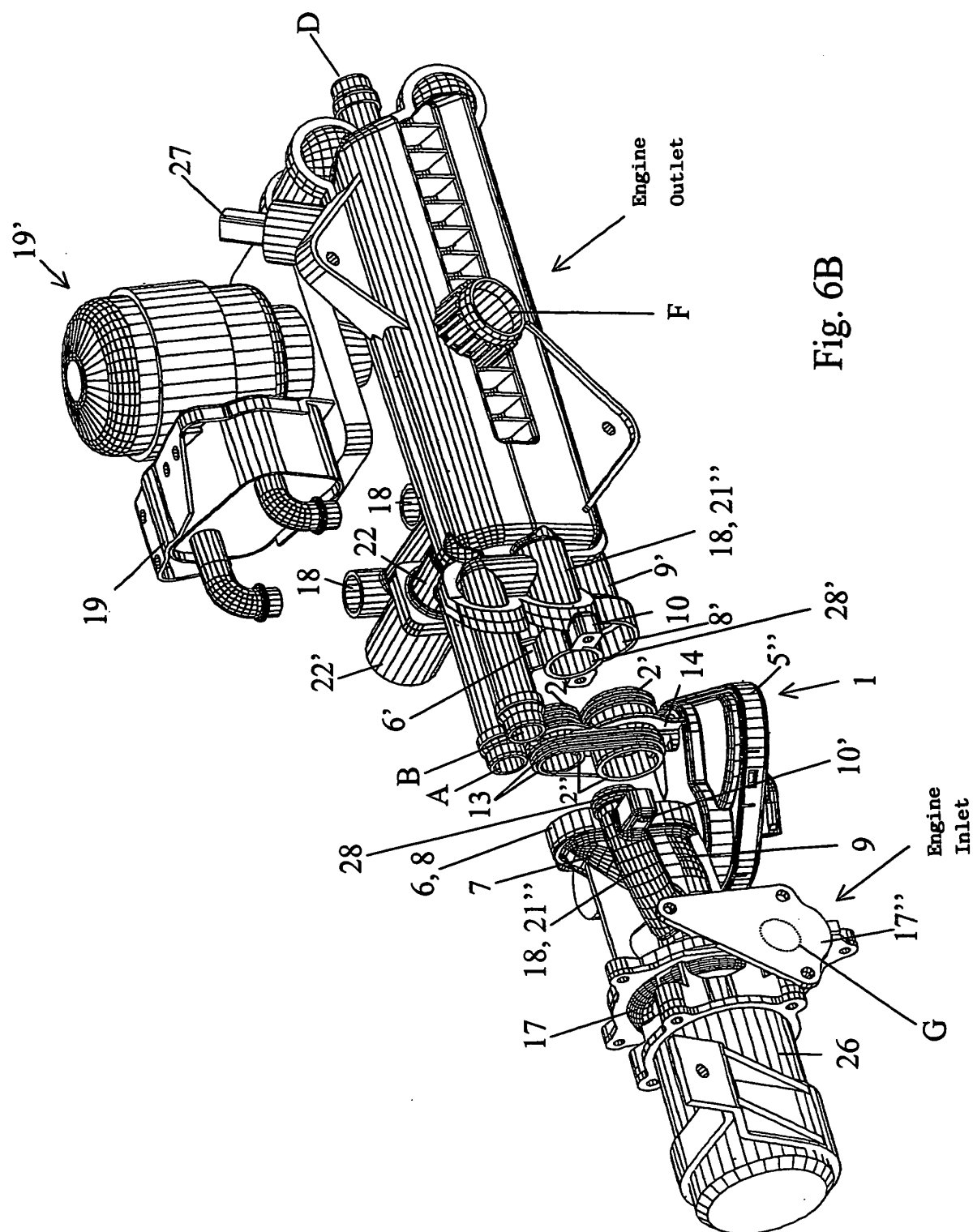


Fig. 6B

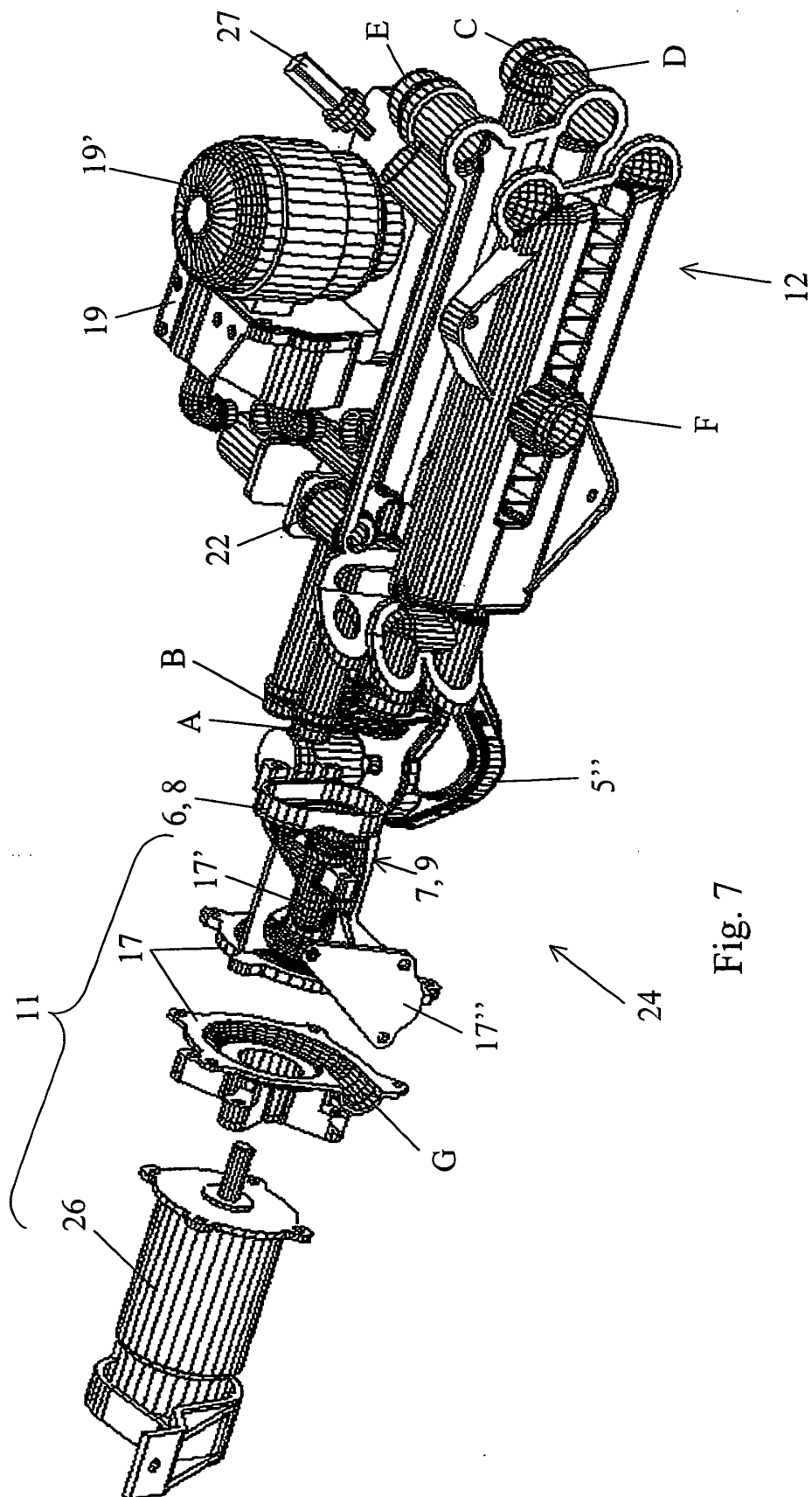


Fig. 7

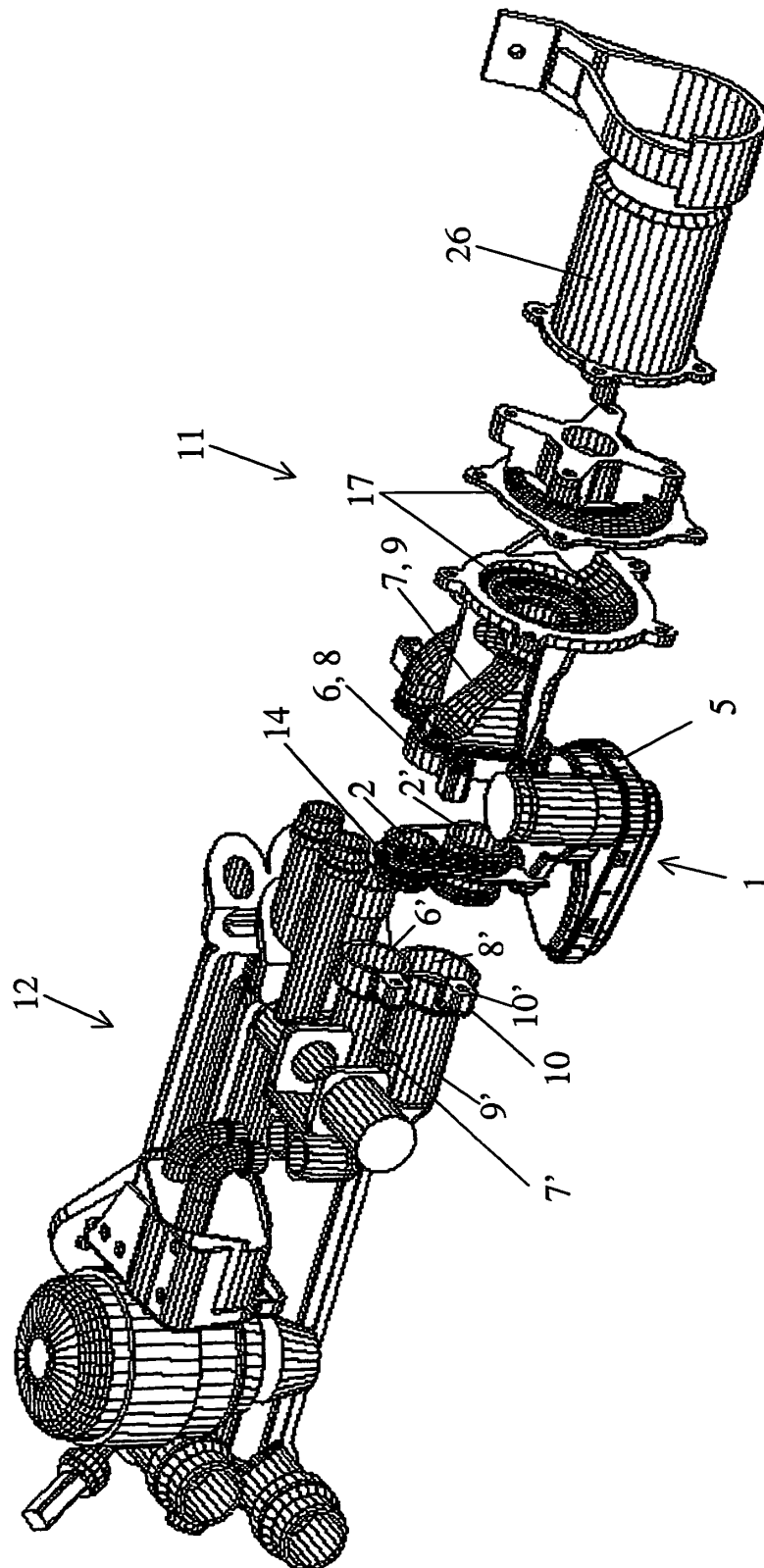
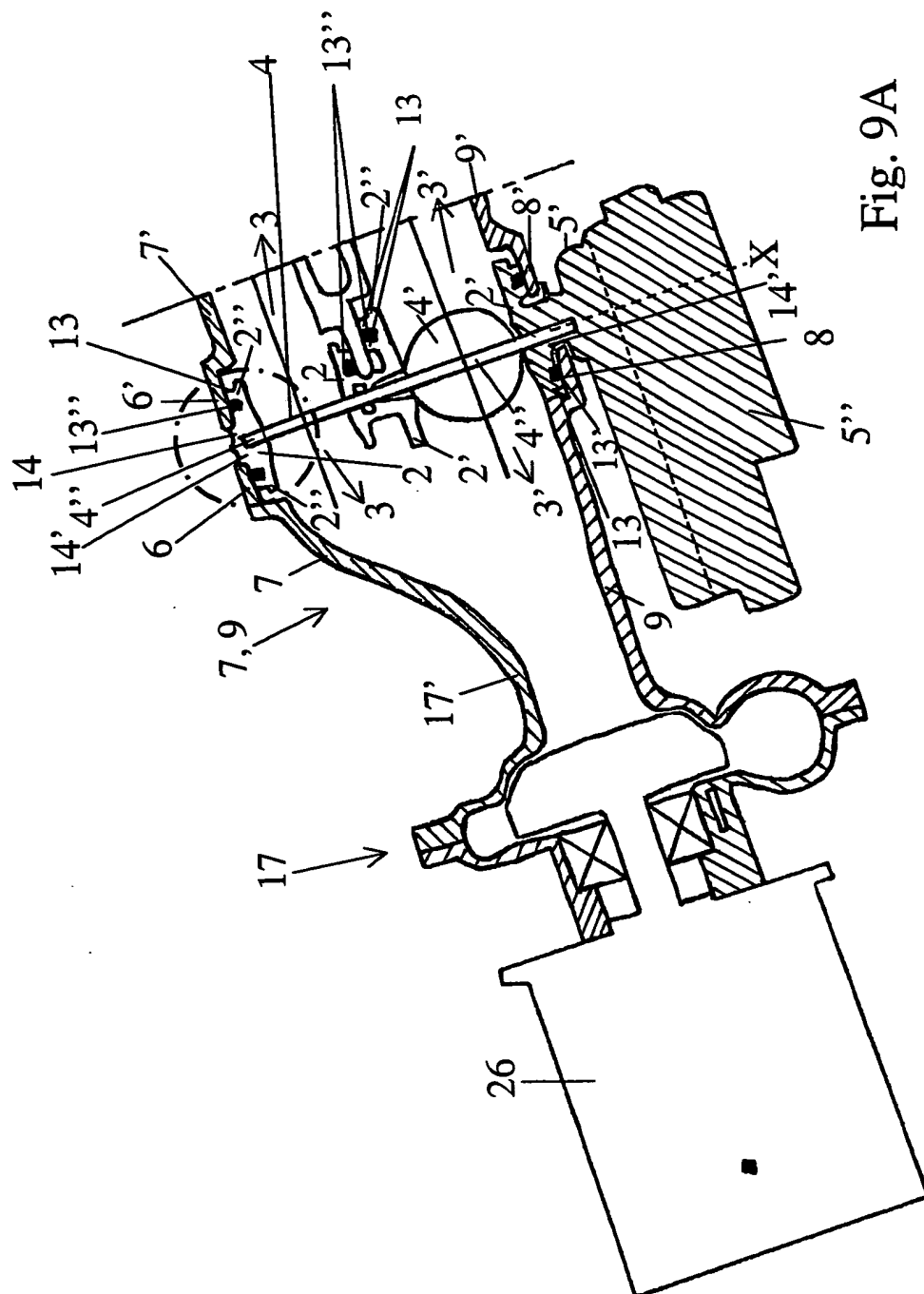


Fig. 8



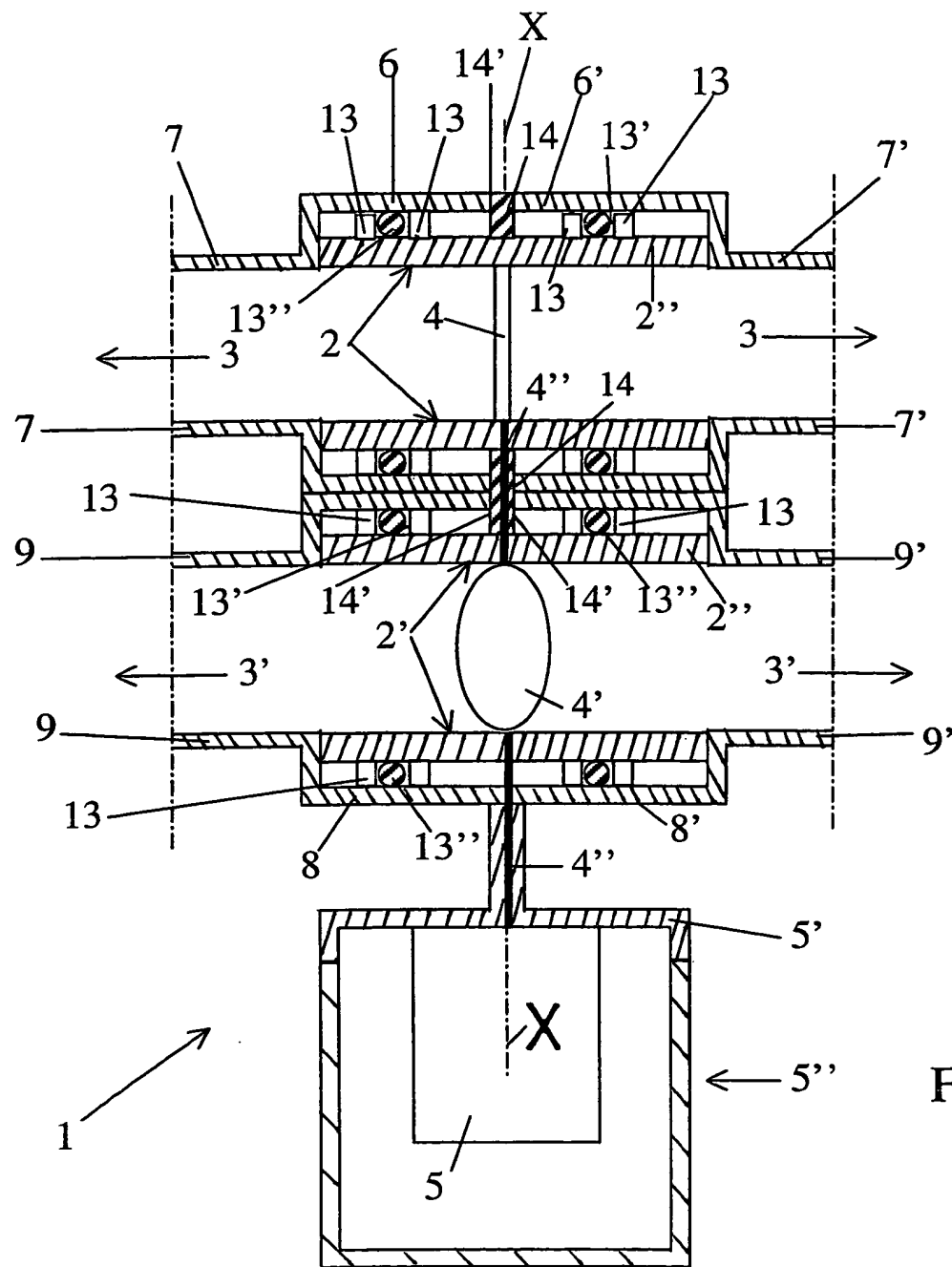
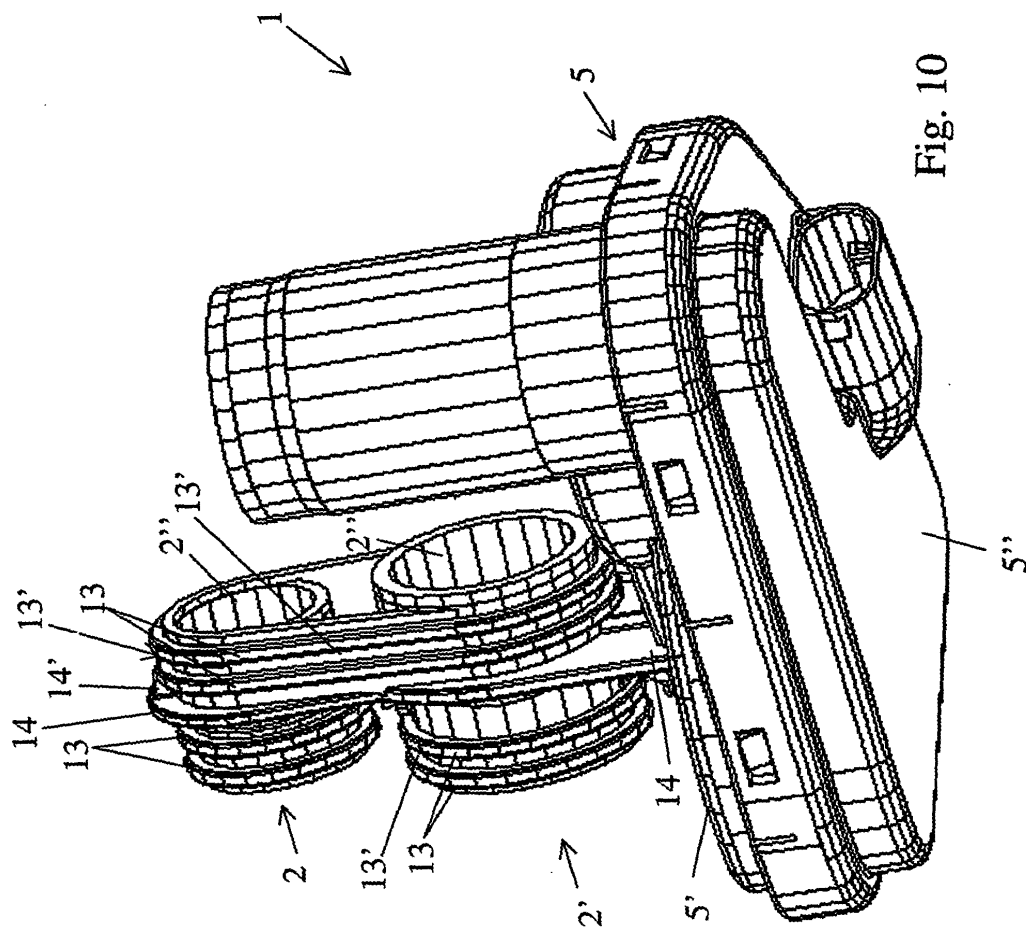


Fig. 9B



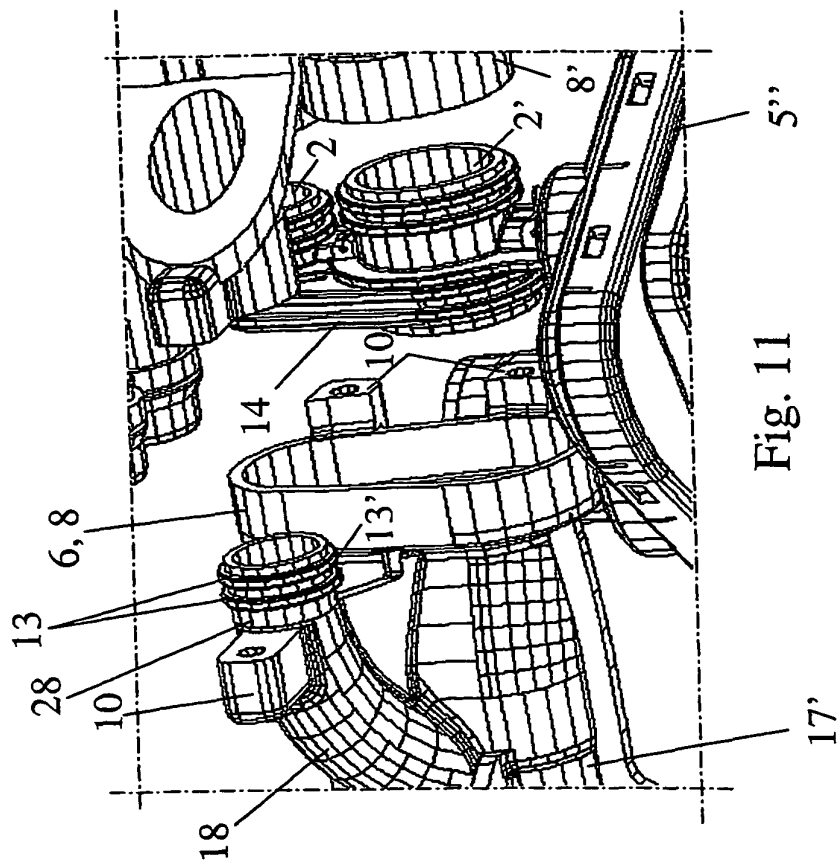


Fig. 11

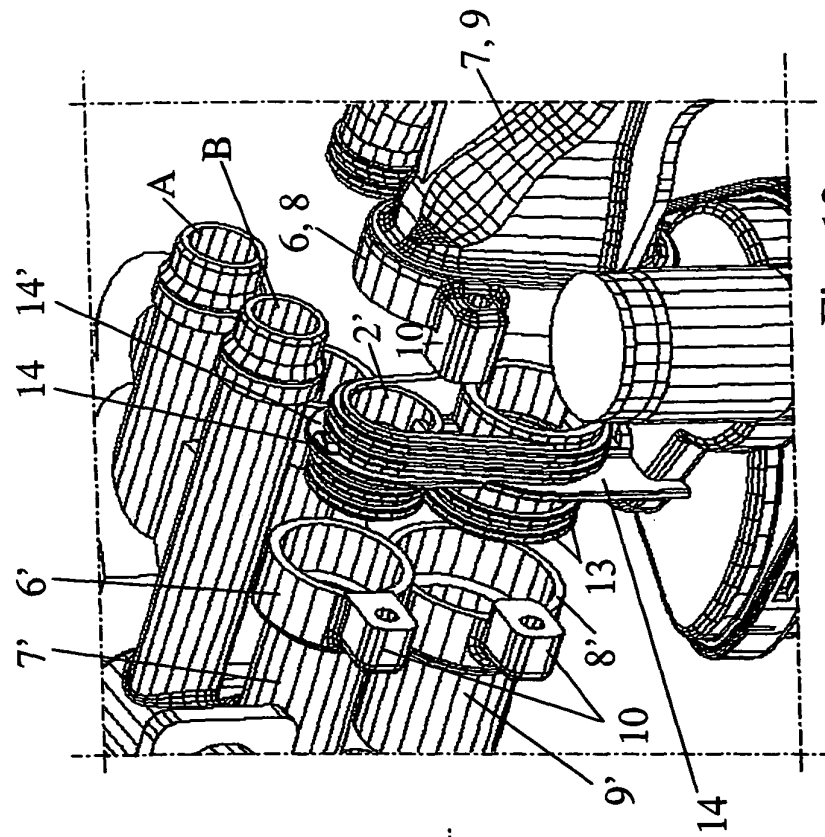


Fig. 12

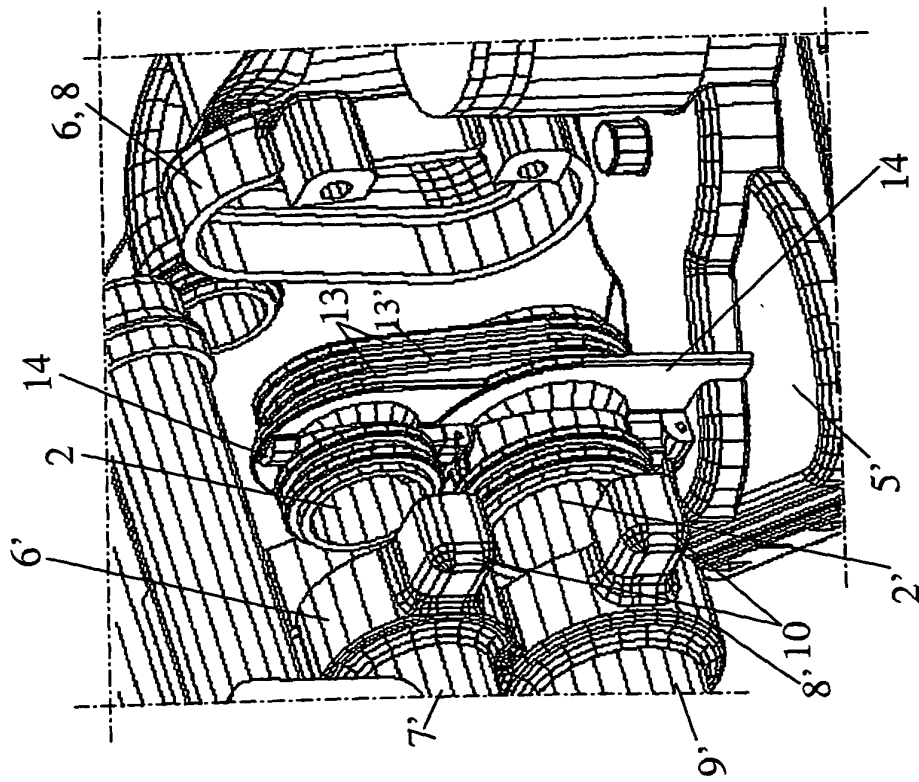


Fig. 13

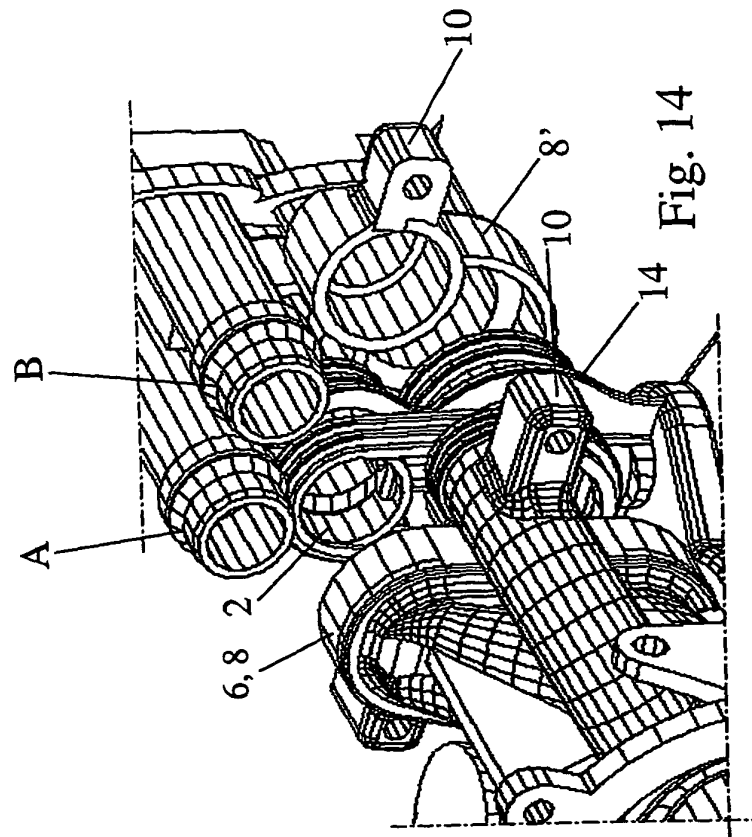


Fig. 14



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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		22 September 2003	Kooijman, F.
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X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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