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(54) ONE-PIECE MULTIFUNCTION BODY FOR A HYDRAULIC VALVE ASSEMBLY USED IN A COMBINED PLANT

(57) A one-piece multifunction body (27) for a hydraulic valve assembly (20) used in a combined plant (10). The one-piece multifunction body (27) comprises a main hollow body (27A) having a substantially polyhedral shape provided with a plurality of types of attachments (86A, 87A, 87B) on the faces ((FC1), (FC2), (FC3), (FC4), (FC5), (FC6)) of the polyhedron. The attachments (86A, 87A, 87B) are designed to be coupled to a plurality of control and interception devices (26, 28A, 29, 30, 33, 35, 38, 61, 62, 63) of the water flow inside the main hollow body (27A). At least one type of attachments (86A, 87A, 87B) includes at least two identical attachments (86A, 87A, 87B) on different faces ((FC1), (FC2), (FC3), (FC4), (FC5), (FC6)) of the polyhedron.

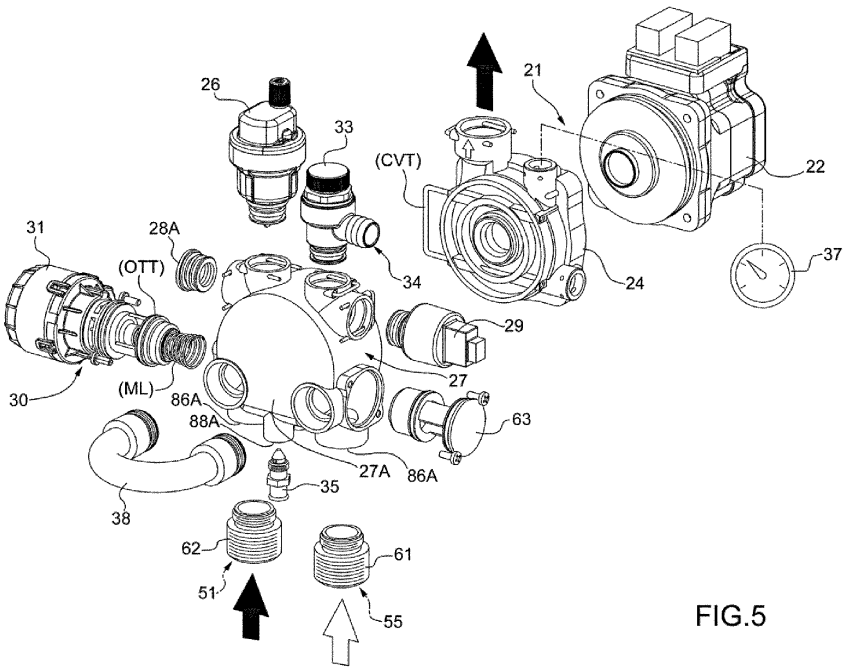

FIG.5

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Description

PRIORITY CLAIM

[0001] This application claims priority from Italian Patent Application No. 102017000022780 filed on March 1, 2017.

[0002] The present invention mainly relates to a one-piece multifunction body for a hydraulic valve assembly. The hydraulic valve assembly is used in a boiler, in particular in a condensing boiler, or in a geothermal heat pump.

[0003] The present invention also relates to a hydraulic valve assembly using a one-piece multifunction body made according to the teachings of the present invention.

[0004] A further object of the present invention is to provide a boiler, in particular a condensing boiler, provided with at least one hydraulic valve assembly comprising at least one one-piece multifunction body made according to the teachings of the present invention.

[0005] As known, the hydraulic assemblies for combined boilers developed in recent years have undergone a significant rationalization of the hydraulic components with the progressive abandonment of single monofunction components connected to each other by means of pipes in favour of increasingly compact multifunction control and safety devices, said devices having have been designed to perform all the hydraulic functions of the boiler.

[0006] It is also known that since the beginning of the 1990s up to ten years ago, in the domestic heating field, multifunction hydraulic assemblies for combined boilers have undergone a considerable evolution, gradually integrating more and more components, devices and functions of the boiler hydraulic circuit.

[0007] Therefore, the efforts of the engineers have been directed above all to the reduction of the size and of the manufacturing costs.

[0008] All this has actually led to the suppression of connecting pipes in favour of very compact multifunction housing units designed to house all the devices of the hydraulic circuit of a combined boiler.

[0009] Some typical one-piece bodies for hydraulic assemblies are described and shown in the documents GB-A-3 388 422, EP-A1-1 026 457 and US-A1-2014/0224194.

[0010] This ever-increasing integration of the hydraulic system has been induced by the large volumes at stake, which today in Europe alone are around five to six millions of combined boilers produced each year.

[0011] It is also well known that the new objectives of the European Union for domestic heating aim at encouraging the use of electricity-powered heat pumps as an alternative to traditional gas- or oil-powered boilers.

[0012] The latest generation of heat pumps has remarkably higher yields than condensing gas boilers and is increasingly employed for new underfloor heating plants in new ecological buildings.

[0013] Heat pumps are combined machines for room heating and domestic hot water production with matching storage tanks of adequate capacity.

[0014] These machines have a hydraulic heat distribution circuit basically corresponding to the one of gas boilers, with separate storage tanks for the production of domestic hot water.

[0015] The layout of heat pumps normally provides a hydraulic circuit consisting mainly of pipes and fittings for connecting the components and functional devices of the machine.

[0016] Compact multifunction housing units designed to house all devices of the heat distribution hydraulic system are still in an embryonic state, since the layout of the heat pumps is still various.

[0017] This causes a proliferation of variants on hydraulic circuits with low amounts of products, or in any case amounts that do not justify any major investment in the integration of components.

[0018] At present, therefore, heating plants using heat pumps are strongly in need of a standardization of the hydraulic layout.

[0019] The standardization of the hydraulic circuit increases production volumes and allows designing and investing in the making of new highly integrated multifunction hydraulic assemblies, carefully sized with low load losses and high flow rates to be used on heat pumps and/or on medium-power condensing boilers.

[0020] Therefore, the new hydraulic assembly for medium-power boilers and for domestic heat pumps according to the present invention is designed and produced by providing versatile attachments and orientations to ease the introduction on layouts of existing machines, while still allowing the manufacturers to maintain a significant diversification of the hydraulic circuit as well. Therefore, the main object of the present invention is to provide an extremely compact hydraulic valve assembly for boilers, whose components are reduced to a single multifunction valve body integrating all control and safety devices, which is predisposed to the coupling with the rest of the hydraulic circuit by means of quick attachments. Although the present description focuses on a simple combined plant for room heating and for the production of domestic hot water using a domestic hot water storage tank, the teachings of the invention may also be extended to a more complex plant, also providing for the use of a heat pump. However, said heat pump plant will not be described in detail not to burden the present description.

[0021] The present invention will now be described with reference to the accompanying drawings showing non-limiting embodiments thereof with the proviso that, given the particular complexity of the drawings and the high number of details, not all the elements have been numbered; in which:

- Figure 1 shows a schematic diagram of a combined plant for room heating and domestic hot water production;

- Figure 2 shows a diagram of a hydraulic valve assembly contained in the combined plant of Figure 1;
- Figure 3 shows a perspective view of the hydraulic valve assembly of Figure 2;
- Figure 4 shows an exploded view of the hydraulic valve assembly shown in Figure 3 observed from a first point of view;
- Figure 5 shows the same exploded view of the hydraulic valve assembly shown in Figure 4 observed from a second point of view (opposite the first point of view);
- Figure 6 shows a first alternative layout of the hydraulic valve assembly as shown in Figures 4 and 5;
- Figure 7 shows a second alternative layout of the hydraulic valve assembly as shown in Figures 4 and 5;
- Figure 8 shows a third alternative layout of the hydraulic valve assembly as shown in Figures 4 and 5;
- Figure 9 shows a first perspective view of a one-piece multifunction body contained in the hydraulic valve assembly referred to in Figures 2-8;
- Figure 10 shows a second perspective view of a one-piece multifunction body contained in the hydraulic valve assembly as shown in Figures 2-8;
- Figure 11 shows a front view (with a sectioned portion) of the one-piece multifunction body according to Figures 9, 10;
- Figure 12 shows various significant views and sections of the one-piece multifunction body according to Figures 9-11;
- Figure 13 shows various significant views and sections of a scroll belonging to a centrifugal pump assembly contained in the combined plant of Figure 1; and
- Figures 14-17 show four possible couplings between the one-piece multifunction body according to Figures 9-12 and the scroll shown in Figure 13.

[0022] In Figure 1, 10 indicates a combined plant for room heating and domestic hot water production.

[0023] As explained hereinafter, a one-piece multifunction body for a hydraulic valve assembly made according to the teachings of the present invention is integrated in said combined plant 10.

[0024] The combined plant 10 comprises a condensing boiler 11 and a hydraulic network 12, hydraulically connected to each other.

[0025] The hydraulic network 12, in turn, comprises, in a known manner, a primary heating circuit (C1) and a secondary circuit (C2) for domestic hot water.

[0026] The primary circuit (C1) comprises a heating hot water delivery duct 50 to at least one heating plant (IR) and a cold water return duct 51 to the condensing boiler 11.

[0027] On the other hand, the secondary circuit (C2) comprises at least one storage tank (SER) of domestic hot water.

[0028] In particular, the storage tank (SER) is supplied with cold water through an inlet duct (CI) for cold water coming from the aqueduct (not shown). Furthermore, the storage tank (SER) has an outlet duct (CU) for domestic hot water that can thus flow towards a point of use (not shown) comprising, for example, one or more taps (not shown).

[0029] As shown in Figure 1, a delivery duct 52 exiting a boiler body (CC) at some point splits into two separate ducts, namely in the aforementioned heating hot water delivery duct 50 and in a delivery duct 53 of a coil 54 immersed in the water contained in the storage tank (SER). The hot water of the primary circuit (C1) flowing in the coil 54 heats the sanitary water contained in the storage tank (SER). It comes out of the coil 54 flowing in a return duct 55 to the condensing boiler 11.

[0030] As shown in Figure 1, the gas condensing boiler 11 comprises the aforesaid boiler body (CC), which in turn comprises:

- a premix gas burner 13 (which is associated with a gas delivery line (LG) controlled by a safety gas valve (VV));
- a main condensing heat exchanger 14;
- a chimney (CHM) for the evacuation of the fumes produced by the gas combustion in the boiler body (CC);
- a cold water delivery duct 15 for transferring the cold water to the main heat exchanger 14;
- a hydraulic valve assembly 20 hydraulically connected, on the one side, to the boiler body (CC), and on the other side, to the return duct 51 of the heating plant (IR) and to the return duct 55 of the water leaving the coil 54 immersed in the storage tank (SER) of the secondary circuit (C2) .

[0031] As shown in more detail in Figures 2-5, the hydraulic valve assembly 20 comprises, besides a one-piece multifunction body 27 (which will be described in greater detail below), the following devices:

- a centrifugal pump assembly 21 comprising, in turn, an electric motor 22, which rotates an impeller 23 (Figure 1), in turn enclosed in a scroll 24 provided with a manometer 37;
- an air vent valve 26;
- a fitting 28A with an expansion vessel 28 (Figure 1);
- a pressure switch 29;
- a three-way valve 30 advantageously shaped as a screw-on cartridge (comprising, in turn, an electric motor 31, which, in turn, actuates a relevant shutter (OTT) opposed by a spring (ML));
- a safety valve 33 which, when required, drains the water through an exhaust duct 34;
- a plant drainage tap 35, also passing through the aforementioned exhaust duct 34;
- a by-pass device 38 provided with a by-pass valve 38A;
- two threaded fittings 61, 62 for hydraulically connect-

ing respectively the one-piece multifunction body 27 with the return duct 55 (Figure 1) of the water leaving the coil 54 and with the return duct 51 (Figure 1) of the heating plant (IR) ;

- a three-way valve cap 63.

[0032] Figure 4 also shows the presence of a fixing jumper (CVT) which, as better shown below, serves to fix the scroll 24 to the one-piece multifunction body 27.

[0033] The hydraulic valve assembly 20 is used as an apparatus for regulating the water flow from/to the condensing boiler 11 in which the hydraulic valve assembly 20 is inserted. Figure 6 shows a first alternative layout of the hydraulic valve assembly shown in Figures 4 and 5.

[0034] In this layout, the three-way valve 30 and the fitting 28A have been moved to the left face of the one-piece multifunction body 27, whereas the pressure switch 29 and the three-way valve plug 63 have been mounted on the right side of the one-piece multifunction body 27. In the same layout of Figure 6, the air vent valve 26 and the safety valve have exchanged seats, whereas the by-pass device 38 has been overturned. All other devices have maintained the same position with respect to the one-piece multifunction body 27.

[0035] In the second alternative layout of Figure 7, the positions of the layout shown in Figures 4 and 5 have been substantially maintained. Only the positions of the by-pass device 38 (now screwed onto the lower face of the one-piece multifunction body 27) and of the two threaded fittings 61, 62 (now screwed onto the rear face of the one-piece multifunction body 27) have changed.

[0036] On the other hand, in the third alternative layout of Figure 8, the one-piece multifunction body 27 is rotated 90° anticlockwise (arrow (R1)) so that the three-way valve 30 and the air vent valve 26 can be screwed on the upper face of the one-piece multifunction body 27. In such a configuration, the by-pass device 38 is screwed onto the rear face of the one-piece multifunction body 27, whereas the two threaded fittings 61, 62 are screwed onto the right face of the one-piece multifunction body 27. The pressure switch 29 and the safety valve 33 have instead been mounted on the left side of the one-piece multifunction body 27, whereas the fitting 28A and the plug 63 have been mounted on its lower face. In the layout of Figure 8, the scroll 24 has been rotated 90° clockwise (arrow (R2)) so that the delivery of the centrifugal pump assembly 21 is on the right instead of upwards as in the previous embodiments shown in Figures 4-7.

[0037] In short, the spatial arrangement of the one-piece multifunction body 27, and consequently also of the hydraulic valve assembly 20 in which this body is inserted, depends on the structural and design characteristics of the condensing boiler 11 in which the whole hydraulic valve assembly 20 must be integrated.

[0038] As shown in more detail in Figures 9 to 11, the one-piece multifunction body 27 comprises a main hollow body 27A made of a piece.

[0039] The extreme compactness of the main hollow body 27A even involves the possible use of a single composite material, said composite material being a thermoplastic material, also called "technopolymer", which guarantees a good resistance to high operating temperatures together with a low permeability to water absorption (hydrolysis).

[0040] The aforesaid main hollow body 27A has a substantially polyhedral hollow shape provided with a plurality of openings formed on the faces of the polyhedron. Advantageously, but not necessarily, the main hollow body 27A has a hollow shape having six faces (Figures 9-11):

- a front frontal face (FC1);
- a rear frontal face (FC2);
- a right side face (FC3);
- a left side face (FC4);
- an upper face (FC5);
- a lower face (FC6).

[0041] A front hole 71, provided with a cylindrical collar 71A projecting from the front frontal face (FC1), is formed in the front frontal face (FC1).

[0042] On the cylindrical collar 71A there are four tangential recesses 71B, 71C, 71D, 71E which, as explained below, can be innovatively coupled to the aforementioned scroll 24 of the centrifugal pump assembly 21 (see below).

[0043] As better shown in Figure 13B, a pair of ambidextrous bars 81, 82 (internally drilled to receive a fixing jumper (CVT)) are prismatically engaged with a first pair 71B, 71D or with a second pair 71C, 71E of tangential recesses; as better shown below, the two drilled ambidextrous bars 81, 82 are fixed to the scroll 24 (see below).

[0044] Both the first pair 71B, 71D and the second pair 71C, 71E of tangential recesses are respectively formed by two straight and parallel tangential recesses.

[0045] As shown in Figures 9 to 11, the main hollow body 27A has a central cavity 85 in hydraulic communication with the front hole 71 that, as previously stated, is on the front frontal face (FC1).

[0046] In the lower part of the rear frontal face (FC2) there are two threaded attachments 86A to which the by-pass device 38 can be coupled. The two threaded attachments 86A are in hydraulic communication with the central cavity 85.

[0047] As shown in Figure 10, the right side face (FC3) has a lower attachment 87A designed to house the cartridge-shaped three-way valve 30, which can be screwed, in a known manner and by means of screws not shown, to two threaded holes 87A*, 87A**.

[0048] The lower attachment 87A is overhung by an upper attachment 87B to which e.g., the fitting 28A to the expansion vessel 28 can be coupled by pressure (Figure 4). The upper attachment 87B (Figure 10) is provided with two holes 87B*, 87B** in which a jumper (substantially shaped as a U-shaped hairpin) is inserted. Once inserted into the two holes 87B*, 87B**, the jumper pre-

vents the fitting 28A from being extracted from the upper attachment 87B (Figure 10).

[0049] The left side face (FC4) (Figure 9) has the same attachments 87A, 87B, which are identical to those already described with respect to the right side face (FC3) and therefore will not be described again.

[0050] Two attachments 87B are provided on the upper face (FC5) . Each attachment 87B on the upper face (FC5) is close to an identical attachment 87B on the right side face (FC3), or on the left side face (FC4), respectively. The symmetry axis of each attachment 87B on the upper face (FC5) is perpendicular to the symmetry axis of the respective attachment 87B on the left side face (FC3) and on the right side face (FC4), respectively.

[0051] In other words, the attachments 87B are grouped into two pairs. Each pair is arranged at an upper vertex of the main hollow body 27A.

[0052] The lower face (FC6), on the other hand, provides a pair of identical threaded attachments 86A on which the aforementioned threaded fittings 61, 62 are screwed (Figure 12) .

[0053] The lower face (FC6) also has a further threaded attachment 88A (Figure 12), which is offset with respect to an ideal straight line connecting the centres of the two threaded attachments 86A.

[0054] The aforementioned drainage tap 35 is screwed onto this threaded attachment 88A.

[0055] The central hole 71 and the attachments 86A, 87A, 87B, 86A are all in hydraulic communication with each other and with the aforementioned central cavity 85.

[0056] Incidentally, the term "multifunction" has been associated with the one-piece body 27 since this element performs both hydraulic and mechanical functions, physically supporting a plurality of devices.

[0057] In particular, the one-piece multifunction body 27 object of the invention comprises the aforementioned main hollow body 27A having a substantially polyhedral shape, and is provided with:

- a first plurality of hydraulic attachments 86A arranged on the faces (FC1), (FC2), (FC3), (FC4), (FC5), (FC6) of the polyhedron;
  and
- a second plurality of functional attachments 87A, 87B, also arranged on the faces ((FC1), (FC2), (FC3), (FC4), (FC5), (FC6)) of the polyhedron. This second plurality of functional attachments 87A, 87B comprises attachments 87A designed to house a three-way valve 30.

[0058] Now consider a first straight line (X1) connecting the centres of the two attachments 87A, and a second straight line (X2) connecting the centres of the two attachments 87B (Figure 12A).

[0059] Figure 12A shows that a plane (ψ) perpendicular to the two straight lines (X1), (X2) and passing through the centre (C1) of the central hole 71 divides the one-piece multifunction body 27 into two identical and specularly symmetrical halves 27* and 27**.

[0060] This specular symmetry is quite relevant to give the product an extremely flexible spatial orientation with regard to its positioning (Figures 3-8).

[0061] Obviously, apart from the aforementioned three-way valve plug 63, the hydraulic valve assembly 20 can be provided with additional plugs (not shown) to close one or more attachments 86A, 87A, 87B, 86A as needed for shaping to the best the hydraulic valve assembly 20 to be received in the condensing boiler 11 in the best possible working conditions.

[0062] Figure 13 shows the scroll 24 in more detail and according to different views.

[0063] Said scroll 24 comprises a main hollow body 24A having a front frontal face (FC7) provided with a substantially square flange 91 having four threaded through holes 91A at the four corners.

[0064] In the threaded through holes 91A, screws (not shown) can be screwed to attach reversibly the scroll 24 to the electric motor 22 (Figures 1, 3).

[0065] A left side face (FC8) of the scroll 24 is provided with an attachment 92, which can be coupled e.g. to a pressure gauge 37 or a pressure switch 29, or which can be closed by a suitable plug (not shown).

[0066] On an upper face (FC9) of the scroll 24 there is a delivery attachment 93 connected to the cold water delivery duct 15 to the main heat exchanger 14 (Figure 1).

[0067] The upper face (FC9) is also provided with a further attachment 92 (identical to the attachment 92 on the left side face (FC8)) to insert e.g. the pressure switch 29.

[0068] The pressure switch 29 can be coupled as desired to one of the two attachments 92 based on the orientation of the scroll 24.

[0069] In other words, the pressure switch 29 is mounted directly on the one-piece multifunction body 27 (more precisely in one of the two upper attachments 87B) or it can be coupled to one of the two attachments 92.

[0070] Depending on where the pressure switch 29 is mounted, the upper attachments 87B and the free attachments 92 are closed with appropriate plugs (not shown).

[0071] The attachments 92 are identical and are arranged on substantially perpendicular faces (FC8), (FC9).

[0072] The flange 91 of the front face (FC7) encloses a snail-shaped cavity 94 in hydraulic communication with a central through hole 95, with the two attachments 92 and with the delivery attachment 93.

[0073] In use, the snail-shaped cavity 94 contains the impeller 23 of the centrifugal pump assembly 21 (FIG. 1). The water is then sucked by the impeller 23 through the central through hole 95 (coupled to the front hole 71 on the front face (FC1) of the one-piece multifunction body 27) and sent to the primary heat exchanger 14 through the delivery attachment 93.

[0074] As shown in Figure 13, on a rear frontal face (FC10) (of the scroll 24), besides the aforementioned

central through hole 95 there are two ambidextrous bars 81, 82, which are internally drilled to receive a fixing jumper (CVT); the two ambidextrous bars 81, 82 are arranged on opposite sides with respect to the central through hole 95.

[0075] As previously stated, the two bars 81, 82 can be each time prismatically coupled to a first pair of recesses 71B, 71D or to a second pair of recesses 71C, 71E so that the scroll 24 can be spatially oriented in four different ways, as shown in Figures 14-17.

[0076] In short, the one-piece multifunction body 27 comprises at least one type of attachments 86A, 87A, 87B, which, in turn, comprises at least two identical attachments 86A, 87A, 87B on different faces of the polyhedron (FC1), (FC2), (FC3), (FC4) to allow an extremely flexible spatial orientation of the main hollow body 27A.

[0077] In particular:

- a first type of attachments 86A comprises four identical attachments, two arranged on the rear frontal face (FC2), and, respectively, two arranged on the lower face (FC6);
- a second type of attachments 87A comprises two identical opposite attachments, one arranged on the right side face (FC3), and, respectively, one arranged on the left side face (FC4);
- a third type of attachments 87B comprises four identical attachments, two arranged on the upper face (FC5), and, respectively, one arranged on the right side face (FC3) and one arranged on the left side face (FC4).

[0078] Besides the embodiments shown in the accompanying Figures, the person skilled in the art can appreciate that, by varying the spatial position of the one-piece multifunction body and/or the arrangement of the various devices mounted on the one-piece multifunction body and/or the spatial position of the scroll of the centrifugal pump assembly, countless configurations of the whole hydraulic valve assembly can be obtained, thus allowing the hydraulic assembly manufacturer to satisfy the most different requests from the producers of combined plants and/or boilers.

[0079] However, it should be clear that, although the present invention has been described in the context of a traditional system, all the present teachings can be applied, without significant changes, to a system comprising a heat pump.

[0080] The main advantage of the one-piece multifunction body object of the present invention consists in providing innumerable configurations of the whole hydraulic valve assembly with rational arrangements of the functional elements, thus making its use possible in many types of heating plants.

[0081] All this means a significant reduction in investment costs in moulds and equipment, as well as a substantial reduction in the overall size of the product and, therefore, in a consequent reduction in manufacturing costs.

Claims

1. A one-piece multifunction body (27) for a hydraulic valve assembly (20) used in a combined plant (10) for room heating and for the instantaneous production of domestic hot water; the one-piece multifunction body (27) comprising a main hollow body (27A) having a substantially polyhedral shape provided with:

   - a first plurality of hydraulic attachments (86A, 87A, 87B) obtained on the faces ((FC1), (FC2), (FC3), (FC4), (FC5), (FC6)) of the polyhedron; and
   - a second plurality of functional attachments (87A, 87B), also obtained on the faces ((FC1), (FC2), (FC3), (FC4), (FC5), (FC6)) of the polyhedron; said second plurality of functional attachments (87A, 87B) comprising attachments (87A) designed to house a three-way valve (30);

   said second plurality of functional attachments (87A, 87B) being designed to be coupled to a plurality of control and interception devices (26, 28A, 29, 30, 33, 35, 38, 61, 62, 63) to control and intercept the water flow inside said main hollow body (27A); said control and interception devices (26, 28A, 29, 30, 33, 35, 38, 61, 62, 63) comprising a three-way valve (30);
   said one-piece multifunction body (27) **being characterized in that** at least one type of attachments (86A, 87A, 87B) of said first plurality (8eA) or of said second plurality (87A, 87B) comprises at least two identical attachments (86A, 87A, 87B) obtained on different faces ((FC1), (FC2), (FC3), (FC4), (FC5), (FC6)) of the polyhedron, so as to ensure the most suitable space orientation of said main hollow body (27A) when mounted on said hydraulic valve assembly (20).

2. One-piece multifunction body (27), according to Claim 1, **characterized in that** it comprises the following faces:

   - a front frontal face (FC1);
   - a rear frontal face (FC2);
   - a right side face (FC3);
   - a left side face (FC4);
   - an upper face (FC5);
   - a lower face (FC6).

3. One-piece multifunction body (27), according to Claim 2, **characterized in that** it comprises:

   - a first type of attachments (86A) comprising

four identical attachments, two arranged on said rear frontal face (FC2) and, respectively, two arranged on said lower face (FC6);
- a second type of attachments (87A) comprising two identical opposite attachments, one arranged on said right side face (FC3) and, respectively, one arranged on said left side face (FC4);
- a third type of attachments (87B) comprising four identical attachments, two arranged on said upper face (FC5) and, respectively, one arranged on said right side face (FC3) and one arranged on the left side face (FC4).

4. One-piece multifunction body (27), according to Claim 3, **characterized in that** said attachments (87B) are grouped in two pairs, each pair being arranged at a vertex of said main hollow body (27A).

5. One-piece multifunction body (27), according to Claim 3 or to Claim 4, **characterized in that** it comprises two attachments (87A), each designed to house a three-way valve (30).

6. One-piece multifunction body (27), according to anyone of the Claims from 3 to 5, **characterized in that** it comprises two pairs of attachments (86A), each pair being designed to house a bypass device (38).

7. One-piece multifunction body (27), according to anyone of the Claims from 2 to 6, **characterized in that** on said front frontal face (FC1) there is a front hole (71) provided with a cylindrical collar (71A) projecting from said front frontal face (FC1); two pairs of tangential recesses (71B, 71C, 71D, 71E) being obtained on said cylindrical collar (71A).

8. A hydraulic valve assembly (20) for a boiler (11), **characterized in that** it is provided with at least one one-piece multifunction body (27) according to anyone of the Claims from 1 to 7.

9. Hydraulic valve assembly (20), according to Claim 8, **characterized in that** it comprises a scroll (24), which is coupled to said one-piece multifunction body (27); said scroll (24) being provided with a central through hole (95) at which there are provided fixing means (81, 82, (CVT)) to be fixed to a pair of tangential recesses (71B, 71C, 71D, 71E) on a cylindrical collar (71A) projecting from a front frontal face (FC1) of said one-piece multifunction body (27) .

10. A combined plant (10), **characterized in that** it is provided with at least one hydraulic valve assembly (20) according to Claim 8 or to Claim 9.

11. Combined plant (10), according to Claim 10, **characterized in that** it comprises at least a condensing boiler (11).

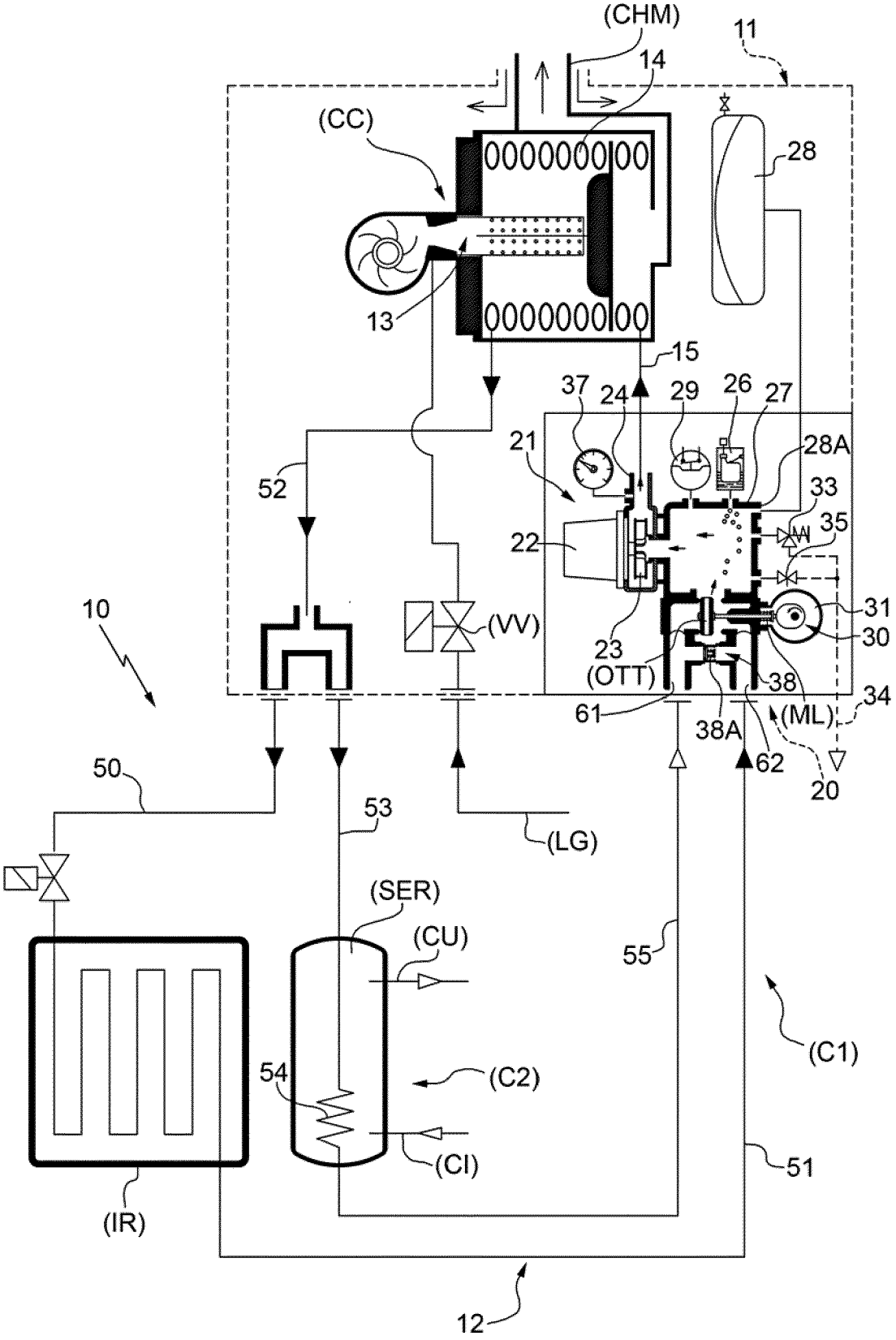
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FIG.1

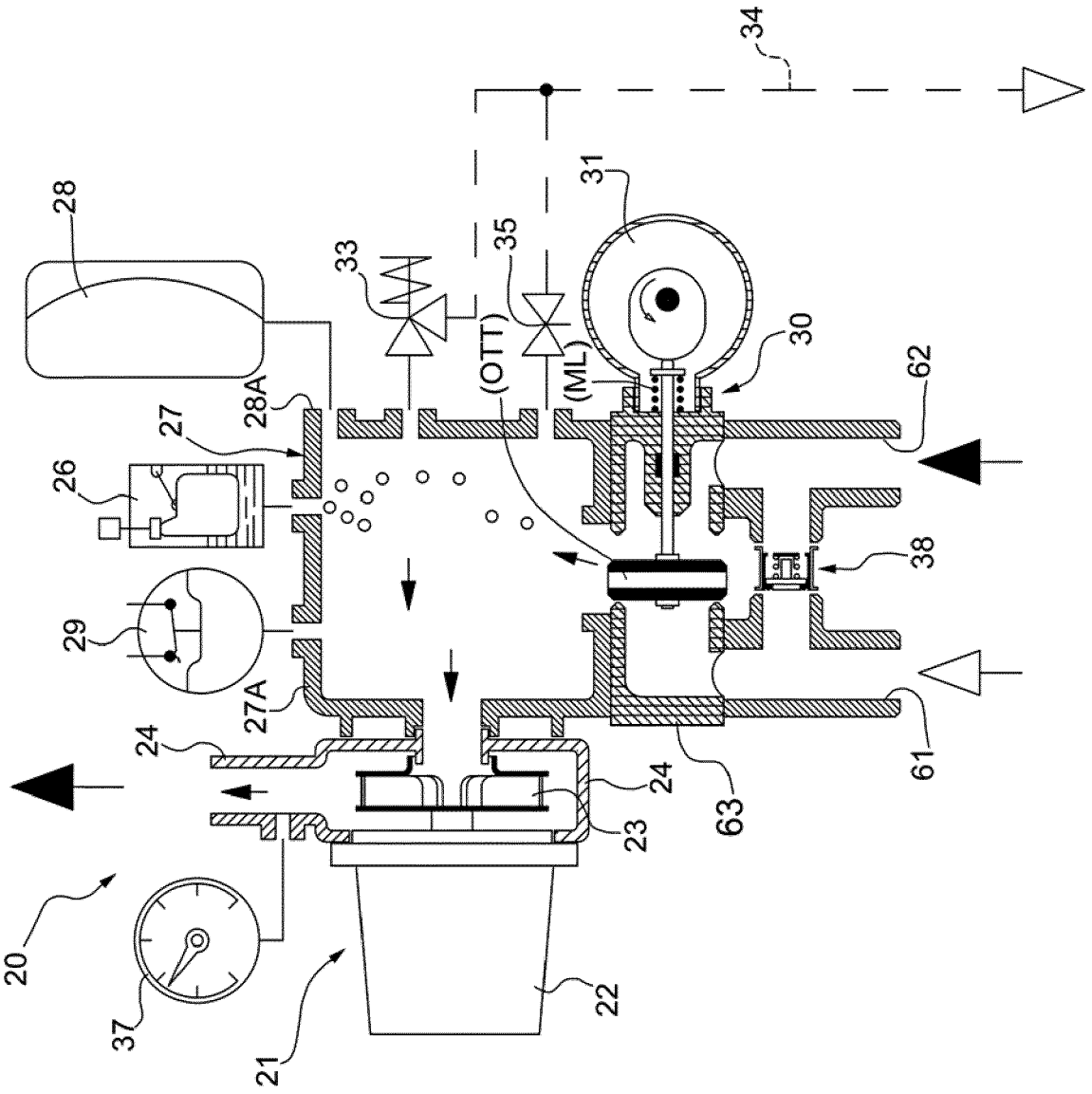
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FIG.2

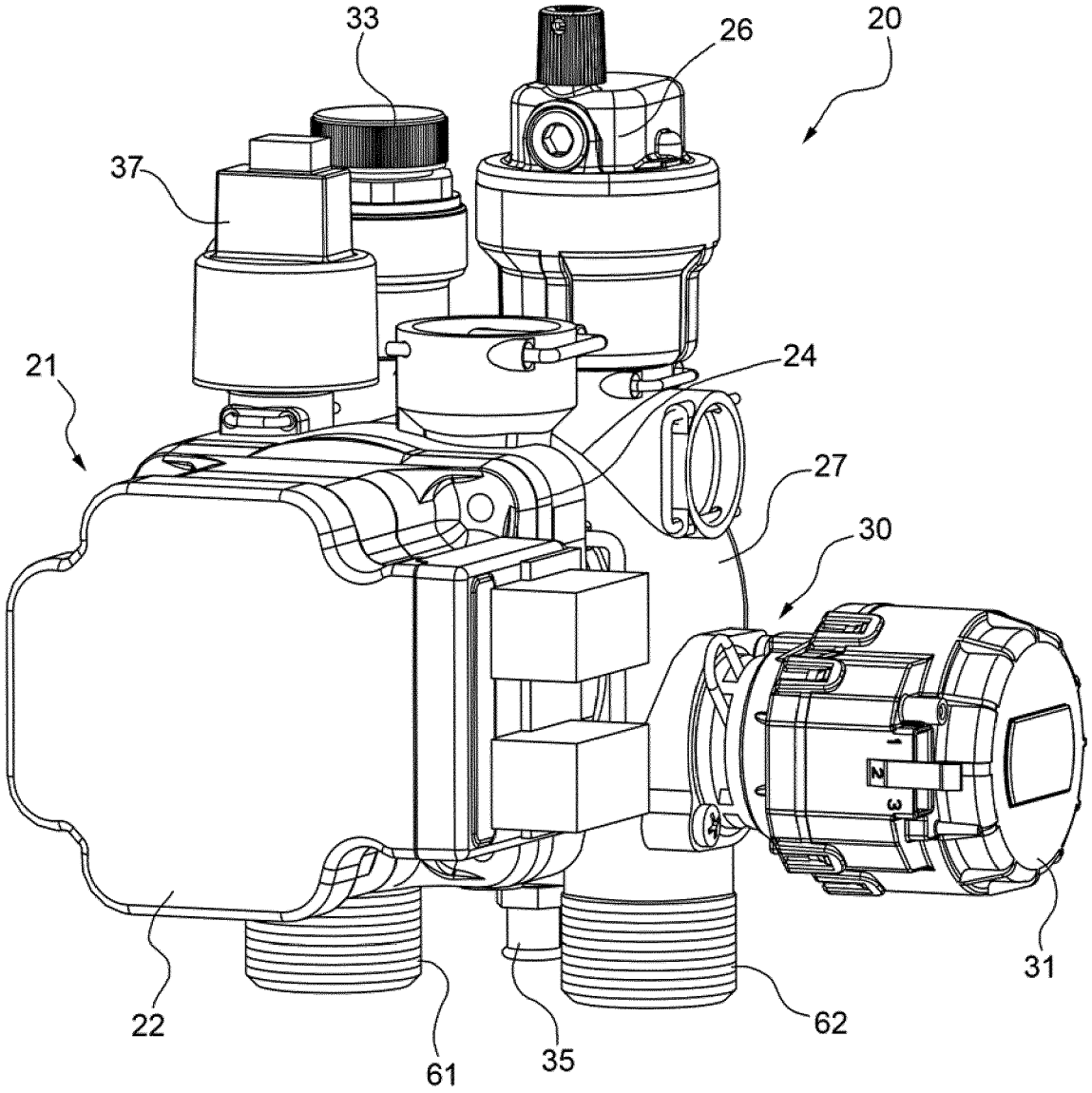
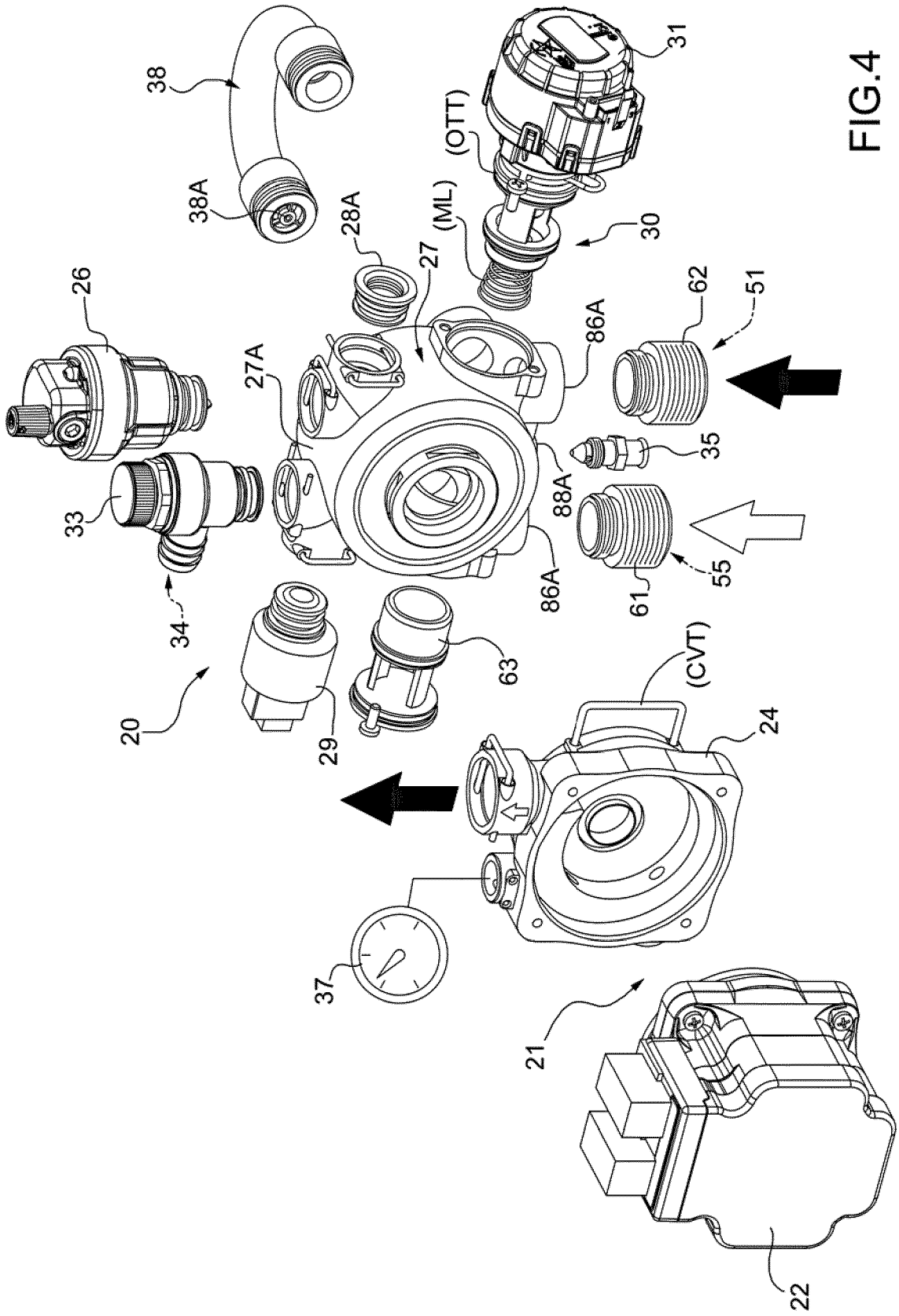


FIG.3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(OTT)
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27A
86A
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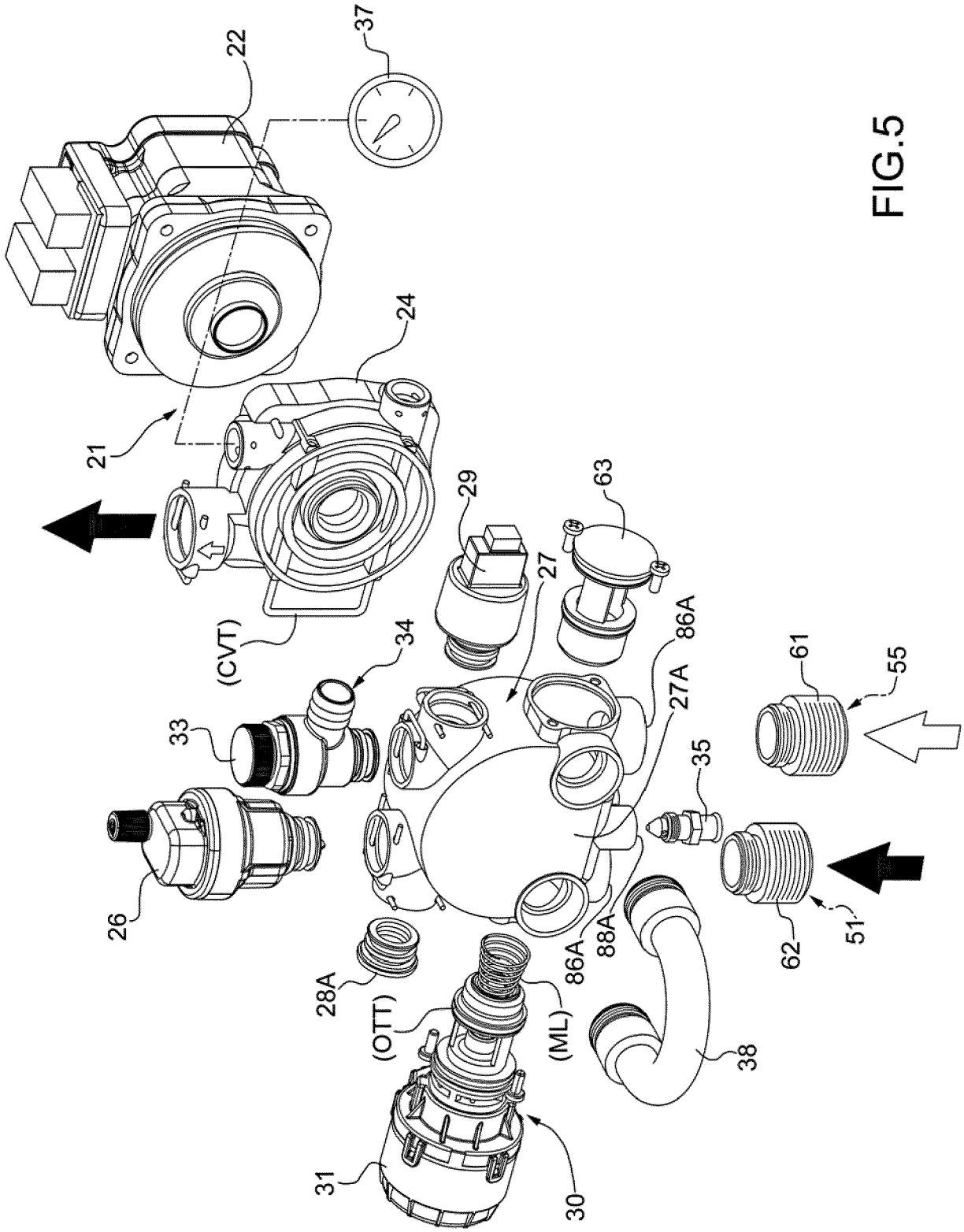
86A
61
55
20
29
63
(CVT)
24
37
21
22

FIG.4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(CVT)
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86A
27A
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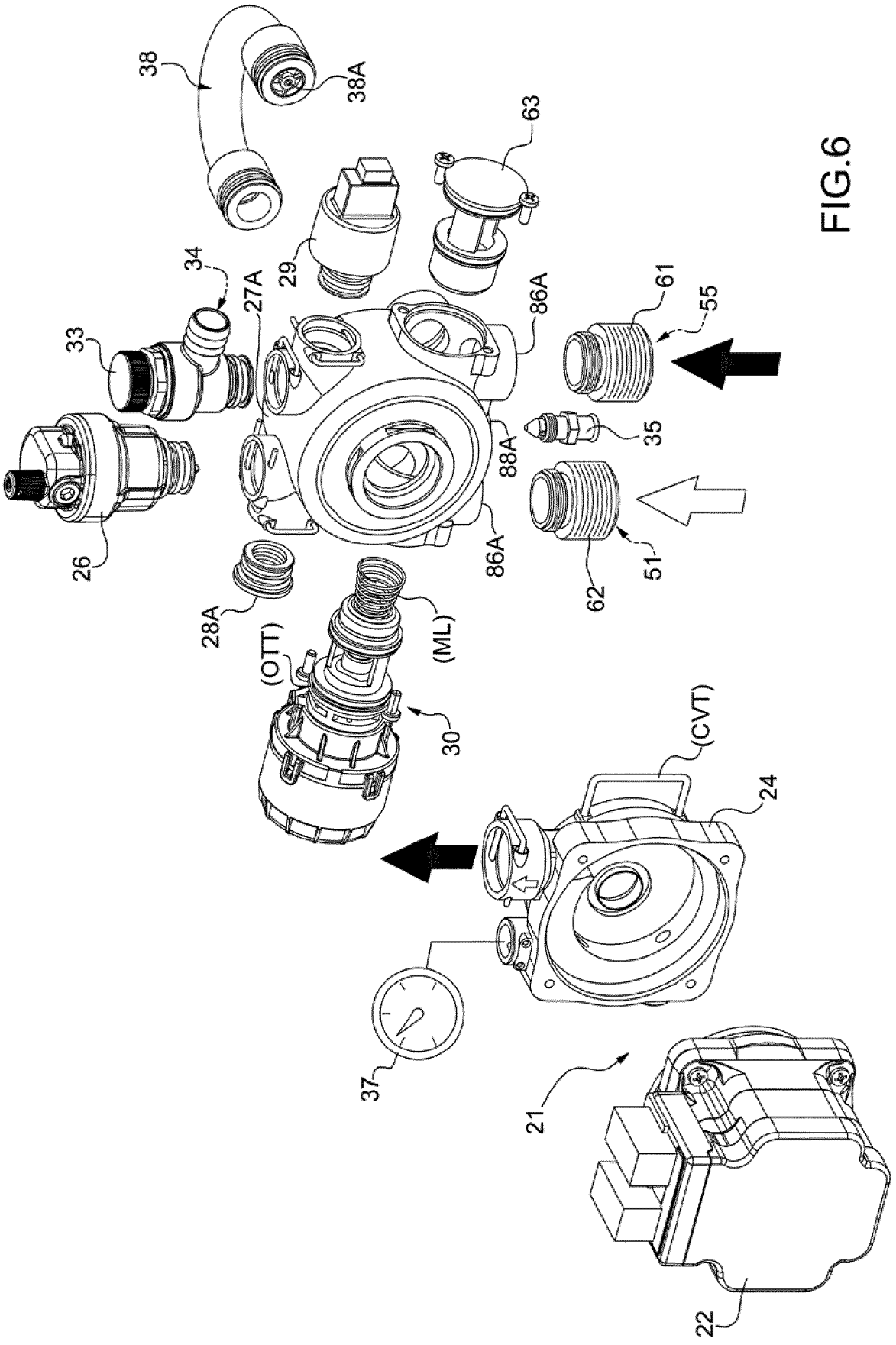
88A
86A
28A
(OTT)
(ML)
38
31
30

FIG.5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(ML)
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(CVT)
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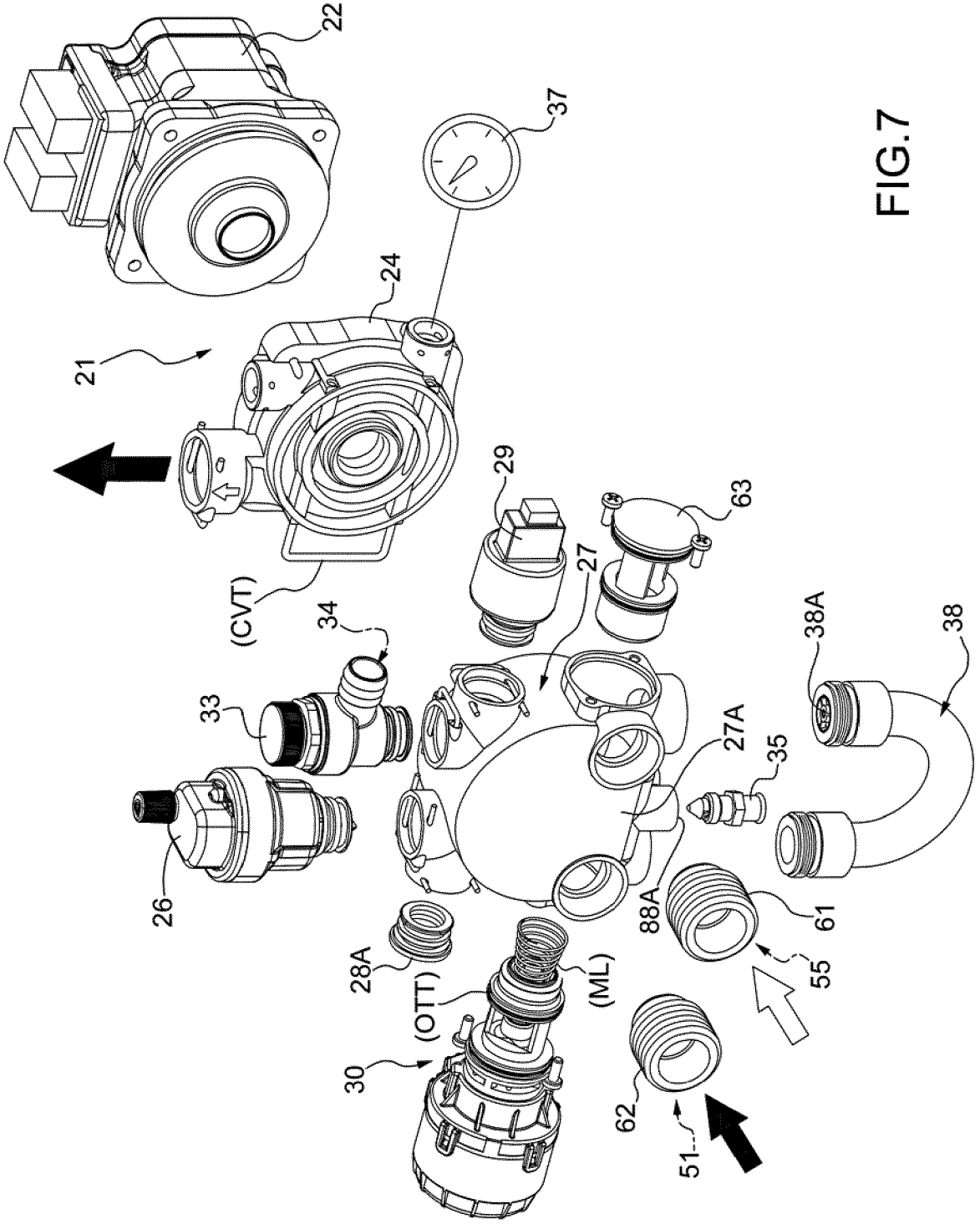
22

FIG.6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(OTT)
(ML)
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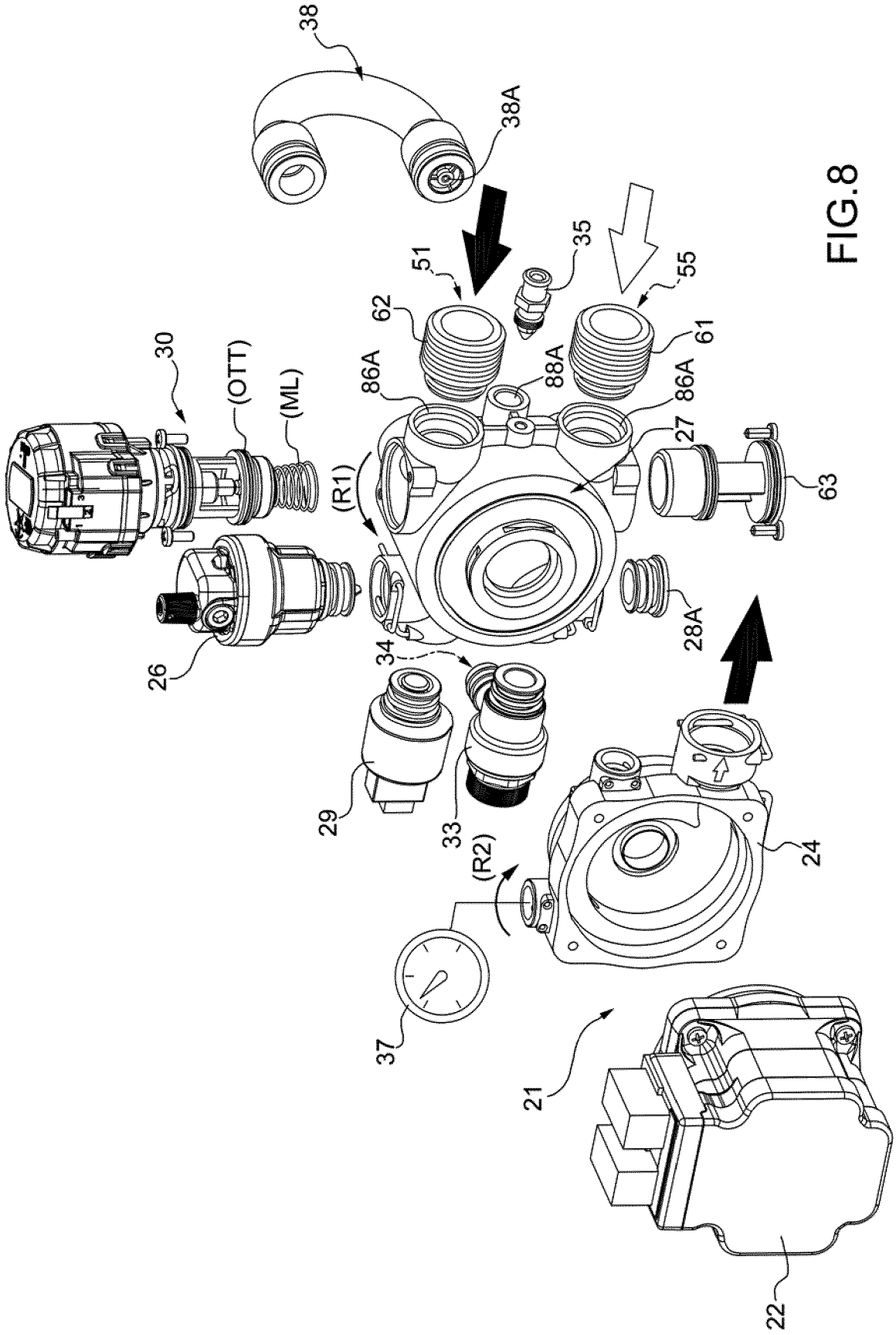
51

FIG.7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(ML)
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(R2)
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37
21
22

FIG.8

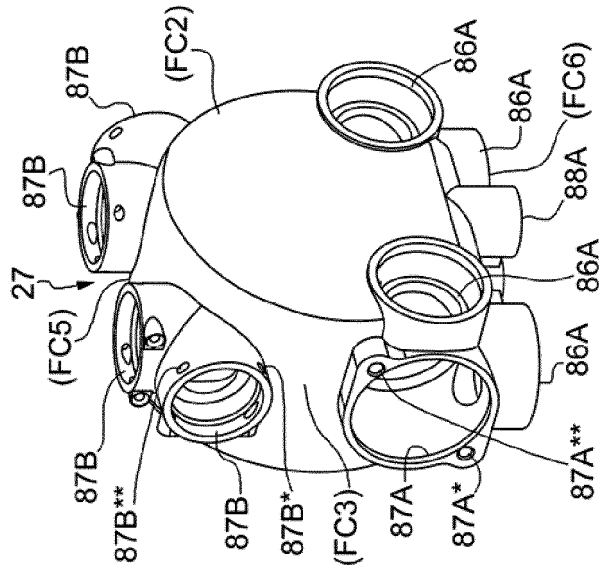


FIG.10

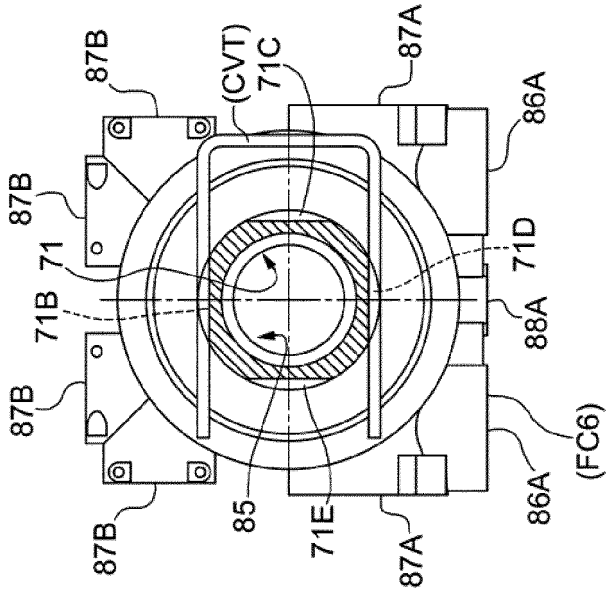


FIG.11

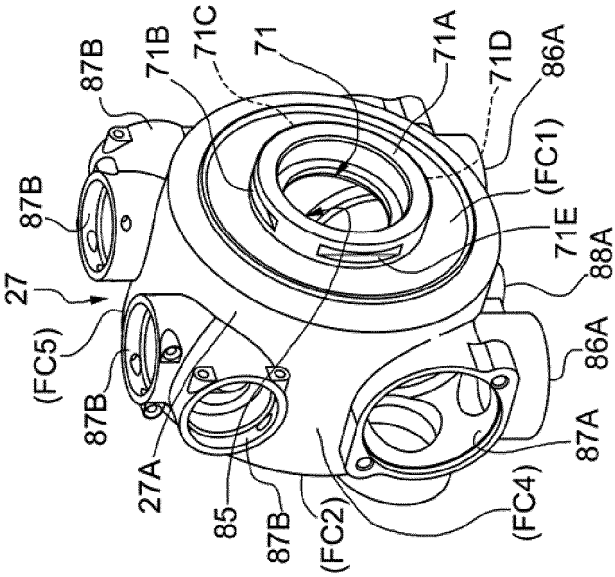
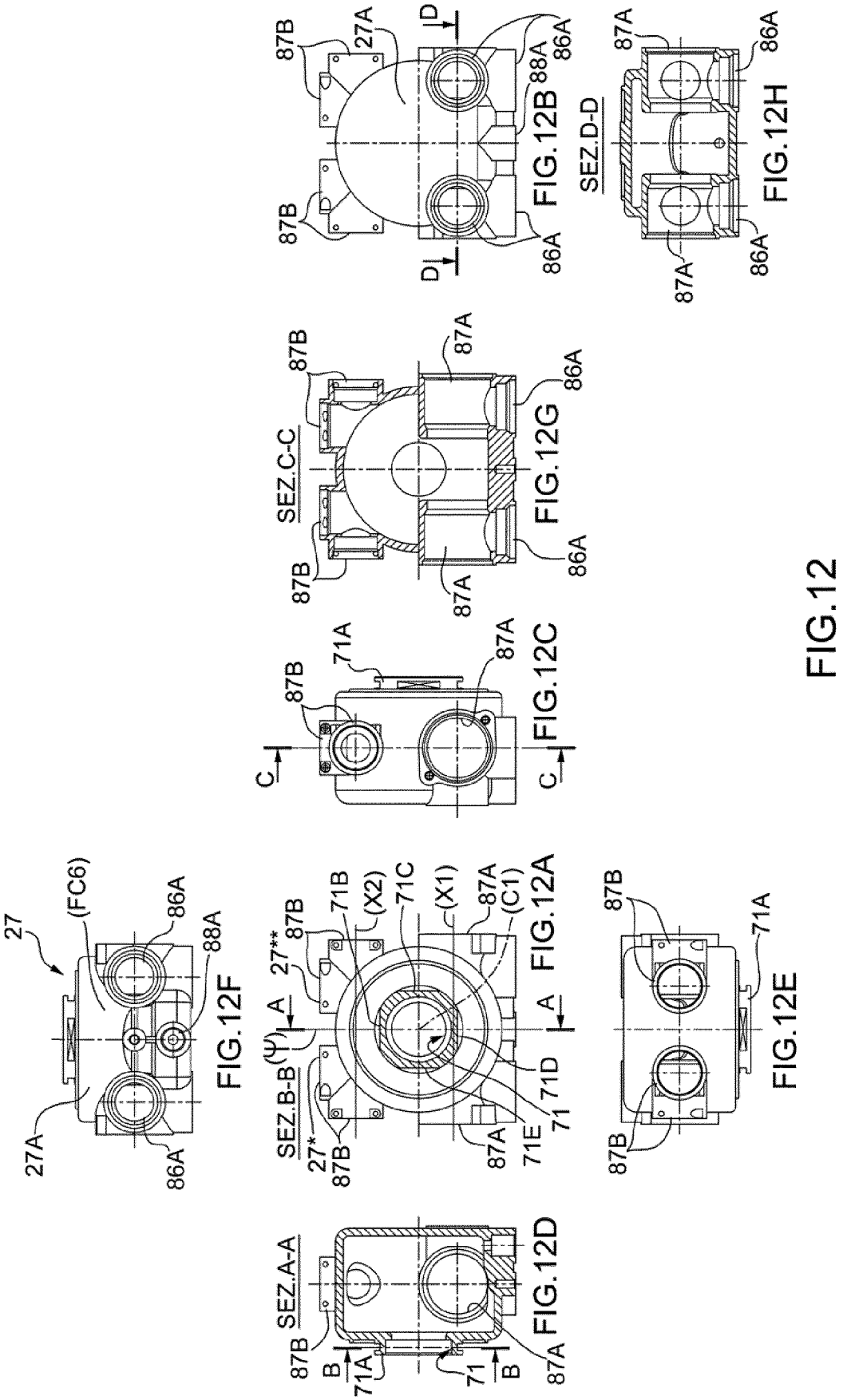


FIG.9


87B
27A
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88A
86A
D
FIG.12B
87A
SEZ.D-D
FIG.12H
SEZ.C-C
FIG.12G
71A
C
FIG.12C
27
(FC6)
FIG.12F
27**
71B
(X2)
71C
(X1)
(C1)
A
(Ψ)
SEZ.B-B
27*
71D
71E
71
FIG.12A
SEZ.A-A
B
FIG.12D
FIG.12E

FIG.12

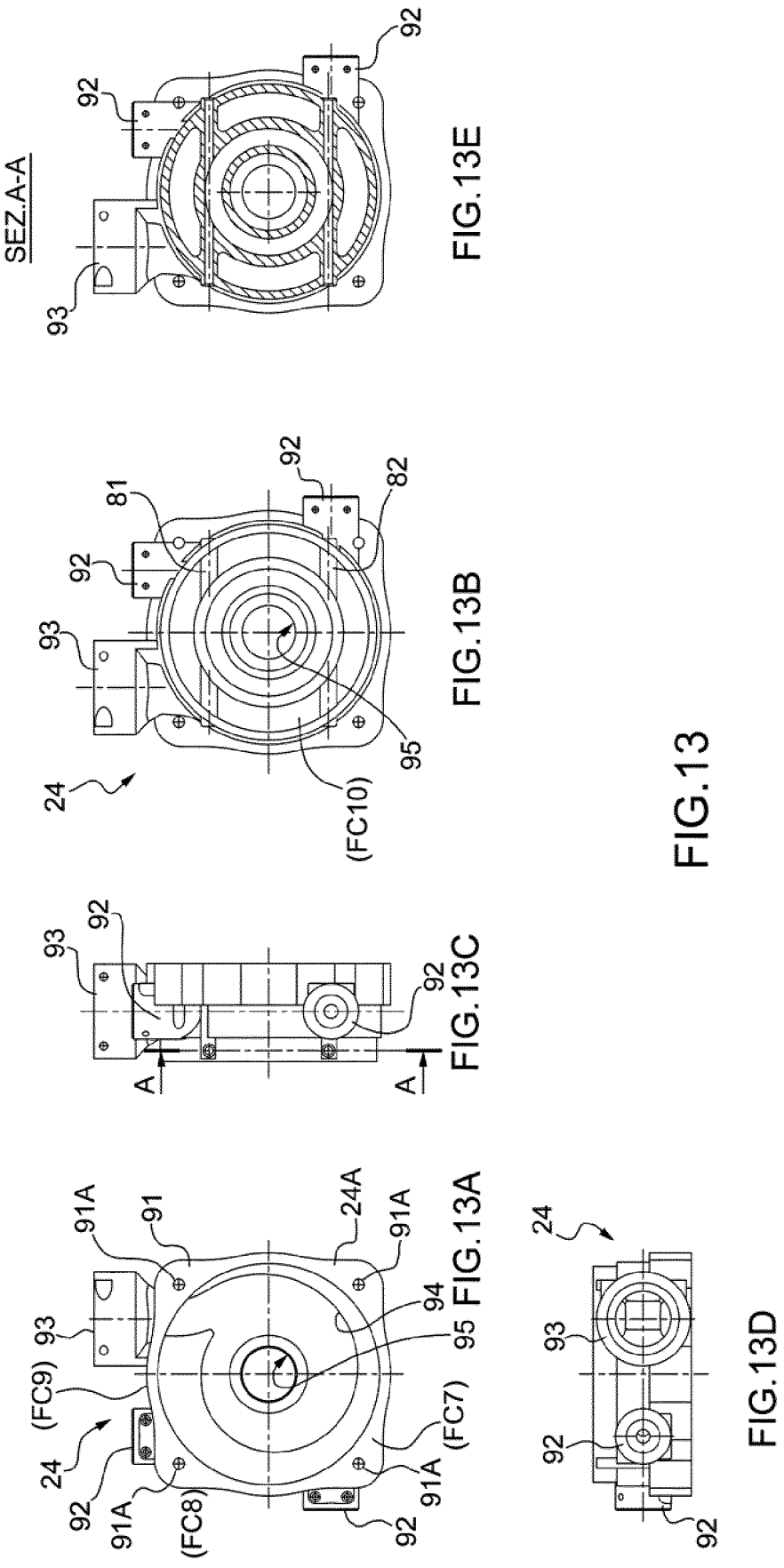

FIG.13E

FIG.13B

FIG.13C

FIG.13A

FIG.13D

FIG.13

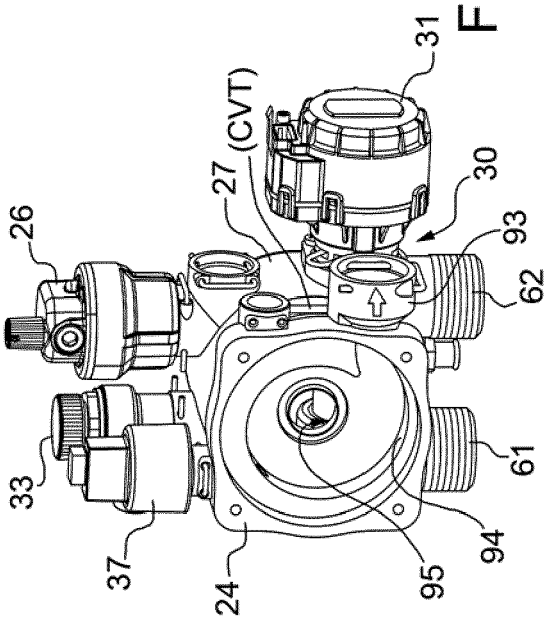

FIG.15

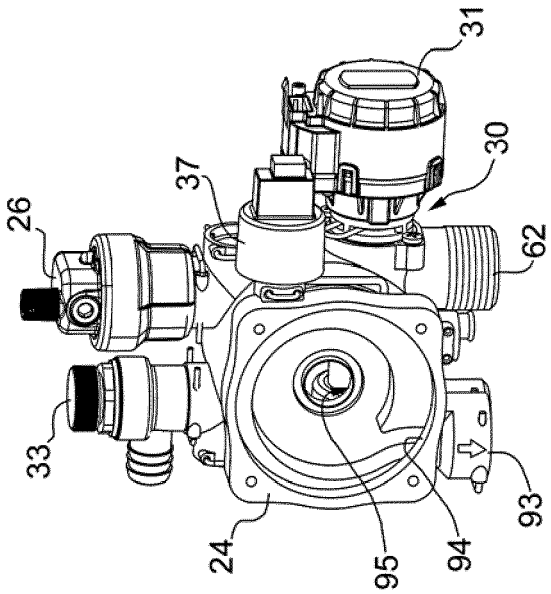

FIG.16

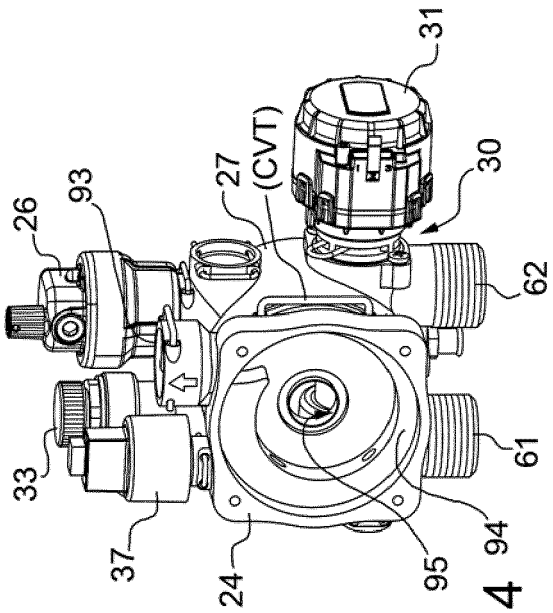

FIG.14

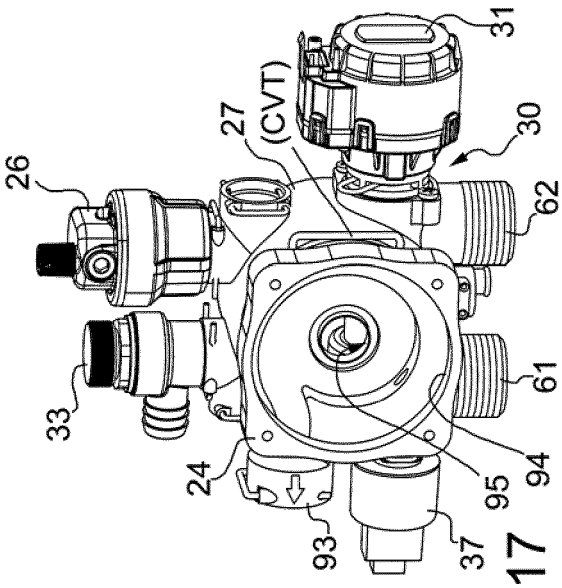

FIG.17

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EUROPEAN SEARCH REPORT

Application Number
EP 18 15 9593

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	GB 2 388 422 A (HEATRAE SADIA HEATING LTD [GB]) 12 November 2003 (2003-11-12) * page 2, line 15 - page 4, line 5; figures 1,2,4,6,7,8 * * pages 6,9 *	1-6,8, 10,11 7,9	INV. F24H9/14 F24D3/10
X Y	EP 1 026 457 A1 (IABER SPA [IT]) 9 August 2000 (2000-08-09) * abstract; figures 1-10 *	1,2,8,10 7,9	
Y	US 2014/224194 A1 (BARNES DAVID M [US]) 14 August 2014 (2014-08-14) * paragraph [0030]; figures 1,3,4 *	7,9	

TECHNICAL FIELDS SEARCHED (IPC)

F24H
F24D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	18 July 2018	García Moncayo, O

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EPO FORM 1503 03.82 (P04C01)

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18-07-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2388422 A	12-11-2003	NONE	
EP 1026457 A1	09-08-2000	NONE	
US 2014224194 A1	14-08-2014	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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Patent documents cited in the description

- IT 102017000022780 **[0001]**
- GB 3388422 A **[0009]**
- EP 1026457 A1 **[0009]**
- US 20140224194 A1 **[0009]**