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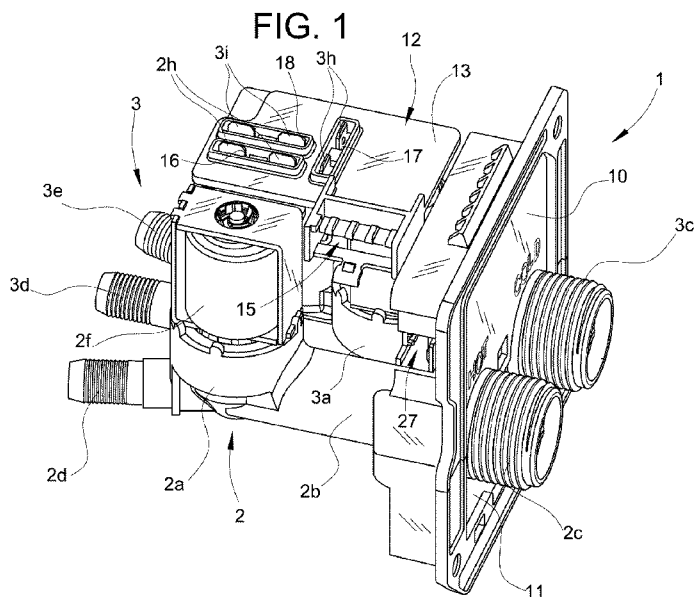
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(54) Title: A SOLENOID VALVE ASSEMBLY, PARTICULARLY FOR A CLOTHES WASHING MACHINE



(57) Abstract: The solenoid valve assembly (1) comprises first and second shut-off solenoid valves (2; 3) for controlling the supply of hot water and cold water, and which have a body (2a; 3 a) with an inlet duct (2b; 3b) and at least one outlet port (2d; 3d, 3e), and with at least one control winding (2f; 3f, 3g) that extends from the body (2a; 3a) orthogonally to the respective inlet duct (2b; 3b) and is provided with electrical connection terminals (2h; 3h, 3i) which are parallel with one another. These solenoid valves (2, 3) are arranged with their respective bodies (2a; 3a) interconnected in a side-by-side arrangement, with the inlet ducts (2b; 3b) parallel with one another and with their respective windings (2f; 3f, 3g) also parallel with one another. The assembly (1) further comprises a connecting structure (12) with an electrically insulating plate-like body (13) carrying a plurality of electrical conductors (14) coupled to an electrical connector portion (15) integrally formed with the connecting structure (12). The terminals of the windings (2f; 3f, 3g) are connected to the conductors (14) of the connecting structure (12).

ture (12).

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A solenoid valve assembly, particularly for a clothes washing machine

The present invention relates to a solenoid valve assembly for the supply of hot and/or cold water, particularly for a washing machine, such as a clothes washing machine.

The prior art includes solenoid valve assemblies of this type, comprising a one-piece plastic injection moulding incorporating the inlet ducts for the hot and cold water and the outlet ports. Making these solenoid valve assemblies is complicated and requires the use of complex and expensive moulds.

It is an object of the present invention to provide an improved solenoid valve assembly of the type specified above, which works reliably and has a relatively simple structure that can be assembled quickly and easily.

This and other objects are achieved according to the invention with a solenoid valve assembly of the type specified above for the controlled supply of hot and/or cold water, particularly for a clothes washing machine, comprising

- first and second shut-off solenoid valves for controlling the supply of hot water and cold water, respectively, which are separate from one another and which each have a body with a tubular inlet duct and, on an essentially opposite side, at least one outlet port, and with at least one respective control winding extending from said body in a direction which is essentially orthogonal to the respective inlet duct and provided with electrical connection terminals which extend parallel with one another;

said solenoid valves being arranged with their respective bodies interconnected in a side-by-side arrangement, with the inlet ducts parallel with one another and with their respective windings also parallel with one another; and

- a connecting structure including an essentially plate-like body made of an electrically insulating material, carrying a plurality of electrical conductors coupled to an electrical connector portion integrally formed with said connecting structure;

the terminals of said windings being connected to said conductors of the connecting structure.

In a solenoid valve assembly according to the present invention it is possible to use two solenoid valves of a type known per se, and which can therefore be produced using standard tooling which is essentially already available. These solenoid valves are combined together quickly and simply to form the solenoid valve assembly, with a substantial reduction in costs.

Other features and advantages of the invention will be made clear by the following detailed description given purely by way of non-limiting example, with reference to the appended drawings, in which:

Figure 1 is a front perspective view of a solenoid valve supply assembly according to the present invention;

Figure 2 is a rear perspective view of the solenoid valve assembly of Figure 1;

Figures 3 and 4 are exploded perspective views of the solenoid valve assembly of the previous figures;

Figures 5 and 6 are perspective views showing two solenoid valves incorporated in the solenoid valve assembly of the previous figures;

Figure 7 is a bottom view of the two solenoid valves shown in Figures 5 and 6; and

Figures 8 to 10 are partial perspective views showing a variant of the connection between the aforementioned two solenoid valves.

In the drawings, reference 1 is a general indication for a solenoid valve supply assembly according to the present invention.

In the embodiment illustrated by way of example, the solenoid valve assembly 1 comprises a first solenoid valve 2 and a second solenoid valve 3 for controlling the supply of hot and cold water, respectively.

These solenoid valves 2 and 3 are shut-off (or "on/off") valves. Their structure is known per se and they are made separately and independently of each other. They have respective bodies 2a, 3a, which may for example be plastic mouldings, with a tubular inlet duct 2b, 3b which in the example illustrated is provided with an externally threaded port 2c, 3c for connection to respective sources (not shown) of hot and cold water.

In the example shown in the drawings, the solenoid valve 2 has a single outlet port 2d, whereas the solenoid valve 3 has two outlet ports 3d, 3e.

The solenoid valve 2 therefore has a single control winding 2f, whereas the solenoid valve 3 has two, 3f and 3g, for selectively controlling the flow of cold water from the inlet duct 3c to one or the other of its outlet ports 3d, 3e (see in particular Figures 4 to 6).

The windings 2f and 3f, 3g extend from the bodies 2a, 3a of the respective solenoid valves in directions essentially orthogonal to the respective inlet ducts 2b, 3b.

As seen particularly in Figures 5 and 6, said windings have respective pairs of terminals 2h, 3h and 3i that extend upwards, parallel with each other, from the distal ends of these windings.

The solenoid valves 2 and 3 are arranged with their bodies 2a, 3a interconnected in a side-by-side arrangement, with their respective inlet ducts 2b, 3b parallel with one another. In the embodiment shown in Figures 1 to 7 these valve bodies 2a, 3a are interconnected in a manner which will now be described with reference to Figures 5 and 6.

On the side of the body 3a of the solenoid valve 3 nearest the other solenoid valve 2 is a transverse cylindrical rod 4 with a terminal conical head 4a (Figures 5 and 6) which fits into a corresponding retaining seat 5 (Figure 6) in the body 2a of the solenoid valve 2, and a square rod 6 split longitudinally to form two half-arms 6a with respective half-pyramidal terminal heads 6b (Figure 5), which fit into a seat 7 in the solenoid valve 2 (Figure 6).

In a variant illustrated (partially) in Figures 8 to 10, the body of one of the two solenoid valves (such as solenoid valve 2) contains a plurality of through guides or holes 115, in which corresponding pins 114 in the body of the other valve fit, their distal ends protruding beyond said guides or holes 115 and therefore being hot upset to stabilize the connection.

The inlet ducts 2b, 3b of the two solenoid valves adjacent to the respective ports 2c, 3c have respective pairs of transversely projecting parallel flanges 8 and 9 of essentially

quadrilateral shape (Figures 6 and 7).

Assembly of the solenoid valves 2 and 3 is completed and stabilized by means of two half-brackets 10 and 11, the former above and the latter below (Figures 1 to 4). These half-brackets have respective essentially semicircular cut-outs 10a and 11a which when combined together define two circular apertures or passages through which the inlet ducts of the two solenoid valves 2 and 3 pass. As can be made out in Figure 3 in particular, in the cut-outs 10a, 11a the half-brackets 10 and 11 form respective seats 10b, 11b, in each of which a corresponding flange 8, 9 of the solenoid valves 2 and 3 fits and is firmly held.

The half-brackets 10 and 11 are joined together firmly by known methods, such as snap-action coupling and retention devices.

In Figures 1 to 4, reference 12 is a general indication for an electrical connecting structure comprising a plate-like body 13 of electrically insulating material in which electrical conductors are embedded, some of which are shown in broken lines marked 14 in Figure 2. These conductors are coupled to an electrical connector portion 15, formed integrally with the plate-like body 13, for connection to a control unit for controlling the machine containing the solenoid valve assembly 1.

The body 13 of the connecting structure 12 forms a plurality of seats 16-18 (Figures 1 and 2) containing exposed portions of the conductors 14. The terminals 2h, 3h and 3i of the control windings 2f, 3f and 3g are inserted into these to connect them to said conductors.

In the assembled condition the connecting structure 12 extends parallel to the inlet ducts of the two solenoid valves 2, 3 adjacent to the distal ends of the windings 2f, 3f and 3g.

Conveniently, as shown in Figures 3 and 4, various auxiliary devices, known per se, are mounted in the inlet ducts 2b, 3b of the solenoid valves 2 and 3; in particular:

- inlet filters 19,
- flow stabilizers 20,
- flow diffusers 21,

- rotors with angled blades (turbines) 22 with permanent magnets at their respective peripheries,
- flow regulators comprising a shaped disc 23 to which a flexible ring 24 is connected.

Reference 25 in Figures 2-4 indicates a printed circuit board (PCB) carrying a pair of devices which, in combination with the magnets of the rotors or turbines 22, are capable of detecting the respective speeds of rotation of these rotors. These speeds are indicative of the (total) flow rates of hot and cold water through the solenoid valve assembly 1.

In the illustrated embodiment, said devices are reed relays 26 (Figures 3 and 4) arranged in positions such that when operating they are sensitive to the field generated by the magnets associated with the corresponding rotors 22. Alternatively, these devices may for example be Hall-effect sensors.

The plate 25 is fixed for example to the lower half-bracket 11, and an upper portion 25a of this half-bracket fits into a socket formation 27 for an electrical connector formed integrally with the upper half-bracket 10 (Figure 1, 2 and 4), for connection to a control unit belonging to the machine.

Clearly, without modifying the principle of the invention, the embodiments and details of construction can be varied significantly compared with those described and illustrated purely by way of non-limiting example, without thereby departing from the scope of the invention as defined in the accompanying claims.

Thus, for example, for the assembly and stabilization of the two solenoid valves 2 and 3, a single bracket rather than two half-brackets may be used, and said solenoid valves may have a different number of outlet ports from the number shown in the example illustrated in the drawings and described above, optionally oriented in different directions to those illustrated. In addition, the control windings of the solenoid valves may be aligned with each other, and the connecting structure 12 may then be arranged in a plane essentially orthogonal to the inlet ducts of the solenoid valves.

CLAIMS

1. A solenoid valve assembly (1) for the controlled supply of hot and/or cold water, particularly for a clothes washing machine, comprising
  - first and second shut-off solenoid valves (2; 3) for controlling the supply of hot water and cold water, respectively, which are separate from one another and which each have a body (2a; 3a) with a tubular inlet duct (2b; 3b) and, on an essentially opposite side, at least one outlet port (2d; 3d, 3e), and with at least one respective control winding (2f; 3f, 3g) extending from said body (2a; 3a) in a direction which is essentially orthogonal to the respective inlet duct (2b; 3b) and provided with electrical connection terminals (2h; 3h, 3i) which extend parallel with one another;
    - said solenoid valves (2, 3) being arranged with their respective bodies (2a; 3a) interconnected in a side-by-side arrangement, with the inlet ducts (2b; 3b) parallel with one another and with their respective windings (2f; 3f, 3g) also parallel with one another; and
    - a connecting structure (12) including an essentially plate-like body (13) made of an electrically insulating material, carrying a plurality of electrical conductors (14) coupled to an electrical connector portion (15) integrally formed with said connecting structure (12);
      - the terminals of said windings (2f; 3f, 3g) being connected to said conductors (14) of the connecting structure (12).
2. A solenoid valve assembly according to claim 1, wherein said electrical connection terminals (2h; 3h, 3i) extend from the distal ends of their respective windings (2f; 3f, 3g), and said connecting structure (12) extends essentially parallel with the inlet ducts (2b, 3b) of said solenoid valves (2, 3), adjacent the distal ends of the control windings (2f; 3f, 3g) thereof.
3. A solenoid valve assembly according to claim 1 or claim 2, wherein the solenoid valve (3) for the supply of cold water has at least two outlet ports (3d, 3e) and two control windings (3f, 3g) for selectively controlling the communication between the inlet duct (3b) and one or the other of said outlet ports (3d, 3e).
4. A solenoid valve assembly according to one of the preceding claims, wherein the



bodies (2a, 3a) of said solenoid valves (2, 3) are provided with respective coupling and mutual locking members (14, 15; 114, 115).

5. A solenoid valve assembly according to one of the preceding claims, wherein the bodies (2a, 3a) of said solenoid valves (2, 3) are connected and locked to one another by retaining means (8, 9, 10, 11, 10b, 11b) associated with the inlet ducts (2b, 3b) thereof.

6. A solenoid valve assembly according to claim 5, wherein said retaining means comprise flanges (8, 9) on the inlet ducts (2b, 3b) and two mutually coupled locking half-brackets (10, 11).

7. A solenoid valve assembly according to one of the preceding claims, wherein said solenoid valves (2, 3) are provided with flow rate detecting devices (22), and the assembly (1) comprises further a printed circuit board (25) carrying sensor devices (26) operatively coupled to said flow rate detecting devices (22).

8. A solenoid valve assembly according to claims 6 and 7, wherein said printed circuit board (25) is connected to an electric connector member (27) integrally formed with one of said half-brackets (10, 11).



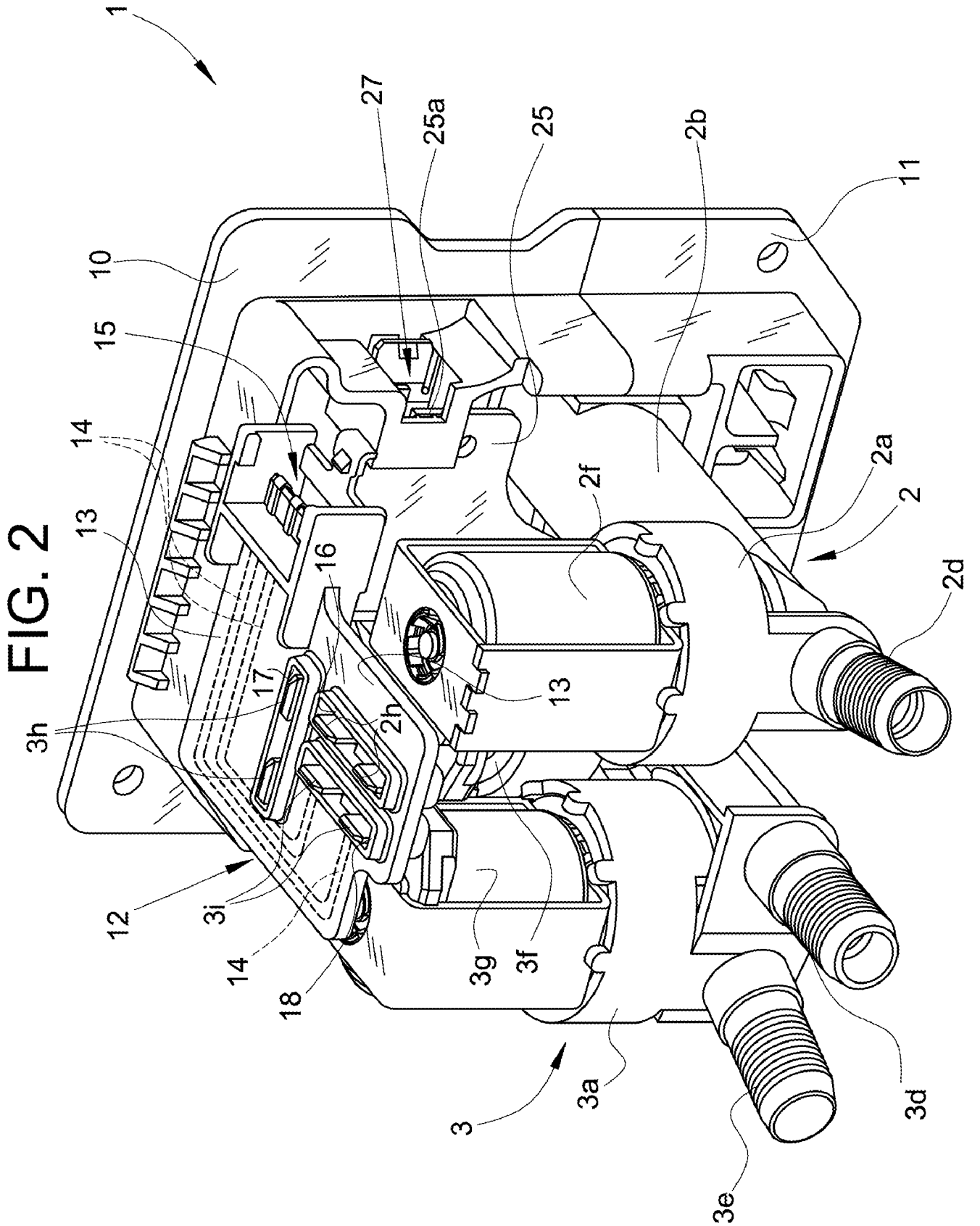
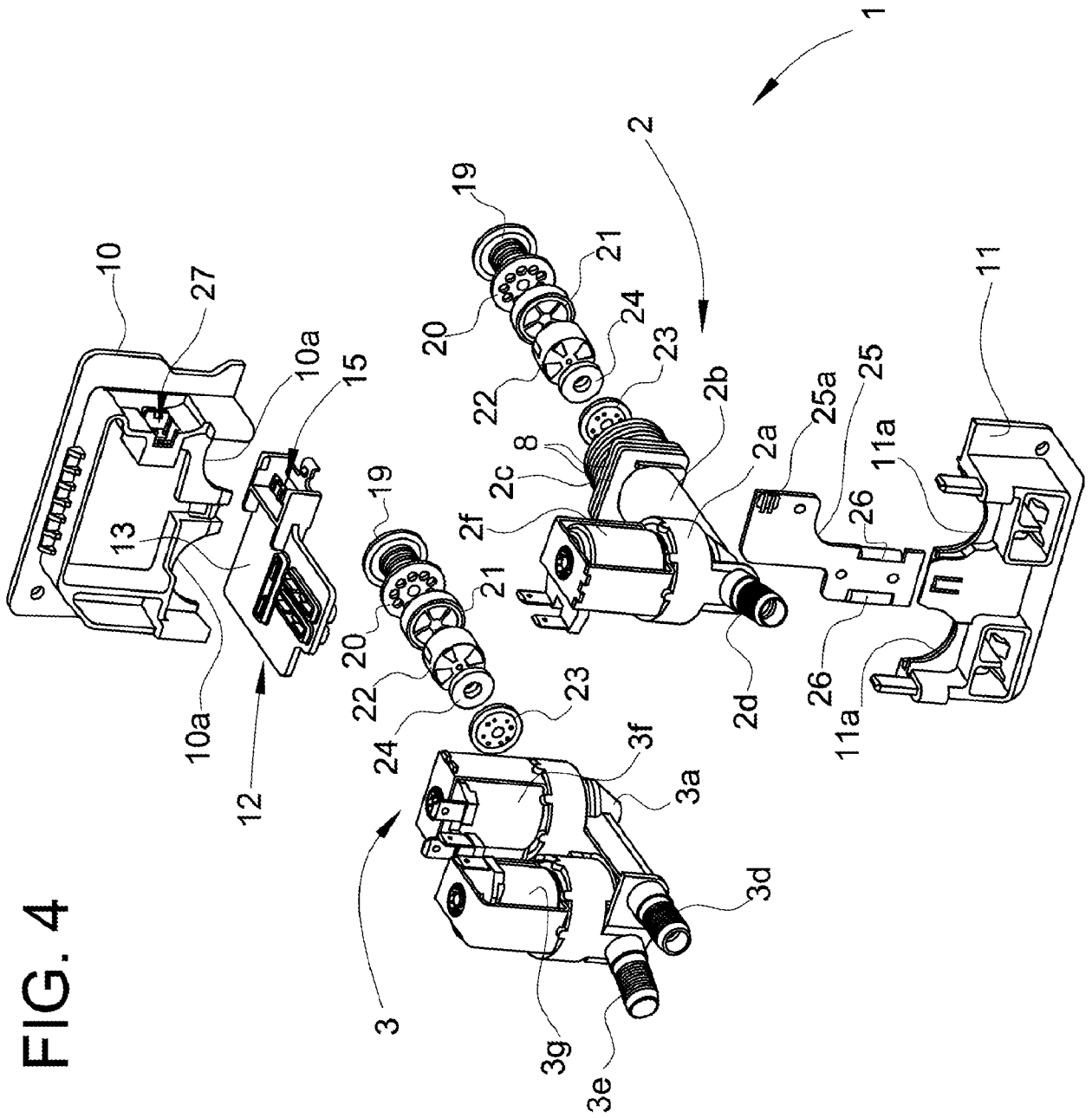




FIG. 4



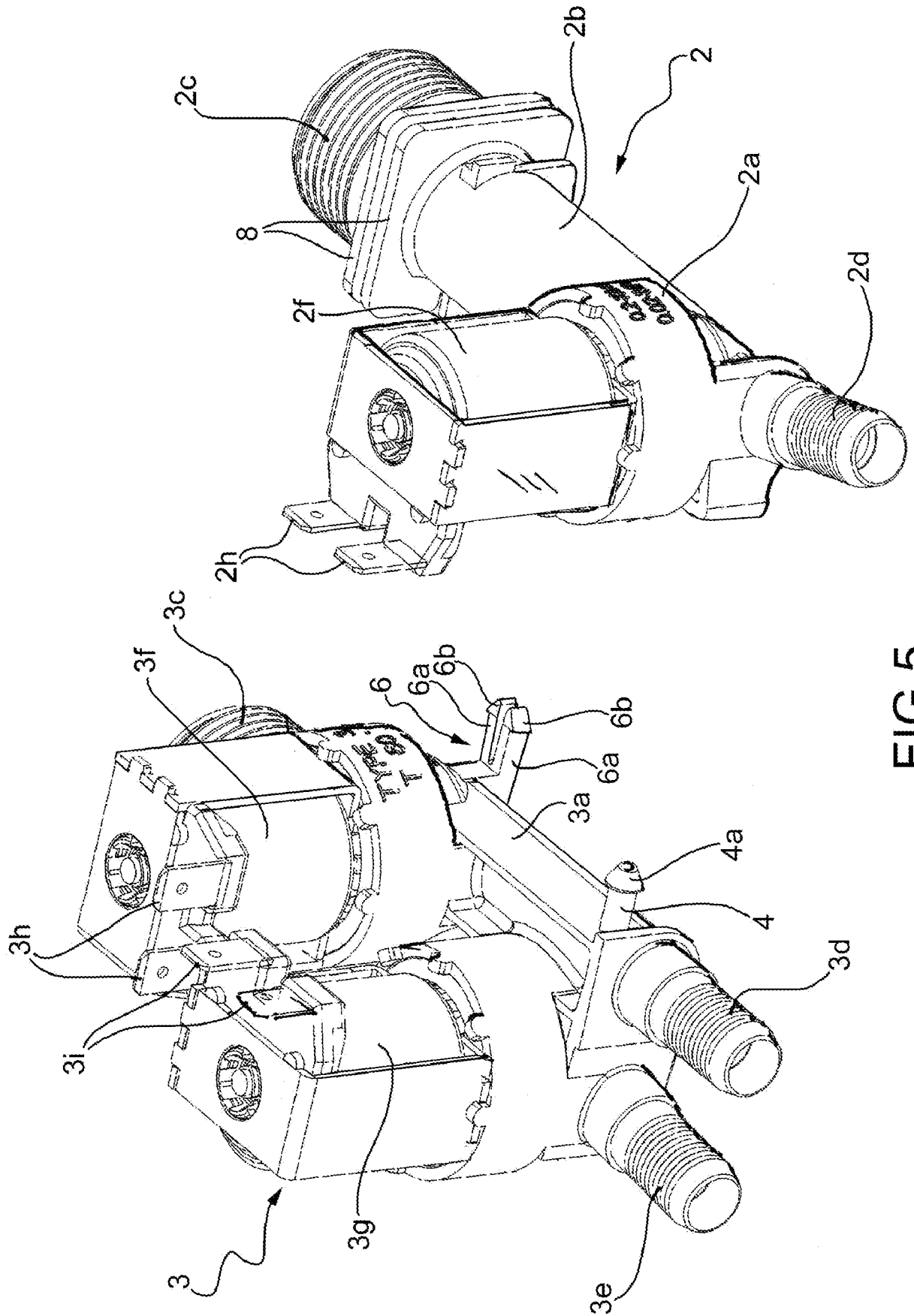


FIG.5

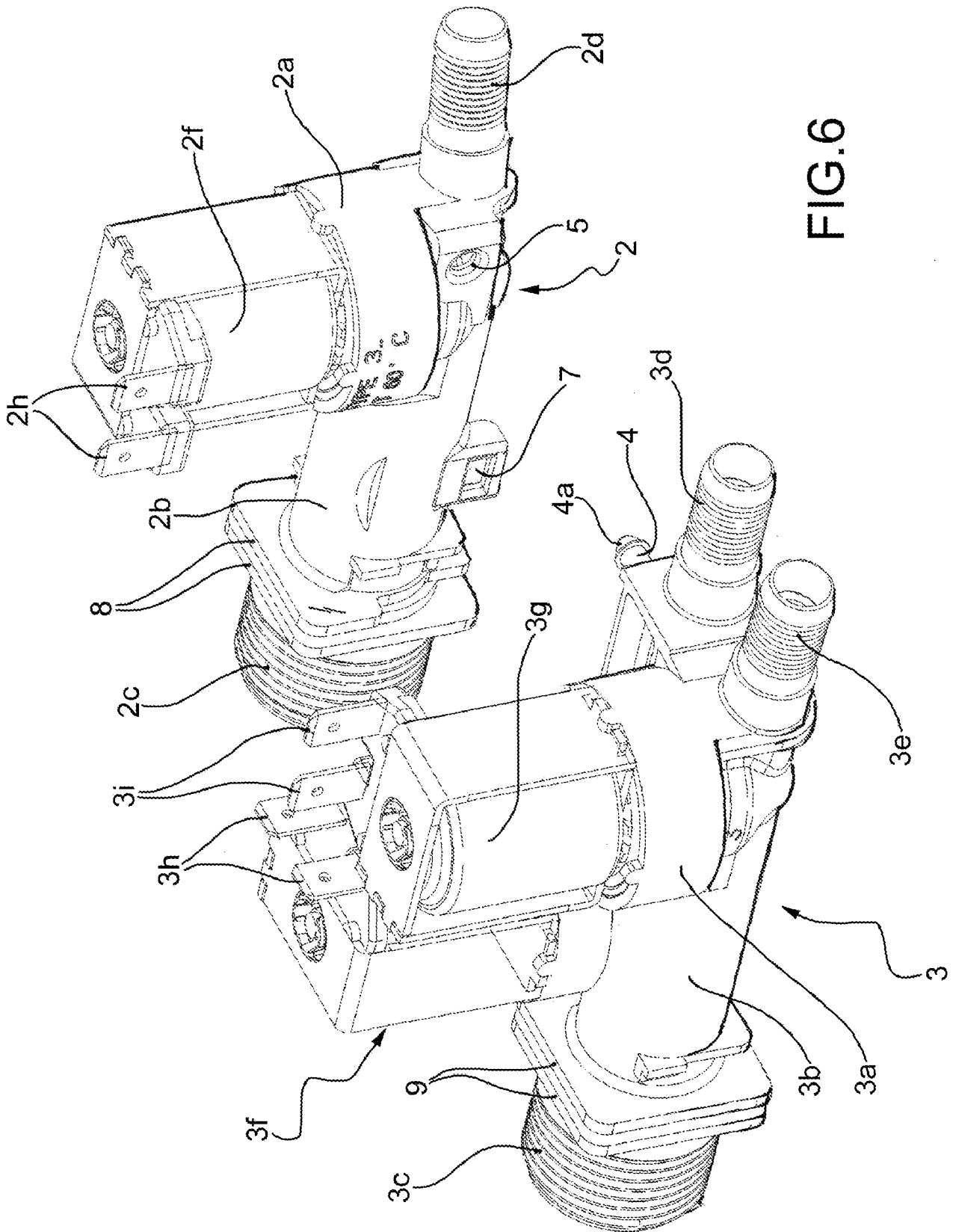


FIG. 6

FIG.7

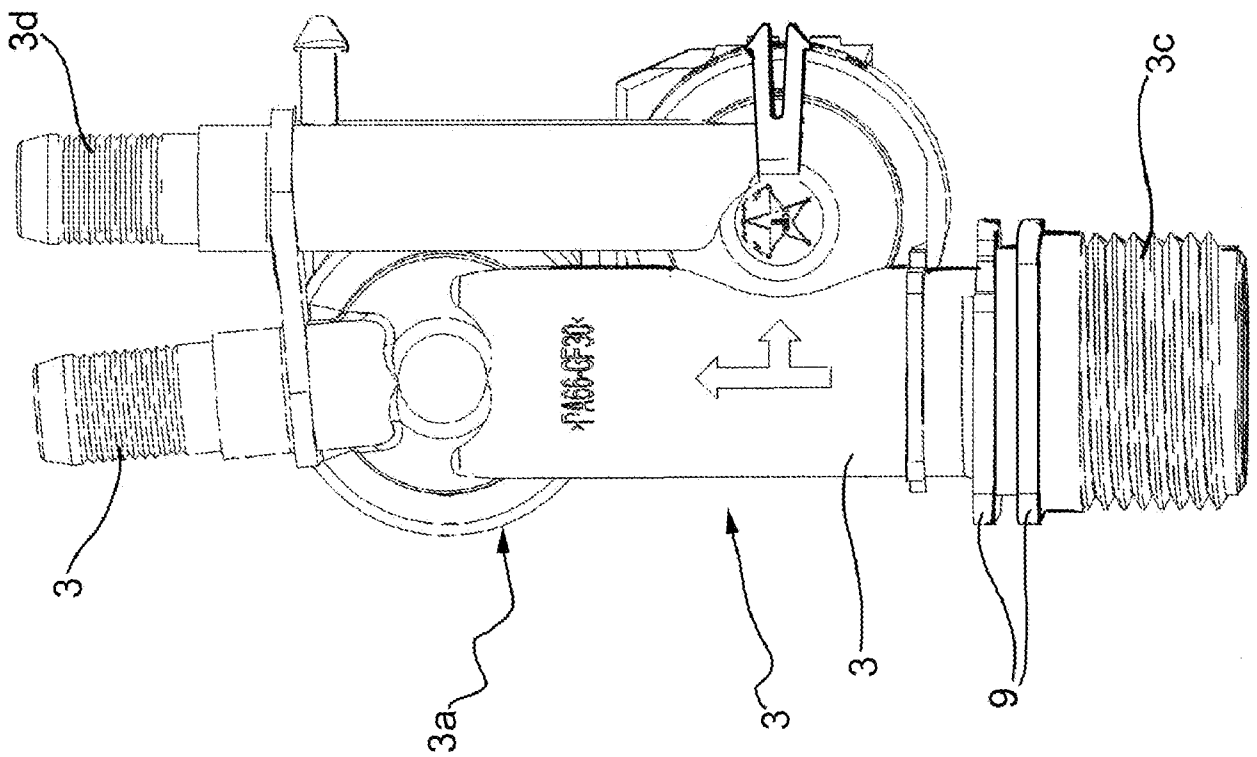
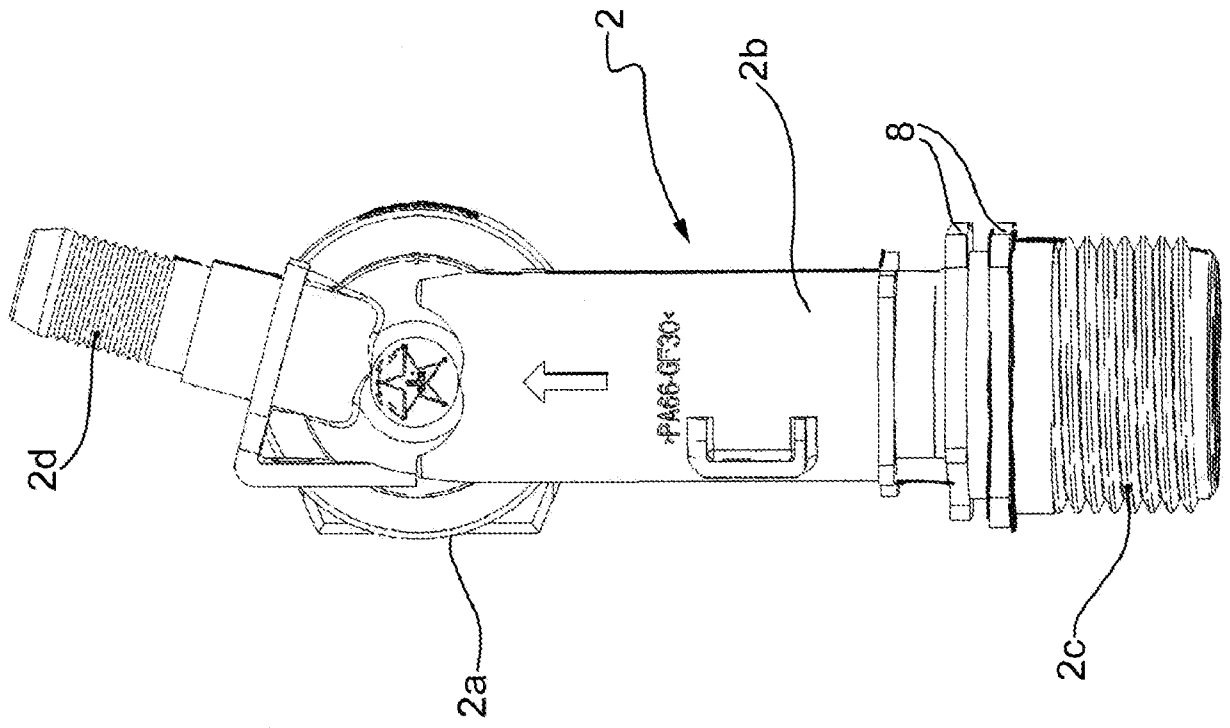




FIG.8

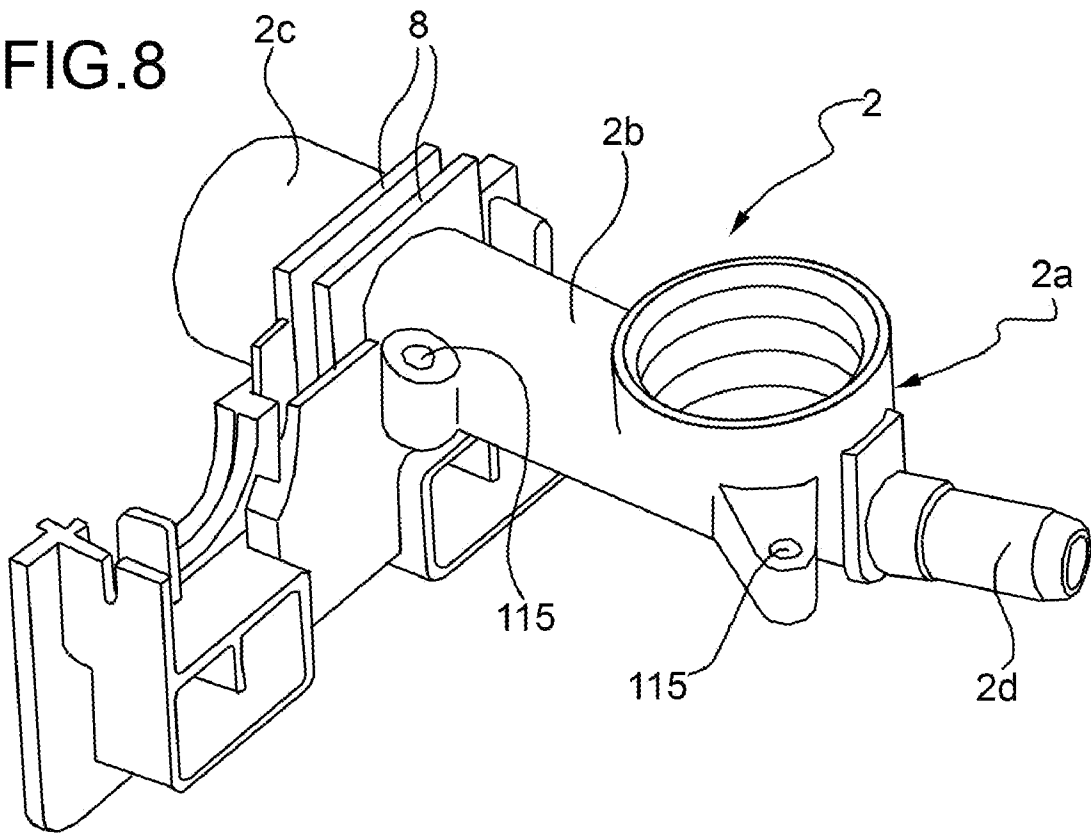
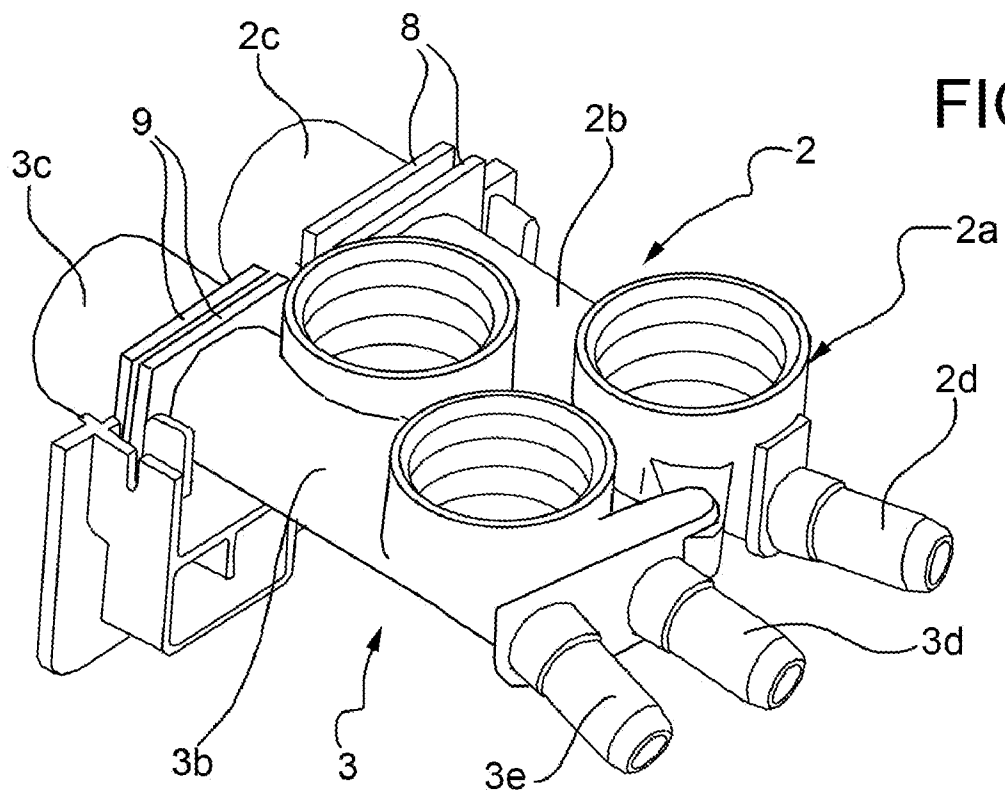


FIG.9



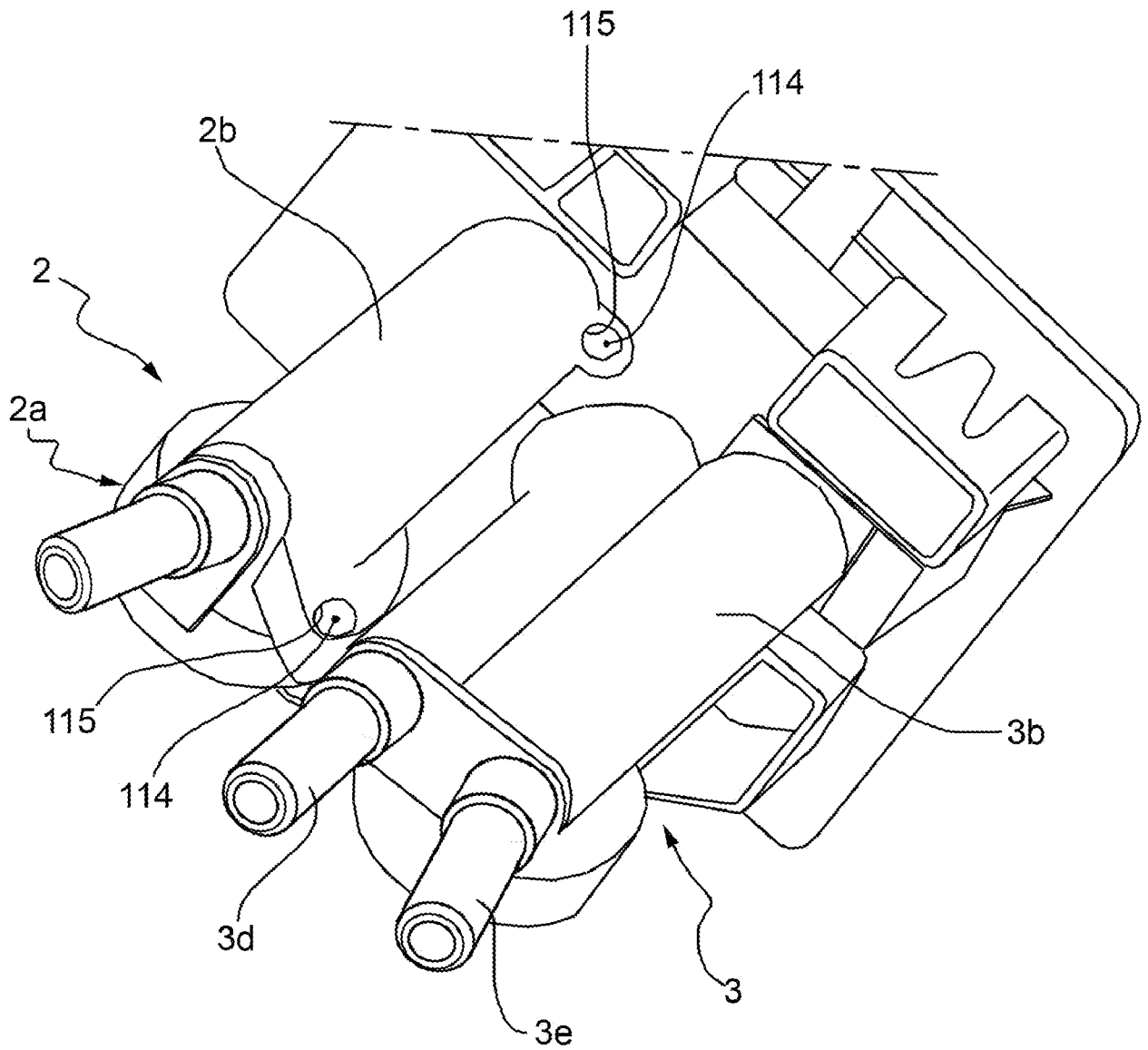


FIG. 10

## INTERNATIONAL SEARCH REPORT

International application No

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A. CLASSIFICATION OF SUBJECT MATTER  
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 ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
 F16K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

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## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2007/289646 A1 (RAVEDATI PAOLO [IT]) 20 December 2007 (2007-12-20) paragraphs [0001], [0024] - [0035]; figures -----	1,4-8
X	US 2007/289647 A1 (RAVEDATI PAOLO [IT]) 20 December 2007 (2007-12-20) paragraphs [0001], [0026] - [0035]; figures 1-4 -----	1,4-8
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International application No

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Information on patent family members

International application No

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