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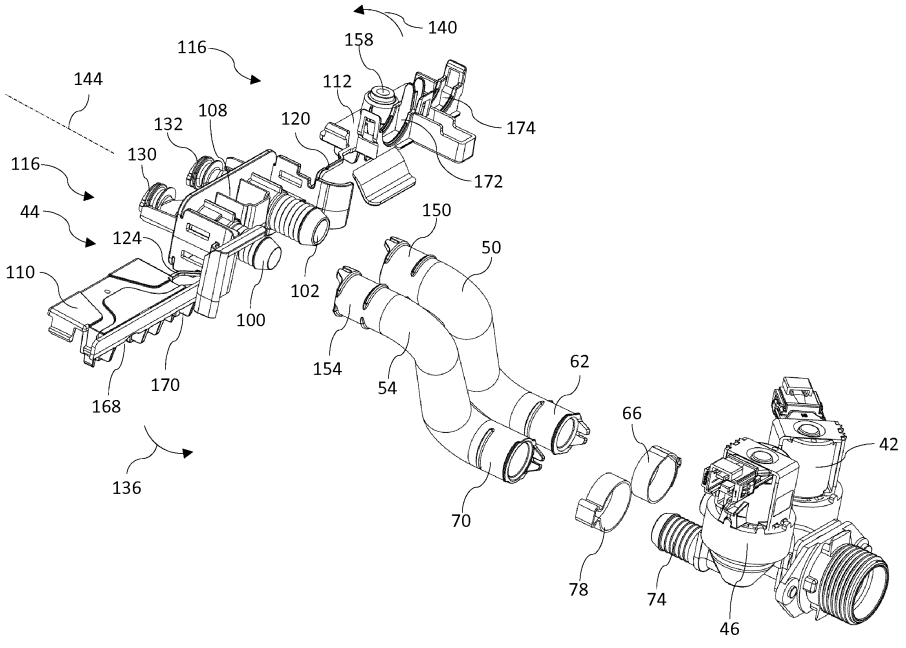
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(54) **Laundry washing machine**

(57) The invention is related to a laundry washing machine (2), comprising: a washing tub (14) containing a rotatable washing drum (16) in which laundry to be washed can be loaded; an additive compartment (34) adapted to be loaded with washing/rinsing products and fluidly connected to said washing tub (14); a water injector (44), arranged for supplying water to said additive compartment (34); at least one valve (42, 46) fluidly connected or connectable, upstream, to water mains external to said washing machine (2), and fluidly connected, downstream, to said water injector (44), in such a way to selectively deliver a water flux from said water mains to said water injector (44); at least one water pipe (50, 54) fluidly connecting said at least valve (42, 46) to said water injector (44). The water injector (44) comprises an integrated fixing device (116) for its watertight fixation to said at least one water pipe (50, 54).

FIG. 6




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## Description

**[0001]** The invention refers to a laundry washing machine.

Background Art

**[0002]** Known laundry washing machines (called also simply washing machine) generally comprise a substantially parallelepiped-shaped casing, typically built for resting on the floor, a substantially cylindrical hollow washing tub which is suspended in floating manner inside the casing by means of a number of coil springs and shock-absorbers and a substantially cylindrical, hollow revolving drum for housing the laundry to be washed, which is housed in axially rotating manner inside the washing tub for rotating about its substantially horizontally-oriented, longitudinal reference axis.

**[0003]** An electric motor assembly, which is located outside of the washing tub, is typically configured for driving into rotation the revolving drum about its longitudinal reference axis inside the washing tub.

**[0004]** In some known washing machines, typically, but not only, of the top-loading type, an additive compartment adapted to be filled with one or more additives (i.e. a washing and/or rinsing products like for example detergent, softener, bleach, etc.) is usually attached to an annular rim of a laundry loading/unloading opening placed at the top of the casing, above a pass-through opening on the lateral wall of the washing tub. A water supply circuit is typically provided, comprising a water inlet connectable to water mains external to the washing machine, and structured for drawing fresh water from the water mains and supplying water into the additive compartment, so as to sweep away into the washing tub the additive(s) (e.g. detergent and/or softener) stored in the compartment. The additive compartment typically comprises two or more chambers adapted to be filled with washing and/or rinsing additives, each chamber having an additives inlet section, i.e. a section from which additive can be poured in the chamber.

**[0005]** Washing machines described above commonly comprise a water distributor which is a component that supplies the water coming from the mains to the different chambers of the additive compartment; for this purpose the distributor comprises a plurality of channels, each one being fluidly connected to one or more chambers of the additive compartment. The distributor is typically the latest component before the additive compartment, and it is connected, upstream, by a water injector to one or more electro-valves (i.e. a plurality of one-way electrovalves and/or one or more electro-valves having a plurality of ways) which are connected, upstream, to the water inlet connectable to external water mains. Such electro-valve(s) are connected, downstream, via a rubber pipe or directly through a fixed pipe departing from electro-valve(s) to the water injector in such a way to selectively take one or more streams of water coming from the water inlet to one or more of the channels of the distributor. The distributor and injector provide the functionality to lead the water coming from the electrovalve(s) into the respective chambers of the additive compartment.

**[0006]** In laundry washing machines as described above, the water injector is usually located in a rear part of the machine. The water injector is, when following the water flow coming from the water mains, usually the last component before the distributor or additive compartment (drawer) and most of the time it is connected to electro-valves by pipes, especially rubber pipes. Electrovalves can have one, two or more ways. In order to obtain water-tight connections, (typically elastic) metal clamps are used which are clamped around the respective pipe which is pushed over an inlet of the water injector. The metal clamps are arranged and deformed to provide the desired water-tight connection.

**[0007]** A disadvantage of this common design is that several different parts are needed and usually tools are needed to work on the metal clamps for a sufficient water-tight connection.

**[0008]** It is the aim of the present invention to provide a water injector providing an improved, especially easy to handle and water-tight, connection to the water pipes.

Disclosure of **Invention**

**[0009]** This aim is achieved by a Laundry washing machine, comprising:

- a washing tub containing a rotatable washing drum in which laundry to be washed can be loaded;
- an additive compartment adapted to be loaded with washing/rinsing products and fluidly connected to said washing tub;
- a water injector, arranged for supplying water to said additive compartment;
- at least one valve fluidly connected or connectable, upstream, to water mains external to said machine, and fluidly connected, downstream, to said water injector, in such a way to selectively deliver a water flux from said water mains to said water injector;
- at least one water pipe fluidly connecting said at least valve to said water injector, wherein said water injector comprises an integrated fixing device for its watertight fixation to said at least one water pipe.

**[0010]** Preferred embodiments of the invention are described in relation to the dependent claims and the description of the enclosed drawings.

**[0011]** The invention is based on the consideration that during assembly of a washing machine, the fluid connections between components are of especial importance and should be realized as long-lasting watertight connections which need no or little adjustments during a lifecycle of a washing machine. Also the concrete handling of the components involved should be as simple and ro-

bust as possible.

**[0012]** Applicant has found that with fixing means which are integrated with or into the water injector, the task of providing a watertight connection is accomplished with the water injector itself, which provides an especially easy and comfortable handling situation, since the fixing functionality is combined with the connection functionality in the same integral component or part.

**[0013]** In the context of this application, the term "integrated" essentially means "made in a single-piece construction with" or "made as a single-body with" (e.g. by injection moulding). Hence, the fixing device is part of the same body as the other parts of the water injector.

**[0014]** The term laundry washing machine includes washing machines as such but also combined washing/drying machines that can incorporate both functionalities. Also the terms laundry washing machine and washing machine are used interchangeably. The laundry machine can be designed as a front-loading laundry washing machine as well as a top-loading laundry washing machine.

**[0015]** In the present application saying that a first component is "fluidly separated" from a second component means that a fluid, that is especially water, cannot flow from the first component to the second one or vice versa. On the contrary, saying that a first component is "fluidly connected" to a second component means that a fluid can flow from the first component to the second component and vice versa.

**[0016]** In a preferred embodiment, the water injector comprises a main body with at least one inlet for fluid connection to said at least one water pipe, wherein the integrated fixing device comprises one or more movable elements, connected to the main body and movable with respect to the latter from an opened position in which it does not keep the at least one water pipe watertight fixated to the at least one inlet, to a closed position in which it keeps or contributes to keep the at least one water pipe watertight fixated to said at least one inlet. The possibility to move moveable elements continuously between these two positions provides a simple handling and assembly routine.

**[0017]** Advantageously the water injector comprises two, most preferably exactly two, movable elements connected to the main body and movable with respect to the latter from said opened position to the closed position, wherein in the closed position the two movable elements partially or totally encompass the at least one water pipe so as to provide the watertight fixation of the at least one water pipe to the at least one inlet. These two moveable elements can be designed as shells which in a closed position surround or enclose the pipe while being fixed to the inlet in a watertight manner.

**[0018]** Preferably the two movable elements provide a crimping connection with the at least one water pipe. Hence, no external tool is needed to realize this type of connection.

**[0019]** In their closed position, the two movable elements are preferably connected to each other. By this connection, the two moveable elements are kept in their close position in such a way that they are prohibited from moving with respect to each other and with respect to the pipe and inlet. This way, an enduring watertight connection can be established.

**[0020]** In a preferred embodiment, in their closed position, the two movable elements are connected to each other by a clip mechanism. Such a mechanism is reliable and simultaneously easy to handle during the installation of the water injector.

**[0021]** Advantageously, the clip mechanism comprises at least two clip elements which in the closed position of the two movable elements engage one another, providing the reciprocal fixation of the two movable elements. For instance, one clip element can be designed as a chamber -or ring-like structure which receives a pin or cam which in the closed position after being inserted in the other clip element provides with it a form-locking connection which can only be released by moving or bending it in order to disengage with the other clip element.

**[0022]** Preferably, in the closed position of the two movable elements, these clip elements are positioned on at least one side of the main body. Such a configuration allows an especially convenient handling during the installation of the water injector and its fixation of the respective pipe to the inlet.

**[0023]** Advantageously, the laundry machine comprises a plurality of water pipes and the water injector comprises a plurality of inlets, wherein each water pipe is fluidly connected or connectable to one of these inlets, wherein the one or more movable elements, in their closed position, provide simultaneous fixation of all water pipes to the respective inlets. Such a configuration allows providing simultaneous watertight connection for all pipes during one installation procedure. In a preferred configuration, these inlets are arranged in a row, side to side of each other, with the water injector having its moveable elements designed in such a way simultaneous fixing. In the preferred embodiment where a crimping connection is provided, this crimping connection established simultaneously when moving the moveable elements into the closed position.

**[0024]** The main body and the one or more movable elements are preferably made of plastic and manufactured by a same injection molding process.

**[0025]** In a preferred embodiment, the water injector comprises one or more bending joints each one respectively connecting one of said one or more movable elements to said main body. In the design made of plastic, the bending joints can be provided by parts which have a thickness of the, preferably plastic, material which allows an elastic bending.

**[0026]** Advantageously, the laundry washing comprises two moveable elements, wherein one of said moveable elements comprises a bushing and the other one of said moveable element provides an opening in such a

way that in their closed position, they can be fixed to each other by a safety screw which is inserted into said bushing through this opening. This design provides an additional safety mechanisms to keep a watertight connection even if other means of connection, such as a clip mechanism, fail or are malfunctioning. This way, especially the water tightness of the connection is sustained. Naturally, also other known connection mechanisms can be used to provide redundant reciprocal fixation of the moveable elements. Alternatively or in combination, fixing means for fixing the moveable elements to the main body can be provided.

**[0027]** The advantages of the invention are especially as follows. Due to the integrated fixing device, a connection of the pipes to the injector can be accomplished without the need of additional components. Especially metal clamps are not needed. The fixing procedure is simplified. The moveable elements can be used to provide a connection of two or more pipes to the injector inlets in one workstep. In order to provide the crimping connection, no separate tools are needed.

Brief description of the Drawings

**[0028]** Further characteristics of and advantages of the present invention will be highlighted in greater detail in the following detailed description of some of its preferred embodiments, provided with reference to the enclosed drawings. In said drawings:

FIG. 1 is a perspective view of the upper portion of a top-loading washing machine with its upper door opened made in accordance with the teachings of the present invention;

FIG 2 shows the washing machine according to FIG. 1 with the upper door closed;

FIG. 3 shows an upper frame of the washing machine according to FIGs. 1 and 2 with a cover attached, in a perspective view;

FIG. 4 shows the upper frame according to FIG. 3 and the cover together with a water collector, in an exploded view;

FIG. 5 shows a water injector, pipes, and valves, in an exploded view;

FIG. 6 shows water injector, pipes, and valves, in an exploded view from another perspective;

FIG. 7 shows water injector, pipes, and valves in an assembled state;

FIG. 8 shows an enlarged view of the water injector;

FIG. 9 shows a top view of the components displayed in FIGs. 5 and 6;

FIG. 10 shows a front view of the water injector;

FIG. 11 shows a side view of the water injector;

FIGs. 12, 13, 14 show detailed side views of the water injector.

Detailed Description of the **Invention**

**[0029]** With reference to FIGs. 1 and 2, a top-loading washing machine 2 is displayed in an isomeric view. Washing machine 2 comprises preferably, but not necessarily:

- a substantially parallelepiped-shaped outer boxlike casing 4, which is preferably structured for resting on the floor;
- an upper door 6, preferably comprising a handle 8 for opening, which is advantageously hinged to a top wall or region 10 of casing 2 by one or more hinges 10a, 10b so as to rotate to and from a closing position in which upper door 6 rests, preferably horizontally, on top wall 10 for closing a laundry loading/unloading opening 12 and watertight sealing a cylindrical, hollow washing tub 14 which is arranged inside casing 2;
- a cylindrical, hollow revolving drum 16 which is structured for housing the laundry to be washed and is housed in an axially rotating manner inside washing tub 14; preferably the drum can be accessed by an opening, not illustrated, provided in its lateral surface and closable by one or two drum lids 90 pivotably associated to the washing drum 16.
- an elastically-deformable bellows 18 which connects in watertight manner a pass-through opening provided on the upper section of the lateral wall of washing tub 14 to an upper frame or rim (also called hopper) 24 of the superjacent laundry loading/unloading opening 12 provided on top wall 10 of boxlike casing 2;
- an electric motor assembly (not shown) which is attached to washing tub 14, outside the latter, and is structured for driving into rotation revolving drum 16 inside washing tub 14.

**[0030]** Upper door 6 preferably comprises an engagement hook 20 that engages for holding upper door 6 in an essentially horizontal closing position with a snap-in hole 22 which is built into upper frame 24.

**[0031]** Washing machine 2 also advantageously comprises a control panel 26 with a user interface 28 allowing the user to select certain parameters of the laundry procedure such as, for example, duration, temperature, and washing/rinsing options. Preferably, optical indicators are provided which indicate the selected laundry routine.

**[0032]** Washing machine 2 further comprises an additive compartment 34 comprising a cover 30 which is pref-

erably inserted in a rigid and stable, though easily detachable manner in a base compartment 32 which is connected, preferably in a removable way, to upper frame 24. Thus, additive compartment 34 comprises both cover 30 and base compartment 32.

**[0033]** With reference now to FIG. 3, upper frame 24 is displayed, whereby cover 30 is detachably inserted in base compartment 32. A water inlet 38 serves to connect washing machine 2 to mains water and preferably leads the water to two valves 42, 46 which can be operated or controlled by a control unit (not shown) and which, preferably dependent on the selected washing program, open and close to allow mains water to flow via a water injector 44 into cover 30 and from there into washing tub 14. Valves 42, 46 are preferably realized as electrovalves (EV).

**[0034]** FIG. 4 shows an exploded view of the components or parts shown in FIG. 3. In the bottom region of the base compartment 32 a preferably removable water collector 94 is provided; water exiting the bottom of the base compartment 32 goes into the water collector 94, which has preferably a sloped shape, so as to guide this water into the underlying washing tub 14.

**[0035]** Preferably, in the bottom region of the base compartment 32 a shock absorbing element 94 is provided, preferably fixed to the water collector 94, positioned in such a way that when the washing drum 16 is opened, the washing drum lid 90 allowing the opening of the latter bumps against the shock absorbing element so as not to damage the base compartment 32.

**[0036]** In FIG. 5, an exploded view of water injector 44 and the components it connects to in an assembled state of washing machine2 is shown. Valves 42, 46 are connected to water injector 44 via pipes 50, 54. Valve 42 comprises an outlet 58 on which an end part 62 of pipe 50 is imposed and fixed to outlet 58 by a metal clamp 66. In a similar manner, an end part 70 of pipe 54 is imposed on and fixed to an outlet 74 of valve 46 by a metal clamp 78. The fixing of water pipes or pipes 50, 54 to water injector 44 is described in connection with the following FIGs. Water injector 44 comprises two outlets 80, 82 which are fluidly connected to additive compartment 34.

**[0037]** In FIG. 6, valves 42, 46, pipes 50, 54 and water injector 44 are shown from a different viewing angle in an exploded view. Water injector 44 is designed in such a way to allow a watertight connection between pipes 50, 54 and inlets 100, 102 which is especially easy to handle and to install and very reliable. To this end, water injector 44 comprises a main body 108 and two moveable elements 110, 112. Moveable elements 110, 112 are parts or components of a fixing device 116 which is integrated into water injector 44 for providing a watertight connection of inlets 100, 102 and pipes 54, 50. This means that with fixing device 116, a watertight connection between inlet 100 and pipe 54 and between inlet 102 and pipe 50, respectively, is realized.

**[0038]** Main body 108 and moveable elements 110, 112 are made of plastic and are preferably produced in the same injection moulding process. Hence, main body 108 and moveable elements 110, 112 are built or designed as a single-piece construction. Moveable elements 110, 112 are displayed in an opened position. They are respectively connected to main body 108 by bending joints 120, 124 which allow a flexible positing of moveable 110, 112 with respect to each other and also with respect to main body 108. Water injector 44 also comprises two outlets 130, 132 for fluidly connecting with additive compartment 34.

**[0039]** In order to provide a watertight connection between pipes 50, 54 and inlets 100, 102, moveable element 110 is moved or folded in folding direction 136 and moveable element 112 is moved or folded in folding direction 140. The movement of moveable elements 110, 112 in order to provide a watertight connection respectively essentially corresponds to a rotation around a central axis 114 passing through main body 108. Moveable elements 110, 112 by this motion are respectively transferred from their opened position to their closed position. In their closed position, moveable elements 110, 112 engage one another and act as shells which partially encompass pipes 50, 54 which have been imposed on inlets 110, 102 at their respective end part 150, 154.

**[0040]** An opening 158 in moveable element 112 corresponds to a bushing in moveable element 110 which functions will be described in connection with FIG. 7.

**[0041]** In order to provide, in the closed state or position of moveable elements 110, 112, a watertight connection with pipes 50, 54, moveable elements 110, 112 provide, respectively, half channels 168, 170 (moveable element 110) and half channels 172, 174 (moveable element 112). They are respectively made of two half shells with a cross section of a semicircle and provide a respective crimping connection. In their folded position, half channels 170 and 174 encompass end part 154 of pipe 54, and half channels 168 and 172 encompass end part 150 of pipe 50. Since the fixing device 116 is integrated into water injector 44, metal clamps are not needed for the water tight connection to pipes 50, 54.

**[0042]** FIG. 7 displays the components shown in FIG. 5 in an assembled state. End part 150 of pipe 50 has been imposed on inlet 102, and end part 154 of pipe 54 has been imposed on inlet 100. Also, at their other end parts 62, 70, pipes 50, 54 have been imposed on outlets 58, 74 and fixed to them by means of metal clamps 62, 70. An enlarged view of main body 108 is shown in FIG. 8.

**[0043]** In FIG 9, the assembly of components according to FIGs. 6 and 7 is shown in a top view. Moveable elements 110, 112 are shown in their closed position after being moved in folding directions 136, 140. Moveable elements 110, 112 in this state or position provide a crimping connection for pipes 50, 54 with the respective inlets 100, 102. Moveable elements 110, 112 in this position are preferably connected to each other by a clip mechanism. Additionally, a safety screw can be inserted into opening 158 which corresponds to a bushing, keeping a connection in case the clip connection fails. Flaps

or wings 174, 178 are provided for fixing the water injector 44 to the upper frame 24.

**[0044]** FIG. 10 displays a front view of water injector 44 with moveable elements 110, 112 in their closed position. A corresponding side view is shown in FIG. 11. An enlarged view of circle 180 in FIG. 10 is shown in FIG. 12. Moveable elements 110, 112 are-in their closed position - connected to each other or fixed with respect to their relative motion by a clip mechanism 184 which is provided on a side 192 of water injector 44; alternatively or additionally, it can be provided on another side 196. Clip mechanism 184 comprises a first clip element 186 and a second clip element 188 which - in the closed position - provides a form-locking and detachable connection with clip element 186. FIGs. 13 and 14 are detailed views of the encircled areas of sides 192 and 196 of FIG. 10 and show clipping elements 186, 188 in a locked position, respectively.

## Claims

**1.** Laundry washing machine (2), comprising:

a washing tub (14) containing a rotatable washing drum (16) in which laundry to be washed can be loaded;
an additive compartment (34) adapted to be loaded with washing/rinsing products and fluidly connected to said washing tub (14);
a water injector (44), arranged for supplying water to said additive compartment (34);
at least one valve (42, 46) fluidly connected or connectable, upstream, to water mains external to said washing machine (2), and fluidly connected, downstream, to said water injector (44), in such a way to selectively deliver a water flux from said water mains to said water injector (44);
at least one water pipe (50, 54) fluidly connecting said at least valve (42, 46) to said water injector (44);
**characterized in that**
said water injector (44) comprises an integrated fixing device (116) for its watertight fixation to said at least one water pipe (50, 54).

**2.** Laundry washing machine (2) according to claim 1, wherein said water injector (44) comprises a main body (108) with at least one inlet (100, 102) for fluid connection to said at least one water pipe (50, 54), and wherein said integrated fixing device (116) comprises one or more movable elements (110, 112), connected to said main body (108) and movable with respect to the latter from an opened position in which it does not keep said at least one water pipe (50, 54) watertight fixated to said at least one inlet (100, 102), to a closed position in which it keeps or contributes to keep said at least one water pipe (50, 54) watertight fixated to said at least one inlet (100, 102).

**3.** Laundry washing machine (2) according to claim 2, wherein said water injector (44) comprises two of said movable elements (110, 112) connected to said main body (108) and movable with respect to the latter from said opened position to said closed position, wherein in said closed position said two movable elements (110, 112) partially or totally encompass said at least one water pipe (50, 54) so as to provide the watertight fixation of said at least one water pipe (50, 54) to said at least one inlet (100, 102)

**4.** Laundry washing machine (2) according to claim 3, wherein said two movable elements (110, 112) provide a crimping connection with said at least one water pipe (50, 54).

**5.** Laundry washing machine (2) according to claim 3 or 4, wherein in their closed position, said two movable elements (110, 112) are connected to each other.

**6.** Laundry washing machine (2) according to claim 5, wherein in their closed position, said two movable elements (110, 112) are connected to each other by a clip mechanism (184).

**7.** Laundry washing machine (2) according to claim 6, wherein said clip mechanism (184) comprises at least two clip elements (186, 188) which in said closed position of said two movable elements (110, 112) engage one another, providing the reciprocal fixation of said two movable elements (110, 112).

**8.** Laundry washing machine (2) according to claim 7, wherein said clip elements (186, 188) are, in said closed position of said two movable elements (110, 112), positioned on at least one side of said main body (108).

**9.** Laundry washing machine (2) according to one of the claims 2 to 8, comprising a plurality of water pipes (50, 54) wherein said water injector (44) comprises a plurality of inlets (100, 102), and wherein each water pipe (50, 54) is fluidly connected or connectable to one of said inlets (100, 102), wherein said one or more movable elements (110, 112), in their closed position, provide simultaneous fixation of all said water pipes (50, 54) to the respective inlets (100, 102).

**10.** Laundry washing machine (2) according to one of the claims 2 to 9, wherein said main body (108) and said or more movable elements (110, 112) are made of plastic and are manufactured by a same injection molding process.

**11.** Laundry washing machine (2) according to one of

the claims 2 to 10, wherein said water injector (44) comprises one or more bending joints (120, 3 124) each one respectively connecting one of said one or more movable elements (110, 112) to said main body (108).

**12.** Laundry washing machine (2) according to one of the claims 2 to 11, comprising two moveable elements (110, 112), wherein one of said moveable elements (110, 112) comprises a bushing and the other one of said moveable element (110, 112) provides an opening (158) in such a way that, in their closed position, they can be fixed to each other by a safety screw which is inserted into said bushing through said opening.

FIG. 1

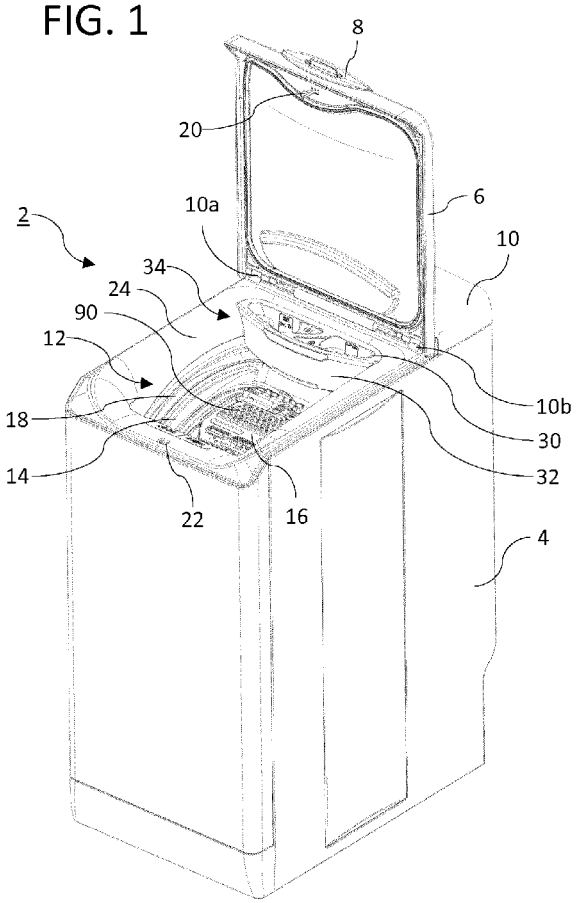



FIG. 2

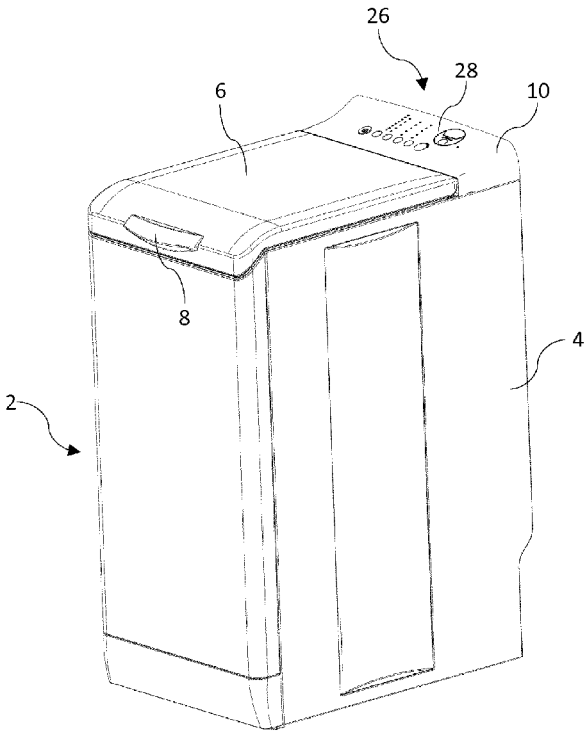


FIG. 3

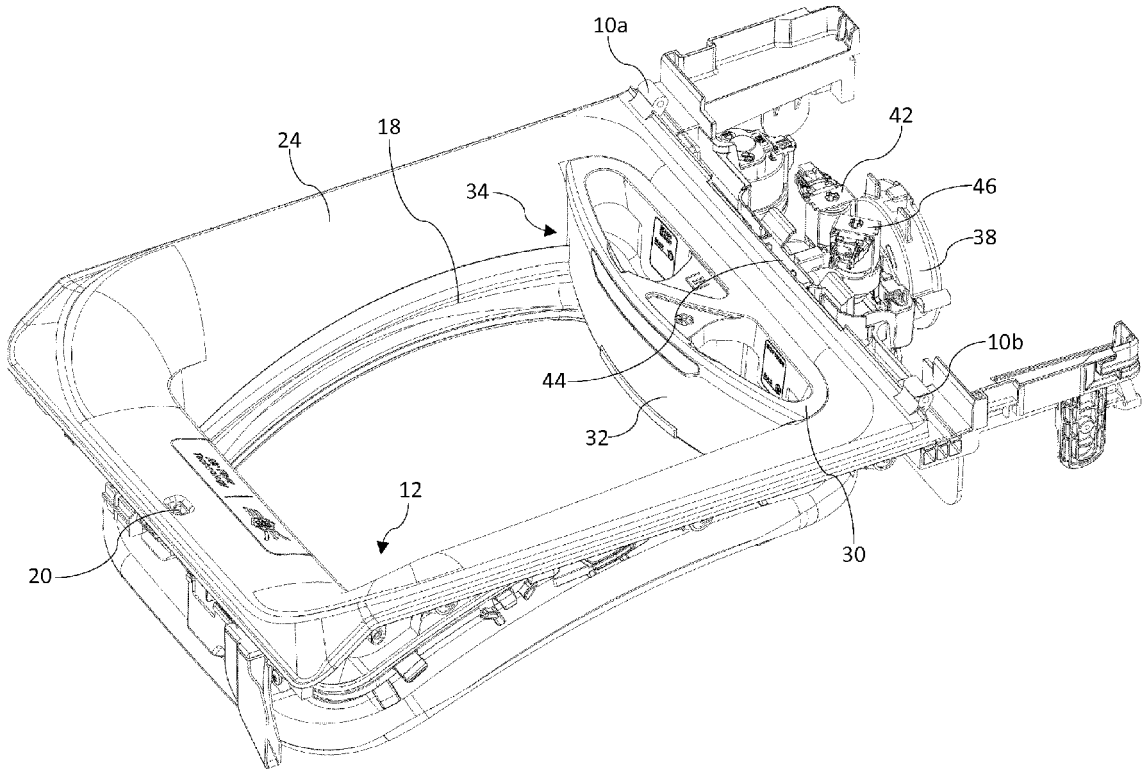


FIG. 4

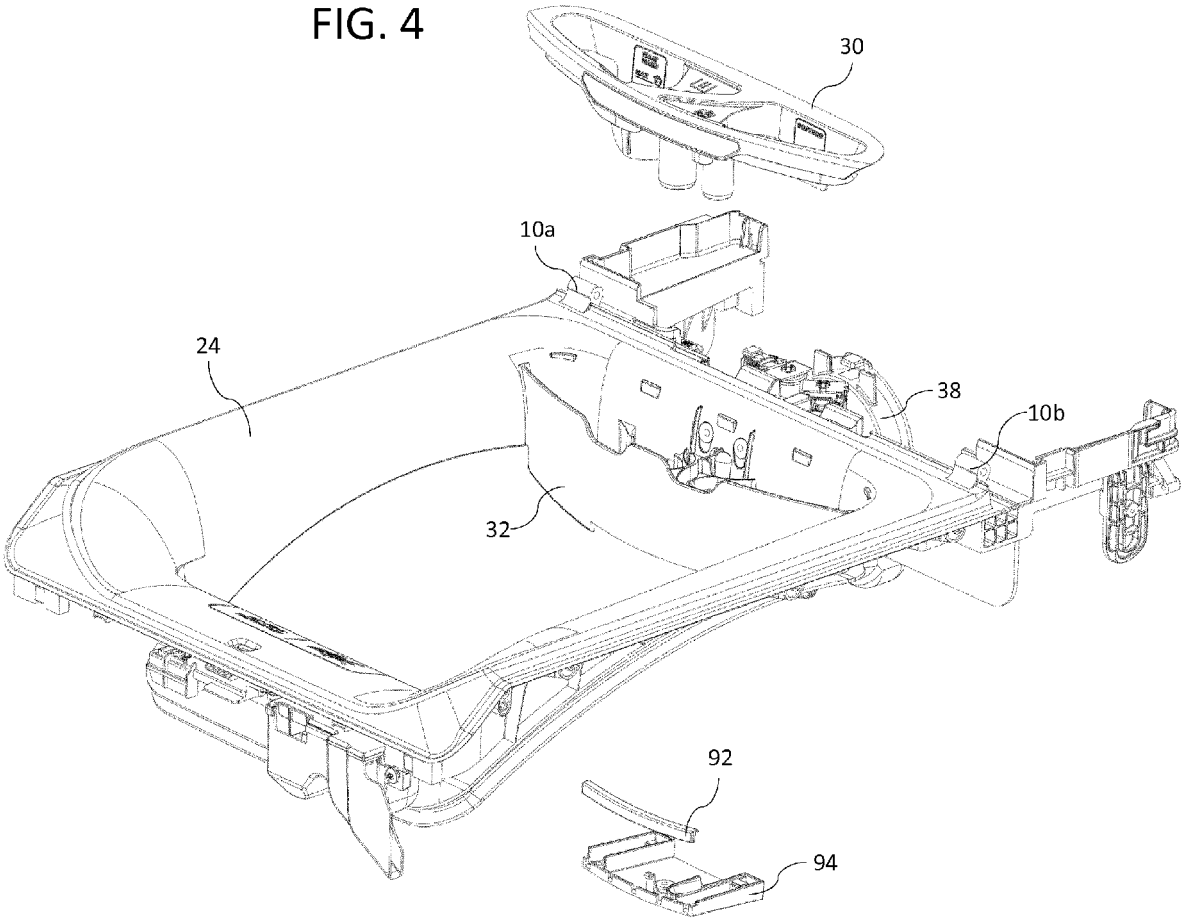


FIG. 5

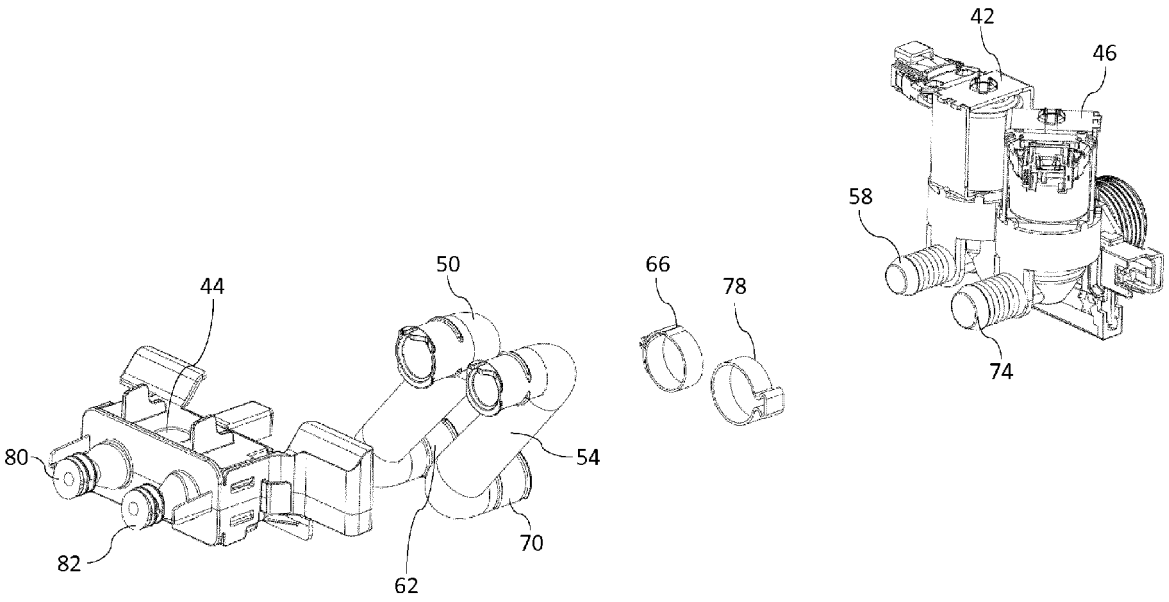


FIG. 6

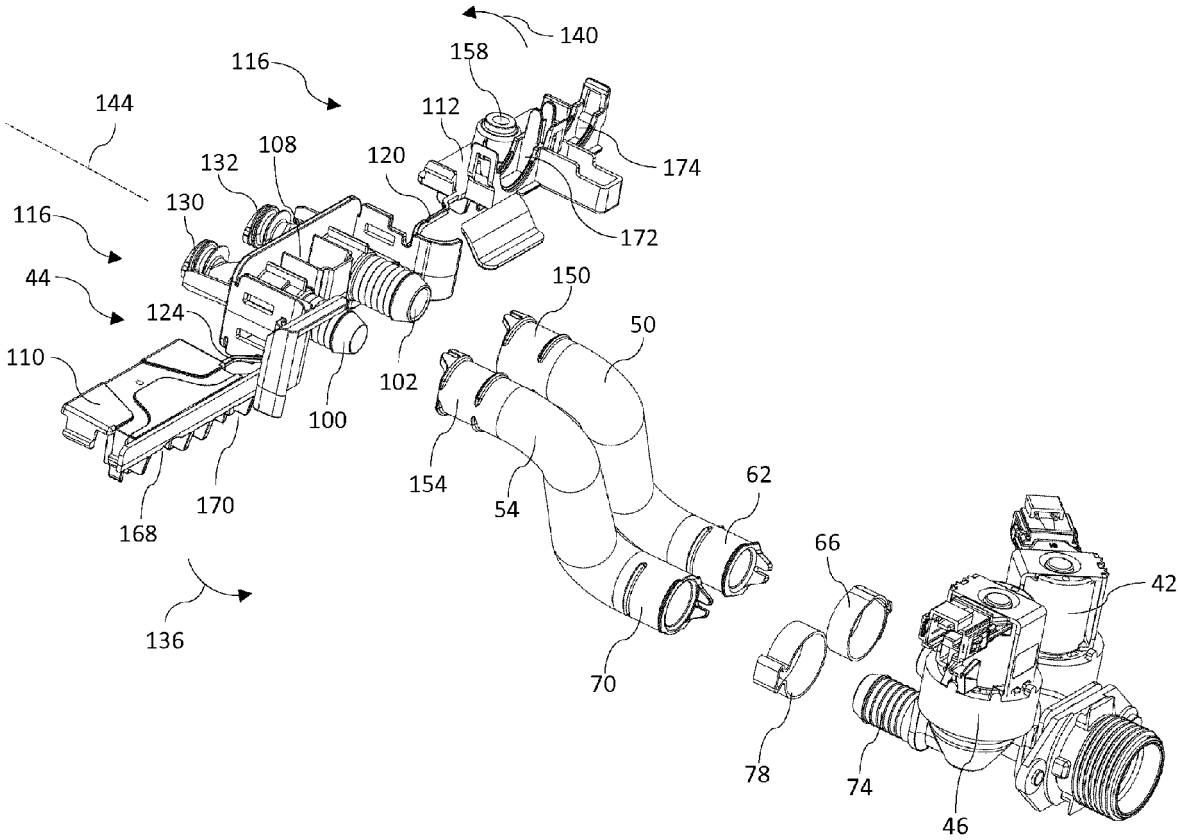

140
158
116
144
112
108
132
120
174
130
116
172
44
150
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100
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46

FIG. 7

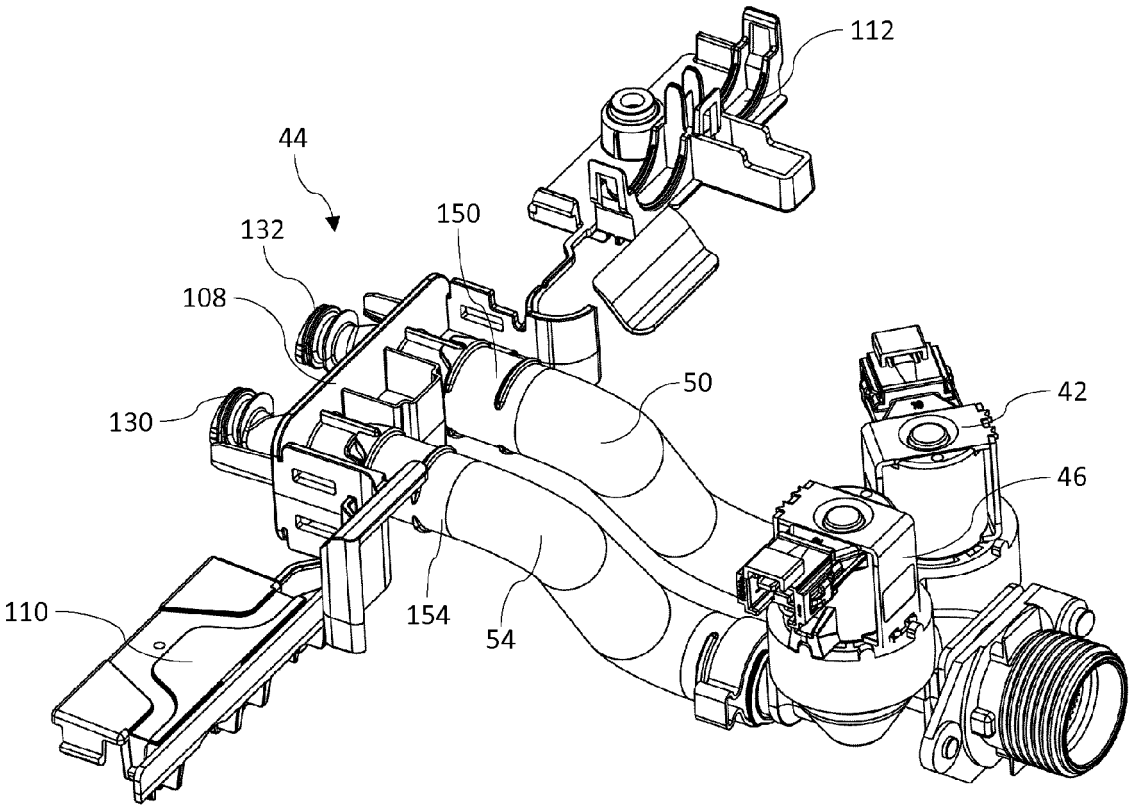


FIG. 8

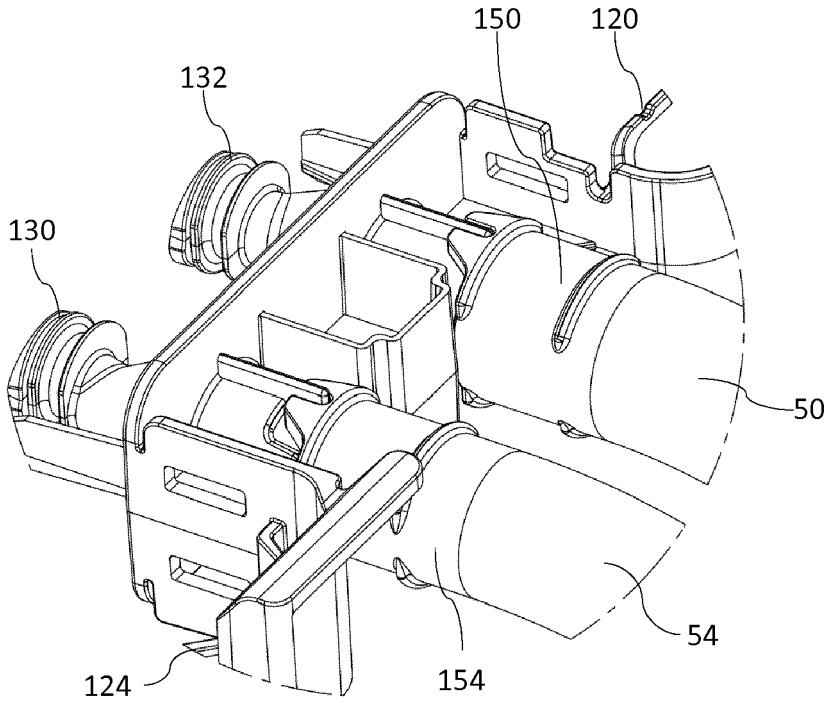


FIG. 9

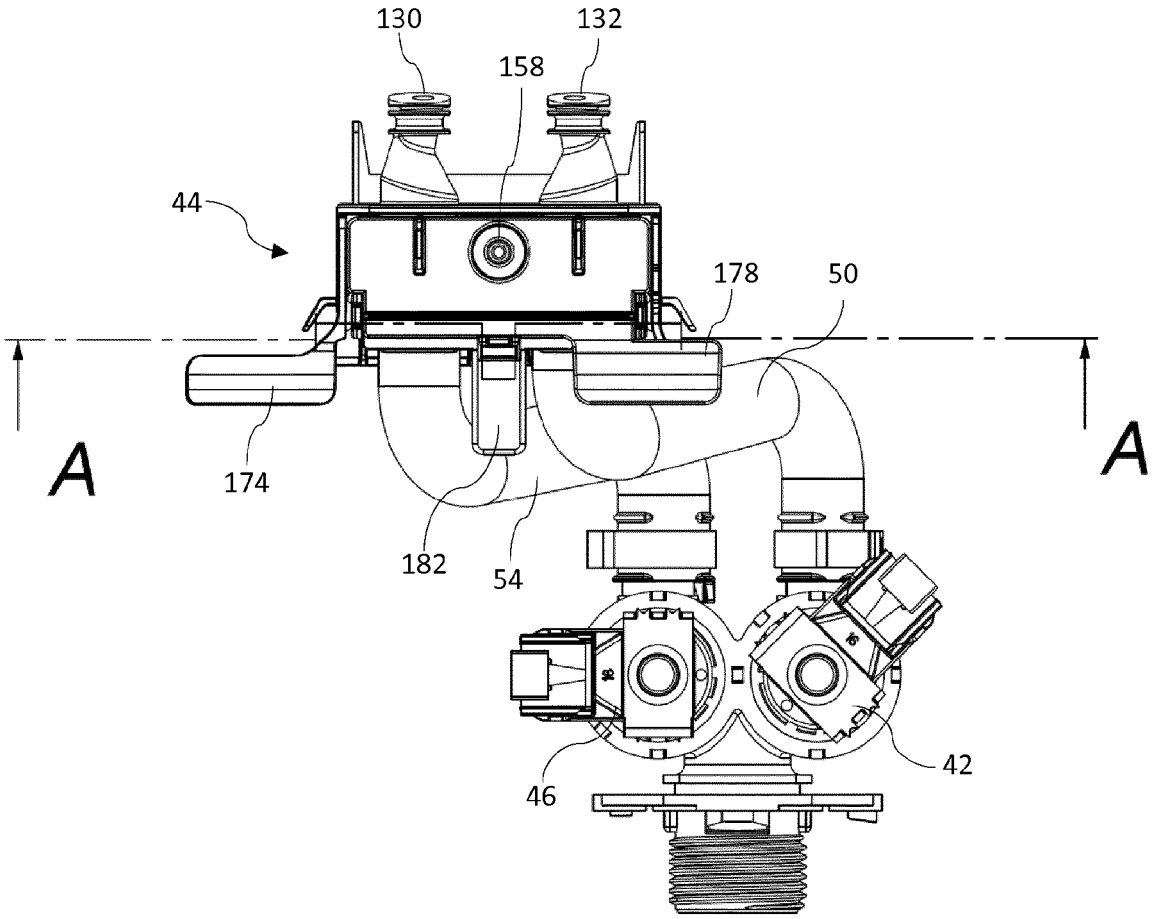


FIG. 10

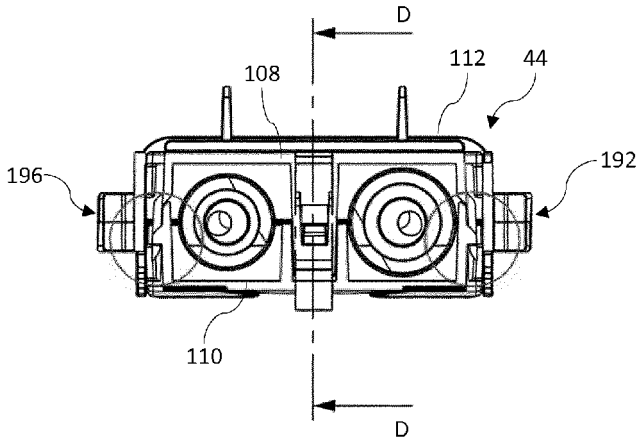



FIG. 11

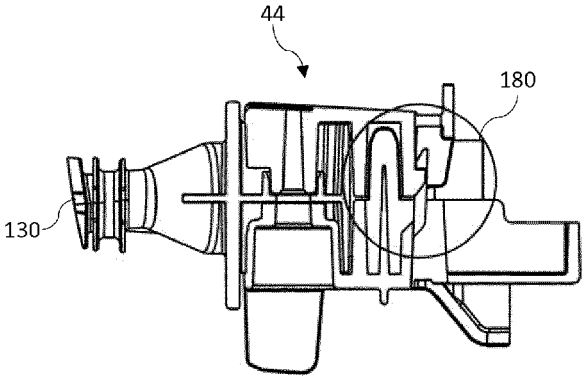


FIG. 12

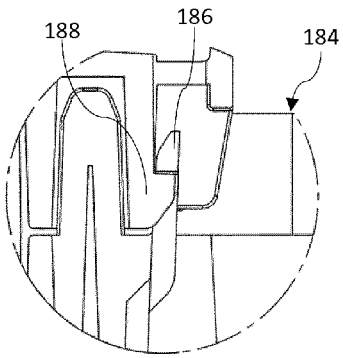



FIG. 13

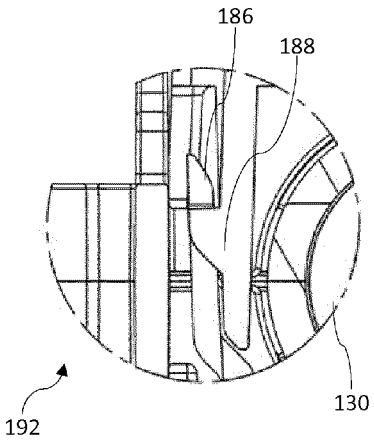
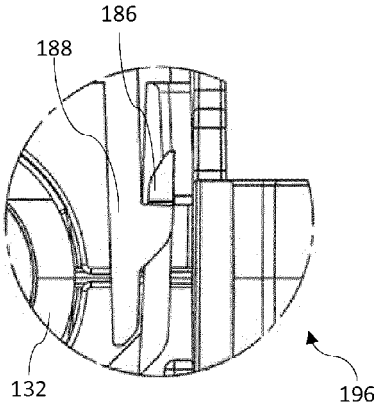



FIG. 14



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# EUROPEAN SEARCH REPORT

Application Number
EP 14 17 7102

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| Munich | 17 October 2014 | Bermejo Pasetti, M |

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