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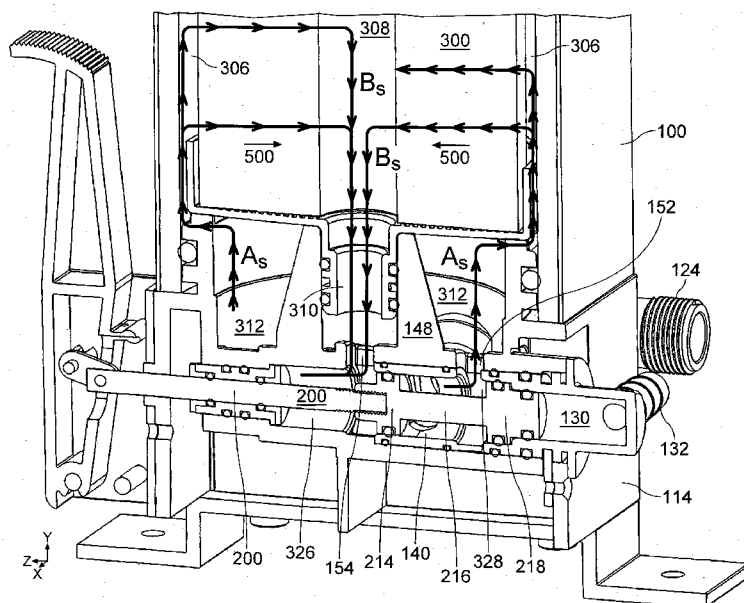


FIG. 5A

(57) Abstract: A water treatment module (100) comprises a water treatment medium (300) disposed within a pressurised container (108). A cover (114) for the pressurised container comprises a backwash mechanism (130) for back washing of the water treatment medium. A cover for a water treatment module and methods of treating water are also disclosed.

WATER TREATMENT MODULE, COVER FOR A WATER TREATMENT MODULE, AND
METHODS OF TREATING WATER

5 The invention relates to a water treatment module. The invention also relates to a cover for a water treatment module. The invention also relates to a method of treating water. The invention has particular, but not exclusive, application in water treatment systems (such as purification/filtration and desalination) for the treatment of the main incoming water to a building, such as a domestic residence.

10 There are numerous different types of systems for treating water in the incoming water supply to a building, such as a house. A type of filter in common usage is a glass-fibre reinforced vessel filled with sand for filtering the water. The vessel is made with a relatively small opening in a top portion through which the filter may be filled with the filter media (e.g. sand). The inlet and outlet are connected to and part
15 mounted on the small opening in the top. This part normally as well includes a backwashing mechanism. In order to extend the lifespan of the media it is backwashed with incoming water periodically. This is done by reversing the water flow direction through the inside the filter and letting the water flush out the collected dirt in the filter through an outlet.

20 The vessels can as well contain or be combined with other filtration media than sand. Two common examples of filter media are activated carbon, for removing the chlorine and Ion Exchange resin for softening the water. There exists a wide range of media for different purpose and the vessels can be combined and connected several
25 in series or in parallel for cleaning different kind of water qualities.

The water inlet and outlet is commonly connected in the top of the vessel.
The tube often runs along near the ground level. This can be rather unsightly and, being relatively unprotected, is prone to damage.

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Another common type is the usage of filters in a filter chamber and module where the filter can be replaced after a certain time of usage.

5 Other design considerations include connection of a UV sterilising unit after the filters. The above vessels and filter chambers are sometimes put in different sizes covers (cabinet) for protecting the system and user for aesthetical reasons. One factor defining the capacity of the water system is its size and height.

10 The filter chambers are typically made of moulded parts in plastic made through injection moulding. The size of the chambers is predetermined by the size of plastic injection tools. One example of this filter chamber is the Pentair Big Blue® series. For instance, one disadvantage of the moulded filter chambers (vessels) is that a different length (size) of the chamber requires specific tooling. The filter chamber normally has to be fabricated in a conical shape in order to pull out the core, which
15 defines the inner cavity of the chamber.

Just one specific system is the stainless steel Coway POE10A filter, but this design is not without its limitations. Just one of these limitations is that the filter lengths are of a fixed sized for a particular tooling range.

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A system which came to the attention of the inventors after the making of the invention is that disclosed in International Patent Publication No. WO 2013/054964.

25 The invention is defined in the independent claims. Some optional features of the invention are defined in the dependent claims.

Implementation of the techniques disclosed herein may provide significant technical advantages in comparison with known systems. For instance, by implementing the techniques below, it may be possible to assemble multiple versions and
30 configurations of one or more water treatment modules. This may be done by -

forming a protective cabinet around the one or more pressure vessels. The modules may be produced in different versions and height with the same tooling setup.

5 In one arrangement, the pressure vessel may comprise an extruded aluminum tube in which one end is provided with a sealing (bottom) cover containing a backwash mechanism and the other end provided with sealing (top) cover. The pressure vessel may optionally be protected against corrosion, such as by through an anodizing process, or additional of a plastic sleeve or coating on the inside and/or outside.

10 When the backwash mechanism (e.g. movable piston) is integrally formed within the cover, this provides an elegant solution, offering significant cost savings in manufacturing and an on-site commissioning. Furthermore, servicing and installation of the water treatment media may be facilitated. Post-installation maintenance and/or upgrading is also facilitated.

15 Other benefits and advantages will become apparent from the following discussion of the invention, now described by way of example only, and with reference to the accompanying drawings in which:

20 Figure 1A is a perspective diagram illustrating a water treatment module;
Figure 1B is a cutaway perspective diagram illustrating an internal configuration for a cover for a water treatment module;
Figure 1C is a perspective diagram illustrating components of a cover for a water treatment module;
25 Figure 2 is a schematic diagram illustrating a piston and its shaft used in a backwash mechanism of a cover for a water treatment module;
Figure 3A is a cross-sectional perspective view illustrating an internal configuration for a cover and a water treatment module when the backwash mechanism is in a first configuration;

Figure 3B is a cross-sectional perspective view illustrating an internal configuration for a cover and a water treatment module when the backwash mechanism is in a second configuration;

Figure 4 is a perspective view illustrating external connections for the cover;

5 Figure 5A is a cross-sectional perspective view illustrating an internal configuration for a cover and a water treatment module when the backwash mechanism is in a first configuration, and the flow of water therethrough;

Figure 5B is an enhanced view of the arrangement of Figure 1B illustrating flow of water therethrough in the first configuration;

10 Figure 5C is an enhanced view of the arrangement of Figure 1C illustrating flow of water therethrough in the first configuration;

Figure 6A is a cross-sectional perspective view illustrating an internal configuration for a cover and a water treatment module when the backwash mechanism is in a second configuration, and the flow of water therethrough;

15 Figure 6B is an enhanced view of the arrangement of Figure 1B illustrating flow of water therethrough in the second configuration;

Figure 6C is an enhanced view of the arrangement of Figure 1C illustrating flow of water therethrough in the second configuration;

20 Figure 7A is an exploded perspective view of a series of the water treatment module of Figure 1;

Figure 7B is another exploded perspective view of a series of the water treatment module of Figure 1; and

Figure 7C is a perspective view illustrating an integral assembly of a series of the water treatment module of Figure 1.

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In the following description, unless stated otherwise, terms such as "first" and "second" are used to distinguish between the elements such terms describe. Thus, these terms are not necessarily intended to indicate temporal or other prioritisation of such elements. When terms such as "left", "right" and the like are used, these are

used simply to describe exemplary positions of elements illustrated in the drawings as viewed from the perspective of the viewer.

Turning first to Figure 1A a water treatment module 100 is illustrated. Water treatment module 100 comprises a housing 102 having a left housing cover 104 and a right housing cover 106. The rear housing cover is obscured in Figure 1, and the front housing cover has been removed for the purpose of illustration of the pressurised container 108 which may be formed by, for example, an extruded pipe. As described in greater detail below, the pressurised container contains at least a water treatment medium such as a filter or desalination medium.

Water treatment module 100 further comprises a top cover 110 fixed to the housing 102 using screws 112. Bottom cover 114 is fixed to the housing 102 using screws 116.

Cover 114 comprises a backwash mechanism (not illustrated in Figure 1A, but described in detail below). In this example, the backwash mechanism is disposed internally to the cover 114. The backwash mechanism may be operated/actuated by actuator 118 disposed on a side face of the cover 114, in this example, the left side cover. In the example of Figure 1A, actuator 118 comprises a foot pedal, for operation, preferably, by the foot of a user. Actuator 118 is retained on the side face of the cover 114 with the actuator (foot pedal) holder 120. In one arrangement, this comprises a housing/framework fixed to the side face of the cover 114, with the actuator 118 being supported thereby.

Water to be treated enters the water treatment module 100 through an inlet aperture 122 not shown in Figure 1A as this is disposed on the rear face of the cover 114. Water is channelled to the inlet aperture by an inlet connector 124, also not shown in Figure 1A but described in greater detail below. Cover 114 comprises a cover outlet/outlet aperture 126 disposed in the front side face of cover 114. Water

may be channelled from the outlet aperture 126 using an outlet connection 128 (e.g. a piece of conduit for insertion into the aperture), omitted from Figure 1A for the sake of clarity. Cover 114 further comprises a backwash outlet/aperture 130, obscured in Figure 1A, but water is channelled therefrom through backwash connection 132 visible in Figure 1A.

Thus it will be appreciated that Figure 1A illustrates a water treatment module 100 comprising: a water treatment medium disposed within a pressurised container 108; and a cover 114 for the pressurised container 108, the cover 114 comprising a backwash mechanism for back washing of the water treatment medium.

The cover may be provided separately, in which case there is provided a cover 114 for a water treatment module 100, the water treatment module 100 comprising a water treatment medium disposed within a pressurised container 108, the cover comprising a backwash mechanism for back washing of the water treatment medium.

Providing a cover for a pressurised container with the cover having a backwash provides a unique and elegant arrangement.

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In one implementation, cover 114 is formed in an injection moulding process, where the internal channels are formed with cores in the tool of the injection mould. In the example of Figure 1, plug 134 is provided to facilitate the injection moulding process. In other arrangements, the backwash mechanism is assembled separately and, for example, placed within the cover, or the cover is formed around it. Thus, in one arrangement, the backwash mechanism is disposed within the cover, In one implementation as illustrated in Figure 1A, the module 100 is supported and fixed on a surface (not shown) by support feet 136 having holes through which fixing screws or bolts may be fastened. The support feet may be fixed to any suitable point(s) on the module such as, for example, the housing or the pressurised container.

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Figure 1B is a cutaway perspective diagram illustrating an exemplary internal configuration for the cover 114 of Figure 1A. This diagram presents a cross-sectional view transverse the longitudinal axis of the water treatment module 100, and from an underside perspective (i.e. looking up from the underside of cover 114).

Inlet aperture 122 is visible in this view. This opens in a first side face 156 of cover 114. Cover 114 further comprises second side face 158 which, in this example, is opposed first side face 156. Cover outlet aperture 126 is disposed in second side face 158. Cover 114 further comprises third side face 160 at right angles to, and between, edges of first and second side faces 156, 158. Backwash aperture 130 is disposed in third side face 160. Thus, the cover inlet, the cover outlet and the backwash outlet comprise respective apertures disposed in side faces of the cover. Cover 114 further comprises fourth side face 162 opposed third side face 160. The backwash mechanism actuator holder 120 is disposed on fourth side face 162.

In one implementation, cover 114 is a generally rectangular prism, also having a height defined by upper and lower surfaces. Together, the four side faces form the sides of the rectangle, when viewed from above or below cover 114.

Water is supplied thereto using the inlet connection piece 124. The water is conveyed into the cover and into a channel network comprising inlet channel 138, piston channel 140, outlet channel 142 and backwash channel 144. Water flow through the channels will be described in greater detail below, particularly with reference to Figures 5 and 6. A backwash mechanism 146 is disposed in piston channel 144. One exemplary backwash mechanism is illustrated in, and described with reference to, Figure 2.

In the example of Figure 1B, inlet channel 138 runs from the first side face 156 of cover 114 internally to the cover orthogonally to the side face. The inlet channel 138

runs to its outlet where the inlet channel 138 merges into piston channel 140. Piston channel 140 runs generally transverse inlet channel 138 in this example, and parallel or generally parallel to first side face 156. In this example, piston channel 140 runs from third side face 160, internally towards, but not necessarily extending all the way to, fourth side face 162.

In a first configuration (described in more detail below) piston channel 140 is in fluid communication with outlet channel 142 – that is, there is a flow path between them – with outlet channel 142 channelling through to outlet aperture 126. In the second configuration (also described in more detail below) the path from piston channel 140 to outlet channel 142 is closed off. In the example of Figure 1B, outlet conduit 142 runs parallel or generally parallel to and spaced from piston channel 140, disposed between piston channel 140 and second side face 158. The flow of the outlet conduit 142 changes so that it then runs transverse piston channel 140, as the outlet conduit 142 runs to outlet aperture 126.

Figure 1C is a perspective diagram illustrating components for the water treatment module of Figure 1A and Figure 1B. The view is from above, looking down on the cover 114 from the perspective of Figure 1A.

In this view, a cover filter plug 148, sitting above piston channel 140, can be seen. The function of cover filter plug 148 will be described in greater detail below, particularly with reference to Figure 3, but it is sufficient to note for now that this defines a generally cylindrical projection, projecting up away from piston channel 140, the plug having a central aperture 150 for receiving an outlet of a water treatment medium. Cover filter plug 148 may comprise an integral part of the cover, or it may be formed separately and attached, affixed or otherwise assembled thereto. Plug 148 comprises support ribs 149 for mechanical strength. Also visible is a first treatment medium aperture 152 through which water can flow, as described in greater detail with reference to Figures 5 and 6. Central aperture 150 of cover

filter plug 148 runs from a second treatment medium aperture 154 (shown in, for example, Figure 3A), which is another aperture in cover 114 through which water can flow, also described in greater detail with reference to Figures 5 and 6. An annular wall 155, disposed concentrically around the cover filter plug 148, rises from an upper surface 157 of the cover. Annular wall 155 may comprise an integral part of the cover, or it may be formed separately and attached, affixed or otherwise assembled thereto. In this example, the cover filter plug 148 and the annular wall both rise to approximately the same height above the upper surface 157 of the cover, best seen in Figure 3.

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Figure 2 is a cross-sectional elevational view of an exemplary backwash mechanism 146 for the water treatment module 100. In the example of Figure 2, the components comprise of a piston mechanism, and are not drawn to scale. All of the components illustrated are of generally cylindrical shape, although other arrangements are contemplated. The diametrical dimensions of the individual parts of the backwash mechanism vary, as will now be described.

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In this example, backwash mechanism 146 comprises a reduced-diameter shaft 200 (reduced with respect to piston channel 140, as will become apparent from the description below). The shaft 200 makes up at least part of a first reduced-diameter portion of the backwash mechanism. Shaft 200 has a first end 202 having a hole 203 formed therethrough for connection (e.g. through a mechanical linkage) to actuator 118, described with reference to Figure 3. Shaft 200 further comprises a second end 204, distal the first end 202. Second end 204 is provided with an external (male) threaded portion. Also provided is a flow controller 206, having a first proximal end 208 (proximal shaft 200 when assembled therewith) and a second distal end 210 (distal shaft 200 when assembled therewith). First end portion 208 comprises a recess 212 having an internal (female) threaded portion for receiving the male threaded portion of second end 204 of shaft 200, for the shaft 200 and the flow

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controller 206 to be assembled together through a screwing action, but other assembly arrangements are of course possible.

In the perspective of Figure 2, flow controller 206 (which can be used to control the flow "direction" of water through the module) comprises a first barrier portion 214, positioned adjacent to, and right of, first end 208. First barrier portion 214 has a diameter which is greater than the diameter of shaft 200. To the right of first barrier portion 214 along the length of the flow controller 208, flow controller 206 comprises a portion 216 of reduced diameter, the diameter of portion 216 being less than the diameter of first barrier portion 214. Portion 216 comprises at least part of a second reduced-diameter portion of the backwash mechanism. Farther along the length of flow controller 216, moving from the first end 208 to the second end 210, flow controller 216 has a second barrier portion 218 having a diameter greater than the diameter of portion 216. In this example, the diameters of first and second barrier portions are generally the same or at least similar given the geometry of the piston channel 140, but other arrangements for the dimensions of the barrier portions are contemplated, and this may depend on the geometry of the piston channel. Yet farther along the length of flow controller 206 there is an (optional) third reduced-diameter portion 220.

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Flow controller 206 further comprises recesses 222 disposed around the surface of flow controller for receiving O-rings seals, not shown in Figure 2.

Referring to Figure 3A now, a cross-sectional view of the water treatment module 100 is illustrated. In addition to the components described above, water treatment module 100 comprises water treatment medium 300, such as a filtration or desalination medium as described above, or other purification, separation, decontamination or similar medium such as an ion exchange treatment medium. The water treatment module 300 in this example is generally cylindrical in shape, having an outer surface 302. Likewise, the pressurised container 108 is cylindrical having an

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internal wall or protection film 304. In this implementation, the pressurised container is concentric with the cylindrical water treatment module 300, but having a gap 306 between the outer surface 302 of the water treatment module 300 and the inner surface of 304 of pressurised container 108.

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The water treatment medium surrounds and opens into an open central core for flow of water therethrough as will be described below. Additionally or alternatively, the water enters the top of the filter and flows down to the bottom of the filter, along the length thereof. The water treatment medium has an output 310

10 comprising a projection extending from a lower portion of the water treatment module, with the projection also having an open aperture, again for flow of water therethrough. The projection of the water treatment module outlet 310 is arranged for insertion into the inlet 150 of the cover filter plug 148, illustrated in Figure 1C such that the open central core 308 of the water treatment module 300, the water
15 treatment outlet 310 and the second water treatment medium aperture 154 are in fluid communication with one another.

Given that the cover filter plug 148 projects upwards away from an upper surface of the cover, and that the water treatment medium outlet 310 projects downwards
20 from the underside thereof, plugging in to the cover filter plug 148, there is a void 312 comprising an empty volume surrounding the cover filter plug 148, enclosed by the annular wall 155 disposed concentrically around the cover filter plug 148, and as described above with reference to Figure 1C.

25 Coming back to piston channel 140, this comprises a generally cylindrical conduit within which the piston mechanism of the shaft 200 and the flow controller 206 are disposed. Piston channel 140 may be of a uniform or generally uniform diameter across its length, but in this example, the channel has some variations in diameter across sections of its length, and such arrangements may assist in helping control
30 movement of the backwash mechanism 146 during a transition between the normal

and backwash operational states of water treatment module 100 described below. The shaft and the flow controller have limited translational movement along and within the piston channel 140. The channel insert 314 is provided in order to distance the sliding seals of the piston to the holes in the channel. Direct contact of the piston seals to the hole edges in the channel would harm the seals when moving the piston between the first and second configurations described below. . Seal holder 316 is provided to hold the seals (o-rings) for the sliding shaft 200

Seals 318 are disposed in the annular recesses 222 around the outer cylindrical surfaces of the flow controller 206 to prevent water leakage around the first and second barrier portions 214, 218. Thus, the barrier portions are arranged to abut the internal surface of the piston channel to form flow barriers, preferably assisted by the O-ring seals.

As noted above, the piston mechanism comprising the rod 200 and flow controller 206 have limited translational movement within piston channel 140 where the limits to the translational movement may be defined by the geometry of sections of the piston channel. For example, if the piston is positioned within a first section of piston channel 140 and moves towards a second section of lesser diameter, this may restrict or limit the movement of the piston beyond the first section. This movement is effected by the piston mechanism actuator 118 which is, in this example, a foot pedal. Foot pedal 118 is mechanically linked to the shaft 200 through a mechanical linkage comprising a joint mechanism 320 pivotally fixed to the first end 202 of the shaft 200 with a pin, stud, bolt or other fixing through the hole 203 bored in the shaft. Upon operation of the foot pedal, to be described in further detail below, a lower end of the foot pedal (at or near floor level, adjacent the support feet 136) pivots about the pedal pivot point 322.

Seals 324 are provided to form a seal between the pressure vessel and the cover.

As noted above, rod 200 and and/or the first end 208 of the flow controller, comprise a first reduced-diameter portion of the backwash mechanism/piston. Thus, this portion is of a diameter which is smaller than the inner bore diameter of the piston channel 140. A volume 326 of the piston channel 140 surrounding the first
5 reduced diameter portion is, therefore, not completely filled with solid matter. As also noted above, portion 216 of flow controller 206 is also of a reduced diameter. This portion comprises a second reduced-diameter portion of the backwash mechanism/piston. Further, this portion 216 is also of a diameter which is smaller than the inner bore diameter of the piston channel 140. The volume 328 of the
10 piston channel 140 surrounding the second reduced-diameter portion 216 is, therefore, not completely filled with solid matter.

As illustrated in Figure 3A, the volume 326 surrounding the first reduced-diameter portion 200 opens out into the second water treatment medium aperture 154. Thus,
15 volume 326 is in fluid communication with the inlet of the cover filter plug 150, the outlet 310 of the water treatment module 300 and the central core 308, through second water treatment medium aperture 154. The volume 328 surrounding the second reduced-diameter portion 216 opens out into the first water treatment medium aperture 152. Thus, volume 328 is in fluid communication with the void 312
20 through first water treatment medium aperture 152.

In Figure 3A the foot pedal is illustrated in a stowed position, corresponding to a first position of the piston mechanism within the piston channel. The first position of the piston mechanism corresponds with a first mode of operation of the water
25 treatment module 100. In this example, the first mode of operation is a "normal" water treatment mode, as will be described in further detail below with reference to Figure 5.

Figure 3B illustrates a second position of the piston mechanism within the piston
30 channel 140 after the foot pedal 118 has been moved to a deployed position. In this

arrangement, the water treatment module 100 is in a second mode of operation, a "backwash" mode.

Upon activation of the foot pedal 118 by a user, the downward pressure effected by a user placing his or her foot on the upper knurled portion of foot pedal 118 causes the upper portion of the foot pedal to pivot away from the pressurised container 108 about the pivot point 322, thus effecting a pulling force on the shaft 200 through the mechanical linkage (joint mechanism 320) thereby effecting the translational movement of the piston mechanism within the piston channel 140. The translational movement is, in the perspective of Figure 3B, from right to left, towards the foot pedal 118.

In this second position, and as illustrated in Figure 3B, the volume 328 surrounding the second reduced-diameter portion 216 opens out into the second water treatment medium aperture 154. Thus, volume 328 is in fluid communication with the inlet of the cover filter plug 150, the outlet 310 of the water treatment module 300 and the central core 308, through second water treatment medium aperture 154.

As illustrated in Figure 3B, the volume 326 surrounding the first reduced-diameter portion 200 is now no longer in communication with the second water treatment medium aperture 154, the flow path therebetween now being blocked by the first barrier portion 214 of the flow controller 206 and the O-ring positioned in the recess 222. Instead, volume 326 is isolated from this flow path. However, the volume 328 surrounding the second reduced-diameter portion 216 now opens into the second water treatment medium aperture 154. Thus, volume 328 is in fluid communication with the inlet of the cover filter plug 150, the outlet 310 of the water treatment module 300 and central core 308, through second water treatment medium aperture 154.

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Referring to Figure 5, water flow through the water treatment module in the first mode of operation, with the foot pedal 118 in the stowed position, is now described.

Water is supplied at pressure to the cover inlet aperture 122. From the cover inlet aperture 122, there is an incoming flow path denoted As, through the inlet channel 138 best viewed in Figure 5B. As mentioned above, the inlet channel 122 has an outlet where it merges into the piston channel 140 in which the piston/backwash mechanism 146 is disposed, into the volume 328 surrounding the second reduced-diameter portion 216 of the flow controller 208. From the piston channel 140, water flows into the first treatment medium aperture 152, best viewed in Figure 5A. As noted above, first treatment medium aperture 152 opens into the void 312 surrounding the plug 148 into which the filter outlet 310 is inserted. As also noted above, second treatment medium 154 provides a flow path between the filter outlet 310 and the piston channel 140, into the volume 326 surrounding the rod 200, the first reduced-diameter portion of the piston mechanism.

Referring again to the discussion above, it will be recalled that the piston mechanism has at least a first portion 200 of reduced diameter so that it does not fill the piston channel 140 fully, and a first piston barrier portion 214 of a larger diameter to form a barrier in the piston channel.

In the first position, it will be recalled that this is the normal treatment mode of operation. Thus, when the water treatment medium 300 comprises a filter, water may be filtered in this mode of operation. In this first position of the piston, the second reduced-diameter portion 216 is positioned such that the outlet of the inlet channel 138 – where the inlet channel 138 merges into the piston channel 140 – opens into the volume 328. The second reduced-diameter portion 216 is positioned such that the volume 328 opens onto the first water treatment medium aperture 152. Therefore, and because of the reduced diameter of the reduced-diameter portion 216, there is a flow path from the outlet of the inlet channel 138, through

the piston channel 140 – specifically through the volume 328 thereof – around the second reduced-diameter portion 216 to the first water treatment medium aperture 152 and to the void 312 surrounding the cover filter plug 148.

- 5 The first barrier portion 214 of the flow controller is disposed between the first treatment medium aperture 152 and the second treatment medium aperture 154 thereby blocking any flow path which might otherwise occur between these apertures along the piston channel 140. Also in this position, the second treatment medium aperture 154 is unblocked, so that there is a flow path from the outlet 310
10 of the water treatment medium 300 into the piston channel 140 – specifically through the volume 326 thereof surrounding the shaft 200, the first reduced-diameter portion. There is also then a flow path from the volume 326 of the piston channel 140 in which the shaft 200 is disposed, through the outlet channel 142 to the outlet aperture 126, as best viewed in Figure 5B.

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In the incoming flow path As water flows through the inlet channel into the piston channel 140, into volume 328, where it flows around the second reduced-diameter portion 216 and then out of the cover through the first water treatment aperture 152. The water then flows into the void 312 surrounding the filter outlet plug 148.

- 20 Water pressure forces the water up around the filter medium 300 in the gap 306 between the outer surface of the filter medium and the internal wall of the pressurised container and then flows through the filter medium in the direction 500 into the open central core 308 of the filter. The outgoing flow path, denoted Bs, flows from the open central core 308 and out through the filter outlet 310. The
25 water then passes through the second treatment medium aperture 154 and into the piston channel 140, into the volume 326 in which the shaft 200, the second reduced-diameter portion, is disposed. From there, the water flows through the piston channel 140 which is also in fluid communication with the cover outlet aperture 126.

Figure 5C provides an enhanced perspective view corresponding with Figure 1C, illustrating the incoming flow path As, and the outgoing flow path Bs with respect to the cover 114.

5 Figure 6 provides a series of views illustrating the water flow path in the second, "backwash" mode of operation. As described above with reference to Figure 3, the piston mechanism is moved to the second position upon activation of the actuator/foot pedal 118 for the backwash operation. Water flow within the water treatment module 100 is diverted, as will now be described. There is translational
10 movement of the piston along an axis of the piston channel 140 towards the actuator 118, so that the first barrier portion 214 is moved in the piston channel from a position between the first and second water treatment medium apertures 152, 154, so that it is now disposed between the second treatment medium aperture 154 and the outlet of the piston channel 140, where the piston channel merges into
15 the outlet channel 142. At the same time, the second reduced-diameter portion 216 of the piston is moved into register/alignment with the second treatment medium aperture 154. That is, the volume 328 of the piston channel 140 surrounding the second reduced-diameter portion 216 opens onto the second treatment medium aperture 154. Therefore, there is an incoming flow path, denoted Ao, from the cover
20 inlet aperture 122, through the inlet channel 138 into the piston channel 140, through the volume 328 around the second reduced-diameter portion 216 of the piston, out of the second water treatment medium aperture 154 to the filter outlet 310, now effectively operating as an inlet to the filter, in this backwash, reversed-flow operation. Further, the second barrier portion 218 is now disposed between the
25 first treatment medium aperture 152 and the second treatment medium aperture 154, thereby meaning there is still no flow path between the first and second cover apertures 152, 154.

At the distal end of the second barrier portion 218, there is another reduced-
30 diameter portion but the piston could simply terminate at the end of the second

barrier portion 218. In any event, the second barrier portion 218 is moved beyond the first treatment medium aperture 152 in the direction towards the actuator 118 so that the second treatment medium aperture 154 opens out into the piston channel 140 and then onto the backwash channel 144 and the backwash outlet 130.

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Thus, in this state of operation, water is supplied at pressure into the water treatment module through the cover inlet aperture 122, flowing through the inlet channel 138 to the piston channel 140, best shown in Figure 6B. Referring now to Figure 6A, the water then flows into the volume 328 of the piston channel 140 around the second reduced-diameter portion 216 of the piston, and out of the piston channel 140 through the second treatment medium aperture 154 and into the filter outlet 310 (being an inlet to the filter in the backwash operation). The water rises through the filter outlet into the filter core 308, and then passes through the filter medium in the reverse direction 502 (reversed when compared to the direction 500 of water flow in the normal operation). Then, the outgoing water flow, denoted Bo, flows into the gap 306 between the outer surface of the filter medium 300 and the inner surface of the pressurised container 308. The water flows into the void 312 surrounding the filter plug 148, through the first treatment medium aperture 152 and back into the piston channel 140. From there, the water flows along the piston channel to the backwash channel 144 and into the backwash outlet.

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Therefore, the cover 114 comprises a first treatment medium aperture 152 and a second treatment medium aperture 154; and wherein the backwash mechanism 146 comprises a piston disposed within a piston channel 140, the piston comprising a first reduced-diameter portion 200 and a second reduced-diameter portion 216, the first reduced-diameter portion 200 and the second reduced-diameter portion 216 each having an external diameter which is less than an internal diameter of the piston channel 140; and wherein the piston is configured to be disposed in a first position in which a volume 328 of the piston channel surrounding the second reduced-diameter portion 216 is in fluid communication with the cover inlet

30

aperture 122 and in fluid communication with the first treatment medium aperture 152, and a volume 326 of the piston channel surrounding the first reduced-diameter portion 200 is in fluid communication with the second treatment medium aperture 154 and the cover outlet aperture 126.

5

Further, the piston is configured to be disposed in a second position in which the volume 328 of the piston channel surrounding the second reduced-diameter portion 216 is in fluid communication with the cover inlet aperture 122 and in fluid communication with the second treatment medium aperture 154 and the first treatment medium aperture 152 is in fluid communication with the backwash outlet 130.

10

Figure 6C illustrates the water flow into and out of the cover through the filter outlet aperture 150 and the first water treatment medium aperture 152.

15

Thus, any accumulated debris in the filter medium may be flushed out, and the way through the backwash outlet 130. Providing a pressurised cover for the water treatment module comprising the backwash mechanism provides a particularly elegant solution.

20

It will be appreciated that the above describes a water treatment module 100 which is configured for the backwash mechanism 146 to be switched between a treatment operational state and a backwash operational state, wherein: in the treatment operational state, there is a first flow path for flow of water from a cover inlet 122 through the water treatment medium 300 in a first direction 500 to a cover outlet 126;

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in the backwash operational state, there is a second flow path for flow of water from the cover inlet 122 through the water treatment medium 300 in a second direction to a backwash outlet 130; and wherein the first flow path and the

second flow path are defined, at least in part, by a channel network 138, 140, 142, 144 formed within the cover.

Figure 4 provides a detailed perspective view of how the inlet connection 124 and the outlet connection 128 may be fixed, respectively, to the inlet aperture 122 and the outlet aperture 126.

Figure 7A provides an exploded perspective view of three water treatment modules 100, 100a, 100b with the left and right housing covers 104, 106 removed. The housing covers can be, for example, fitted together in a "snap fit" action with the clips 700. An external top cover 702 is also provided to prevent any debris falling into the top cover 110.

Figure 7B provides an alternative view, detailing the manner in which the inlet connection 124 and outlet connection 128 may be connected between modules. An integrated water treatment system, having three individual treatment modules 100, 100a, 100b is shown in Figure 7. Thus the cover inlet aperture 122 is disposed in a first side face 156 of the cover 114, the cover outlet aperture 126 is disposed in a second side face 158 of the cover 114, the first side face 156 being opposite the second side face 158, and wherein the cover outlet aperture 126 is disposed in the second side face 158 in a position for registration with a second cover inlet aperture of a second water treatment module 100a.

As can be seen, a particularly elegant solution is provided, where multiple modules may be provided to enhance the water treatment operation. For example, multiple water treatment modules can be connected in series – as in this example – with each of the modules performing either the same or a different function. For example, a water treatment medium in one or all of them may comprise of a sand filter.

Alternatively, in another arrangement, the water treatment medium may be an activated carbon filter. The water treatment medium in the other of the water

treatment modules may be, for example, another type of filtration medium, desalination medium, ion exchange medium or similar.

Further, the above description has it that the backwash mechanism is provided in the bottom cover, but additionally or alternatively, the or another backwash mechanism may be provided in the top cover too. But situating the backwash mechanism in the bottom cover is a preferred configuration to minimise the amount of external piping necessary to convey water from water piping (typically installed at or below ground level) to the top cover. And, additionally, this facilitates easier replacement of treatment media or filters from above.

It will of course be appreciated that other configurations are possible.

It will also be appreciated by those skilled in the art that the invention has been described by way of example only, and that a variety of alternative approaches may be adopted without departing from the scope of the invention, as defined by the appended claims.

CLAIMS

1. A water treatment module comprising:
a water treatment medium disposed within a pressurised container; and
5 a cover for the pressurised container, the cover comprising a backwash mechanism for back washing of the water treatment medium.
2. The water treatment module of claim 1, wherein the backwash mechanism is disposed within the cover.
- 10 3. The water treatment module of claim 2, wherein the water treatment module is configured for the backwash mechanism to be switched between a treatment operational state and a backwash operational state, wherein:
in the treatment operational state, there is a first flow path for flow of water
15 from a cover inlet through the water treatment medium in a first direction to a cover outlet;
in the backwash operational state, there is a second flow path for flow of water from the cover inlet through the water treatment medium in a second direction to a backwash outlet; and
20 wherein the first flow path and the second flow path are defined, at least in part, by a channel network formed within the cover.
4. The water treatment module of claim 3, wherein the cover inlet, the cover outlet and the backwash outlet comprise respective apertures disposed in side faces
25 of the cover.
5. The water treatment module of claim 4, wherein the cover inlet aperture is disposed in a first side face of the cover, the cover outlet aperture is disposed in a second side face of the cover, the first side face being opposite the second side face,
30 and wherein the cover outlet aperture is disposed in the second side face in a

position for registration with a second cover inlet aperture of a second water treatment module.

6. The water treatment module of claim 5, wherein the second water treatment module is a water treatment module in accordance with claim 1.

7. The water treatment module of claim 6, wherein the cover further comprises a first treatment medium aperture and a second treatment medium aperture; and wherein the backwash mechanism comprises a piston disposed within a piston channel, the piston comprising a first reduced-diameter portion and a second reduced-diameter portion, the first reduced-diameter portion and the second reduced-diameter portion each having an external diameter which is less than an internal diameter of the piston channel; and wherein the piston is configured to be disposed in a first position in which a volume of the piston channel surrounding the second reduced-diameter portion is in fluid communication with the cover inlet aperture and in fluid communication with the first treatment medium aperture, and a volume of the piston channel surrounding the first reduced-diameter portion is in fluid communication with the second treatment medium aperture and the cover outlet aperture.

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8. The water treatment module of claim 6 or claim 7, wherein the piston is configured to be disposed in a second position in which the volume of the piston channel surrounding the second reduced-diameter portion is in fluid communication with the cover inlet aperture and in fluid communication with the second treatment medium aperture and the first treatment medium aperture is in fluid communication with the backwash outlet.

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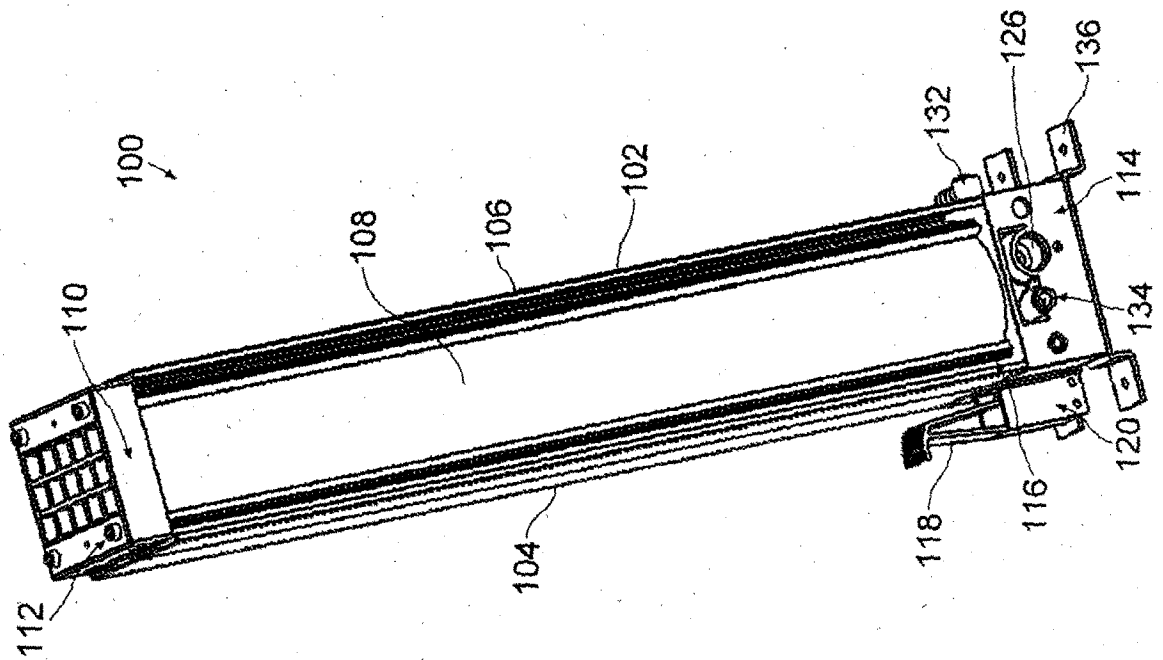
9. The water treatment module of any preceding claim wherein the pressurised container comprises a length of extruded pipe.

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10. The water treatment module of claim 9, wherein the length of extruded pipe is composed, at least in part, from aluminium.
11. The water treatment module of any preceding claim, wherein the cover
5 comprises a bottom cover for the water treatment module.
12. A cover for a water treatment module, the water treatment module comprising a water treatment medium disposed within a pressurised container, the cover comprising a backwash mechanism for back washing of the water treatment
10 medium.
13. A method of treating water using the water treatment module of any of claims 1 to 11 or using the cover for a water treatment module of claim 12.

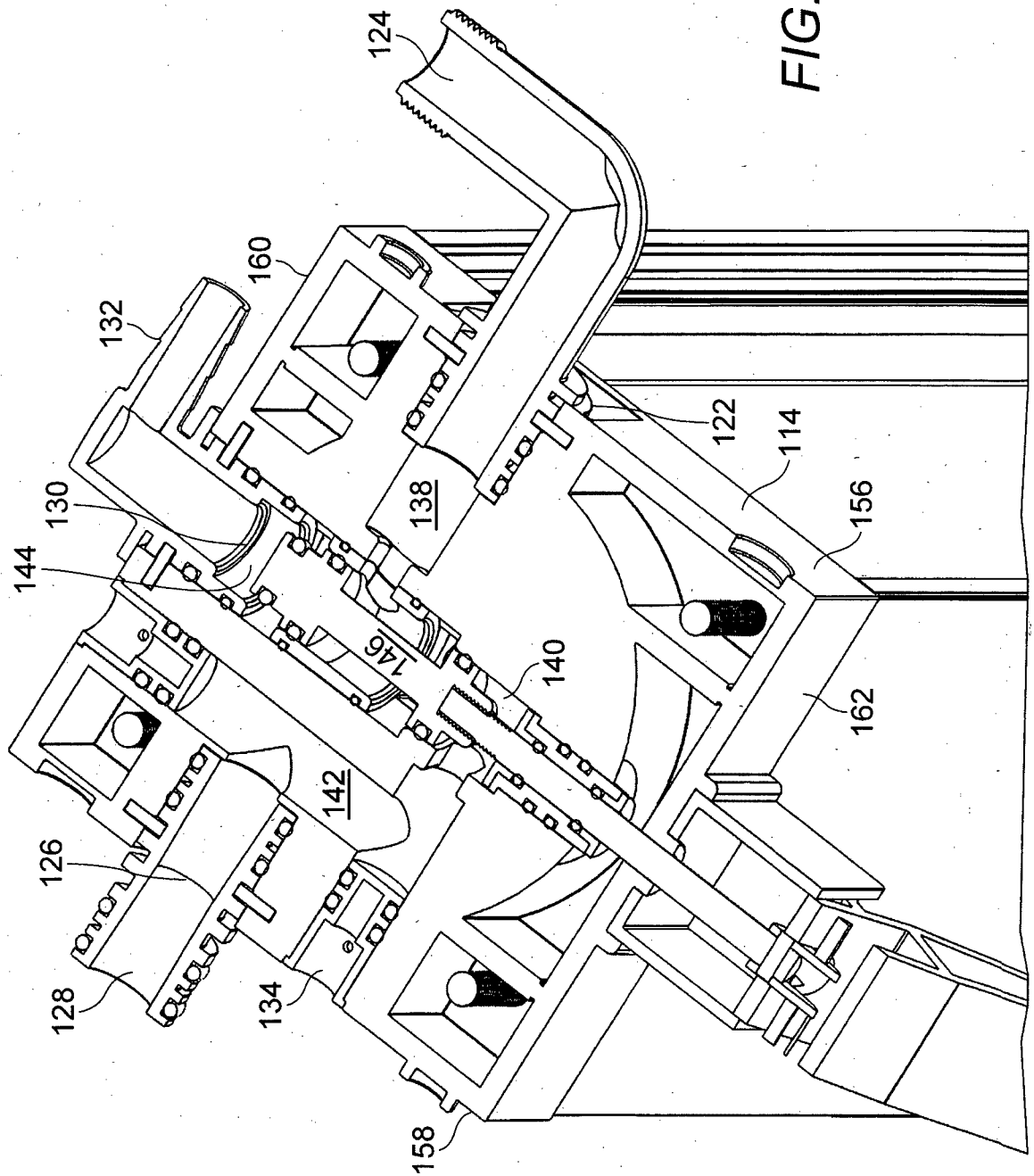
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FIG. 1A



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FIG. 1B



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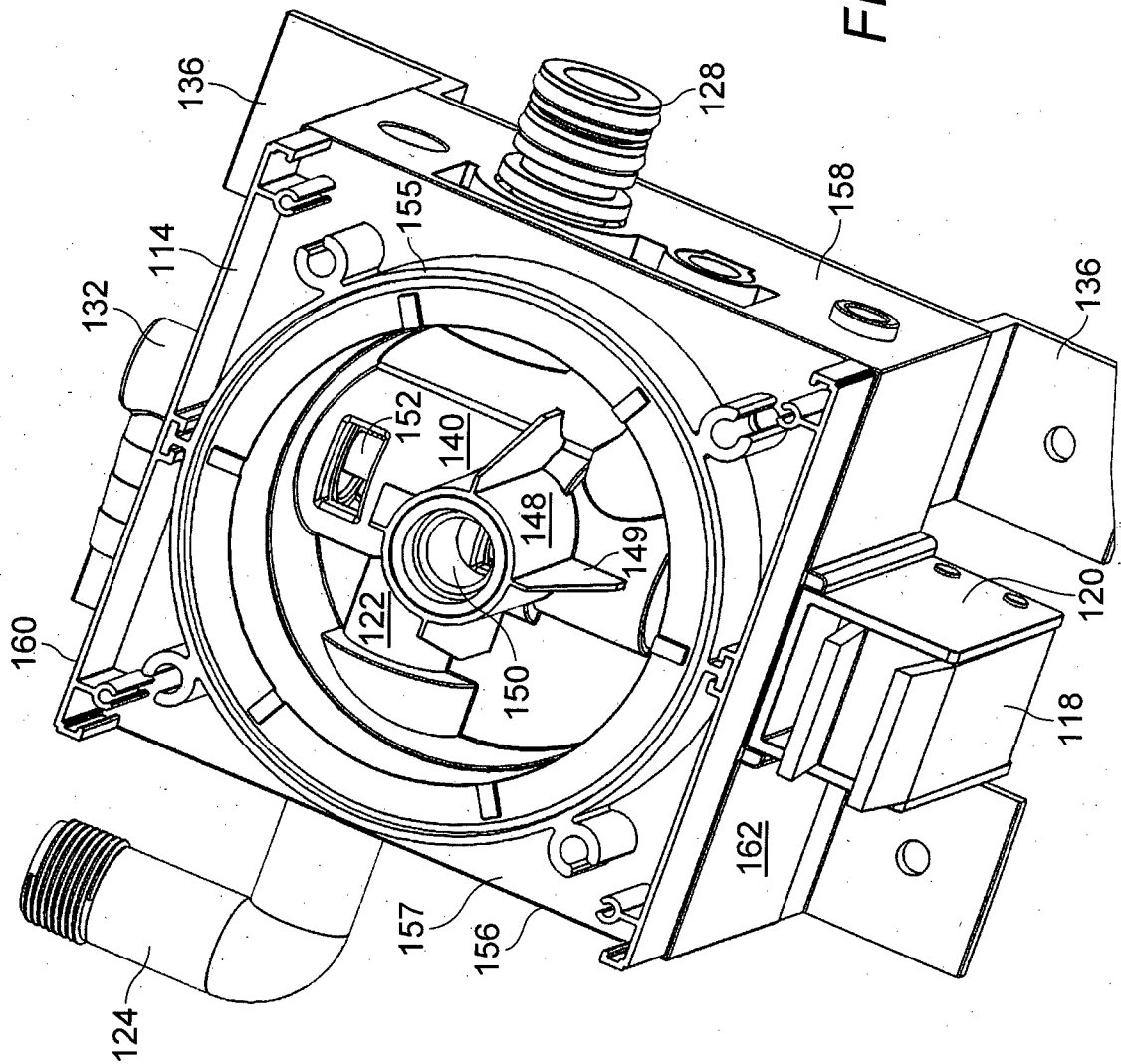


FIG. 1C

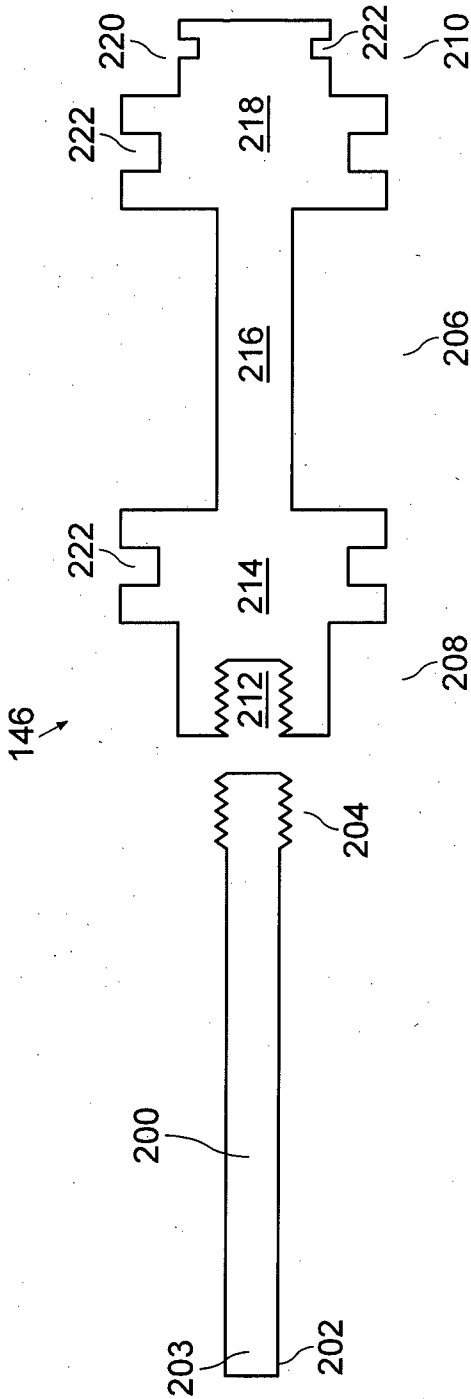


FIG. 2

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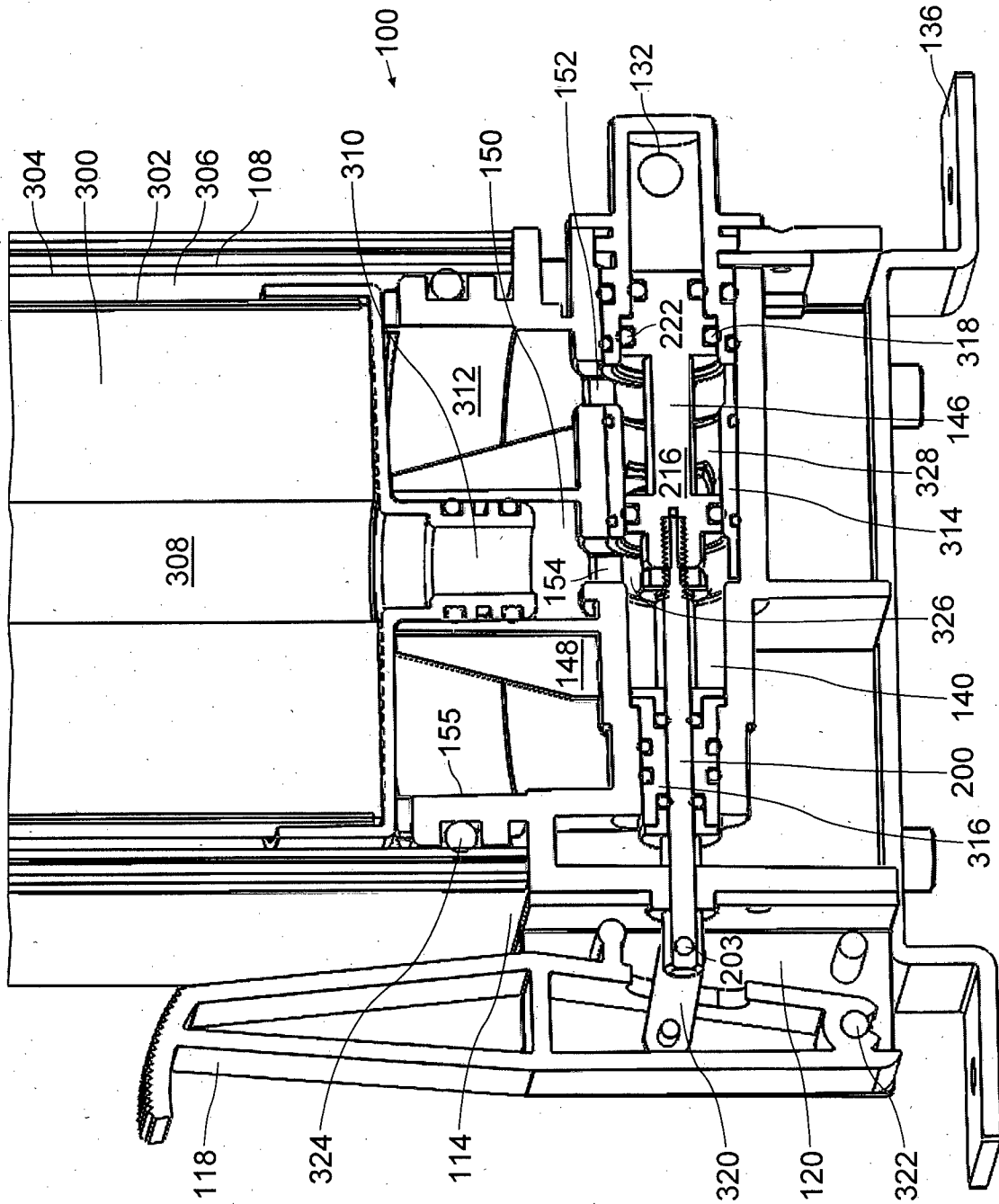


FIG. 3A

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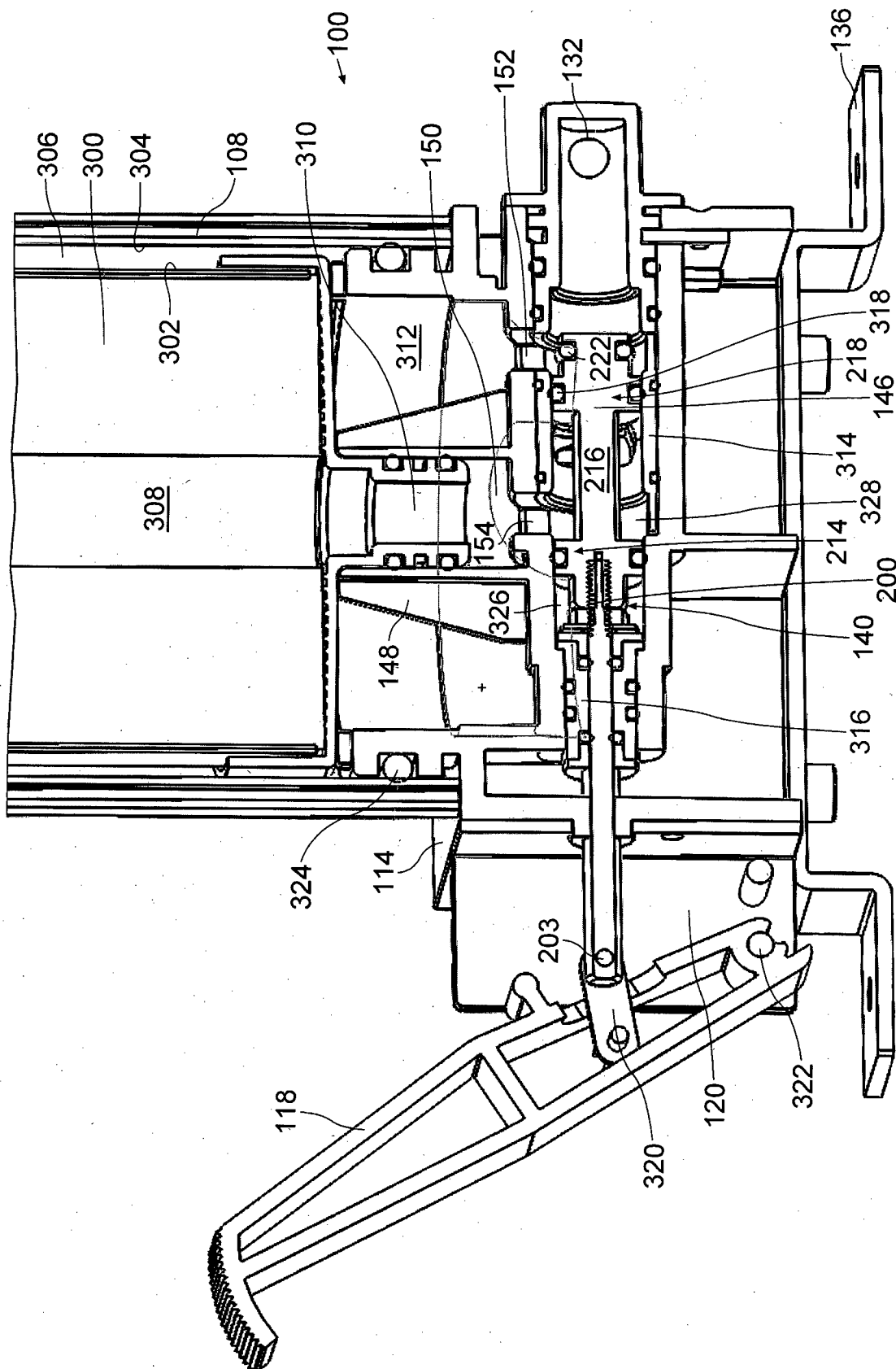


FIG. 3B

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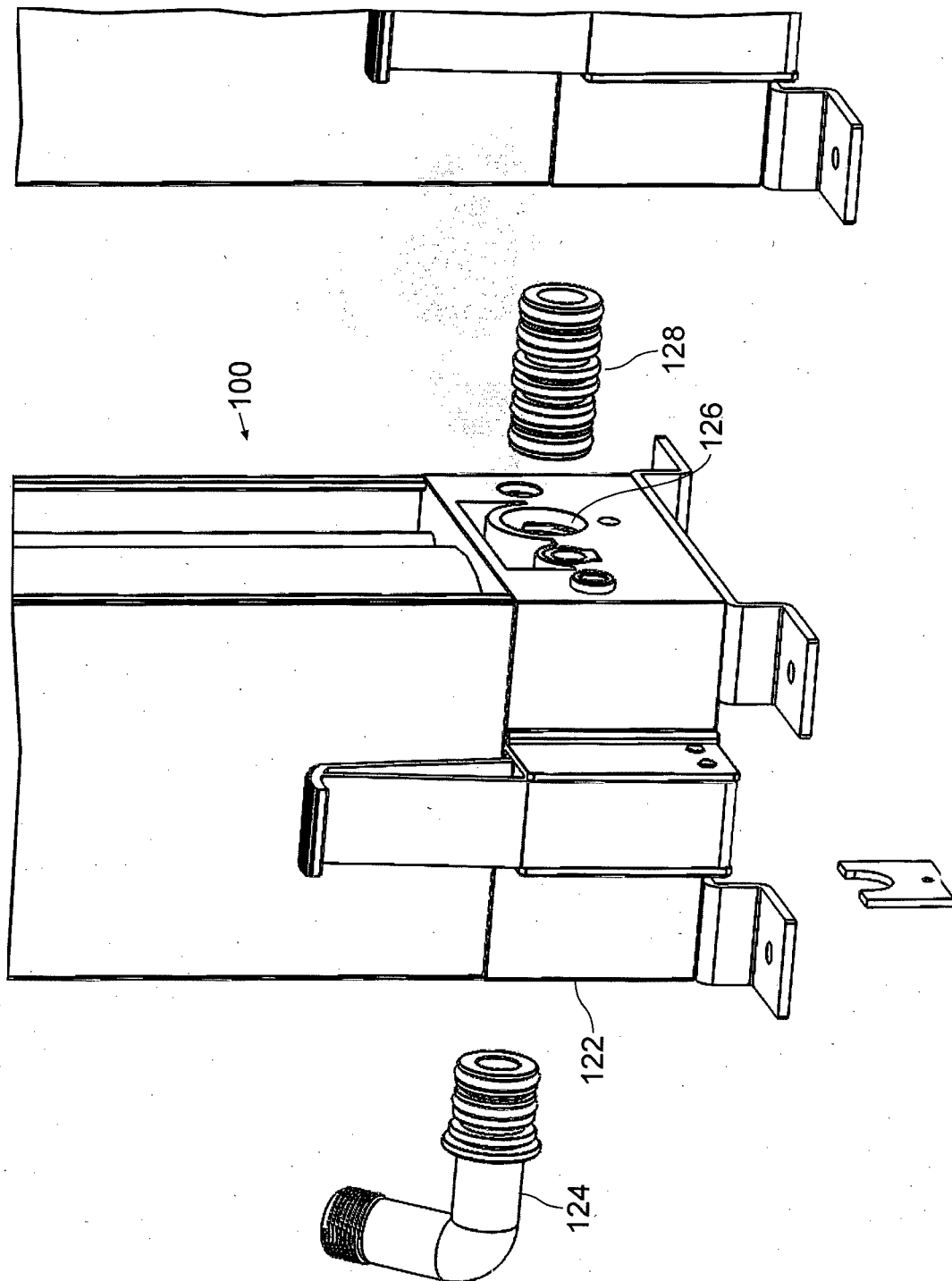


FIG. 4

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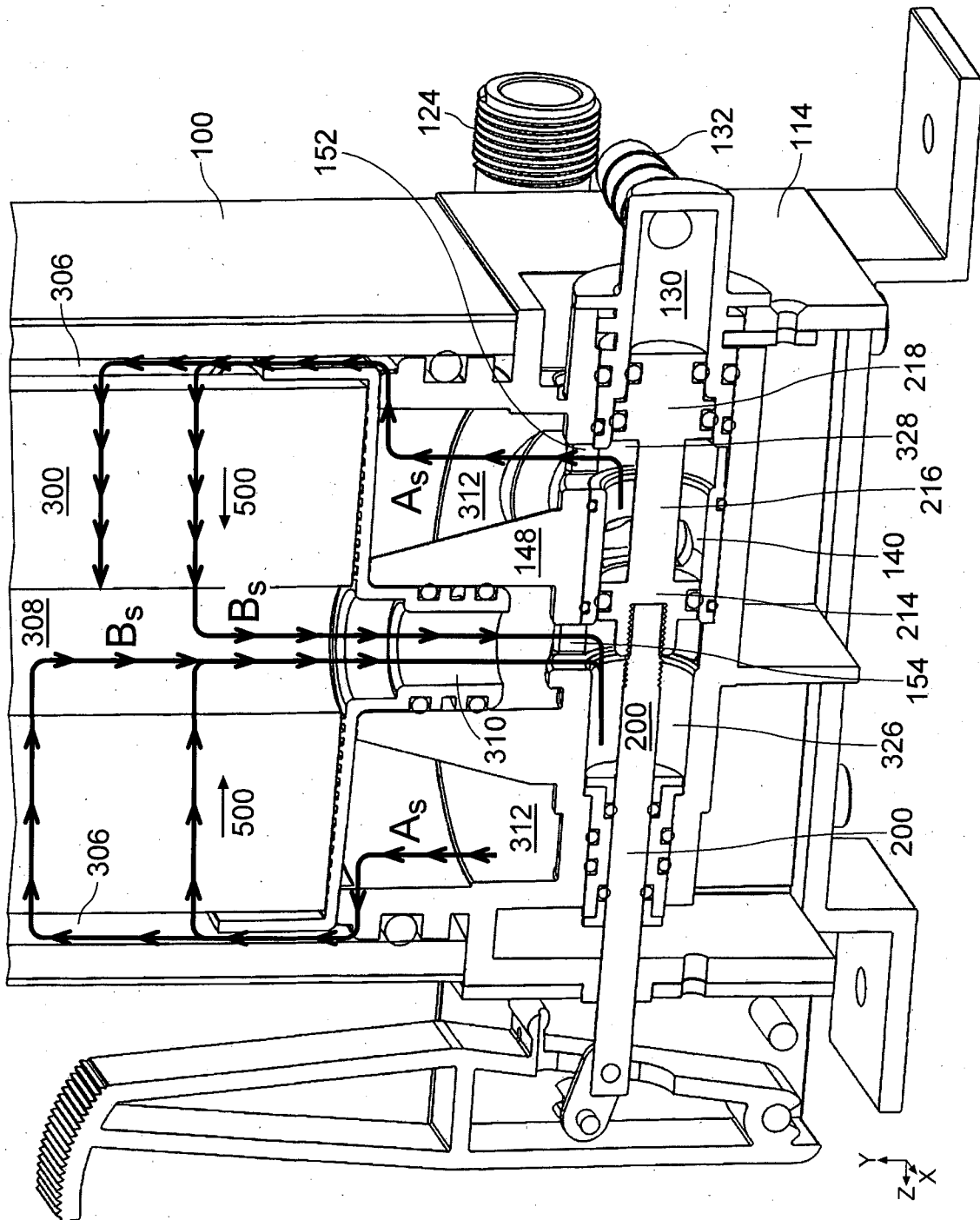


FIG. 5A

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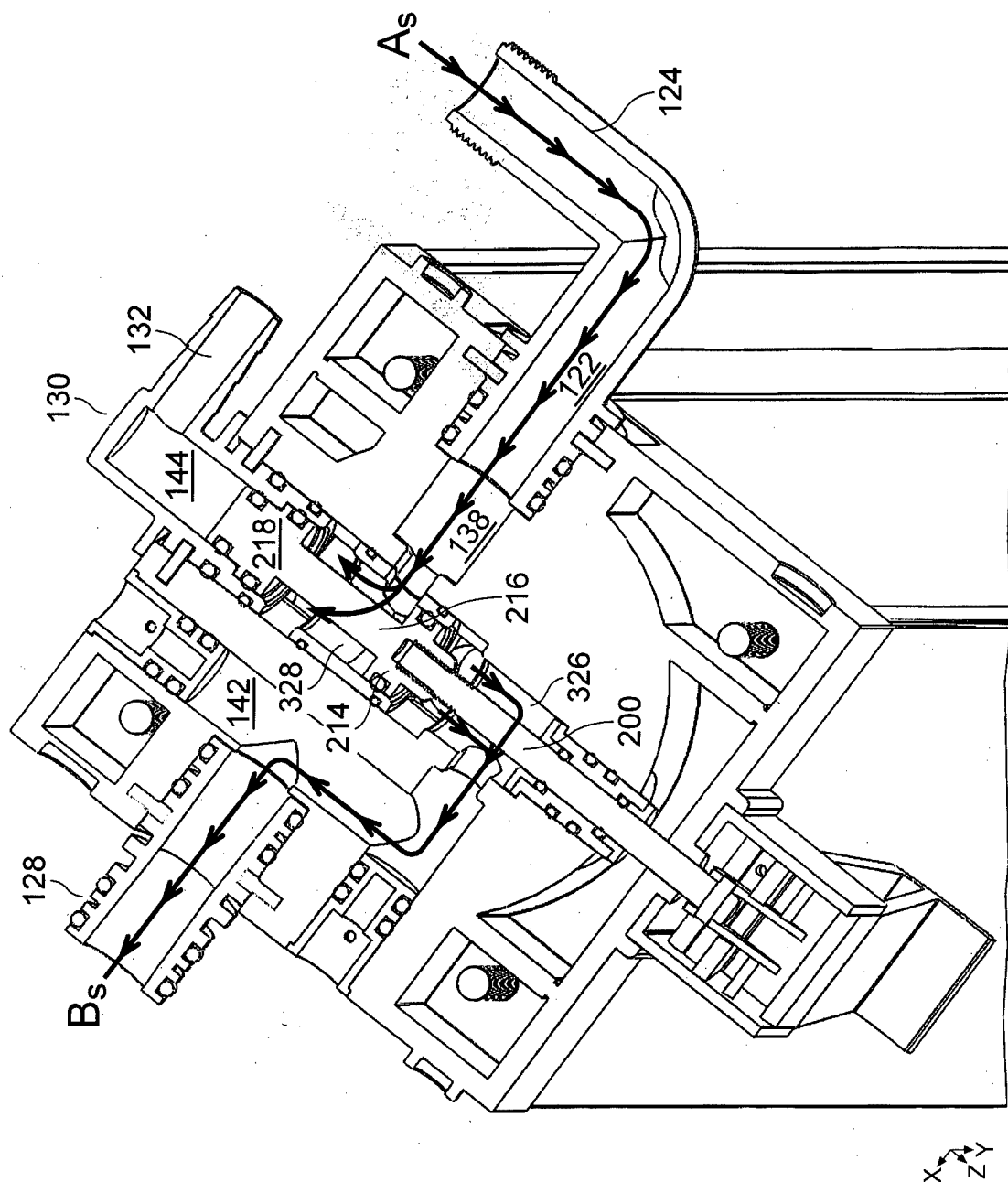
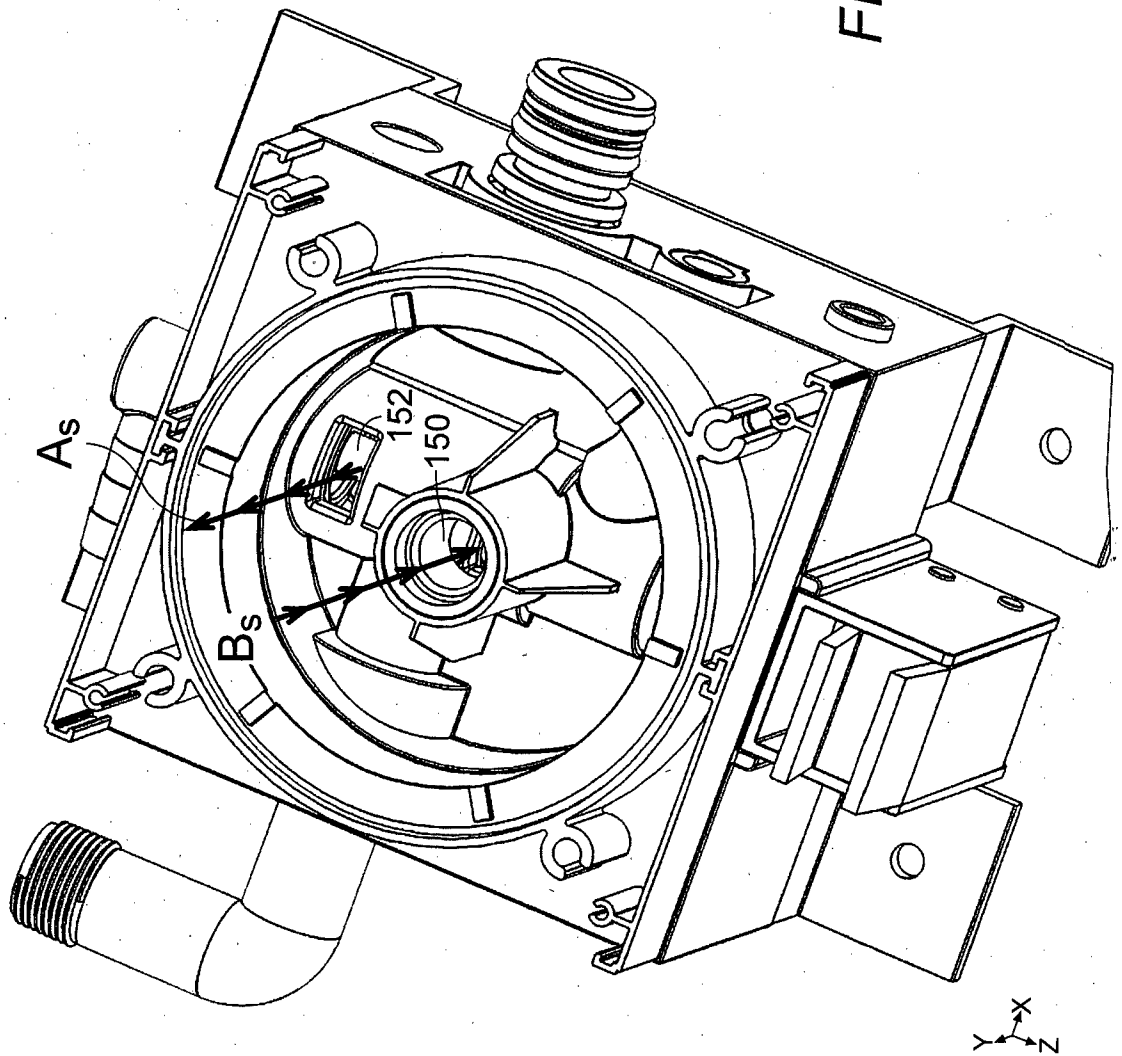


FIG. 5B

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FIG. 5C



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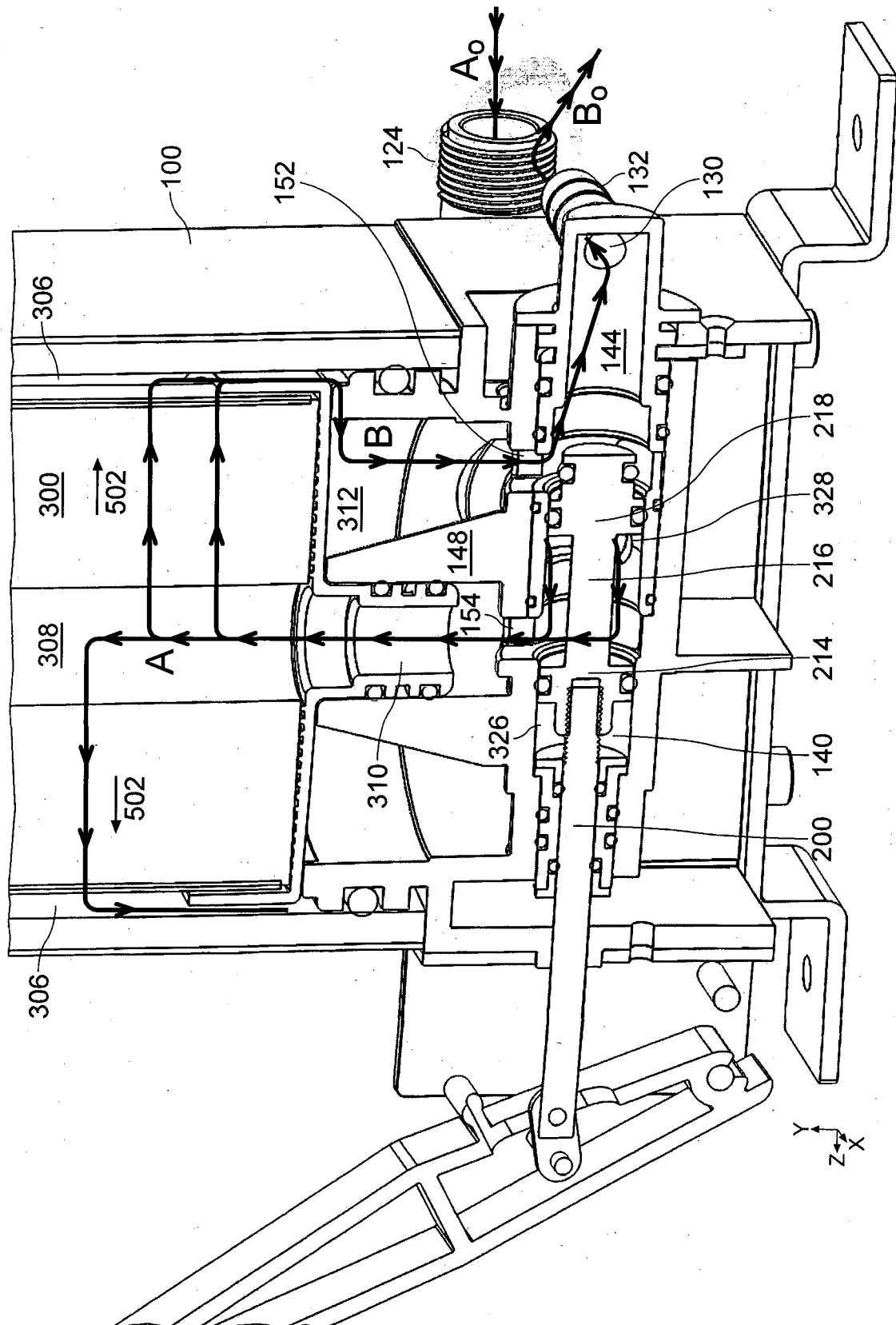
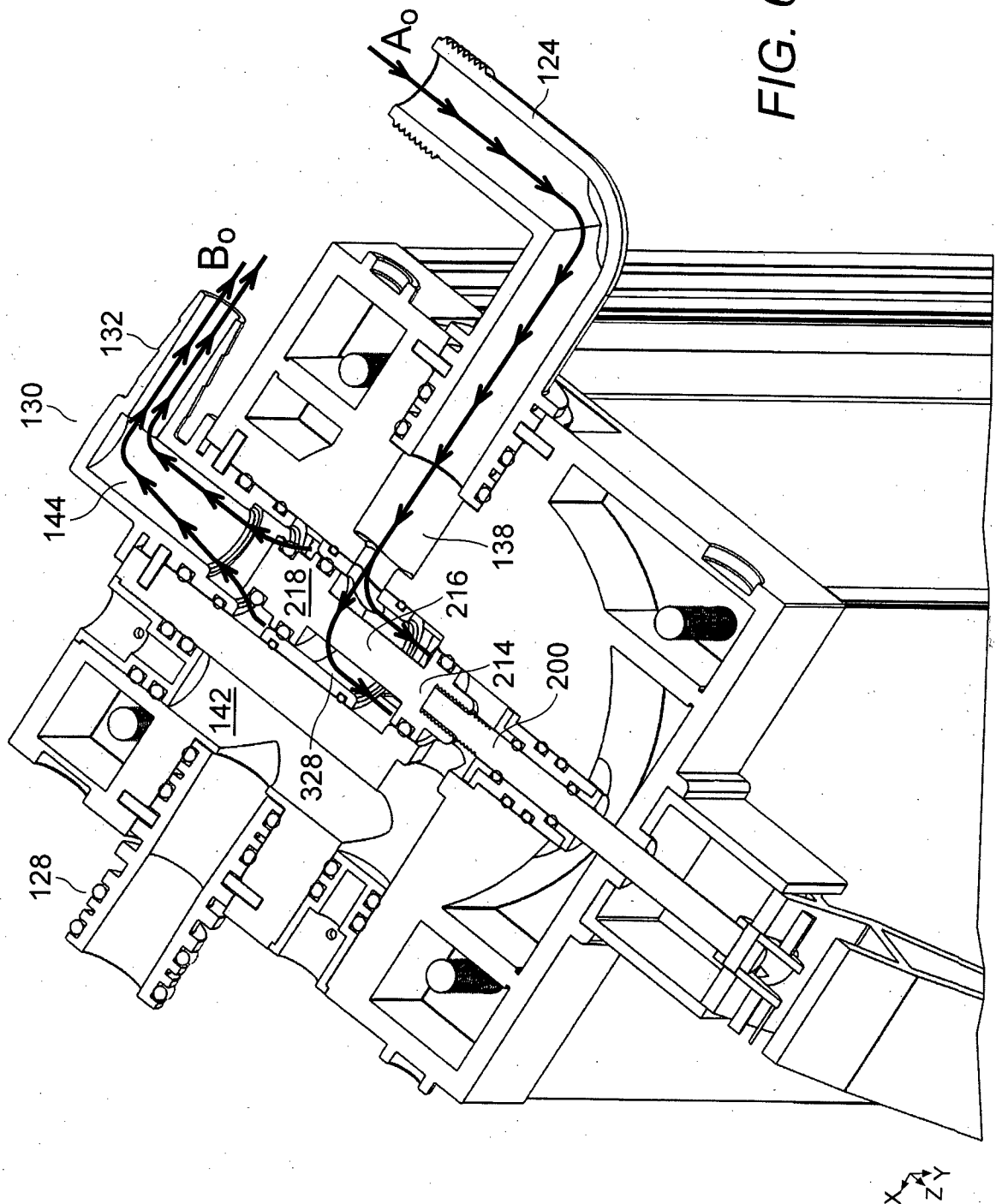


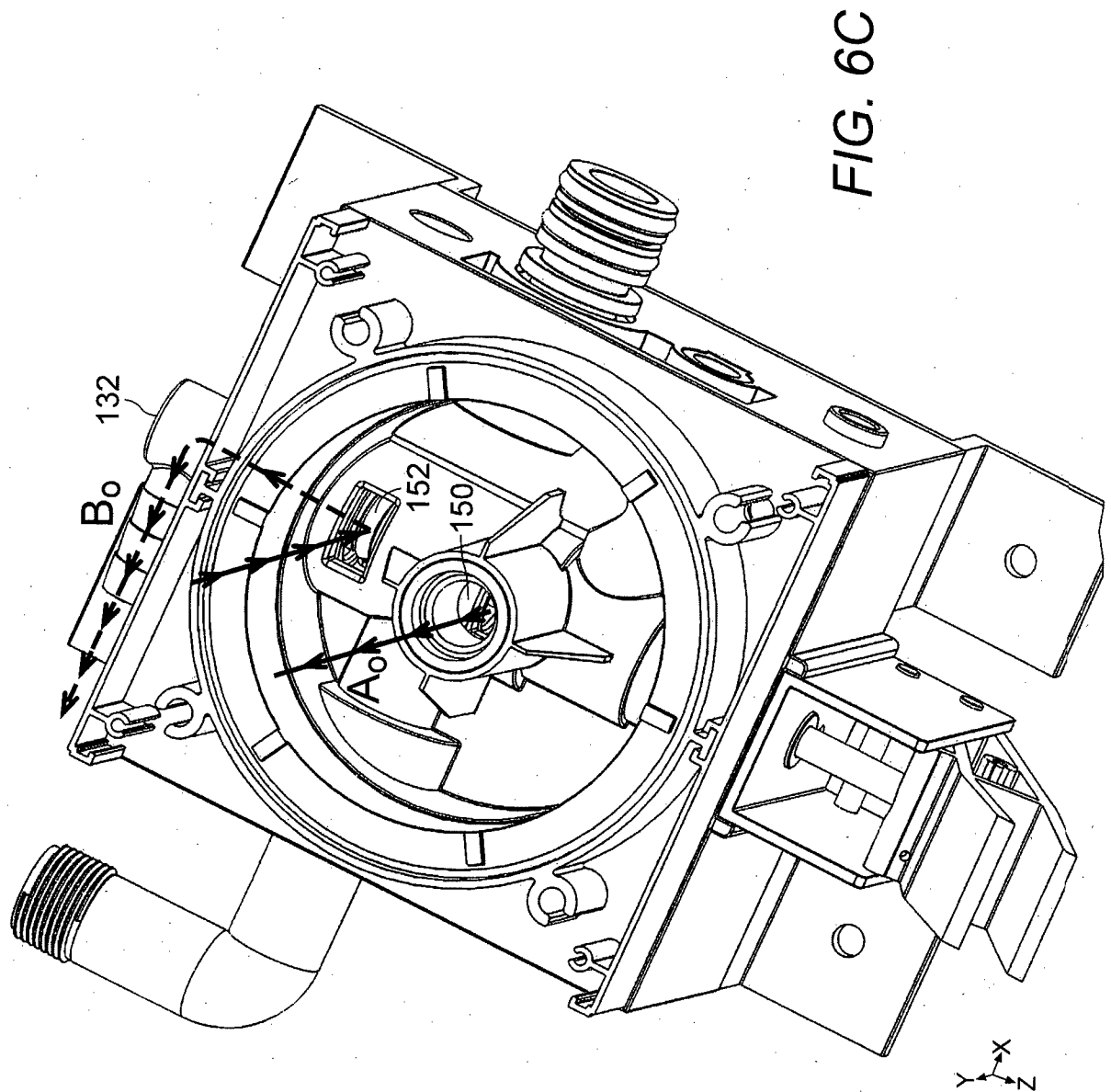
FIG. 6A

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FIG. 6B



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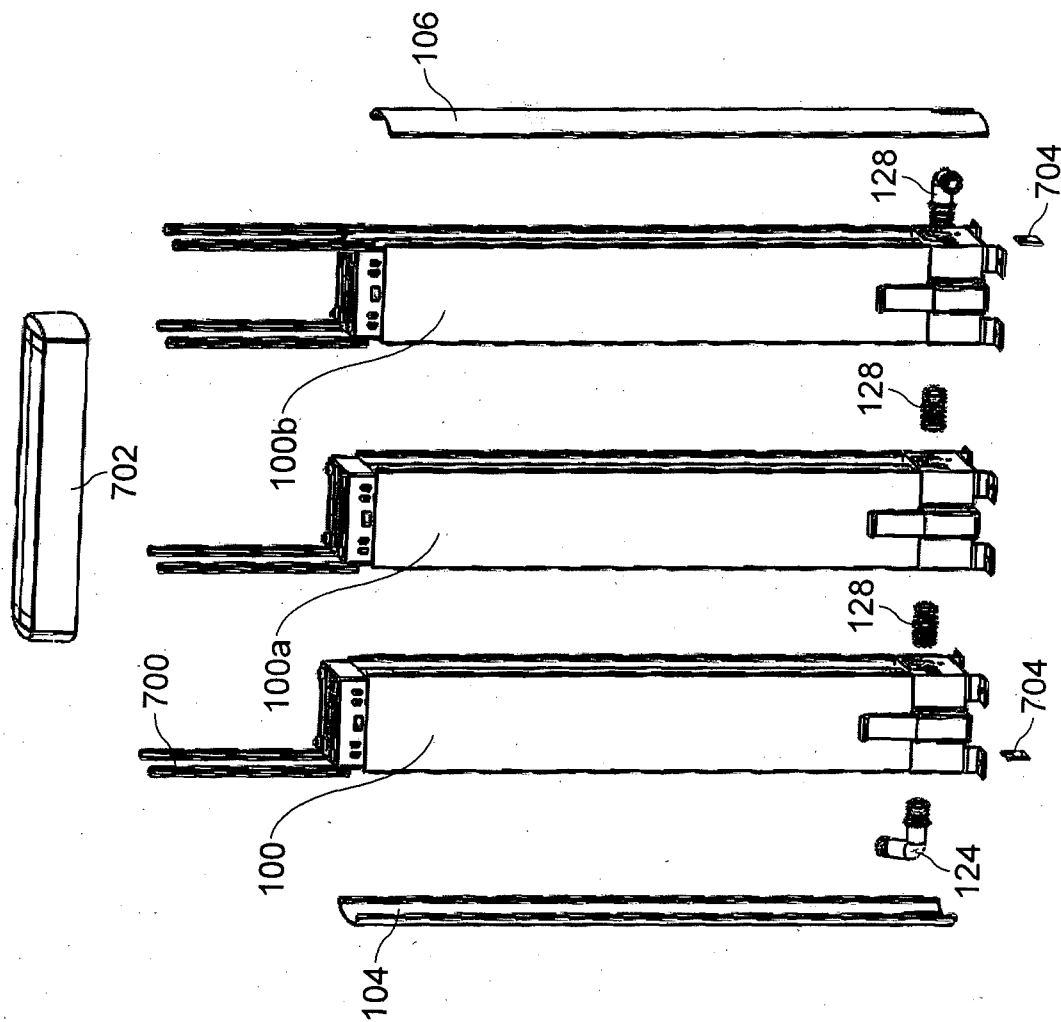


FIG. 7A

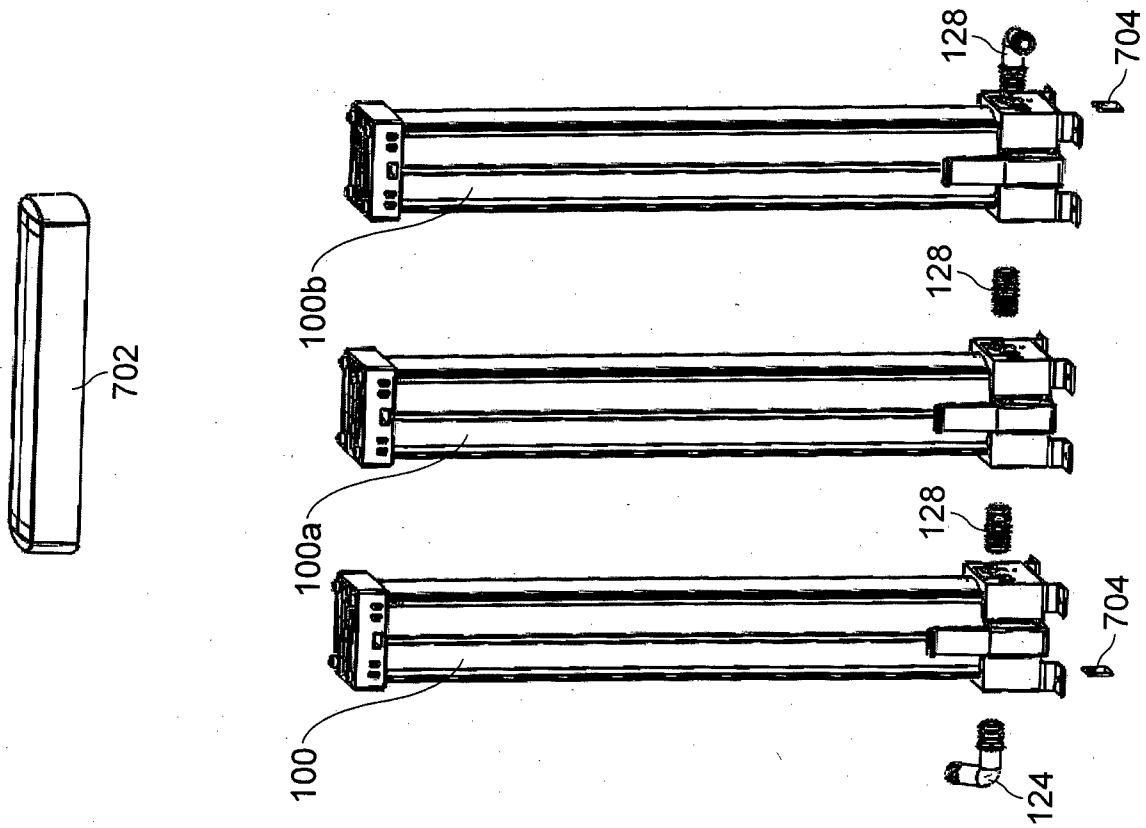


FIG. 7B

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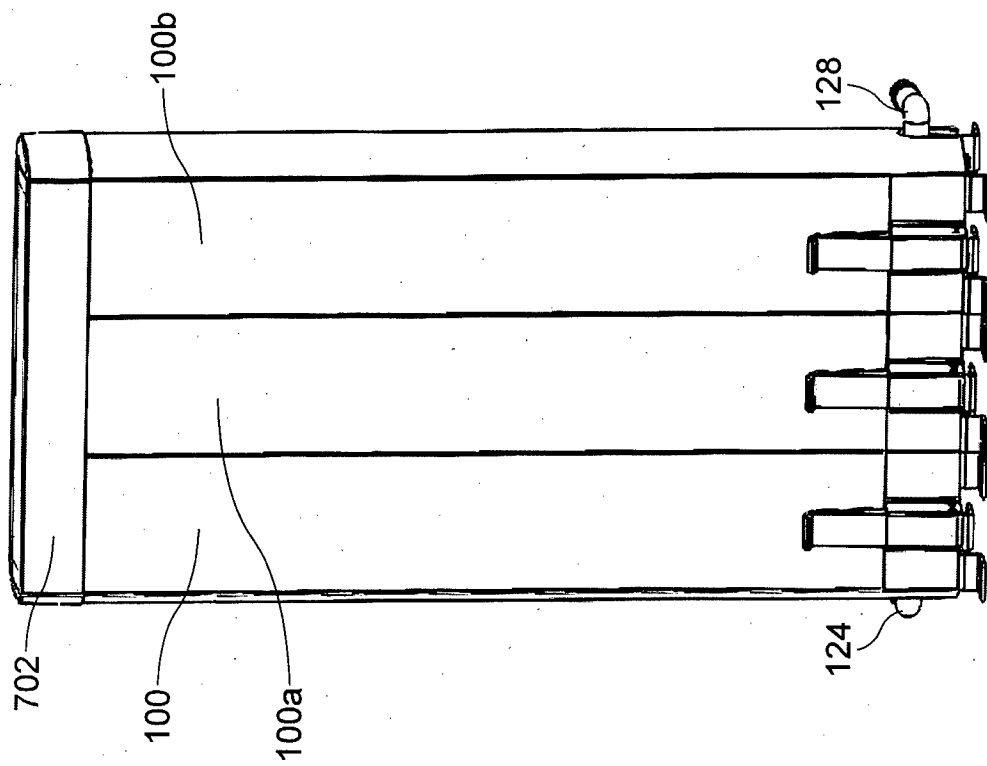


FIG. 7C

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SG2014/000367

A. CLASSIFICATION OF SUBJECT MATTER

B01D 29/66 (2006.01) B01D 35/12 (2006.01)

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)

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 practicable, search terms used)

WPI, EPODOC, INSPEC: IPC and CPC Marks: IC/CC B01D 29/66, B01D 35/12, B01D 33/48, B01D 29/665, B01D 2201/08, B01D 2201/291, B01D 23/24; keywords: filter, filtration, cartridge, purification, desalination, cover, lid, cap, closure, backwash, flushing, washback, backward washing, reverse washing, regenerate, pressurise, pressurize, compress, piston, container, vessel, chamber, tank, housing, actuate, control and "Applicant/Inventor name search": "Blondal Tech/ LARSSON, Anders" through AusPat and Esp@cenet; Esp@cenet, USPTO & Google Patents using keywords: filter, filtration, cartridge, purification, desalination, cover, lid, cap, closure, backwash, flushing, washback, backward washing, reverse washing, regenerate, pressurise, pressurize, compress, piston, container, vessel, chamber, tanks, housing, actuate, control and similar search terms.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	



Further documents are listed in the continuation of Box C



See patent family annex

* "A"	Special categories of cited documents: document defining the general state of the art which is not considered to be of particular relevance	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E"	earlier application or patent but published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed		
Date of the actual completion of the international search 22 October 2014		Date of mailing of the international search report 22 October 2014	
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA Email address: pct@ipaustalia.gov.au		Authorised officer Debashis Roy AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No. 0262256125	

INTERNATIONAL SEARCH REPORT		International application No.
C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		PCT/SG2014/000367
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2013/054964 A1 (PANASIA CO LTD et al.) 18 April 2013 Abstract; paragraphs [0002]-[0003], [0014], [0019], [0024], [0042], [0044]; Fig. 3	1-13
A	US 6206042 B1 (CHANNELL et al.) 27 March 2001 Abstract; claims 1-33	1-13
A	US 5855799 A (HERRMANN) 05 January 1999 Abstract; Fig. 1; claims 1-2	1-13

Form PCT/ISA/210 (fifth sheet) (July 2009)

INTERNATIONAL SEARCH REPORT Information on patent family members		International application No. PCT/SG2014/000367	
This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.			
Patent Document/s Cited in Search Report		Patent Family Member/s	
Publication Number	Publication Date	Publication Number	Publication Date
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US 5855799 A	05 January 1999	AU 3729495 A	22 Mar 1996
		WO 9606667 A2	07 Mar 1996
End of Annex			
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001. Form PCT/ISA/210 (Family Annex)(July 2009)			