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(54) **PUMP ASSEMBLY COMPRISING A DRAIN PLUG**

(57) A pump assembly (100) includes a pump housing (110) adapted to house a drive motor (112) therein. The pump housing (110) defines an inlet opening (114), an outlet opening (116) and a drainage opening (118) therein. A drainage plug (120) is adapted to be engaged with the drainage opening (118). The pump assembly (100) is characterized in that the drainage plug (120) includes a first plug element (120A) having a first

cross-sectional area (A1) and a second plug element (120B) having a second cross-sectional area (A2). The second plug element (120B) is coupled to the first plug element (120A) through a coupling rod (120C). A cross-sectional area (A3) of the coupling rod (120C) is smaller than the first cross-sectional area (A1) and the second cross-sectional area (A2).

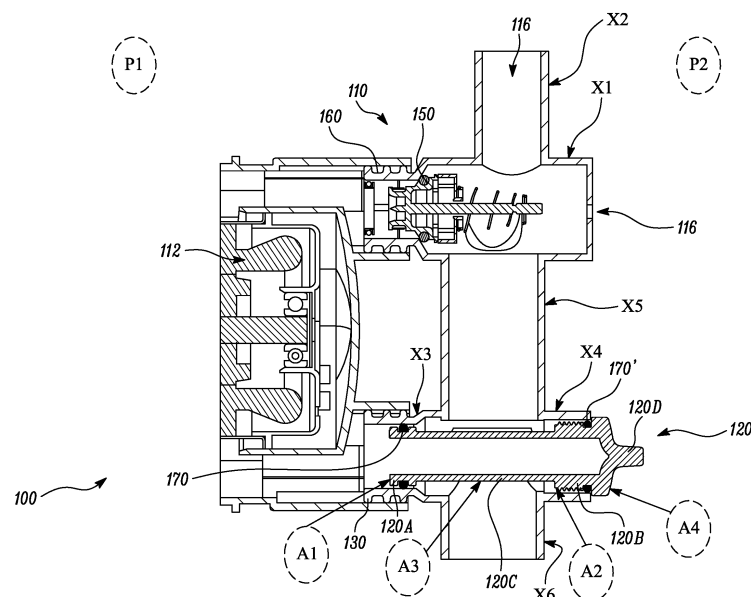


FIG. 2

Description

TECHNICAL FIELD

[0001] The present disclosure relates to a pump assembly, and more particularly to structure of a drainage plug to be used with the pump assembly.

BACKGROUND

[0002] A pump assembly may often be required to operate in a cold environment. When the pump assembly may stop due to normal or abnormal reasons, the water may be required to be drained out of the pump assembly to prevent the pump assembly from damage due to the freezing water. Hence, a drainage structure may be required to be included with the pump assembly.

[0003] An example of such a pump assembly is provided by the Chinese patent 2,826,032 (hereinafter referred to as '032 reference). The '032 reference provides a pump with a drain valve structure. A nut is sealed and welded on a side of a pump casing. An O-shaped sealing ring is sleeved on the drain plug. The drain plug is sealed and screwed into the nut through the O-shaped sealing circle, and an inner screw plug is screwed on the drain. The screw plug is screwed tightly (equivalent to closing the faucet and acting as a seal), unscrewed (equivalent to a part of the faucet switch being turned on, and acting as a slow drain), and unscrewed (equivalent to fully opening the faucet switch for rapid drainage). The head of the inner plug is tapered and the drain port on the wall of the water inlet cavity of the pump casing is in sealed contact. The water outlet end of the water drain plug is a groove and an O-shaped sealing ring is inlaid in the groove, and the purpose is to form a sealed contact with the inner screw plug wall to prevent leakage. However, there is still a need for a simple, quick, and easy to install drainage structure.

SUMMARY

[0004] In view of the above, it is an objective of the present invention to solve or at least reduce the drawbacks discussed above. The objective is at least partially achieved by a pump assembly. The pump assembly includes a pump housing containing an impeller arrangement driven by a drive motor, preferably arranged inside the pump housing, wherein the drive motor is adapted to drive a fluid at an entrance of the modular pump assembly to a pressure chamber upstream of the main flow direction of the fluid, and wherein. The pump housing defines an inlet opening, an outlet opening and a drainage opening therein. A drainage plug is adapted to be engaged with the drainage opening. A fluid channel, in particular a water channel, is originating from the outlet opening. The pump assembly is characterized in that the drainage plug includes a first plug element having a first cross-sectional area and a second plug element having a sec-

ond cross-sectional area. The second plug element is coupled to the first plug element through a coupling rod. A cross-sectional area of the coupling rod is smaller than the first cross-sectional area and the second cross-sectional area. The coupling rod is located inside the fluid channel originating from the outlet opening with the fluid, in particular water, being able to flow around the coupling rod and flow past the coupling rod.

[0005] Thus, the pump assembly of the present disclosure advantageously provides a single piece drainage plug for emptying the complete pump assembly. The drainage plug is simple, quick, and easy to install in the drainage opening of the pump assembly. Due to its smaller cross-sectional area, the coupling rod even when being located inside a water channel does not restrict the flow of water too much. The water may flow around the coupling rod and flow past the coupling rod. Thus, the drainage plug does not provide a lot of hinderance to the flow of water. It is possible that the cross-sectional area of the coupling rod is even minimized that much that it just constitutes a mere rigid wire coupling the first plug with the second plug.

[0006] According to an embodiment of the present disclosure, an adapter is coupled to the drainage opening. The drainage plug is sealably coupled to the drainage opening via the adapter. The adapter further advantageously couples a pipe on a pressure side of the pump assembly with the drainage opening.

[0007] According to an embodiment of the present disclosure, a pressure tank unit is coupled to the drainage opening. The pump assembly is advantageously coupled to the pressure tank unit. The pressure tank unit may supplement the pumping operation of the pump assembly. Further, the pressure tank unit may allow the drive motor of the pump assembly to be switched OFF while still maintaining the pressure required for the execution of various domestic and industrial operations.

[0008] According to an embodiment of the present disclosure, a non-return valve is adapted to be engaged with the outlet opening. The non-return valve may serve to maintain pressure on the pressure side of the pump assembly even when the pump assembly is not operating.

[0009] According to an embodiment of the present disclosure, the first cross-sectional area may be smaller than or equal to the second cross-sectional area. The flexibility with the dimensions or the cross-sections of the first plug element and the second plug element may serve to plug in the pipes or the adapters of different known dimensions without fear of leakage of water and loss in pressure especially towards the pressure side of the pump assembly.

[0010] According to an embodiment of the present disclosure, the first plug element and the second plug element include threads on their outer surfaces. The threads may allow for an easy as well as secure coupling between the drain plug and the adapter or the drain plug and the pipes of the pump assembly.

[0011] According to an embodiment of the present dis-

closure, the drainage plug includes a head element for inserting in and removing the drainage plug from the drainage opening. The head element may serve as a handle for gripping and moving the drainage plug in and out of the drainage opening.

[0012] Other features and aspects of this invention will be apparent from the following description and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The invention will be described in more detail with reference to the enclosed drawings, wherein:

FIG. 1 illustrates a schematic diagram of a pump assembly with a pressure tank unit, in accordance with an aspect of the present disclosure;

FIG. 2 illustrates a cross-sectional view of a pump assembly integrated with a drainage plug, in accordance with an aspect of the present disclosure; and

FIG. 3 illustrates a cross-sectional view of a drainage plug, in accordance with an aspect of the present disclosure.

DESCRIPTION OF EMBODIMENTS

[0014] The present invention will be described more fully hereinafter with reference to the accompanying drawings, in which example embodiments of the invention incorporating one or more aspects of the present invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. For example, one or more aspects of the present invention may be utilized in other embodiments and even other types of structures and/or methods. In the drawings, like numbers refer to like elements.

[0015] Certain terminology is used herein for convenience only and is not to be taken as a limitation on the invention. For example, "upper", "lower", "front", "rear", "side", "longitudinal", "lateral", "transverse", "upwards", "downwards", "forward", "backward", "sideward", "left", "right", "horizontal", "vertical", "upward", "inner", "outer", "inward", "outward", "top", "bottom", "higher", "above", "below", "central", "middle", "intermediate", "between", "end", "adjacent", "proximate", "near", "distal", "remote", "radial", "circumferential", or the like, merely describe the configuration shown in the Figures. Indeed, the components may be oriented in any direction and the terminology, therefore, should be understood as encompassing such variations unless specified otherwise.

[0016] **FIGS. 1** and **2** illustrate a pump assembly **100**. The pump assembly **100** may be used for irrigation, water

supply, sewage movement among other domestic and industrial applications. The pump assembly **100** includes a pump housing **110**. The pump housing **110** containing an impeller arrangement driven by a drive motor (**112**) arranged inside the pump housing (**110**), wherein the drive motor (**112**) is adapted to drive a fluid at an entrance of the modular pump assembly (**100**) to a pressure chamber upstream of the main flow direction of the fluid, and wherein. The pump housing **110** further includes an inlet opening **114**, an outlet opening **116**, and a drainage opening **118**. The inlet opening **114** is provided on a suction side "P1" of the pump housing **110**. The water from a water source (not shown) may enter the inlet opening **114** of the pump housing **110** due to a sucking action of an impeller (not shown) housed in the pump housing **110**. Further, the outlet opening **116** is provided on a pressure side "P2" of the pump housing **110**. The pressurized water from the pump housing **110** may be accessed for use with various domestic and industrial applications. The outlet opening **116** (as shown in **FIG. 2**) is extended by virtue of a first pipe "X1" and a second pipe "X2" to provide use with multiple applications simultaneously. Further, the first pipe "X1" is coupled to the outlet opening **116** using an adapter **160**.

[0017] The drainage opening **118** may be used to drain the water in the event of service or decommissioning. Further, the drainage opening **118** may prevent the pump assembly **100** from damage due to the freezing water when the pump assembly **100** stops due to normal or abnormal reasons while working in a cold environment. The drainage opening **118** (as shown in **FIG. 2**) is extended by virtue of a third pipe "X3" and a fourth pipe "X4". The third pipe "X3" is coupled to the drainage opening **118** using an adapter **130**. Further, the third pipe "X3" and the fourth pipe "X4" are interconnected to each other via a fifth pipe "X5". The fifth pipe "X5" is coupled to the first pipe "X1". The first pipe "X1", the second pipe "X2", the third pipe "X3", the fourth pipe "X4", the fifth pipe "X5" and the sixth pipe "X6" may be coupled to each other by any means known and understood in the art without limiting the scope of the present disclosure in any manner.

[0018] With continued reference to **FIGS. 1** and **2**, a drainage plug **120** is adapted to be engaged with the drainage opening **118**. The drainage plug **120** extends across the adapter **130**, third pipe "X3", the fourth pipe "X4" and the fifth pipe "X5". The drainage plug **120** may prevent leakage of water from the drainage opening **118** when drainage through the pump assembly **100** is not required.

[0019] The drainage plug **120** (as shown in **FIGS. 2** and **3**) includes a first plug element **120A** having a first cross-sectional area "A1" and a second plug element **120B** having a second cross-sectional area "A2". The second plug element **120B** is coupled to the first plug element **120A** through a coupling rod **120C**. A cross-sectional area "A3" of the coupling rod **120C** is smaller than the first cross-sectional area "A1" and the second cross-sectional area "A2".

[0020] In some embodiments, as shown in **FIGS. 2** and **3**, the first cross-sectional area "A1" may be smaller than the second cross-sectional area "A2". In some embodiments, the first cross-sectional area "A1" may be equal to the second cross-sectional area "A2". The flexibility with the dimensions or the cross-sections "A1, A2" of the first plug element **120A** and the second plug element **120B** respectively may in general serve to plug in the pipes or the adapters of different known dimensions without fear of leakage of water and loss in pressure especially in the pressure side "P2" of the pump assembly **100**.

[0021] Further, the drainage plug **120** includes a head element **120D** for inserting in and removing the drainage plug **120** from the drainage opening **118**, which extends across the adapter **130**, third pipe "X3", the fourth pipe "X4" and the fifth pipe "X5". The head element **120D** may serve as a handle for gripping and moving the drainage plug **120** in and out of the drainage opening **118**. Further, a cross-sectional area "A4" of the head element **120D** is greater than the cross-sectional area of the fourth pipe "X4". The head element **120D** stays outside the fourth pipe "X4" and can be easily accessed as the handle for gripping and moving the drainage plug **120**.

[0022] Further, due to the smaller cross-sectional area, the coupling rod **120C** does not restrict the flow of water too much. The water flowing from a sixth pipe "X6" may flow around the coupling rod **120C**. The water may flow around the coupling rod **120C** and flow through to the fifth pipe X5 from the sixth pipe X6. The coupling rod **120C** does not provide a lot of hinderance to the flow of water and allows the water to flow easily from the sixth pipe X6 to the fifth pipe X5. Thus, the shape of the drainage plug **120** allows for efficient fluid coupling between the fifth pipe X5 and the sixth pipe X6 as per usage requirements even when the drainage plug **120** is in place.

[0023] The drainage plug **120** when fully or partly moved out of the drainage opening **118** by gripping the head element **120D**, connects the suction side "P1" and the pressure side "P2" of the pump assembly **100** via outlet opening **116** and the drainage opening **118**. Further, in this position, the drainage plug **120** allows drainage of water from the pump assembly **100**.

[0024] The drainage plug **120** that includes the first plug element **120A**, the second plug element **120B**, the coupling rod **120C** and the head element **120D** is formed as a single piece drain plug **120**. In some embodiments, the elements of the drain plug **120** may be manufactured separately and then coupled to each other by adhesives, or any other means known in the art before being operatively inserted in the drain opening **118**. In some embodiments, the drain plug **120** is manufactured in a molding process as one complete element. Further, the first plug element **120A**, the second plug element **120B**, the coupling rod **120C** and the head element **120D** of the drain plug **120** may be formed with any suitable material known in the art. In some embodiments, the material of the first plug element **120A**, the second plug element **120B**, the coupling rod **120C** and the head element **120D**

may be same. In some embodiments, the material of the first plug element **120A**, the second plug element **120B**, the coupling rod **120C** and the head element **120D** may be different.

[0025] Further, as illustrated in **FIG. 2**, the first plug element **120A** is sealably coupled with the adapter **130** and the second plug element **120B** is sealably coupled with the fourth pipe "X4" by virtue of grooves (not shown) on the respective outer surfaces of the first plug element **120A** and the second plug element **120B**. The sealable coupling between the first plug element **120A** and the adapter **130** may be achieved by virtue of a sealing element **170**. Similarly, the sealable coupling between the second plug element **120B** and the fourth pipe "X4" may be achieved by virtue of a sealing element **170'**. The sealing elements **170, 170'** may be selected from one or more of an O-ring, a gasket, or any other similar sealing element suitable for usage with various aspects of the present disclosure. Further, the sealing elements **170, 170'** may be same or different as per the application requirement of the present disclosure.

[0026] In some embodiments, the first plug element **120A** and the second plug element **120B** of the drain plug **120** may include threads (not shown) on respective outer surfaces. The threads may allow for an easy as well as secure coupling between the drain plug **120** and the adapter **130** or the drain plug **120** and the fourth pipe "X4".

[0027] With continued reference to **FIGS. 1** and **2**, a pressure tank unit **140** is coupled to the drainage opening **118**. The pressure tank unit **140** includes a pressure tank **142** and a pressure sensor **144**. The pressure tank unit **140** is coupled to the drainage opening **118** via a water channel formed by the third pipe "X3", the fifth pipe "X5" and the sixth pipe "X6". Whereby the third pipe "X3" is mechanically coupled the drainage opening **118** while the drainage plug **120** is sealing fixed with the pump and is mechanically and fluidly coupled with the drainage opening **118** when the drainage plug **120** fully or partly moved out of the drainage opening **118**. Further the third pipe "X3" is mechanically and fluidly coupled with the fifth pipe "X5" and the sixth pipe "X6". The pressure sensor **140** may be a pressure switch or any other pressure sensor **140** known and understood in the art without restricting the scope of the present disclosure in any manner. The pressure tank unit **140** may supplement the pumping operation of the pump assembly **100**. Further, the pressure tank unit **140** may allow the drive motor **112** of the pump assembly **100** to be switched OFF while still maintaining the pressure required for the execution of various domestic and industrial operations.

[0028] Further, a non-return valve **150** is adapted to be engaged with the outlet opening **116**. The non-return valve **150** advantageously extends from the adapter **160** towards the first pipe "X1". The non-return valve **150** prevents the emptying of the pressure tank **142** when the drive motor **112** of the pump assembly **100** is switched OFF. The non-return valve **150** may serve to maintain

the pressure on the pressure side "P2" of the pump assembly **100** even when the pump assembly **100** is not operating.

[0029] Thus, the pump assembly **100** of the present disclosure advantageously provides a single piece drainage plug **120** for emptying the complete pump assembly **100**. The drainage plug **120** is simple, quick, and easy to install in the drainage opening **118** of the pump assembly **100**.

[0030] In the drawings and specification, there have been disclosed preferred embodiments and examples of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for the purpose of limitation of the scope of the invention being set forth in the following claims.

LIST OF ELEMENTS

[0031]

100	Pump Assembly	
110	Pump Housing	
112	Drive Motor	
114	Inlet Opening	
116	Outlet Opening	
118	Drainage Opening	
120	Drainage Plug	
120A	First Plug Element	
120B	Second Plug Element	
120C	Coupling Rod	
120D	Head Element	
130	Adapter	
140	Pressure Tank Unit	
142	Pressure Tank	
144	Pressure Sensor	
150	Non-Return Valve	
160	Adapter	
170, 170'	Sealing Element	
A1	First Cross-Sectional Area	
A2	Second Cross-Sectional Area	
A3	Cross-Sectional Area	
A4	Cross-Sectional Area	
P1	Suction Side	
P2	Pressure Side	
X1	First Pipe	
X2	Second Pipe	
X3	Third Pipe	
X4	Fourth Pipe	
X5	Fifth Pipe	
X6	Sixth Pipe	

Claims

1. A pump assembly (**100**) comprising:
a pump housing (**110**) containing an impeller arrangement driven by a drive motor (**112**), pref-

erably arranged inside the pump housing (**110**), wherein the drive motor (**112**) is adapted to drive a fluid at an entrance of the modular pump assembly (**100**) to a pressure chamber upstream of the main flow direction of the fluid, and wherein

the pump housing (**110**) defining an inlet opening (**114**), an outlet opening (**116**) and a drainage opening (**118**) therein;

a drainage plug (**120**) adapted to be engaged with the drainage opening (**118**);

and a fluid channel (**X3, X5, X6**), in particular a water channel, originating from the outlet opening (**116**);

characterized in that:

the drainage plug (**120**) comprises:

a first plug element (**120A**) having a first cross-sectional area (**A1**),

a second plug element (**120B**) having a second cross-sectional area (**A2**), wherein the second plug element (**120B**) is coupled to the first plug element (**120A**) through a coupling rod (**120C**), and

wherein a cross-sectional area (**A3**) of the coupling rod (**120C**) is smaller than the first cross-sectional area (**A1**) and the second cross-sectional area (**A2**);

whereby the coupling rod (**120C**) is located inside the fluid channel (**X5, X6**) with the fluid, in particular water, being able to flow around the coupling rod (**120C**) and flow past the coupling rod (**120C**).

2. The pump assembly (**100**) of any one of the preceding claims, wherein an adapter (**130**) is coupled to the drainage opening (**118**).
3. The pump assembly (**100**) of claim 1, wherein a pressure tank unit (**140**) is mechanically coupled to the drainage opening (**118**) via the water channel (**X3, X5, X6**).
4. The pump assembly (**100**) of any one of the preceding claims, wherein a non-return valve (**150**) is adapted to be engaged with the outlet opening (**116**).
5. The pump assembly (**100**) of any one of the preceding claims, wherein the first cross-sectional area (**A1**) is smaller than the second cross-sectional area (**A2**).
6. The pump assembly (**100**) of any one of the preceding claims, wherein the first cross-sectional area (**A1**) is equal to the second cross-sectional area (**A2**).
7. The pump assembly (**100**) of any one of the preceding claims, wherein the first plug element (**120A**) and the second plug element (**120B**) include threads.

8. The pump assembly **(100)** of any one of the preceding claims, wherein drainage plug **(120)** includes a head element **(120D)** for inserting in and removing from the drainage opening **(118)**.

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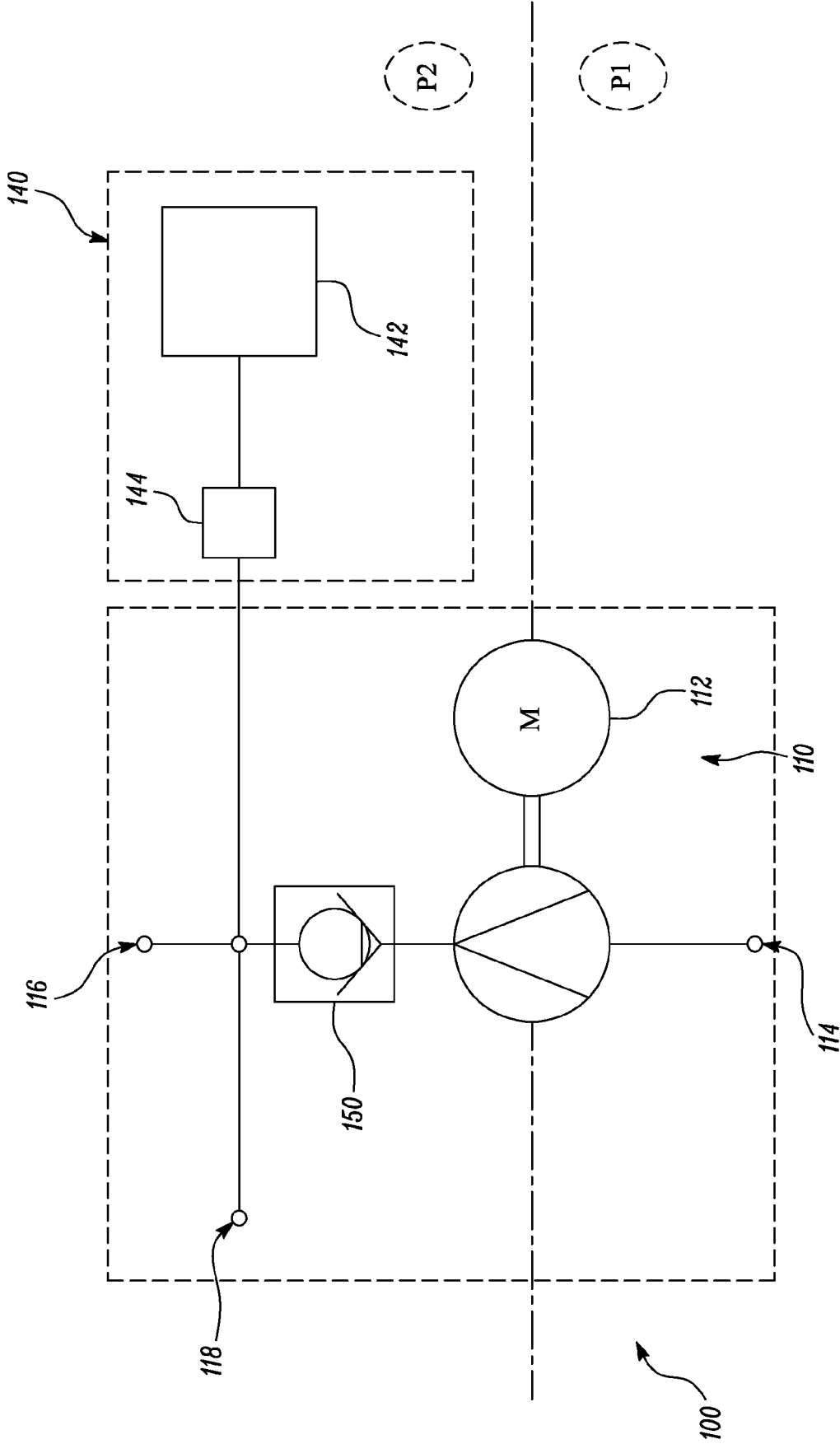


FIG. 1

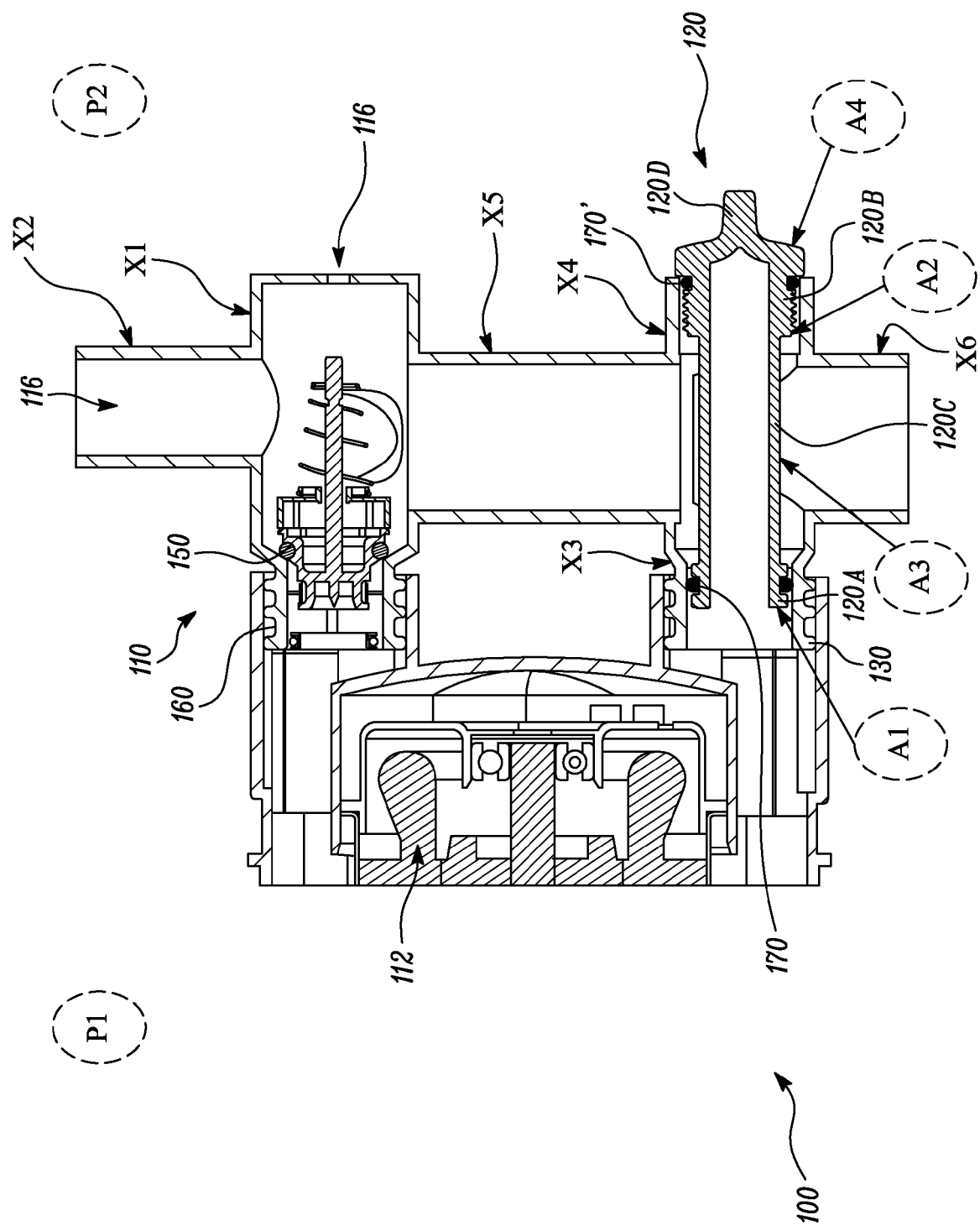


FIG. 2

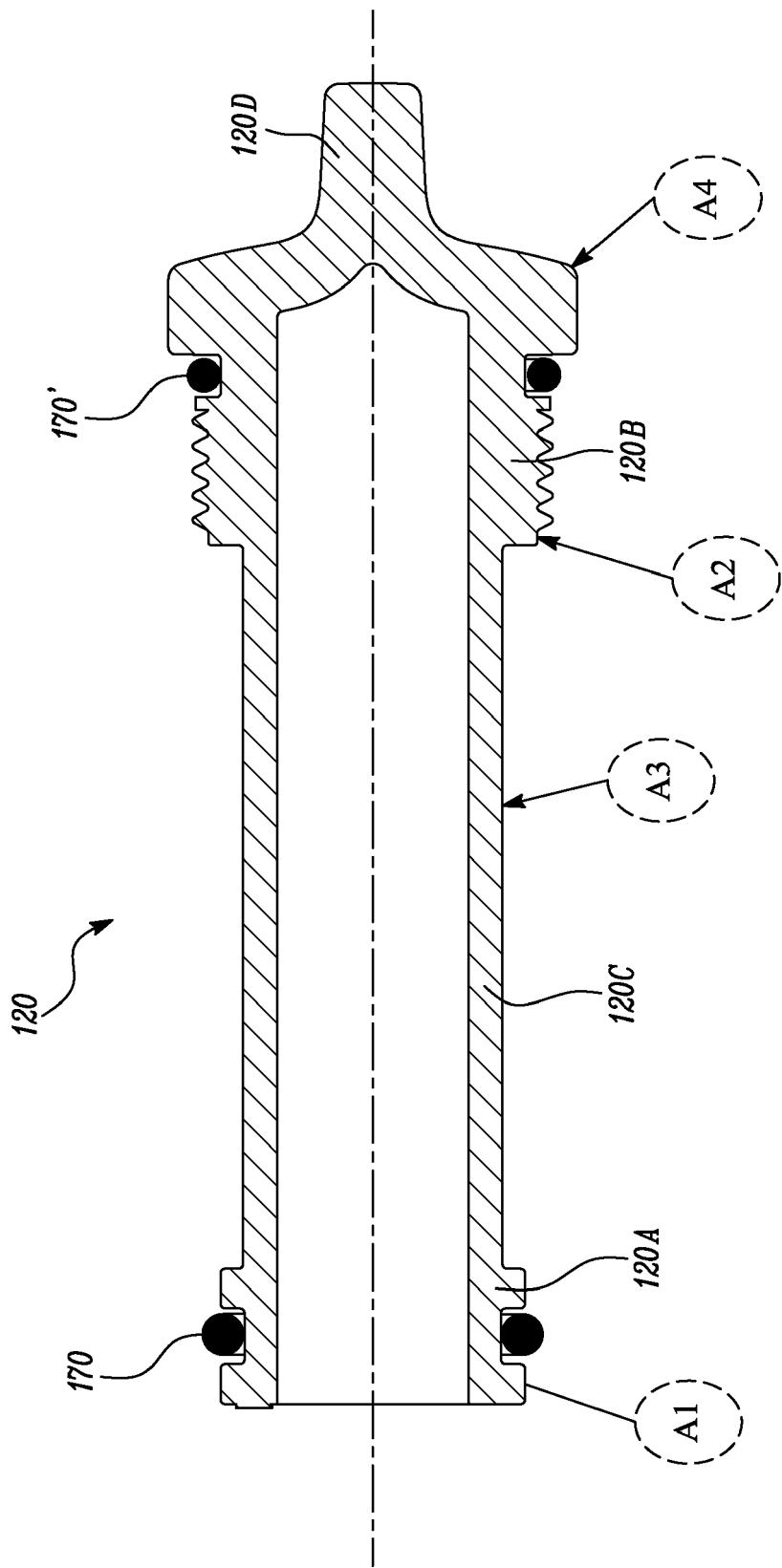


FIG. 3



EUROPEAN SEARCH REPORT

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