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(54) **FOOT FOR A PUMP**

(57) A foot (106) for a pump (150) having a pump housing (105). The foot (106) comprises a base body (110) and a coupling structure (112, 134) coupled to the base body (110). The coupling structure (112, 134) comprises a front panel (114), wherein the front panel (114) is movable between a first stable position and a second stable position in respect to the base body (110). Thereby the front panel (114) is accessible during the operational position of the pump (150) from the side of its pump housing (105) and pushing and pulling of the foot (106) moves it between its first stable position and a second stable position.

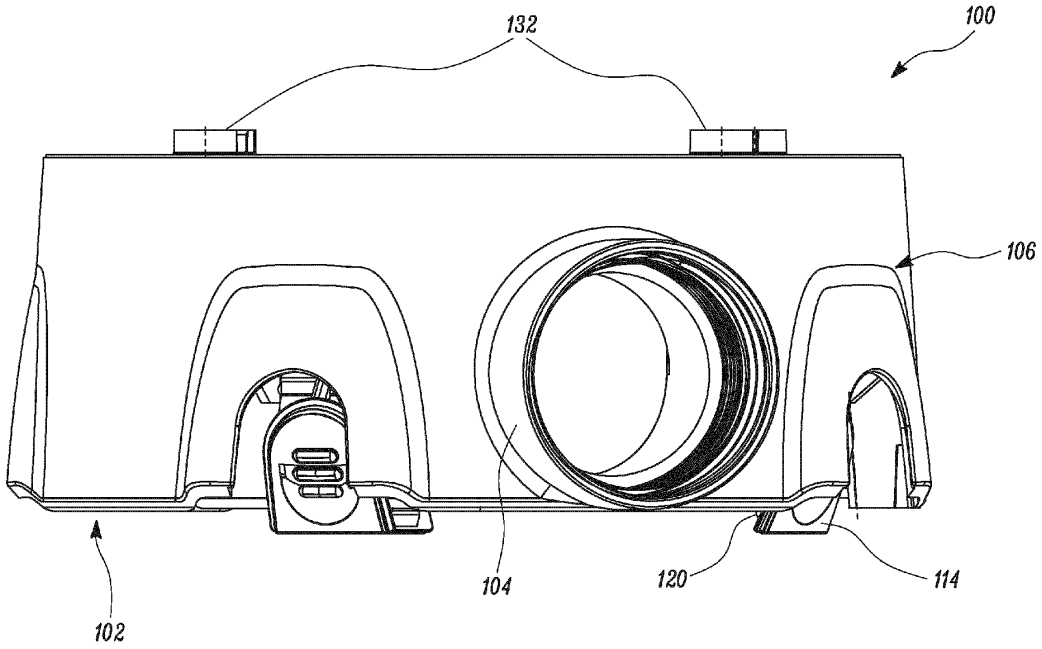

FIG. 8

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Description

TECHNICAL FIELD

[0001] The present disclosure relates to a foot for a pump. More specifically, the present disclosure relates to a foot for a pump which provides simple and convenient methods to adjust or manage different heights of the pump as per the requirements of common users.

BACKGROUND

[0002] A pump is a device that allows transport of fluids such as liquids or gases, or sometimes slurries, by mechanical actions. For example, a submersible pump is a device which has a hermetically sealed motor close-coupled to a pump body. The submersible pump may be submerged in a fluid to be pumped. Generally, the pumps are used to pump water from wells, or to filter aquariums, ponds, or may be used in car industries or energy industries for desired purposes. The pump may include a foot. The foot may help to attain desired heights depending on a liquid level in which the pump is submersed.

[0003] However, there may be instances where working with adjustment of pump heights with the help of foots of the pump may become troublesome process. Generally, an additional structure (such as base of a pump) may be coupled or uncoupled with the pump to get the desired height of the pump. Further, the coupling and uncoupling of additional parts to the pump may lead to formation of unrequired complex construction of the pump. Moreover, many technical issues may occur during assembly or disassembly of the additional structures with the pump.

[0004] The Chinese utility model CN 201 568 282 U describes a pump that has feet attached to its pump housing from underneath. The feet are connected to their respective base body via a hinge. The hinge and thus the coupling is sturdily secured by a securing element that is at the hinge screwed onto the base body after coupling. By accessing the pump housing from underneath in its non-operational position, the feet of the pump can be pivoted between a first stabile position and a second stabile position in respect to the base body. Doing this changes the height of the pumps water inlet in respect to the ground when the pump is back in its operational position.

[0005] Thus, there is a need for an improved pump which allows safe, convenient and trouble-free adjustments of heights of the pump.

SUMMARY

[0006] 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 foot for a pump having a pump housing. The foot **(106)** comprises a base body and a coupling structure coupled it. The coupling structure comprises a front panel that is movable between a first stable position and a second stable position in respect to the base body. Herein the front panel is accessible during the operational position of the pump from the side of its pump housing and wherein pushing and pulling of the foot moves it between its first stable position and a second stable position. Thus, the present disclosure provides a simple, efficient, and convenient foot to adjust different heights of the pump.

[0007] According to first embodiment of the present invention, the coupling structure includes a first arm, a second arm and a third arm. The first arm is coupled to the base body at a first end. The second arm is coupled to the base body at a second end. Further, third arm is positioned to actuate both the first arm and the second arm. Moreover, the first arm, the second arm and the third arm are cooperatively movable relative to each other between the first stable position and the second stable position, such that the front panel is adapted to actuate the third arm to move against the first arm and the second arm. This helps in engagement of the front panel with the base body. A general bistable mechanism is described by U.S. patent 6,215,081 whether naming naming any exemplary use, in particular not for use for the feet of pumps, nor describing any featural additions necessary for a certain use case.

[0008] According to a second embodiment of the present invention, the coupling stucture includes a first end and a second end. The first end of a pivotable element adapted to be pivotally coupled to the base body. The pivotable element is engaged with at least one of a first structural feature and a second structural feature defined on the base body. The pivotable element engages with the first structural feature in the first stable position and the pivotable element engages with the second structural feature in the second stable position of the coupling structure. This provide the foot with an ability to stay in the first stable position and the second stable position without power input and despite small external disturbances.

[0009] According to this second embodiment of the present invention, the front panel is coupled to the second end of the pivotable element. This allows free movement or actuation of the front panel by the common user.

[0010] According to an embodiment of the present invention, the first stable position corresponds to a first height of the pump base and the second stable position corresponds to a second height of the pump base. This may help in achieving the desired heights which are meant to suck/pump a large quantity of liquid in which the pump is submerged.

[0011] According to an embodiment of the present invention, the second height is greater than the second height. This may allow suction or pumping of liquid when the liquid level is relatively high.

[0012] According to an embodiment of the present invention, the first height and the second height are 1mm

and 5mm respectively. This may allow the pump to force the liquid entry at both desired liquid heights.

[0013] According to an embodiment of the present invention, the front panel include at least one tab. This may allow the front panel to get engaged with the base body.

[0014] According to an embodiment of the present invention, the base body is structurally integrated with the pump. This may prevent strength to the foot of the pump.

[0015] According to an embodiment of the present invention, the foot is removably coupled with the pump. This may allow assembly of the foot to the pump as per the applicational requirements of the common users.

[0016] According to an embodiment of the present invention, the first arm and the second arm are coupled by flexible hinges. As durability of the flexible hinges may allow repetitional movements of the foot. The flexible hinges may experience little friction when the first arm, the second arm, and the third arm are actuated. Further, the flexible hinges may typically result in a long service life. Moreover, an integration of the flexible hinges may eliminate the need of extra components.

[0017] According to an embodiment of the present invention, the first arm and the third arm are coupled by a snap connection. The snap connection may provide simple and cost -effective ways to assemble different parts of the foot.

[0018] According to an embodiment of the present invention, the base body includes one or more recesses/grooves. This may allow assembly of the foot to the on remainder part of the pump housing through the one or more recesses/grooves.

[0019] According to an embodiment of the present invention, the base body is engaged to the pump through the one or more recesses/grooves. This may connect the foot to the pump to form a single body.

[0020] According to an embodiment of the present invention, the foot **(106)** for a pump **(150)** having a pump housing **(105)** may be manufactured using a three-dimensional (3-D) printing process. A user of a pump having an according foot may be provided with a data file having pre-stored instructions to print the foot using a three-dimensional (3-D) printer. In order to do so, the foot may be presented in digital format. Use of three-dimensional printing (alternatively, 3D printing) may provide versatility of using different materials along with lower lead-time in manufacturing and design of the foot.

[0021] An embodiment of the present invention also concerns a pump having a pump housing and have the claimed foot associated with it.

[0022] Other features and aspects of this invention will be apparent from the following description and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] The invention will be described in more detail with reference to the enclosed drawings, wherein:

FIG. 1 illustrates a pump base with one or more feet, in accordance with an aspect of the present disclosure;

FIG. 2A illustrates a side view of the foot for the pump in a first stable position, in accordance with an aspect of the present disclosure;

FIG. 2B illustrates a front view of the foot for the pump in the first stable position, in accordance with an aspect of the present disclosure;

FIGS. 3A and **3B** illustrate side and front views of the foot in a second stable position respectively, in accordance with an aspect of the present disclosure;

FIGS. 4A and **4B** illustrate front and side views of another embodiment of the foot, in accordance with an aspect of the present disclosure;

FIGS. 5A and **5B** illustrate front and side views of another embodiments of the foot in the first stable position, in accordance with another aspect of the present disclosure;

FIGS. 6A and **6B** illustrate front and side views of another embodiments of the foot in the second stable position, in accordance with another aspect of the present disclosure;

FIG. 7 illustrates the pump base in the first stable position, in accordance with another aspect of the present disclosure; and

FIG. 8 illustrates the pump base in the second stable position, in accordance with another aspect of the present disclosure.

DESCRIPTION OF EMBODIMENTS

[0024] 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.

[0025] 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.

[0026] **FIG. 1** illustrates a pump base **100** of a pump **150.** The pump **150** is a mechanical device which pumps fluids such as liquids, gases, or sometimes slurries. The pump **150** may be used indoors or outdoors according to applicational needs of a common user. In the depicted example the pump **150** includes a handle **103** to lift or displace the pump **150.** The body includes an water inlet **102** (not visible). The water inlet **102** is present at the bottom of the pump housing **105,** that is at the bottom of its pump base **100** and allows a liquid to be sucked by the pump **150.** Further, the pump **150** has an outlet **104.** The outlet **104** discharges the liquid. The discharged liquid may be used to different applications such as irrigation, washing etc.

[0027] **FIG. 1** shows the pump **150** in its operational position that allows to suck water via its water inlet **102** (not visible) on the bottom of the pump housing **105** that find itself on the bottom of the pump **150** in its operational position. The pump housing **105** comprising a pump base **100** including one or more feet **106.** The one or more feet **106** are accessible during the normal operation of pump **150** from side of the pump housing **105.** This allows to adjust desired heights of the pump **150** being in its operational position. The common user may need the pump **150** to get adjusted at different heights. The pump **150** at different heights may cater to different application requirements. Pushing and pulling of the foot **(106)** moves it between its first stable position and its second stable position. The pump base **100** may be an integral part of the pump housing **105** or may be assembled or disassembled with a pump housing **105** through one or more pump base connectors **132** connecting the pump base **100** to the remainder part of the pump housing **105.**

[0028] In some embodiments, the one or more feet **106** may be manufactured by three-dimensional printing. Use of three-dimensional printing (alternatively, 3D printing) may provide versatility of using different materials along with lower lead-time in manufacturing and design of the one or more feet **106.**

[0029] In some embodiments, the one or more feet **106** may be made up of a material selected from steel, brass, stainless steel, aluminum or plastic. Nature of the material is chosen as per the requirements of the common user. The desired nature of the material provides the one or more feet **106** with certain characteristic features such as flexibility, elasticity, rigidity, heat or vibrations resistant properties.

[0030] **FIG. 2A** illustrates a side view of the foot **106** for the pump **150** in a first stable position. As from the point of clarity and consideration only one foot **106** is discussed in further figures. Another, one or more feet **106** may be similar or variant from the foot **106** described in the **FIG. 2A.** The foot **106** includes a base body **110.** The foot **106** further includes a coupling structure **112.** The coupling structure **112** is coupled to the base body **110.** The base body **110** has a first end **116** and a second end **118.** The coupling structure **112** allows the foot **106** to pivotally move between the first stable position and a second stable position (shown in **FIGS. 3A** and **3B** respectively).

[0031] Moreover, the pump **150** further includes a front panel **114.** The front panel **114** is actuated by a user to move the foot **106** between the first stable position and the second stable position. The front panel **114** includes a tab **120.** The tab **120** allows an engagement (shown in **FIGS. 3A** and **3B)** and disengagement of the front panel **114** with the second end **118** of the base body **110.** The foot **106** further includes a first arm **122,** a second arm **124** and a third arm **126.** The first arm **122** is coupled to the base body **110** at the first end **116.** Further, the second arm **124** is coupled to the base body **110** at the second end **118.** Moreover, the third arm **126** is positioned to actuate both the first arm **122** and the second arm **124.** The first arm **122,** the second arm **124** and the third arm **126** are cooperatively movable relative to each other between the first stable position and the second stable position.

[0032] As illustrated in **FIG. 2A,** the first arm **122** and the second arm **124** are coupled by one or more flexible hinges **128.** As durability of the one or more flexible hinges **128** may allow repetitional movements of the foot **106.** The one or more flexible hinges **128** may experience little friction when the first arm **122,** the second arm **124,** and the third arm **126** are actuated. Further, the one or more flexible hinges **128** may typically result in a long service life. An integration of the one or more living hinges **128** may eliminate the need of extra components. The first arm **122** and the third arm **126** are coupled by a snap connection **130.** Moreover, the snap connection **130** may provide simple and cost-effective ways to assemble different parts of the foot **106.**

[0033] **FIG. 2B** illustrates a front view of the foot **106** in the first stable position. The base body **110** is directly coupled to the pump **150.** The foot **106** includes one or more recesses/grooves **132.** This may connect the foot **106** to the pump **150** to form a single body. In some embodiments, the base body **110** is structurally integrated with the pump base **100.** This may provide strength/ rigidity to the foot **106** of the pump **150.** In some other embodiments, the foot **106** is removably coupled with the pump base **100.** This may allow assembly or disassembly of the foot **106** with the pump base **100** as per the applicational requirements of the common users.

[0034] The base body **110** may engage with the pump base **100** through the one or more recesses/grooves **132.** The base body **110** of the foot **106** may be engaged with

the pump base **100** by both temporary and permanent means. The temporary connection may be done by gluing, screwing, tying with threads and the like. The permanent connection may be done by welding, riveting and any other fabrication technique which is used or known in the art. Alternatively, and additionally, the base body **110** and the pump base **100** may be connected by snap connections.

[0035] **FIGS. 3A** and **3B** illustrate side and front views of the foot **106** in the second stable position respectively. The front panel **114** is adapted to actuate the third arm **126** to move against the first arm **122** and the second arm **124.** This helps in engagement of the front panel **114** with the base body **110.** The actuation of the front panel **114** engages the tab **120** with the second end **118** of the base body **110.** The front panel **114** may engage with the base body **110** by pressing or pushing the front panel **114** towards the base body **110.** The front panel **114** may be actuated by pressing a top portion **133** of the front panel **114.** The front panel **114** may engage with the base body **110** manually or by using simple tools. The second stable position of the front panel **114** with the base body **110** increases height of the pump **150** (shown in **FIG. 8**).

[0036] In some embodiments, the front panel **114** may be provided by some grooves. The grooves may help to actuate the front panel **114.** The user may actuate the front panel **114** by inserting fingers into the grooves or by using some simple tool to actuate the front panel **114.**

[0037] In some embodiments, the tab **120** may be made up of any material selected from one or more of a plastic, steel, nylon, rubber etc. The tab **120** may provide support to the front panel **114** to stay engaged with the second end **118** of the base body **110.** In some embodiments, the second end **118** of the base body **110** may have some protrusions which may lock or engage with grooves present on the front panel **114.** This arrangement may also provide firmness to the second stable position. Alternatively, or additionally, some designed structures may be present on the front panel **114.** The designed structures may get engaged with complementary designed structures present on the second end **118** of the base body **110.**

[0038] **FIGS. 4A** and **4B** illustrate front and side views of another embodiment of the present invention. The foot **106** includes a coupling structure **134.** The coupling structure **134** includes a first end **136** and a second end **138.** The coupling structure **134** further includes a first portion **140** towards the first end **136** of the coupling structure **134.** Moreover, the coupling structure **134** includes a second portion **142** towards the second end **138** of coupling structure **134.** The first end **136** of the coupling structure **134** is adapted to be pivotally coupled to the base body **110.** The base body **110** of the foot **106** includes a first structural feature **144.** Further, the base body **110** of the foot **106** includes a second structural feature **146.** The coupling structure **134** engages with the first structural feature **144** in the first stable position and the coupling structure **134** engages with the second structural feature **146** in the second stable position. The base body **110** further includes a slanting portion **148.** The coupling structure **134** engages at least one of the first structural feature **144** and the second structural feature **146** of the base body **110.**

[0039] In some embodiments, the coupling structure **134** and the slanting portion **148** may be made up of three-dimensional printing. Use of three-dimensional printing (alternatively, 3D printing) may provide versatility of using different materials along with lower lead-time in manufacturing and design of the coupling structure **134** and the slanting portion **148.** In some embodiments, the coupling structure **134** and the slanting portion **148** may be made up of a material selected from steel, brass, stainless steel, aluminum or plastic and the like.

[0040] **FIGS. 5A** and **FIG. 5B** illustrate front and side views of the foot **106** in the first stable position. The coupling structure **134** is engaged with the first structural feature **144** of the base body **110.** The coupling structure **134** engages with the first structural feature **144** in the first stable position. The first end **136** of the coupling structure **134** may act as pivot for the engagement or disengagement of the front panel **114** with the first structural feature **144** and the second structural feature **146** (shown in **FIG. 6A** and **6B).** The engagement of the front panel **114** with the first structural feature **144** and the second structural feature **146** may be done manually or by using some basic techniques used or known in the art.

[0041] **FIGS. 6A** and **6B** illustrate front and side views of the foot **106** in the second stable position. The coupling structure **134** is engaged with the second structural feature **146.** The coupling structure **134** engages with the second structural feature **146** in the second stable position. The slanting portion **148** may provide support to the second portion **142** of the coupling structure **134** to stay engaged in the second stable position. The top portion **133** of the front panel **114** along with the tab **120** help to engage the front panel **114** with the second structural feature **146** of the base body **110.** On actuating the front panel **114,** the front panel **114** may engage with the first structural feature **144** and the second structural feature **146** as per the requirements.

[0042] In some embodiments, a control unit may be present to control different movements of the front panel **114.** An increase or decrease in water level may be sensed by sensors present over the pump **150.** The sensors may actuate the front panel **114** to move between the first stable position and the second stable position. On an increase in liquid level, the pump **150** may attain second stable position. Similarly, on lowering of liquid level, the pump **150** may attain the first stable position.

[0043] **FIG. 7** illustrates the pump base **100** in the first stable position. The first stable position is attained by the pump **150,** whenever the liquid level is quite low. The first stable position corresponds to a first height of the pump base **100.** In an embodiment, the first height is 1mm. The first height of the pump **150** may help in sucking or pumping of water, even when the water level is quite low. **FIGS.**

2A, 2B and **5A, 5B** corresponds to **FIG. 7.** The movement of the front panel **114** between the first stable position and the second stable position may eliminate need of external resources to lift or drop the pump **150.**

[0044] The front panel **114** may stay only in the first stable position and the second stable position. The front panel **114** may not stay in any intermediate position between the first stable position and the second stable position. Therefore, the front panel **114** may follow a bistabile mechanism. This may provide stability to the front panel **114** to stay in the first stable position and the second stable position without much power input and despite small external disturbances.

[0045] **FIG. 8** illustrates the pump base **100** in the second stable position. The second stable position is attained by the pump **150,** whenever the liquid level is quite high. With the feet of the pump in this second stable position that particles of a size by 5 mm can pass the pump.. The second stable position corresponds to a second height of the pump base **100.** In an embodiment, the second height is 5mm. The second height of the pump **150** may help in sucking or pumping of water, even when the water level is quite high. **FIGS. 3A, 3B** and **6A, 6B** corresponds to **FIG. 8.** The second height is greater than the first height. The first height and the second height may allow the pump **150** to force the liquid entry at both desired liquid heights.

[0046] 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

[0047]

100 Pump Base
102 Water Inlet
103 Handle
104 Outlet
105 Pump Housing
106 Foot/ One or more feet
110 Base Body
112 Coupling Structure
114 Front Panel
116 First end
118 Second end
120 Tab
122 First Arm
124 Second Arm
126 Third Arm
128 One or more flexible hinges
130 Snap Connection
132 Pump Base Connectors
133 Top Portion
134 Coupling structure
136 First End
138 Second End
140 First Portion
142 Second Portion
144 First structural feature
146 Second structural feature
148 Slanting Portion
150 Pump

Claims

1. A foot **(106)** for a pump **(150)** having a pump housing **(105),**
the foot **(106)** comprising:

a base body **(110);**
a coupling structure **(112, 134)** coupled to the base body **(110),**
the coupling structure **(112, 134)** comprises a front panel **(114),** wherein the front panel **(114)** is movable between a first stable position and a second stable position in respect to the base body **(110);**

characterized in that:

the front panel **(114)** is accessible during the operational position of the pump **(150)** from the side of its pump housing **(105)** and
wherein pushing and pulling of the foot **(106)** moves it between its first stable position and a second stable position.

2. The foot **(106)** of claim 1, wherein the coupling structure **(112)** includes:

a first arm **(122)** adapted to be coupled to the base body **(110)** at a first end **(116);**
a second arm **(124)** adapted to be coupled to the base body **(110)** at a second end **(118);** and
a third arm **(126)** positioned to actuate both the first arm **(122)** and the second arm **(124);**
wherein the first arm **(122),** the second arm **(124)** and the third arm **(126)** are cooperatively movable relative to each other between the first stable position and the second stable position, such that the front panel **(114)** is adapted to actuate the third arm **(126)** to move against the first arm **(122)** and the second arm **(124).**

3. The foot **(106)** of claim 1, wherein the coupling structure **(134)** includes:

a first end **(136)** of the coupling structure **(134)** adapted to be pivotally coupled to the base body **(110);**
the coupling structure **(134)** adapted to engage

at least one of a first structural feature **(144)** and a second structural feature **(146)** defined on the base body **(110);**
wherein the coupling structure **(134)** engages with the first structural feature **(144)** in the first stable position and the pivotable element **(134)** engages with the second structural feature **(146)** in the second stable position.

4. The foot **(106)** of claim **3,** wherein the front panel **(114)** is coupled to a second end **(138)** of the coupling structure **(134).**

5. The foot **(106)** of any of preceding claims, wherein the coupling structure **(112, 134)** is sturdily coupled to the base body **(110).**

6. The foot **(106)** of any of preceding claims, wherein the first stable position corresponds to a first height of the pump base **(100)** and the second stable position corresponds to a second height of the pump base **(100),** wherein the second height is greater than the first height.

7. The foot **(106)** of any of preceding claims, wherein the front panel **(114)** include at least one tab **(120).**

8. The foot **(106)** of any of preceding claims, wherein the base body **(110)** is structurally integrated with the pump **(150).**

9. The foot **(106)** of any of preceding claims, wherein the foot **(106)** is removably coupled with the pump **(150).**

10. The foot **(106)** of any of claims 1 to 9, wherein the first arm **(122)** and the second arm **(124)** are coupled by flexible hinges.

11. The foot **(106)** of any of preceding claims, wherein the base body **(110)** is engaged to the remainder part of the pump housing **(105)** through the one or more recesses/grooves **(132).**

12. The foot **(106)** of any of the claims 1-11, **characterized in that**, the foot **(106)** is manufactured using a three-dimensional (3-D) printing process.

13. The foot **(106)** of claim 12, **characterized in that**, a user of the foot **(106)** is provided with a data file having pre-stored instructions to print the foot **(106)** using a three-dimensional (3-D) printer.

14. The foot **(106)** of claim 12 or 13, wherein the foot **(106)** is presented in digital format.

15. A pump **(150)** having a pump housing **(105)** as well as a foot **(106)** of any of the claims 1 to 14.

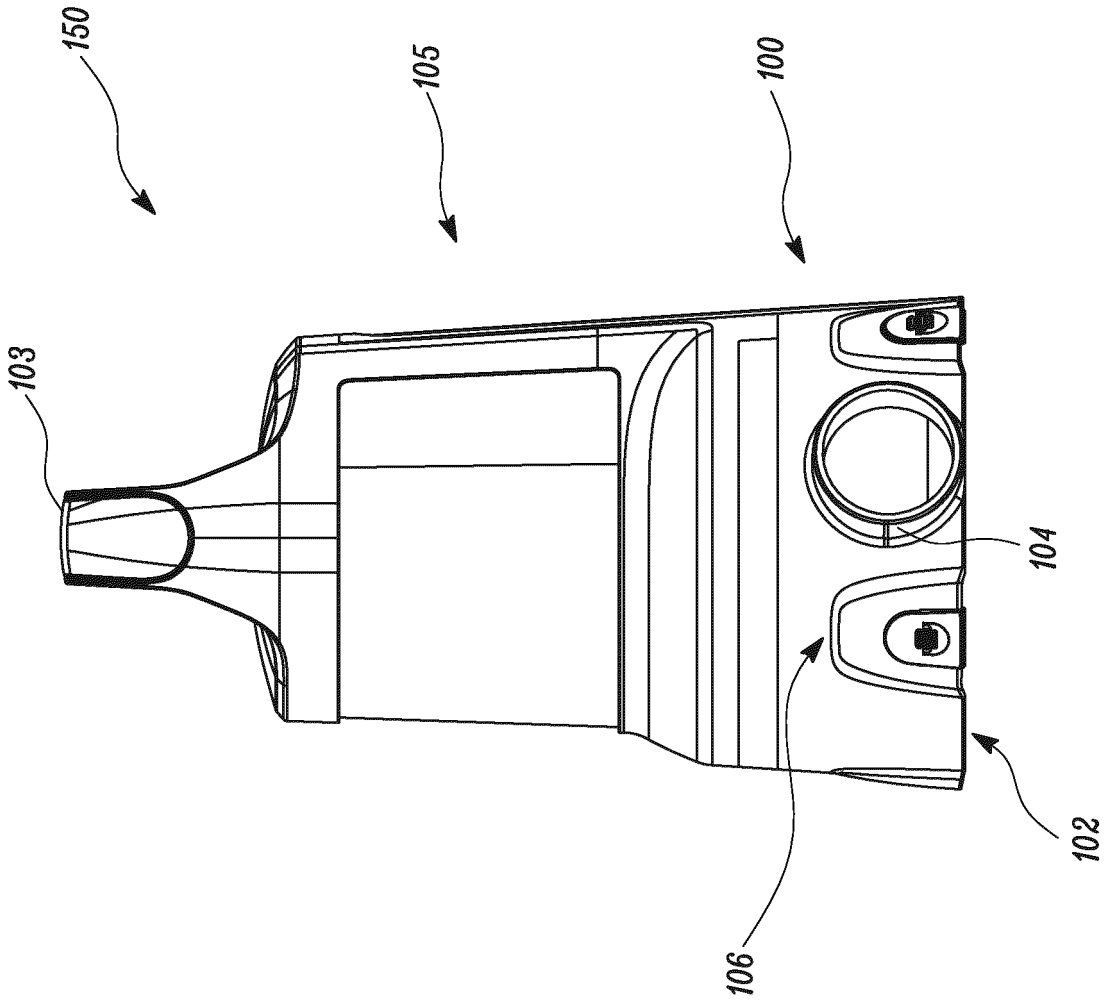

FIG. 1

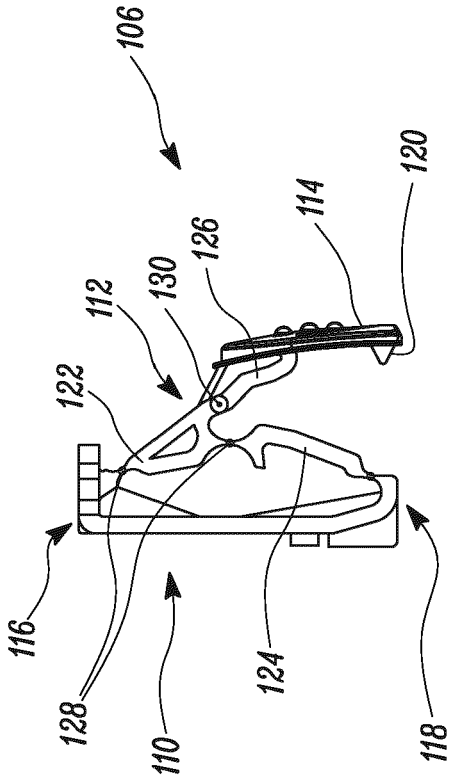
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FIG. 2A

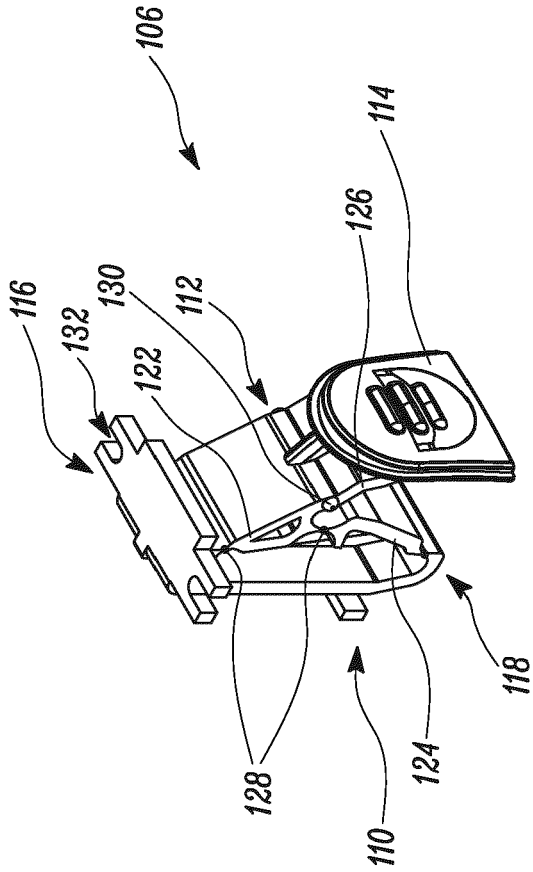
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FIG. 2B

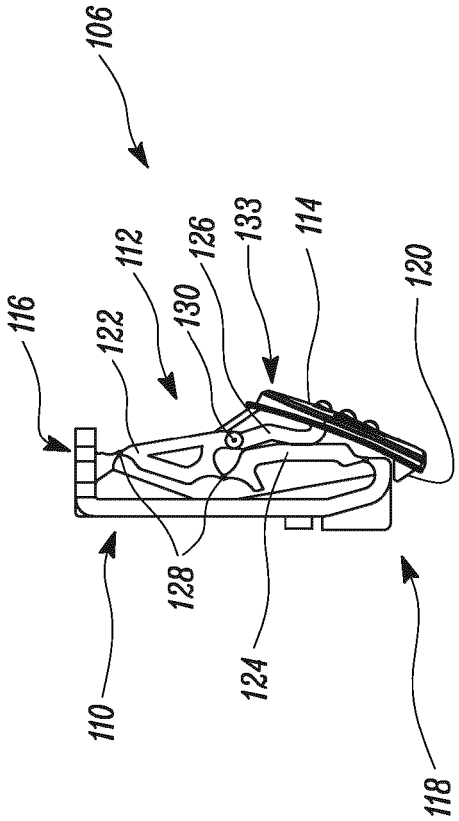
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FIG. 3A

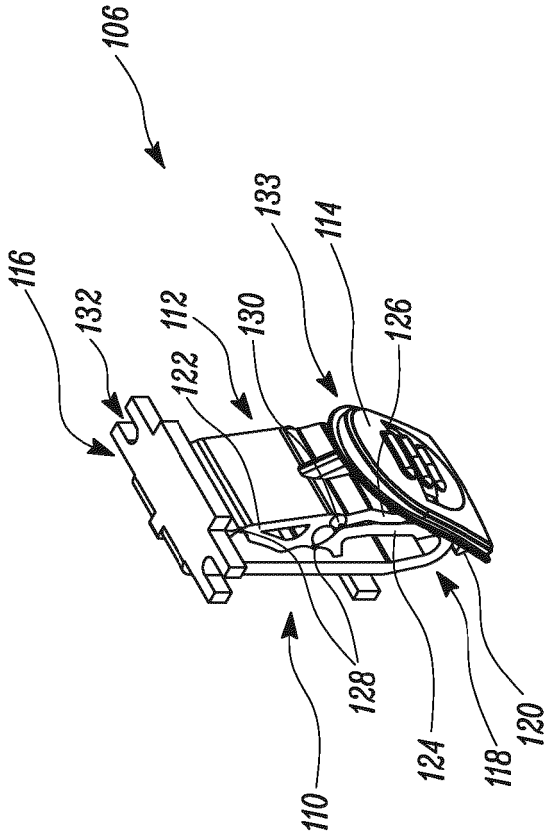
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FIG. 3B

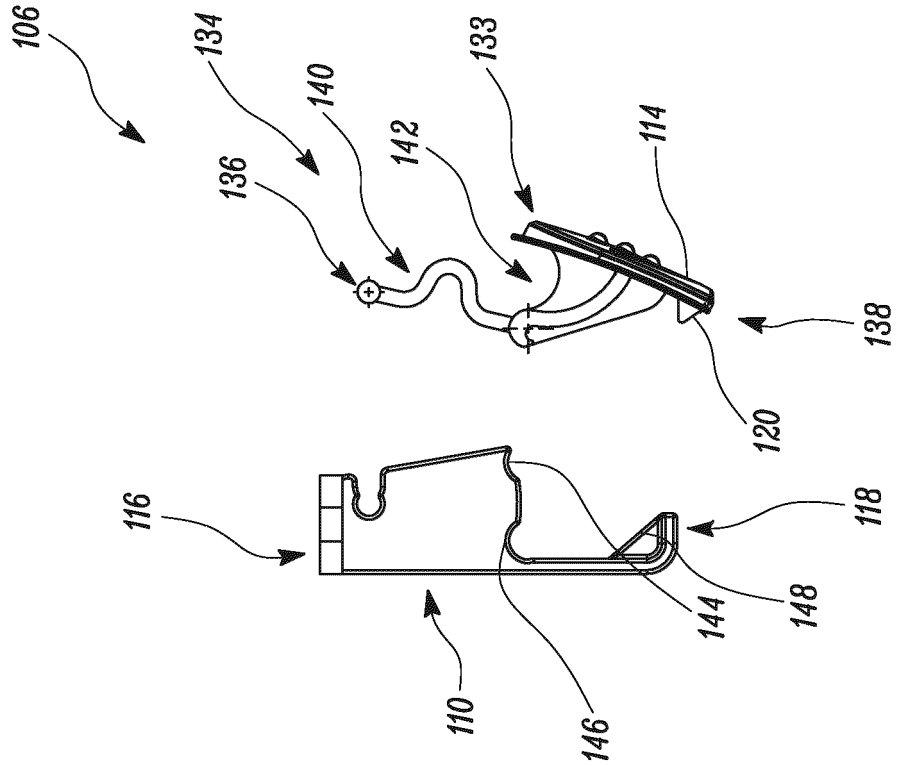
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FIG. 4B

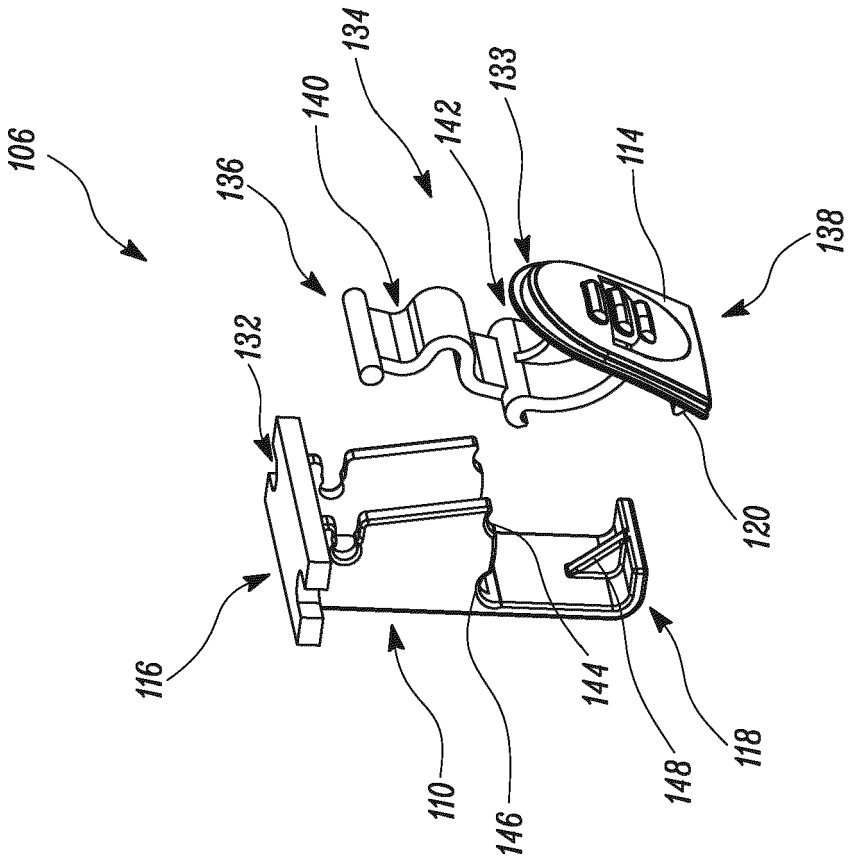
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FIG. 4A

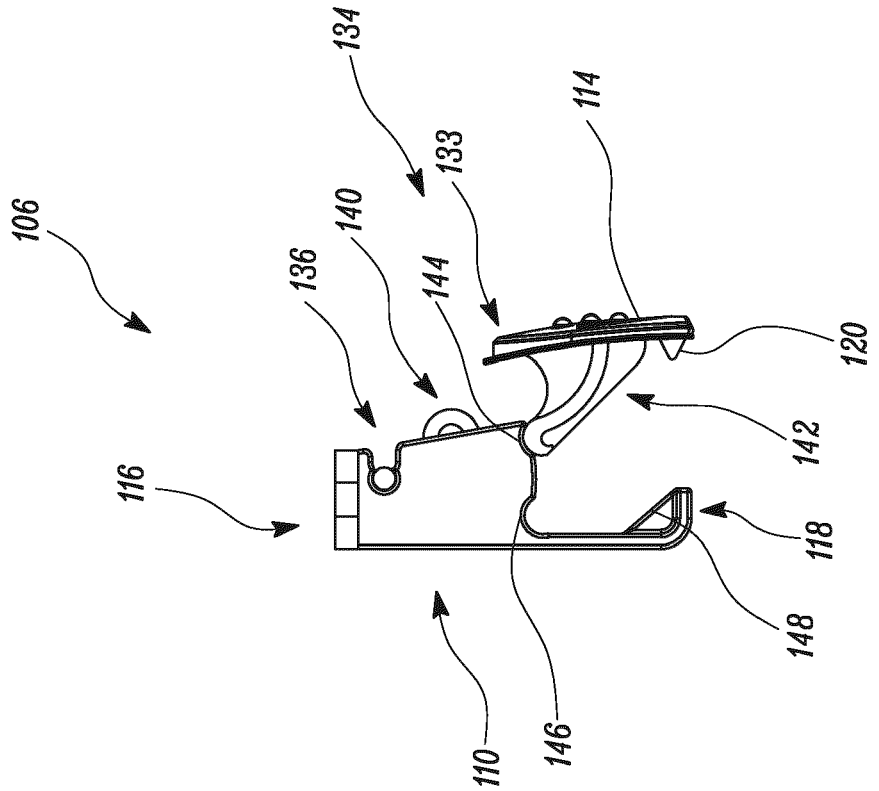
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FIG. 5B

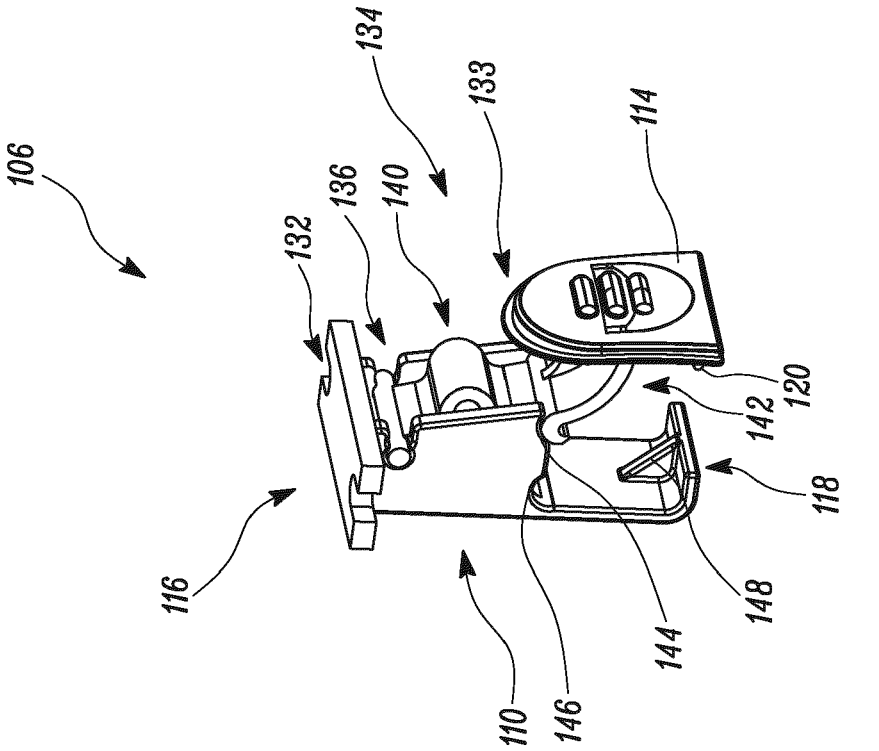
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FIG. 5A

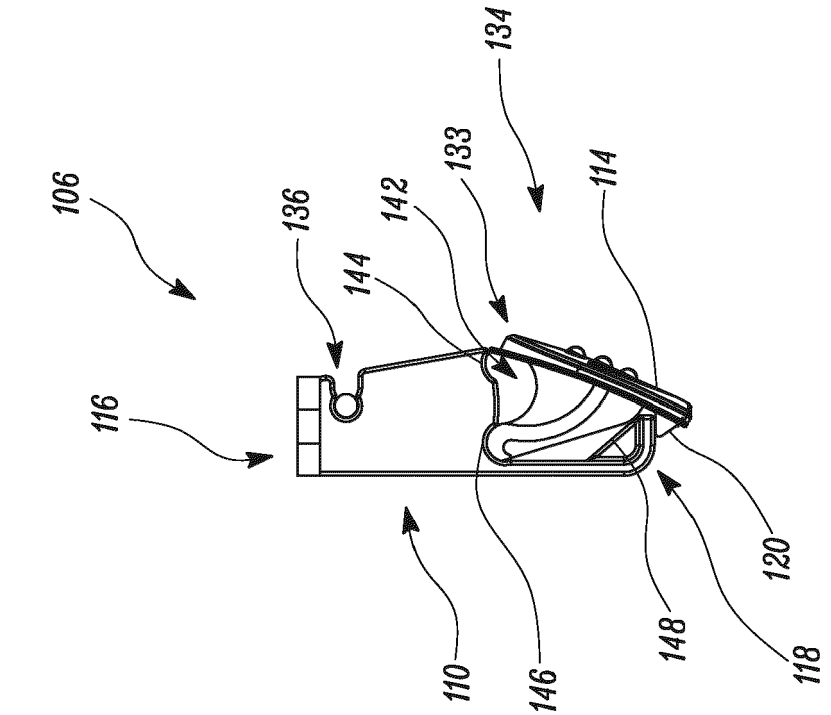
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FIG. 6B

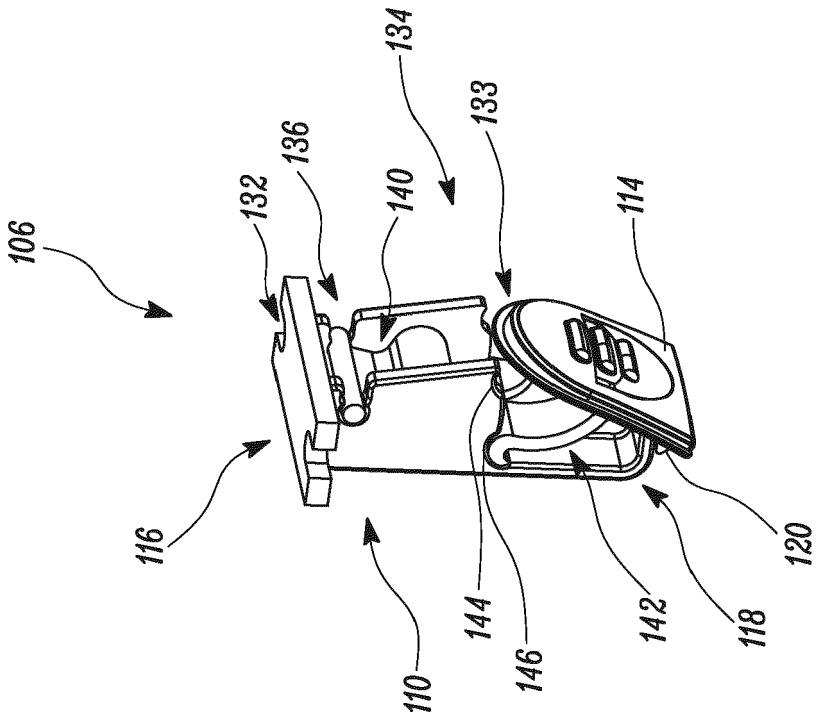
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FIG. 6A

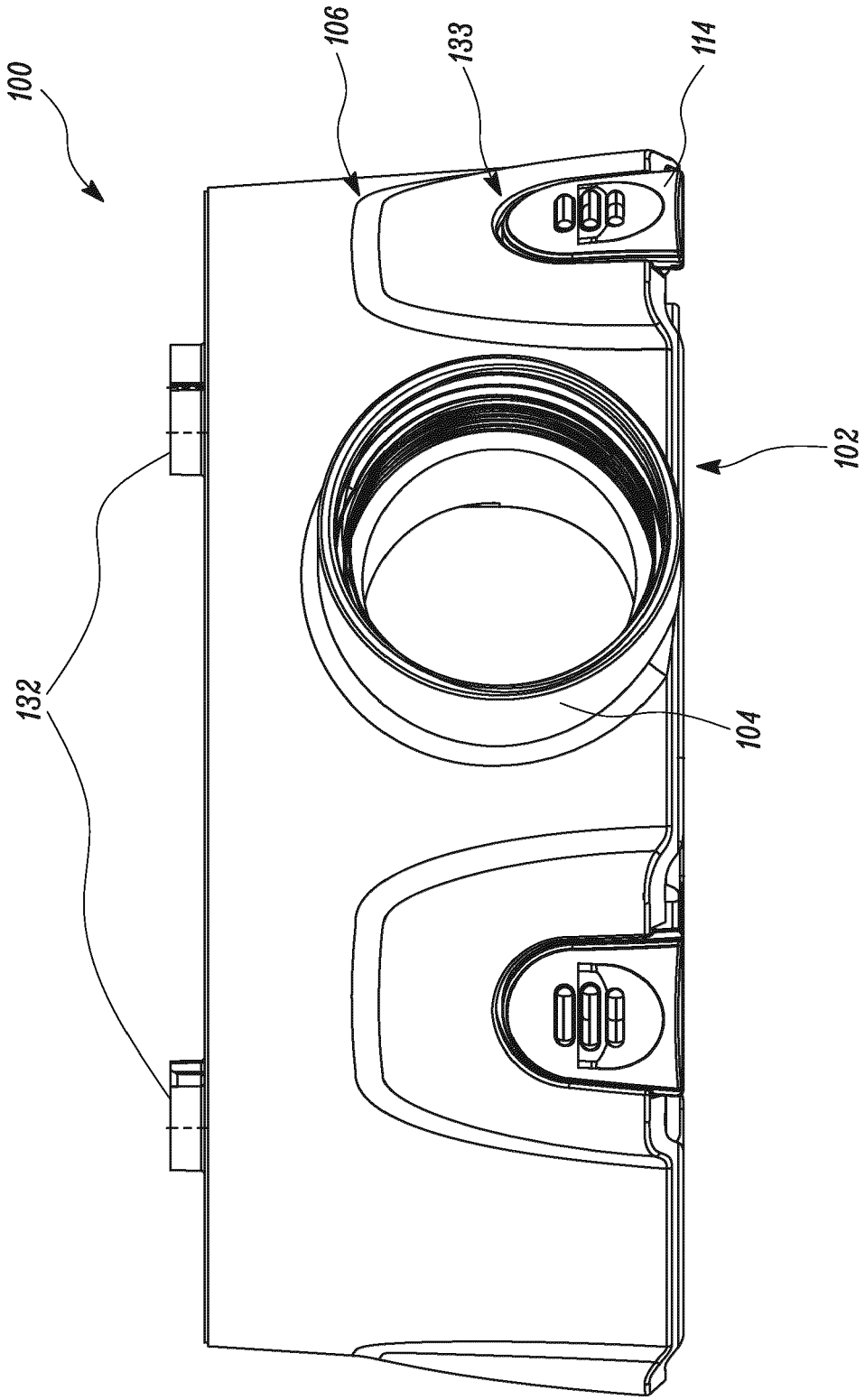

FIG. 7

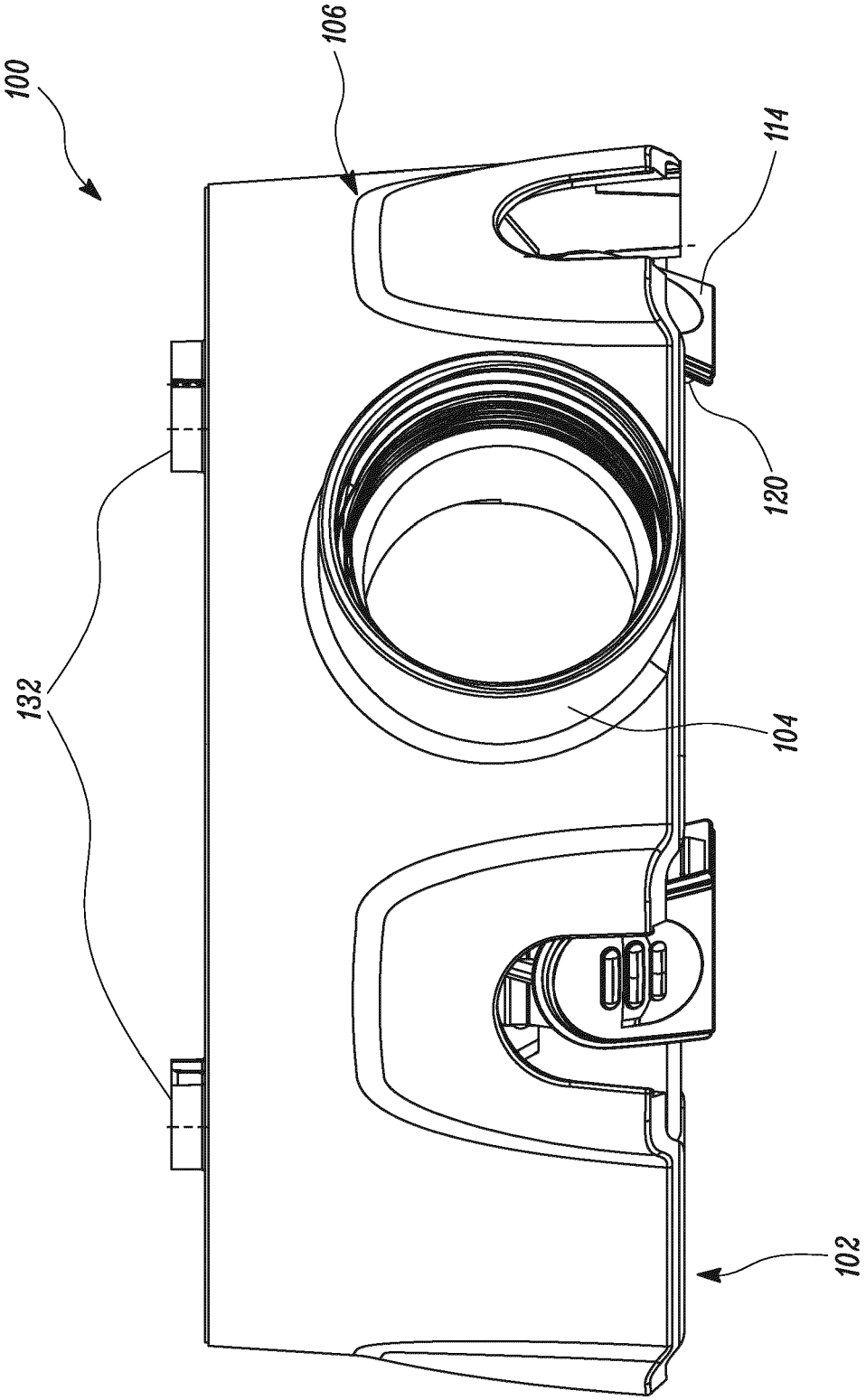

FIG. 8

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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	24 August 2020	Oliveira, Damien

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