



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
27.01.2021 Bulletin 2021/04

(51) Int Cl.:
F04D 9/00 (2006.01) **F04D 13/06** (2006.01)
F04D 15/00 (2006.01)

(21) Application number: **20184144.2**

(22) Date of filing: **06.07.2020**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

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(30) Priority: **25.07.2019 IT 201900012861**

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(54) **ELECTRIC PUMP WITH AIR VENTING DEVICE**

(57) A device (10) for venting air of an electric pump, comprising a body (11) which can be associated detachably with a pump body (51) of an electric pump (50). The body (11) comprises at least one cavity (12) having a substantially longitudinal axis of extension (X), the cavity (12) having at least one inlet (13) which can be connected fluidically to the inside of the pump body (51) and at least one outlet (14) which can be connected fluidically to the

outside of the pump body (51), valve means (20) arranged inside the cavity (12) being adapted to adjust a flow of fluid between the inlet (13) and the outlet (14) as a function of the difference in pressure between the inside of the pump body (51) and the outside of the pump body (51). The invention also relates to an electric pump (50) comprising the device (10).

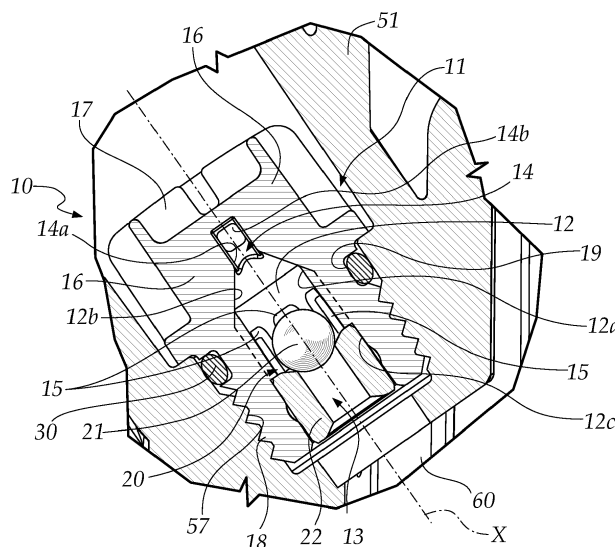


Fig.4

Description

[0001] The present invention relates to an electric pump with air venting device and also relates to said device.

[0002] As is known, electric pumps are electrically actuated hydraulic machines adapted to lift or move liquids, which once aspirated are directed toward user devices of various kinds.

[0003] Among known electric pumps, immersion electric pumps or submersed electric pumps, the work of which is performed directly inside the liquid that must be pumped, stand out in particular.

[0004] Generally, the installation of a submersed electric pump therefore entails its immersion in the water or in the liquid to be pumped.

[0005] This operation can give rise to an unwanted accumulation of air, a sort of "diving bell", inside the intake duct of the electric pump and the body of the latter.

[0006] Some submersed electric pumps do not start autonomously in such cases and if the circuit is not filled with water the pump runs dry, with the risk of being damaged.

[0007] It is important that impellers of electric pumps always operate in the presence of liquid.

[0008] Indeed, when submersed electric pumps are installed out of the water by means of appropriate accessories, before using them it is necessary to proceed with the so-called priming operations, i.e., it is necessary to make the air contained inside them exit by introducing liquid through adapted inlets.

[0009] The aim of the present invention is to provide an electric pump and a device that overcome the drawbacks of the cited background art.

[0010] Within this aim, an object of the invention is to provide a device that allows to expel externally the air that has accumulated inside a submersed electric pump during its immersion in the pumping liquid.

[0011] Another object of the invention is to provide a device that is structured to be installed and/or adapted outside the original assembly of a submersed electric pump.

[0012] Another object of the invention is to provide a submersed electric pump in which said device can be applied to the priming connector and, depending on the various requirements, can be replaced with an ordinary plug.

[0013] Another object of the invention is to provide a device that is relatively simple to provide and can be obtained at competitive costs.

[0014] This aim, as well as these and other objects which will become better apparent hereinafter, are achieved by a device for venting air from an electric pump, comprising a body which can be associated detachably with a pump body of an electric pump, characterized in that said body comprises at least one cavity having a substantially longitudinal axis of extension, said cavity having at least one inlet which can be connected

fluidically to the inside of said pump body and at least one outlet which can be connected fluidically to the outside of said pump body, valve means arranged inside said cavity being adapted to adjust a flow of fluid between said inlet and said outlet as a function of the difference in pressure between the inside of said pump body and the outside of said pump body.

[0015] The invention also relates to an electric pump comprising a pump body which has a chamber adapted to accommodate at least one impeller which is turned by electric motor means, said chamber comprising at least one intake port and at least one delivery port which is located at the outlet of a delivery duct, said electric pump being characterized in that it comprises said air venting device.

[0016] Further characteristics and advantages of the invention will become better apparent from the description of a preferred but not exclusive embodiment of a device and an electric pump according to the invention, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is an exploded perspective view of the device according to the invention;

Figure 2 is a side view of an electric pump according to the invention;

Figure 3 is a sectional view, taken along the plane III-III of Figure 2;

Figure 4 is an enlarged-scale view of a portion of the cross-section of Figure 3 of the device according to the invention, installed on an electric pump according to the invention.

[0017] With reference to the figures, the device for venting the air of an electric pump, according to the invention, is shown on its own in the exploded view of Figure 1, where it is designated generally by the reference numeral 10.

[0018] In the specific case, the device 10 is adapted to be mounted in an electric pump 50 according to the invention, shown in Figures 2 to 4.

[0019] The device 10 comprises a plug-like body 11, which forms a cavity 12 that has an elongated shape and is extended predominantly along an axis of extension X.

[0020] At the two opposite axial ends of the cavity 12 there are an inlet 13, adapted to be placed in fluid connection with the inside of a pump body 51 of the electric pump 50 so as to affect its delivery duct 60, and an outlet 14, adapted to be placed in fluid connection with the outside of the pump body 51, i.e., with the environment in which the electric pump 50 is placed.

[0021] In the cavity 12 there are valve means 20 which adjust a flow of fluid between the inlet 13 and the outlet 14 as a function of the difference in pressure that exists between the inside of the pump body 51 and the outside thereof.

[0022] In the specific case, the valve means 20 comprise a spherical flow control element 21 which is accom-

modated in a central portion 12a of the cavity 12 and has a substantially cylindrical shape.

[0023] The spherical flow control element 21 can move alternately along the axis of extension X and can affect selectively by gravity the inlet 13 of the cavity 12.

[0024] Advantageously, the spherical flow control element 21 is guided in its alternating linear motion by a series of ribs 15 that protrude from the internal face of the central portion 12a and are extended substantially parallel to the axis of extension X.

[0025] The valve means 20 furthermore comprise a tubular insert 22, made of a flexible material such as for example the rubber known by the trade name "FOOD-GUM/55/N", inserted in a wider portion 12c of the cavity 12 that is formed at one end of the central portion 12a.

[0026] Preferably, the wider portion 12c has a substantially cylindrical shape and a larger diameter than the central portion 12a.

[0027] A calibrated passage is provided centrally to the tubular insert 22 and in practice forms the inlet 13.

[0028] Advantageously, around the inlet 13, on the tubular insert 22 there is an abutment seat 23 that is adapted to cooperate with the spherical flow control element 21 in an inactive condition of the device 10 and of the electric pump 50.

[0029] In an active condition, defined more clearly hereinafter, the spherical flow control element 21 is instead adapted to interact with a flared portion 12b of the cavity 12, which is formed at the end of the central portion 12a that is opposite the one in which the wider portion 12c is provided.

[0030] The flared portion 12b has a substantially frustum-like shape and its internal surface converges in a main portion 14a of the outlet 14 that is coaxial with the axis of extension X.

[0031] The main portion 14a is divided into a plurality of branches 14b which are transverse to the axis of extension X, only one of which is shown in Figure 4, which place the inside of the cavity 12 in fluid connection with the outside of the pump body 51.

[0032] The branches 14b are provided in a contoured head 16 that is arranged at an axial end of the body 11.

[0033] In the specific case, the contoured head 16 has a substantially cylindrical shape and two opposite branches 14b are provided therein.

[0034] However, it is evident to the person skilled in the art that the shape and the dimensions of the contoured head of the device according to the invention can be variable, and likewise the number and the geometric characteristics of said branches can be variable.

[0035] Advantageously, the contoured head 16 is provided with a cross-shaped or rectilinear slot 17 adapted to be engaged with a screwdriver.

[0036] At the end of the body 11 that is opposite the end from which the contoured head 16 protrudes there is a threaded portion 18 that is adapted to couple to a corresponding complementarily threaded portion 57 of a coupling provided on the electric pump 50 and arranged

in fluid connection with the inside of the pump body 51, so as to affect the delivery duct 60.

[0037] Advantageously, the body 11 has, on its outer surface, a substantially annular groove 19, which is formed between the contoured head 16 and the threaded portion 18.

[0038] The groove 19 is configured to accommodate sealing means 30, for example an O-ring, which are adapted to be arranged between the contoured head 16 and said coupling provided on the electric pump 50 when the device 10 is mounted on the latter.

[0039] In the specific case, the electric pump 50 is of the submersed or submersible type and comprises the pump body 51, which forms a chamber 52 inside which one or more impellers 53 are accommodated which are turned by electric motor means 54.

[0040] The chamber 52 has an intake port 55 and a delivery port 56, which is arranged at the output of a delivery duct 60.

[0041] However, it is evident to the person skilled in the art that the electric pump might be differently configured in alternative embodiments of the present invention, not shown in the figures, without thereby losing generality.

[0042] The electric pump 50 according to the invention comprises a device 10 according to the invention, which is preferably mounted at a complementarily threaded portion 57 of a coupling in fluid connection with the inside of the pump body 51.

[0043] Advantageously, the complementarily threaded portion 57 of the coupling in fluid connection with the inside of the pump body 51 is arranged so as to affect the delivery duct 60.

[0044] The operation of the electric pump and of the device according to the invention is as follows.

[0045] Assuming for example that the electric pump 50 and the device 10 are initially in an inactive condition, in which the pump body 51 is not immersed in a liquid and the electric motor means 54 are off, the spherical flow control element 21 affects by gravity the inlet 13 of the cavity 12 in cooperation with the abutment seat 23 of the tubular insert 22.

[0046] By immersing the pump body 51 in the pumping liquid, the air that is present inside the intake port 55 and the chamber 52 flows through the inlet 13 of the device 10, opens the valve means 20 and exits through the outlet 14, being dispersed into the environment or into the liquid itself.

[0047] In greater detail, the pressure of the air that flows through the inlet 13 gradually overcomes the inertia of the spherical flow control element 21, making it slide in the central portion 12a of the cavity 12 along the axis of extension X.

[0048] By passing through the spaces which, by virtue of the ribs 15, are created between the spherical flow control element 21 and the internal surface of the central portion 12a, the air therefore flows toward the flared portion 12b, first entering the main portion 14a of the outlet

14 and then entering the branches 14b through which it is dispersed into the environment in which the electric pump 50 is immersed.

[0049] Once all the air contained in the pump body 51 has flowed out, the spherical flow control element 21 resumes affecting by gravity the inlet 13.

[0050] When the electric pump 50 is started, the impellers 53, actuated by the electric motor means 54, aspirate water through the intake port 55, pushing it under pressure toward the delivery port 56 through the duct 60.

[0051] The pressurized water flows through the inlet 13 and by suddenly overcoming the inertia of the spherical flow control element 21 makes it slide in the central portion 12a of the cavity 12 along the axis of extension X, until it pushes it toward the flared portion 12b, where it affects the outlet 14, avoiding losses of pressure and in practice sealing the inside of the pump body 51 from the air.

[0052] It is important to point out that by virtue of a suitable accessory the electric pump 50 can also be installed out of the water.

[0053] In this circumstance, the device 10 can be replaced with an ordinary plug that has a substantially similar shape and the coupling provided with the complementarily threaded portion 57, being in fluid connection with the inside of the pump body 51, can be used to prime the electric pump 50.

[0054] In practice it has been found that the invention achieves the intended aim and objects, providing a device and an electric pump which are capable of expelling externally the air that has accumulated inside the electric pump itself, for example during immersion in the pumping liquid.

[0055] Moreover, the device according to the invention is substantially structured like a plug and therefore can be installed and/or adapted outside the original assembly of the electric pump according to the invention.

[0056] This allows, for example, to apply the device according to the invention to the priming connector of an electric pump according to the invention, with the possibility to replace it with an actual plug in some configurations for use.

[0057] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the appended claims.

[0058] All the details may furthermore be replaced with other technically equivalent elements.

[0059] In practice, the materials used, so long as they are compatible with the specific use, as well as the contingent shapes and dimensions, may be any according to the requirements and the state of the art.

[0060] The disclosures in Italian Patent Application No. 102019000012861 from which this application claims priority are incorporated herein by reference.

[0061] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such

reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A device (10) for venting air from an electric pump, comprising a body (11) which can be associated detachably with a pump body (51) of an electric pump (50), **characterized in that** said body (11) comprises at least one cavity (12) having a substantially longitudinal axis of extension (X), said cavity (12) having at least one inlet (13) which can be connected fluidically to the inside of said pump body (51) and at least one outlet (14) which can be connected fluidically to the outside of said pump body (51), valve means (20) arranged inside said cavity (12) being adapted to adjust a flow of fluid between said inlet (13) and said outlet (14) as a function of the difference in pressure between the inside of said pump body (51) and the outside of said pump body (51).
2. The device (10) according to claim 1, **characterized in that** said cavity (12) comprises a substantially cylindrical central portion (12a), at the opposite ends of said central portion (12a) there being a substantially frustum-shaped flared portion (12b) connected fluidically to said outlet (14) and a substantially cylindrical wider portion (12c) connected fluidically to said inlet (13).
3. The device (10) according to one or more of the preceding claims, **characterized in that** said outlet (14) comprises a main portion (14a) which is substantially coaxial to said axis of extension (X) and a plurality of branches (14b) which are transverse to said axis of extension (X) and are fluidically connected to said main portion (14a).
4. The device (10) according to one or more of the preceding claims, **characterized in that** said valve means (20) comprise at least one spherical flow control element (21) which is accommodated in said central portion (12a) and can move alternately along said axis of extension (X), said spherical flow control element (21) being adapted to selectively affect by gravity said inlet (13).
5. The device (10) according to one or more of the preceding claims, **characterized in that** it comprises a plurality of ribs (15) which protrude from the internal face of said central portion (12a), said ribs (15) having an extension that is substantially parallel to said axis of extension (X) and being adapted to guide the alternating linear movement of said spherical flow control element (21).

6. The device (10) according to one or more of the preceding claims, **characterized in that** said valve means (20) comprise a tubular insert (22) which is inserted in said wider portion (12c), said tubular insert (22) forming said inlet (13) and an abutment seat (23) for said spherical flow control element (21). 5

7. The device (10) according to one or more of the preceding claims, **characterized in that** said body (11) comprises a contoured head (16) provided with a cross-shaped (17) and/or rectilinear slot. 10

8. The device (10) according to one or more of the preceding claims, **characterized in that** said body (11) comprises a threaded portion (18) for coupling to a complementarily threaded portion (57) of a coupling in fluidic connection with the inside of said pump body (51), said threaded portion (18) being longitudinally opposite with respect to said contoured head (16). 15
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9. The device (10) according to one or more of the preceding claims, **characterized in that** said body (11) comprises a groove (19) which is arranged between said contoured head (16) and said threaded portion (18), said groove (19) being adapted to accommodate sealing means (30) which can be arranged between said contoured head (16) and said electric pump (51) substantially at said complementarily threaded portion (57). 25
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10. An electric pump (50) comprising a pump body (51) which has a chamber (52) adapted to accommodate at least one impeller (53) which is turned by electric motor means (54), said chamber (52) comprising at least one intake port (55) and at least one delivery port (56) which is located at the outlet of a delivery duct (16), said electric pump (50) being **characterized in that** it comprises at least one device (10) for venting the air of an electric pump according to any one of the preceding claims. 35
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11. The electric pump (50) according to claim 10, **characterized in that** said device (10) is mounted at a complementarily threaded portion (57) of a coupling in fluidic connection with the inside of said pump body (51). 45
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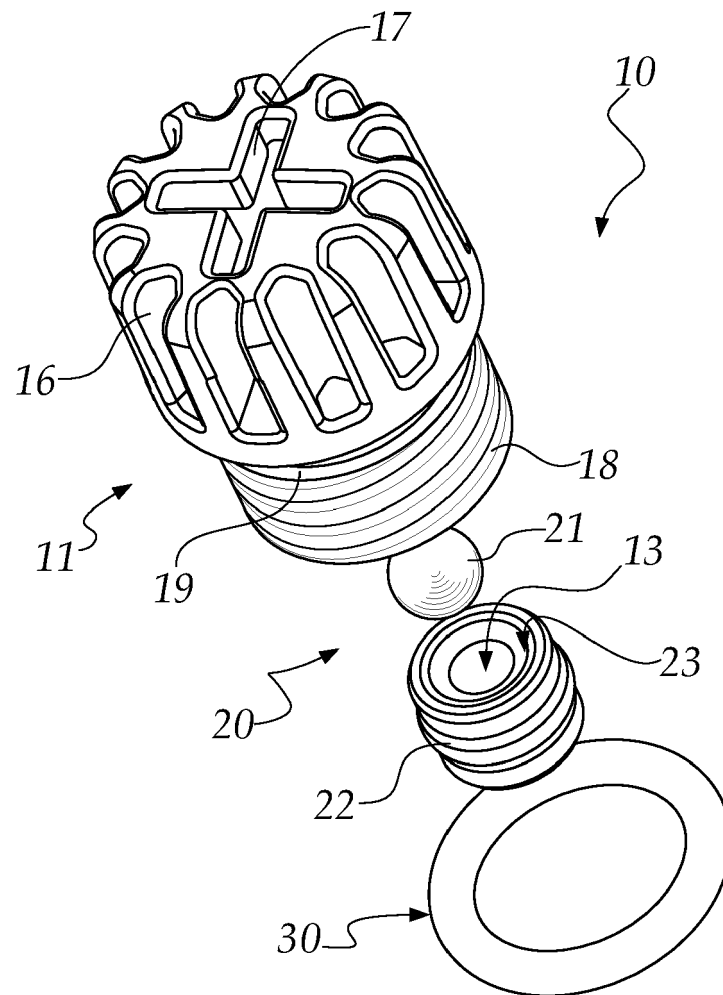


Fig.1

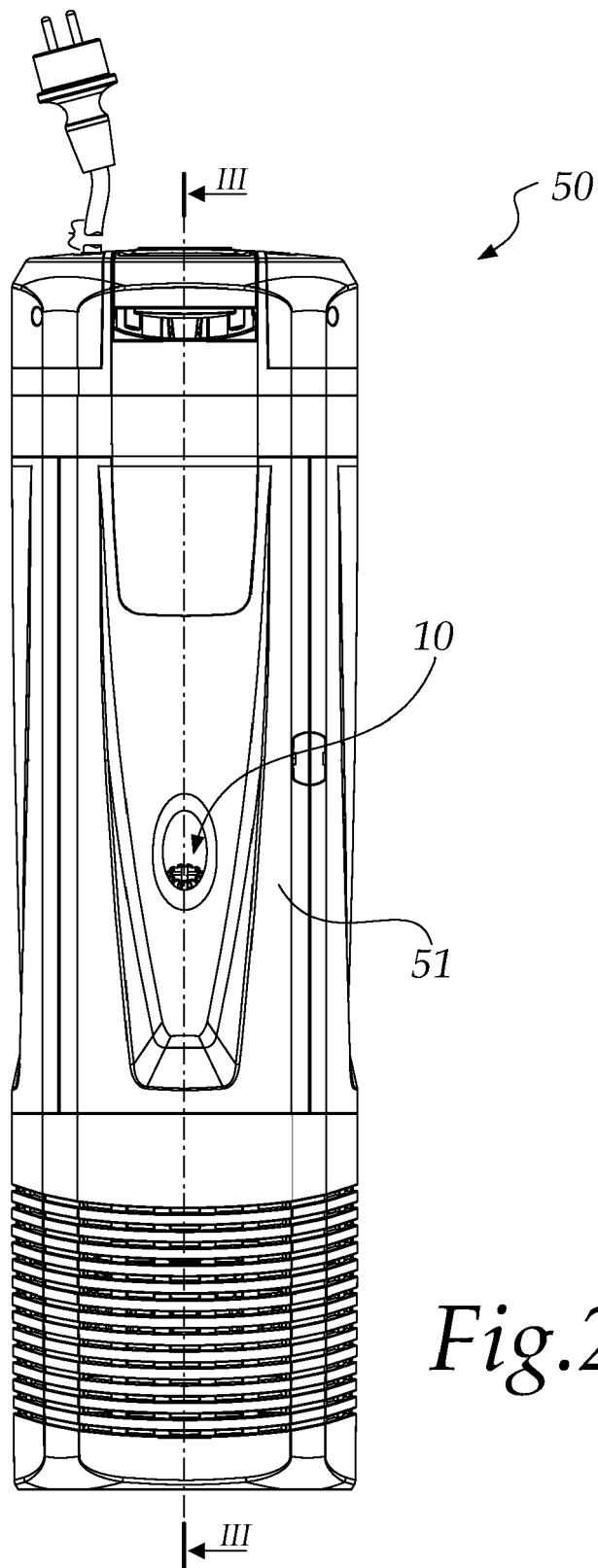


Fig.2

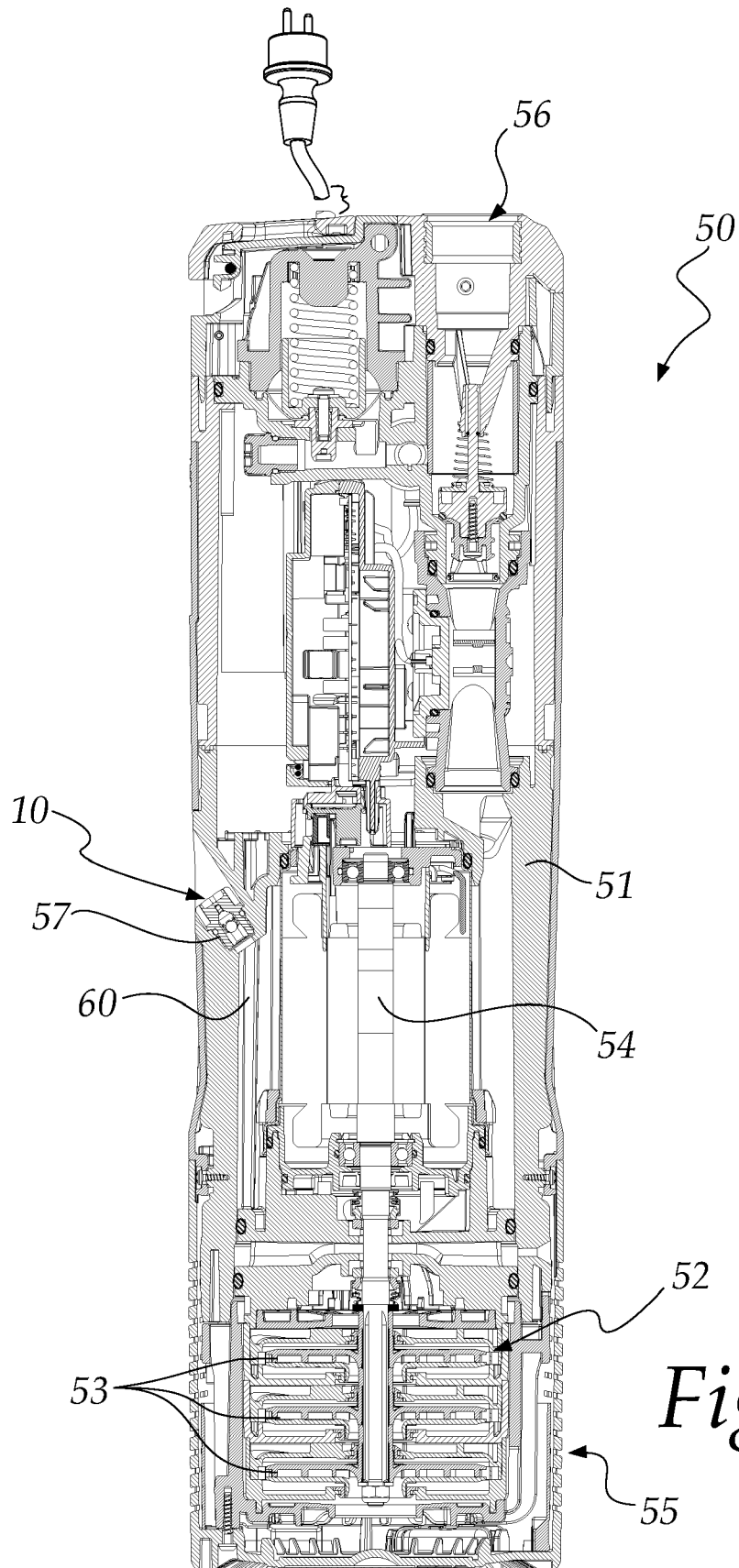


Fig.3

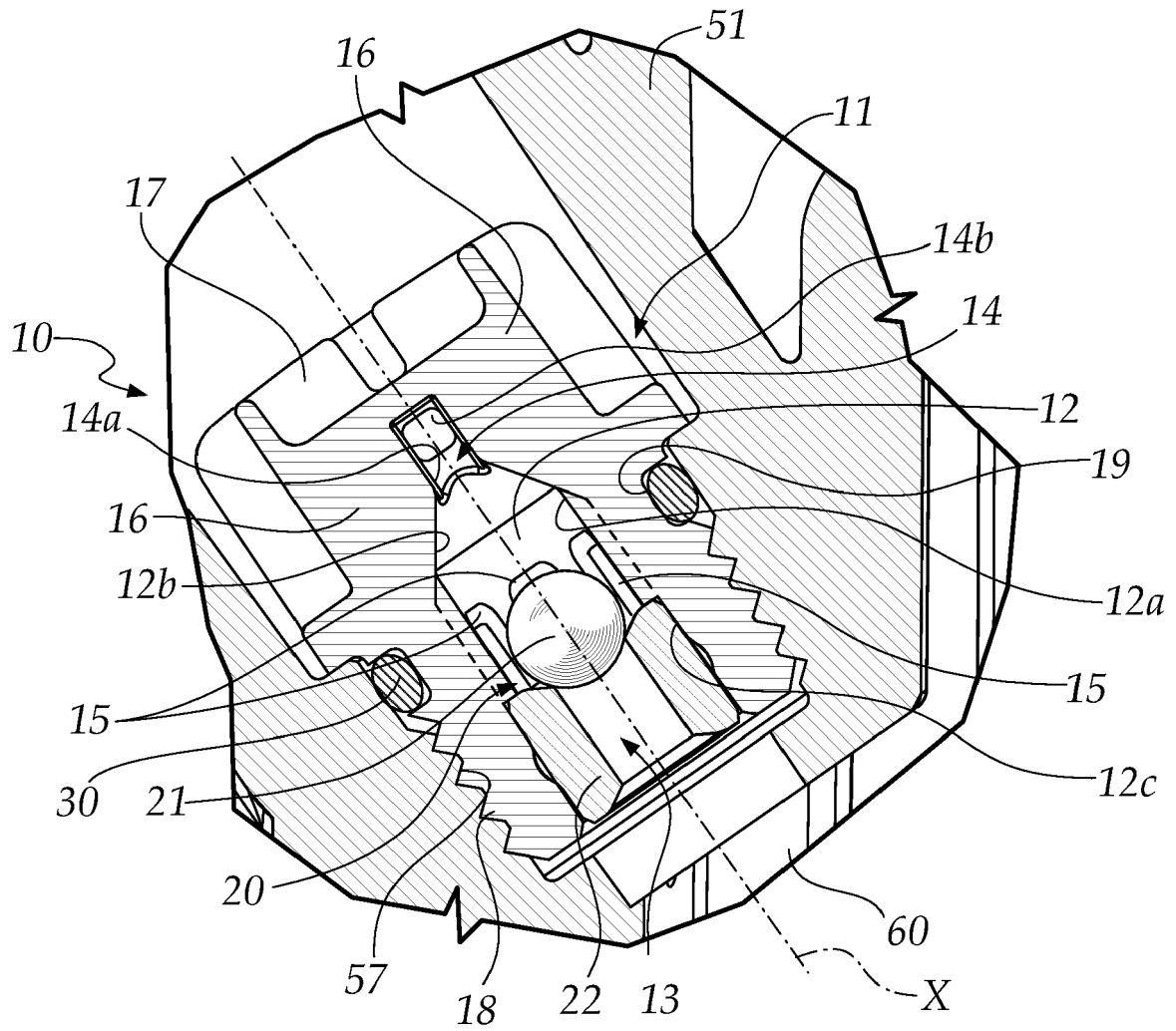


Fig.4



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Application Number
EP 20 18 4144

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 24 November 2020	Examiner de Martino, Marcello
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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