(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 540 225 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
18.09.2019 Bulletin 2019/38

(51) Int Cl.:
F04B 49/025 *(2006.01)* ***F04D 15/02*** *(2006.01)*
H01H 35/18 *(2006.01)*

(21) Application number: **19162490.7**

(22) Date of filing: **13.03.2019**

(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

(30) Priority: **14.03.2018 IT 201800003542**

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(54) CONTROL DEVICE FOR PUMPS

(57) Described is a control device (1) for pumps, comprising a hollow body (5) connected to an end of a flexible element (10), an orientation sensor (15) positioned on the hollow body (5) and configured for measuring an angle of it relative to a horizontal plane and switching it into a electric output signal, a control unit (16) positioned at the hollow body (5) and connected to the orientation sensor (15) in such a way as to receive the output signal, a power supply terminal (17a, 17b) connected to the control unit (16) and configured for connecting it to a source of electrical power (102) and a control terminal (18) connected to the control unit (16), wherein the control unit (16) is configured to determine in the control terminal (18) a power current for actuating an electric pump (101) as a function of the output signal coming from the orientation sensor (15).

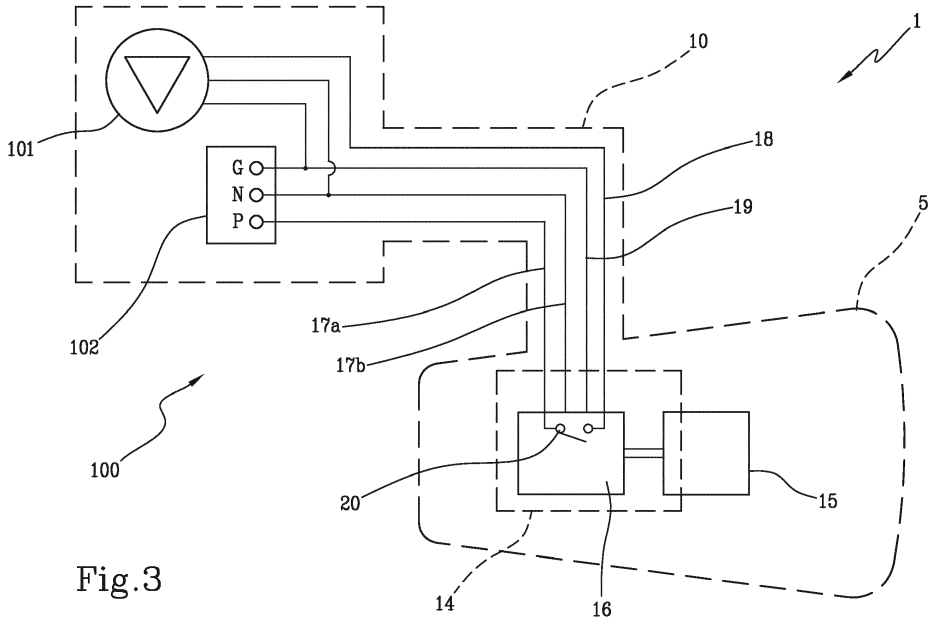

Fig.3

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Description

[0001] This invention relates to the field of the hydraulic machines, in particular a control device for pumps and a level regulator comprising the above-mentioned control device.

[0002] Devices are known for controlling pumps known as floating switches and comprising a floating body connected to a pump by means of a flexible cable.

[0003] The floating body is configured so that it can be placed in a chamber or tank "P" and, if totally or partly immersed in a liquid, be subject to a pair of forces which determine a moment on the floating element such as to incline it with an angle depending on the height of the liquid in the chamber or tank "P".

[0004] The pair of forces consists of the hydrostatic force directed upwards and the opposing force directed downwards applied by the cable which fixes the floating body to the pump.

[0005] Moreover, the floating body in the prior art devices comprises a sensor for measuring the inclination, which normally consists of a ball or a sliding body which can be moved along a guide in such a way as to activate a switch when the guide (and, therefore, the floating body) reaches a angle of inclination greater than a predetermined threshold.

[0006] In the prior art floating switches the switch is directly connected to the pump for driving it and powering it through an electrical connection inside the flexible cable.

[0007] Disadvantageously, this configuration limits, due to the intrinsic limitations of the switches of the type described which are available in the prior art, the maximum intensity of the electric current directed to the pump to 8 inductive amperes, which is not sufficient for the most heavy-duty uses.

[0008] To overcome the drawback of the low current intensity directed to the pump, level regulators have been developed comprising a floating switch configured as described above connected, on the side of the pump, to a control panel which switches the currents coming from the sensor into higher intensity currents, in such a way as to operate pumps with a greater power.

[0009] A prior art device is described, for example, in patent document DE3610984A1.

[0010] In this context, the technical purpose which forms the basis of this invention is to provide a control device for pumps and a relative level regulator which overcomes at least some of the above-mentioned drawbacks of the prior art.

[0011] More specifically, the aim of this invention is to provide a control device for pumps and a relative level regulator which can increase the electrical power available for powering the electric pump.

[0012] A further aim of this invention is to provide a control device for pumps and a relative level regulator which is less bulky than prior art devices.

[0013] The technical purpose indicated and the aims specified are substantially achieved by a control device for pumps and a relative level regulator comprising the technical features described in one or more of the appended claims.

[0014] The dependent claims correspond to possible embodiments of the invention.

[0015] Further features and advantages of the invention are more apparent in the non-limiting description which follows of a preferred embodiment of a control device for pumps and a relative level regulator illustrated in the accompanying drawings.

[0016] The description is set out below with reference to the accompanying drawings which are provided solely for purposes of illustration without restricting the scope of the invention and in which:

- Figure 1 is a simplified side view of a control device for pumps made according to the invention;
- Figure 2 is a simplified view of a configuration of use of a level regulator made in accordance with the invention;
- Figure 3 shows a schematic representation of the level regulator of Figure 2.

[0017] With reference to the accompanying drawings, a control device for pumps is indicated generically with the reference numeral 1 and it will be referred to below as "control device 1".

[0018] The control device 1 comprises a hollow body 5 extending about an axis or main plane of extension in such a way as to have, in at least one condition of use, the above-mentioned plane or main axis of extension oriented substantially parallel to the horizontal plane.

[0019] In the preferred embodiment the hollow body 5 extends along a main axis of extension and has a portion with increasing cross-section along the above-mentioned axis of extension and a rounded end portion at the end of the portion with increasing cross-section, in such a way as to be provided with a greater displacement (and therefore buoyancy) at the side of the rounded end portion.

[0020] More specifically, in the embodiment illustrated, the hollow body 5 has a substantially rounded shape having a centre of hydrostatic thrust not coinciding with the centre line of the same, but moved more to the side of the rounded end portion.

[0021] The hollow body 5 is connected at the end of a flexible element 10 and configured to be positioned in a chamber or tank "P" for controlling the level of liquid present therein.

[0022] Preferably, the flexible element 10 comprises a flexible cable 11 connectable to an electric pump 101, configured to apply on the hollow body 5 a constraining force which, in combination with the weight force acting on the hollow body 5, balances the buoyancy thrust and defines a centre of rotation about which the hollow body 5 can rotate by modifying its inclination relative to a horizontal plane.

[0023] The hollow body 5 has a shape such as to determine a buoyancy thrust acting on it which defines an arm relative to the above-mentioned centre of rotation, in such a way as to apply a moment on the hollow body 5 and determine a change in its inclination relative to the horizontal plane as a function of the volume of the immersed portion.

[0024] This causes a variation in the orientation of the hollow body 5 as a function of the height of the liquid mass in the chamber or tank "P" in which the hollow body 5 is at least partly immersed.

[0025] Preferably, the flexible cable 11 is connected to the hollow body 5 in such a way as to protrude from it along an incident direction and preferably substantially perpendicular to the main axis of extension (or of the main plane of extension in the embodiment wherein the hollow body 5 has one). According to an equivalent embodiment, the flexible cable 11 of the control device 1 is connected to the hollow body 5 in such a way as to be substantially parallel or slightly angularly spaced relative to the direction of the hydrostatic thrust force acting on it when the hollow body 5 is positioned according to the orientation typical of a configuration of normal use, except for variations of inclination due to the configuration of use in relation to the level of water in the chamber or tank "P".

[0026] Preferably, the flexible cable 11 is connected to the hollow body 5 at a lateral surface close to an end portion of it, in particular of the end portion opposite the rounded end portion described above, in such a way as to be spaced from the portion with greater buoyancy.

[0027] More specifically, the hydrostatic thrust force, which is directed upwards and of variable intensity as a function of the volume of the immersed part of the hollow body 5, the weight force directed downwards and the tension of the flexible cable 11 contribute to determining the equilibrium of forces of the hollow body 5 (and therefore its orientation in space).

[0028] Preferably, the flexible cable 11 and its connection with the hollow body 5 are configured for balancing any differences between the weight force and the of hydrostatic thrust force.

[0029] In this regard, different configurations of use are possible: in a first embodiment, illustrated in Figures 1 and 2, the weight of the hollow body 5 is greater than the intensity of the hydrostatic thrust force and the flexible cable 11 is configured to exert a tension upwards on the hollow body 5 to keep it at least partly raised relative to the bottom of the chamber or tank "P".

[0030] In a second embodiment not illustrated, the weight of the hollow body 5 is less than the intensity of the hydrostatic thrust force and the flexible cable 11 is configured to apply a downward thrust on the hollow body 5.

[0031] In both the embodiments described above, the connection point between the flexible cable 11 and the hollow body 5 determines the position of the centre of rotation of the hollow body 5 with regard to the rotations due to the variations of the thrust force.

[0032] More specifically, the flexible cable 11 is connected to the hollow body 5 in a position moved away from the centre of hydrostatic thrust in such a way as to determine an arm between the centre of hydrostatic thrust and the centre of rotation, corresponding to the moment arm of the hydrostatic thrust force acting in use on the hollow body 5.

[0033] Preferably, the above-mentioned arm is large enough to allow, in use, a variation of inclination of the hollow body 5 as a function of the intensity of the hydrostatic thrust force.

[0034] In other words, the arm is configured for determining a variation of inclination of the hollow body 5 as a function of the volume of the immersed portion of it, and therefore, in a condition of use, the quantity of liquid in the chamber or tank "P".

[0035] In the embodiment illustrated the arm is defined by the distance between the respective vertical projections on the axis (or plane) of main extension of the centre of rotation and the centre of hydrostatic thrust in an operating configuration of the control device 1, for example an operating configuration wherein the above-mentioned axis or plane of vertical extension is horizontal.

[0036] In the preferred embodiment, the hollow body 5 supports a printed circuit 14 and forms an impermeable casing for the printed circuit 14 and the flexible cable 11 has on the inside of a plurality of electrical contacts configured to connect the printed circuit 14 to the electric pump 101.

[0037] Moreover, the hollow body 5 supports an orientation sensor 15 which is configured for measuring an angle relative to a horizontal plane and switching the angle to an electrical output signal.

[0038] Preferably, the orientation sensor 15 comprises a rotary or slidable body positioned on a guide and movable along it by the force of gravity as a function of the inclination of the guide and a switch positioned along the guide in such a way as to be able to be activated by the rotary or slidable body in the presence of a predetermined angle of inclination of the guide (and therefore of the hollow body 5).

[0039] More specifically, the above-mentioned switch is connected to the printed circuit 14 or preferably linked or integrated with it in such a way as to transmit the output signal to a control unit 16, positioned at the hollow body 5 and preferably also integrated in the printed circuit 14.

[0040] Moreover, the control device 1 comprises a power supply terminal, connected to the control unit 16 for connecting it to a source of electrical power 102 through the flexible cable 11.

[0041] Preferably, the power supply terminal comprises a first phase connection 17a and a neutral connection 17b associated with it.

[0042] Moreover, the control device 1 comprises a control terminal connected to the control unit 16 preferably comprising a second phase connection 18 which passes through the flexible cable 11.

[0043] Advantageously, the control unit 16 is configured to determine a power current in the control terminal as a function of the output signal coming from the orientation sensor 15.

[0044] The above-mentioned power current is such as to actuate an electric pump 101 of a level regulator 100 to which the control device 1 can be connected by means of the flexible cable 11 in such a way that the control terminal is connected to the power supply circuit of the same.

[0045] More specifically, the control unit 16 comprises an actuation relay 20 controlled by the output signal of the orientation sensor 15 and connected to the first and second phase connection 17a and 18 in such a way as to establish and interrupt an electrical contact between them in a controlled manner in such a way as to establish and interrupt the power supply to the electric pump 101.

[0046] Preferably, the control device 1 also comprises an earthing connection 19 which passes through the flexible cable 11 for earthing all the electrical components supported by the hollow body 5.

[0047] In the preferred embodiment, the components listed above which constitute the power supply and/or control terminals and the control unit 16 are dimensioned and configured for operating in the presence of currents even greater than 16 inductive amperes and, in particular, are suitable for operating in the presence of electric currents of between 9 and 22 inductive amperes, preferably between 11 and 16 inductive amperes.

[0048] Another object of the invention is a level regulator 100 comprising the control device 1 described above, an electric pump 101 electrically connected to the second phase connection 18 and to the neutral connection 17b and a source of alternating current electrical power 102 electrically connected to the first phase connection 17a and to the neutral connection 17b.

[0049] The control device 1, depending on the orientation of the hollow body 5 establishes and/or interrupts the electrical connection between the electrical power source 102 and the electric pump 101 in such a way as to control the level of liquid in the chamber or tank "P".

[0050] Preferably, the electric pump 101 and the electrical power source 102 are configured for the operation in the presence of currents of between 9 and 16 Amperes, preferably between 11 and 14 Amperes.

[0051] The invention achieves the set aim by obviating the drawbacks of the prior art.

[0052] In fact, the control device and the regulator level described, thanks to the mutual configuration of the orientation sensor and control unit and the respective terminals, allow the use of electric pumps with a higher power compared with the prior art in which the switch opens and closes directly the circuit for powering the electric pump and without requiring the use of additional control panels, thus allowing a greater elasticity of use and resulting in a reduced overall size.

Claims

1. A control device (1) for pumps, comprising:

- a hollow body (5) connected to an end of a flexible element (10);
- an orientation sensor (15) positioned on the hollow body (5) and configured for measuring an angle of the hollow body (5) relative to a horizontal plane and converting the angle into a electric output signal;
- a control unit (16) positioned at the hollow body (5) and connected to the orientation sensor (15) in such a way as to receive the output signal;
- a power supply terminal (17a, 17b) connected to the control unit (16) and configured for connecting the control unit (16) to a source of electrical power (102);
- a control terminal (18) connected to the control unit (16),

characterised in that the control unit (16) being configured to determine in the control terminal (18) a power current for actuating an electric pump (101) as a function of the output signal coming from the orientation sensor (15).

2. The control device (1) according to claim 1, wherein the control unit (16) comprises an actuation relay (20), acting on the power supply terminal (17a, 17b) for powering a motor of the electric pump (101) as a function of the output signal.

3. The control device (1) according to claim 1 or 2, wherein the orientation sensor (15) comprises a rotary or sliding body which can be moved by gravity along a guide integral with the hollow body (5) and a switch which can be operated by the sliding body.

4. The control device (1) according to claim 2 or 3, wherein the hollow body (5) supports a printed circuit (14), and wherein the actuation relay (20) and the switch of the orientation sensor (15) are mounted on the printed circuit (14) in such a way that the switch commands the opening and closing of the actuation relay (20).

5. The control device (1) according to any one of the preceding claims, wherein the flexible element (10) comprises a flexible cable (11) connectable to an electric pump (101), the flexible cable (11) being configured to determine, in use, a change in the orientation of the hollow body (5) as a function of a height of a liquid mass in which the hollow body (5) is at least partly immersed, the control terminal (18) and/or the power supply terminal (17a, 17b) comprising a plurality of respective electrical connections positioned inside the flexible element (10) and con-

figured for connecting the control unit (16) to the electric pump (101).

6. The control device (1) according to claim 5, comprising an earthing connection (19) which passes through the flexible cable (11) for earthing the control unit (16).

7. The control device (1) according to any one of the preceding claims, wherein the power supply and/or control terminals (17a, 17b, 18) and the control unit (16) are dimensioned and/or configured for operating in the presence of currents of up to 16 inductive Amperes.

8. The control device (1) according to any one of the preceding claims, wherein the power supply terminal comprises a first phase connection (17a) and a neutral connection (17b) associated with the first phase connection (17a) and the control terminal comprises a second phase connection (18), the control unit (16) controlling an electrical contact between the first phase connection (17a) and the second phase connection (18).

9. The control device (1) according to any one of the preceding claims, wherein the hollow body (5) comprises the control unit (16), preferably positioned inside the hollow body (5).

10. A level adjusting device (100) comprising a control device (1) according to any one of the preceding claims and an electric pump (101) connected to the control terminal (18) of the control device (1) in such a way that a current coming by the control unit (16) of the control device (1) powers the electric pump (101) and preferably controls the pumping speed of the electric pump (101).

11. The level adjusting device (100) according to claim 10, wherein the electric pump (101) is configured for operation in the presence of currents coming from the control device (1) of up to 16 inductive Amperes.

Fig.1

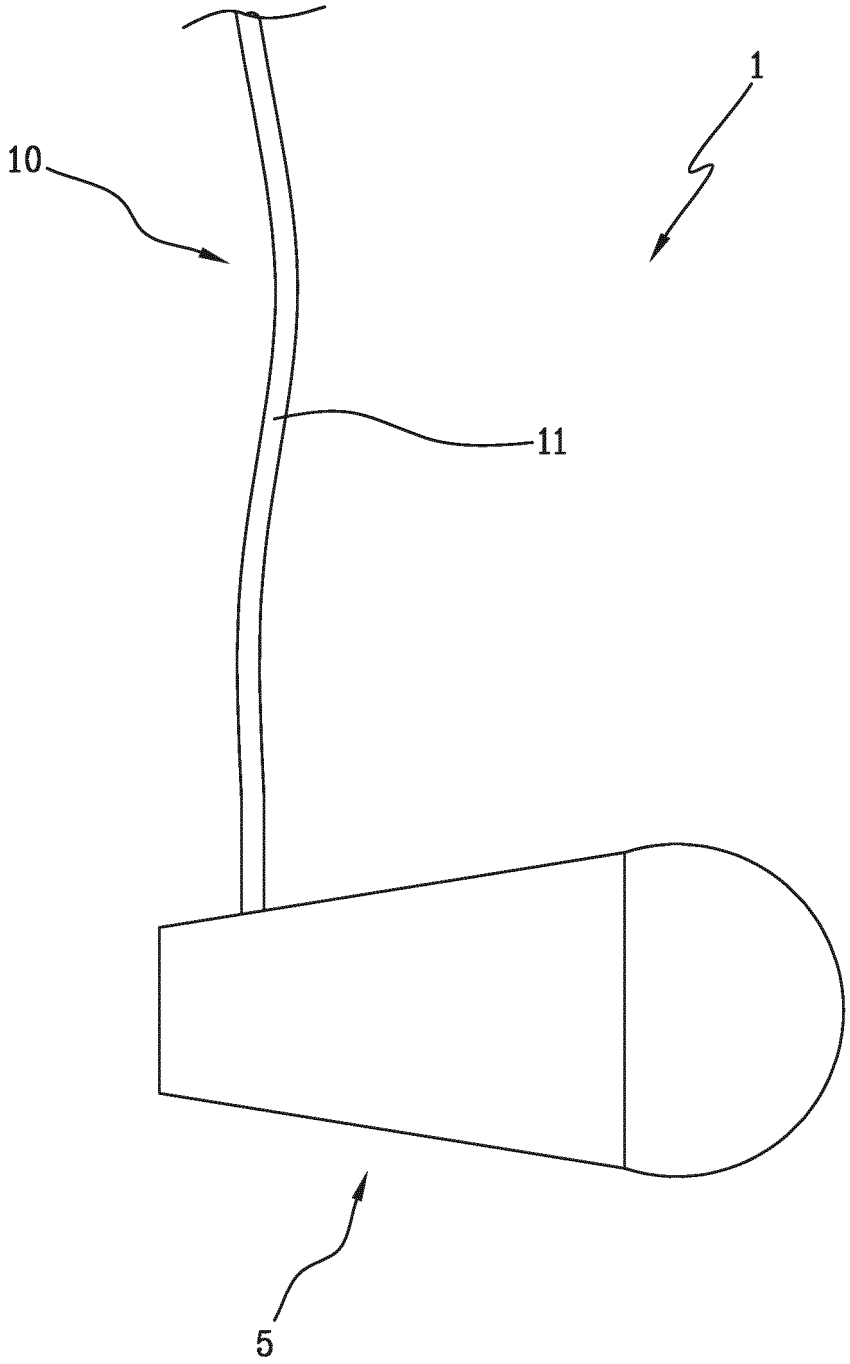
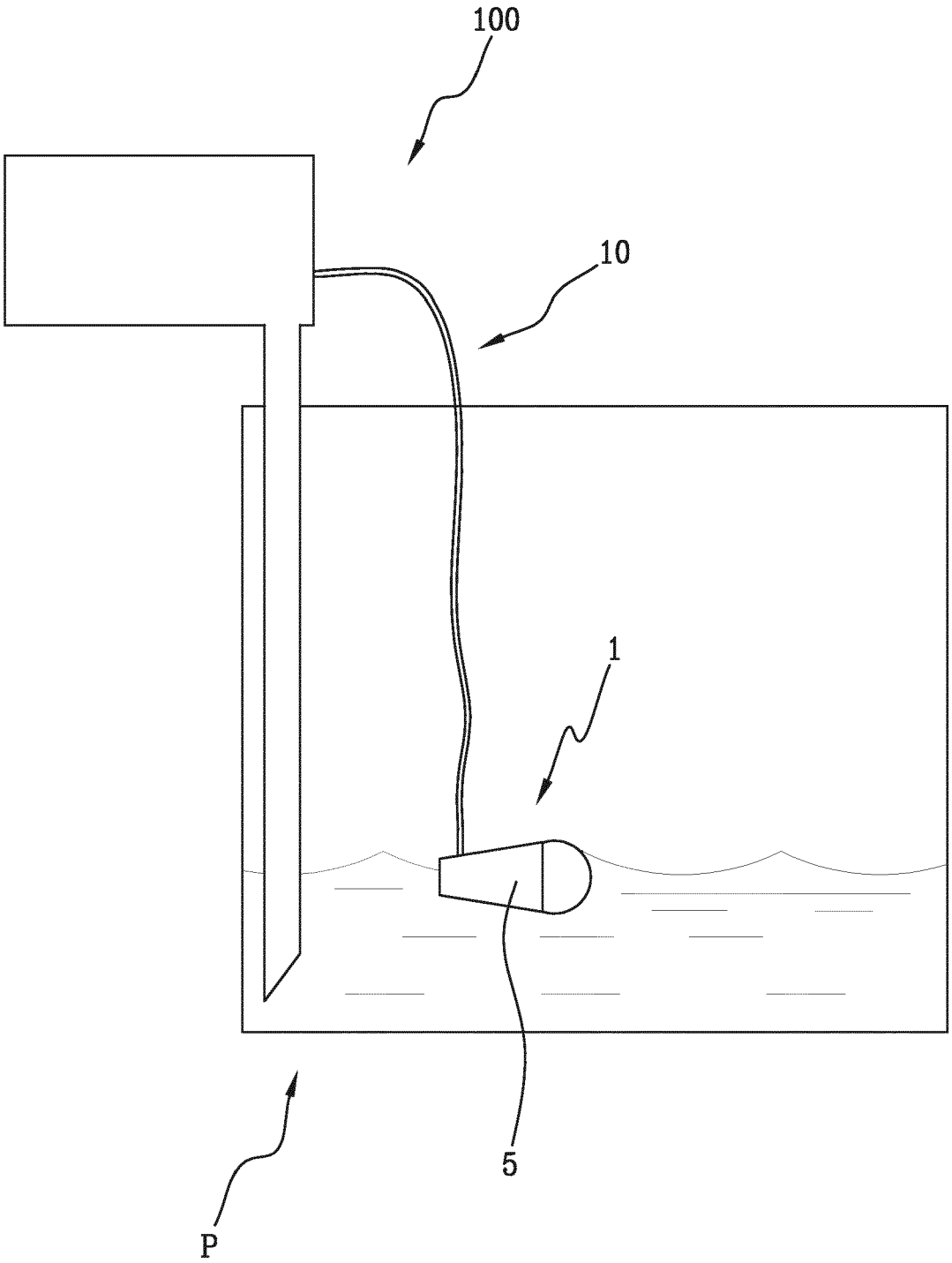


Fig.2



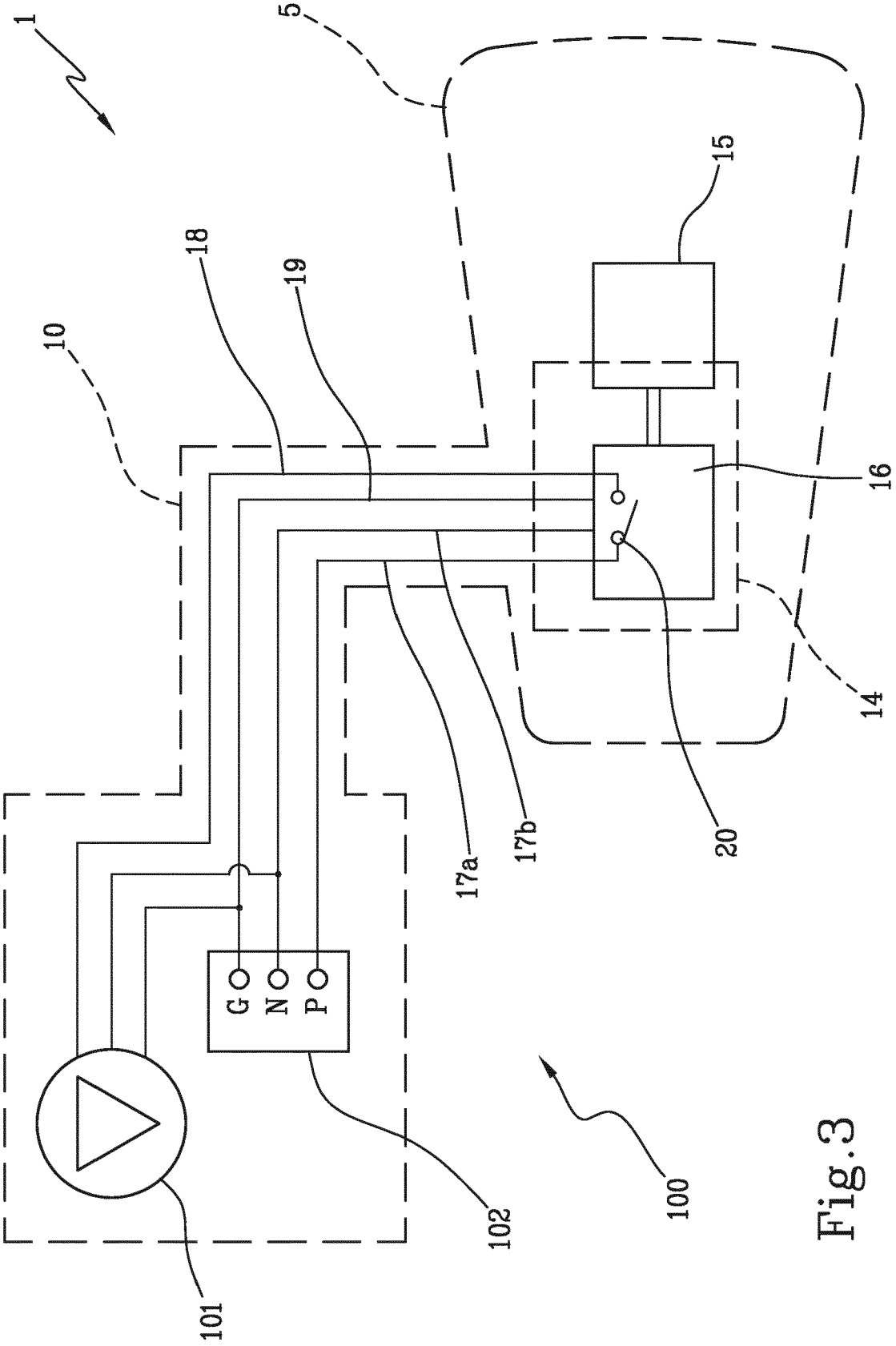


Fig.3

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EUROPEAN SEARCH REPORT

Application Number
EP 19 16 2490

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC) F04B F04D H01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	18 April 2019	Ziegler, Hans-Jürgen

CATEGORY OF CITED DOCUMENTS

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