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(54) **Apparatus for controlling start-up and shut-down of a pump of a water distribution network**

(57) Apparatus for controlling start-up and shut-down of a pump of a water distribution network, comprising:
- a chamber (12) provided with an inlet (13) which can be operatively associated with the delivery side of a pump and an outlet (14) operatively connected to the water network,
- a system (18) for detecting and/or measuring the flow of water through said outlet (14) adapted to emit a start-up signal for the pump upon reaching a preset flow threshold value,
- a device (21) for detecting and/or measuring the pres-

sure in said chamber (12) adapted to emit a start-up signal for the pump of the network upon reaching a preset value defined "cut-in pressure",
- electronic means (17) for controlling and managing operation of the device.

The distinctive feature of the invention resides in the fact that it comprises a plurality of preset cut-in pressure values stored in said electronic control and management means, and interface means (Q) available to the user to select one of the preset cut-in pressure values of said plurality.

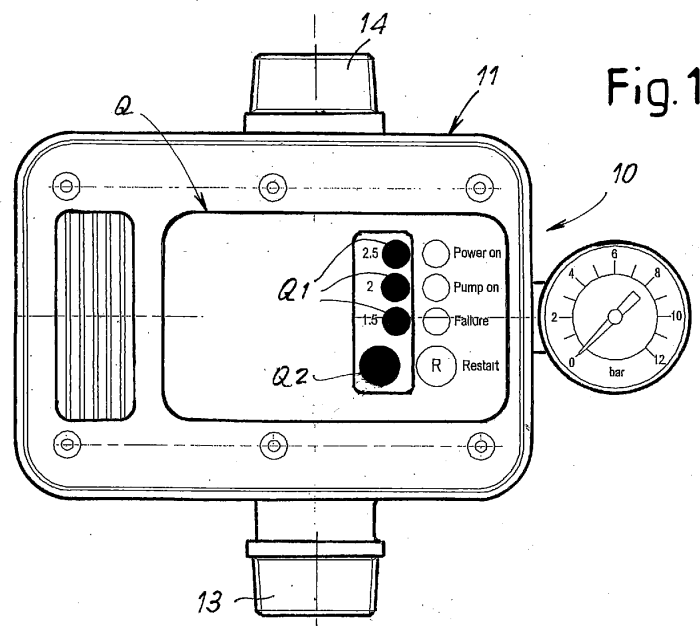


Fig. 1

Description

Technical field

[0001] The present invention relates to the field of water distribution systems and more in particular to an apparatus for controlling start-up and shut-down of a pump of water distribution network.

State of the art

[0002] As is known, pumps are used in water distribution systems to deliver water to utilities. Various solutions have been developed to enable adequate control of the start-up and shut-down of these pumps.

[0003] One of the most widely used solutions is described in the European patent EP0539721. This patent describes an apparatus comprising a chamber defined in a body, having an inlet conduit intended to be connected to the delivery side of the pump, and an outlet conduit intended to be connected to the water distribution network. A check valve is positioned in the inlet conduit while a water flow switch is positioned in the outlet conduit. Differently, a water pressure switch is located in the chamber. The inlet and outlet conduits are arranged substantially vertically.

[0004] Switching on, or start-up, of the pump is controlled by the flow switch and by the pressure switch, depending on different cases (start-up for opening of utilities, shut-down for closing of utilities, shut-down due to lack of water, system operating normally, system blocked, etc.).

[0005] The pressure switch is formed by a stem fixed to an elastic membrane and associated with a spring. The pressure of the water in the chamber presses on the membrane overcoming the force of the spring and causing the stem to take a balanced position. Variation in pressure consequently also causes variation in the position of the stem, which can translate horizontally (each position of the stem corresponds to a different pressure value in the chamber). The stem is provided with a magnet to generate a magnetic field. The body with the chamber has a compartment separated from the chamber on the bottom thereof. The control electronics of the apparatus are arranged in this compartment. These electronics comprise a reed device adapted to interact with the magnet of the stem (as is known, a reed device is in practice a normally open reed switch that closes when immersed in a magnetic field of a given value). In practice, the pressure in the chamber causes the stem, and consequently the magnet fixed thereto, to take a certain position. When the pressure drops below a certain value, for example due to utilities being opened or due to a leak in the network, the magnet moves toward the reed and surrounds it with its magnetic field. As is known, the magnetic field becomes increasingly stronger toward the polarization axis of the magnet, so that when the magnet is sufficiently close to the reed to surround it with the magnetic field

equal to the closing value of the same reed, the reed closes, closing an electrical circuit that controls switch-on of the pump. The cut-in pressure of the pump corresponds to the position of the stem that controls closing of the reed.

[0006] The cut-in pressure value, i.e. the pressure at which the pump starts up, is set in the factory, for example by regulating the axial position of the stem with respect to the spring. Once in use, this value can no longer be modified. This means that in the case of systems with pressure values variable in time or different to the design values, the cut-in pressure value may not be sufficient for requirements. In these cases, it is necessary to replace the apparatus with another one having a more suitable cut-in pressure value. If this is not possible, there is the risk that the pump will start up when this is not necessary or will fail to start up when required.

Object and summary of the invention

[0007] The object of the present invention is to solve the problems highlighted in apparatus for controlling start-up and shut-down of a pump of a water distribution network described above, and more in particular to produce an apparatus for controlling start-up and shut-down of a pump of a water distribution network which is particularly flexible when applied to various types of distribution systems.

[0008] These and other objects are achieved with an apparatus for controlling start-up and shut-down of a pump of a water distribution network as claimed in the appended claim 1.

[0009] According to the main aspect of the invention, the apparatus comprises

- a chamber provided with an inlet which can be operatively associated with the delivery side of a pump and an outlet operatively connected to the water network,
- a flow switch, adapted to emit a start-up signal for the pump upon reaching a preset flow threshold value,
- a pressure switch adapted to emit a start-up signal for the pump of the network upon reaching a preset value defined "cut-in pressure" in said chamber;
- electronic means for controlling and managing operation of the device,

the distinctive feature of the apparatus is that of comprising a plurality of preset cut-in pressure values stored in the electronic control and management means, and interface means available to the user to select one of the preset cut-in pressure values of said plurality.

[0010] In practice, the apparatus according to the invention is an electronic pressure and flow switch, i.e. a device adapted to drive a water pump, switching it on and off on the basis of the pressure conditions of the hydraulic system in which it is inserted and of the flow of

water required by the user.

[0011] Both the pressure of the system and the flow required are detected with a system that detects the presence or absence of both the aforesaid parameters (pressure, flow), identifying whether these are above or below a given threshold value. The threshold pressure is said cut-in pressure.

[0012] In particular, the pump is switched on concurrently with the transition below this pressure value.

[0013] Normally, as specified above, apparatus of this type, as described in EP0539721, are characterized by a single cut-in pressure value, which is predetermined in the factory and maintained for the whole of the period of use of the apparatus (for example 1.5 bar).

[0014] A distinctive feature of the invention is in practice that of providing the user with a plurality of cut-in pressure values, one of which can subsequently be chosen by the user on the basis of the conditions of the specific hydraulic system (for example, 3 levels: 1.5, 2.0, 2.5 bar).

[0015] In a preferred embodiment of the invention, the cut-in pressure is detected through a system comprising, in its base elements, a magnet (mounted inside the movable stem of the apparatus), the position of which is variable along an axis, on the basis of the pressure of the system, and a reed device, mounted on the electronic card of the device, the position of which is fixed. During decrease of the pressure in the system, the magnet moves toward the reed: when the position is such that the magnetic field is sufficiently strong, the contact of the reed closes, generating a signal that is interpreted by the electronic circuit as cut-in pressure, activating a relay that switches on the pump.

[0016] The value of the cut-in pressure depends on the "sensitivity" of the reed contact to the field generated by the magnet; according to the invention, this value is varied by acting on the magnet-reed system. To reach this objective, an example of embodiment provides for the positioning, on the electronic card of the apparatus according to the invention, for example, of two coils or inductors that can be polarized (i.e. capable of generating a magnetic field), which interact magnetically on the magnet-reed system, consequently modifying the behavior of the same reed.

[0017] In this example, the coils are placed as adjacent as possible to the reed, in a fixed position on the electronic card; consequently, the magnet is the only moving element of the whole system.

[0018] The coils are driven through a specific electronic circuit, which sets the polarization level (i.e. the intensity of the magnetic field generated) suitable to obtain the desired cut-in value: the higher the polarization value is, the greater the effective sensitivity of the reed, and consequently also the cut-in pressure, will be.

[0019] A given polarization level, which is maintained constant until the selection is modified by the user, corresponds to a given cut-in value; when a different value is chosen by the user, the polarization is modified, taking

it to a new level. The choice of the cut-in pressure value, i.e., in the preferred embodiment, the polarization level of the coils, is implemented by the user simply by pressing a button, viewing the selection, for example, through an LED indicator.

[0020] The polarization levels are predetermined during manufacture, through comparison with a pressure sensor of reference, and stored in the memory of the device permanently.

[0021] Preferably, when the apparatus is disconnected from the power supply, the last setting selected is stored in the memory of the device.

Brief description of the drawings

[0022] Further characteristics and advantages of the invention will be more apparent from the description of a preferred but non-exclusive embodiment thereof, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Fig. 1 represents a front view of the apparatus according to the invention;

Fig. 2 represents a schematic front view of the card containing the reed for activation of the pump and the coils for adjusting the sensitivity of this reed;

Fig. 3 represents a schematic top view of the card of Fig. 2, with the position of the reed activation magnet highlighted;

Fig. 4 represents a side view of the apparatus of Fig. 1, in section, with the pump shut down and maximum pressure in the chamber of the apparatus;

Fig. 5 represents the view of Fig. 4 showing the apparatus at a first cut-in pressure;

Fig. 6 represents the view of Fig. 4 showing the apparatus at a second cut-in pressure;

Fig. 7 represents the view of Fig. 4 showing the apparatus at a third cut-in pressure.

Detailed description of an embodiment of the invention

[0023] With reference to the aforesaid figures, an apparatus for controlling start-up and shut-down of a pump of water distribution network is indicated as a whole with the number 10.

[0024] This apparatus comprises a casing 11, which defines a first chamber 12 provided with an inlet 13 which can be operatively associated with the delivery side of a pump (not shown in the figures) and an outlet 14 to connect to the distribution network (also not shown in the figures).

[0025] The casing 11 also comprises a second chamber 15, hydraulically isolated from the first chamber 12 by means of a wall 16. This second chamber houses therein at least part of the electronic means for controlling and managing the apparatus, and in particular a card 17 with electronic components mounted thereon, some of which are described below.

[0026] At the outlet 14 there is arranged a system for detecting and/or measuring the flow of water there-through, such as, in this example, a flow switch 18 of known type, which comprises, for example, a slider 19 arranged slidingly in the vertical portion of the outlet 14 and movable upward by the flow of water, when present, opposing its weight force. When there is no flow, the slider 19 remains lowered to close the outlet 14. The head 19A of the slider has a given hydraulic tightness with the outlet 14 and is dimensioned so that a minimum predetermined flow rate corresponds to the pressure jump sufficient to overcome the weight of the slider.

[0027] The flow switch also comprises a first magnet 20A fixed on one side of the slider 19 close to the wall 16, and a first reed switch 20B arranged on the card 17. When the flow is below the preset threshold flow value that enables lifting of the slider, the magnet interacts with the reed switch, which is closed. When the slider is lifted, the magnet disengages magnetically from the switch, which opens, resulting in the generation of a signal enabling pump start-up.

[0028] On the vertical portion of the inlet 13 there is provided a check valve 20 for water from the first chamber toward the pump.

[0029] In the first chamber 12 there is provided a device 21 for detecting and/or measuring the pressure in said chamber, such as a pressure switch, adapted to emit a start-up signal for the pump upon reaching a preset value defined "cut-in pressure".

[0030] According to the invention, the apparatus 10 comprises a plurality of preset cut-in pressure values stored in the electronic control and management means, so that the user is able to choose, according to needs, the cut-in pressure value most suitable for the actual plant design.

[0031] To choose the most suitable cut-in pressure value, the apparatus is provided with interface means available to the user to select one of the preset cut-in pressure values of said plurality. In this example, these interface means comprise, for example, a control panel Q arranged on the outside of the casing 11, on which there are available selection controls and other operating indicators. With reference to Fig. 1, the control panel Q has three LEDs Q1 that indicate the cut-in pressure value currently in use (in the specific example 1.5/2/2.5 bar) and a button Q2 that enables selection of the most suitable value, by multiple pressing.

[0032] Preferably, this device 21 for detecting and/or measuring the pressure in the chamber 12 comprises sensor means 22, better described below, sensitive to the magnetic field and adapted to produce an effect or a signal when the size of the magnetic field that surrounds these sensor means exceeds a given operating value, corresponding to the cut-in pressure, and therefore the effect or signal generated by these sensor means 22 is correlated with the drive of the pump.

[0033] The device 21 also comprises a body 23 sensitive to the pressure in the first chamber 12, movable

along a direction as a function of the pressure value in the same chamber 12 in such a manner that a portion 23A thereof moves toward or away from the sensor means 22 on the basis of the pressure in the chamber.

[0034] For example, this body 23 is a stem constrained to translate in a predetermined direction (for example horizontal). According to a configuration of known type, this stem 23 is fixed to a membrane 24 and interacts with a spring 25 in such a manner that the stem is adapted to take an axial position inside the chamber as a function of the pressure present in the chamber. When the pressure increases, the stem is drawn by the membrane in a direction of compression of the spring 25, moving away from the wall 16 that divides the first chamber from the second chamber with the card 17 and the sensor means 22; when the pressure drops, the spring 25 thrusts the stem in the opposite direction (toward the wall 16).

[0035] It can be noted how the end 23A of the stem 23 is adapted to enter a recess 16A defined on the wall 16, which extends inside the second chamber 15; the card 17 has a through hole 17A to enable arrangement of the recess 16A.

[0036] The device 21 for detecting and/or measuring the pressure in the first chamber also comprises magnetic means 26 integral with the portion of the stem 23 that moves toward the sensor means 22. These magnetic means 26 are adapted to produce a magnetic field, hereinafter defined primary magnetic field, the field lines of which are indicated with the letter M1.

[0037] Preferably, the sensor means 22 can consist of a second reed device (hereinafter also indicated with the number 22) and the magnetic means 26 can consist of a magnet (hereinafter also indicated with the number 26), in such a manner that when the magnet 26 moves toward the second reed device, the reed switch is closed and a start-up signal for the pump is generated. It is clear that the value of the primary magnetic field M1 that surrounds the sensor means 22, i.e. the reed device, is correlated to the pressure value in the chamber, as the position of the stem 23 with respect to the reed device 22, i.e. the distance of the magnet 26 from this reed device, is a function of the pressure in the chamber.

[0038] Advantageously, the device for detecting and/or measuring the pressure 21 comprises means 27 adapted to generate at least one secondary magnetic field (for example, two secondary magnetic fields, but which can also be considered as components of a single secondary magnetic field), distinct from the primary magnetic field generated by the magnet 26, adapted to surround the second reed device 22. Therefore, this second reed device 22 is surrounded by the at least one secondary magnetic field and, when the stem 23 moves the magnet 26 toward the reed, due to a negative pressure variation, also by the primary magnetic field M1 generated by the magnet 26. Therefore, the operating value of the magnetic field that causes on the reed device 22 closing of the switch and generation of the signal/ effect that enables activation of the pump, is given by the sum of the

value of the secondary magnetic fields and of the value of the primary magnetic field that surrounds the second reed device 22.

[0039] In this configuration, a correlated value of secondary magnetic field (or secondary magnetic fields) that surrounds the second reed device 22 corresponds to each said preset cut-in pressure value of the plurality of values selectable by the user (in the example of the figures, three values, respectively 1.5, 2 and 2.5 bar; it is understood that in other examples these values can only be two or can also be more than three).

[0040] In practice, the presence of a secondary magnetic field modifies the "sensitivity" of the second reed device 22, i.e. a lower value of primary magnetic field is sufficient (with respect to the case with no secondary magnetic field) to cause it to close, producing the effect/signal that activates the pump; a position of the magnet moved further away from the second reed device with respect to the case of no secondary magnetic field i.e. a position of the stem 23 corresponding to a higher cut-in pressure, corresponds to a lower value of primary magnetic field. Figs. 5, 6 and 7 show the different positions of the stem 23 with the magnet 26 with respect to the second reed device 22, respectively corresponding to the cut-in pressures equal to 2.5 - 2 - 1.5 bar. The sensitivity of the second reed device 22 is indicated in the figures by an activation area S inside which the flow lines of the primary magnetic field M1 of the magnets must be contained. According to the value of the secondary magnetic field, this area S has larger or smaller dimensions.

[0041] Preferably, the lower cut-in pressure corresponds to the case in which the secondary magnetic field is substantially null, i.e. corresponds to the conventional case.

[0042] According to the preferred embodiment, the means 27 that generate the secondary magnetic field consist of at least one coil or inductance through which the electrical current circulates, thereby generating a magnetic field that surrounds the second reed device 22. In this example, there are two coils 28, arranged on the card 17 with their axes parallel to each other, which generate two secondary magnetic fields; in particular, they are arranged on the same side of the card as the reed, but on opposite sides of the reed, as can be seen in Figs. 2 and 3 (for example, with the reed 22 prevalently comprised in the space defined between the two axes of the coils). The movement of the magnet is preferably orthogonal or almost orthogonal to the axes of the coils and to the card (and preferably orthogonal to the card).

[0043] The electronic means for controlling and managing operation of the device preferably comprise a voltage stabilizer inside the circuit (not shown), a microcontroller processing circuit, with the program for managing the whole of the apparatus (not shown), a user interface (the control panel Q), a circuit for driving the pump (not shown), the first reed contact 20B for detecting the flow, the second reed contact 22 for detecting the pressure; a pair of coils (inductances) 28.

[0044] Advantageously, the electronic control and management means also comprise means for varying the electrical current circulating along the coils 28, not described herein but of a type well known to the person skilled in the art. For example, these variation means can be activated by pressing the button Q2 on the control panel Q. In practice, by pressing the button Q2 this varies, through an appropriate drive circuit, the current circulating along the coils and therefore the total secondary magnetic field that surrounds the second reed device 22, varying the sensitivity thereof, as described above. Therefore, a given value of electrical current circulating along the coils (which can also be equal to "0") corresponds to each cut-in pressure.

[0045] As already stated, the value of the hydraulic pressure for which the second reed 22 is activated is called cut-in pressure; the characteristic of the apparatus is that of providing a plurality of cut-in pressure values, which means that it can be regulated by the user.

[0046] The cut-in pressure value depends firstly on the primary magnetic field generated by the magnet 26 (and therefore by its position with respect to the second reed device 22). According to the preferred example, the apparatus enables regulation of the cut-in pressure value by modifying the magnetic field that surrounds the reed 22 produced through the insertion of two coils (one or more) in position adjacent to the same reed device.

[0047] The typical sequences of actions that are performed during use of the apparatus are described below.

[0048] Standard operation, with coils not polarized, i.e. with no current passing through (as if they were not present). The typical sequence of actions is as follows:

- starting from the situation in which the hydraulic system is pressurized (for example 5 bar)
- the magnet is in "rest position" (position A1 in Fig. 3);
- the polarization level of the coils is equal to L1 (preferably null, i.e. no current is circulating and the secondary magnetic field generated thereby is null);
- the magnetic field generated (very small or null value) is insufficient to activate the reed, therefore the contact is open and the pump is not activated;
- the hydraulic pressure starts to decrease, consequently the stem 23 starts to move, with the magnet 26 that starts to move in the direction of the reed 22 (according to the direction z);
- when the magnet 26 reaches the position A2, the reed contact closes, and the microcontroller interprets this as permission to start the pump;
- the cut-in pressure of the pump, at the position A2, is called P1 (for example 1.5 bar).

[0049] Operation with the cut-in pressure regulated (with coils polarized, i.e. generating a secondary magnetic field). The typical sequence of actions is as follows:

- starting from the situation in which the hydraulic

system is pressurized (for example 5 bar);

- the magnet is in "rest position" A1;
- the polarization level of the coils is taken to a value (non null) equal to L2 ($L2 > L1$);
- the magnetic field generated is in any case insufficient to activate the second reed 22, therefore the contact is open and the pump is not activated;
- the hydraulic pressure starts to decrease, consequently the magnet starts to move in the direction of the second reed 22;
- in order for the reed contact 22 to close, it is now sufficient for the magnet 26 to reach the position A3, as the presence of the additional contribution of the secondary magnetic field generated by the coils 28 has increased the total value of the magnetic field that acts on the reed 22;
- the cut-in pressure of the pump, at the position A3, is called P2 ($P2 > P1$, for example 2 bar).

[0050] It is evident that the sequence of actions in the two cases is the same, but with a change in the polarization level applied to the coils (i.e. the current that circulates therethrough and consequently the value of magnetic field that they generate).

[0051] The number of polarization levels corresponds to the number of cut-in pressures to be placed at the user's disposal.

[0052] The values are pre-loaded in the memory of the electronic means, and determined during calibration of the apparatus.

[0053] It is understood that the drawing only shows possible non-limiting embodiments of the invention, which can vary in forms and arrangements without however departing from the scope of the concept on which the invention is based. Any reference numerals in the appended claims are provided purely to facilitate the reading thereof, in the light of the above description and accompanying drawings, and do not in any way limit the scope of protection.

Claims

1. Apparatus for controlling start-up and shut-down of a pump of a water distribution network, comprising:

- a chamber (12) provided with an inlet (13) which can be operatively associated with the delivery side of a pump and an outlet (14) operatively connected to the water network,
- a system (18) for detecting and/or measuring the flow of water through said outlet (14) adapted to emit a start-up signal for the pump upon reaching a preset flow threshold value,
- a device (21) for detecting and/or measuring the pressure in said chamber (12) adapted to emit a start-up signal for the pump of the network upon reaching a preset value defined "cut-in

pressure",

- electronic means (17) for controlling and managing operation of the device,

characterized in that it comprises a plurality of preset cut-in pressure values stored in said electronic control and management means, and interface means (Q) available to the user to select one of the preset cut-in pressure values of said plurality.

2. Apparatus according to claim 1, wherein said device for detecting and/or measuring the pressure (21) in said chamber (12) comprises:

- sensor means (22), sensitive to the magnetic field, adapted to produce an effect/signal when the size of the magnetic field that surrounds said sensor means (22) exceeds a given operating value, said effect/signal being correlated with the drive of said pump,

- a body (23) sensitive to the pressure in said chamber (12), movable along a direction as a function of the pressure value in said chamber (12) in such a manner that a portion (23A) thereof moves toward or away from said sensor means (22) on the basis of the pressure in said chamber (12),

- magnetic means (26) integral with said portion (23A) of movable body, adapted to produce a magnetic field, defined primary magnetic field (M1); the value of the primary magnetic field (M1) that surrounds said sensor means (22) being correlated to the pressure value in said chamber (12), the position of said body (23), or the distance of said magnetic means (26) from said sensor means (22), being a function of the pressure in said chamber (12).

3. Apparatus according to claim 2, wherein said sensor means (22), sensitive to the magnetic field, comprise a reed device.

4. Apparatus according to claim 2 or 3, wherein said magnetic means comprise at least one magnet (26) integral with said body (23).

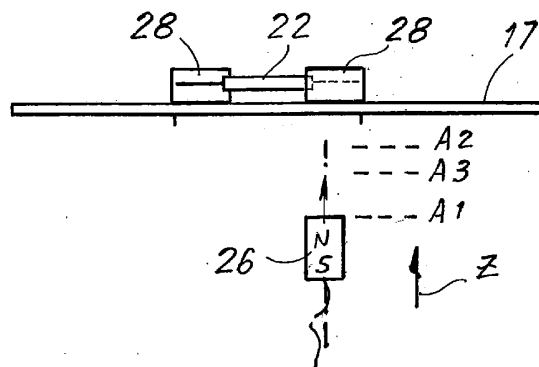
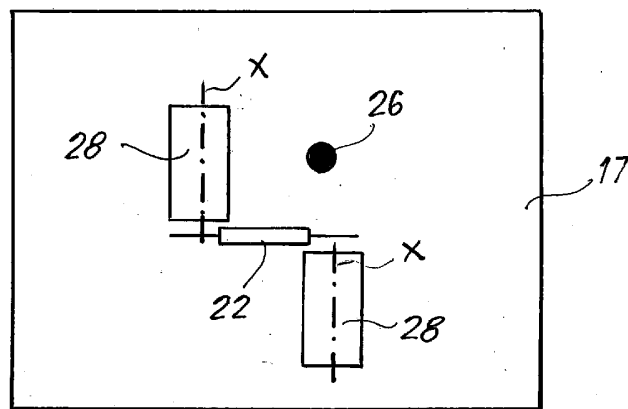
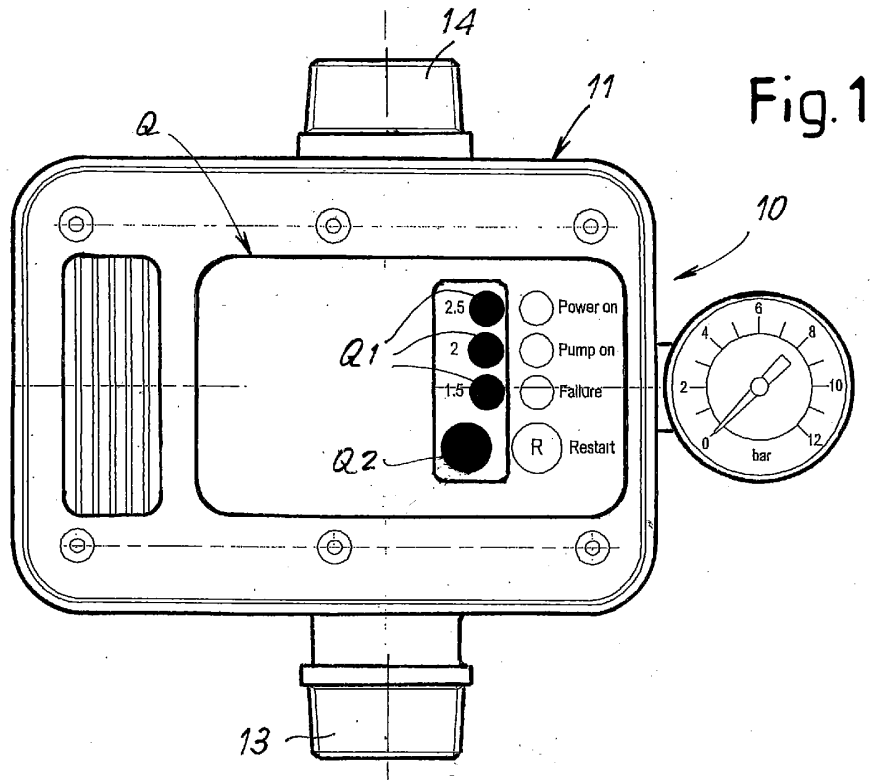
5. Apparatus according to one or more of claims 2, 3 or 4, wherein said device for detecting and/or measuring the pressure (21) in said chamber (12) comprises means (28) adapted to produce at least a secondary magnetic field, distinct from the primary magnetic field (M1) produced by said magnetic means (26), adapted to surround said sensor means (22), said at least one secondary magnetic field surrounding said sensor means (22) with a value such that it does not produce said effect/signal; the operating value that produces said signal/effect being given by the sum of the value of secondary magnetic field that

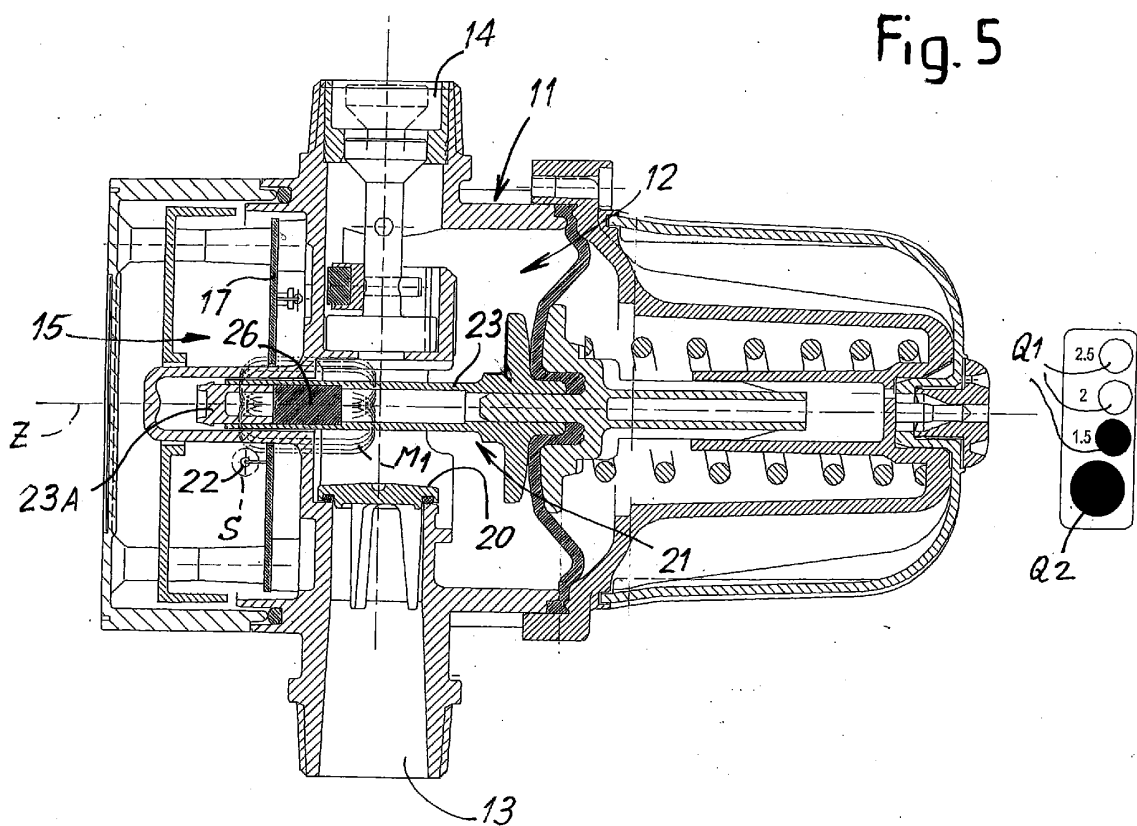
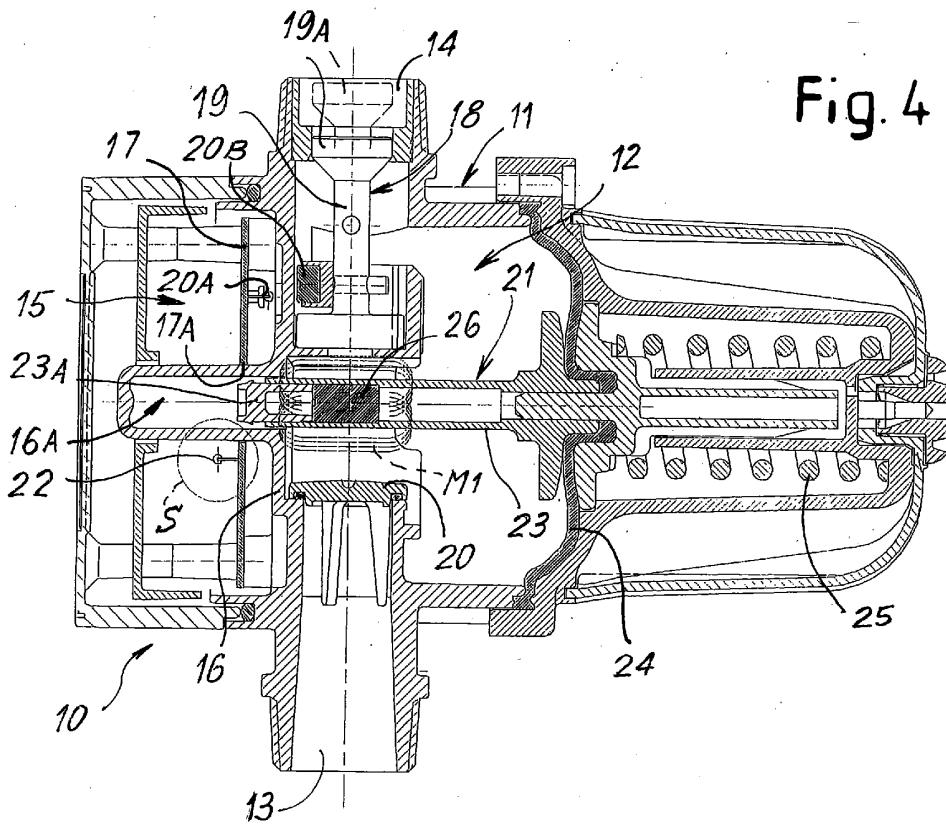
surrounds said sensor means (22) and of the value of primary magnetic field (M1) that surrounds the same sensor means (22), a correlated value of said at least one secondary magnetic field that surrounds said sensor means (22) corresponding to each said preset cut-in pressure value of said plurality of values selectable by the user. 5

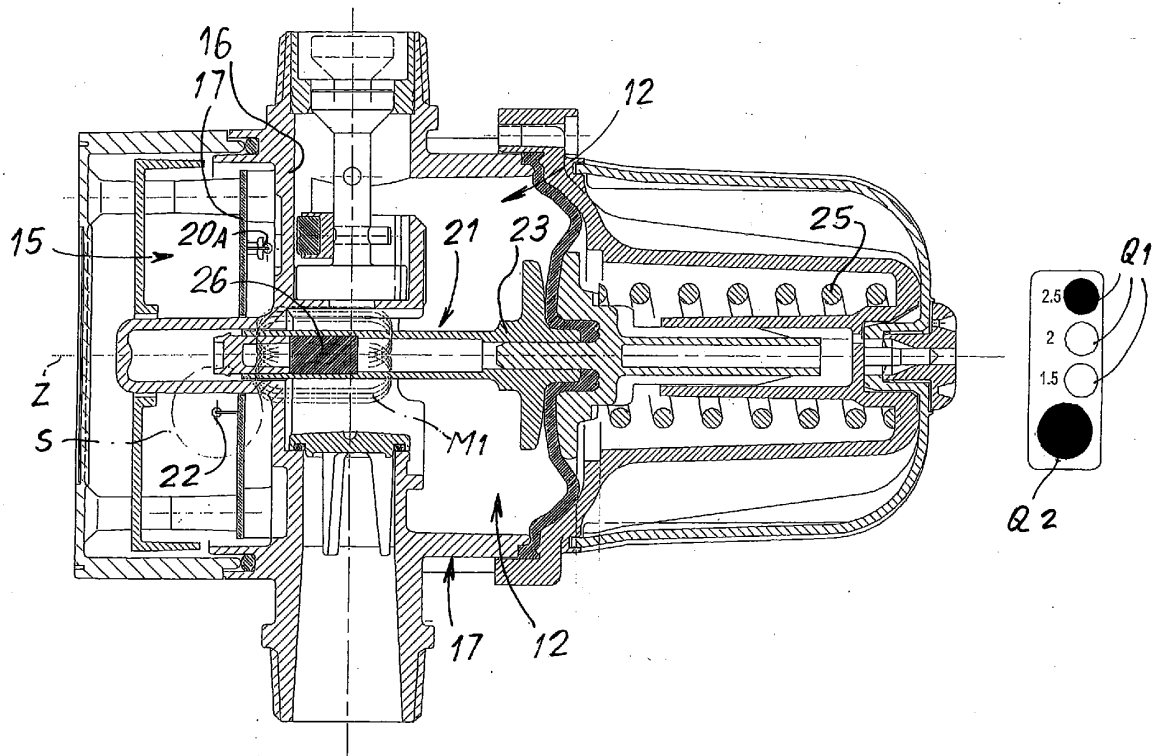
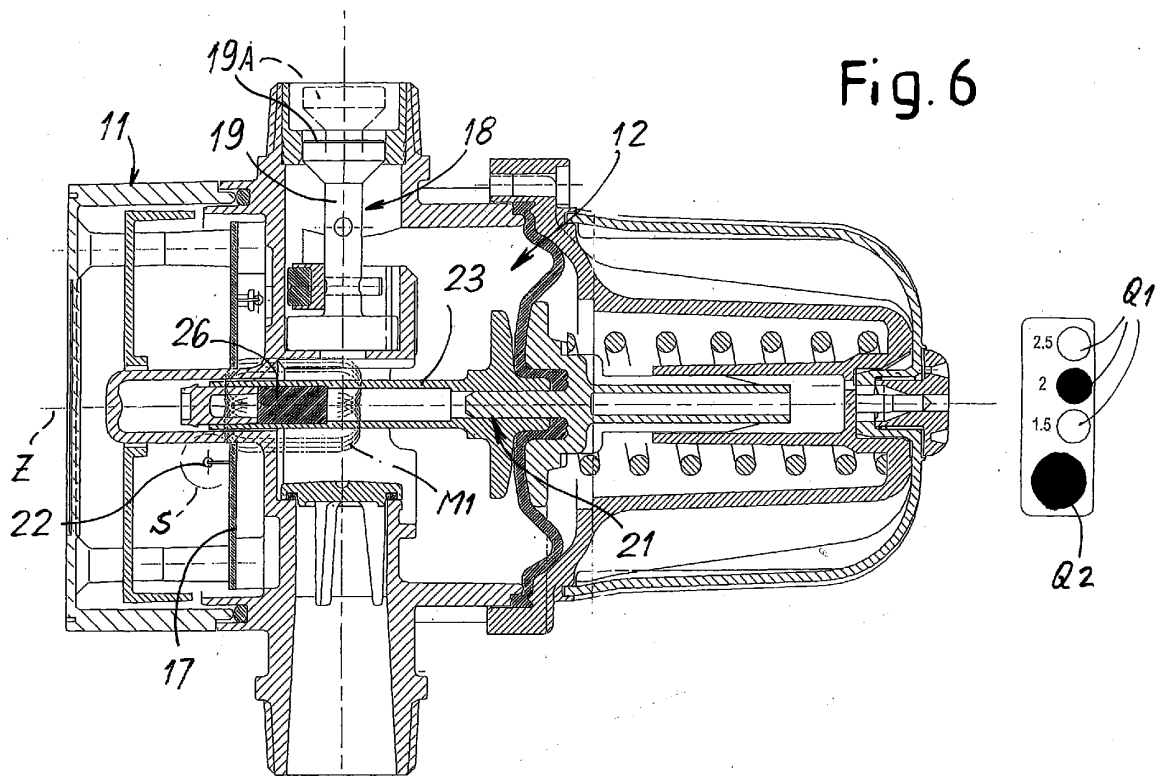
6. Apparatus according to claims 3, 4 and 5, wherein said means for producing said at least one secondary magnetic field comprise at least one coil or inductance (28) adapted to generate a magnetic field that surrounds said reed device (22). 10
7. Apparatus according to claim 6, wherein said means for producing said at least one secondary magnetic field comprise means for variation of the current circulating along said coil/inductance (28) associated with said electronic means and with said interface means (Q) on which there is at least one control adapted to vary the quantity of said current in said at least one coil (28). 15 20
8. Apparatus according to claim 6 or 7, comprising an electronic card (17) in which there is arranged said reed device (22) and at least one coil (28) generating said at least one secondary magnetic field arranged on the same side of said card (17) with respect to said reed device (22). 25 30
9. Apparatus according to claim 6, 7 or 8, comprising at least two coils (28) generating said at least one secondary magnetic field arranged with its axes (x) of polarization mutually parallel; the axis of polarization of said at least one magnet (26) being orthogonal to the plane on which the axes of said coils (28) lie; preferably, the direction of movement of said at least one magnet (26) being orthogonal to the plane on which the axes of said coils (28) lie; the plane on which the axes of said coils (28) lie preferably being substantially parallel to said electronic card (17). 35 40
10. Apparatus according to claim 9, wherein said reed device (22) is comprised in a space defined between two parallel planes on which the axes of said coils (28) lie. 45

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EUROPEAN SEARCH REPORT

Application Number
EP 13 16 4394

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	W0 98/36339 A1 (HYDROSERVICE S.R.L. [IT]) 20 August 1998 (1998-08-20)	1	INV. F04B49/02 F04B49/06 F04B49/08 F04D15/02 G01L9/14 G05D7/01
A	* figures 1,2,4 * * page 5, line 9 - page 9, line 16 * * claim 1 *	2-10	
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