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(54) Multi-stage electric pump

(57) Multi-stage electric pump (1), which comprises a multi-stage pump (2) coupled to an electric motor (3). The multi-stage pump (2) is essentially formed from a tubular body (4) which, at the end opposite that of the electric motor (3), is equipped with a water inlet (6) and

a suction chamber (7) and, at the other end beside the electric motor (3), with a discharge chamber (8) and a water outlet (9), which is equipped with a pressure detector (10) and a non-return valve (11) equipped with a zero or minimum discharge detector (12).

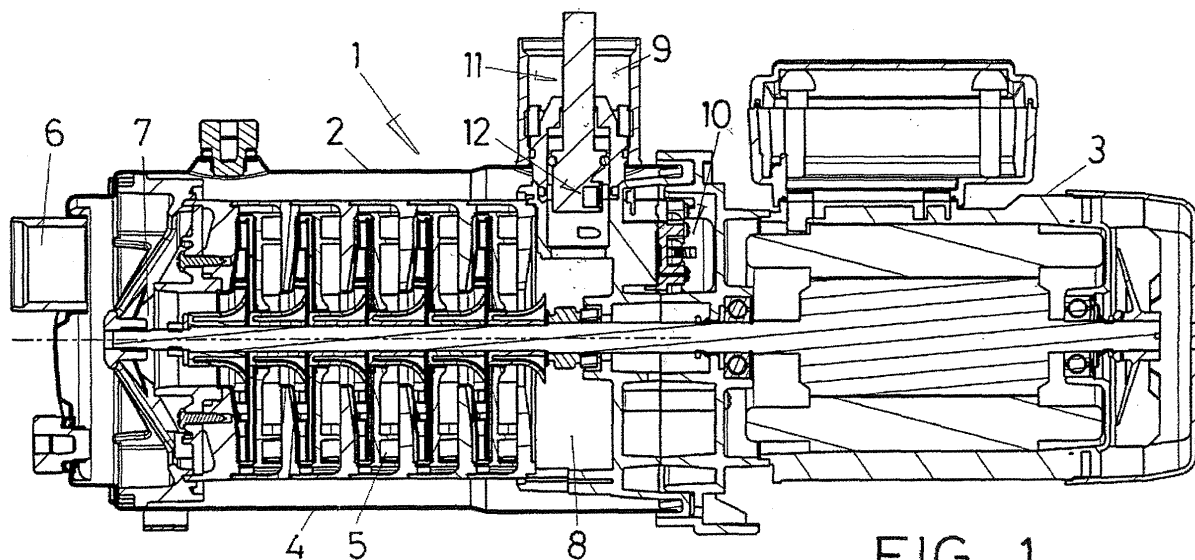


FIG. 1

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Description

Technical field of the invention

[0001] The object of the invention is a multi-stage electric pump formed from a suction-discharge pump and an electric motor coupled together axially, of those widely used to lift water.

Background of the invention

[0002] Multiple embodiments of multi-stage electric pumps of the aforementioned type are known. Said electric pumps require the installation of operation control elements which essentially comprise a non-return valve, which is used to prevent the emptying of the water pipes below the installation, and a zero or minimum discharge detector which has the purpose of halting the electric pump when the demand for water stops. In addition to these control elements, the installation may have a pressure regulator which, amongst other functions, detects a drop in pressure of the mains water system, given by consumer demand, causing the electric pump to start-up.

[0003] In general, the non-return valve, the zero or minimum discharge detector and the pressure regulator are arranged in an electric pump operation control unit assembled upstream thereof, at a certain distance therefrom. This arrangement of the operation control unit has the main drawback that its assembly in the water pipe requires accessories adapted to the specific case of the application, specifically in accordance with the existing relative position between the control unit and the electric pump, in addition to a relatively long assembly time, all of which makes the cost of the installations more expensive; furthermore, another drawback consists of the control unit not being operative as regards the water pressure inside the electric pump, pressure that under certain working conditions can reach a high level leading to malfunctioning of the electric pump.

Explanation of the invention

[0004] The multi-stage electric pump object of the invention comprises a multi-stage pump coupled axially to an electric motor, the multi-stage pump being essentially formed from a tubular body which, at the end opposite that of the electric motor, is equipped with a water inlet and a suction chamber and, at the other end beside the electric motor, with a discharge chamber and a water outlet.

[0005] The multi-stage electric pump according to the invention is characterized in that the water outlet is equipped with a pressure detector and a non-return valve equipped with a zero or minimum discharge detector.

[0006] Another characteristic of the invention consists of the pressure detector essentially comprising an elas-

tic membrane which, on its outer face, establishes permanent hydraulic communication with the water outlet, a spring which exerts a controllable reaction on the other face of the membrane and a microswitch whose switching off and on is determined by the membrane deformation, produced in accordance with the hydraulic pressure in the water outlet and the load of the spring.

[0007] According to another characteristic of the invention, the non-return valve comprises a rod arranged axially in relation to the water outlet, capable of axial displacement in both directions through a bracket guide, the rod being equipped with a gasket adapted to rest on a closing seat.

[0008] In accordance with another characteristic of the invention, the non-return valve is equipped with a spring that permanently tends to place the rod in the closed position.

[0009] It is also a characteristic of the invention that the zero or minimum discharge detector comprises a permanent magnet, which displaces with the non-return valve rod, and a reed relay or a Hall-effect sensor.

[0010] The aforementioned characteristics of the multi-stage electric pump according to the invention provide an innovative solution to the problems derived from the assembly of an operation control unit external to the electric pump, as well as the problems produced by the absence of pressure control inside the electric pump. Indeed, the fact that the non-return valve is positioned in the electric pump water outlet and the non-return valve is equipped with a zero or minimum discharge detector, permits the control functions of these elements being integrated in the electric pump which, in this way, does not require the assembly of external elements for said purpose; on the other hand, the fact that the electric pump water outlet is equipped with a pressure detector permits avoiding overpressure inside the electric pump.

Brief description of the drawings

[0011] In the attached drawings, an embodiment of a multi-stage electric pump, object of the invention, is illustrated by way of non-limiting example. In said drawings:

- Fig. 1, is a longitudinal sectional view of the multi-stage electric pump of the invention;
- Fig. 2, is a sectional view of the pressure detector arranged in the electric pump discharge chamber of Fig. 1; and
- Fig. 3, is a sectional view of the non-return valve equipped with zero or minimum discharge detector, arranged in the electric pump water outlet of Fig. 1.

Detailed description of the drawings

[0012] In Fig.1 the multi-stage electric pump object of the invention is represented, described as an example

of embodiment. Therein it is observed that the electric pump, indicated with reference 1, is formed from a multi-stage pump 2 and by an electric motor 3 coupled coaxially. The multi-stage pump 2 comprises a tubular body 4 wherein a plurality of impellers 5 are housed. At the far end of the electric motor 3, the tubular body 4 is equipped with a water inlet 6 and a suction chamber 7, while the other end, beside the electric motor 3, is equipped with a discharge chamber 8 and a water outlet 9 to which a water pipe, not represented, can be coupled to feed the consumption points.

[0013] The water outlet 9 is equipped with a pressure detector 10, arranged in the tubular body 4 of the multi-stage pump 2 and which permanently establishes hydraulic communication thereto, and a non-return valve 11 equipped with a zero or minimum discharge detector 12, all of this as represented in the overall view of Fig. 1.

[0014] In Fig. 2 it is observed that the pressure detector 10 comprises a hollow detector body 13 open at one of its ends and fixed to the electric motor 3; an elastic membrane 14 coupled to the open end of the detector body 13 and which, on its outer face 18, establishes permanent hydraulic communication with the water outlet 9 by an orifice 19; and inside the detector body 13, a piston 15 capable of displacing in both directions which rests on the inner face 20 of the elastic membrane 14, and a spring 16 equipped with a load regulator, not represented, which permanently works by compression, resting one of the ends against the piston 15 and its other end against a spring 16 guide-body 17. A microswitch, not represented, is mechanically linked to the piston 15 displacements.

[0015] The operation of the pressure detector 10 is disclosed below. The outer face 18 of the elastic membrane 14 receives, through the orifice 19, the pressure in the water outlet 9 of the multi-stage pump 2, while the inner face 20 receives the reaction of the spring 16 by the piston 15. When the pressure in the water outlet 9 reaches a pressure below that determined on the inner face 20 of the elastic membrane 14, the subsequent piston displacement 15 causes the microswitch to be operated which causes the electric motor 3 to start-up.

[0016] In Fig. 3 it is observed that the non-return valve 11 is axially positioned in relation to the water outlet 9 and is essentially formed from a bracket guide 22 and by a rod 21. The bracket guide 22 has a general hollow cylindrical form, open at both ends and it is fixed to the tubular body 4 by a nut 23, the outer end of the bracket guide 22 being equipped with a linear pitch 26 arranged at the intersection of a plurality of radii 30. The rod 21 is essentially formed from a first cylindrical portion 27 adapted to be displaced axially in both directions through the linear pitch 26 of the bracket guide 22, and by a second cylindrical portion 28 coaxial with the first portion 27 and equipped with a gasket 29, adapted to be seated in a closing seat 24 made in the outlet 25 of the discharge chamber 8.

[0017] Said non-return valve 11 operates as de-

scribed below. When the multi-stage electric pump 1 is operating, the passage of water through the non-return valve 11, specifically the passage of water through the interradii spaces defined between the radii 30, positions the rod 21 in the open position shown in Fig. 3. When the water stops circulating, due to closing the installation taps, the rod 21 slips downwards by gravity until the gasket 29 is seated in the closing seat 24, preventing, in this way, the emptying of the water pipes below the non-return valve 11. Optionally, and in those cases in which the position of the multi-stage electric pump 1 so requires, the non-return valve 11 can be equipped with a closing spring, not represented, arranged between the radii 30 and the second cylindrical portion 28 of the rod 21, adapted so that it permanently tends to place the rod 21 in the closed position, not represented.

[0018] In Fig. 3 it is observed that the zero or minimum discharge detector 12 on the non-return valve 11 rod 21, comprises a permanent magnet 31 which displaces with the rod 21 and a reed relay or alternatively a Hall-effect sensor, designated with reference 33.

[0019] The operation of the zero or minimum discharge detector 12 is disclosed below. The permanent magnet 31 displaces with the rod 21, its position in relation to the reed relay or the Hall-effect sensor is determinant of its action thereon; the rod 21 being in the open position shown in Fig. 3, the permanent magnet 31 operating the reed relay or Hall-effect sensor 33 which generates a corresponding electrical signal indicative of the water circulation through the non-return valve, on the other hand, if the rod 21 is in the closed position, the permanent magnet 31 does perform any action on any of said elements which, in turn, generates an electric signal complementary to that of the previous, i.e. indicative that the water is not circulating through the non-return valve 11.

Claims

1. Multi-stage electric pump (1), which comprises a multi-stage pump (2) coupled axially to an electric motor (3), the multi-stage pump (2) being essentially formed from a tubular body (4) which, at the end opposite that of the electric motor (3), is equipped with a water inlet (6) and a suction chamber (7) and, on the other end beside the electric motor (3), with a discharge chamber (8) and a water outlet (9), **characterized in that** the water outlet (9) is equipped with a pressure detector (10) and a non-return valve (11) equipped with a zero or minimum discharge detector (12).
2. Multi-stage electric pump according to claim 1, **characterized in that** the pressure detector (10) essentially comprises an elastic membrane (14) which, on its outer face (18), establishes permanent hydraulic communication with the water outlet (9),

a spring (16) which exerts a controllable reaction on the other face (20) of the membrane (14) and a microswitch whose switching off and on is determined by the deformation of the membrane (14), produced according to the hydraulic pressure in the water outlet (9) and the load of the spring (16). 5

3. Multi-stage electric pump according to claim 1, **characterized in that** the non-return valve (11) comprises a rod (21) arranged axially in relation to the water outlet (9) capable of being displaced axially in both directions through a bracket guide (22), the rod (21) being equipped with a gasket (29) adapted to rest on a closing seat (24). 10

4. Multi-stage electric pump according to claim 3, **characterized in that** the non-return valve (11) is equipped with a spring that permanently tends to place the rod (21) in the closed position. 15

5. Multi-stage electric pump according to claims 3 or 4, **characterized in that** the zero or minimum discharge detector (12) comprises a permanent magnet (31), which displaces with the non-return valve (11) rod (21), and a reed relay. 20

6. Multi-stage electric pump according to claims 3 or 4, **characterized in that** the zero or minimum discharge detector (12) comprises a permanent magnet (31), which displaces with the non-return valve (11) rod (21), and a Hall-effect sensor. 25

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