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

(11) EP 1 365 149 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
26.11.2003 Bulletin 2003/48

(51) Int Cl.[7]: **F04B 17/04**

(21) Application number: **03010665.2**

(22) Date of filing: **13.05.2003**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LU MC NL PT RO SE SI SK TR
Designated Extension States:
AL LT LV MK

(30) Priority: **23.05.2002 IT MI20020271 U**

(71) Applicant: **C.E.M.E. Engineering S.p.A.**
20122 Milano (IT)

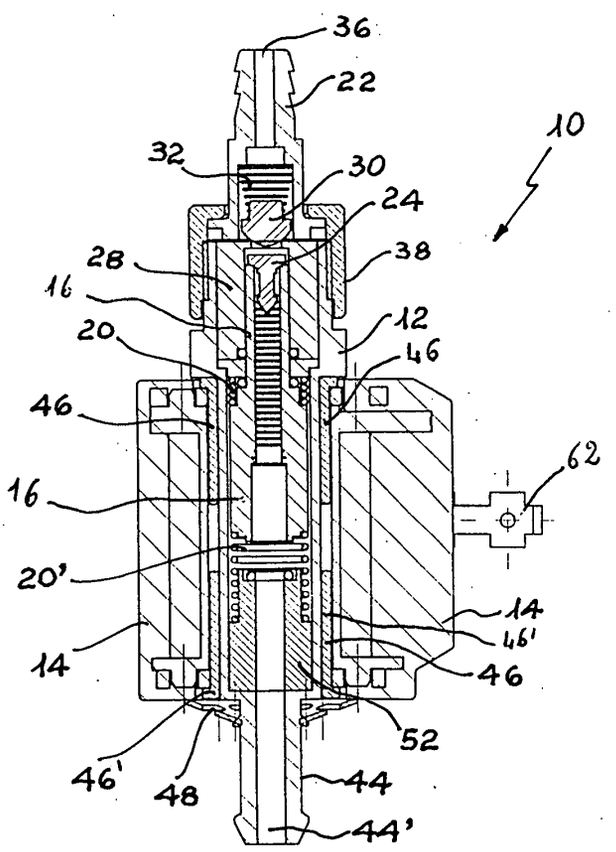
(72) Inventor: **Botti, Rino**
20063 Cernusco S/N, Milan (IT)

(74) Representative: **Lecce, Giovanni**
UFFICIO BREVETTI CALCIATI S.r.l.
Via Fratelli Ruffini, 9
20123 Milano (IT)

(54) Hydraulic-electromagnetic motor pump with floating piston

(57) A motor pump (10) of the hydraulic-electromagnetic type with floating piston comprising a container body (12) being partly delimited, in its external part, by a coil (14); an inlet duct (44') and an opposite outlet duct (36); a couple of opposite magnetic bearings (46, 46') that are spaced between them and placed between said body (12) and coil (14); a delivery piston (16) that is placed inside the body (12) and slides in it supported by a front helical-shaped spring (20) and by a rear one (20') and a magnetic bushing (52) placed in the central-lower part of the body (12) facing the inlet duct (44).

FIG. 2



EP 1 365 149 A2

Description

[0001] The present invention refers to a motor pump of the hydraulic-electromagnetic type with floating piston.

[0002] More particularly, the present invention refers to a motor pump of the hydraulic-electromagnetic type with floating piston, particularly suitable for the use in the fluid motion, especially water.

[0003] This type of motor pumps is applied to various apparatuses such as irons, electric coffee percolators, irrigation systems and also in the automotive industry.

[0004] The operation of said motor pumps is based on the presence of a coil that cooperates with a couple of magnetic bearings; the coil is electrically powered and causes the axial movement of the floating piston or delivery piston with an alternate motion. The coil is placed outside the body of the motor pump, while the magnetic bearings are positioned in an annular seat formed between the same coil and a sleeve housing said piston. Said piston is elastically supported by opposite helical springs that are alternatively compressed during the floating in order to allow the passage of the fluid from the inlet duct to the delivery one. Known valves, rings and rubber gaskets associated to the piston and to the relevant sleeve assure the seal of the fluid moving inside the body of the motor pump.

[0005] These motor pumps have an important drawback that is essentially related to the pressure level that can be obtained, considering that sometimes, for particular uses, a high fluid pressurization is required. It is known that an increase in fluid pressurization can be obtained increasing the intensity of the magnetic field by the oversizing of the coil. This implies an unavoidable increase of the motor pump dimensions and a considerable additional cost due. to the increase of the winding coils. A greater size of the body of the motor pump in its whole sometimes is not compatible with the installation of the motor pump on the target apparatus or it requires at least structural changes of the same apparatus. Even the increase in cost is an important factor that could lead to the manufacturing of uncompetitive products.

[0006] Object of the present invention is to remove the above-mentioned drawbacks.

[0007] More particularly, object of the present invention is the provision of a motor pump of the hydraulic-electromagnetic type with floating piston wherein the pressure level of the delivery fluid can be increased without oversizing the coil with a subsequent increase of its dimensions and production costs.

[0008] A further object of the present invention is to provide a motor pump of the above-mentioned type that can guarantee a high resistance and reliability level in time and it is easily manufactured.

[0009] According to the present invention these and other purposes are obtained by a motor pump comprising: a container body that is partly delimited, in its external part, by a coil; an inlet duct and an opposite outlet duct; a couple of opposite magnetic bearings that are spaced between them and placed between said container body and coil and a delivery piston that is placed inside the container body, slides in it and it is supported by a front and a rear helical spring wherein a magnetic bushing is placed in the central-lower part of said container body facing said inlet duct.

[0010] The magnetic bearing is preferably made of steel with a low magnetic residual content.

[0011] The manufacturing and operating features of the motor pump of the present invention will be better understood from the following description wherein reference is made to the table of the attached drawings representing a preferred embodiment given by way of non-limitative example wherein:

Figure 1 is an exploded schematic view of the improved motor pump of the present invention;
Figure 2 is a schematic view of a cross section of the assembled motor pump of Figure 1.

[0012] With reference to the above-mentioned figures, the motor pump of the present invention, marked in its whole with 10 in Figure 2, comprises: an inlet duct 44'; an opposite outlet duct 36; a container body 12 which is partly delimited, in its external part, by a coil 14; a couple of opposite magnetic bearings 46, 46' that are spaced between them and placed between said body 12 and coil 14; a delivery piston 16 that is placed in said body 12, slides in it and it is elastically supported by a common front helical spring 20 and by a rear one 20'. In front of said piston 16, in the part facing the delivery duct 22, a seal valve 24 and a packing 26 of the delivery piston 16 are commonly placed. Said packing 26 and said seal valve 24 cooperate with a support bearing 28 and with a rubber gasket 30 that is elastically tensioned by a further helical spring 32. Said spring 32 and partly the rubber gasket 30 are housed inside a seat 34 of the delivery duct 22 whose diameter is fit to house the ensemble formed by the rubber gasket 30 and by the helical spring 32 and it is generally higher than the one of the outlet duct or hole 36 of the delivery duct 22. A locking ring 38 with an internal thread engaging with a matching part that is threaded in the outer part of the container body 12 is put on said duct 22 in a known way. Said tubular-shaped container body 12, comprises a front part 40 with a higher diameter that faces the outlet duct 36; an adjacent intermediate part 42 with a lower diameter than the one of the front part 40 delimiting the sliding axial chamber of the piston 16 and a terminal part 44 whose diameter is extremely lower than the one of the intermediate part 42 that defines the inlet duct 44'.

[0013] The opposite magnetic bearings 46 and 46', that are properly spaced between them with the use of a known spacing element if necessary, are fit on the external side surface of said intermediate part 42 of the body 12. The coil 14 is in its turn fit on the body 12 so that it can comprise said bearings 46, 46'. The coil 14 is

stabilized with known means that are for instance made of a shaped elastic ring 48 that matches with a face of the coil and a shoulder 50 placed on the body 12 between the front part 40 and the intermediate one 42 with a lower diameter that matches with the opposite face.

[0014] Inside said container body 12 in the central-lower part facing the inlet duct 44', a magnetic bushing 52, preferably made of steel with a low magnetic residual content, is advantageously placed. The external side surface of said magnetic bearing 52 has differentiated diameters and defines a rear area 54 that faces the duct 44' with a diameter that is equal or slightly lower than the internal one of the intermediate part 42 of the body 12 and an adjacent front area 56 facing the outlet hole or duct 36 with a lower diameter. Said areas 54 and 56 with different diameters form a matching shoulder 58 for the rear spring 20'. The lower end of the magnetic bushing 52 matches with the body 12 in the intermediate part 42 near the narrowing of the terminal part 44 that defines the inlet duct 44'.

[0015] The axial sliding return of the piston 16 is obtained by known means such as the couple of helical springs 20 and 20' previously described that cooperate with the piston.

[0016] The power of the coil 14 is obtained, for example, by a conventional couple of electric connections of the fast-on 62 type.

[0017] The applicant has found out, by way of experiment, that the motor pump object of the present invention is highly efficient thanks to the presence of the magnetic bushing 52 that being aligned with the sliding axis of the piston 16 with one of its ends, it is close to the piston and therefore at a lower distance between the latter and one of the two magnetic bushings 46, 46' when it is placed in the position reached by the piston 16 during the loading of the rear spring 20', generally near the terminal part 44 of the body 12. The interaction between the bushing 52 and the two bearings 46, 46' creates a magnetic field whose intensity is higher than the one of the two bearings 46, 46' only and it therefore increases the magnetic attraction force exerted on the piston 16 and the one exerted on the fluid going out of the delivery duct 22.

[0018] With the use of the bearing 52, in the event of keeping the efficiency level that would be created only with the two bearings 46, 46', it is obviously possible to reduce the number of wirings of the coil 14 with considerable production savings. The motor pump manufactured according to the above description does not imply impediments or additional costs caused by the size increase of the coil and of the relevant wiring coils, while the magnetic bushing 52 can be easily obtained and installed at a low cost.

[0019] Even though the present invention has been described with reference to one possible embodiment given as an illustrative and non-limitative example, many changes and variations in the arrangement of components can be carried out by a person skilled in the art according to the above-mentioned description. It is therefore understood that the present invention is meant to comprise all changes and variations in the arrangement of components falling within the spirit and the protective scope of the following claims.

Claims

1. A motor pump (10) of the hydraulic-electromagnetic type with floating piston comprising a container body (12) being partly delimited, in its external part, by a coil (14), an inlet duct (44') and an opposite outlet duct (36), a couple of opposite magnetic bearings (46, 46') that are spaced between them and placed between said body (12) and coil (14) and a delivery piston (16) that is placed inside the body (12) and slides inside it, supported by a front helical-shaped spring (20) and by a rear one (20'), **characterized in that** it comprises also a magnetic bushing (52) placed in the central-lower part of the container body (12) facing the inlet duct (44).

2. The motor pump according to claim 1, **characterized in that** said body (12) comprises a front part (40) with a higher diameter facing the outlet duct (36); an adjacent intermediate part (42) with a lower diameter than the one of the front part (40) delimiting a sliding chamber of the piston (16) and a terminal part (44) whose diameter is extremely lower than the one of the intermediate part (42) that defines the inlet duct (44').

3. The motor pump according to claims 1 or 2, **characterized in that** the external side surface of the magnetic bearing (52) comprises a rear area (54) facing the duct (44') whose diameter is the same or is slightly lower than the internal diameter of the intermediate part (42) of the body (12) and an adjacent front area (56) facing the outlet duct (36), whose diameter is lower; said areas (54, 56) define a matching shoulder (42) for the rear spring (20').

4. The motor pump according to any of the previous claims, **characterized in that** the lower end of the magnetic bearing (52) matches with the container body (12) in the intermediate part (42) adjacent to the narrowing of the terminal part (44) that defines the inlet duct (44'), the distance between the opposite end of said bearing (52) and the piston (16) being lower than the one between the latter and the one or the other of the two magnetic bearings (46, 46') placed in the position that is reached by the piston (16) during the rear spring loading step (20').

5. The motor pump according to any of the previous claims, **characterized in that** said magnetic bearing (52) is made of steel with a low magnetic resid-

ual content.

FIG. 1

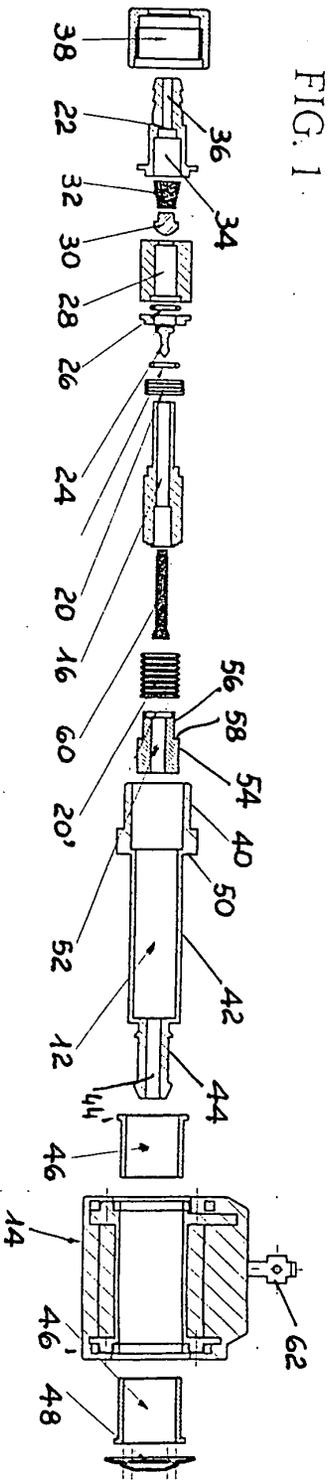
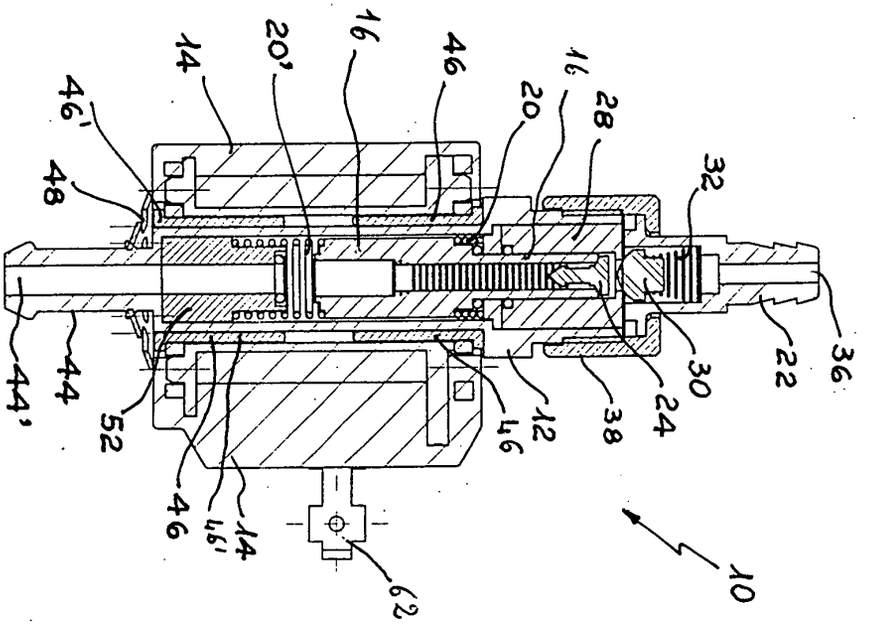

38
22
36
32
34
30
28
26
24
20
16
56
58
54
60
20'
40
50
52
42
12
44'
44
46
14
46'
62
48

FIG. 2


14
20'
16
46
18
20
28
32
46'
48
30
22
36
44'
44
52
12
38
24
46
46'
14
62
10