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(54) A diaphragm-plate group for diaphragm pumps

Membranplattengruppe für Membranpumpen

Groupe plaque-diaphragme pour pompes à membrane

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Description

[0001] The present invention relates to diaphragm pumps, and more in particular to a diaphragm plate group thereof.

[0002] Diaphragm pumps comprise at least a pump chamber, delimited by an elastomer membrane and provided with aspiration and delivery conduits.

[0003] The pumping effect is carried out by means of cyclic deformations of the membrane which respectively reduce and increase the volume of the pump chamber.

[0004] These deformations are very frequent, can reach up to 9 cycles a second, and are impressed on the membrane by a plate on which the membrane rests, activated to move alternately.

[0005] The membrane is substantially flat and it has been found that in flat membranes at present used, the material is stretched in traction, cyclically, by the plate in the alternating motion thereof.

[0006] Further, in the motion thereof the membrane nears the peripheral edge of the plate, risking splitting by continuous friction of a non-perfectly connecting surface. Lastly there is a rubbing between the membrane and the plate in the contact zone between the membrane and the plate, which generates extra wear because the membrane tends to stick to the smooth surface of the plate.

[0007] The membrane is fashioned from a rubber-based material or an electrically nonconductive and chemically-inert thermoplastic elastomer, while the plate is generally made of metal.

[0008] The above phenomena have a negative influence on the duration of the membrane and on the reliability of the pump.

[0009] The aim of the present invention is to obviate the above-mentioned drawbacks with a solution that is simple, reliable and relatively inexpensive.

[0010] The aim is attained by a diaphragm plate group, destined to be used in a diaphragm pump, having the characteristics cited in the independent claim.

[0011] The dependent claims relate to other advantageous characteristics of the invention.

[0012] According to the invention, the plate has a dome-shape, slightly convex and connected on an edge, so as to prevent splits on contact of the membrane with the edge.

[0013] The plate can be advantageously clad with non-stick material, such as for example Teflon (polytetrafluoroethylene).

[0014] The surface of the plate can advantageously comprise, on the face in contact with the membrane, lowered or dropped zones or parts, obtainable directly in the moulding process of the plate.

[0015] The membrane does not come into contact with the plate at the positions of the lowered parts, thus preventing sticking phenomena. The membrane, while maintaining its circular shape, it is not flat but it is shaped to be able to deform without being subjected to traction forces, but only to bending forces.

[0016] The lowered parts are preferably uniformly distributed on the surface of the plate. They preferably have a radial extension, and occupy at least thirty per cent of the surface of the plate.

5 [0017] The advantages and constructional and functional characteristics of the invention will emerge from the detailed description that follows, which with the aid of the accompanying tables of drawings illustrates a preferred embodiment given by way non-limiting example.

10 [0018] Figure 1 is a schematic axial section of the pump chamber of an example of a diaphragm pump not covered by the claims but useful for understanding the invention, configured in a position in which the membrane is positioned in an intermediate point of the travel of the plate.

15 [0019] Figure 2 is a schematic axial section of the pump chamber of an embodiment of a diaphragm pump according to the invention, configured in a position in which the membrane is positioned in an intermediate point of the travel of the plate.

20 [0020] Figure 3 is a plan view of the elastomer membrane of Figs. 1 and 2.

[0021] Figure 4 is a plan view of the activating plate of the membrane of Figs. 1 and 2.

25 [0022] The figures illustrate a diaphragm pump 1 comprising the pump chamber 2 delimited by the membrane 3, 30 made of an elastomer material.

[0023] The delivery and aspiration valves that are part of the pump chamber are omitted, as they do not relate to the present invention.

30 [0024] The activating piston 4 is located beneath the membrane 3, 30.

[0025] The piston 4 exhibits a convexity thereof facing towards the membrane 3, 30. The membrane 3 exhibits a hub 31 at the centre thereof.

35 [0026] In the example of Fig.1 the membrane is flat, while the piston exhibits a lowered part 41 able to receive an end of the hub.

[0027] In the embodiment of Fig.2, the profile of the membrane seen in axial section and in rest position (not deformed) exhibits, at a centre thereof, a first circular concavity 32 facing towards the pump chamber 2 and connected to the hub 31, and a second circular concavity 33 facing in an opposite direction and connected with the edge of the membrane.

45 [0028] The membrane 3 is blocked between the piston 4 and a profiled plate 40.

[0029] The piston 4 and the profiled plate 40 are blocked together at the hub 31 on a pin 5, which is moved in alternating motion by the crank 51.

50 [0030] With reference to Fig.1, Fig.2 and Fig.4, lowered parts 42 having a radial extension are illustrated, distributed in a regular fashion on all the convex surface of the plate which comes into contact with the membrane 3, 30.

55 [0031] The surface of the plate 40 facing towards the membrane 3 is clad with a non-stick material, such as Teflon (polytetrafluoroethylene) or an equivalent material. The edge of the plate 40 is further slightly rounded so as to exclude cutting effects when it comes into contact

with the membrane.

[0032] Observing Fig.2, it can be seen that the deformations of the membrane during the functioning do not induce radially-directed stretches in the membrane, which reduces to a minimum the rubbing between the plate and the membrane during the functioning of the pump.

[0033] The friction between the diaphragm and the plate is reduced by the non-stick cladding of the plate.

[0034] Further, a sticking phenomenon between the membrane and the plate is greatly reduced by the presence of the lowered parts 42, distributed uniformly on the surface of the plate in contact with the membrane, and occupying at least 30% of the surface of the plate.

[0035] Thanks to the peculiar characteristics of the plate/membrane group, the stresses induced in the membrane are practically limited to flexion stresses, while the sticking between the membrane and the plate is excluded by the shape of the plate.

[0036] Thus all the aims of the invention are attained.

[0037] The invention is not limited to the preferred embodiment described above, and any variants and improvements might be brought thereto without departing from the scope of the invention, which is solely defined by the following claims.

Claims

1. A diaphragm pump (1), comprising a pump chamber (2) delimited by a circular membrane (3) blocked between a piston (4) and a circular plate (40), wherein the circular membrane (3) is made of an elastomer material and is activated by the circular plate (40) moved in alternating motion, and wherein the plate (40) is slightly convex with a convexity thereof facing towards the membrane (3), the plate (40) is directly in contact with the membrane (3), and the plate (40) exhibits, on a whole surface thereof facing towards the membrane (3) and destined to come into contact there-with, a series of lowered parts (42), **characterised in that** the membrane (3), viewed in an axial section, exhibits a first central concavity (32) facing towards the plate (40) and a second concavity (33), concentric to the preceding first central concavity (32), facing in an opposite direction and terminating on the edge of the membrane (3).
2. The diaphragm pump (1) of claim 1, **characterised in that** the lowered parts (42) are uniformly distributed on the surface of the plate (40).
3. The diaphragm pump of claim 1, **characterised in that** the lowered parts occupy overall a portion of the surface of the plate equal to at least thirty per cent.
4. The diaphragm pump (1) of claim 1, **characterised**

in that the plate (40) exhibits a rounded peripheral edge in the axial section of the plate (40).

5. The diaphragm pump (1) of claim 1, **characterised in that** the surface of the plate (40) destined to come into contact with the membrane (3) is clad with non-stick material.
6. The diaphragm pump (1) of claim 5, **characterised in that** the non-stick material is polytetrafluoroethylene.

Patentansprüche

1. Membranpumpe (1), umfassend eine Pumpkammer (2), die durch eine kreisförmige Membran (3) abgegrenzt ist, die zwischen einem Kolben (4) und einer kreisförmigen Platte (40) blockiert ist, wobei die kreisförmige Membran (3) aus einem Elastomermaterial ist und durch die kreisförmige Platte (40) aktiviert wird, die in abwechselnder Bewegung bewegt wird, und wobei die Platte (40) leicht konvex ist, wobei eine Konvexität davon zu der Membran (3) zeigt, wobei die Platte (40) direkt in Kontakt mit der Membran (3) ist und die Platte (40) auf einer gesamten Fläche davon, die zu der Membran (3) zeigt und dazu bestimmt ist, in Kontakt damit zu kommen, eine Reihe von vertieften Teilen (42) aufweist, **dadurch gekennzeichnet, dass** die Membran (3), gesehen in eine axiale Richtung, eine erste mittlere Konkavität (32) aufweist, die zu der Platte (40) zeigt, und eine zweite Konkavität (33), die konzentrisch zu der vorherigen ersten mittleren Konkavität (32) in eine entgegengesetzte Richtung ist, und am Rand der Membran (3) endet.
2. Membranpumpe (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** die vertieften Teile (42) gleichförmig auf der Fläche der Platte (40) verteilt sind.
3. Membranpumpe nach Anspruch 1, **dadurch gekennzeichnet, dass** die vertieften Teile insgesamt einen Abschnitt der Fläche der Platte gleich wie mindestens dreißig Prozent belegen.
4. Membranpumpe (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** die Platte (40) einen abgerundeten Umfangsrand im axialen Abschnitt der Platte (40) aufweist.
5. Membranpumpe (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** die Fläche der Platte (40), die in Kontakt mit der Membran (3) kommen soll, mit nicht klebrigem Material kaschiert ist.
6. Membranpumpe (1) nach Anspruch 5, **dadurch gekennzeichnet, dass** das nicht klebrige Material Po-

lytetrafluorethylen ist.

Revendications

1. Pompe à diaphragme (1), comprenant une chambre de pompage (2) délimitée par une membrane circulaire (3) bloquée entre un piston (4) et une plaque circulaire (40), dans laquelle la membrane circulaire (3) est composée de matériau élastomère et est actionnée par la plaque circulaire (40) déplacée dans un mouvement alternatif, et dans laquelle la plaque (40) est légèrement convexe avec une convexité orientée vers la membrane (3), la plaque (40) étant directement en contact avec la membrane (3), et la plaque (40) reposant sur la totalité d'une surface de cette dernière orientée vers la membrane (3) et destinée à entrer en contact avec celle-ci une série de parties inférieures (42), **caractérisée en ce que** la membrane (3), envisagée dans une section axiale, repose sur une première concavité centrale (32) orientée vers la plaque (40) et une seconde concavité (33), concentrique à la précédente première concavité centrale (32), orientée dans une direction opposée et prenant fin sur l'extrémité de la membrane (3). 5
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2. Pompe à diaphragme (1) selon la revendication 1, **caractérisée en ce que** les parties inférieures (42) sont uniformément réparties sur la surface de la plaque (40). 30
3. Pompe à diaphragme (1) selon la revendication 1, **caractérisée en ce que** les parties inférieures occupent, dans l'ensemble, une partie de la surface de la plaque, égale à au moins trente pour cent de celle-ci. 35
4. Pompe à diaphragme (1) selon la revendication 1, **caractérisée en ce que** la plaque (40) repose sur une extrémité périphérique arrondie sur la section axiale de la plaque (40). 40
5. Pompe à diaphragme (1) selon la revendication 1, **caractérisée en ce que** la surface de la plaque (40) destinée à entrer en contact avec la membrane (3) est revêtue d'un matériau antiadhésif. 45
6. Pompe à diaphragme (1) selon la revendication 5, **caractérisée en ce que** le matériau antiadhésif est en polytétrafluoroéthylène. 50

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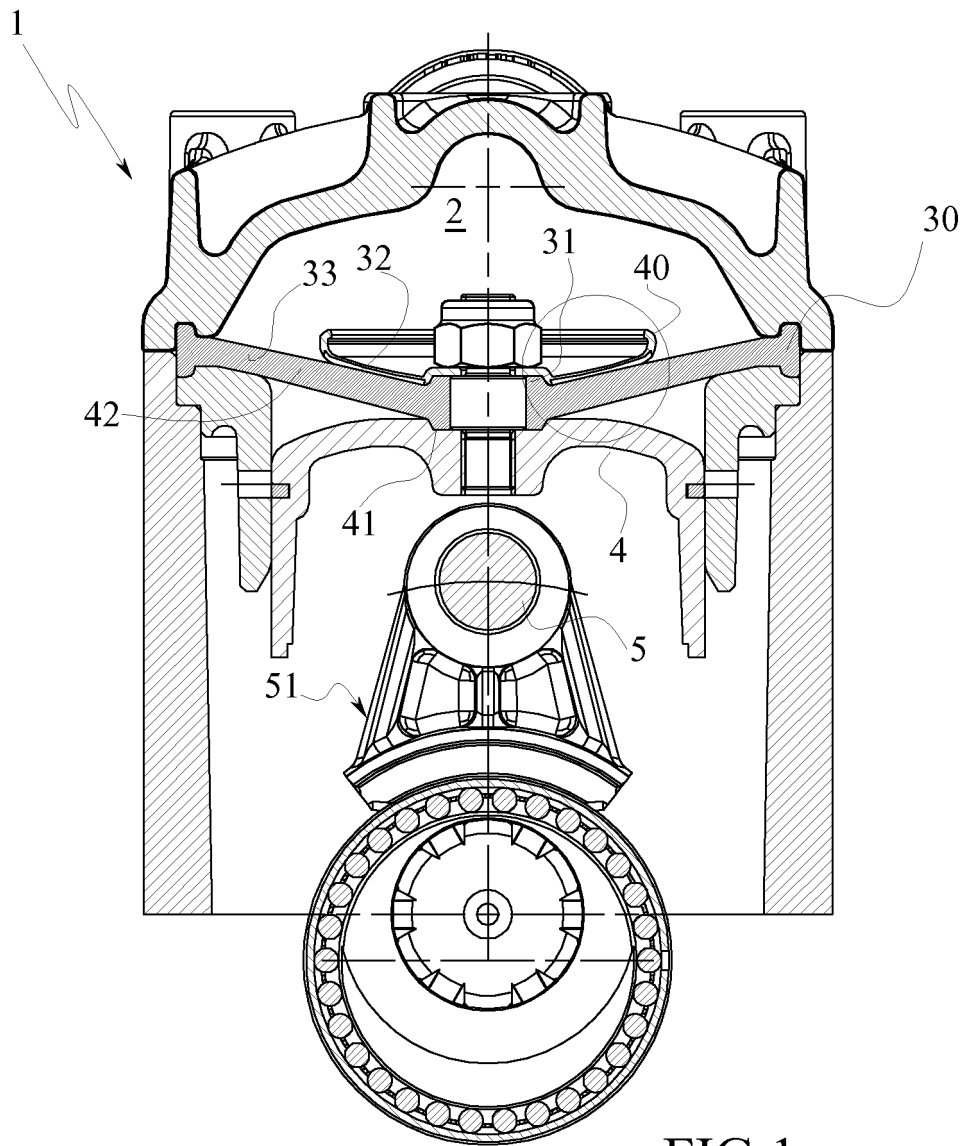


FIG.1

