

Pump arrangement

The invention relates to a pump arrangement, in particular a magnetic clutch pump arrangement, having an interior space formed by a pump casing of the pump arrangement, having a containment can which hermetically seals off a chamber surrounded by said containment can with respect to the interior space formed by the pump casing, having an impeller shaft which can be driven in rotation about an axis of rotation, having an impeller which is arranged on one end of the impeller shaft, having an inner rotor arranged on the other end of the impeller shaft, and having an outer rotor which interacts with the inner rotor.

A pump arrangement of said type is known from DE 10 2004 003 400 A1, which pump arrangement, in order to increase the range of use, has a drive rotor formed as an identical part for outer drive elements. This however permits an increase in the range of use only to a particular degree. Above a certain structural size, an adaptation of the rotor size is unavoidable.

EP 0 814 268 A1 has disclosed a modular construction kit for producing pumps, which modular construction kit is intended to afford the possibility of producing pumps in any desired manner from a small number of structural elements in accordance with the usage requirements. The proposed solution however permits only an exchange of components associated with a single structural size.

The documents cited above however do not take into consideration that, owing to different rotational speeds, delivery heights, delivery volumes and densities of the medium to be delivered, a large range of torques is required for one and the same hydraulic size.

It is the object of the invention to provide a magnetic clutch pump arrangement in the case of which as large as possible a number of magnetic clutches with
5 different diameters is available for one hydraulic size, and the greatest possible number of different hydraulic sizes can be used for one magnetic clutch size. It is likewise the intention for different
10 containment cans, that is to say different pressure stages and/or materials, to be able to be used within one magnetic clutch size.

The object of the invention is achieved by means of an adapter element which connects the containment can to
15 the pump casing or to a component assigned to the pump casing, in particular to a casing cover, which adapter element has a mounting flange which, at the side close to the interior space, bears against an abutment
20 surface of the pump casing, in particular of the casing cover.

Through the use of different adapter elements, a modular construction kit is made available which permits efficient structural size configuration for one
25 hydraulic size with different magnetic clutch sizes, or for one magnetic clutch size and different hydraulic sizes.

It is thus possible in a simple manner, by adaptation
30 of the adapter element in terms of shape and/or size, to adapt a magnetic clutch size to different hydraulic sizes. The large range of torques required for one and the same hydraulic size owing to different rotational speeds, delivery heights, delivery volumes and
35 densities of the medium to be delivered is covered in this way. It is no longer necessary to use the in each case maximum clutch size for all combinations; rather, it is possible in each case for the suitable magnetic

clutch size to be adapted to a hydraulic size, with corresponding advantages with regard to energy efficiency, eddy current losses and/or procurement costs. A further advantage of the invention is the
5 reduced number of components that have to be stocked for a pump type series.

In a further refinement, the abutment surface has a region which is recessed in an axial direction and into
10 which a centering ring formed on the mounting flange engages. It is firstly possible for a seal ring to be arranged in the recessed region, and secondly, the adapter element can be aligned exactly and fastened in fluid-tight fashion to the casing cover.

15 By virtue of the fact that, on the side situated opposite the mounting flange, the adapter element has multiple threaded holes for the fastening of the containment can, it is possible, within one magnetic
20 clutch size, to use or interchange different containment cans of different pressure stages or strengths and/or different materials.

According to the invention, on the side situated
25 opposite the mounting flange, a ring is provided which extends further in the axial direction into the interior space, which ring forms a run-on safeguard and prevents contact between the outer rotor and the containment can.

30 To improve the flow guidance of the medium, and for easier and thus cheaper production by casting, the outer contour of the adapter element has a substantially conical profile.

35 Here, the adapter element preferably narrows, substantially proceeding from the mounting flange toward the ring.

In a further refinement, it is provided that that end of the outer rotor which points in the direction of the casing cover has a radially encircling projection. In this way, the radial spacing of the outer rotor to the ring for normal operation can be produced in an exact manner.

For the same reason, it is proposed that, alternatively or in addition, the projection be formed on the inner side of the ring.

In a further exemplary embodiment of the invention, it is provided that that end of the outer rotor which points in the direction of the casing cover has a region of reduced outer diameter. The mounting capability of the adapter element in the case of small clutch diameters is thus ensured.

In a further advantageous refinement, between the impeller and inner rotor, there is arranged a bearing arrangement which is operatively connected to the impeller shaft, which can be driven rotatably about the axis of rotation.

In the context of the invention, it is proposed that, in a further embodiment, a spring device is arranged between the inner rotor and the bearing arrangement.

According to the invention, in one embodiment, between the spring device and the inner rotor, there is situated a spacer sleeve, which is pushed onto the impeller shaft and by means of which the inner rotor extends deeper into the outer rotor in an axial direction. Thus, the magnets of the inner rotor and the magnets of the outer rotor are optimally aligned with respect to one another in order to ensure an optimum

transmission of power from the outer rotor to the inner rotor.

The object of the invention is furthermore achieved by way of a modular construction kit for producing a pump arrangement according to the invention.

Exemplary embodiments of the invention are illustrated in the drawings and will be described in more detail below. In the drawings:

- figure 1 shows the longitudinal section through a magnetic clutch pump arrangement,
- figure 2 shows the longitudinal section through the magnetic clutch pump arrangement as per figure 1 with an adapter element according to the invention,
- figure 3 shows the longitudinal section through the magnetic clutch pump arrangement as per figure 1 with a further adapter element according to the invention,
- figure 4 shows the longitudinal section through a magnetic clutch pump arrangement with a casing cover which serves as a heat barrier, and with an adapter element according to the invention as per figure 2.

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Figure 1 shows a pump arrangement 1 in the form of a magnetic clutch pump arrangement. The pump arrangement 1 has a multi-part pump casing 2 of a centrifugal pump, which pump casing comprises a hydraulics casing 3 in the form of a spiral casing, a casing cover 4, a bearing carrier cage 5, a bearing carrier 6 and a bearing cover 7.

The hydraulics casing 3 has an inlet opening 8 for the intake of a delivery medium and has an outlet opening 9 for the discharge of the delivery medium. The casing cover 4 is arranged on that side of the hydraulics casing 3 which is situated opposite the inlet opening 8. The bearing carrier cage 5 is fastened to that side of the casing cover 4 which is averted from the hydraulics casing 3. The bearing carrier 6 is mounted on that side of the bearing carrier cage 5 which is situated opposite the casing cover 4. The bearing cover 7 in turn is fastened to that side of the bearing carrier 6 which is averted from the bearing carrier cage 5.

A containment can 10 is fastened to that side of the casing cover 4 which is averted from the hydraulics casing 3, and said containment can extends at least partially through an interior space 11 delimited by the pump casing 2, in particular by the casing cover 4, by the bearing carrier cage 5 and by the bearing carrier 6. The containment can 10 has a substantially cylindrical main body 12. The main body 12 is open on one side and is closed by way of a domed base 13 on the side situated opposite the open side. At the open side there is arranged a ring-shaped fastening flange 14 which is formed integrally with the main body 12 or which is connected to said main body by welding or by way of other suitable fastening means or devices, for example screws, rivets or the like. The fastening flange 14 bears, at the side close to the interior space 11, against an abutment surface 15 of the casing cover 4, and has multiple installation holes 16 through which screws 17 can be passed and screwed into threaded bores 18 provided in the casing cover 4. The containment can 10 hermetically seals off a chamber 19, which is enclosed by said containment can and by the casing cover 4, with respect to the interior space 11.

An impeller shaft 20 which is rotatable about an axis of rotation A extends from a flow chamber 21, which is delimited by the hydraulics casing 3 and by the casing cover 4, into the chamber 19 through an opening 22 provided in the casing cover 4. An impeller 23 is fastened to a shaft end, situated within the flow chamber 21, of the impeller shaft 20, and an inner rotor 24 arranged within the chamber 19 is provided on the opposite shaft end, which has two shaft sections 20a, 20b with increasing diameters in each case. The inner rotor 24 is equipped with multiple magnets 25 which are arranged on that side of the inner rotor 24 which faces toward the containment can 10.

Between the impeller 23 and the inner rotor 24 there is arranged a bearing arrangement 26 which is operatively connected to the impeller shaft 20, which can be driven in rotation about the axis of rotation A. A bearing ring carrier 27, which is arranged coaxially with respect to the axis of rotation A and by means of which the static parts, that is to say the parts which do not rotate with the impeller shaft 20, of the bearing arrangement 26 are held in place, bears by way of a flange-like region 28 against a further abutment surface 29 of the casing cover 4, is fastened by way of a screw connection (not illustrated) to the casing cover 4, and extends into the chamber 19.

Between the inner rotor 24 or the shaft section 20a and the bearing arrangement 26, in particular those parts of the bearing arrangement 26 which rotate with the impeller shaft 20, there is arranged a spring device 30 in the form of a plate spring pack, which spring device exerts a spring force on the clamped assembly composed of impeller 23, an impeller nut 32 which fastens the impeller 23 to the impeller shaft 20 via a disk 31, those parts of the bearing arrangement 26 which rotate with the impeller shaft 20, and the inner rotor 24, in

such a way that the clamped assembly is held in abutment, in particular by way of the inner rotor 24, with a certain degree of elasticity against an abutment surface 33 which arises owing to the different diameters of the shaft sections 20a and 20b, wherein the diameter of the shaft section 20b is greater than the diameter of the shaft section 20a. The clamped assembly thus comprises substantially the components which rotate with the impeller shaft 20 about the axis of rotation A.

A drive motor, preferably an electric motor, which is not illustrated drives a drive shaft 34. The drive shaft 34, which can be driven about the axis of rotation A, is arranged substantially coaxially with respect to the impeller shaft 20. The drive shaft 34 extends through the bearing cover 7, through the bearing carrier 6, and at least partially into the bearing carrier cage 5. The drive shaft 34 is mounted in two ball bearings 35, 36 which are accommodated in the bearing carrier 6. On the free end of the drive shaft 34 there is arranged an outer rotor 38, which bears multiple magnets 37. The magnets 37 are arranged on that side of the outer rotor 38 which faces toward the containment can 10. The outer rotor 38 extends at least partially over the containment can 10 and interacts with the inner rotor 24 such that the rotating outer rotor 38, by way of magnetic forces, sets the inner rotor 24 and thus likewise the impeller shaft 20 and the impeller 23 in rotation.

Figure 2 shows a pump arrangement 1, the outer dimensions of which correspond to the outer dimensions shown in figure 1. In accordance with a construction kit principle, the hydraulics casing 3, casing cover 4, bearing carrier cage 5, bearing carrier 6 and bearing 7 are thus of the same dimensions. Furthermore, in both embodiments, the impeller 23, bearing arrangement 26

and bearing ring carrier 27 are of the same dimensions. In the embodiment shown in figure 2, both the diameter and axial extent of containment can 10, inner rotor 24 and outer rotor 38 are smaller than in the embodiment shown in figure 1. This is particularly advantageous if lower power demands, for example a lower delivery height or delivery flow rate, with the highest possible efficiency, are placed on the pump arrangement 1.

To adapt the containment can 10 with reduced axial extent and reduced diameter, a separate adapter element 39 is provided which, on one side, has a mounting flange 40, the design of which substantially corresponds to the design of the fastening flange 14 of the containment can 10 as shown in figure 1. At the side close to the interior space 11, the mounting flange 40 bears against the abutment surface 15 of the casing cover 4 and has multiple installation holes 41, through which the screws 17 can be passed and screwed into threaded bores 18 provided in the casing cover 4. The abutment surface 15 has a region 42 which is recessed in an axial direction and in which a seal ring 43 is arranged and into which a centering ring 44 formed on the mounting flange 40 engages, whereby the adapter element 39 can be fastened in an exactly aligned and fluid-tight manner to the casing cover 4.

On the side situated opposite the mounting flange 40, the adapter element 39 has multiple threaded holes 45 into which there can be screwed screws 46 which extends through the installation holes 16 in the fastening flange 14 of the containment can 10. It is thereby possible, within a magnetic clutch size, to interchange different containment cans 10 of different pressure stages or strengths and/or different materials. Furthermore, on the side situated opposite the mounting flange 40, there is provided a ring 47 which extends further in an axial direction into the interior space

11, which ring forms a run-on safeguard and prevents contact between the magnets 37 of the outer rotor 38 and the main body 12 of the containment can 10. The outer contour of the adapter element 39 has in each case a substantially conical profile. Here, proceeding substantially from the mounting flange 40, the adapter element 39 narrows toward the ring 47. The inner contour of the adapter element 39 is at least partially of narrowing form. In the embodiment illustrated in figure 2, that end of the outer rotor 38 which points in the direction of the casing cover 4 has a radially encircling projection 48 facing toward the ring 47, which projection, in the possible case of an outer rotor 38 rotating with an imbalance, makes contact firstly with the inner side of the ring 47 of the adapter element 39 before the magnets 37 of the outer rotor 38 come into contact with the main body 12 of the containment can 10. In an alternative embodiment, the projection 48 may also be formed on the inner side of the ring 47. In a further embodiment, the projection 48 may be formed both on the end of the outer rotor 38 and on the inner side of the ring 47.

Between the spring device 30 and the inner rotor 24 there is situated a spacer sleeve 49 which is pushed onto the impeller shaft 20, and which expands the above-described clamped assembly by this component. In the embodiment shown, the impeller shaft 20, in particular shaft section 20a, is lengthened in relation to the embodiment shown in figure 1 by the length of the spacer sleeve 49. By means of the spacer sleeve 49, the inner rotor 24 extends deeper into the outer rotor 38 in the axial direction. In this way, the magnets 25 of the inner rotor 24 and the magnets 37 of the outer rotor 38 are optimally aligned with respect to one another in order to ensure an optimum transmission of power from the outer rotor 38 to the inner rotor 24.

Figure 3 shows a pump arrangement 1, the outer dimensions of which correspond to the outer dimensions shown in figures 1 and 2. Likewise, the impeller 23, bearing arrangement 26 and bearing ring carrier 27 are of the same dimensions as in the embodiment shown in figures 1 and 2. In the embodiment shown in figure 3, both the diameter and the axial extent of the containment can 10, inner rotor 24 and outer rotor 38 have been reduced further in relation to the embodiment shown in figure 2. The impeller shaft 20, in particular shaft section 20a, has the same axial extent as in the embodiment shown in figure 2. That end of the outer rotor 38 which points in the direction of the casing cover 4 has a region 50, facing toward the ring 47, of reduced outer diameter, wherein an outer rotor 38, in the possible event of it rotating with an imbalance, comes into contact with the inner side of the ring 47 of the adapter element 39 by way of said region 50 first, before the magnets 37 of the outer rotor 38 come into contact with the main body 12 of the containment can 10.

As can be seen from figure 4, the adapter element 39 may also be used on a casing cover 4, formed as a heat barrier, in a pump arrangement 1 which conducts a hot medium. Here, the hydraulics casing 3, major regions of the casing cover 4, the bearing carrier cage 5, the bearing carrier 6 and the bearing cover 7 are of the same dimensions as in the exemplary embodiments shown in figures 1 to 3. The containment can 10, the adapter element 39 and the outer rotor 38 are of the same dimensions, correspondingly to the magnetic clutch size as per figure 2.

List of reference designations

1	Pump arrangement	27	Bearing ring carrier
2	Pump casing	28	Flange-like region
3	Hydraulics casing	29	Abutment surface
4	Casing cover	30	Spring device
5	Bearing carrier cage	31	Disk
6	Bearing carrier	32	Impeller nut
7	Bearing cover	33	Abutment surface
8	Inlet opening	34	Drive shaft
9	Outlet opening	35	Ball bearing
10	Containment can	36	Ball bearing
11	Interior space	37	Magnet
12	Main body	38	Outer rotor
13	Base	39	Adapter element
14	Fastening flange	40	Mounting flange
15	Abutment surface	41	Installation hole
16	Installation hole	42	Recessed region
17	Screw	43	Seal ring
18	Threaded bore	44	Centering ring
19	Chamber	45	Threaded hole
20	Impeller shaft	46	Screw
20a	Shaft section	47	Ring
20b	Shaft section	48	Projection
21	Flow chamber	49	Spacer sleeve
22	Opening	50	Region of reduced outer diameter
23	Impeller		
24	Inner rotor		
25	Magnet	A	Axis of rotation
26	Bearing arrangement		

Claims

1. A modular construction kit to produce a pump arrangement having an interior space formed by a pump casing of the pump arrangement, having a containment can which hermetically seals off a chamber surrounded by said containment can with respect to the interior space formed by the pump casing, having an impeller shaft which can be driven in rotation about an axis of rotation, having an impeller which is arranged on one end of the impeller shaft, having an inner rotor arranged on the other end of the impeller shaft, and having an outer rotor which interacts with the inner rotor, wherein different adapter elements which connect the containment can to the pump casing or to a component assigned to the pump casing, which adapter elements have a mounting flange which, at a side close to the interior space, bears against an abutment surface of the pump casing.
2. The modular construction kit as claimed in claim 1, wherein the component assigned to the pump casing is the casing cover.
3. The modular construction kit as claimed in claim 1 or claim 2, wherein the abutment surface of the pump casing that the mounting flange bears against is the casing cover.
4. A pump arrangement, produced from a modular kit as claimed in any one of the preceding claims.
5. The pump arrangement as claimed in claim 4, wherein the pump arrangement is a magnetic clutch pump arrangement.
6. The pump arrangement as claimed in claim 4 or claim 5, wherein the abutment surface has a region which is recessed in an axial direction and into

which a centering ring formed on the mounting flange engages.

- 5 7. The pump arrangement as claimed in any one of claims 4 to 6, characterized in that, on the side situated opposite the mounting flange, the adapter element has multiple threaded holes.
- 10 8. The pump arrangement as claimed in any one of claims 4 to 7, wherein on the side situated opposite the mounting flange, a ring is provided which extends further in the axial direction into the interior space.
- 15 9. The pump arrangement as claimed in any one of claims 4 to 8, wherein the outer contour of the adapter element has a substantially conical profile.
- 20 10. The pump arrangement as claimed in claim 9, wherein proceeding from the mounting flange, the adapter element narrows toward the ring.
- 25 11. The pump arrangement as claimed in any one of claims 4 to 10, wherein that end of the outer rotor which points in the direction of the casing cover has a radially encircling projection.
- 30 12. The pump arrangement as claimed in claim 11, wherein the projection is formed on the inner side of the ring.
- 35 13. The pump arrangement as claimed in any one of claims 4 to 10, wherein that end of the outer rotor which points in the direction of the casing cover has a region of reduced outer diameter.
- 40 14. The pump arrangement as claimed in any one of claims 4 to 13, wherein between the impeller and inner rotor, there is arranged a bearing

arrangement which is operatively connected to the impeller shaft, which can be driven rotatably about the axis of rotation (A).

- 5 15. The pump arrangement as claimed in claim 14,
 wherein a spring device is arranged between the
 inner rotor and the bearing arrangement.
- 10 16. The pump arrangement as claimed in claim 15,
 wherein between the spring device and the inner
 rotor, there is situated a spacer sleeve, which is
 pushed onto the impeller shaft.