

Description

Pump arrangement

5 The invention relates to a pump arrangement, in particular 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
10 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
15 arranged on the other end of the impeller shaft, having a drive motor, having a drive shaft which can be driven rotatably about the axis of rotation by the drive motor, and having an outer rotor which is arranged on the drive shaft and which interacts with the inner
20 rotor, wherein the outer rotor has a hub with a hub inner surface formed by a passage bore, in which hub inner surface there is formed an axial groove which extends parallel to the axis of rotation and which interacts with a feather key inserted into a feather
25 key groove of the drive shaft.

DE 84 36 638 U1 has disclosed a pump arrangement of said type. Despite a tight sliding fit of the outer magnet carrier on the drive shaft, the fit clearance
30 that still exists has the effect that the outer magnet carrier tilts relative to the drive shaft, whereby, as the drive shaft is driven in rotation, the outer magnet carrier performs a wobbling movement, which can lead to damage to the containment can or to other parts within
35 the pump arrangement. If the fit is selected to be too tight, mounting is possible only with a heating action, and dismounting is possible only with the use of special tools.

It is the object of the invention to provide a pump arrangement which permits clearance-free mounting, which can be performed without the use of special tools, of the outer rotor, which bears the magnets, onto the drive shaft of a drive motor.

The object of the invention is achieved in that at least one radially encircling first groove and at least one radially encircling second groove are formed in the hub inner surface, wherein a tolerance ring is arranged at least in two of the grooves.

It is preferable for a tolerance ring to be arranged in at least one or more of the first grooves and in one or more of the second grooves.

It is expedient for a tolerance ring to be arranged in one of the first grooves and for a tolerance ring to be arranged in one of the second grooves.

In one refinement of the invention, it is proposed that the pump arrangement is of a block-type design, that is to say the pump casing is connected to the motor casing. In this way, no baseplate, or a baseplate of relatively small size, is required for the pump arrangement. Furthermore, a mechanical coupling can be dispensed with. Furthermore, expenditure of effort that is otherwise required for alignment purposes is omitted.

Adverse true running characteristics of the outer rotor which is driven rotatably by way of the drive shaft are avoided if at least one first groove is formed in a region of the hub inner surface which is situated substantially between the center of the hub and the first carrier element in the axial direction, and/or at least one second groove is formed in a region of the

hub inner surface which extends substantially from the center of the hub to a point close to that end of the hub which is situated opposite the first carrier element.

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What has proven to be particularly advantageous is a refinement in which the outer shell surface of the hub is of smooth form. By virtue of bores, discontinuities or slots in or on the outer shell surface of the hub being omitted, it is made possible for the outer rotor to be slid onto the drive shaft without damage being caused to seal elements arranged in said region.

For simple mounting and dismounting of the hub and drive shaft, there is provided a threaded bore which is formed in the outer rotor in the region of the first carrier element.

With regard to the simple mounting and dismounting of hub and drive shaft, it is provided here that the threaded bore has a larger diameter than a threaded blind bore provided in the drive shaft.

In a further advantageous refinement, the tolerance rings are dimensioned such that they do not extend into the feather key groove which receives the feather key.

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 having a hub-shaft connection according to the invention,

figure 2 shows a hub-shaft connection corresponding to figure 1 in an enlarged illustration,

figure 3 shows a section along the line III-III from figure 2,

5 figure 4 shows the mounting of the hub onto the shaft, and

figure 5 shows the dismounting of the hub from the shaft.

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Figure 1 shows a pump arrangement 1 in the form of a magnetic clutch pump arrangement having a pump part and having an electrical part. The pump part of the pump arrangement 1 has a multi-part pump casing 2 of a
15 centrifugal pump, which pump casing comprises a hydraulics casing 3 designed as a spiral casing, a casing cover 4, a bearing carrier cage 5 and a connecting element 6.

20 The hydraulics casing 3 has an inlet opening 7 for the intake of a delivery medium and has an outlet opening 8 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
25 7. The bearing carrier cage 5 is fastened to that side of the casing cover 4 which is averted from the hydraulics casing 3. The connecting element 6 is mounted on that side of the bearing carrier cage 5 which is situated opposite the casing cover 4. On the
30 connecting element 6, on the side situated opposite the bearing carrier cage 5, there is arranged a drive motor 9 which forms the electrical part. The pump arrangement 1 is of a block-type design, that is to say the pump casing 2 and the casing of the drive motor 9 are
35 connected to one another, for example by way of the connecting element 6.

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 connecting element 6. The containment can 10 hermetically seals off a chamber 12, which is enclosed by said containment can, with respect to the interior space 11.

An impeller shaft 13 which is rotatable about an axis of rotation A extends from a flow chamber 14, which is delimited by the hydraulics casing 3 and by the casing cover 4, into the chamber 12 through an opening 15 provided in the casing cover 4.

An impeller 16 is fastened to a shaft end, situated within the flow chamber 14, of the impeller shaft 13, and an inner rotor 17 arranged within the chamber 12 is arranged on the opposite shaft end, which has two shaft sections 13a, 13b with increasing diameters in each case. The inner rotor 17 is equipped with multiple magnets 18 which are arranged on that side of the inner rotor 17 which faces toward the containment can 10.

Between the impeller 16 and the inner rotor 17 there is arranged a bearing arrangement 19 which is operatively connected to the impeller shaft 13, which can be driven in rotation about the axis of rotation A.

The drive motor 9 drives a drive shaft 20. The drive shaft 20, which can be driven about the axis of rotation A, is arranged substantially coaxially with respect to the impeller shaft 13. The drive shaft 20 extends into the connecting element 6 and possibly at least partially into the bearing carrier cage 5. On the free end of the drive shaft 20 there is arranged an outer rotor 22, which bears multiple magnets 21. The

magnets 21 are arranged on that side of the outer rotor 22 which faces toward the containment can 10. The outer rotor 22 extends at least partially over the containment can 10 and interacts with the inner rotor 17 such that the rotating outer rotor 22, by way of magnetic forces, sets the inner rotor 17 and thus likewise the impeller shaft 13 and the impeller 16 in rotation.

- 10 The outer rotor 22, which is illustrated on an enlarged scale in figure 2, comprises a hub 23 with a smooth outer shell surface 24, a flange-like first carrier element 25, which is formed or arranged on that side of the hub 23 which faces toward the containment can 10, and a hollow cylindrical second carrier element 26, which is formed or arranged on the first carrier element 25 and which at least partially surrounds the containment can 10 and on which the magnets 21 are arranged. The first and second carrier elements 25, 26 are illustrated as two parts that can be connected to one another, though may also be produced as one part.

- A passage bore 27 extends through the hub 23 and forms a hub inner surface 28. In the hub inner surface 28 there is formed an axial groove 29 which extends parallel to the axis of rotation A. Furthermore, at least one radially encircling first groove 30 is formed on the hub inner surface 28 at the side situated close to the first carrier element 25, and at least one radially encircling second groove 31 is formed on the hub inner surface 28 at the side remote from the first carrier element 25. In the illustration shown, the first and second grooves 30, 31 are of the same dimensions. If required, the dimensions may be selected so as to differ. At least one first groove 30 is formed in a region of the hub inner surface 28 which is situated substantially between the center of the hub 23 and the first carrier element 25 in the axial

direction. At least one second groove 31 is formed in a region of the hub inner surface 28 which extends substantially from the center of the hub 23 to a point close to that end of the hub 23 which is situated opposite the first carrier element 25. In the drive shaft 20 there is formed a feather key groove 32 which is oriented toward the axial groove 29 and into which a feather key 33 is inserted for the transmission of the motor torque to the hub 23 of the outer rotor 22. In figure 2, a tolerance ring 34 is situated in the first groove 30 and a tolerance ring 35 is situated in the second groove 31. If multiple first and second grooves 30, 31 are used, a tolerance ring 34, 35 is arranged in at least one or more of the first grooves 30 and in one or more of the second grooves 31. In particular, a tolerance ring 34 is arranged in precisely one of the first grooves 30, and a tolerance ring 35 is arranged in precisely one of the second grooves 31.

As can be seen from figure 3, the tolerance ring 34 arranged in the first groove 30 is dimensioned such that it does not extend into the feather key groove 32 which receives the feather key 33. This applies correspondingly to the tolerance ring 35 arranged in the second groove 31. Depending on the size of the feather key groove 32, the tolerance ring 34 spans an angle of approximately 300° to approximately 320° . The same applies to the tolerance ring 35. The tolerance rings 34, 35 are furthermore dimensioned such that tilting of the outer rotor 22 within the clearance fit that still exists between hub 23 and drive shaft 20 is prevented. The spring force of the tolerance rings 34, 35 corresponds at least to the weight force of the overhung outer rotor 22 plus a centrifugal force that arises from an imbalance of the outer rotor 22. The forces are composed of weight force and centrifugal force in the ratio of the spacing of the tolerance rings 34, 35 and the lever arms.

Figure 4 shows a possible process of the mounting of the hub 23 onto the drive shaft 20. It can be seen that, on the free end of the drive shaft 20, a threaded blind bore 36 is provided concentrically with respect to the axis of rotation A. In the outer rotor 22, in the region of the first carrier element 25, there is provided a threaded bore 37, which is likewise formed concentrically with respect to the axis of rotation A. Here, the threaded bore 37 has a greater diameter than the threaded blind bore 36. For the mounting of the outer rotor 22 onto the drive shaft 20, a stud screw 38 is firstly screwed into the threaded blind bore 36. Subsequently, the hub 23 of the outer rotor 22 is placed onto the drive shaft 20, wherein the stud screw 38 extends through the threaded bore 37. A shim washer 39 is pushed over the stud screw 38 until it abuts against the outer rotor 22. By means of a threaded nut 40 screwed onto the stud screw 38, the hub 23 of the outer rotor 22 is pushed onto the drive shaft 20. Since bores, discontinuities or slots in or on the outer shell surface 24 of the hub 23 are dispensed with, the latter is of smooth form, that is to say of uniform or level form, and it is possible for the outer rotor 22 to be slid onto the drive shaft 20 without damage being caused to any seal elements, which are however not shown but which are for example shaft sealing rings, arranged in said region.

As can be seen from figure 5, to pull the outer rotor 22 off, a screw 41 is screwed into the threaded bore 37 until it abuts against the drive shaft 20. Screwing the screw 41 further into the threaded bore 37 causes the outer rotor 22, with its hub 23, to be pulled off the drive shaft 20.

List of reference designations

1	Pump arrangement	23	Hub
2	Casing	24	Outer shell surface
3	Hydraulics casing	25	First carrier
4	Casing cover		element
5	Bearing carrier cage	26	Second carrier
6	Connecting element		element
7	Inlet opening	27	Passage bore
8	Outlet opening	28	Hub inner surface
9	Drive motor	29	Axial groove
10	Containment can	30	First groove
11	Interior space	31	Second groove
12	Chamber	32	Feather key groove
13	Impeller shaft	33	Feather key
13a	Shaft section	34	Tolerance ring
13b	Shaft section	35	Tolerance ring
14	Flow chamber	36	Threaded blind bore
15	Opening	37	Threaded bore
16	Impeller	38	Stud screw
17	Inner rotor	39	Shim washer
18	Magnet	40	Threaded nut
19	Bearing arrangement	41	Screw
20	Drive shaft		
21	Magnet	A	Axis of rotation
22	Outer rotor		

Patent claims

Pump arrangement

5 1. A pump arrangement, in particular 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
10 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
15 on the other end of the impeller shaft, having a
drive motor, having a drive shaft which can be
driven rotatably about the axis of rotation by the
drive motor, and having an outer rotor which is
arranged on the drive shaft and which interacts
20 with the inner rotor, wherein the outer rotor has
a hub with a hub inner surface formed by a passage
bore, in which hub inner surface there is formed
an axial groove which extends parallel to the axis
of rotation and which interacts with a feather key
25 inserted into a feather key groove of the drive
shaft,

characterized in that

30 at least one radially encircling first groove (30)
and at least one radially encircling second groove
(31) are formed in the hub inner surface (28),
wherein a tolerance ring (34, 35) is arranged at
least in two of the grooves (30, 31).

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2. The pump arrangement as claimed in claim 1,
characterized in that a tolerance ring (34, 35) is
arranged in at least one or more of the first

grooves (30) and in one or more of the second grooves (31).

3. The pump arrangement as claimed in claim 2,
5 characterized in that a tolerance ring (34) is arranged in one of the first grooves (30) and a tolerance ring (35) is arranged in one of the second grooves (31).
- 10 4. The pump arrangement as claimed in one of claims 1, 2 or 3, characterized in that the pump arrangement (1) is of a block-type design.
- 15 5. The pump arrangement as claimed in one of claims 1 to 4, characterized in that at least one first groove (30) is formed in a region of the hub inner surface (28) which is situated substantially between the center of the hub (23) and the first carrier element (25) in the axial direction, and
20 in that at least one second groove (31) is formed in a region of the hub inner surface (28) which extends substantially from the center of the hub (23) to a point close to that end of the hub (23) which is situated opposite the first carrier
25 element (25).
6. The pump arrangement as claimed in one of claims 1 to 5, characterized in that the outer shell surface (24) of the hub (23) is of smooth form.
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7. The pump arrangement as claimed in one of claims 1 to 6, characterized in that, in the outer rotor (22), there is provided a threaded bore (37) which is formed in the region of the first carrier
35 element (25).
8. The pump arrangement as claimed in claim 7, characterized in that the threaded bore (37) has a

larger diameter than a threaded blind bore (36) provided in the drive shaft (20).

- 5 9. The pump arrangement as claimed in one of claims 1 to 8, characterized in that the tolerance rings (34, 35) are dimensioned such that they do not extend into the feather key groove (32) which receives the feather key (33).