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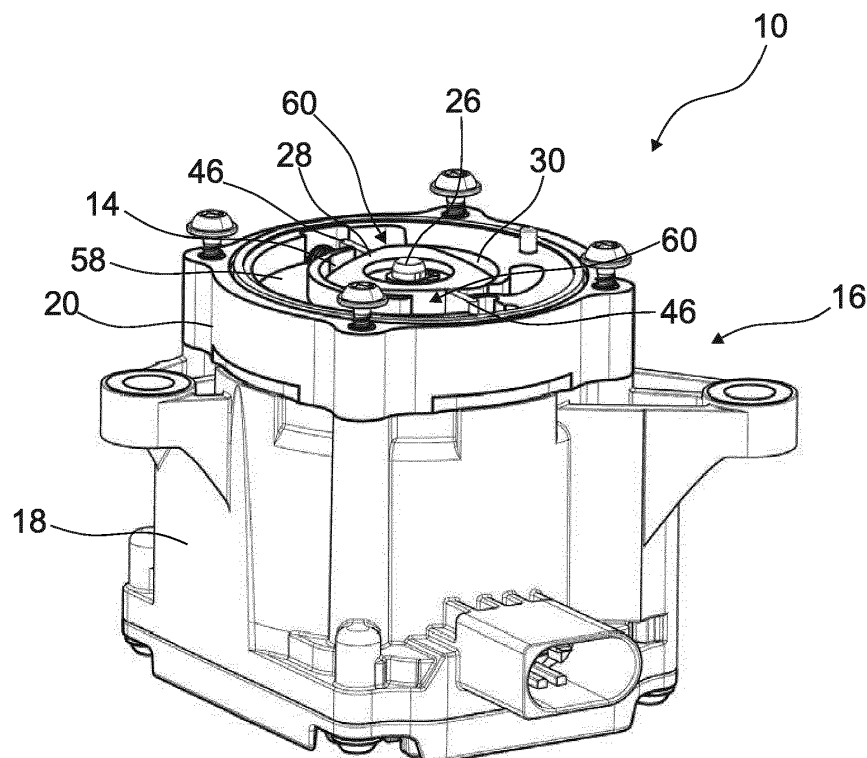
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(54) **SLIDING-VANE PUMP**

(57) A sliding-vane pump (10) is described, with a housing (16) in which a cylindrical fluid chamber (14) is formed, a conveyor rotor (28) which is rotatable in the fluid chamber (14) and is guided on a circumferential wall (30) of the fluid chamber (14), wherein in the fluid chamber (14), the conveyor rotor (28) delimits at least one conveyor chamber (32, 33, 34, 35, 36) having a volume

which is variable by rotation of the conveyor rotor (28), and with a drive motor (22) having a rotor (24) which is attached rotationally fixedly on a drive shaft (26), wherein the conveyor rotor (28) is arranged positionally fixedly on the drive shaft (26) and the drive shaft (26) is radially mounted in the housing (16) by means of the conveyor rotor (28).

Fig. 1



Description

[0001] The invention concerns a sliding-vane pump with a housing in which a cylindrical fluid chamber is formed, and a conveyor rotor which is rotatable in the fluid chamber. The conveyor rotor is rotationally fixedly arranged on a drive shaft.

[0002] Sliding-vane pumps are used for example in motor vehicles to convey fuel for an internal combustion engine, in particular to aspirate the content of a tank and deliver this to an injection system of the internal combustion engine.

[0003] By rotation of the conveyor rotor, fluid is conveyed from a suction port of the sliding-vane pump to a pressure port of the sliding-vane pump.

[0004] In known sliding-vane pumps, the conveyor rotor is mounted on the drive shaft by means of an Oldham coupling which serves to compensate for tolerances between the conveyor rotor and the drive shaft, in particular a radial offset between the conveyor rotor and the drive shaft. Such couplings are however complex and expensive.

[0005] It is therefore an object of the present invention to provide a sliding-vane pump with simplified structure.

[0006] This object is achieved according to the invention by a sliding-vane pump with a housing in which a cylindrical fluid chamber is formed, a conveyor rotor which is rotatable in the fluid chamber and is guided on a circumferential wall of the fluid chamber, wherein in the fluid chamber, the conveyor rotor delimits at least one conveyor chamber having a volume which is variable by rotation of the conveyor rotor, and with a drive motor having a rotor which is attached rotationally fixedly on a drive shaft, wherein the conveyor rotor is arranged positionally fixedly on the drive shaft and the drive shaft is radially mounted in the housing by means of the conveyor rotor.

[0007] Because of the bearing concept according to the invention, in particular the use of the conveyor rotor for radial mounting of the drive shaft, the structure is simpler than in known sliding-vane pumps. In particular, there is no need for a coupling between the conveyor rotor and the drive shaft. More precisely, no compensation elements for concentricity tolerances between the conveyor rotor and a bearing are required.

[0008] The bearing concept according to the invention is suitable above all for pumps for conveying fluids at a relatively low fluid pressure.

[0009] The housing and/or the conveyor rotor are for example made of plastic. This contributes to a low-cost design of the sliding-vane pump. The use of plastic parts is also particularly suitable in the case of a low fluid pressure.

[0010] The conveyor rotor is preferably mounted directly on the drive shaft.

[0011] For example, the drive shaft is radially mounted in the housing at a further bearing point, axially spaced from the conveyor rotor. This achieves a particularly stable support of the drive shaft.

[0012] The bearing point may take the form of a bearing bush or a bore in the housing. This also helps achieve a simple structure of the sliding-vane pump.

[0013] Outside of the bearing points, the drive shaft is preferably radially spaced from the housing in order to minimise friction.

[0014] According to one embodiment, the conveyor rotor is axially fixed on the drive shaft and, together with the housing, forms an axial bearing for the rotor. The conveyor rotor accordingly functions as both an axial bearing and a radial bearing.

[0015] For example, the conveyor rotor is moulded or pressed onto the drive shaft, or secured thereon by means of a locking ring.

[0016] The conveyor rotor may have three circumferentially spaced, cylindrical guide faces which guide the conveyor rotor on the circumferential wall of the fluid chamber. The conveyor rotor is supported on the circumferential wall by means of the guide faces, thus providing the radial bearing function. Since three guide faces are provided, a particularly stable guidance and high concentricity precision are achieved. In concrete terms, the three guide faces achieve a particularly precise centring of the conveyor rotor in the fluid chamber of the housing.

[0017] The housing may receive two radially displaceably mounted sliding-vanes which lie against the conveyor rotor, wherein the sliding-vanes lie diametrically opposite one another. In particular, the sliding-vanes are each elastically loaded, for example by means of a spring. The diametrically opposing arrangement of the sliding means allows the superposition of two suction and pressure flows with phase offset, so that a pulsation of the pressure flow is as low as possible.

[0018] Preferably, the width of the cylindrical guide faces is greater than the width of the sliding-vanes. This prevents the conveyor rotor from sticking in a housing gap during rotation, because one sliding-vane is mounted displaceably.

[0019] The conveyor rotor is preferably formed from a material which has a higher coefficient of thermal expansion than the material from which the housing is formed. At low temperatures, when the conveyed medium is more viscous, the conveyor rotor has a greater distance from the housing than at high temperatures, whereby friction of the conveyor rotor on the housing is reduced. Leakage at low temperatures is prevented by the viscosity of the fluid or is only so low that this does not adversely affect the function of the sliding-vane pump. At high temperatures, when the conveyed medium is less viscous, the conveyor rotor lies against the housing with less play and thus reliably prevents leakage, while friction is also low because of the lubrication from the low-viscosity fluid.

[0020] Because the friction of the conveyor rotor on the housing is low both at low temperatures and at high temperatures because of the different thermal expansion coefficients, a drive motor with a correspondingly reduced drive power may be used, which contributes to a compact construction of the sliding-vane pump.

[0021] During operation of the sliding-vane pump, for example temperature fluctuations from -40 to +150°C occur.

[0022] For example, the housing and conveyor rotor are made from different plastics.

[0023] According to one embodiment, at least one fluid supply channel opens into the fluid chamber from each side in the axial direction. In this way, a particularly high volume flow of supplied fluid can be achieved with simultaneously compact construction.

[0024] The drive motor is preferably an electric motor, i.e. the drive motor comprises a rotor and a stator. Thus the sliding-vane pump can be operated particularly efficiently.

[0025] Further advantages and features of the invention can be found in the following description and from the accompanying drawings, to which reference is made. In the drawings:

- Figure 1 shows a sliding-vane pump according to the invention in a perspective view,
- Figure 2 shows the sliding-vane pump from Figure 1 in a view from above.
- Figure 3 shows a longitudinal section through the sliding-vane pump along line A-A in Figure 2,
- Figure 4 shows a section through the sliding-vane pump along line B-B in Figure 2, and
- Figure 5 shows a section through the sliding-vane pump along line C-C in Figure 2.

[0026] Figures 1 to 5 show a sliding-vane pump 10 which is used for example for conveying fuel in a motor vehicle.

[0027] Figures 1 and 2 show the sliding-vane pump 10 in a perspective view and in a view from above, wherein a housing cover 12 of the sliding-vane pump 10 is not shown, in order to allow a view of a cylindrical fluid chamber 14.

[0028] The fluid chamber 14 is formed in a housing 16.

[0029] In this exemplary embodiment, the housing 16 is made of two parts and comprises a motor housing 18 and a fluid housing 20.

[0030] The motor housing 18 contains a drive motor 22 (see Figure 3) of the sliding-vane pump 10, and the fluid chamber 14 is formed in the fluid housing 20.

[0031] The drive motor 22 has a rotor 24 (see Figure 3), which is attached rotationally fixedly on a drive shaft 26, and a stator 25.

[0032] The drive motor 22 is an electric motor in this exemplary embodiment.

[0033] As shown in Figures 1 and 2, the sliding-vane pump 10 has conveyor rotor 28 which is rotatable in the fluid chamber 14 and is guided on a circumferential wall 30 of the fluid chamber 14.

[0034] Depending on the position of the conveyor rotor, up to five conveyor chambers 32, 33, 34, 35, 36 are delimited in the fluid chamber, each with a volume which is variable by rotation of the conveyor rotor 28.

5 **[0035]** The direction of rotation of the conveyor rotor 28 is illustrated by an arrow 37 in Figure 2.

[0036] The conveyor rotor 28 is arranged positionally fixedly on the drive shaft 26, in particular directly on the drive shaft 26, i.e. without the presence of an intermediate element.

10 **[0037]** For example, the conveyor rotor 28 is pressed or moulded onto the drive shaft 26, or axially secured on the drive shaft by means of a locking ring 38.

[0038] Thus the conveyor rotor 28 is also axially fixed on the drive shaft 26, whereby the conveyor rotor 28, together with the housing 16 (in particular the fluid housing 20), forms an axial bearing for the rotor 24.

[0039] The drive shaft 26 is radially mounted in the housing 16 by means of the conveyor rotor 28.

20 **[0040]** In concrete terms, the conveyor rotor 28 radially supports the drive shaft 26 at one end or close to one axial end.

[0041] In the exemplary embodiment, the radial mounting is achieved in that the conveyor rotor 28 has three circumferentially spaced, in particular evenly spaced, cylindrical guide faces 40 which guide the conveyor rotor 28 on the circumferential wall 30 of the fluid chamber 14.

[0042] Also, the conveyor rotor 28 is centred in the housing 16 by the guide faces 40.

30 **[0043]** The conveyor rotor 28 in particular has the form of a triangle with rounded tips.

[0044] In the region of the conveyor rotor 28, the drive shaft 26 for example has a double-D profile for better torque transmission.

35 **[0045]** As Figure 3 shows, the drive shaft 26 is radially mounted in the housing 16 at a further bearing point 42 which is axially spaced from the conveyor rotor 28.

[0046] To this end, a bearing bush 44 is provided in the exemplary embodiment. It is however also conceivable that the bearing point 42 takes the form of a housing bore.

[0047] Outside of the bearing point 42, the drive shaft 26 is radially spaced from the housing.

[0048] The housing 16, in particular the fluid housing 20, receives two radially displaceably mounted sliding-vanes 46 which lie against the conveyor rotor 28.

[0049] The sliding-vanes 46 lie diametrically opposite one another.

45 **[0050]** The sliding-vanes 46 are elastically loaded against the conveyor rotor 28 by a spring element 48. This ensures that no gap occurs between the sliding-vanes 46 and the conveyor rotor 28.

[0051] The housing 16 has corresponding recesses 50 in which the spring elements 48 are arranged, and into or out of which the sliding-vanes 46 can move on rotation of the conveyor rotor 28.

55 **[0052]** Together with the conveyor rotor 28 and circumferential wall 30, the sliding-vanes delimit the conveyor

chambers 32, 33, 34, 35, 36.

[0053] The width of the cylindrical guide faces 40 is greater than the width of the sliding-vanes 46 or recesses 50.

[0054] Two fluid ports 54, 56 (see Figure 3) are provided in the housing cover 12 for a pressure line and a suction line. The lines themselves are not shown for the sake of simplicity.

[0055] The sliding-vane pump 10 in particular draws in fluid from the suction line via the fluid port 56 and delivers this to the pressure line via the fluid port 54.

[0056] Figure 2 shows a pressure region 58 in the fluid housing 20, into which fluid is expelled on rotation of the conveyor rotor 28 because of the diminishing volume of the corresponding conveyor chamber 32, 33, 34, 35, 36.

[0057] In the exemplary embodiment, two pressure openings 60 are provided in the circumferential wall, from which fluid is conveyed in parallel to the pressure region 58.

[0058] The sliding-vanes 46 are hydraulically pressurised on the back by the pressure region 58, and pressure-dependently also pressed onto the conveyor rotor 28.

[0059] Outside of the pressure openings 60, the fluid chamber 14 is separated from the pressure region 58 by the circumferential wall 30. This is also clear from the sectional illustrations in Figures 3 to 5, which show that the pressure region 58 is in portions formed as a circumferentially closed channel.

[0060] In addition, two suction openings 62 (see Figures 4 and 5) are provided in the fluid housing 20, from which, on further rotation of the conveyor rotor 28, the fluid is drawn into the corresponding conveyor chamber 32, 33, 34, 35, 36 and conveyed to the fluid port 54, which is connected to the pressure line, when the volume of the corresponding conveyor chamber 32, 33, 34, 35, 36 is reduced because of the rotation of the conveyor rotor 28.

[0061] In the position of the conveyor rotor 28 shown in Figure 2, the volume of the conveyor chambers 36, 33 increases while the volume of the conveyor chambers 32, 34 reduces. The conveyor chamber 35 temporarily has a constant volume until the conveyor chamber 35 meets the sliding-vane 46.

[0062] As evident from the detail view in Figure 2, the circumferential wall 30 may have a widening 64 in the region of a suction opening 62. The widening 64 ensures that a good inflow is possible into the initially crescent-shaped, small cross-section of the corresponding conveyor chamber 32, 33, 34, 35, 36.

[0063] Figure 2 also shows that several openings 68 leading to the motor housing 18 are provided in the fluid housing 20. Some of the fluid can circulate through the motor housing 18 via these openings 68 in order to cool the drive motor 22. In concrete terms, the fluid is pushed through the corresponding openings 68 into the motor housing 18 or is extracted from the motor housing 18 by rotation of the conveyor rotor 28, in order to maintain a

circulation.

[0064] The openings 68 are also visible in Figures 3 and 5.

[0065] The sectional illustration in Figure 5 shows a suction channel 66 running in the housing cover 12 and leading to the fluid port 56 which is connected to the suction line.

[0066] A corresponding suction channel 66 is also present in the region of the further suction openings 62, as Figure 4 shows.

[0067] In addition, a further fluid supply channel 70 is provided which runs through the motor housing 18, in particular through the rotor 24, as illustrated in Figure 3 which shows a recess 72 in the rotor 24. Thus at least one fluid supply channel opens into the fluid chamber 14 from each side in the axial direction, wherein the fluid port 56 also constitutes a fluid supply channel. Thus particularly high volume flows can be achieved.

[0068] The housing 16 and the conveyor rotor 28 may be made of plastic.

[0069] The conveyor rotor 28 is preferably formed from a material which has a higher coefficient of thermal expansion than the material from which the housing 16, in particular the fluid housing 20, is formed. Thus both at low temperatures down to - 40°C and also at high temperatures up to +150°C, optimal friction conditions are achieved and leakage is reliably prevented.

Claims

1. Sliding-vane pump (10) with a housing (16) in which a cylindrical fluid chamber (14) is formed, a conveyor rotor (28) which is rotatable in the fluid chamber (14) and is guided on a circumferential wall (30) of the fluid chamber (14), wherein in the fluid chamber (14), the conveyor rotor (28) delimits at least one conveyor chamber (32, 33, 34, 35, 36) having a volume which is variable by rotation of the conveyor rotor (28), and with a drive motor (22) having a rotor (24) which is attached rotationally fixedly on a drive shaft (26), wherein the conveyor rotor (28) is arranged positionally fixedly on the drive shaft (26) and the drive shaft (26) is radially mounted in the housing (16) by means of the conveyor rotor (28).
2. Sliding-vane pump (10) according to Claim 1, **characterized in that** the drive shaft (26) is radially mounted in the housing (16) at a further bearing point (42) axially spaced from the conveyor rotor (28).
3. Sliding-vane pump (10) according to any of the preceding claims, **characterized in that** the conveyor rotor (28) is axially fixed on the drive shaft (26) and, together with the housing (16), forms an axial bearing for the rotor (24).
4. Sliding-vane pump (10) according to any of the pre-

ceding claims, **characterized in that** the conveyor rotor (28) has three circumferentially spaced, cylindrical guide faces (40) which guide the conveyor rotor (28) on the circumferential wall (30) of the fluid chamber (14).

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5. Sliding-vane pump (10) according to any of the preceding claims, **characterized in that** the housing (16) receives two radially displaceably mounted sliding-vanes (46) which lie against the conveyor rotor (28), wherein the sliding-vanes (46) lie diametrically opposite one another. 10
6. Sliding-vane pump (10) according to Claims 4 and 5, **characterized in that** the width of the cylindrical guide faces (40) is greater than the width of the sliding-vanes (46). 15
7. Sliding-vane pump (10) according to any of the preceding claims, **characterized in that** the conveyor rotor (28) is formed from a material which has a higher coefficient of thermal expansion than the material from which the housing (16) is formed. 20
8. Sliding-vane pump (10) according to any of the preceding claims, **characterized in that** at least one fluid supply channel (70, 56) opens into the fluid chamber (14) from each side in the axial direction. 25
9. Sliding-vane pump (10) according to any of the preceding claims, **characterized in that** the drive motor (22) is an electric motor. 30

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Fig. 1

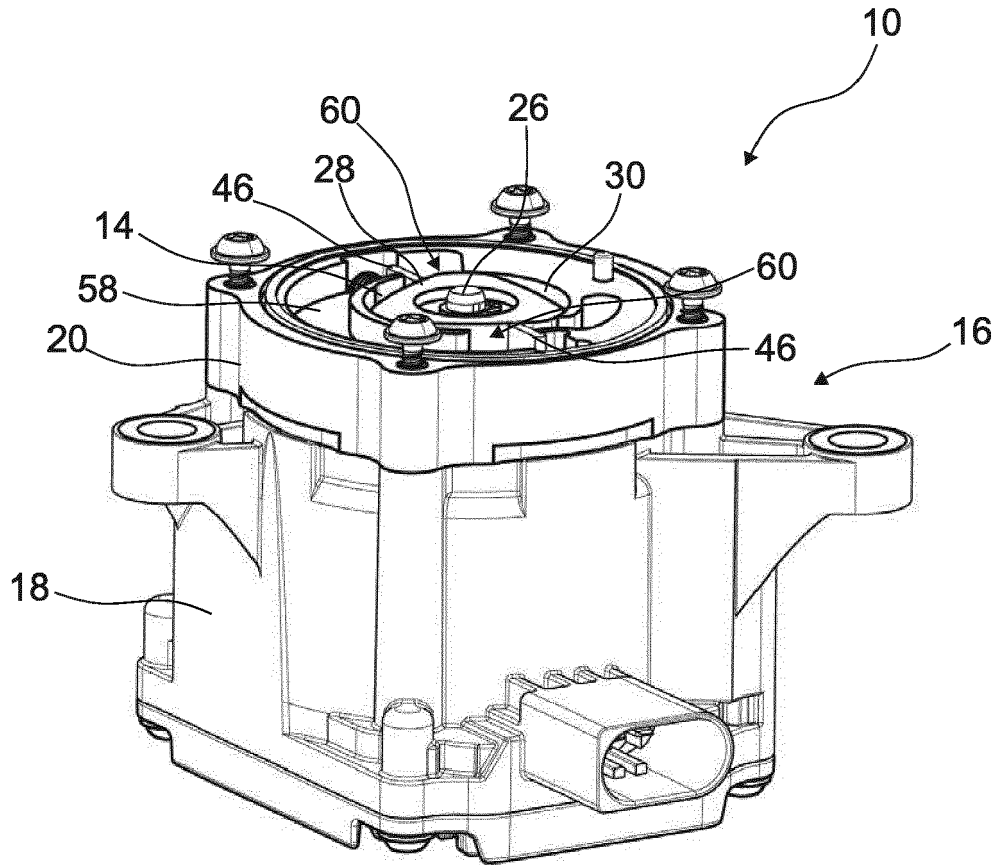


Fig. 2

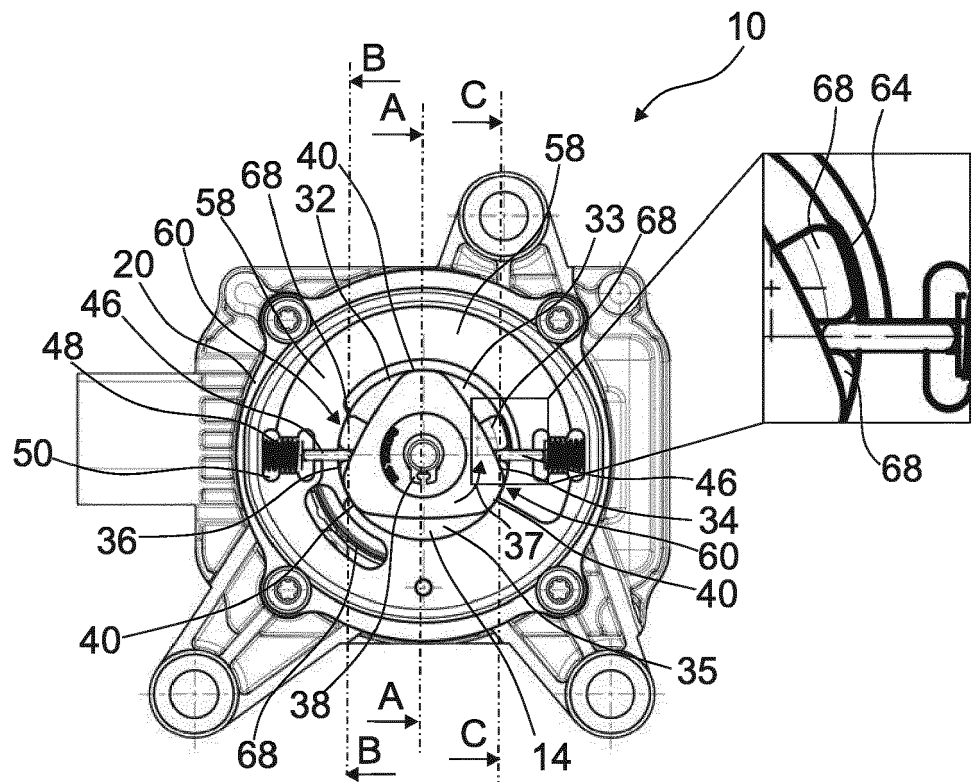


Fig. 3

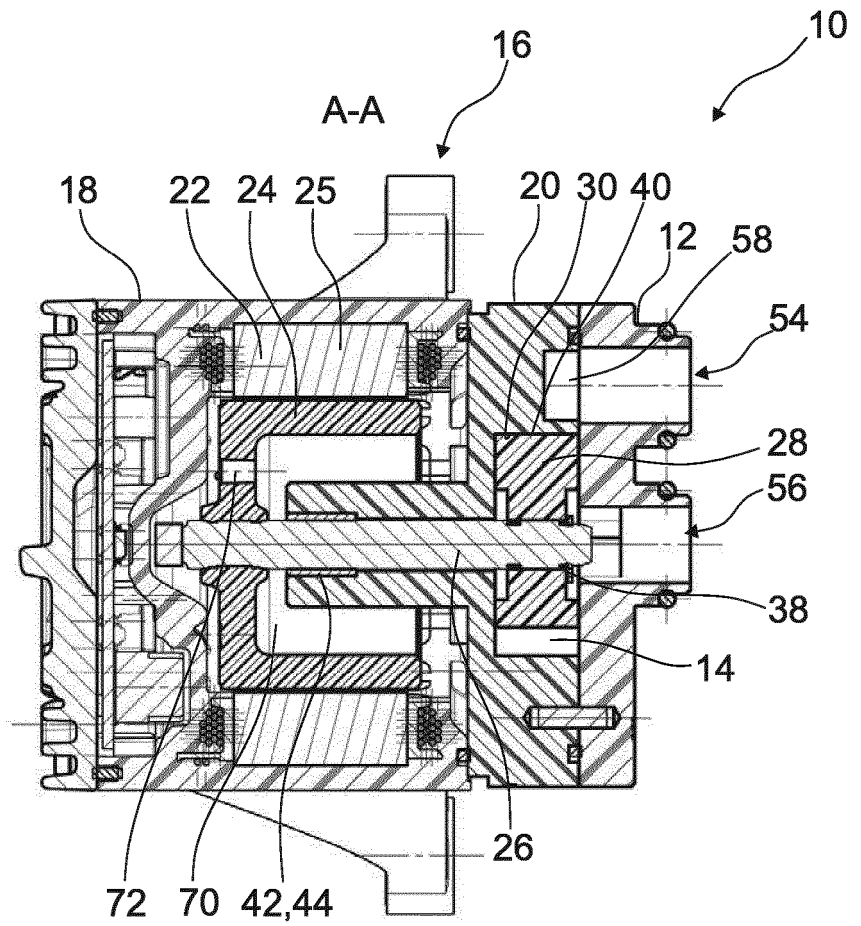


Fig. 4

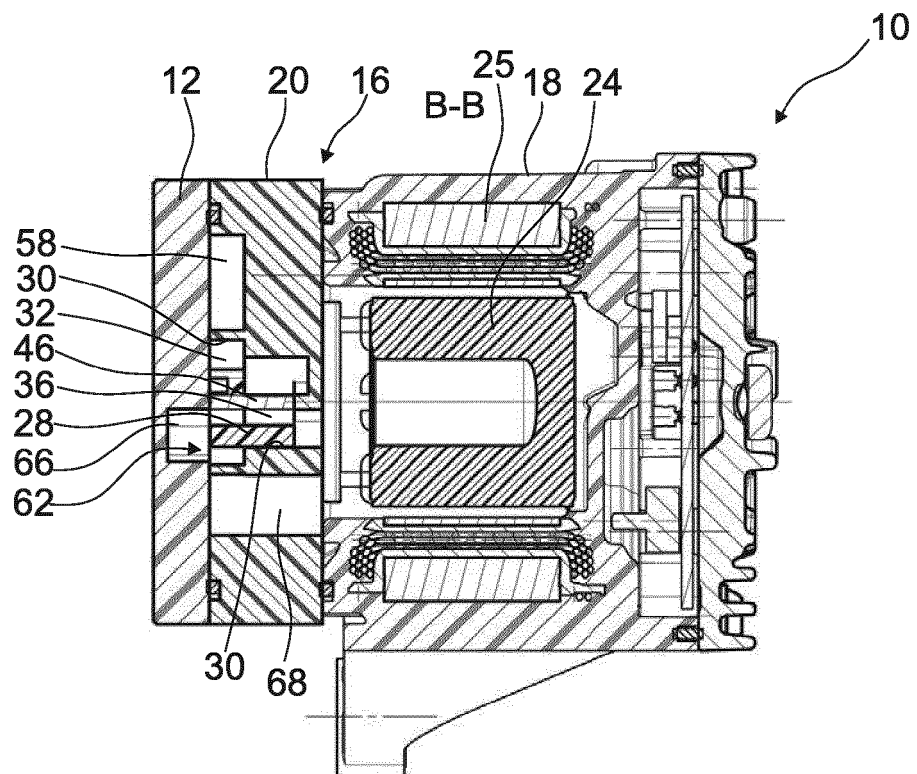
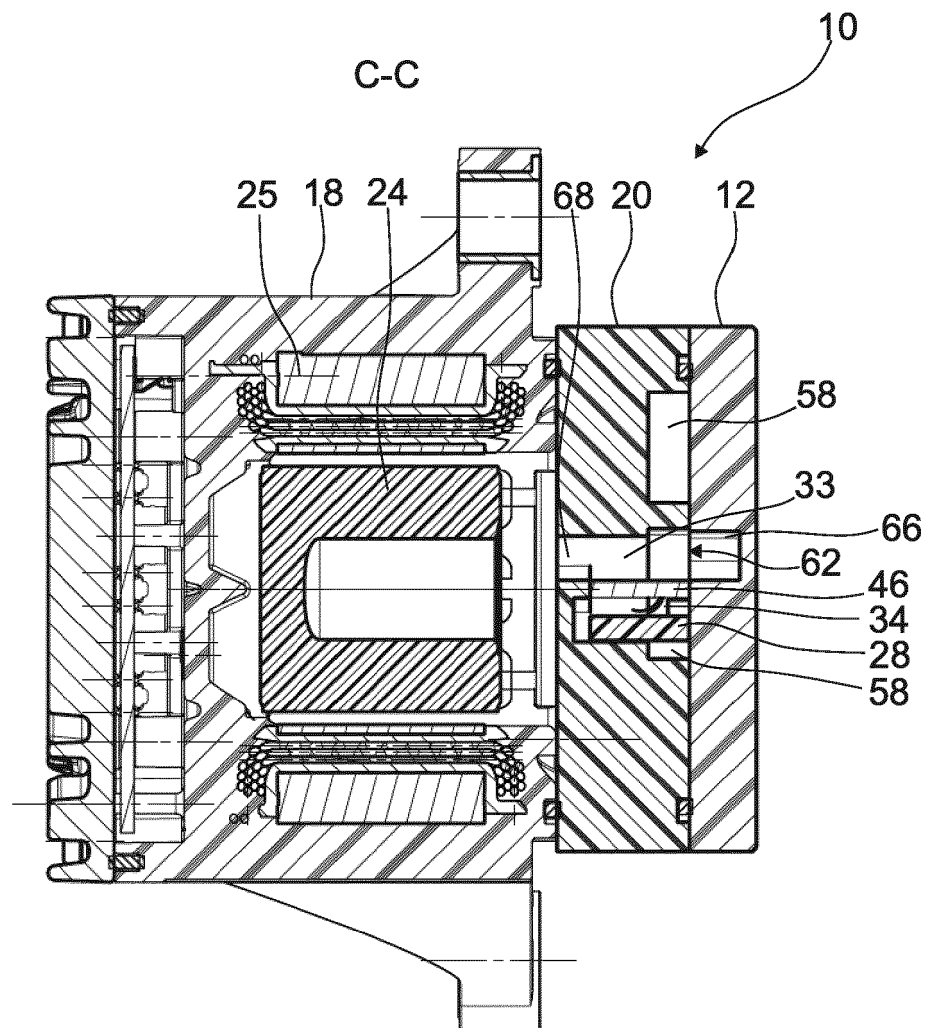


Fig. 5





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Application Number

EP 23 20 5053

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Place of search Munich		Date of completion of the search 19 February 2024	Examiner Alquezar Getan, M
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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