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

(11) EP 2 211 059 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
28.07.2010 Bulletin 2010/30

(51) Int Cl.:
F04C 2/10 *(2006.01)*

(21) Application number: **10150603.8**

(22) Date of filing: **13.01.2010**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR
Designated Extension States:
AL BA RS

(30) Priority: **26.01.2009 IT MI20090017 U**

(71) Applicant: **Fluid-O-Tech S.r.l.**
20094 Corsico (MI) (IT)

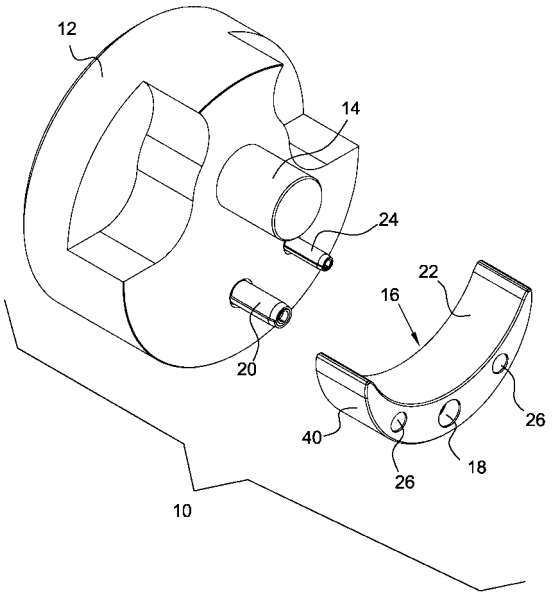
(72) Inventors:
- **Andreis, Vittorio**
  20146 Milano MI (IT)
- **Copelli, Stefano**
  20032 Cormano MI (IT)

(74) Representative: **Branca, Emanuela et al**
Barzanò & Zanardo Milano S.p.A.
Via Borgonuovo, 10
20121 Milano (IT)

(54) Separation system between the high-pressure chamber and the low-pressure chamber in a volumetric pump

(57) The finding describes a separation system (10) between the high-pressure chamber and the low-pressure chamber in a volumetric pump of the type with gears (36, 38). The separation system (10) comprises a hub (12), torsionally forming a unit with a central pin (14) around which rotates a first gear (36) of the gears of the pump, and at least one half-moon shaped dividing wall (16), the function of which is to separate the high and low pressure chambers that are created following the rotation of the gears (36, 38) of the pump. The half-moon shaped dividing wall (16) consists of a separate component with respect to the hub (12) and is provided with connection means (18, 20) to the body of the hub (12) itself, so as to improve the efficiency and the resistance to wear of the separation system (10) and of the entire pump.

Fig. 7



EP 2 211 059 A2

Description

[0001] The present finding refers to a separation system between the high-pressure chamber and the low-pressure chamber in a volumetric pump, in particular but not exclusively a volumetric pump with internal gears that can be used for the treatment of alimentary liquids.

[0002] As known, a volumetric pump is a particular type of pump that exploits the variation in volume in a chamber to cause an intake or a thrust on an incompressible fluid. Amongst volumetric pumps there are rotary pumps of the type using gears, in which the variation in volume of the work chamber is obtained through the rotation of elements, typically two gear wheels that engage with one another, capable of defining rotary chambers having variable volume. Pumps using gears are widely used for the treatment of non-alimentary fluids, abrasive fluids and fluids with particles in suspension, which can have a considerable size and hardness, and in general in all applications in which the liquid to be transferred is particularly viscous.

[0003] In particular, so-called internal gear pumps are built with the two gears arranged one inside the other but on offset axes. A separation system takes care of separating the two gears by means of a half-moon shaped dividing wall. The depression caused by the movement of the gears, when the respective teeth move apart, allows the liquid to enter into the cavity that is created between the teeth of the gears themselves. When, on the other hand, the teeth of the gears come together, an overpressure is created that pushes the liquid towards the discharge area of the pump.

[0004] Currently, the separation systems between the high and low pressure chambers in an internal gear pump usually consist of a hub fitted onto a central pin around which rotates the internal gear of the pump. The hub is shaped in such a way as to comprise, made in a single piece with the hub itself, the half-moon shaped dividing wall that separates the two gears.

[0005] Due to the specific functions that are carried out, both the separation system as a whole and, in particular, the half-moon shaped separating wall are subjected to high mechanical stresses. It is thus clear that excessive wearing thereof can compromise the correct operation of the entire gear pump.

[0006] The purpose of the present finding is therefore to make a separation system between the high-pressure chamber and the low-pressure chamber in a volumetric pump, in particular an internal gear pump, which is more efficient and resistant to wear than known separation systems of the aforementioned type.

[0007] Another purpose of the finding is also to make a separation system between the high-pressure chamber and the low-pressure chamber in a volumetric pump that is particularly simple and cost-effective to produce.

[0008] These purposes according to the present finding are accomplished by making a separation system between the high-pressure chamber and the low-pressure chamber in a volumetric pump as outlined in claim 1.

[0009] Further characteristics of the finding are highlighted by the dependent claims, which are an integral part of the present description.

[0010] The characteristics and advantages of a separation system between the high-pressure chamber and the low-pressure chamber in a volumetric pump according to the present finding shall become clearer from the following description, given as an example and not for limiting purposes, referring to the attached schematic drawings, in which:

figure 1 is a perspective view that illustrates a separation system between the high-pressure chamber and the low-pressure chamber in a volumetric pump made according to the prior art;
figure 2 is a perspective view that illustrates the separation system of figure 1, with the gears of the pump in assembled configuration;
figure 3 is an exploded view of the components shown in figure 2;
figure 4 is another exploded view of the components shown in figure 2;
figure 5 is a section view of the components shown in figure 2;
figure 6 is another section view of the components shown in figure 2;
figure 7 is a perspective view that illustrates a first example embodiment of a separation system between the high-pressure chamber and the low-pressure chamber in a volumetric pump made according to the present finding; and
figure 8 is a perspective view that illustrates a second example embodiment of a separation system between the high-pressure chamber and the low-pressure chamber in a volumetric pump made according to the present finding.

[0011] It should be specified that, in the different attached figures, identical reference numerals indicate elements that are identical or equivalent to one another.

[0012] With reference in particular to figures 1 to 6, they show a separation system between the high-pressure chamber and the low-pressure chamber in an internal gear volumetric pump (not shown) made according to the prior art. The separation system, wholly indicated with reference numeral 10, comprises a substantially cylinder-shaped hub 12, torsionally forming a unit with a central pin 14 around which rotates the internal gear 36 of the pump. The hub 12 is shaped in such a way as to comprise, made in a single piece with the hub 12 itself, a half-moon shaped dividing wall 16, the function of which is to separate the high and low pressure chambers that are created following the rotation of the two gears 36 and 38 of the pump. The hub 12 is usually manufactured with a metallic or ceramic material having high strength.

[0013] Figure 7, on the other hand, shows a first example embodiment of a separation system 10 between

the high-pressure chamber and the low-pressure chamber in an internal gear volumetric pump made according to the present finding. In this example embodiment, the half-moon shaped dividing wall 16 consists of a separate component with respect to the hub 12 and is thus provided with suitable connection means to the body of the hub 12 itself.

[0014] More specifically, the dividing wall 16, or floating half-moon, is provided with at least one central hole 18, preferably a through hole, in which a pin 20 inserts, coupled by interference with the hub 12, so as to make a dynamic connection between the dividing wall 16 and the hub 12 itself. When the separation system 10 is assembled, the axis of the pin 20 is parallel to the axis of the central pin 14, in such a way that the concave surface 22 of the half-moon shaped dividing wall 16 can at least partially surround the teeth of the internal gear 36 of the pump. Similarly, the convex surface 40 of the half-moon shaped dividing wall 16 will at least partially surround the teeth of the external gear 38 of the pump.

[0015] Therefore, thanks to the presence of the dynamic connection pin 20 between the hub 12 and the dividing wall 16, the concave and convex surfaces 22 and 40 of the latter are able to make small movements, during the operation of the pump, to adapt to the movement of the teeth both of the internal gear 36 and of the external gear 38, with the advantage of reducing the radial leakage of fluid.

[0016] It is also possible to foresee at least one secondary pin 24, also coupled by interference with the hub 12 and inserted in a corresponding through hole 26 made on the dividing wall 16, having the function of simplifying the assembly operations of the dividing wall 16 itself on the hub 12. The axis of the secondary pin 24 is parallel to those of the main pin 20 and of the central pin 14, whereas the thickness of the secondary pin 24 itself and, consequently, the diameter of the through hole 26, are preferably smaller, respectively, than the thickness of the main pin 20 and the diameter of the relative hole 18.

[0017] Finally, figure 8 shows a second example embodiment of a separation system 10 between the high-pressure chamber and the low-pressure chamber in an internal gear volumetric pump made according to the present finding. In this example embodiment, between the hub 12 and the dividing wall 16 at least one sliding plate 28 is arranged that allows the gears 36 and 38 of the pump not to come into contact with the body of the hub 12 when they are in rotation. The sliding plate 28 is provided with a plurality of through holes 30, 32 and 34 that allow the passage, respectively, of the central pin 14, of the main pin 20 and, when present, of the secondary pin 24, and that at the same time allow the sliding plate 28 itself to be kept in position on the hub 12.

[0018] It has thus been seen that the separation system between the high-pressure chamber and the low-pressure chamber in a volumetric pump according to the present finding achieves the purposes highlighted earlier. In particular, the improved efficiency is achieved thanks:

- to the elimination of the discharge channels, necessary for the mechanical processing of the separation system when made in a single piece, which cause flow leaks from the high pressure zone to the low pressure zone of the pump, actually placing the two chambers in communication. These discharge channels are indeed no longer necessary when there is a separation system manufactured in many parts, thus improving the hydraulic efficiency of the entire pump group;
- to the floating half-moon system 16, matching up with the particular internal profile of the above that is positioned, during the operation of the pump, so as to reduce the radial leakage of fluid, not increasing the sliding friction and therefore the torque absorbed at the shaft.

[0019] The better resistance to wear is achieved using ceramic materials to manufacture the floating half-moon 16 and the sliding plate 28 of the gears 36 and 38. These components (floating half-moon 16 and sliding plate 28) can be obtained through common and established manufacturing technologies, in a simple and less troublesome way with respect to the construction of the separation system in a single piece and with the same material.

[0020] Finally, the reduction of the manufacturing costs is achieved by dividing the separation system into many geometrically simpler parts. These parts can be obtained through less troublesome processing and with conventional machinery, instead of the complex machinery necessary for construction in a single piece, and it is thus possible to keep the necessary tolerances with less difficulty. In addition, the particular geometry and the positioning of the floating half-moon 16 during the operation of the pump allow production with looser tolerances with respect to those normally necessary for known separation systems.

[0021] The separation system between the high-pressure chamber and the low-pressure chamber in a volumetric pump of the present finding thus conceived can in any case undergo numerous modifications and variants, all of which are covered by the same innovative concept; moreover, all of the details can be replaced with technically equivalent elements. In practice, the materials used, as well as the shapes and sizes, can be whatever according to the technical requirements.

[0022] The scope of protection of the finding is therefore defined by the attached claims.

Claims

1. Separation system (10) between the high-pressure chamber and the low-pressure chamber in a volumetric pump of the type with gears (36, 38), said separation system (10) comprising a hub (12), tor-

sionally forming a unit with a central pin (14) around which rotates a first gear (36) of the gears of the pump, and at least one half-moon shaped dividing wall (16), the function of which is to separate the high and low pressure chambers that are created following the rotation of the gears (36, 38) of the pump, **characterised in that** said half-moon shaped dividing wall (16) consists of a separate component with respect to said hub (12) and is provided with connection means (18, 20) to the body of said hub (12).

2. Separation system (10) according to claim 1, **characterised in that** said connection means (18, 20) comprise at least one hole (18), made centrally on said dividing wall (16), and at least one main pin (20), coupled by interference with said hub (12), which inserts into said hole (18) to make a dynamic connection between said dividing wall (16) and said hub (12).

3. Separation system (10) according to claim 2, **characterised in that** the axis of said main pin (20) is parallel to the axis of said central pin (14), in such a way that the concave surface (22) of said dividing wall (16) can at least partially surround the teeth of said first gear (36) of the pump and that the convex surface (40) of said dividing wall (16) can at least partially surround the teeth of a second gear (38) of the gears of the pump.

4. Separation system (10) according to claim 3, **characterised in that** it comprises at least one secondary pin (24), also coupled by interference with said hub (12) and inserted in a corresponding hole (26) made on said dividing wall (16), said secondary pin having the function of simplifying the assembly operations of said dividing wall (16) itself on said hub (12).

5. Separation system (10) according to claim 4, **characterised in that** the axis of said secondary pin (24) is parallel to the axis of said main pin (20) and to the axis of said central pin (14), and **in that** the thickness of said secondary pin (24) and the diameter of the corresponding hole (26) are smaller, respectively, than the thickness of said main pin (20) and than the diameter of the relative hole (18) made centrally on said dividing wall (16).

6. Separation system (10) according to any one of the previous claims, **characterised in that** between said hub (12) and said dividing wall (16) at least one sliding plate (28) is arranged that allows the gears (36, 38) of the pump not to come into contact with the body of said hub (12) when said gears (36, 38) are in rotation.

7. Separation system (10) according to claim 6, **characterised in that** said sliding plate (28) is provided with a plurality of through holes (30, 32, 34) that allow the passage, respectively, of said central pin (14) and of said connection means (18, 20) between said hub (12) and said dividing wall (16).

Fig. 1

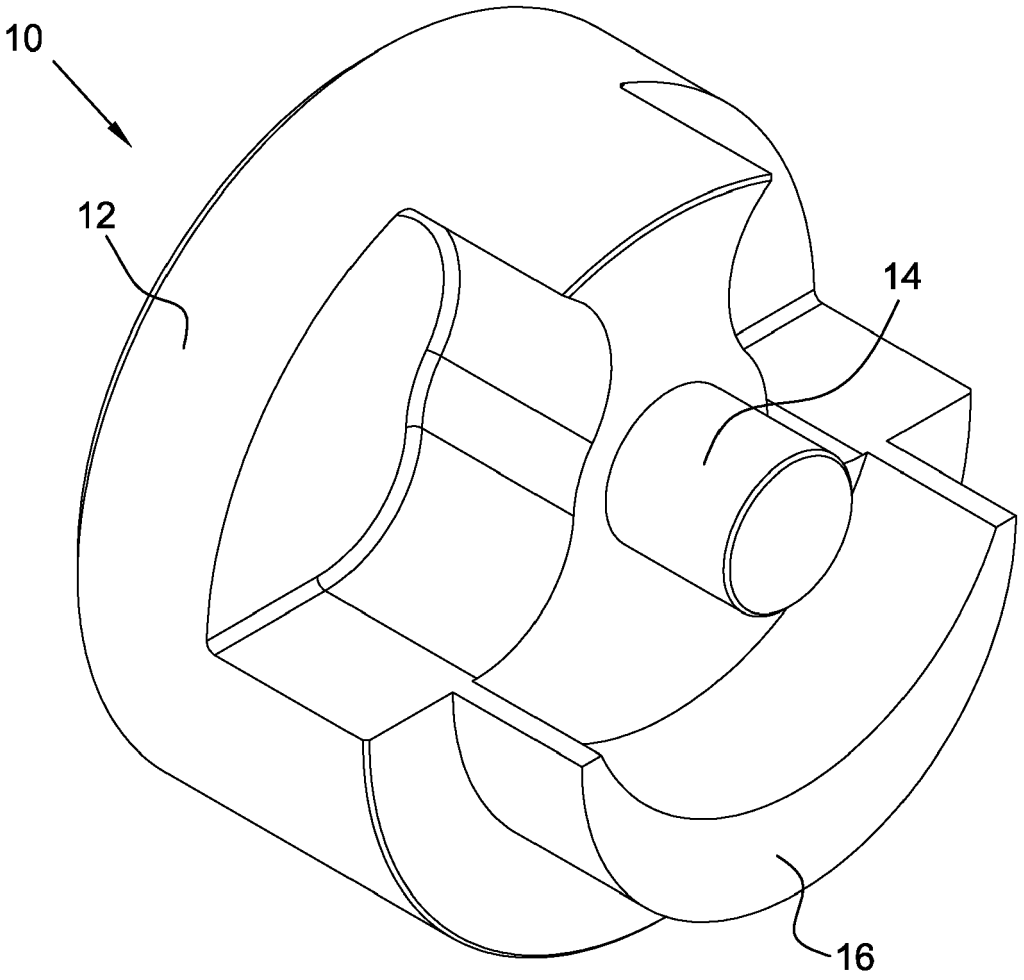


Fig. 2

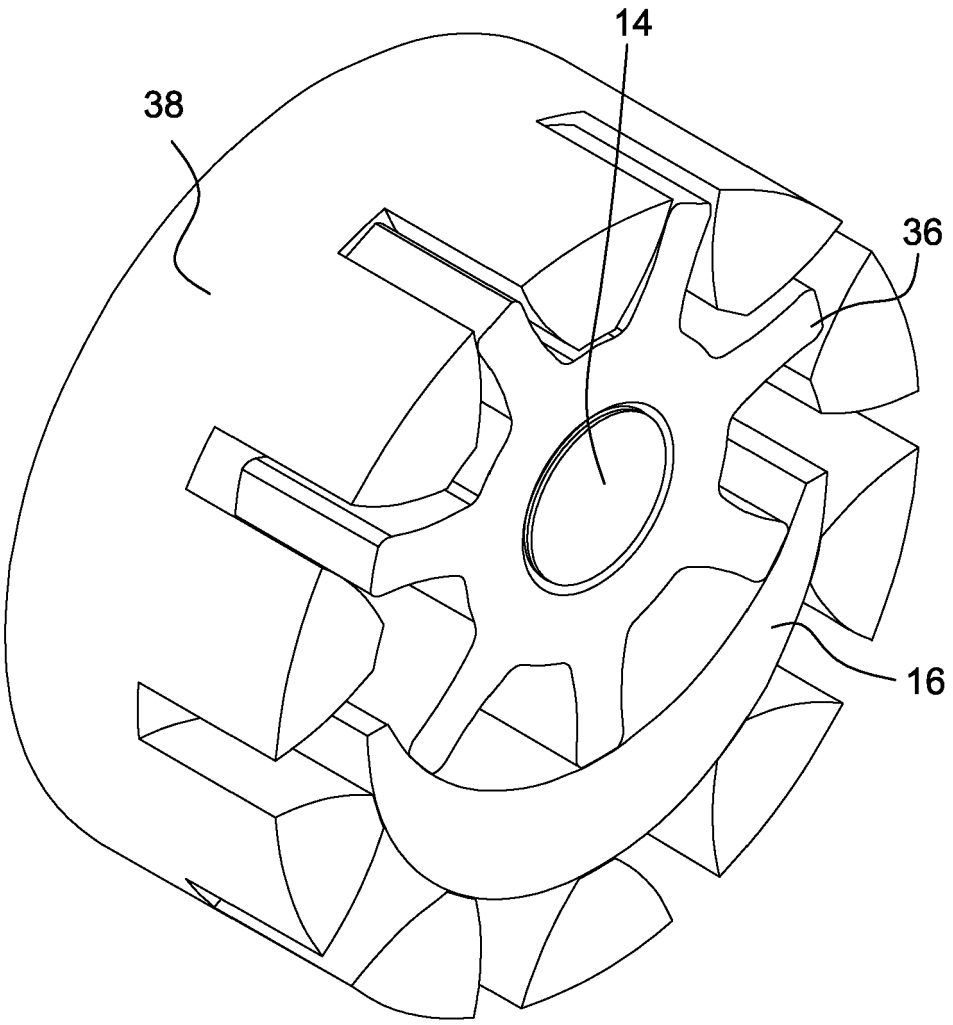


Fig. 3

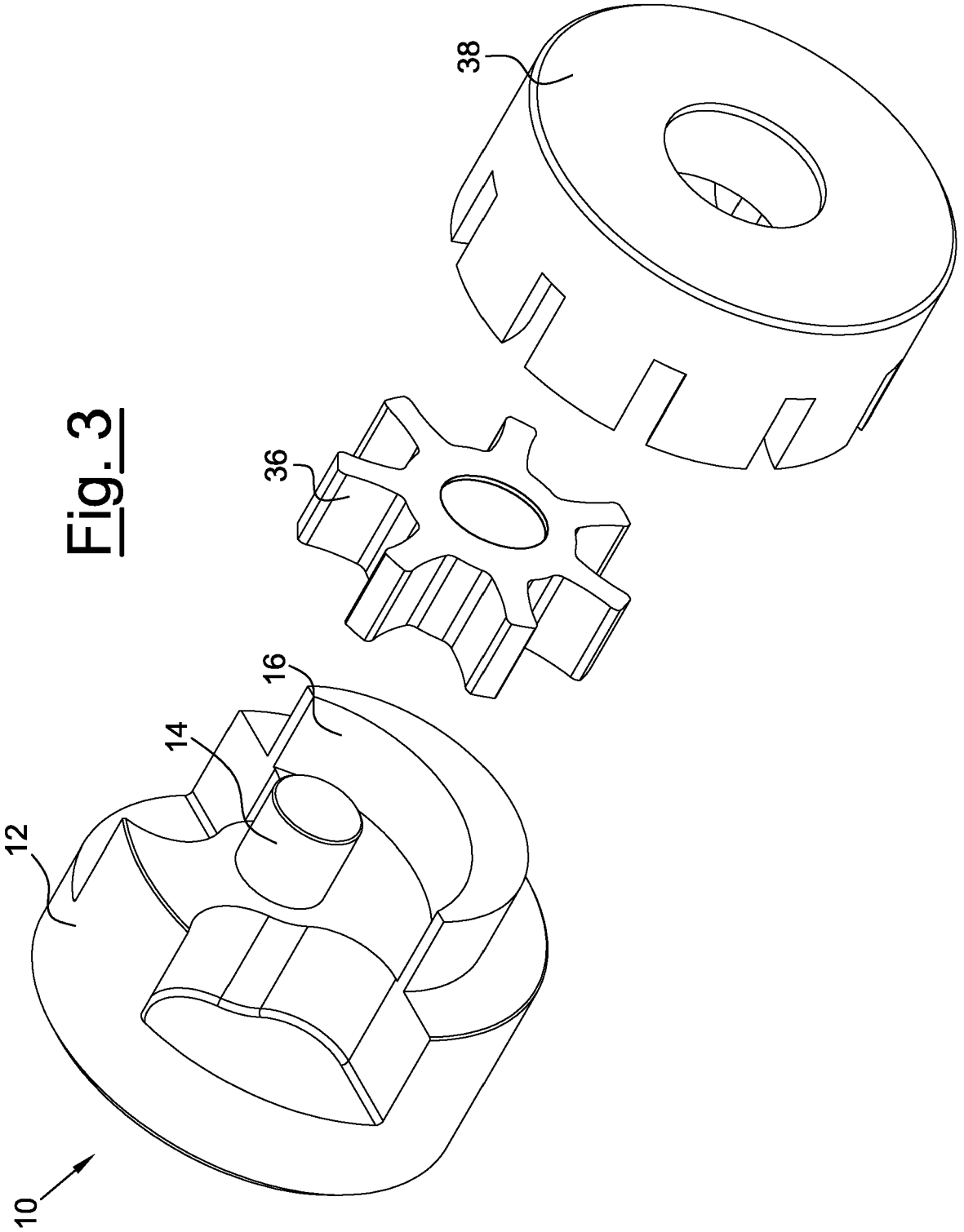


Fig. 4

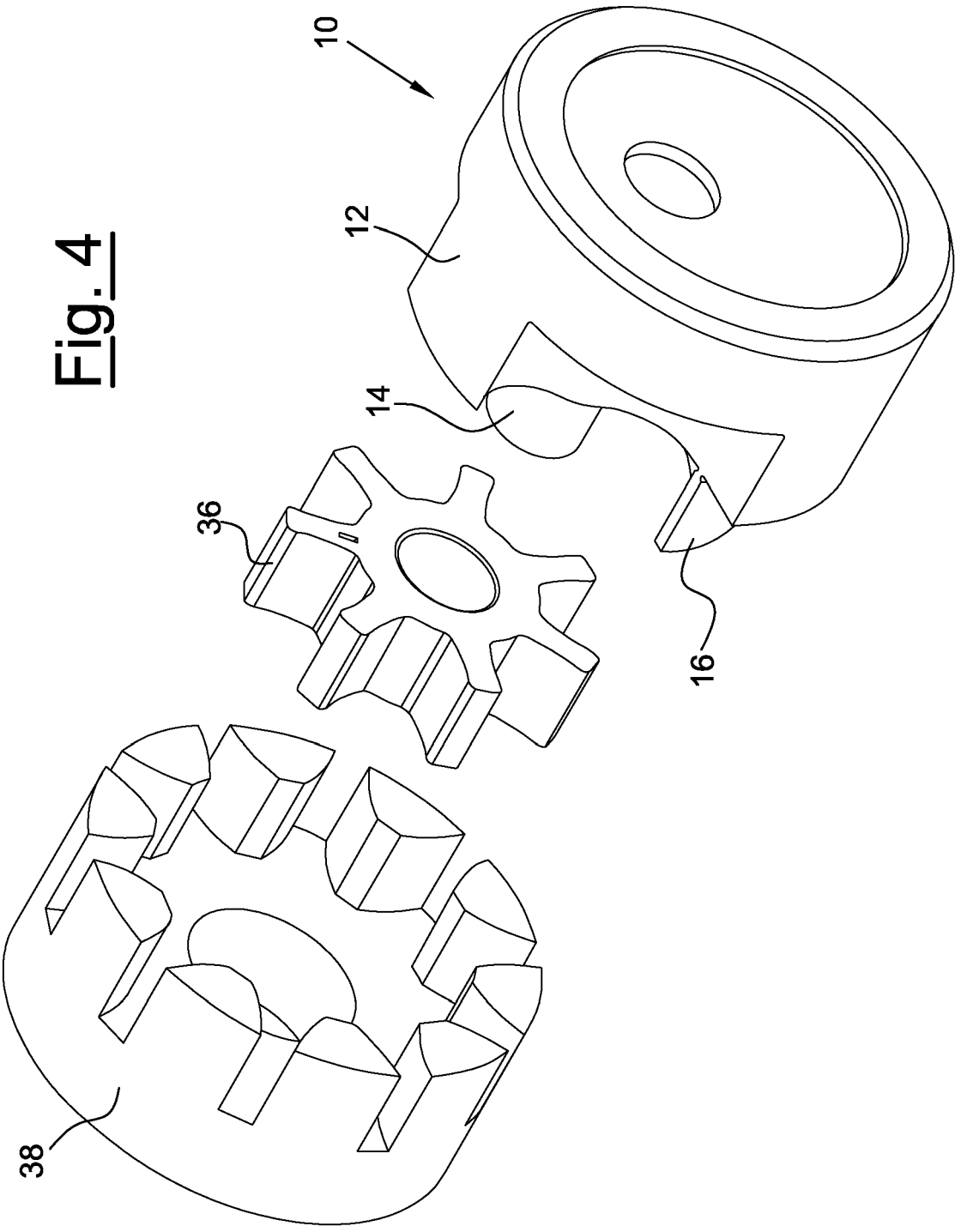


Fig. 5

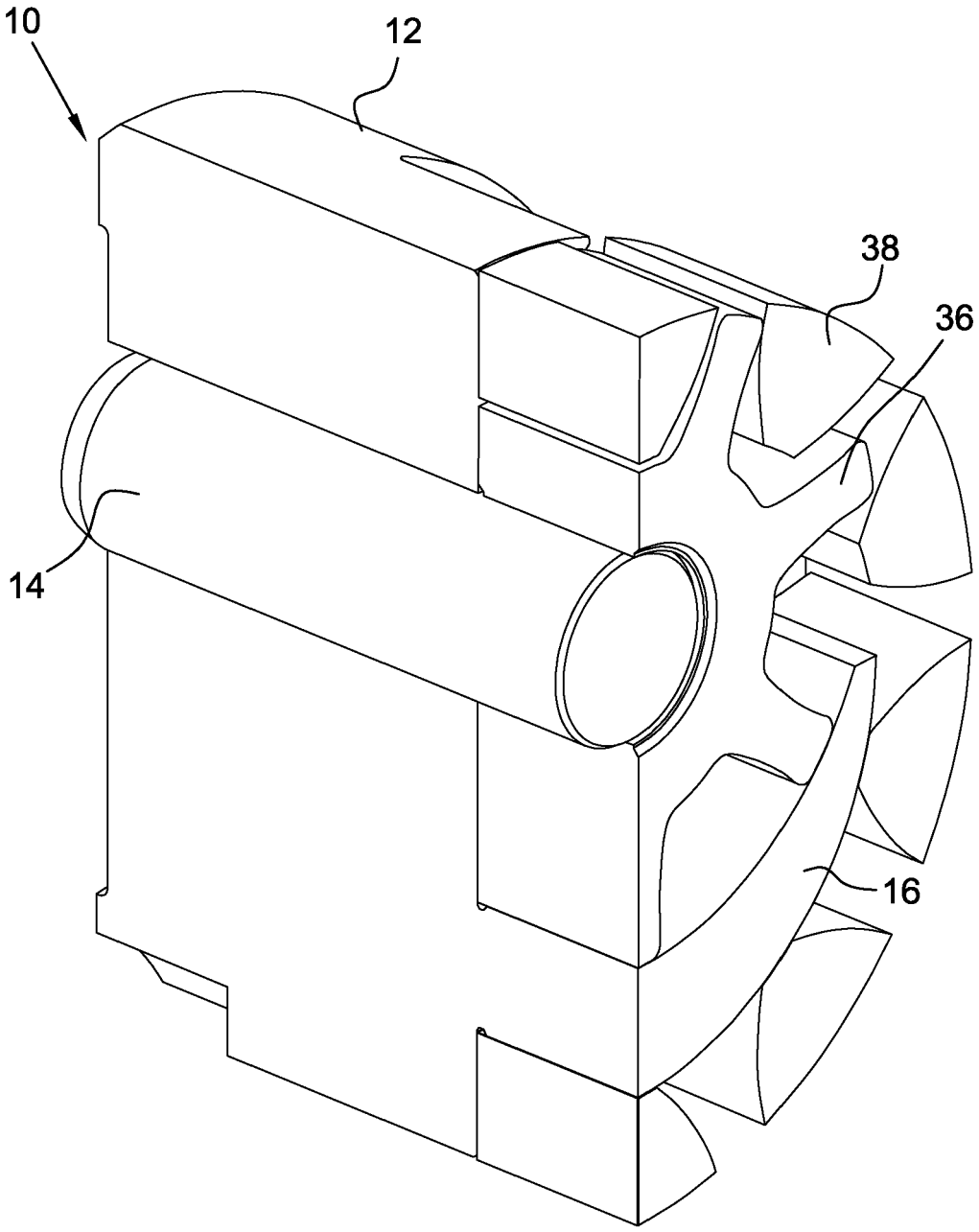


Fig. 6

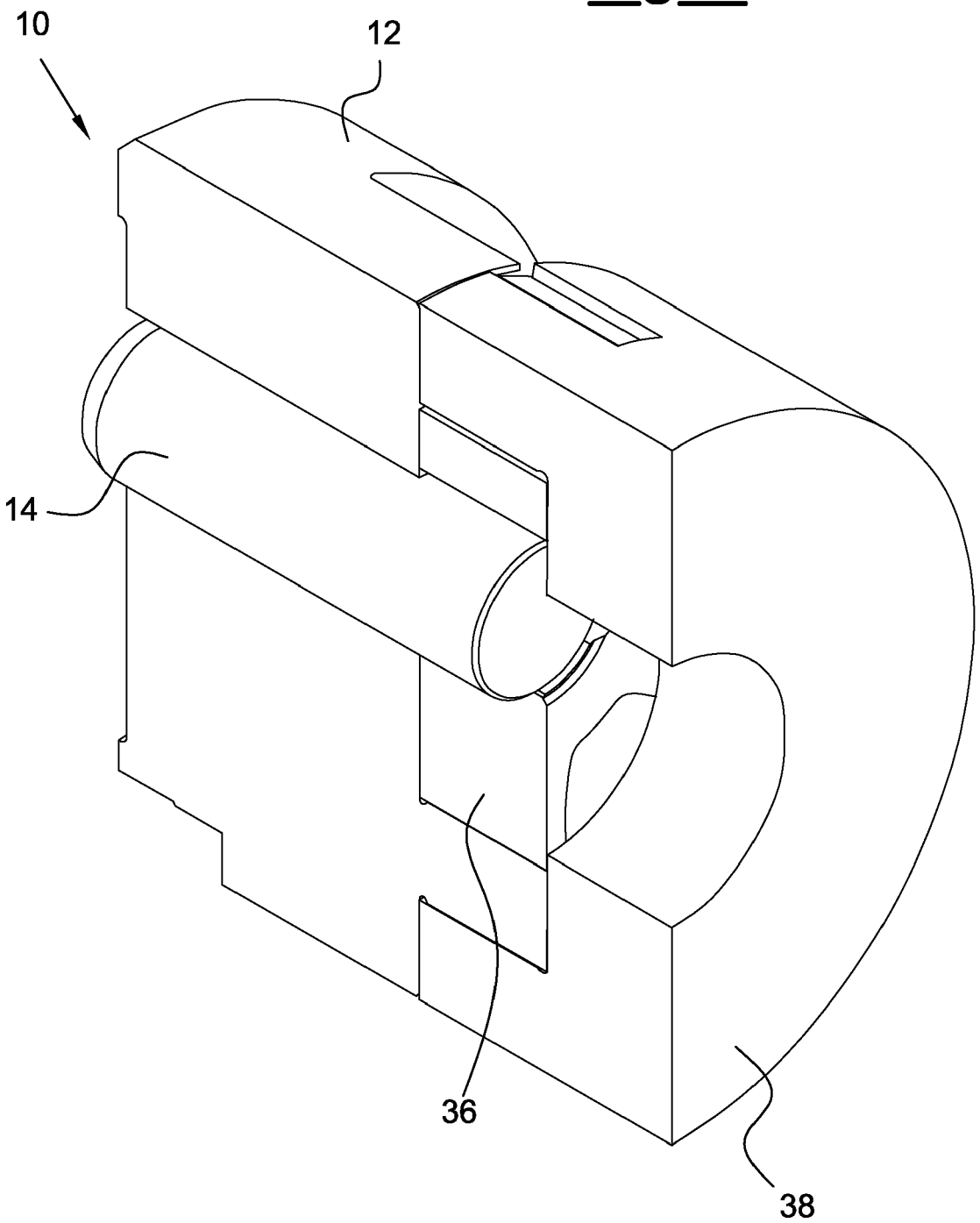


Fig. 7

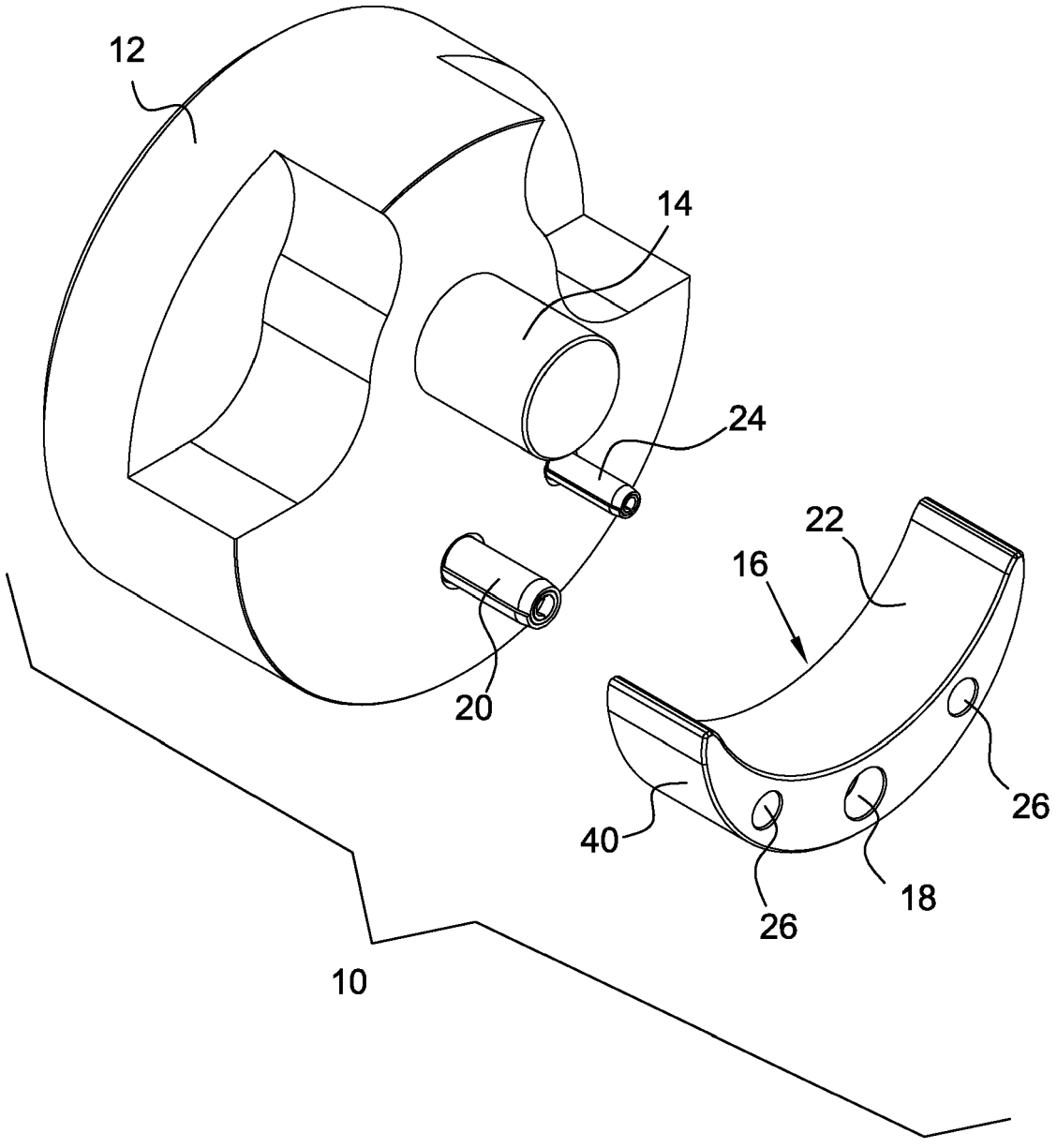


Fig. 8