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(54) GEAR PUMP

GETRIEBEPUMPE

POMPE À ENGRENAGES

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Description

[0001] The present invention relates to a gear pump and a method for constructing it.

[0002] Gear pump means a pump in which the change in volume induced by the meshing of two bodies is exploited to transfer energy to a fluid passing through the pump.

[0003] There are known gear pumps comprising:

- a compartment housing the bodies which transfer energy to the fluid passing through the pump;
- an aspirating conduit which causes the fluid to be treated to enter the housing compartment;
- a delivery conduit which causes the fluid under pressure to exit the housing compartment.

[0004] One drawback of gear pumps is tied to the need to reinforce the delivery conduit, since greater pressures occur in that zone. In this way both stress and deformations are reduced to the advantage of correct functioning, but the overall dimensions of the pump are increased because of the larger thicknesses required.

[0005] A known gear pump is disclosed by WO2009/126223.

[0006] In this context, the technical task at the basis of the present invention is to provide a pump which enables the overall dimensions to be reduced without penalising the correct functioning and reliability thereof.

[0007] The stated technical task and specified objects are substantially achieved by a gear pump comprising the technical features disclosed in one or more of the appended claims.

[0008] Additional features and advantages of the present invention will become more apparent from the approximate, and thus non-limiting description, of a preferred, but not exclusive embodiment of a gear pump, as illustrated in the appended drawings, in which:

- figure 1 shows a front view of a pump according to the present invention;
- figure 2 shows a view of the pump according to the section plane F-F of figure 1;
- figure 3 shows a view of the pump according to the section plane A-A of figure 1;
- figure 4 shows a view of the pump according to the section plane B-B of figure 1.

[0009] In the appended figures, the reference number 1 indicates a gear pump.

[0010] Said pump 1 comprises a compartment 20 housing said gears which transfer energy to a fluid crossing the pump 1. Advantageously, the gears comprise two cogwheels that reciprocally mesh and are positioned in the housing compartment 20. One of the gears could possibly have external teeth and the other internal teeth. More in general, the two gears could be rolling bodies that interact with each other, but do not have an involute profile (for example, a lobe pump).

[0011] The pump 1 also comprises a first conduit 21 which develops from the housing compartment 20. In a first operating mode said first conduit 21 is a delivery conduit. The first conduit 21 is thus used for discharging the fluid under pressure from the compartment 20.

[0012] The pump 1 comprises a first stiffening rib 31 that crosses the first conduit 21. The first stiffening rib 31 divides the flow of fluid into at least two parts. The two parts reconverge downstream of said first rib 31.

[0013] The first rib 31 thus serves to stiffen the delivery conduit, minimising the tensions of the material and consequently the deformations without oversizing in thickness the walls of the first conduit 21. It is thus possible to minimise the outer dimensions of the pump 1.

[0014] The first stiffening rib 31 comprises a fin 310 having an aerodynamic profile. This enables pressure drops to be minimised. An even more important advantage may be had in the case of a reversible pump, as better explained below.

[0015] The pump 1 advantageously comprises a second conduit 22 which terminates in said housing compartment 20. In the first operating mode the second conduit 22 is an aspirating conduit.

[0016] The pump 1 also comprises a second stiffening rib 32 crossing said second conduit 22.

[0017] Advantageously, the pump 1 is reversible. It can thus also function in a second operating mode in which the first conduit 21 becomes an aspirating conduit and the second conduit 22 becomes a delivery conduit.

[0018] Given the reversibility of the pump 1, the presence of the rib 32 also in the second conduit 22 is thus important. In fact, the second conduit 22 can also become a delivery conduit and therefore be subject to considerable stresses due to the fluid under pressure.

[0019] Conveniently, the second stiffening rib 32 comprises a fin 320 having an aerodynamic profile.

[0020] In the first operating mode, this feature serves to minimise the pressure drops on the aspirating side in order to reduce the risk of cavitation (in the first operating mode the second rib 32 operates under aspiration and the aerodynamic profile helps for that purpose).

[0021] Advantageously, the first conduit 21 and the second conduit 22 comprise two ports 23, 24 which lie side by side on a same wall of the pump 1, turned outward. Internally of the pump the first and the second conduit 21, 22 extend side by side.

[0022] In an alternative embodiment, the two ports 23, 24 of the first and the second conduit 21, 22 could be located on two distinct walls of the pump 1; in particular, they could be lateral.

[0023] Conveniently, the first conduit 21 and the first rib 31 are in a single monolithic body.

[0024] In the preferred embodiment, in addition to the first conduit 21 and the first rib 31, the second conduit 22, the second rib 32 and at least a part of the housing compartment 20 are in a single monolithic body. The single monolithic body is advantageously made of cast iron.

The single monolithic body also defines an external casing that delimits at least in part the pump 1 from the outside.

[0025] As exemplified in figure 4, the first conduit 21, the second conduit 22, the first and second rib 31, 32 and at least a part of the housing compartment 20 are symmetrical with respect to a median plane 4 interposed between the first and the second conduit 21, 22.

[0026] The first rib 31 comprises:

- a first and a second surface 311, 312 that are mutually opposite one another;
- a leading edge 313 and an exit edge 314 of the first rib 31 which are rounded and which reciprocally connect the first and the second surface e 311, 312.

[0027] With respect to a path that goes from the housing compartment 20 towards an outside of the pump 1 along the first conduit 21, the first and the second surface 311, 312 comprise a portion 315 in which they are reciprocally divergent and a portion 316 in which they are reciprocally convergent.

[0028] One of the two parts of the flow divided by said first rib 31 skims over the first surface 311 and the other over the second surface 312.

[0029] The first conduit 21 comprises a first delimiting wall 25 that faces the first surface 311 and defines a concavity turned toward the first surface 311. Analogously, the first conduit 21 comprises a second delimiting wall 26 of that faces the second surface 312 and defines a concavity turned toward the second surface 312.

[0030] The first rib 31 connects to remaining parts of the monolithic body at a first and a second end 317, 318 thereof, which are reciprocally opposite. The first end 317 is closer to an outer surface of the pump than the second end 318.

[0031] At least a transversal section that is intermediate with respect to the first and the second end 317, 318 has a smaller surface than a surface of the transversal section measured at the first and second end 317, 318. In particular, the intermediate section has a chord and/or average thickness that is/are smaller than those of the transversal section measured at the first and the second end 317, 318. The above-mentioned transversal sections are executed along planes oriented according to the direction of the fluid and transversal to the direction which joins the first and the second end 317, 318.

[0032] In a particular example embodiment, the first rib 31 has a larger transversal section at the first end 317 than at the second end 318.

[0033] Conveniently, what was previously described with reference to the first rib 31 and/or the first conduit 21 can be repeated for the second rib 32 and/or the second conduit 22.

[0034] The invention thus conceived enables multiple advantages to be obtained. First of all, it permits a reduction in the overall dimensions of the pump 1. In fact, the first rib 31 (positioned in the first conduit 21) enables the delivery side of the pump 1 to be stiffened without reinforcing the thickness of the conduits. Moreover, the aerodynamic shape of the fin makes it possible to avoid significant pressure drops on the aspirating side (and the consequent risk of cavitation) in the event that the pump functions in a reversible mode and the first conduit 21 thus acts as an aspirating conduit. The invention thus conceived is susceptible of numerous modifications and variants, all falling within the scope of the inventive concept characterising it. Moreover, all of the details may be replaced with technically equivalent elements. In practice, all of the materials used, as well as the dimensions, may be of any type, according to need.

Claims

1. A gear pump comprising:

- a housing compartment (20) of said gears which transfer energy to a fluid crossing the pump (1) ;
- a first conduit (21) which develops from the housing compartment (20), in a first operating mode said first conduit (21) being a delivery conduit;

characterised by comprising

- a first stiffening rib (31) that crosses said first conduit (21) and is destined to divide into at least two parts the flow of fluid transiting at said first rib (31);

said first rib (31) comprises:

- a first and a second surface (311, 312) that are mutually opposite one another;
- a leading edge (313) and an exit edge (314) of the first rib (31) which are rounded and which reciprocally connect the first and the second surface (311, 312).

2. The pump according to claim 1, **characterised in that** said first stiffening rib (31) comprises a fin (310) having an aerodynamic profile.

3. The pump according to claim 1 or 2, **characterised in that** it comprises:

- a second conduit (22) which terminates in said housing compartment (20), in the first operating mode said second conduit (22) being an aspirating conduit;
- a second stiffening rib (32) crossing said second conduit (22);

the pump (1) being reversible and being able to func-

tion also in a second operating mode in which said first conduit (21) becomes an aspirating conduit and said second conduit (22) becomes a delivery conduit.

4. The pump according to claim 3, **characterised in that** said second stiffening rib (32) comprises a fin (320) having an aerodynamic profile.

5. The pump according to any one of the preceding claims, **characterised in that** said first conduit (21) and said first rib (31) are in a single monolithic body.

6. The pump according to claim 3 or 4, **characterised in that** said first conduit (21), said second conduit (22), said first and second rib (31, 32) and at least a part of the housing compartment (20) are in a single monolithic body.

7. The pump according to claim 3 or 4 or 6, **characterised in that** said first conduit (21), said second conduit (22), said first and second rib (31, 32) and at least a part of the housing compartment (20) are symmetrical with respect to a median plane (4) interposed between the first and the second conduit (21, 22).

8. The pump according to any one of the preceding claims, **characterised in that** with respect to a path that goes from the housing compartment (20) towards an outside of the pump (1) along the first conduit (21), the first rib (31) comprises:

- a portion (315) in which the first and the second surface (311, 312) are reciprocally divergent; and
- a portion (316) in which the first and the second surface (311, 312) are reciprocally convergent.

9. The pump according to claim 5 or 6, **characterised in that** said first rib (31) connects to remaining parts of the monolithic body at a first and a second end (317, 318) thereof, reciprocally opposite;
at least a transversal section that is intermediate with respect to the first and the second end (317, 318) having a smaller surface than a surface of the transversal section measured between the first and the second end.

Patentansprüche

1. Getriebepumpe, umfassend:

- einen Aufnahmeraum (20) der Getrieben, die Energie auf ein die Pumpe (1) kreuzendes Fluid übertragen;
- eine erste Leitung (21), die sich aus dem Aufnahmeraum (20) erstreckt, wobei die erste Leitung (21) in einem ersten Betriebsmodus eine Förderleitung ist;

dadurch gekennzeichnet, dass sie umfasst:

- eine erste Versteifungsrippe (31), die die erste Leitung (21) kreuzt und dazu ausgelegt ist, den an der ersten Rippe (31) durchströmenden Fluidstrom in mindestens zwei Teile aufzuteilen;

die erste Rippe (31) umfasst:

- eine erste und eine zweite Oberfläche (311, 312), die einander gegenüberliegen;
- eine Vorderkante (313) und eine Austrittskante (314) der ersten Rippe (31), die abgerundet sind und die die erste und die zweite Oberfläche (311, 312) gegenseitig verbinden.

2. Pumpe nach Anspruch 1, **dadurch gekennzeichnet, dass** die erste Versteifungsrippe (31) einen Flügel (310) aufweisend ein aerodynamisches Profil umfasst.

3. Pumpe nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** sie umfasst:

- eine zweite Leitung (22), die im Aufnahmeraum (20) endet, wobei die zweite Leitung (22) in dem ersten Betriebsmodus eine Ansaugleitung ist;
- eine zweite Versteifungsrippe (32), die die zweite Leitung (22) kreuzt;

wobei die Pumpe (1) reversibel ist und auch in einem zweiten Betriebsmodus arbeiten kann, in dem die erste Leitung (21) eine Ansaugleitung und die zweite Leitung (22) eine Förderleitung wird.

4. Pumpe nach Anspruch 3, **dadurch gekennzeichnet, dass** die zweite Versteifungsrippe (32) einen Flügel (320) aufweisend ein aerodynamisches Profil umfasst.

5. Pumpe nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sich die erste Leitung (21) und die erste Rippe (31) in einem einzigen monolithischen Körper befinden.

6. Pumpe nach Anspruch 3 oder 4, **dadurch gekennzeichnet, dass** sich die erste Leitung (21), die zweite Leitung (22), die erste und die zweite Rippe (31, 32) und mindestens ein Teil des Aufnahmeraums (20) in einem einzigen monolithischen Körper befinden.

7. Pumpe nach Anspruch 3 oder 4 oder 6, **dadurch gekennzeichnet, dass** sich die erste Leitung (21), die zweite Leitung (22), die erste und die zweite Rip-

pe (31, 32) und mindestens ein Teil des Aufnahmeraums (20) symmetrisch in Bezug auf eine Mittelebene (4) befinden, die zwischen der ersten und der zweiten Leitung (21, 22) angeordnet ist.

8. Pumpe nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** in Bezug auf einen Weg, der vom Aufnahmeraum (20) zu einer Außenseite der Pumpe (1) entlang der ersten Leitung (21) verläuft, die erste Rippe (31) umfasst:

- einen Abschnitt (315), in dem die erste und die zweite Oberfläche (311, 312) gegenseitig divergent sind; und
- einen Abschnitt (316), in dem die erste und die zweite Oberfläche (311, 312) gegenseitig konvergent sind.

9. Pumpe nach Anspruch 5 oder 6, **dadurch gekennzeichnet, dass** sich die erste Rippe (31) mit verbleibenden Teilen des monolithischen Körpers an einem ersten und einem zweiten Ende (317, 318) davon verbindet, die einander gegenüber liegen; mindestens einen Querschnitt, der in Bezug auf das erste und das zweite Ende (317, 318) dazwischenliegt, aufweisend eine Oberfläche, die kleiner als eine Oberfläche des Querschnitts ist, die zwischen dem ersten und dem zweiten Ende gemessen ist.

Revendications

1. Pompe à engrenages comprenant :

- un compartiment de logement (20) desdits engrenages qui transfèrent de l'énergie vers un fluide traversant la pompe (1) ;
- une première conduite (21) se développant à partir du compartiment de logement (20), dans un premier mode de fonctionnement ladite première conduite (21) étant une conduite de refoulement ;

caractérisée en ce qu'elle comprend

- une première nervure de renforcement (31) traversant ladite première conduite (21) et étant destinée à diviser en au moins deux parties le flux de fluide transitant en correspondance de ladite première nervure (31) ;

ladite première nervure (31) comprend :

- une première et une seconde surface (311, 312) étant mutuellement opposées l'une à l'autre ;
- un bord d'attaque (313) et un bord de sortie (314) de la première nervure (31) étant arrondis et qui relient réciproquement la première et la seconde surface (311, 312) .

2. Pompe selon la revendication 1, **caractérisée en ce que** ladite première nervure de renforcement (31) comprend une ailette (310) ayant un profil aérodynamique.

3. Pompe selon la revendication 1 ou 2, **caractérisée en ce qu'**elle comprend :

- une seconde conduite (22) se terminant dans ledit compartiment de logement (20), dans le premier mode de fonctionnement ladite seconde conduite (22) étant une conduite d'aspiration ;
- une seconde nervure de renforcement (32) traversant ladite seconde conduite (22) ;

la pompe (1) étant réversible et pouvant fonctionner aussi dans un second mode de fonctionnement dans lequel ladite première conduite (21) devient une conduite d'aspiration et ladite seconde conduite (22) devient une conduite de refoulement.

4. Pompe selon la revendication 3, **caractérisée en ce que** ladite seconde nervure de renforcement (32) comprend une ailette (320) ayant un profil aérodynamique.

5. Pompe selon l'une quelconque des revendications précédentes, **caractérisée en ce que** ladite première conduite (21) et ladite première nervure (31) se présentent sous la forme d'un corps monolithique unique.

6. Pompe selon la revendication 3 ou 4, **caractérisée en ce que** ladite première conduite (21), ladite seconde conduite (22), lesdites première et seconde nervures (31, 32) et au moins une partie du compartiment de logement (20) se présentent sous la forme d'un corps monolithique unique.

7. Pompe selon la revendication 3 ou 4 ou 6, **caractérisée en ce que** ladite première conduite (21), ladite seconde conduite (22), lesdites première et seconde nervures (31, 32) et au moins une partie du compartiment de logement (20) sont symétriques par rapport à un plan médian (4) interposé entre la première et la seconde conduite (21, 22).

8. Pompe selon l'une quelconque des revendications précédentes, **caractérisée en ce que** par rapport à un parcours allant du compartiment de logement (20) vers un extérieur de la pompe (1) le long de la première conduite (21), la première nervure (31) comprend :

- une partie (315) dans laquelle la première et la seconde surface (311, 312) sont divergentes réciproquement ; et
- une partie (316) dans laquelle la première et la seconde surface (311, 312) sont convergentes réciproquement.

9. Pompe selon la revendication 5 ou 6, **caractérisée en ce que** ladite première nervure (31) relie les parties restantes du corps monolithique à ses première et seconde extrémités (317, 318), réciproquement opposées ;
au moins une section transversale, étant intermédiaire par rapport aux première et seconde extrémités (317, 318), comportant une surface plus petite qu'une surface de la section transversale mesurée entre la première et la seconde extrémité.

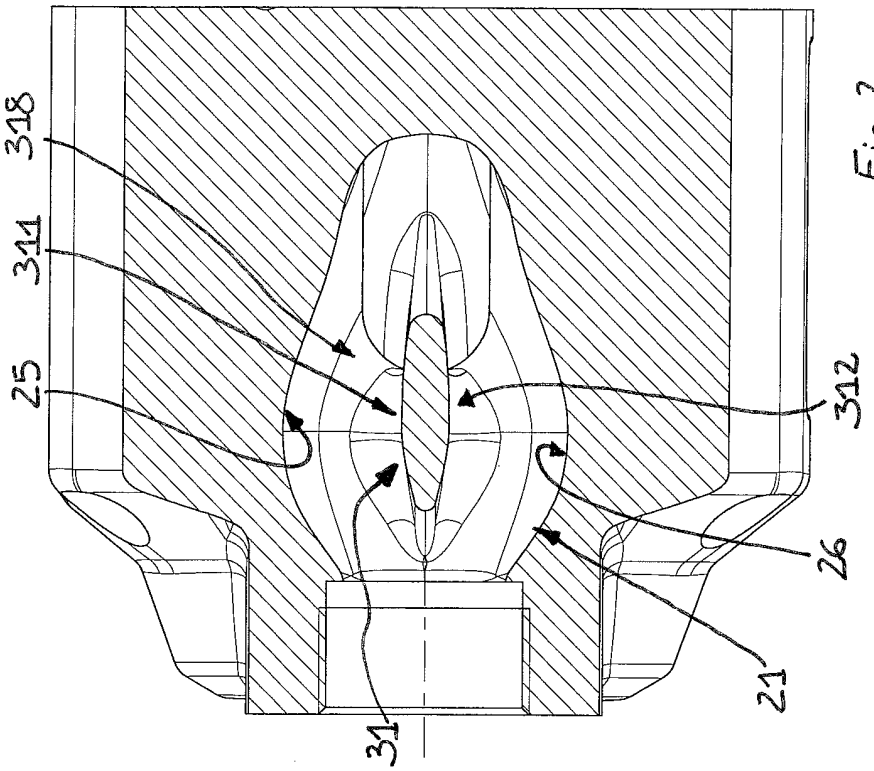

Fig. 2

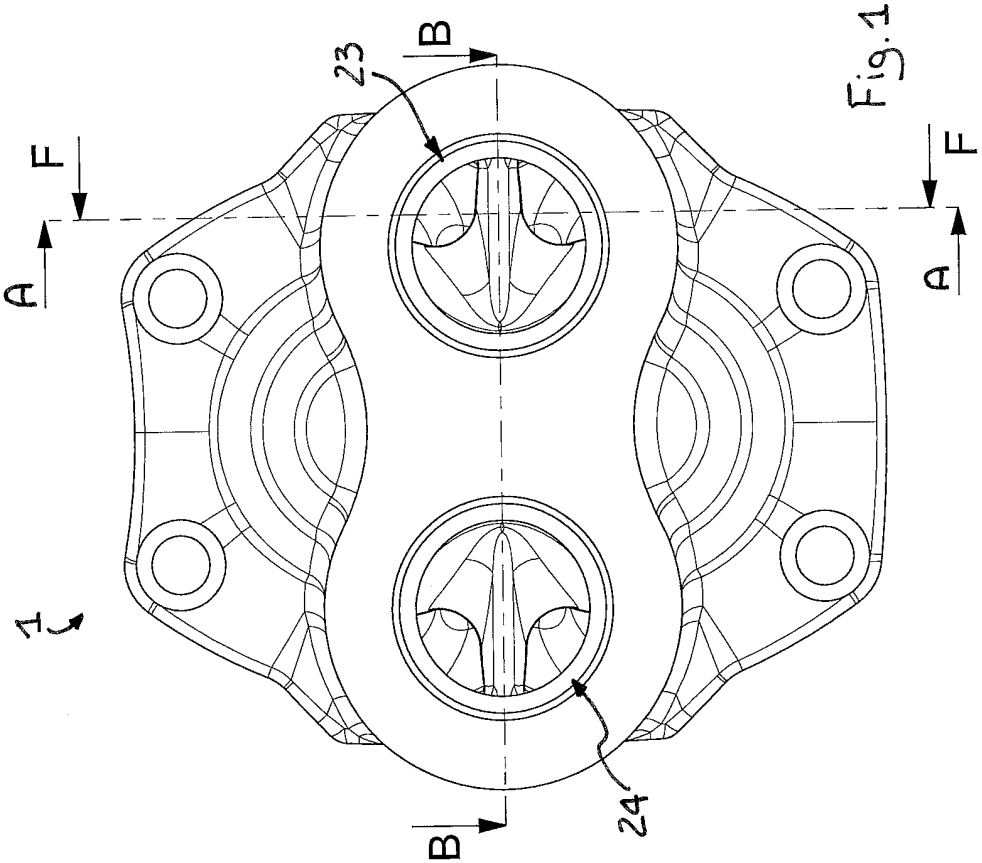

Fig. 1

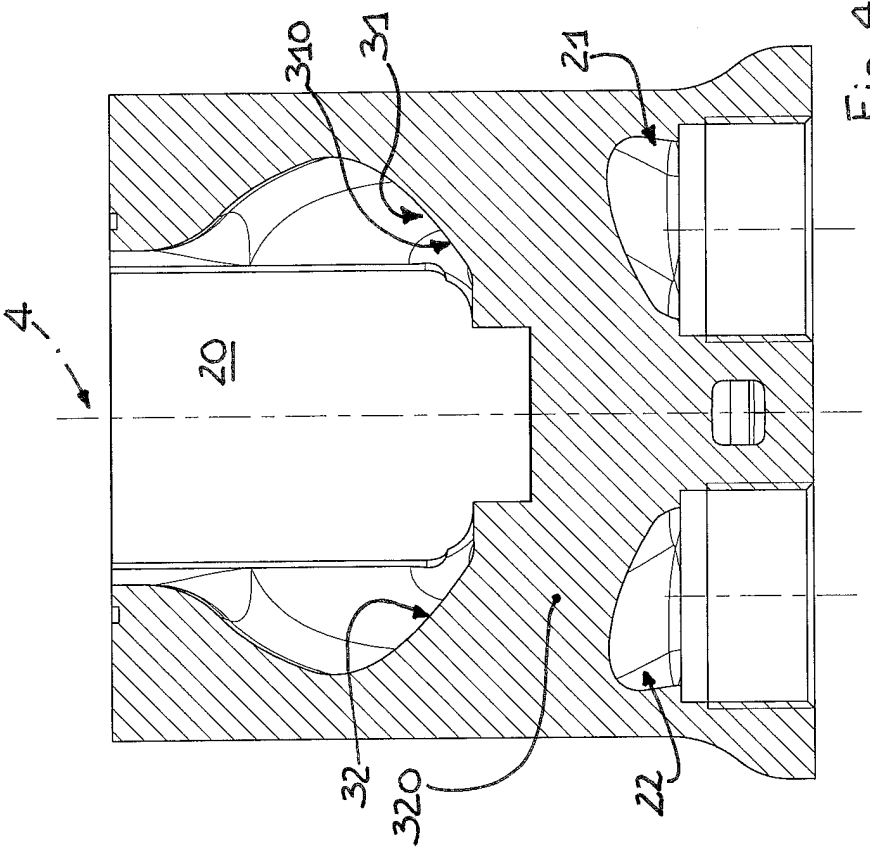

Fig. 4

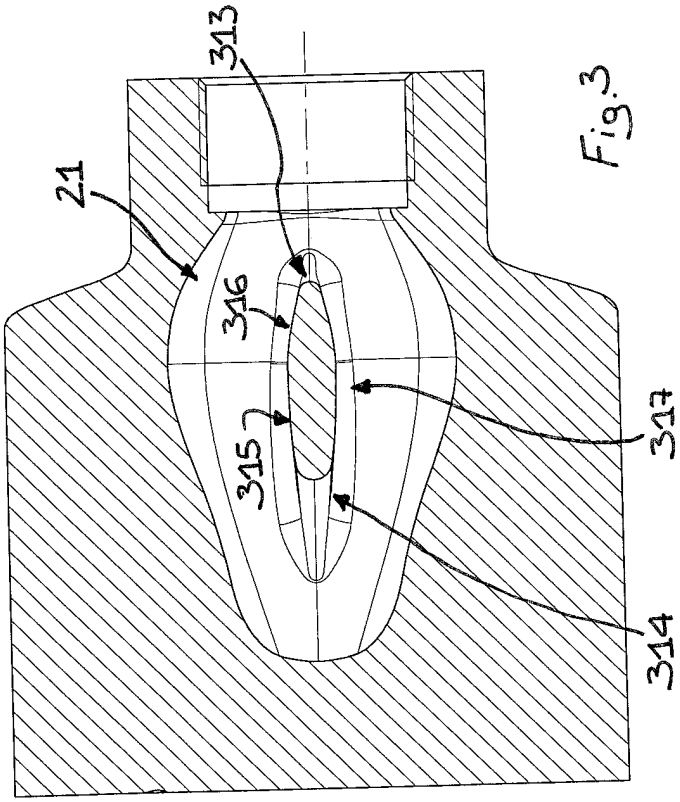

Fig. 3

REFERENCES CITED IN THE DESCRIPTION

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