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

(11) EP 2 746 582 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
01.07.2015 Bulletin 2015/27

(51) Int Cl.:
F04C 2/344 *(2006.01)* ***F01C 19/04*** *(2006.01)*
F04C 18/344 *(2006.01)*

(21) Application number: **13191325.3**

(22) Date of filing: **04.11.2013**

(54) **Vane for a rotor of a positive displacement vane pump, pump comprising the vane and pumping method using the pump**

Rotorflügel für eine Verdrängerflügelzellenpumpe, Pumpe mit dem Flügel und Pumpverfahren mit der Pumpe

Aube pour rotor d'une pompe à ailettes à déplacement positif, pompe comprenant l'aube et procédé de pompage à l'aide de la pompe

(84) Designated Contracting States:
AL 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 RS SE SI SK SM TR

(30) Priority: **16.11.2012 IT TO20120997**

(43) Date of publication of application:
25.06.2014 Bulletin 2014/26

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(56) References cited:
DE-A1- 1 551 147
DE-B- 1 154 316
DE-B- 1 194 210
DE-B- 1 198 149
GB-A- 1 003 613

EP 2 746 582 B1

Printed by Jouve, 75001 PARIS (FR)

Description

Technical field

[0001] This invention relates to rotary positive displacement pumps and more specifically it concerns a vane for a pump having a vane rotor.

[0002] The invention also concerns a pump using the vane and a pumping method using such a pump.

[0003] Preferably, but not exclusively, the invention is applied in the so-called single-vane pumps, i.e. pumps where the rotor includes a single vane with constant length, and the following description will mainly refer to this preferred application.

Background of the invention

[0004] Single-vane pumps are often used as vacuum pumps, for instance in the automotive field. They comprise a body defining a chamber with non-circular cross section in which the rotor rotates, in tangential contact, about an eccentric axis. The rotor has a diametrical slot where the vane is mounted and the vane is radially movable in the slot so that, while the rotor is rotating, its ends slide substantially in contact with the internal wall of the chamber. The chamber is divided by the rotor and vane into an intake room and a pressure room, between which a pumped fluid is displaced. An example is disclosed in EP 2 299 055.

[0005] A problem encountered in these pumps is the possible loss of contact between the vane ends and the internal wall of the chamber, in particular at the instants where the radial movement of the vane is reversed (what, as known, occurs twice at each rotor revolution), with a sudden speed change. At those instants, communication can thus be established between the intake and pressure rooms, and this is detrimental to the pump efficiency. Moreover, such a temporary loss of contact also causes a "bounce" of the vane against the wall: this results in a noisy operation and in an early wear of the parts that are designed for being subjected to a mutual sliding friction and, on the contrary, become subjected also to a "pulsating" friction. The problems can become more severe as the vane ends wear.

[0006] Those problems also exist in pumps having a plurality of constant-length vanes angularly distributed on the rotor (which pumps are often used in the automotive field as pumps for the engine lubrication oil) and in pumps with a single variable-length vane, e.g. a vane with tips or contact members distinct from the vane body and capable of a limited radial displacement relative to the body, or a vane comprising two half-vanes radially displaceable relative to each other in their common seat.

[0007] No solution for the above problems is known.

[0008] DE1198149 discloses a vane for a rotor of a multi-vane pump comprising an inertial damper and a resilient member.

Description of the invention

[0009] It is an obj ect of the present invention to provide a vane for a rotor of a vane pump solving the problems of the prior art.

[0010] According to the invention, this is achieved in that at least one inertial damper or shock-absorber is mounted in said body, said damper including at least one inertial dampening member (hereinafter simply referred to as "dampening member") radially movable within a respective seat, and at least one resilient member opposing the movement of the dampening member.

[0011] In a first embodiment, a single damper is provided and is mounted in an axially central zone of the vane.

[0012] In a second embodiment, a pair of dampers are provided and are mounted in respective seats formed at axially opposite edges of the vane.

[0013] In case of use in a single-vane pump, the or each damper comprises a dampening member kept in a central position by a pair of opposing resilient members engaging the dampening member on the one side and opposite end walls of the respective seat on the other side, or it comprises a pair of dampening members kept agains said walls by an opposing resilient member arranged between the dampening members.

[0014] According to a variant embodiment, each damper includes a single dampening member and a single resilient member, consisting of a leaf spring engaging the ends of the dampening member and the end walls of the seat.

[0015] In case of use in multi-vane pumps, each vane includes, for instance, at least one damper.

[0016] The invention also concerns a vane pump where the or each vane is made in accordance with the invention.

[0017] In a further aspect, the invention also provides a method of pumping by means of a vane pump, comprising the step of inertially dampening the or each vane, at points where the radial sliding direction is reversed, so as to ensure the contact, at said points, between the vane and the internal surface of the pumping chamber, and the inertial dampening is achieved by arranging, inside the or each vane, at least one inertial dampening member radially movable within a respective seat and associated with opposing resilient members arranged to keep the dampening member, in rest conditions, in position in its seat.

Brief Description of the Figures

[0018] The above and other features and advantages of the present invention will become apparent from the following description of preferred embodiments given by way of non limiting example with reference to the accompanying Figures, which show the invention applied to a single-vane pump and in which:

- Fig. 1 shows a conventional single-vane pump;
  Fig. 2 shows an alternative vane that can be used in the pump shown in Fig. 1;
  Fig. 3 is a cross-sectional axonometric view of a vane according to the invention, in a first embodiment;
  Fig. 4 is an exploded axonometric view of the vane shown in fig. 3;
  Figs. 5 and 6 are views similar to Figs. 3 and 4, relative to a variant;
- Fig. 7 is an axonometric view of a vane according to the invention, in a second embodiment;
- Figs. 8 and 9 are a cross-sectional axonometric view and a partially exploded axonometric view, respectively, of the vane shown in fig. 7;
- Figs. 10 to 12 are views similar to Figs. 7 and 9, relative to a first variant;
- Figs. 13 and 14 are views similar to Figs. 8 and 9, relative to a second variant; and
- Fig. 15 shows a single-vane pump with an example of a vane according to the invention.

Description of Preferred Embodiments

[0019] The invention will be described in detail in connection with its application in a single-vane pump, as defined above. In order to make understanding of the invention easier, the structure of a conventional single-vane pump will be shortly described. To this end, Figs. 1 and 3 of document EP 2 299 055 are annexed as Figs. 1 and 2, and the same reference numerals have been maintained for the sake of clarity. As said, the present invention is however employable in any pump with vane rotor.

[0020] As shown, pump 10 comprise a housing 40 with fluid inlet and outlet openings 47 and 48, respectively. Housing 40 defines a non-circular pumping chamber 44 having an internal wall 42. Chamber 44 houses a rotor 30 that, in conventional manner, rotates substantially tangent to wall 42, while keeping a small constant clearance. The rotor has a radial slot 26 where a vane 20, radially slidable within the same slot, is mounted. Vane 20 has a body 22 and two tips 24, mounted in body 22 so that they can perform a limited radial movement. The tips slide on wall 42 during rotation of rotor 30, so that the vane and the rotor divide chamber 44 into an intake room 45 and a pressure room 46. Body 20 may have lightening recesses that, depending on their orientation, confer an axial grid structure (recesses 25 in fig. 1) or a radial grid structure (recesses 27 in fig. 2) to the body.

[0021] The vane according to the invention will now be described with reference to Figs. 3 to 14, assuming that it includes a body and two separate tips as in EP 2 299 055. In the Figures relating to the different embodiments of the invention, elements corresponding to those shown in Figs. 1 and 2 are denoted by the same reference numerals, yet preceded by digit 1, 2 etc. Also elements introduced by the invention and having the same or similar functions in the different embodiments are denoted by reference numerals differing by 100 with respect to one another.

[0022] Figs. 3 and 4 show a first exemplary embodiment of the invention, applied to a vane 120 with a radial grid, obtained for instance by means of two pairs of cavities 127 into which teeth 124A of tips 124 are snap fitted. The tips are thus fixed relative to body 122, whereby vane 120 has a constant length.

[0023] A through bore 101, preferably cylindrical, is formed between both pairs of cavities 127, substantially in a central position, and it forms a seat for an inertial shock-absorber or damper 100. "Inertial damper" means a component that, by inertia, tends to oppose the vane movements, in particular to the reversal of the direction of the radial displacement of the vane.

[0024] In this exemplary embodiment, damper 100 includes a dampening member 102, it too cylindrical, arranged to move along bore 101, and a pair or resilient members 103a, 103b, e.g. a pair of coil springs, opposing the movement of dampening member 102 and arranged at both sides of dampening member 102. An end of each spring engages an end portion of dampening member 102, whereas the opposite end abuts against the inner face of tips 124. Springs 103a, 103b have substantially the same length so as to keep dampening member 102, in rest conditions, at a substantially central position.

[0025] Advantageously, dampening member 102 has a smaller mass than vane 120. In any case, its mass depends on the vane mass.

[0026] The material of the dampening member can depend on the material of which the vane body is made, but this is not essential.

[0027] It is clear that the provision of inertial damper 100 confers a greater stability to vane 120, thereby solving the problems mentioned above, since it prevents that any loss of contact between tips 124 and the internal wall of the chamber occurs. Thus, possible bounces and the drawbacks related thereto are avoided. It is also to be noted that the action of damper 100 is favoured by the fluid (air, oil, etc.) present in the chamber where vane 120 moves and penetrating into seat 101.

[0028] In the variant shown in Figs. 5 and 6, damper 200 of vane 220 comprises, in place of a central dampening member opposed by two resilient members, a pair of dampening members 202a, 202b located at the ends of seat 201, so that they rest at one end against tips 224, whereas at the other end they are opposed by the single resilient member 203, still shown as a coil spring, arranged between dampening members 202a, 202b. In this case, it is the overall mass of dampening members 202a, 202b that is smaller than the mass of vane 220.

[0029] It is clear that damper 200 is perfectly equivalent to damper 100.

[0030] Figs. 7 to 9 show a second exemplary embodiment of the invention, applied to a vane 320 with an axial grid comprising two sets of blind cavities 325. In such an embodiment, tips 324 are moulded together with body 322 or moulded onto body 322 and are always fixed relative to the body. Radial seats for a pair of inertial dampers 300', 300" are formed along the opposite axial edges of body 322. Only one seat 301 is clearly visible in the Figures. Cavities 325 open in the bottom of those seats. Each damper 300', 300" is made in similar manner to damper 100 shown in Figs. 3 and 4 and therefore it includes a dampening member 302', 302" (which, in this example, preferably has the shape of a parallelepiped), capable of displacing along seat 301, and a pair of resilient opposing members 303a', 303b' and 303a", 303b", respectively, for instance coil springs. The springs are located at both sides of the respective dampening member 302', 302" and are arranged to keep it, in rest conditions, in a substantially central position in seat 301. The ends of opposing springs 303a', 303b', 303a", 303b" remote from dampening members 302', 302" are kept in position by undercuts or centring members 304', 304" formed e.g. on the internal surface of tips 324 or in the end walls of seats 301, if the latter are shorter than body 322.

[0031] The Figures also show that seats 301 of both dampers 300', 300" communicate at their ends through axial bores 312.

[0032] In the variant shown in Figs. 10 to 12, similarly to the variant shown in Figs. 5 and 6, each damper 400', 400" comprises a pair of dampening members 402a', 402b' and 402a", 402b" having the shape of parallelepipeds, which are located at the ends of respective seats 401 and are opposed by a central spring 403', 403". The dampening members are kept in position by undercuts or centring members 404', 404".

[0033] Figs. 13 and 14 show a further variant of a vane with axial grid. In such a variant, each damper 500', 500" in vane 520 comprises a single dampening member 502', 502", for instance cylindrical, having substantially the same length as the respective seat 501, and an opposing resilient member 503', 503" consisting of a leaf spring, which, for instance, engages cuts 505 in the ends of the respective dampening member 502', 502" and is kept in position by an undercut or a centring member 504', 504" similar to those shown in Figs. 7 to 12.

[0034] Also in all variants of this second embodiment, it is of course the overall mass of the dampening members that is lower than the vane mass.

[0035] For the sake of completeness, Fig. 15 shows, in a view similar to Fig. 1, a pump 110 of the kind shown in Fig. 1 and equipped with the vane according to the invention, in particular and by way of example only vane 120 shown in Figs. 3 to 5. The elements of pump 110 other than vane 120 and the components thereof are still denoted by the same reference numerals as in Fig. 1. Both opposing springs of the dampening member are simply denoted 103.

[0036] It is clear that the above description has been given only by way of non-limiting example and that changes and modifications are possible without departing from the scope of the invention as defined in the following claims.

[0037] More particularly, parallelepiped dampening members can be used in place of the cylindrical dampening members and vice versa. The dampening members could also be prismatic with any cross-sectional shape.

[0038] Moreover, the lightening cavities could be through cavities instead of blind cavities as shown in the drawings.

[0039] Furthermore, in the embodiments shown in Figs. 7 to 12, in case of blind lightening cavities, a single damper located in a central through bore could be used, like in the embodiment shown in Figs. 3 to 6.

[0040] Lastly, even though a vane for a single-vane pump has been shown and discussed in detail, the invention can also be applied to multi-vane pumps, as said before. For instance, in such an application, the vanes could include a single inertial damper in an axially central position, or a pair of dampers at opposite axial edges.

[0041] In accordance with a possible application to multi-vane pumps, the or each damper could include, for instance, a single dampening member and a single opposing member, of which the first is located for instance at the radially internal end of the seat and the second is located for instance at the radially external end of the seat

Claims

1. A vane for a rotor of a rotary positive displacement vane pump, said pump having at least one pumping chamber (44) with an internal wall (42), and said vane (120; 220; 320; 420; 520) having a vane body (122; 222; 322; 422; 522) and two tips (124; 224; 324; 424; 524) and being configured so as to be displaceable in radial direction and to reverse its motion inside said at least one pumping chamber (44), wherein at least one inertial damper (100; 200; 300', 300"; 400', 400"; 500', 500") is mounted in said vane body, **characterised in that** said damper includes at least one inertial dampening member (102; 202a, 202b; 302', 302"; 402a', 402b', 402a", 402b"; 502', 502") radially movable within a respective seat (101; 201; 301; 401; 501), and at least one resilient member (103a, 103b; 203; 303a', 303b', 303a", 303b"; 403', 403"; 503', 503") opposing the radial movement of said at least one dampening member (102; 202a, 202b; 302', 302"; 402a', 402b', 402a", 402b"; 502', 502") so as to ensure the contact between each tip (24; 124; 224; 324; 424; 524) and the internal wall (42) of the pumping chamber (44).

2. The vane as claimed in claim 1, wherein it comprises a single damper (100; 200) mounted in a radial seat (101; 201) formed in an axially central region of the vane (120; 220).

3. The vane as claimed in claim 1, wherein it comprises a pair of dampers (300', 300"; 400', 400"; 500', 500")

mounted in respective radial seats (301; 401; 501) formed on axially opposite edges of the vane (320; 420; 520).

4. The vane as claimed in any one of preceding claim, wherein the damper (100) or each damper (300', 300") includes a single dampening member (102; 302', 302") and a pair of substantially identical opposing resilient members (103a, 103b; 303a', 303b', 303a", 303b"), arranged to engage one end of the dampening member (102; 302', 302") on the one side and an end wall of the seat (101; 301) on the other side in order to keep the dampening member (102; 302', 302"), in rest conditions, at a substantially central position in said seat (101; 301).

5. The vane as claimed in any one of claims 1 to 3, wherein the damper (200) or each damper (400', 400") includes a pair of dampening members (202a, 202b; 402a', 402b', 402a", 402b") mounted at opposite ends of said seat (201; 401), and a single opposing resilient member (203; 403', 403") located between the dampening members (202a, 202b; 402a', 402b', 402a", 402b") of said pair and arranged to push such members (202a, 202b; 402a', 402b', 402a", 402b"), in rest conditions, against end walls of the respective seats.

6. The vane as claimed in any one of claims 1 to 3, wherein the damper or each damper includes a single dampening member located at a radially inner end of said seat and a single opposing resilient member located at a radially outer end of said seat.

7. The vane as claimed in claim 3, wherein each damper (500', 500") includes a single dampening member (502', 502") and a single opposing resilient member (503', 503") consisting of a leaf spring of which the ends engage the ends of said dampening member (502', 502") and the end walls of the seat (501).

8. The vane as claimed in any one of preceding claim, wherein said dampening member (102) has a mass, or said dampening members (202a, 202b; 302', 302"; 402a', 402b', 402a", 402b"; 502', 502") have an overall mass, smaller than the vane mass.

9. A positive displacement rotary pump having a rotor including at least one vane, **characterised in that** the at least one vane (120; 220; 320; 420; 520) is a vane as claimed in any one of preceding claim.

10. A method of pumping by means of a positive displacement rotary pump having at least one pumping chamber (44) with an internal wall (42) and a rotor including at least one vane (120; 220; 320; 420; 520) with two tips (124; 224; 324; 424; 524), said vane being arranged to radially slide relative to the rotor (30), during rotation thereof, so that each said tip (124; 224; 324; 424; 524) is in contact with the internal wall (42) of the pumping chamber (44), the rotor and the at least one vane dividing said chamber into at least one intake room (45) and at least one pressure room (46), the method being **characterised in that** it comprises the step of inertially dampening the at least one vane (120; 220; 320; 420; 520), at points where the radial sliding direction is reversed, so as to ensure the contact, at said points, between each tip of said vane (120; 220; 320; 420; 520) and said internal wall (42) of said at least one chamber (44)), said inertial dampening being achieved by arranging, inside the at least one vane (120; 220; 320; 420; 520), at least one inertial dampening member (102; 202a, 202b; 302', 302"; 402a', 402b', 402a", 402b"; 502', 502") radially movable within a respective seat (101; 201; 301; 401; 501) and associated with opposing resilient members (103a, 103b; 203; 303a', 303b', 303a", 303b"; 403', 403"; 503', 503") arranged to keep the dampening member, in rest conditions, in position in its seat.

11. The method as claimed in claim 10, wherein the inertial dampening is achieved by means of at least one dampening member having a mass, or an overall mass, smaller than the vane mass.

Patentansprüche

1. Rotorflügel für eine rotierende Verdrängerflügelzellenpumpe, wobei die Pumpe mindestens eine Pumpenkammer (44) mit einer Innenwand (42) aufweist und der Flügel (120; 220; 320; 420; 520) einen Flügelkörper (122; 222; 322; 422; 522) und zwei Flügelenden (124; 224; 324; 424; 524) aufweist und so gestaltet ist, dass er in radialer Richtung verdrängbar ist und seine Bewegung innerhalb der mindestens einen Pumpenkammer (44) umkehren kann, wobei mindestens ein Trägheitsdämpfer (100; 200; 300', 300"; 400', 400"; 500', 500") in dem Flügelkörper montiert ist, **dadurch gekennzeichnet, dass** der Dämpfer mindestens ein Trägheitsdämpfungselement (102; 202a, 202b; 302', 302"; 402a', 402b', 402a", 402b"; 502', 502"), das in einer entsprechenden Aufnahme (101; 201; 301; 401; 501) radial verschiebbar ist, und mindestens ein federndes Element (103a, 103b; 203; 303a', 303b', 303a", 303b"; 403', 403"; 503', 503"), das der radialen Bewegung des mindestens einen Dämpfungselements (102; 202a, 202b; 302', 302"; 402a', 402b', 402a", 402b"; 502', 502") entgegenwirkt, umfasst, sodass der Kontakt zwischen jedem Flügelende (24; 124; 224; 324; 424; 524) und der Innenwand (42) der Pumpenkammer (44) gewährleistet ist.

2. Flügel nach Anspruch 1, wobei er einen einzigen

Dämpfer (100; 200) umfasst, der in einer in einem axial mittleren Bereich des Flügels (120; 220) gebildeten radialen Aufnahme (101; 201) gelagert ist.

3. Flügel nach Anspruch 1, wobei er ein Paar von Dämpfern (300', 300"; 400', 400"; 500', 500") umfasst, die in entsprechenden, an axial gegenüberliegenden Kanten des Flügels (320; 420; 520) gebildeten radialen Aufnahmen (301; 401; 501) gelagert sind.

4. Flügel nach irgendeinem der vorhergehenden Ansprüche, wobei der Dämpfer (100) oder jeder Dämpfer (300', 300") ein einziges Dämpfungselement (102; 302', 302") und ein Paar von im Wesentlichen identischen entgegenwirkenden federnden Elementen (103a, 103b; 303a', 303b', 303a", 303b") umfasst, so angeordnet sind, dass sie einerseits mit einem Ende des Dämpfungselements (102; 302', 302") und andererseits mit einer Endwand der Aufnahme (101; 301) im Eingriff stehen, um das Dämpfungselement (102; 302', 302"), im Ruhezustand, in einer im Wesentlichen zentralen Stellung in der Aufnahme (101; 301) zu halten.

5. Flügel nach irgendeinem der Ansprüche 1 bis 3, wobei der Dämpfer (200) oder jeder Dämpfer (400', 400") ein Paar von an gegenüberliegenden Seiten der Aufnahme (201; 401) gelagerten Dämpfungselementen (202a, 202b; 402a', 402b', 402a", 402b") hat und ein einziges entgegenwirkendes federndes Element (203; 403', 403") umfasst, das zwischen den Dämpfungselementen (202a, 202b; 402a', 402b', 402a", 402b") des Paars angeordnet ist und dazu eingerichtet ist, um diese Elemente (202a, 202b; 402a', 402b', 402a", 402b"), im Ruhezustand, gegen Endwände der entsprechenden Aufnahmen zu drücken.

6. Flügel nach irgendeinem der Ansprüche 1 bis 3, wobei der Dämpfer oder jeder Dämpfer ein einziges Dämpfungselement, das an einem radial inneren Ende der Aufnahme angeordnet ist, und ein einziges entgegenwirkendes federndes Element, das an einem radial äußeren Ende der Aufnahme angeordnet ist, umfasst.

7. Flügel nach Anspruch 3, wobei jeder Dämpfer (500', 500") ein einziges Dämpfungselement (502', 502") hat und ein einziges entgegenwirkendes federndes Element (503', 503") umfasst, die von einer Blattfeder gebildet ist, deren Enden mit den Enden des Dämpfungselements (502', 502") sowie mit den Endwänden der Aufnahme (501) im Eingriff stehen.

8. Flügel nach irgendeinem der vorhergehenden Ansprüche, wobei das Dämpfungselement (102) eine Masse hat, oder die Dämpfungselemente (202a, 202b; 302', 302"; 402a', 402b', 402a", 402b"; 502', 502") eine Gesamtmasse haben, die kleiner als die Flügelmasse ist.

9. Rotierende Verdrängerflügelzellenpumpe mit einem mindestens einen Flügel umfassenden Rotor, **dadurch gekennzeichnet, dass** der mindestens einen Flügel (120; 220; 320; 420; 520) ein Flügel nach irgendeinem der vorhergehenden Ansprüche ist.

10. Verfahren zum Pumpen mittels einer rotierenden Verdrängerflügelzellenpumpe, die mindestens eine Pumpenkammer (44) mit einer Innenwand (42) und einen mindestens einen Flügel (120; 220; 320; 420; 520) mit zwei Enden (124; 224; 324; 424; 524) umfassenden Rotor aufweist, wobei der Flügel dazu eingerichtet ist, um relativ zu dem Rotor (30) bei dessen Rotation radial zu gleiten, sodass jedes Ende (124; 224; 324; 424; 524) in Kontakt mit der Innenwand (42) der Pumpenkammer (44) ist, wobei der Rotor und der mindestens einen Flügel die Kammer in mindestens eine Einlasskammer (45) und mindestens eine Druckkammer (46) trennt, wobei das Verfahren **dadurch gekennzeichnet ist, dass** es den Schritt einer Trägheitsdämpfung des mindestens einen Flügels an Stellen, wo die radiale Gleitrichtung umgekehrt wird, umfasst, sodass an diesen Stellen der Kontakt zwischen jedem Ende des Flügels (120; 220; 320; 420; 520) und der Innenwand (42) der mindestens einen Kammer (44) gewährleistet ist, wobei die Trägheitsdämpfung erreicht wird, indem innerhalb des mindestens eines Flügels (120; 220; 320; 420; 520) mindestens ein Trägheitsdämpfungselement (102; 202a, 202b; 302', 302"; 402a', 402b', 402a", 402b"; 502', 502") angeordnet ist, das in einer entsprechenden Aufnahme (101; 201; 301; 401; 501) radial verschiebbar ist und mit entgegenwirkenden federnden Elementen (103a, 103b; 203; 303a', 303b', 303a", 303b"; 403', 403"; 503', 503") verbunden ist, die dazu eingerichtet sind, um das Dämpfungselement, im Ruhezustand, an seiner Stelle in der Aufnahme zu halten.

11. Verfahren nach Anspruch 10, wobei die Trägheitsdämpfung mittels mindestens eines Dämpfungselements mit einer Masse, oder Gesamtmasse, die kleiner als die Flügelmasse ist, erreicht wird.

Revendications

1. Palette pour un rotor d'une pompe rotative à palettes à déplacement positif, ladite pompe ayant au moins une chambre de pompage (44) pourvue d'une paroi interne (42), et ladite palette (120; 220; 320; 420; 520) ayant un corps de palette (122; 222; 322; 422; 522) et deux pointes (124; 224; 324; 424; 524) et étant configurée de manière à être déplaçable dans la direction radiale et à inverser son mouvement à l'intérieur de ladite au moins une chambre de pompage (44), au moins un amortisseur à inertie (100; 200; 300', 300"; 400', 400"; 500', 500") étant monté dans ledit corps de palette, **caractérisée en ce que** ledit amortisseur comprend au moins un élément amortissant inertiel (102; 202a, 202b; 302', 302"; 402a', 402b', 402a", 402b"; 502', 502") qui est mobile dans la direction radiale à l'intérieur d'un siège respectif (101; 201; 301; 401; 501), et au moins un élément élastique (103a, 103b; 203; 303a', 303b', 303a", 303b"; 403', 403"; 503', 503") s'opposant au mouvement radial dudit au moins un élément amortissant (102; 202a, 202b; 302', 302"; 402a', 402b', 402a", 402b"; 502', 502") de manière à assurer le contact entre chaque pointe (24; 124; 224; 324; 424; 524) et la paroi interne (42) de la chambre de pompage (44).

2. Palette selon la revendication 1, **caractérisée en ce qu'**elle comprend un seul amortisseur (100; 200) monté dans un siège radial (101; 201) formé dans une région axialement centrale de la palette (120; 220).

3. Palette selon la revendication 1, **caractérisée en ce qu'**elle comprend un couple d'amortisseurs (300', 300"; 400', 400"; 500', 500") montés dans des respectifs sièges radiaux (301; 401; 501) formés sur des bords axialement opposés de la palette (320; 420; 520).

4. Palette selon l'une quelconque des revendications précédentes, dans laquelle l'amortisseur (100) ou chaque amortisseur (300', 300") comprend un seul élément amortissant (102; 302', 302") et un couple d'éléments élastiques opposés sensiblement identiques (103a, 103b; 303a', 303b', 303a", 303b"), agencés de façon à engager d'un côté une extrémité de l'élément amortissant (102; 302', 302") et de l'autre côté une paroi d'extrémité du siège (101; 301) afin de maintenir l'élément amortissant (102; 302', 302"), lors de conditions de repos, dans une position sensiblement centrale dans ledit siège (101; 301).

5. Palette selon l'une quelconque des revendications 1 à 3, dans laquelle l'amortisseur (200) ou chaque amortisseur (400', 400") comprend un couple d'éléments amortissants (202a, 202b; 402a', 402b ', 402a" , 402b") montés à des extrémités opposées dudit siège (201; 401), et un seul élément élastique antagoniste (203; 403', 403") placé entre les éléments amortissants (202a, 202b; 402a', 402b', 402a" , 402b") dudit couple et agencé de façon à pousser lesdits éléments amortissants (202a, 202b; 402a', 402b', 402a", 402b"), lors de conditions de repos, contre des parois d'extrémité des sièges respectifs.

6. Palette selon l'une quelconque des revendications 1 à 3, dans laquelle l'amortisseur ou chaque amortisseur comprend un seul élément amortissant placé à une extrémité radialement interne dudit siège et un seul élément élastique antagoniste placé à une extrémité radialement externe dudit siège.

7. Palette selon la revendication 3, dans laquelle chaque amortisseur (500', 500") comprend un seule élément amortissant (502', 502") et un seul élément élastique antagoniste (503', 503") constitué par un ressort à lames dont les extrémités engagent les extrémités dudit élément amortissant (502', 502") et les parois d'extrémité du siège (501).

8. Palette selon l'une quelconque des revendications précédentes, dans laquelle ledit élément amortissant (102) a une masse, ou lesdits éléments amortissants (202a, 202b; 302', 302"; 402a', 402b', 402a", 402b"; 502', 502") ont une masse globale, plus petite que la masse de la palette.

9. Pompe rotative à déplacement positif comprenant un rotor comportant au moins une palette, **caractérisée en ce que** ladite au moins une palette (120; 220; 320; 420; 520) est une palette selon l'une quelconque des revendications précédentes.

10. Procédé de pompage par une pompe rotative à déplacement positif ayant au moins une chambre de pompage (44) avec une paroi interne (42) et un rotor comportant au moins une palette (120; 220; 320; 420; 520) avec deux pointes (124; 224; 324; 424; 524), ladite palette étant agencée de façon à coulisser radialement par rapport au rotor (30), pendant la rotation de celui-ci, de telle sorte que chacune desdites pointes (124; 224; 324; 424; 524) est en contact avec la paroi interne (42) de la chambre de pompage (44), le rotor et ladite au moins une palette séparant ladite chambre de pompage en au moins une chambre d'admission (45) et au moins une chambre de pression (46), ledit procédé étant **caractérisé en ce qu'**il comprend l'étape d'amortir par inertie ladite au moins une palette (120; 220; 320; 420; 520), au niveau de points où la direction de coulissement radial est inversée, de manière à assurer le contact, au niveau desdits points, entre chaque pointe de ladite palette (120; 220; 320; 420; 520) et ladite paroi interne (42) de ladite au moins une chambre de pompage (44), ledit amortissement à inertie étant obtenu en agençant, à l'intérieur de ladite au moins une palette (120; 220; 320; 420; 520), au moins un élément amortissant inertiel (102; 202a, 202b; 302', 302"; 402a', 402b', 402a", 402b"; 502', 502") qui est radialement mobile dans un siège respectif (101; 201 ; 301; 401; 501) et qui est associé à des éléments élastiques antagonistes (103a, 103b; 203; 303a', 303b', 303a", 303b"; 403', 403"; 503', 503") agencés pour maintenir l'élément amortissant, lors de conditions de repos, en position dans son siège.

11. Procédé selon la revendication 10, dans lequel l'amortissement à inertie est obtenu par au moins un élément amortissant ayant une masse, ou une masse globale, plus petite que la masse de la palette.

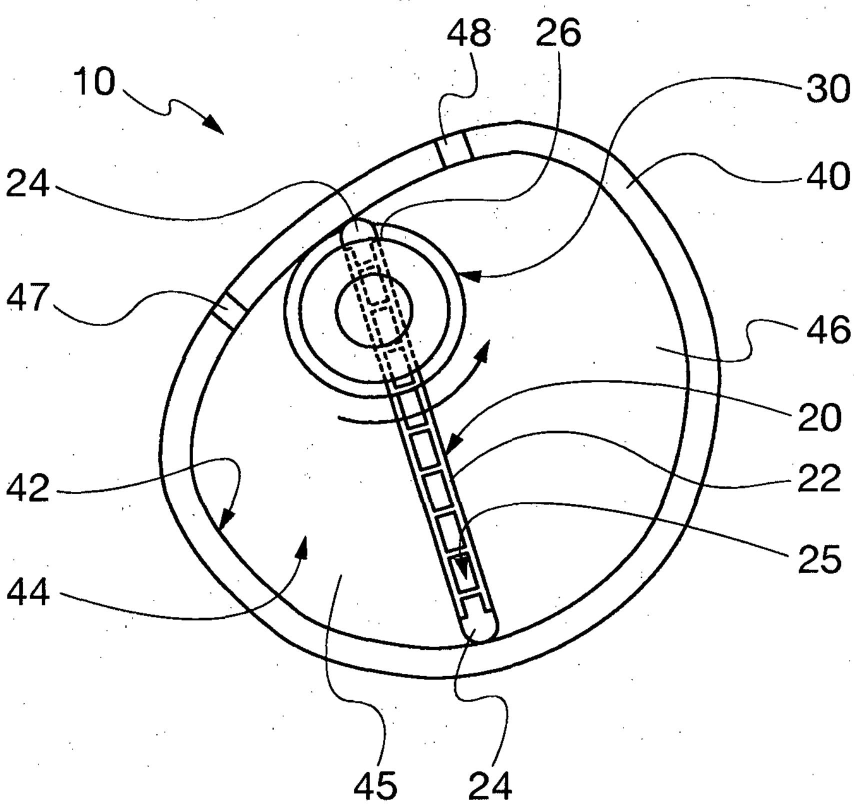

Fig. 1

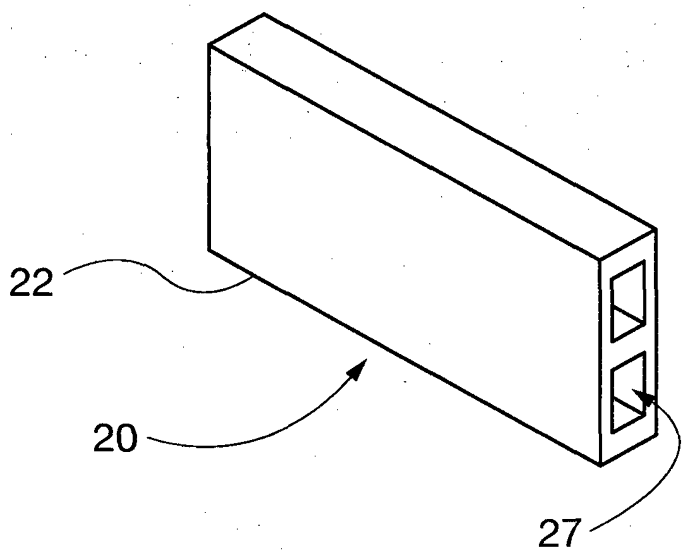

Fig. 2

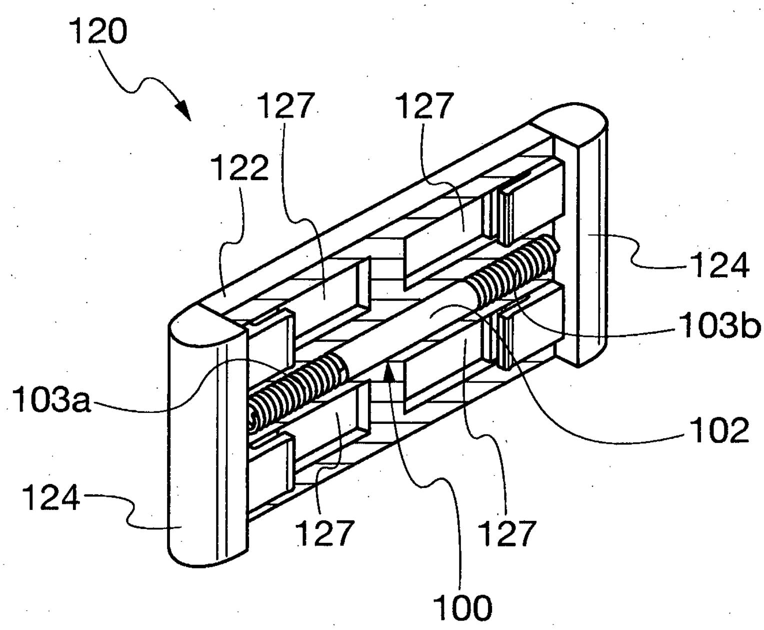
120
127
127
122
124
103b
103a
102
124
127
127
100

Fig. 3

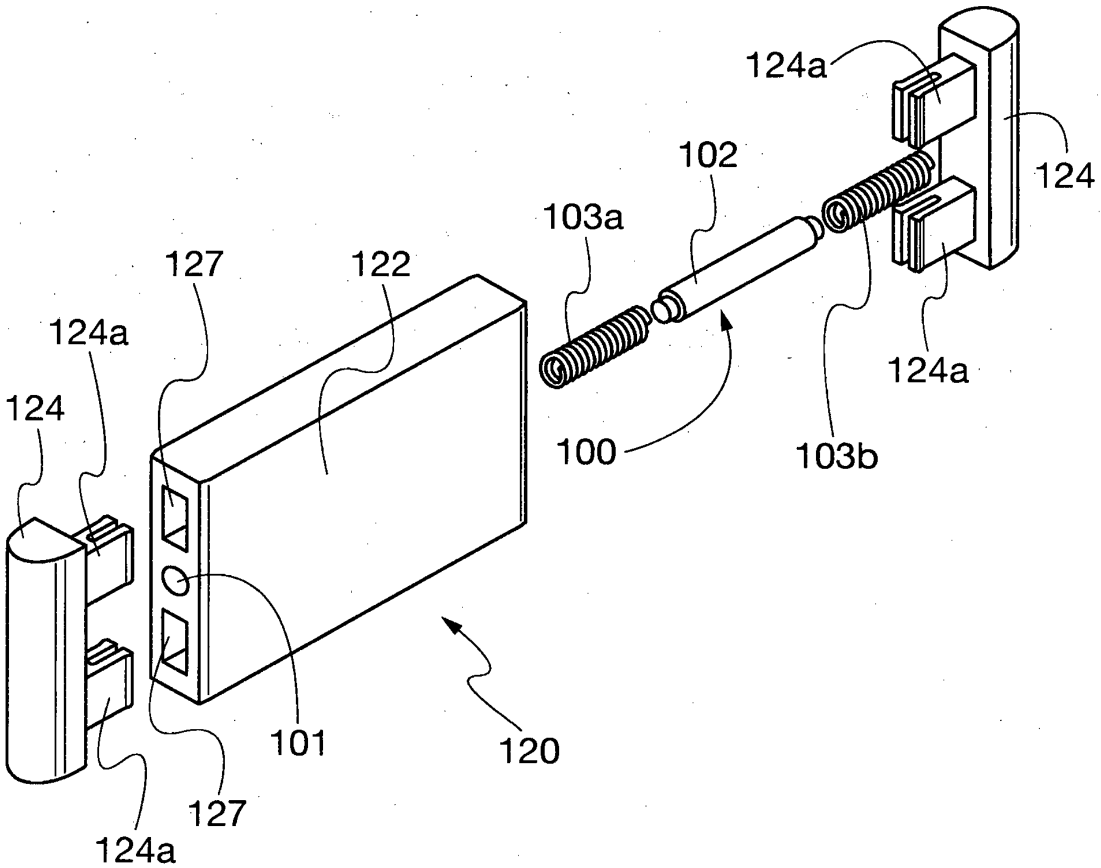
124a
102
124
103a
127
122
124a
124
100
103b
124a
101
120
127
124a

Fig. 4

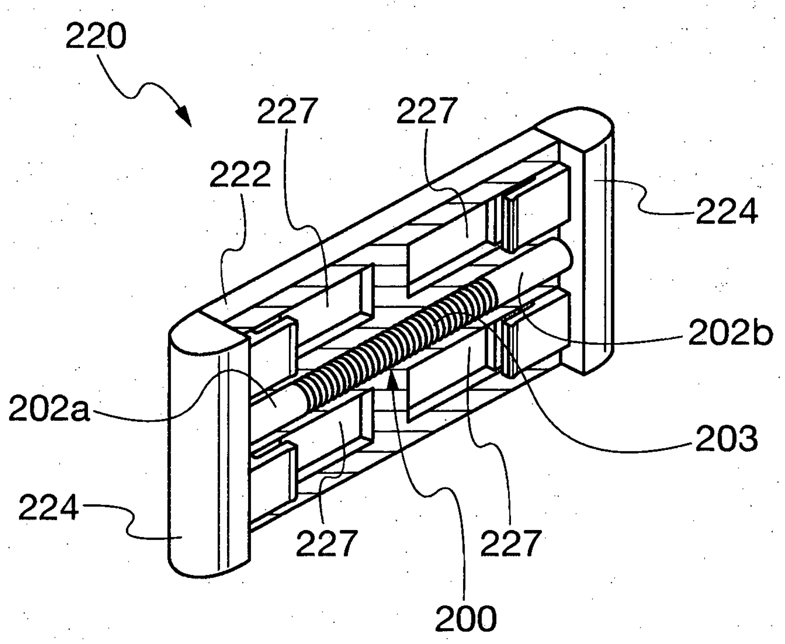
220
227
227
222
224
202b
202a
203
224
227
227
200

Fig. 5

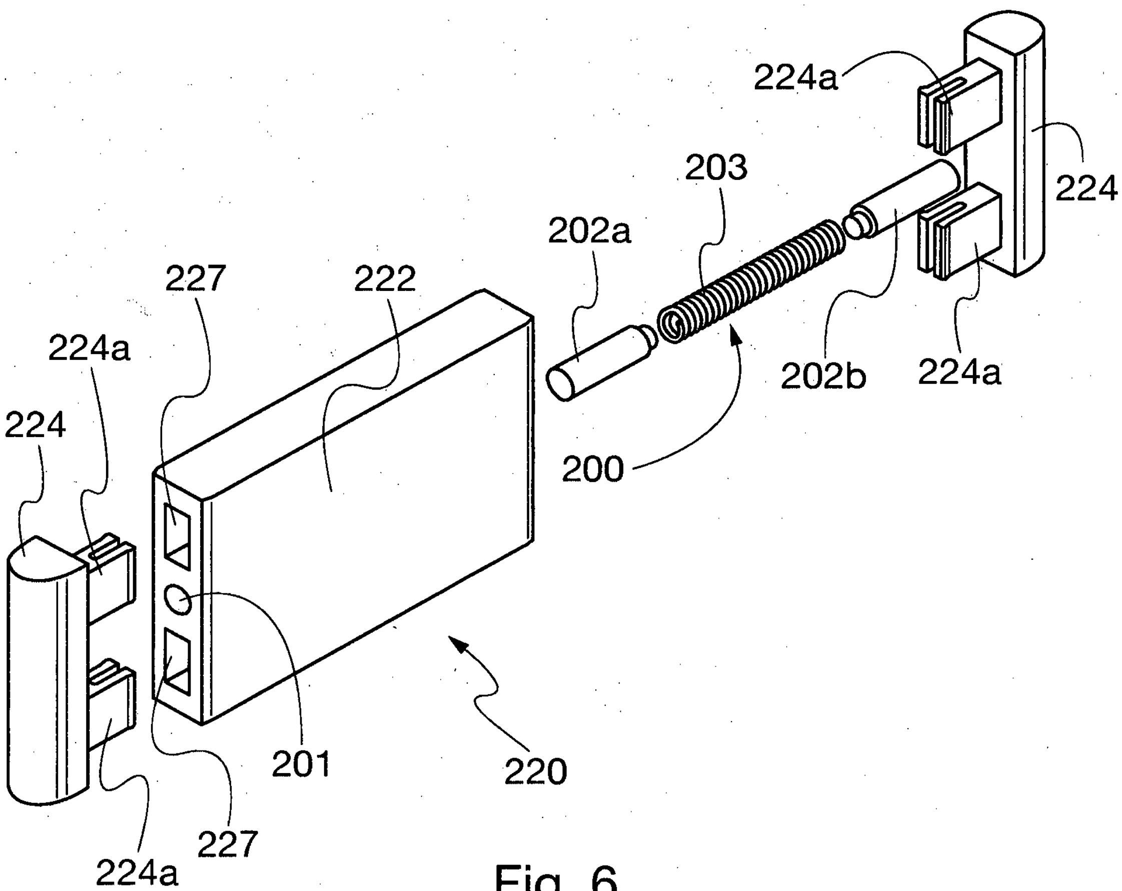
224a
224
203
202a
227
222
224a
202b
224a
224
200
201
220
227
224a

Fig. 6

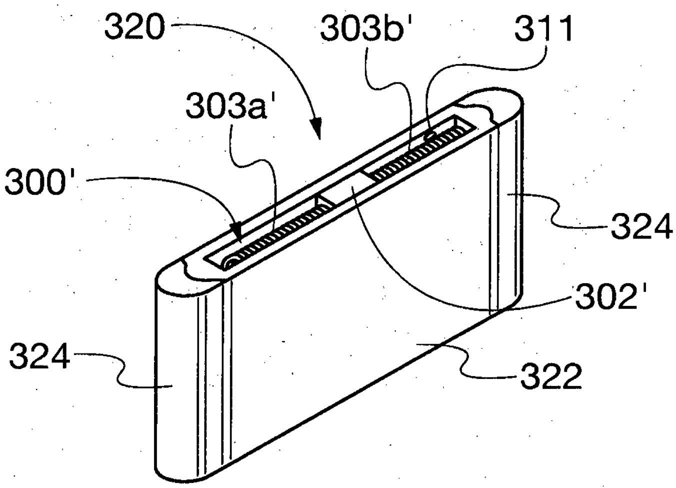

Fig. 7

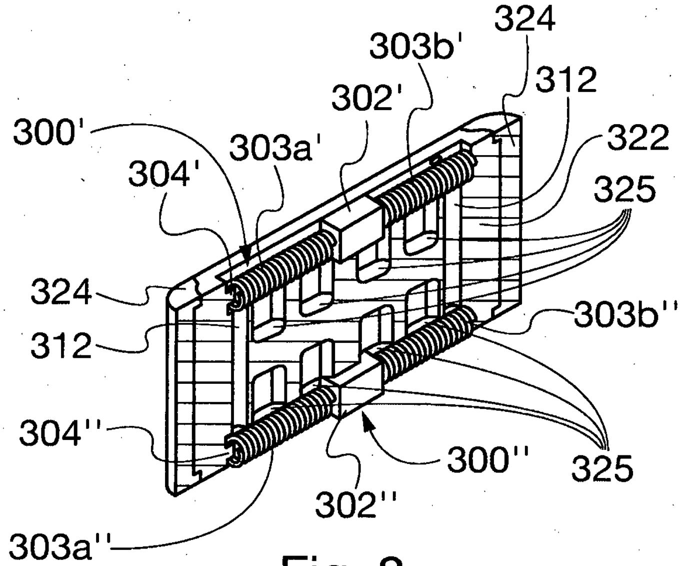

Fig. 8

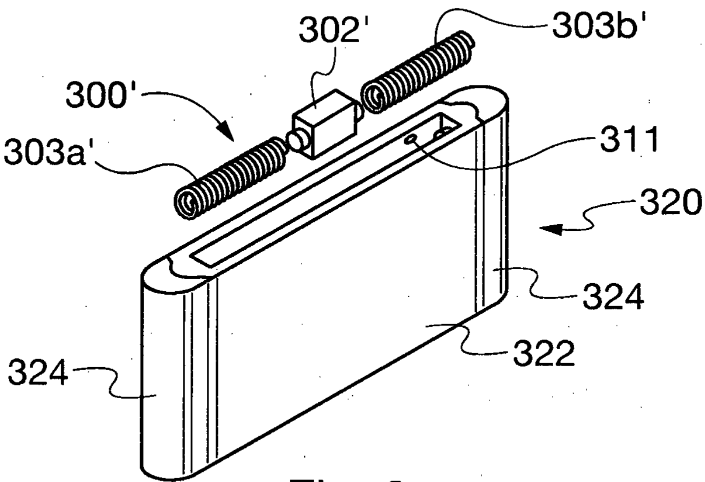

Fig. 9

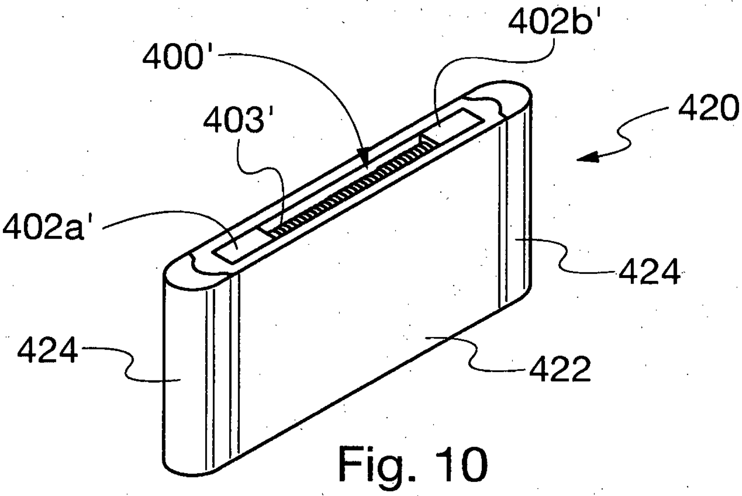

Fig. 10

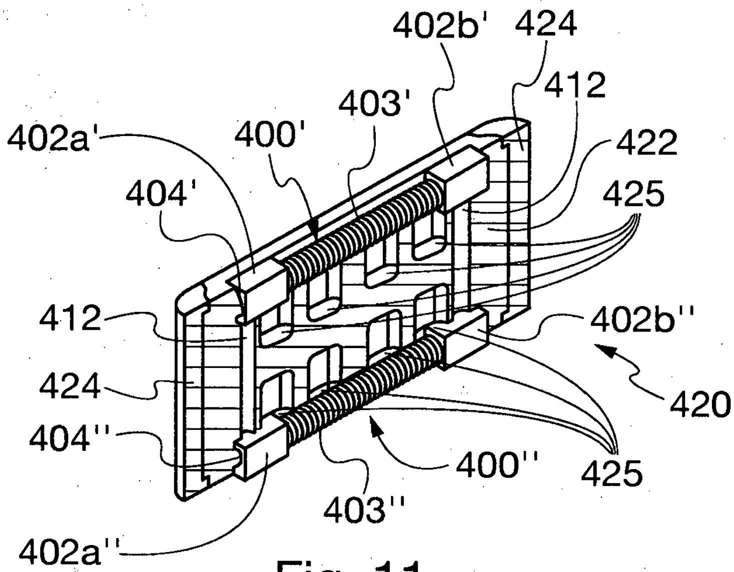

Fig. 11

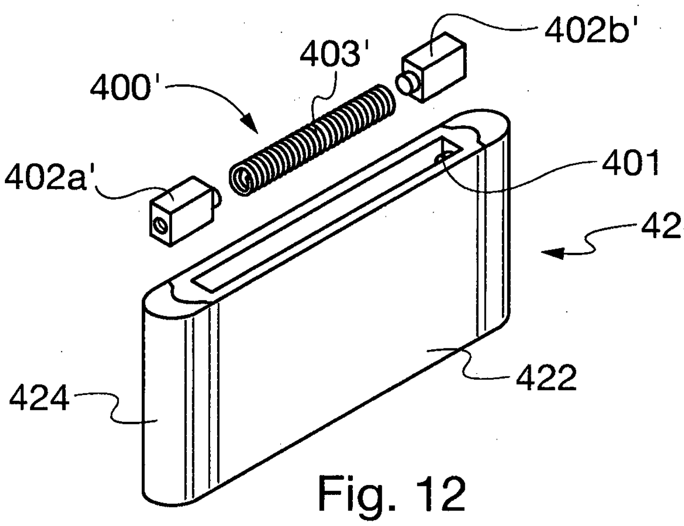

Fig. 12

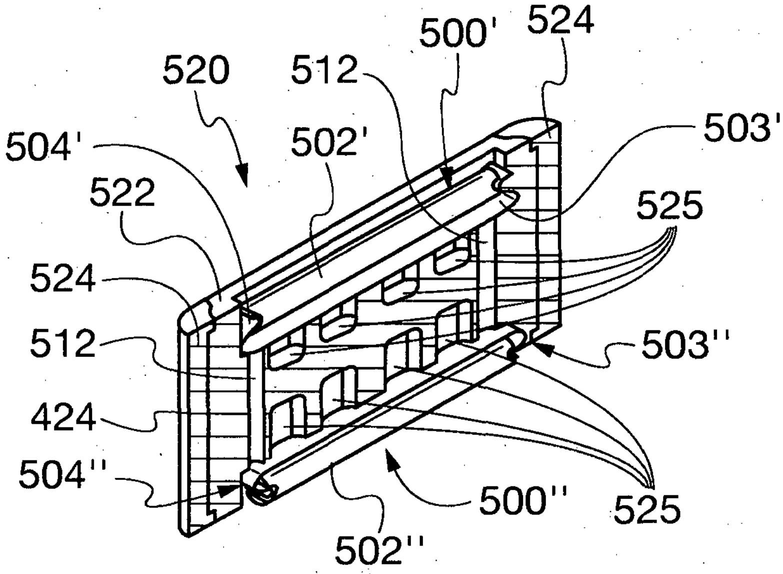
520
512
500'
524
504'
502'
503'
522
525
524
512
503''
424
504''
500''
525
502''

Fig. 13

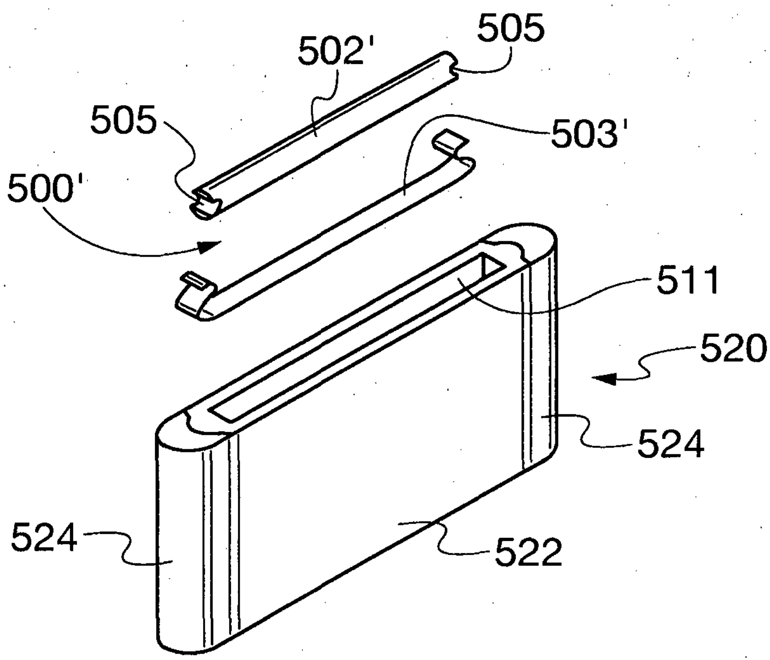
502'
505
505
503'
500'
511
520
524
524
522

Fig. 14

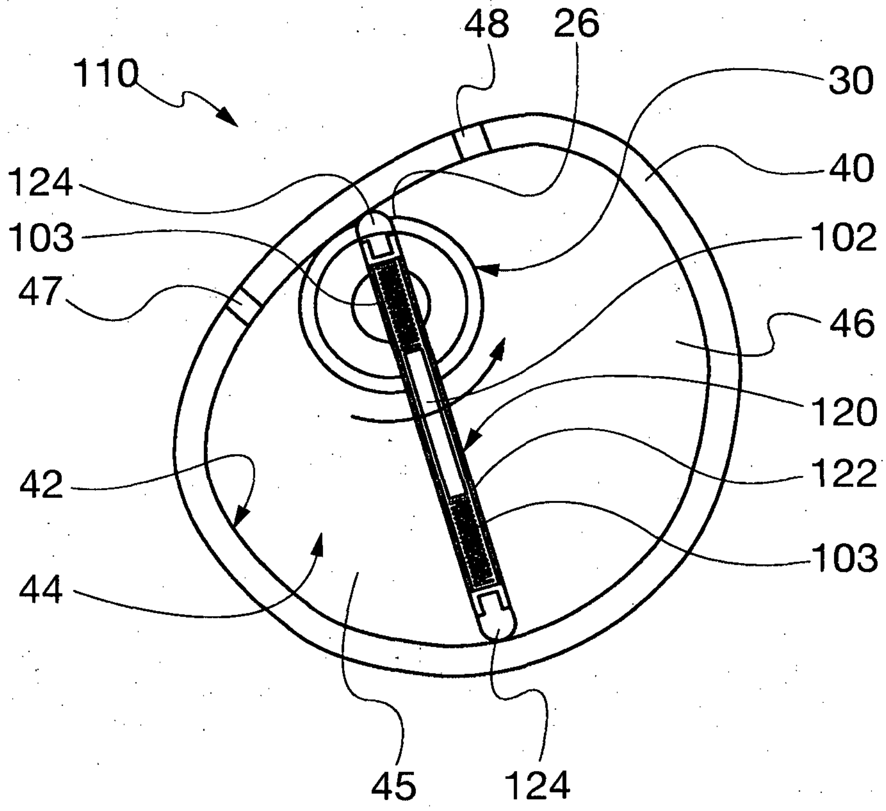

Fig. 15

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 2299055 A **[0004] [0019] [0021]**
- DE 1198149 **[0008]**