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(54) **FLUID VANE MOTOR/PUMP**

FLÜSSIGKEITSDREHFLÜGELMOTOR/-PUMPE

POMPE/MOTEUR HYDRAULIQUE A PALETTES

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Description

Field of the Invention

[0001] The present invention relates to an apparatus capable for use as a pump or motor, and in particular, to a fluid vane pump/motor.

Background of the Invention

[0002] Typically, fluid vane motors comprise a housing having a cylindrical bore closed by end plates and a rotor mounted for rotation within the bore. The rotor is in the form of a solid cylindrical billet of metal with longitudinally extending slots formed about its periphery. The axis of rotation of the rotor is parallel to but offset from the longitudinal axis of the housing. A plurality of vanes are supported in respective longitudinal slots in the rotor in a manner so as to allow movement in the radial direction. Fluid chambers are formed between adjacent vanes, the volume of the chambers varying as the rotor rotates. When functioning as a pump, the chambers act to displace fluid from an inlet in the housing to an outlet, and when acting as a motor, the chambers allow for the release of pressure of a pressurised fluid to cause rotation of a shaft attached to the rotor.

[0003] Conventional fluid vane motors/pumps are notoriously inefficient due to leakage of fluid between adjacent chambers via leakage paths formed about the periphery of the vanes as well as through the rotor itself. Additionally, high frictional losses occur due to the substantial contact area between the peripheral edges of the vanes and end plates of the housing.

Summary of the Invention

[0004] It is an object of the present invention to provide an apparatus capable for use as a pump or motor of increased efficiency.

[0005] EP-A-0230054 discloses a rotary vane machine in which a rotor is rotatable eccentrically within a cylinder. The rotor comprises a hollow drum with axial slots in its outer periphery for vanes which are radially slidable within the slots. The rotor has reduced diameter support regions extending axially away from the hollow drum at each end. The rotor is supported in bearings via these reduced diameter regions. The slots in the hollow drum extend up to but not into the reduced diameter support regions of the rotor.

[0006] According to the present invention, there is provided an apparatus as defined in claim 1.

[0007] Preferably said opposite ends of each slot are arcuate in shape.

[0008] Preferably each end of said housing is provided with a stepped inner surface formed by the junction of two faces and each seal can make sealing contact with both of said faces of an adjacent end of said housing.

[0009] Preferably a groove extending radially from each end of each slot is formed on a surface at each of said first and second ends interior of said rotor body for receiving axially opposite ends of a vane received in that slot.

[0010] Preferably said grooves on said interior surface at said first end of said rotor body extend beyond the centre of said rotor body.

[0011] In an alternate embodiment said interior surface at said first end of said rotor body is provided with a circular recess centered about said rotation axis and the grooves formed on this interior surface extends radially from the end of the slots near said first end to said circular recess.

[0012] Preferably said rotor comprises a shaft extending from the first end of said rotor body and through an aperture formed in a first of said ends of said housing, wherein when said apparatus is used as a pump, torque can be applied to said shaft to impart rotational motion to said rotor, and when said apparatus is used as a motor, said shaft can act as a power take off.

[0013] Preferably the second end of said rotor body opposite said shaft is provided with a recess for receiving a stub shaft formed on a second of said ends of said housing for rotatably supporting said second end of said rotor body.

[0014] Preferably said axially opposite edges of said vanes are formed with arcuate surfaces for sliding and substantially sealing contact with respective adjacent first and second ends of said housing.

[0015] Preferably the radially remote edge of each vane is formed with an arcuate surface for sliding and substantially sealing contact with said inner circumferential surface of said housing.

[0016] Preferably said apparatus further comprises biasing means disposed within said rotor body for biasing said vanes radially outwardly towards said inner circumferential surface of said housing.

[0017] Preferably a recess is formed in the radially inner edge of each vane inboard of axially opposite ends of each vane for receiving said biasing means.

[0018] Preferably said rotor comprises a shaft extending from the first end of said rotor body and through an aperture formed in a first of said ends of said housing, wherein when said apparatus is used as a pump, torque can be applied to said shaft to impart rotational motion to said rotor, and when said apparatus is used as a motor, said shaft can act as a power take off.

[0019] Preferably said resilient element comprises one of a split sleeve or a tube of resilient material; a length of natural or synthetic rubber tubing or rod; a tube or rod made of plastics material; a flat section helical -spring fitted axially within said rotor body; a solid or hollow rod or tube of material provided with resilient circumferentially spaced inserts at intervals corresponding to the location of said vanes. In an alternate embodiment, said biasing means comprises a pressurised fluid retained within said rotor body.

Brief Description of the Drawings

[0020] An embodiment of the present invention will now be described by way of example only, with reference to the accompanying drawings in which:

Figure 1 is an axial section and partly exploded view of an embodiment of an apparatus according to the present invention;

Figure 2 is an end elevation view of one end of a rotor incorporated in the apparatus shown in Figure 1;

Figure 3 is an end elevation of an opposite end of the rotor shown in Figure 2;

Figure 4 is a side elevation of the rotor shown in Figures 1 and 2;

Figure 5A is a side elevation of a vane incorporated in the apparatus shown in Figure 1;

Figure 5B is a bottom elevation of the vane shown in Figure 5A;

Figure 5C is a view of Section A-A of the vane shown in Figure 5A;

Figure 6A is a side elevation of a biasing element incorporated in the apparatus shown in Figure 1;

Figure 6B is an end elevation of the biasing element shown in Figure 6A;

Figure 7 is an axial section and partly exploded view of a second embodiment of the apparatus;

Figure 8 is an end elevation of an end of the rotor shown in Figure 7;

Figure 9A is a side elevation of a second embodiment of a vane used in the present apparatus;

Figure 9B is a bottom view of the vane shown in Figure 9A; and

Figure 9C is a view of Section A-A of the vane shown in Figure 9A.

Detailed Description of the Preferred Embodiments

[0021] Referring to Figure 1, it can be seen that an apparatus 10 capable for use as a pump or motor comprises a housing 12 having sealed ends 14 and 16 and provided with a cavity 18 between said ends 14 and 16. First and second ports 20 and 22 are also formed in the housing 12 for allowing fluid communication between the interior and exterior of the housing 12. Rotor 24 having a substantially hollow body 26 is supported by the housing 12 for rotation within the cavity 18 about a rotation axis 28 which is parallel to but offset from longitudinal axis 30 of the cavity 18. A plurality of vanes 32 are retained by the rotor 24 for movement radially of the rotation axis 28. The vanes 32, rotor 24 and housing 12 are juxtaposed so that a substantially sealed chamber is formed between adjacent vanes 32, inner surface 34 of the housing 12 and outer circumferential surface 36 of the rotor body 26. The first and second ports 20 and 22 are disposed in different chambers.

[0022] The housing 12 is composed of a cylindrical member 38, the interior of which forms cavity 18. Ends 14 and 16 of the housing 12 are in the form of plates 40 and 42 respectively which can be bolted to opposite ends of the cylindrical element 38. As is apparent from Figure 1, the surface of each of the plates 40 and 42 facing the rotor 24 is stepped. In the case of first plate 40, the interior surface 44 is stepped so as to reduce in width in the radial direction toward rotation axis 28. More particularly, surface 44 comprises a first annular-like radially outer-most surface 46, a stepped surface 47, an adjacent second radially inner intermediate annular-like surface 48, a further stepped surface 49, and adjacent and radially innermost third annular-like third surface 50. An aperture or hole 52 is formed through the first plate 40 centred on rotation axis 28.

[0023] The second plate 42 has an inner surface 54 which is composed of a first radially outermost annular-like surface 56, first stepped surface 57, an adjacent and radially inner annular-like second surface 58, second stepped surface 59, and a radially innermost annular-like third surface 60. Extending from the third surface 60 concentrically with rotation axis 28 is stub shaft 62. A plurality of axially extending holes 64 are formed circumferentially about the first and second plates 40 and 42 which are disposed to register with threaded holes 66 formed in the opposite ends of the cylindrical element 38. Bolts (not shown) are passed through holes 64 and threadingly engage holes 66 for fastening the first and second plates 40 and 42 to opposite ends of the cylindrical element 38.

[0024] As seen in Figures 2 to 4, rotor body 26 is in the general form of a hollow cylinder being closed at a first end 68 and open at an opposite second end 70. The rotor body 26 is provided with reduced diameter portions 72 and 74 at the first and second ends 60 and 70 respectively. As seen most clearly in Figure 1, the reduced diameter portions 72 and 74 seat annular seals 76 and 78 respectively. Shaft 80 extends from the first end 68 concentric with rotation axis 28 through the hole 52 in the first plate 40. A short length 82 of the shaft 80 adjacent the first end 68 is formed of an increased diameter. Bearing 83 is fitted onto shaft 80 up to short length 82 and is sealed against surfaces 49 and 50 of the first plate 40.

[0025] Second end 70 is formed with a radially inward-

ly extending circumferential lip 84 and an axially extending annular boss 86. Stub shaft 62 can be received in the opening formed by the lip 84 and boss 86. The juxtaposition of annular surface 90 of the lip 84 facing a second plate 42 and the radially innermost circumferential surface 92 of the boss 86 form a seat for bearing 94. The bearing 94 has an inner race 96 which receives, with an interference fit, the stub shaft 62.

[0026] A plurality of slots 96 (refer Figures 2 to 4) are formed in the rotor body 26 which extend between and inboard of the first end 68 and second end 70. As seen most clearly in Figure 4, opposite ends 98 and 100 of the slots 96 are arcuate in shape and terminate on the reduced diameter portions 72 and 74 respectively. Slots 96 pass wholly through the thickness of the rotor body 26. In this particular embodiment, four equally spaced slots 96 are formed circumferentially about the rotor body 26. A radially extending groove 102 (refer Figures 1 and 3) is formed on an interior surface of first end 68 extending colinearly with the depth of each slot 96 at end 98. Each groove 102 extends to the rotational axis 28 and runs into a corresponding groove 102 of an opposing slot 96.

[0027] Grooves 104 of similar configuration to grooves 102 are formed at the opposite end 100 of each slot 96 on an axially inner annular surface 106 of the lip 84. However, as the grooves 104 only extend for the axial length of lip 84, they do not pass through the rotational axis 28 nor do grooves 104 of opposing slots 96 run into each other.

[0028] Vanes 32 are in the form of generally rectangular plates having arcuate, and more particularly convexly curved axial edges 108 and 110 and similarly curved radially remote edge 112 and radially near edge 114. The axial edges 108 and 110 extend in a radial direction below the radially near edge 104 so as to form protruding tabs 116 and 118 respectively between which a recess 120 is defined.

[0029] A biasing means in the form of a split sleeve 122 (refer Figures 1, 6A and 6B) is disposed within the cylindrical element 38 for biasing the vanes 32 radially outwardly from rotation axis 28 so that radially remote edge 112 of the vanes 32 are in sliding and sealing contact with inner surface 34 with at most a layer of lubricant therebetween. The split sleeve 122 is received in the recess 120 between tabs 116 and 118 of each vane 32 preventing axial movement of the sleeve 122 during operation of the apparatus 10. The sleeve 122 is made of a spring metal and dimensioned so as to maintain contact with all of the vanes 32 during rotation of the rotor 24. It will be appreciated that the sleeve 122 floats within the rotor 24 and adopts a position that is concentric with and parallel to axis 30 of the housing 12. Generally, the outside diameter of the sleeve 122 is equal to the internal diameter of housing 12 minus twice the distance between the radially remote and near edges 112 and 114 of a vane 32. However, in the specific case of the present split sleeve the outside diameter is fractionally larger to provide a degree of spring loading the radially near edges 114 of the vanes 32.

[0030] When the apparatus 10 is fully assembled, the seal 76 overlies end 98 of each slot 96 and abuts axial edge 108 of each vane 32. Seal 78 is similarly juxtaposed relative to the end 100 of slots 96 and axial edge 110 of vanes 32. As a result, the seals 76 and 78 effectively seal the ends of slots 96. Further, seal 76 sealingly abuts surfaces 47 and 48 of first plate 40. Likewise, seal 78 sealingly abuts surfaces 57 and 58 of the second plate 42. Radially remote edge 112 of each vane 32 forms a sliding seal against inner surface 34 of housing 12.

[0031] The curvature on the radially remote and radially near edges 112 and 114 of the vanes 32 are shaped to suit the curvature of the inner surface 34 of housing 12 and the curvature and location of the outer peripheral surface of sleeve 122 respectively. The vanes 32 are of a length equal to that of cylindrical element 38 of the housing less a lubricating tolerance, similarly the width of the slots 96 and thickness of vanes 32 are relatively dimensioned so as to allow sliding of the vanes 32 within the slots 96 with a lubricating tolerance therebetween. By forming these components of the apparatus 10 with such a close tolerance together with the inclusion of seals 76 and 78 fluid leakage within the apparatus 10 is minimised.

[0032] An embodiment of the apparatus 10 with three vanes is illustrated in Figures 7 and 8. In these Figures like numbers indicate the same features as described with reference to the embodiment shown in Figures 1 to 6B.

[0033] It will be appreciated that when the apparatus 10 comprises three (or any other odd number) of vanes 32 there will not be pairs of diametrically opposed grooves 102, which in the case of an apparatus 10 with an even number of vanes 32, allows retraction of the vanes 32 within the rotor beyond the central axis 28. In order to allow for such over center retraction of vanes 32 in the present embodiment the interior surface of first end 68 is counter bored about axis 28 to form a circular recess 103 of a depth equal to the depth of grooves 102.

[0034] In a further possible embodiment, the design of the vanes 32 can be modified so that the radially inner edge 114 is tapered on both sides as shown in Figures 9A to 9C. The tapering is not necessary in the case of the rotor 24 supporting six or less vanes 32. However, it is particularly advantageous for preventing interference between the radially inner edge 114 of adjacent vanes 32 in the case of a rotor having seven or more vanes when adjacent vanes are at or nearing full retraction and extend over the axis 28.

[0035] From the foregoing description, it will be apparent to those skilled in the art that the above embodiments include numerous advantages and benefits over prior known radial vane motors and pumps including:

(a) The hollow rotor offers a considerable weight re-

duction when compared with the conventional solid slotted rotor.

(b) A smaller diameter rotor can be employed with a greater degree of eccentricity within a housing of a given internal diameter, resulting in an increase in effective vane extension with an attendant increase in volumetric capacity.

(c) A greater number of vanes can be employed in the hollow rotor with a larger effective vane extension from the rotor than can be achieved with the conventional slotted rotor, due to the fact that the grooves 102 of the hollow rotor intersect at the rotor axis 28 (see Fig. 3). It follows that if the slots in a conventional rotor were to intersect at the rotor axis, there would remain no segmental web at the root of the slots and the rotor could not exist in this form. Conversely, because the segmental web of the hollow rotor is at its outside diameter, the intersection of the grooves at the rotor axis does not affect the integrity of the rotor. Therefore the hollow rotor motor has the potential to deliver more power with less torque variation than the conventional unit having the same external dimensions, and as a pump, provide a greater fluid delivery with lower pulse amplitude than a conventional unit having the same external dimensions.

(d) The sleeve 122 supporting nearly the total length of the vanes 32 ensures the proper vane 32 to housing sealing contact, preventing partial retraction of the vanes when subjected to high operating pressures as is the case with reliance being on fluid pressure for vane extension, and preventing bowing of vanes under high fluid pressure when such vanes are only supported at their ends by cams or rings etc. The prevention of fluid by-pass between the vanes 32 and inner surface 34 of housing 12 will result in improved efficiency of the device.

(e) In conventional radial sliding vane pumps and motors flat axial ends of the vanes are in constant contact with the surfaces of the end plates regardless of whether they are retracted or extended relative to the rotor, which is a cause of significant lateral frictional drag. In the described embodiment, because the end plates 40, 42 are recessed to the outside diameter of the rotor body 26, the vanes 32 can only contact the end plates 40, 42 when they are extended beyond the outer circumferential surface 36 of the rotor body 26, therefore the frictional drag attributable to the axial vane ends 108, 110 is considerably reduced by limiting their contact to approximately 50% of the end plate working areas. This frictional drag is further reduced by the smaller contact area of the radiused axial vane ends 108, 110 as opposed to that generated by full thickness flat vane ends. This feature also precludes the possibility of the rotor ends contacting the end plates as is common in conventional sliding vane units.

(f) Correctly toleranced seals 76, 78 prevent internal by-pass of operating fluid between adjacent or other chambers either around the axial vane ends 108, 110 or via the unoccupied sections of the slots 96 due to their common access to the operating fluid as is usual in conventional sliding vane type pumps or motors. This feature also limits fluid loss or internal by-pass when the unit is in the stalled condition under operating load conditions.

[0036] Now that an embodiment of the invention has been described in detail, it will be apparent to those skilled in the relevant arts that numerous modifications and variations may be made without departing from the basic inventive concepts. For example, although the housing 12 is shown as including separate end plates 40 and 42, one of those ends may be formed integrally with the cylindrical element 38 of the housing 12 and machined to provide the relevant step surfaces. Also, while the rotor 24 is shown as being a four vane (ie. four slot 96) greater or fewer vanes can be incorporated. In addition, the biasing element for biasing the vanes 32 radially outwardly is shown as being a split sleeve 122. However, other types of biasing elements can be used to achieve the same effect for example: a length of resilient tubing or rod such as may be made from natural or synthetic rubber, or plastics material; a flat section helical spring; a solid or hollow rod or tube of material provided with resilient circumferentially spaced inserts at intervals corresponding to the location of the vanes 32; of a pressurised fluid sealed within the rotor body. All such modifications and variations are deemed to be within the scope of the present invention, the nature of which is to be determined from the following claims.

Claims

1. An apparatus (10) capable for use as a pump or motor, said apparatus (10) having:

a housing (12) having sealed ends (14, 16) and provided with a cavity (18) between said ends, said housing further including first and second ports (20, 22) both allowing fluid communication between the interior and exterior of said housing (12);
a rotor (24) having a substantially hollow rotor body (26) supported by said housing (12) for rotation within said cavity (18) about a rotation axis (28) extending parallel to and offset from a longitudinal axis (30) of said cavity (18), said rotor body (26) having opposite first and second ends (68, 70) which include respective portions

(72, 74) of reduced diameter with respect to an intermediate portion of said rotor body;
a plurality of slots (96) formed in said rotor body (26); and
a plurality of vanes (32), individual ones of which are slidably retained in separate slots (96) for movement radially of said rotation axis (28);
said vanes (32), rotor (24) and housing (12) being juxtaposed so that a substantially sealed chamber is formed between adjacent vanes (32), an inner circumferential surface (34) of said housing (12) and said rotor (24), and wherein said first and second ports (20, 22) are disposed in different ones of said chambers;

characterised in that said slots (96) extend between said opposite first and second ends (68, 70) and terminate in and inboard of said reduced diameter portions (72, 74), and by seals (76, 78) located about said reduced diameter portions (72, 74) respectively, said seals (76, 78) being seated so as to cover opposite ends (98, 100) of each slot (96) and sealing abut axially opposite ends (108, 110) of said vanes (32).

2. An apparatus according to claim 1, **characterised in that** said opposite ends (98, 100) of each slot (96) are arcuate in shape.

3. An apparatus (10) according to claim 2, **characterised in that** said housing (12) is provided with two stepped inner surfaces (47, 48; 57, 58) each formed by the junction of two faces and respective seals (76, 78) make sealing contact with both of said faces (47, 48; 57, 58) of said stepped inner surfaces.

4. An apparatus (10) according to claim 3, **characterised by** a groove (102, 104) extending radially from each end of each slot (96) along a surface at each of said first and second ends (68, 70) interior of said rotor body (26) for receiving axially opposite ends (108, 110) of a vane (32) received in that slot (96).

5. An apparatus (10) according to claim 4, **characterised in that** said grooves (102) at said first end (68) of said rotor body (26) extend beyond the centre of said rotor body (26).

6. An apparatus (10) according to claim 4, **characterised in that** said interior surface at said first end (68) of said rotor body (26) is provided with a circular recess (103) centered about said rotation axis (28) and the grooves (102) formed on this interior surface extend radially from the end of the slots (96) near said first end (98) to said circular recess (103).

7. An apparatus (10) according to claim 1, **characterised in that** axially opposite edges (108, 110) of said vanes (32) are formed with arcuate surfaces for sliding and substantially sealing contact with respective adjacent first and second ends (14, 16) of said housing (12).

8. An apparatus (10) according to claim 1, **characterised in that** a radially remote edge (112) of each vane (96) is formed with an arcuate surface for sliding and substantially sealing contact with said inner circumferential surface (34) of said housing (12).

9. An apparatus according to claim 1, **characterised by** biasing means (122) disposed within said rotor body (26) for biasing said vanes (96) radially outwardly towards said inner circumferential surface (34) of said housing (12).

10. An apparatus (10) according to claim 9, **characterised in that** said biasing means (122) comprises a resilient element extending in the direction of said rotation axis (28) and adapted to act simultaneously on each of said vanes (96).

11. An apparatus (10) according to claim 10, **characterised in that** said resilient element (122) comprises one of a split sleeve or a tube of resilient material; a length of natural or synthetic rubber tubing or rod; a tube or rod made of plastics material; a flat section helical spring fitted axially within said rotor body; a solid or hollow rod or tube of material provided with resilient circumferentially spaced inserts at intervals corresponding to the location of said vanes (96).

12. An apparatus (10) according to claim 11, **characterised by** a recess (120) formed in the radially inner edge (114) of each vane (96) inboard of axially opposite ends (108, 110) of each vane (96) for receiving said biasing means (122).

13. An apparatus (10) according to claim 9, **characterised in that** said biasing means (122) comprises a pressurised fluid retained within said rotor body (26).

14. An apparatus (10) according to claim 1, **characterised in that** said rotor (24) comprises a shaft (80) extending from the first end (68) of said rotor body (26) and through a hole (52) formed in a first of said ends (140) of said housing (12), wherein when said apparatus (10) is used as a pump, torque can be applied to said shaft (80) to impart rotational motion to said rotor (24), and when said apparatus is used as a motor, said shaft (80) can act as a power take off.

15. An apparatus (10) according to claim 14, **characterised in that** the second end (70) of said rotor

body (26) opposite said shaft (80) is provided with a recess (92) for receiving a stub shaft (62) formed on a second (16) of said ends of said housing (12) for rotatably supporting said second end (70) of said rotor body (26).

Patentansprüche

1. Vorrichtung (10), geeignet zur Verwendung als Pumpe oder Motor, wobei die Vorrichtung (10) aufweist:

ein Gehäuse (12) mit abgedichteten Enden (14,16) und mit einem Hohlraum (18) zwischen den Enden, wobei das Gehäuse ferner einen ersten und zweiten Anschluß (20,22) aufweist, die beide eine Fluidverbindung zwischen dem Inneren und Äußeren des Gehäuses (12) erlauben;
einen Rotor (24) mit einem im wesentlichen hohlen Rotorkörper (26), der von dem Gehäuse (12) gehalten wird, um sich innerhalb des Hohlraums (18) um eine Rotationsachse (28) zu drehen, die sich parallel und versetzt zu einer Längsachse (30) des Hohlraums (18) erstreckt, wobei der Rotorkörper (26) ein erstes und zweites Ende (68,70) hat, die sich gegenüberliegen und jeweils Abschnitte (72,74) mit bezüglich eines mittleren Abschnitts des Rotorkörpers verringertem Durchmesser aufweisen;
mehrere in dem Rotorkörper (26) geformte Schlitze (96); und
mehrere Flügel (32), von denen einzelne gleitbar in getrennten Schlitzen (96) gehalten werden, um sich radial zur Rotationsachse (28) zu bewegen;

wobei die Flügel (32), der Rotor (24) und das Gehäuse (12) aneinander angrenzen, so daß eine im wesentlichen abgedichtete Kammer zwischen benachbarten Flügeln (32), einer inneren Umfangsfläche (34) des Gehäuses (12) und dem Rotor (24) gebildet ist, und wobei der erste und zweite Anschluß (20,22) in unterschiedlichen Kammern angeordnet sind;

dadurch gekennzeichnet, daß sich die Schlitze (96) zwischen dem ersten und dem gegenüberliegenden zweiten Ende (68,70) erstrecken und innenbords und in den Abschnitten mit verringertem Durchmesser (72,74) enden, und **gekennzeichnet durch** Dichtungen (76,78), die jeweils um die Abschnitte (72,74) mit verringertem Durchmesser herum angeordnet sind, wobei die Dichtungen (76,78) so eingesetzt sind, daß sie gegenüberliegende Enden (98,100) jedes Schlitzes (96) abdekken und an axial gegenüberliegenden Enden (108,110) der Flügel (32) abdichtend anliegen.

2. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, daß** die sich gegenüberliegenden Enden (98,100) jedes Schlitzes (96) bogenförmig sind.

3. Vorrichtung (10) nach Anspruch 2, **dadurch gekennzeichnet, daß** das Gehäuse (12) mit zwei gestuften Innenflächen (47,48;57,58) versehen ist, die jeweils von der Verbindungsstelle zweier Flächen gebildet werden, und die jeweiligen Dichtungen (76,78) einen Dichtungskontakt mit beiden der Flächen (47,48;57,58) der gestuften Innenflächen herstellen.

4. Vorrichtung (10) nach Anspruch 3, **gekennzeichnet durch** eine Nut (102,104), die sich radial von jedem Ende jedes Schlitzes (96) entlang einer Oberfläche sowohl am ersten wie auch am zweiten Ende (68,70) innerhalb des Rotorkörpers (26) erstreckt, um axial gegenüberliegende Enden (108,110) eines in diesem Schlitz (96) aufgenommenen Flügels (32) aufzunehmen.

5. Vorrichtung (10) nach Anspruch 4, **dadurch gekennzeichnet, daß** sich die Nuten (102) an dem ersten Ende (68) des Rotorkörpers (26) über das Zentrum des Rotorkörpers (26) hinaus erstrecken.

6. Vorrichtung (10) nach Anspruch 4, **dadurch gekennzeichnet, daß** die Innenfläche des ersten Endes (68) des Rotorkörpers (26) mit einer um die Rotationsachse (28) zentrierten kreisförmigen Aussparung (103) versehen ist und sich die an dieser Innenfläche gebildeten Nuten (102) radial von dem Ende der Schlitze (98) nahe dem ersten Ende (96) zu der kreisförmigen Aussparung (103) erstrecken.

7. Vorrichtung (10) nach Anspruch 1, **dadurch gekennzeichnet, daß** für einen Gleit- und wesentlichen Dichtungskontakt mit dem jeweiligen ersten und zweiten Ende (14,16) des Gehäuses (12) axial gegenüberliegende Kanten (108,110) der Flügel (32) mit bogenförmigen Flächen gebildet sind.

8. Vorrichtung (10) nach Anspruch 1, **dadurch gekennzeichnet, daß** für einen Gleit- und wesentlichen Dichtungskontakt mit der inneren Umfangsfläche (34) des Gehäuses (12) eine radial fern gelegene Kante (112) jedes Flügels (96) mit einer bogenförmigen Fläche gebildet ist.

9. Vorrichtung (10) nach Anspruch 1, **gekennzeichnet durch** innerhalb des Rotorkörpers (26) angeordnete Vorspannungseinrichtungen (122) zum Vorspannen der Flügel (96) radial nach außen in Richtung auf die innere Umfangsfläche (34) des Gehäuses (12).

10. Vorrichtung (10) nach Anspruch 9, **dadurch ge-**

kennzeichnet, daß die Vorspannungseinrichtung (122) ein federndes Element aufweist, das sich in Richtung der Rotationsachse (28) erstreckt und angepaßt ist, um gleichzeitig auf jeden Flügel (96) zu wirken.

11. Vorrichtung (10) nach Anspruch 10, **dadurch gekennzeichnet, daß** das federnde Element (122) ein Element aus der folgenden Auflistung aufweist: eine geschlitzte Manschette oder ein Rohr aus einem federnden Material; ein Stück eines Rohrs oder Stabs aus Natur- oder synthetischem Kautschuk; ein Rohr oder einen Stab aus Kunststoffmaterial; eine axial innerhalb des Rotorkörpers eingesetzte Schraubenfeder mit flachem Querschnitt; einen massiven oder hohlen Stab oder ein massives oder hohles Rohr aus einem Material, das mit in Umfangsrichtung beabstandet angeordneten federnden Einsätzen in Abständen versehen ist, die dem Ort der Flügel (96) entsprechen.

12. Vorrichtung (10) nach Anspruch 11, **gekennzeichnet durch** eine Aussparung (120), die in der radial inneren Kante (114) jedes Flügels (96) innenbords der axial gegenüberliegenden Enden (108,110) jedes Flügels (96) gebildet ist, um die Vorspannungseinrichtung (122) aufzunehmen.

13. Vorrichtung (10) nach Anspruch 9, **dadurch gekennzeichnet, daß** die Vorspannungseinrichtung (122) ein unter Druck stehendes Fluid aufweist, das innerhalb des Rotorkörpers (26) gehalten wird.

14. Vorrichtung (10) nach Anspruch 1, **dadurch gekennzeichnet, daß** der Rotor (24) eine Welle (80) aufweist, die sich von dem ersten- Ende (68) des Rotorkörpers (26) aus und durch ein Loch (52) erstreckt, das in einem ersten Ende der Enden (140) des Gehäuses (12) gebildet ist, wobei bei einer Verwendung der Vorrichtung (10) als Pumpe ein Drehmoment an die Welle (80) angelegt werden kann, um auf den Rotor (24) eine Rotationsbewegung zu übertragen, und bei Verwendung der Vorrichtung als Motor die Welle (80) als Abtrieb wirken kann.

15. Vorrichtung (10) nach Anspruch 14, **dadurch gekennzeichnet, daß** das der Welle (80) gegenüberliegende zweite Ende (70) des Rotorkörpers (26) mit einer Aussparung (92) versehen ist, um eine in einem zweiten Ende (16) der Enden des Gehäuses (12) gebildete Flanschwelle (62) aufzunehmen, um das zweite Ende (70) des Rotorkörpers (26) drehbar zu halten.

Revendications

1. Dispositif (10) pouvant être utilisé en tant que pompe ou moteur, ledit dispositif (10) comprenant :

un carter (12) doté d'extrémités étanches (14, 16) et prévu avec une cavité située entre lesdites extrémités, ledit carter comprenant en outre des premier et second orifices (20, 22) les deux permettant la communication de fluide entre l'intérieur et l'extérieur dudit carter (12) ;
un rotor (24) doté d'un corps de rotor sensiblement creux (26) supporté par ledit logement (12) en rotation à l'intérieur de ladite cavité (18) autour d'un axe de rotation (28) qui s'étend parallèlement à et décalé à partir d'un axe longitudinal (30) de ladite cavité (18), ledit corps de rotor (26) étant doté de première et seconde extrémités opposées (68, 70) qui comprennent des parties respectives (72, 74) de diamètre réduit par rapport à une partie intermédiaire dudit corps de rotor ;
une pluralité d'encoches (96) formées dans ledit corps de rotor (26) ; et
une pluralité de palettes (32), dont les palettes individuelles sont retenues de façon coulissante dans des encoches séparées (96) pour le mouvement de façon radiale dudit axe de rotation (28) ;
lesdites palettes (32), ledit rotor (24) et ledit carter (12) étant juxtaposés de sorte qu'une chambre sensiblement étanche est formée entre les palettes adjacentes (32), une surface circonférentielle interne (34) dudit carter (12) et ledit rotor (24), et dans lequel lesdits premier et second orifices (20, 22) sont disposés dans des chambres différentes desdites chambres ;

caractérisé en ce que lesdites encoches (96) s'étendent entre lesdites première et seconde extrémités opposées (68, 70) et se terminent dans et à l'intérieur desdites parties de diamètre réduit (72, 74), et **en ce que** des joints d'étanchéité (76, 78) se situent autour desdites parties de diamètre réduit (72, 74) respectivement, lesdits joints d'étanchéité (76, 78) étant installés afin de recouvrir les extrémités opposées (98, 100) de chaque encoche (96) et de venir en butée de façon étanche contre les extrémités opposées de façon axiale (108, 110) desdites palettes (32).

2. Dispositif selon la revendication 1, **caractérisé en ce que** les extrémités opposées (98, 100) de chaque encoche (96) ont une forme arquée.

3. Dispositif (10) selon la revendication 2, **caractérisé en ce que** ledit carter (12) est prévu avec deux surfaces internes étagées (47, 48 ; 57, 58), chacune formée par la jonction de deux faces et les joints d'étanchéité respectifs (76, 78) créent le contact d'étanchéité avec les deux desdites faces (47, 48 ;

57, 58) desdites surfaces internes étagées.

4. Dispositif (10) selon la revendication 3, **caractérisé en ce qu'**une rainure (102, 104) s'étend de façon radiale à partir de chaque extrémité de chaque encoche (96) sur une surface au niveau de chacune desdites première et seconde extrémités (68, 70) à l'intérieur dudit corps de rotor (26) pour recevoir des extrémités opposées (108, 110) de façon axiale d'une palette (32) reçue dans cette encoche (96).

5. Dispositif (10) selon la revendication 4, **caractérisé en ce que** lesdites rainures (102) au niveau de ladite première extrémité (68) dudit corps de rotor (26) s'étendent au-delà du centre dudit corps de rotor (26).

6. Dispositif (10) selon la revendication 4, **caractérisé en ce que** ladite surface intérieure au niveau de ladite première extrémité (68) dudit corps de rotor (26) est prévue avec un enfoncement circulaire (103) centré autour dudit axe de rotation (28) et les rainures (102) formées sur cette surface intérieure s'étendent de façon radiale à partir de l'extrémité des encoches (96) près de ladite première extrémité (98) vers ledit enfoncement circulaire (103).

7. Dispositif (10) selon la revendication 1, **caractérisé en ce que** les bords opposés de façon axiale (108, 110) desdites palettes (32) sont formés avec des surfaces arquées pour le contact coulissant et sensiblement étanche avec les première et seconde extrémités (14, 16) adjacentes respectives dudit carter (12).

8. Dispositif (10) selon la revendication 1, **caractérisé en ce qu'**un bord (112) à distance de façon radiale de chaque palette (96) est formé avec une surface arquée pour le contact coulissant et sensiblement étanche avec ladite surface circonférentielle interne (34) dudit carter (12).

9. Dispositif selon la revendication 1, **caractérisé en ce que** les moyens de sollicitation (122) sont disposés à l'intérieur dudit corps de rotor (26) pour solliciter lesdites palettes (96) de façon radiale vers l'extérieur, vers ladite surface interne circonférentielle (34) dudit carter (12).

10. Dispositif (10) selon la revendication 9, **caractérisé en ce que** lesdits moyens de sollicitation (122) comprennent un élément résilient qui s'étend dans la direction dudit axe de rotation (28) et adaptés pour agir simultanément sur chacune desdites palettes (96).

11. Dispositif (10) selon la revendication 10, **caractérisé en ce que** ledit élément résilient (122) comprend l'un d'un manchon fendu ou d'un tuyau de matériau résilient ; une longueur de tubage ou tige de caoutchouc synthétique ou naturel ; un tuyau ou tige en matière plastique ; un ressort hélicoïdal à section plate monté de façon axiale à l'intérieur dudit corps de rotor ; une tige ou tuyau plein ou creux de matériau prévu avec des insertions résilientes espacées de façon circonférentielle à des intervalles qui correspondent à l'emplacement desdites palettes (96).

12. Dispositif (10) selon la revendication 11 **caractérisé en ce qu'**un enfoncement (120) est formé dans le bord intérieur de façon radiale (114) de chaque palette (96) à l'intérieur des extrémités opposées de façon axiale (108, 110) de chaque palette (96) pour recevoir lesdits moyens de sollicitations (122).

13. Dispositif (10) selon la revendication 9, **caractérisé en ce que** lesdits moyens de sollicitations (122) comprennent un fluide sous pression retenu à l'intérieur dudit corps de rotor (26).

14. Dispositif (10) selon la revendication 1, **caractérisé en ce que** ledit rotor (24) comprend un arbre (80) qui s'étend à partir de la première extrémité (68) dudit corps de rotor (26) et à travers un trou (52) formé dans une première desdites extrémités (140) dudit carter (12), dans lequel au moment où l'on utilise ledit dispositif (10) en tant que pompe, le couple peut être appliqué audit arbre (80) pour communiquer le mouvement de rotation audit rotor (24), et lorsque l'on utilise ledit dispositif en tant que moteur, ledit arbre (80) peut agir en tant prise de mouvement.

15. Dispositif (10) selon la revendication 14 **caractérisé en ce que** la seconde extrémité (70) dudit corps de rotor (26) opposée audit arbre (80) est prévue avec un enfoncement (92) pour recevoir un arbre tronqué (62) formé sur une seconde (16) desdites extrémités dudit carter (12) pour supporter de façon rotative ladite seconde extrémité (70) dudit corps de rotor (26).

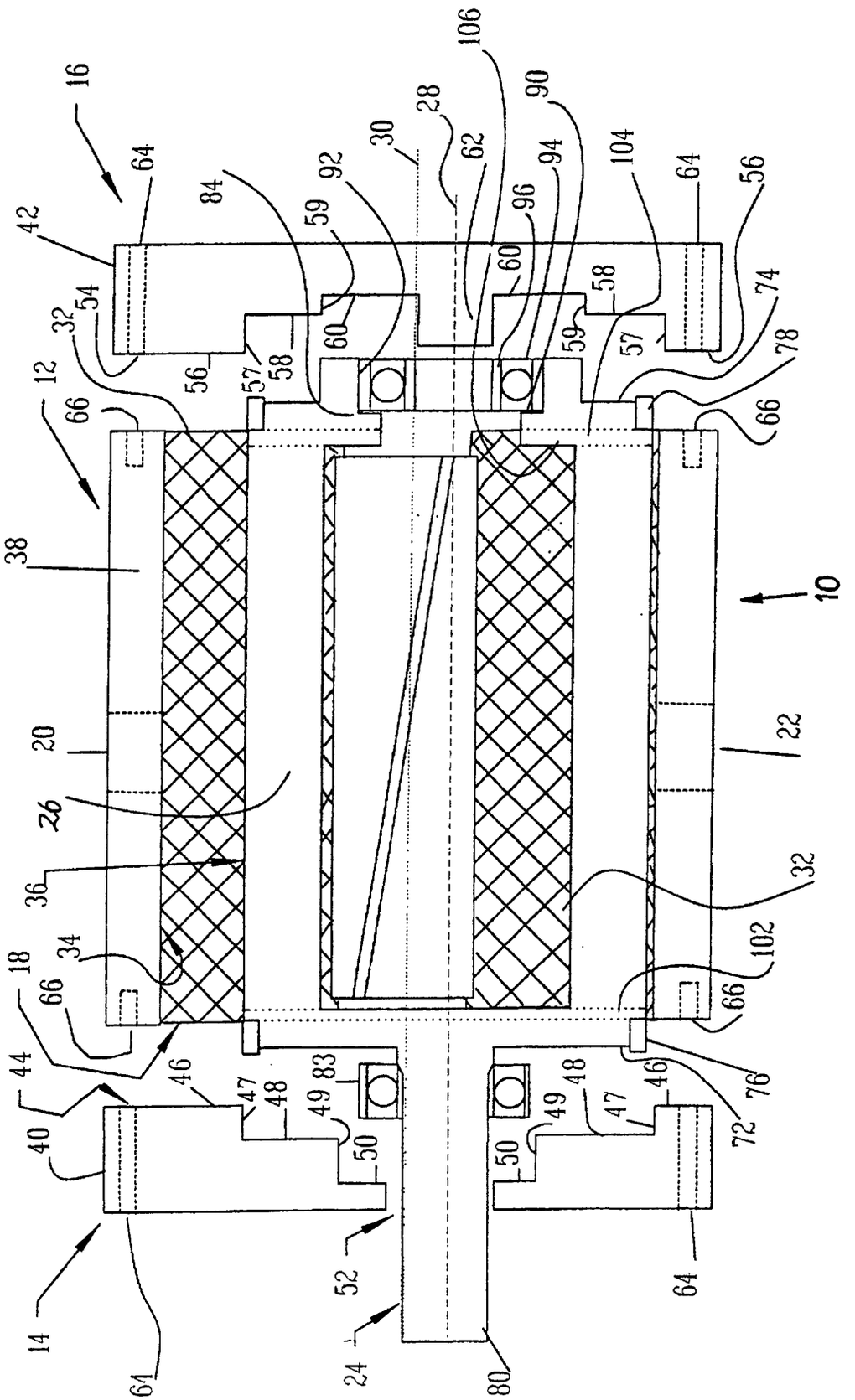
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Fig. 1

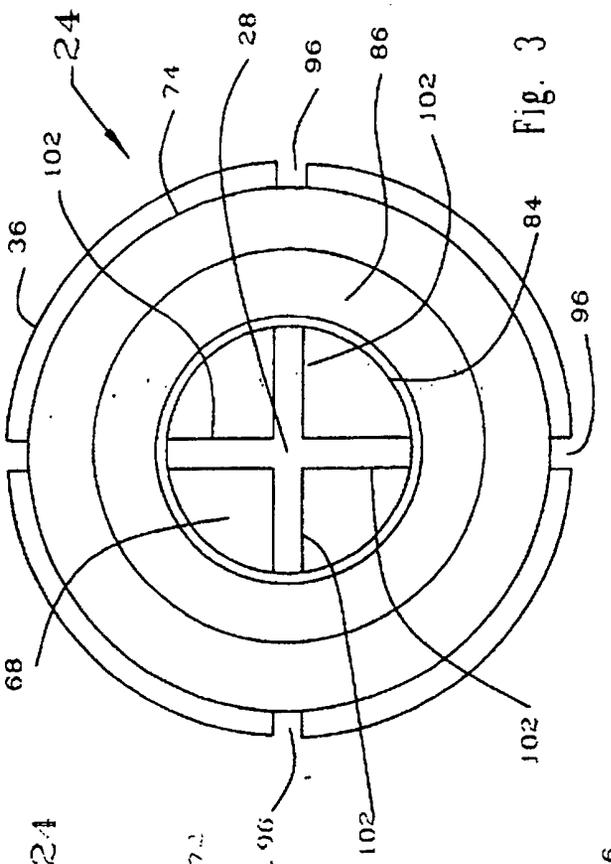

Fig. 3

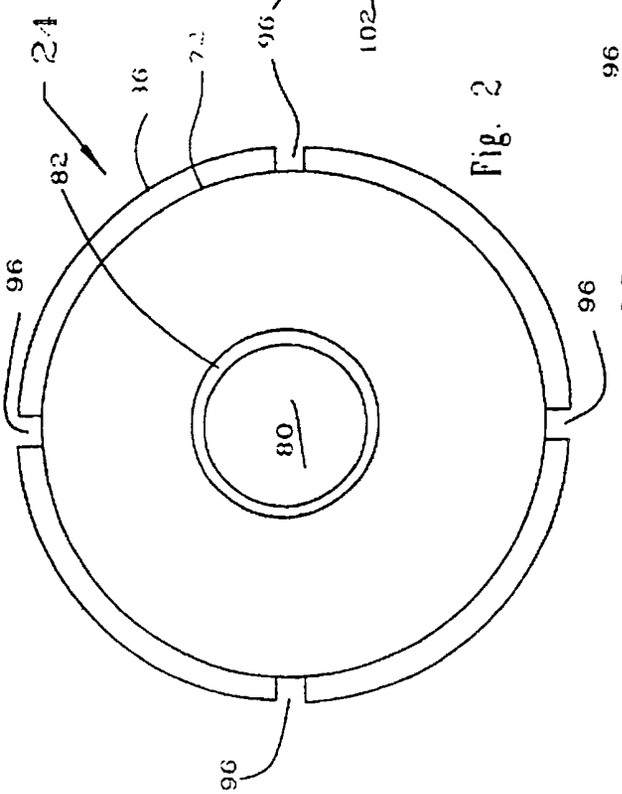

Fig. 2

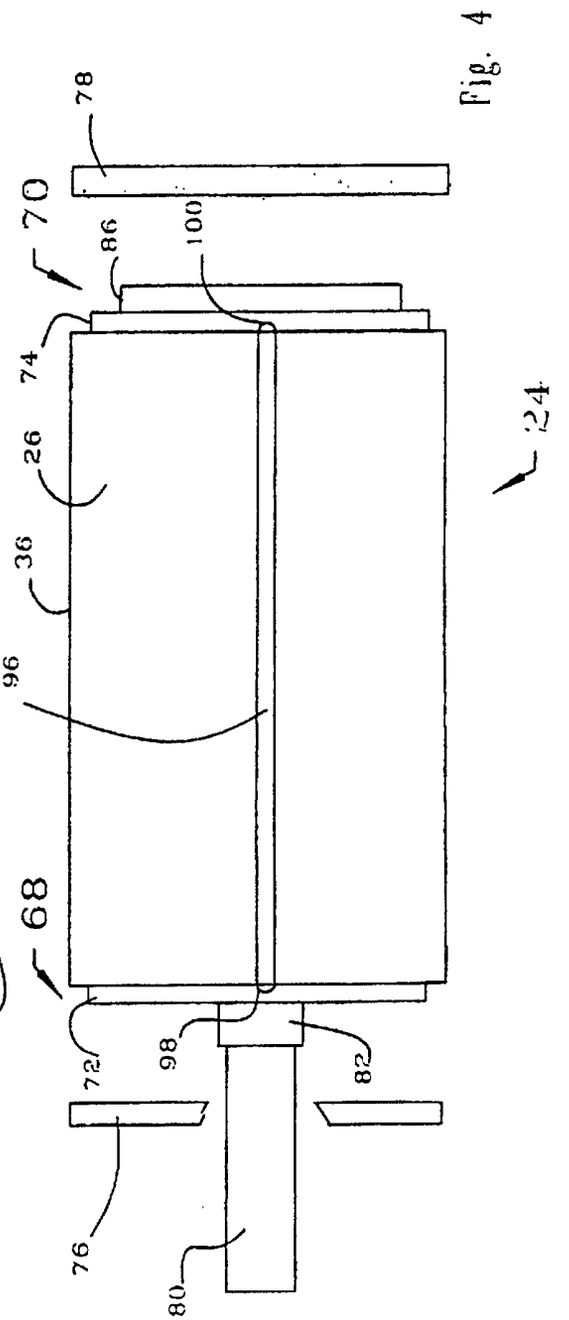

Fig. 4

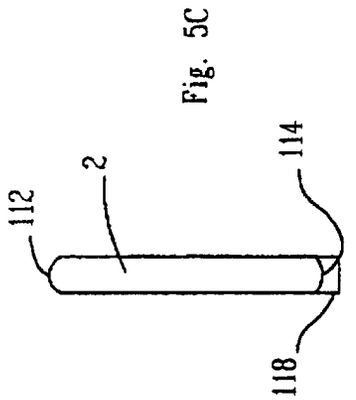

Fig. 5C

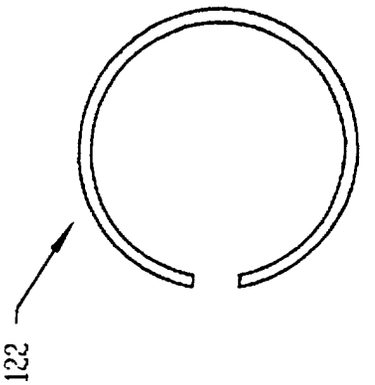

Fig. 6B

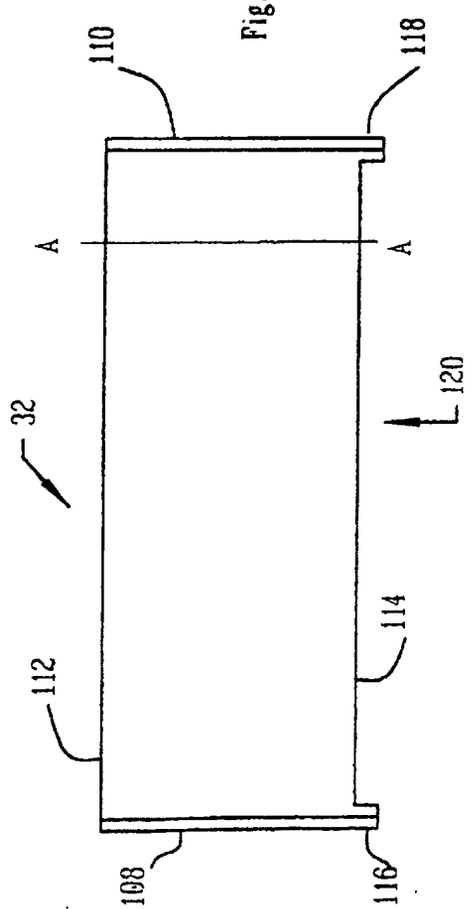

Fig. 5A

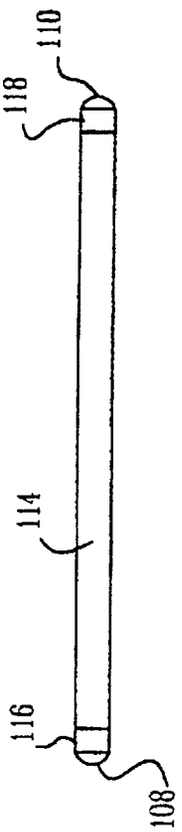

Fig. 5B

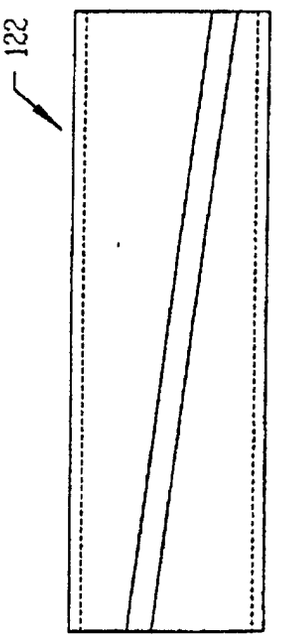

Fig. 6A

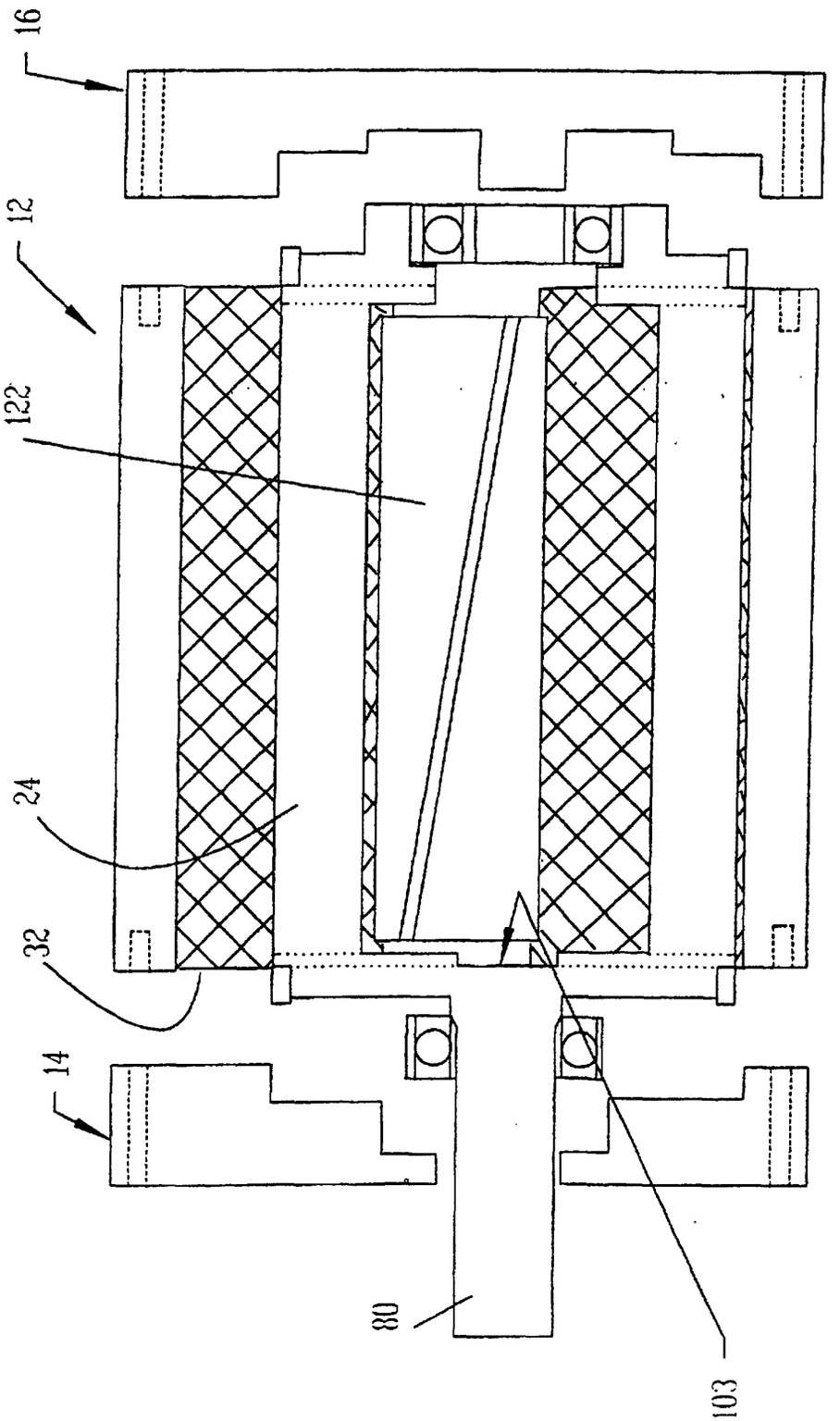

Fig. 7

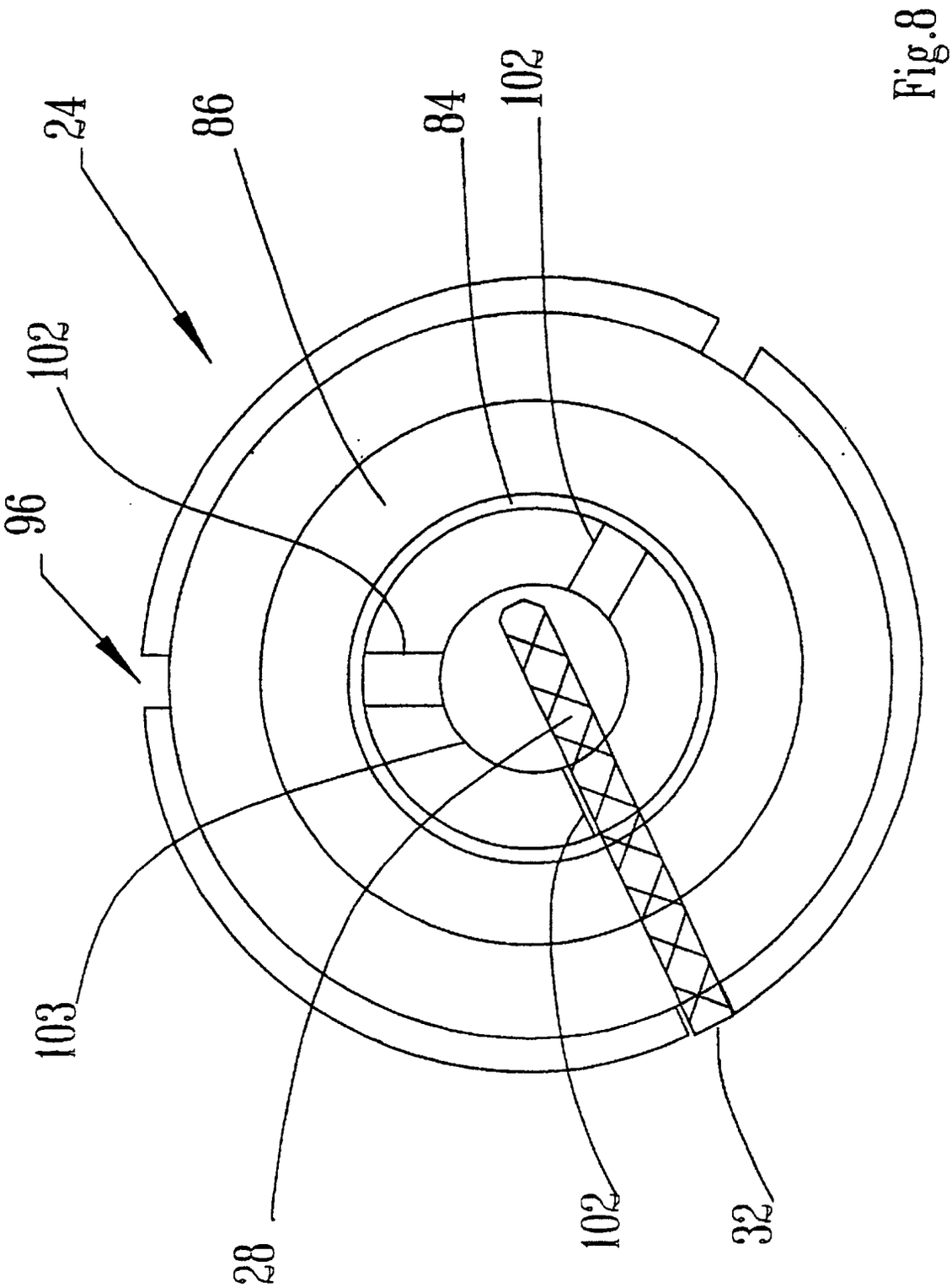

Fig.8

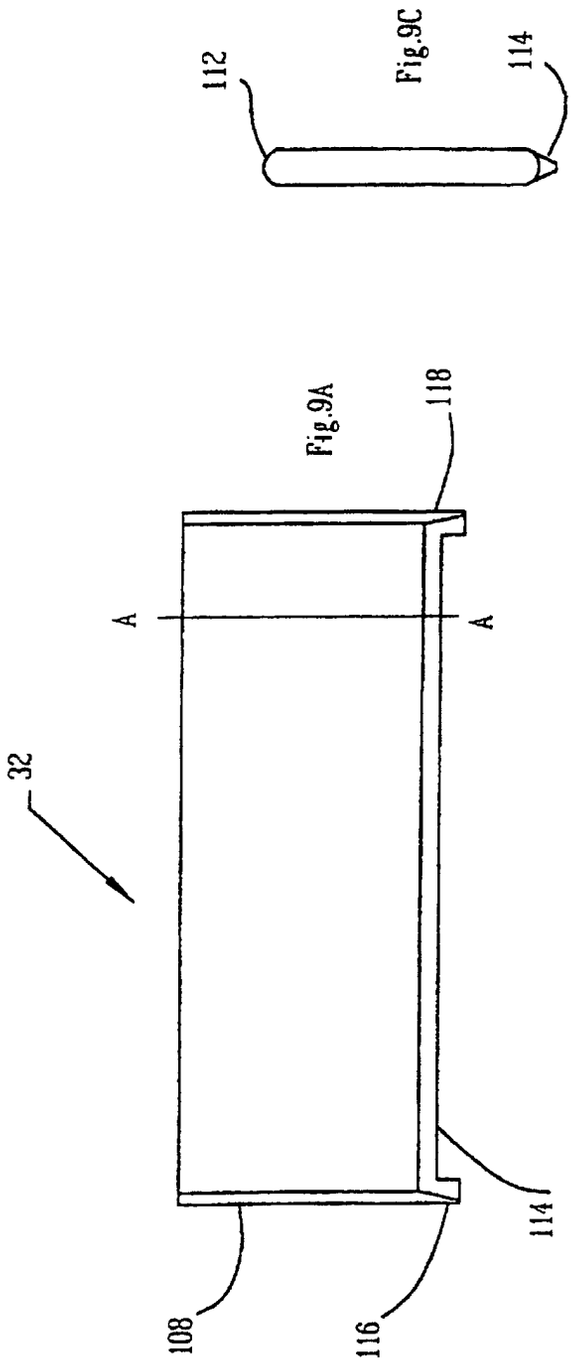

Fig.9A

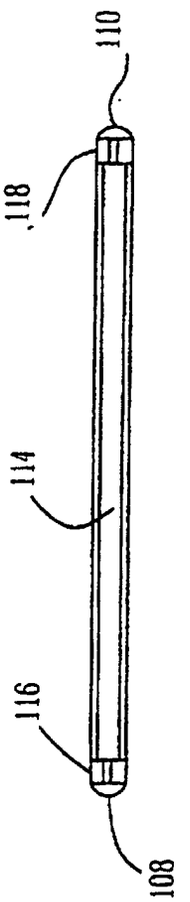

Fig.9B

Fig.9C