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(54) **VARIABLE DISPLACEMENT VANE PUMP**

FLÜGELZELLENPUMPE MIT VERSTELLBARER DURCHFLUSSMENGE

POMPE A AILETTES A CYLINDREE VARIABLE

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US-A- 5 752 815

- **PATENT ABSTRACTS OF JAPAN vol. 008, no. 280 (M-347), 21 December 1984 (1984-12-21) & JP 59 147890 A (TOYODA KOKI KK), 24 August 1984 (1984-08-24)**

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The subject invention relates to a variable displacement fluid pressure vane pump as defined in the preamble of claim 1.

[0002] Such a pump is known of from JP-A-59 147 890.

2. Background of the Related Art

[0003] For many years, main engine fuel pumps have been fixed displacement gear pumps. Although such pumps are durable they are also inefficient. Fixed displacement vane pumps were developed in order to overcome certain deficiencies of gear pumps. An example of such a pump is disclosed in U.S. Patent No. 4,354,809, the disclosure of which is herein incorporated by reference in its entirety.

[0004] Vane pumps include a rotor element that has slots for supporting radially movable vane elements. The rotor element is mounted within a cam member defining a cam surface. The cam surface has a fluid inlet port through which fluid is delivered to the low pressure inlet areas of the rotor surface. The fluid is subsequently compressed and discharged from the high pressure outlet areas of the rotor surface as pressurized fluid.

[0005] Variable displacement vane pumps are known, as disclosed for example in U.S. Patent Nos. 5,545,014 and 5,545,018, the disclosures of which are herein incorporated by reference in their entireties. These pumps contain a swing cam element which pivots relative to the rotor element, so as to change the relative volumes of the inlet and outlet discharge areas and thereby vary the displacement capacity of the pump.

[0006] Variable displacement vane pumps often have leakage problems in the high pressure discharge arc area. Spring biased cam seal elements that frictionally engage the faces of the swing cam in the discharge arc area have been designed to overcome these problems, as described for example in U.S. Patent No. 5,783,500, the disclosure of which is incorporated by reference herein in its entirety.

[0007] In the past, seal elements associated with the swing cam have been aligned with the horizontal centerline of the pump. Thus, the cam seals follow the cam stroke. If one or both of the cam seals should happen to bind up due to contamination and be unable to follow the cam, a major leak path would result. In the worst case, the sealed high pressure cavity on the outer diameter of the cam will become inlet pressure, and internal leakage will increase across the fixed clearance between the cam and the sideplates. It is readily apparent that a solution to this problem is necessary.

SUMMARY OF THE INVENTION

[0008] The subject invention is directed to an improved cam seal arrangement for a variable displacement vane pump which solves the problems associated with cam seals on prior art vane pumps. In particular, the subject invention is directed to a variable displacement vane pump in which the cam seals are located along the arc defined by the cam as it swings about its pivot point relative to the rotor member. Consequently, the seals function as static seals, and will not bind up in their slots. This will minimize cam seal leakage if a seal fails to follow the cam stroke.

[0009] The present invention is characterized by the features of claim 1.

[0010] In accordance with a preferred embodiment of the subject invention the variable displacement vane pump disclosed herein includes a pump housing having a cylindrical interior chamber defining a central axis through which a vertical centerline and a horizontal centerline extends. A cylindrical rotor member is mounted for rotational movement within the interior chamber of the pump housing about an axis aligned with the central axis of the interior chamber. The rotor member has a central vane section including a plurality of circumferentially spaced apart radial vane slots formed therein. Each vane slot supports a corresponding vane element which is mounted for radial movement therein, and each vane element has an outer tip surface.

[0011] A cam member is mounted for pivotal movement within the interior chamber of the pump housing about a fulcrum aligned with the vertical centerline of the interior chamber. The cam member defines a cam body having a circular bore extending therethrough for receiving the rotor member. The circular bore forms a cam chamber defining a smooth cam surface making continuous contact with the outer tip surfaces of the vane elements during the rotation of the rotor member. The cam body has opposed lateral sealing lands formed thereon which have arcuate sealing surfaces that define segments of a cam arc through which the cam member pivots or swings relative to the rotor member.

[0012] The variable displacement vane pump of the subject invention further includes lateral cam seals supported within the interior chamber of the pump housing for sealingly isolating the high pressure zone of the pump from the relatively lower inlet pressure of the pump. Each cam seal is biased into a continuous contact position with an adjacent sealing surface of the cam member. The cam seals are oriented on each end of a chord of the cam arc. The chord of the cam arc extends parallel to and is located below the horizontal centerline of the interior chamber. Consequently, the cam seals act as static seals which are less likely to bind up during operation and cause internal leakage across the fixed clearance between the cam member and the sideplates.

[0013] Preferably, the variable displacement vane pump of the subject invention includes opposed side-

plates disposed within the interior chamber of the pump housing. The sideplates support the rotor member and cam member therebetween. An axial spacer having an axial thickness slightly greater than an axial thickness of the cam member is preferably positioned between the opposed sideplates for reducing or eliminating friction between the sideplates and the cam member. The static cam seals are supported by the axial spacer and are oriented on each end of a chord of the cam arc through which the cam member swings so as to prevent fuel leakage between the high and low pressure zones formed in the area defined between the sideplates.

[0014] These and other unique features of the subject invention will become more readily apparent from the following description of the drawings taken in conjunction with the description of the preferred embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] So that those having ordinary skill in the art to which the subject invention appertains will more readily understand how to construct the variable displacement vane pump of the subject invention, reference may be had to the drawings wherein:

Fig. 1 is a cross-sectional view of a prior art variable displacement vane pump, taken along a plane extending transverse to the longitudinal axis of the pump, wherein the cam seals are located along the horizontal center line of the pump housing;

Fig. 2 is an enlarged localized view of a lateral cam seal of the variable displacement vane pump illustrated in Fig. 1;

Fig. 3 is a cross-sectional view of a variable displacement vane pump constructed in accordance with a preferred embodiment of the subject invention taken along a plane extending parallel to the longitudinal axis of the pump, and illustrating the direction of fuel flow through the pump housing;

Fig. 4 is a an exploded perspective view of the variable displacement vane pump of Fig. 4 with parts separated for ease of illustration;

Fig. 5 is a cross-sectional view of the variable displacement vane pump of the subject invention, taken along line 5-5 of Fig. 4, wherein the cam seals are located at opposite ends of a chord of an arc through which the cam member swings, and the cam member is illustrated in a maximum stop position;

Fig. 6 is an enlarged localized view of a cam seal of the variable displacement vane pump illustrated in Fig. 5 when the cam member is disposed in a maximum stop position;

Fig. 7 is a cross-sectional view of the variable displacement vane pump of the subject invention, taken along line 5-5 of Fig. 4, wherein the cam member is illustrated in a minimum stop position; and

Fig. 8 is an enlarged localized view of the cam illustrated in Fig. 6 when the cam member is disposed in the minimum stop position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0016] Referring now to the drawings wherein like reference numerals identify similar structural elements of the disclosed apparatus, there is illustrated in Fig. 1 a prior art variable displacement vane pump designated generally by reference numeral 10. Vane pump 10, which is substantially similar to the vane pump disclosed in commonly assigned U.S. Patent No. 5,545,014, includes a pump housing 12 defining an interior chamber which supports a cam member 14 and a rotor member 16. Rotor member 16 includes a plurality of radially extending slots, each for supporting a corresponding vane element 18. Cam member 14 is mounted for pivotal movement about pivot pin 20 supported in housing 12 and defines a circular bore 22 forming a cam chamber. The cam chamber defines a cam surface 24 making continuous contact with the outer tip surfaces of the vane elements 18.

[0017] Spring biased cam seals 26a and 26b are supported within corresponding slots 28a and 28b formed in axial spacer member 30, as best seen in Fig. 2. Axial spacer 30 is supported within housing 12 by a plurality of threaded fasteners disposed about the periphery thereof. Cam seals 26a and 26b are aligned with the horizontal centerline of the rotor member 16 and are configured in such a manner so that the tips of the cam seals remain in contact with the radially outer surface of the cam member 14 regardless of the position of the cam member 14. The cam seals 26a and 26b are positioned so as to divide the cavity formed between the axial spacer 30 and the cam member 14 into a high pressure zone and a low pressure zone, and prevent circumferential fuel flow therebetween so as to improve pump efficiency.

[0018] In operation, as the cam member 14 pivots about pin 18 relative to rotor member 16 in response to actuation of piston 35 to vary the displacement of the pump 10, the cam seals 26a and 26b reciprocate within slots 28a and 28b, as they follow the cam stroke. If one or both of the horizontally disposed cam seal 26a and 26b should happen to bind up in its slot and be unable to follow the cam member, a major leak path would result, decreasing pump efficiency.

[0019] Referring now to Figs. 3 and 4, there is disclosed a variable displacement vane pump constructed in accordance with a preferred embodiment of the subject invention and designated generally by reference numeral 100. Vane pump 100 includes a pump housing 112 defining an interior pumping chamber having a central longitudinal axis extending therethrough and including an inlet region 104 for admitting low pressure fuel into the pumping chamber and a discharge region 106 for discharging high pressure fuel from the pumping chamber.

[0020] A main drive shaft 132 extends through the interior chamber of pump housing 112 along the longitudinal axis thereof for driving a central shaft member 134.

Shaft member 134 is supported for rotation by opposed journal bearings 136a and 136b, and is keyed to rotor member 116 for imparting rotational motion thereto. Rotor member 116 includes a plurality of radially extending slots 138, each for supporting a corresponding vane elements 118. The vane elements fit snugly within the slots and function like pistons as they are depressed radially inwardly during movement of the rotor member through the discharge arc of the pump. Each slot has an undervane cavity defining an area that is open to inlet pressure when the vane element is in the inlet arc region of the pump, and to discharge pressure when the vane element is in the discharge arc region of the pump.

[0021] A cam member 114 is mounted for pivotal movement within pump housing 112 about pivot pin 120 defining a fulcrum, to vary the displacement of vane pump 100. Cam member 114 includes a one-piece body that defines a circular bore 122 forming a cam chamber 125. Cam chamber 125 defines a smooth continuous annular cam surface 124 dimensioned and configured to make continuous contact with the outer tip surfaces of the plural vane elements 118 as rotor member 116 rotates about the axis of the pump housing 112. A lever 145 extends from the body of cam member 114 and is pivotably connected to an actuation piston 135 for varying the position of the cam member 114 relative to the rotor member 116. (See Figs. 5 and 7).

[0022] Opposed sideplates 140 and 142 disposed within a cylindrical housing member 150 form a sealed cavity between cam member 114 and rotor member 116, and provide inlet and discharge ports for the cavity. An axial spacer 130 having a thickness that is slightly greater than the thickness of cam member 114 is disposed between sideplates 140 and 142. This allows the sideplates 140 and 142 to be tightly clamped against the spacer 130 by a plurality of threaded fasteners 152 while allowing small gaps to remain between the cam member 114 and the sideplates to reduce or eliminate friction therebetween.

[0023] As best seen in Figs. 5 through 8, cam member 114 includes opposed radially outwardly extending sealing lands 114a and 114b. The sealing lands define arcuate cam surfaces 115a and 115b, respectively. Cam surfaces 115a and 115b are configured in such a manner so as to define arcuate segments of the cam arc A-B through which cam member 114 swings relative to rotor member 116.

[0024] Spring biased cam seals 126a and 126b are supported in slots 128a and 128b, respectively, formed in spacer 130 for controlling fluid leakage between the high pressure and lower pressure zones defined in the cavity formed between opposed sideplates 140 and 142. Cam seals 126a and 126b have intersecting axes that are radially aligned with the fulcrum of cam member 114, and are positioned at each end of a chord of the cam arc A-B. The chord extends parallel to and is located below the horizontal centerline of the interior chamber of pump housing 112. Those skilled in the art will readily appreciate that the relative distance between the chord of cam arc A-B and the horizontal centerline of pump housing 112, and hence the positions of cam seals 126a and 126b, can vary, so long as the cam surfaces 115a and 115b of cam member 114 coincide with cam arc A-B.

[0025] The cam seals 126a and 126b are adapted and configured to remain in continuous contact with the radially outer surface of cam member 114 at all times during operation under the bias of coiled springs 146a and 146b. More particularly, as the cam member 114 moves between the maximum stop position illustrated in Figs. 5 and 6, and the minimum stop position illustrated in Fig. 7 and 8, the cam seals remain in a static condition, biased into contact with the cam member 114 by springs 146a and 146b.

[0026] Thus, cam seals 126a and 126b function as static seals, in that they do not translate within slots 128a and 128 in response to pivotal movement of the cam member between the maximum and minimum stop positions. Consequently, the cam seals will not have a tendency to bind up in their slots during operation. This advantageously minimizes the risk of fuel leakage between the low pressure and high pressure zones of the pump.

[0027] Although the subject invention has been described with respect to a preferred embodiment, it should be readily apparent to those having ordinary skill in the art that modifications and changes may be made thereto if not departing from the scope of the subject invention as defined by the appended claims.

Claims

1. A variable displacement vane pump comprising:

a) a pump housing (112) having a cylindrical interior chamber defining a central axis through which a vertical centerline and a horizontal centerline extends;

b) a cylindrical rotor member (116) mounted for rotational movement within the interior chamber of the pump housing (112) about an axis aligned with the central axis of the interior chamber (125), the rotor member (116) having a central vane section including a plurality of circumferentially spaced apart radial vane slots (138) formed therein, each vane slot (138) supporting a corresponding vane element (118) mounted for radial movement therein, each vane element having an outer tip surface;

c) a cam member (114) mounted for pivotal movement within the interior chamber of the pump housing (112) about a fulcrum (120) aligned with the vertical centerline of the interior chamber, the cam member (114) defining a cam body having a circular bore (122) extending therethrough for receiving the rotor member (116), the circular bore (122) forming a cam

chamber (125) defining a cam surface (124) making continuous contact with the outer tip surfaces of the vane elements (118) during the rotation of the rotor member (116),
the cam body having lateral sealing lands (114a, 114b) formed thereon, the sealing lands (114a, 114b) having arcuate sealing surfaces (115a, 115b) defining segments of a cam arc through which the cam member (114) pivots relative to the rotor member (116), and
d) lateral cam seals (126a, 126b) supported within the interior chamber of the pump housing (112) and movable along a sealing axis, **characterized in that** said lateral cam seals (126a, 126b) are oriented on each end of a chord of the cam arc through which the cam member (114) pivots, each cam seal (126a, 126b) including a biasing element (146a, 146b) being adapted and configured for biasing the cam seal (126a, 126b) along the sealing axis into contact with the cam member (114), the sealing axis being radially aligned with the fulcrum (120) of the cam member (114).

2. A variable displacement vane pump as recited in Claim 1, wherein the chord of the cam arc extends parallel to the horizontal centerline of the interior chamber.

3. A variable displacement vane pump as recited in Claim 1, wherein the chord of the cam arc extends parallel to and is located below the horizontal centerline of the interior chamber.

4. A variable displacement vane pump as recited in any one of Claims 1 to 3, wherein the cam seals (126a, 126b) are supported by a spacer (130) mounted between opposed sideplates (140, 142).

5. A variable displacement vane pump as recited in any one of Claims 1 to 4, further comprising means (135, 145) for adjusting the position of the cam member (114) relative to the rotor member (116).

6. A variable displacement vane pump as recited in Claim 1, wherein the cam chamber (125) defines a continuous cam surface (124) making contact with the outer tip surfaces of the vane elements (118) during the rotation of the rotor member (116) and the sealing lands (114a, 114b) have arcuate sealing surfaces (115a, 115b) defining segments of a cam arc through which the cam member (114) pivots about the fulcrum (120) relative to the rotor member (116); and wherein the variable displacement vane pump further comprises static cam seals (126a, 126b) supported within the interior chamber of the pump housing (112) and oriented on each end of a chord of the cam arc, each cam seal (126a, 126b) biased into a continuous contact position with an adjacent sealing surface (115a, 115b) of the cam member (114).

Patentansprüche

1. Flügelzellenpumpe mit variabler Verdrängung umfassend:

a) ein Pumpengehäuse (112) mit einer zylindrischen Innenkammer, welche eine Mittelachse definiert, durch welche sich eine vertikale Mittellinie und eine horizontale Mittellinie erstreckt;
b) ein zylindrisches Rotorelement (116), welches für eine Drehbewegung um eine Achse herum innerhalb der Innenkammer des Pumpengehäuses (112) montiert ist, welche Achse zu der Mittelachse der Innenkammer (125) ausgerichtet ist, wobei das Rotorelement (116) einen zentralen Flügelabschnitt aufweist, welcher eine Mehrzahl von darin ausgebildeten, in Umfangsrichtung voneinander beabstandeten, radialen Flügelschlitzen (138) umfasst, wobei jeder Flügelschlitz (138) ein entsprechendes Flügelelement (118) lagert, welches darin für eine radiale Bewegung montiert ist, wobei jedes Flügelelement eine äußere Endfläche hat;
c) ein Nockenelement (114), welches für eine Schwenkbewegung innerhalb der Innenkammer des Pumpengehäuses (112) um einen Drehpunkt (120) montiert ist, welcher zu der vertikalen Mittellinie der Innenkammer ausgerichtet ist, wobei das Nockenelement (114) einen Nokkenkörper definiert, welcher eine sich hindurch erstrekkende kreisförmige Bohrung (122) hat, um das Rotorelement (116) aufzunehmen, wobei die kreisförmige Bohrung (122) eine Nokkenkammer (125) ausbildet, welche eine Nokkenfläche (124) definiert, die während der Drehung des Rotorelements (116) mit den äußeren Endflächen der Flügelelemente (118) einen kontinuierlichen Kontakt herstellt,
wobei der Nockenkörper darauf ausgebildete seitliche Dichtungsstege (114a, 114b) aufweist, wobei die Dichtungsstege (114a, 114b) bogenförmige Dichtungsflächen (115a, 115b) aufweisen, welche Segmente eines Nockenbogens definieren, durch welche das Nockenelement (114) relativ zu dem Rotorelement (116) schwenkt, und
d) seitliche Nockendichtungen (126a, 126b), welche innerhalb der Innenkammer des Pumpengehäuses (112) gelagert sind und längs einer Dichtungsachse beweglich sind,
dadurch gekennzeichnet, dass
die seitlichen Nockendichtungen (126a, 126b) auf jedes Ende einer Sehne von dem Nockenbogen ausgerichtet sind, durch welchen das

Nockenelement (114) schwenkt, wobei jede Nockendichtung (126a, 126b) ein Vorspannelement (146a, 146b) umfasst, welches dazu ausgebildet und konfiguriert ist, die Nockendichtung (126a, 126b) entlang der Dichtungsachse in Kontakt mit dem Nockenelement (114) vorzuspannen, wobei die Dichtungsachse radial zu dem Drehpunkt (120) des Nokkenelements (114) ausgerichtet ist.

2. Flügelzellenpumpe mit variabler Verdrängung nach Anspruch 1, wobei sich die Sehne von dem Nockenbogen parallel zu der horizontalen Mittellinie der Innenkammer erstreckt.

3. Flügelzellenpumpe mit variabler Verdrängung nach Anspruch 1, wobei sich die Sehne von dem Nockenbogen parallel zu der horizontalen Mittellinie der Innenkammer erstreckt und unter der horizontalen Mittellinie der Innenkammer angeordnet ist.

4. Flügelzellenpumpe mit variabler Verdrängung nach einem der Ansprüche 1 bis 3, wobei die Nockendichtungen (126a, 126b) durch einen Abstandhalter (130) gelagert sind, welcher zwischen gegenüberliegenden Seitenplatten (140, 142) montiert ist.

5. Flügelzellenpumpe mit variabler Verdrängung nach einem der Ansprüche 1 bis 4, ferner umfassend Mittel (135, 145), um die Position des Nockenelements (114) relativ zu dem Rotorelement (116) einzustellen.

6. Flügelzellenpumpe mit variabler Verdrängung nach Anspruch 1, wobei die Nockenkammer (125) eine kontinuierliche Nockenfläche (124) definiert, welche mit den äußeren Endflächen der Flügelelemente (118) während der Drehung des Rotorelements (116) einen Kontakt herstellt, und die Dichtungsstege (114a, 114b) bogenförmige Dichtungsflächen (115a, 115b) aufweisen, welche Segmente eines Nockenbogens definieren, durch welchen das Nokkenelement (114) relativ zu dem Rotorelement (116) um den Drehpunkt (120) herum schwenkt; und wobei die Flügelzellenpumpe mit variabler Verdrängung ferner statische Nockendichtungen (126a, 126b) umfasst, welche innerhalb der Innenkammer des Pumpengehäuses (112) gelagert sind und auf jedes Ende einer Sehne des Nockenbogens ausgerichtet sind, wobei jede Nockendichtung (126a, 126b) in eine kontinuierliche Kontaktposition mit einer benachbarten Dichtungsfläche (115a, 115b) des Nockenelements (114) vorgespannt ist.

Revendications

1. Pompe à ailettes à cylindrée variable, comprenant :

a) un logement de pompe (112) ayant une chambre intérieure cylindrique définissant un axe central à travers lequel s'étendent une ligne centrale verticale et une ligne centrale horizontale ;
b) un élément de rotor cylindrique (116) monté pour un mouvement rotatif dans la chambre intérieure du logement de pompe (112) autour d'un axe aligné avec l'axe central de la chambre intérieure (125), l'élément de rotor (116) ayant une section à ailette centrale, comprenant une pluralité de fentes d'ailettes radiales espacées de manière circonférencielle (138) ménagées à l'intérieur, chaque fente d'ailette (138) supportant un élément d'ailette correspondant (118) monté pour un mouvement radial à l'intérieur, chaque élément d'ailette ayant une surface de pointe extérieure ;
c) un élément à came (114) monté pour un mouvement pivotant dans la chambre intérieure du logement de pompe (112) autour d'un pivot (120) aligné avec la ligne centrale verticale de la chambre intérieure, l'élément à came (114) définissant un corps de came ayant un alésage circulaire (122) s'étendant à travers lui pour recevoir l'élément de rotor (116), l'alésage circulaire (122) formant une chambre de came (125) définissant une surface de came (124) faisant un contact continu avec les surfaces de pointe extérieures des éléments à ailettes (118) pendant la rotation de l'élément de rotor (116),
le corps de came ayant des zones d'étanchéité latérales (114a, 114b) formées dessus, les zones d'étanchéité (114a, 114b) ayant des surfaces d'étanchéité arquées (115a, 115b) définissant des segments d'un arc de came à travers lequel l'élément à came (114) pivote relativement à l'élément de rotor (116) et
d) des joints de came latéraux (126a, 126b) supportés dans la chambre intérieure du logement de pompe (112) et mobiles le long d'un axe d'étancheité, **caractérisés en ce que** lesdits joints de came latéraux (126a, 126b) sont orientés à chaque extrémité d'une corde de l'arc de came, à travers lequel l'élément à came (114) pivote, chaque joint de came (126a, 126b) comprenant un élément de sollicitation (146a, 146b) adapté et configuré pour solliciter le joint de came (126a, 126b) le long de l'axe d'étanchéité en contact avec l'élément à came (114), l'axe d'étanchéité étant radialement aligné avec le pivot (120) de l'élément à came (114).

2. Pompe à ailettes à cylindrée variable selon la revendication 1, dans laquelle la corde de l'arc de came s'étend parallèlement à la ligne centrale horizontale de la chambre intérieure.

3. Pompe à ailettes à cylindrée variable selon la reven-

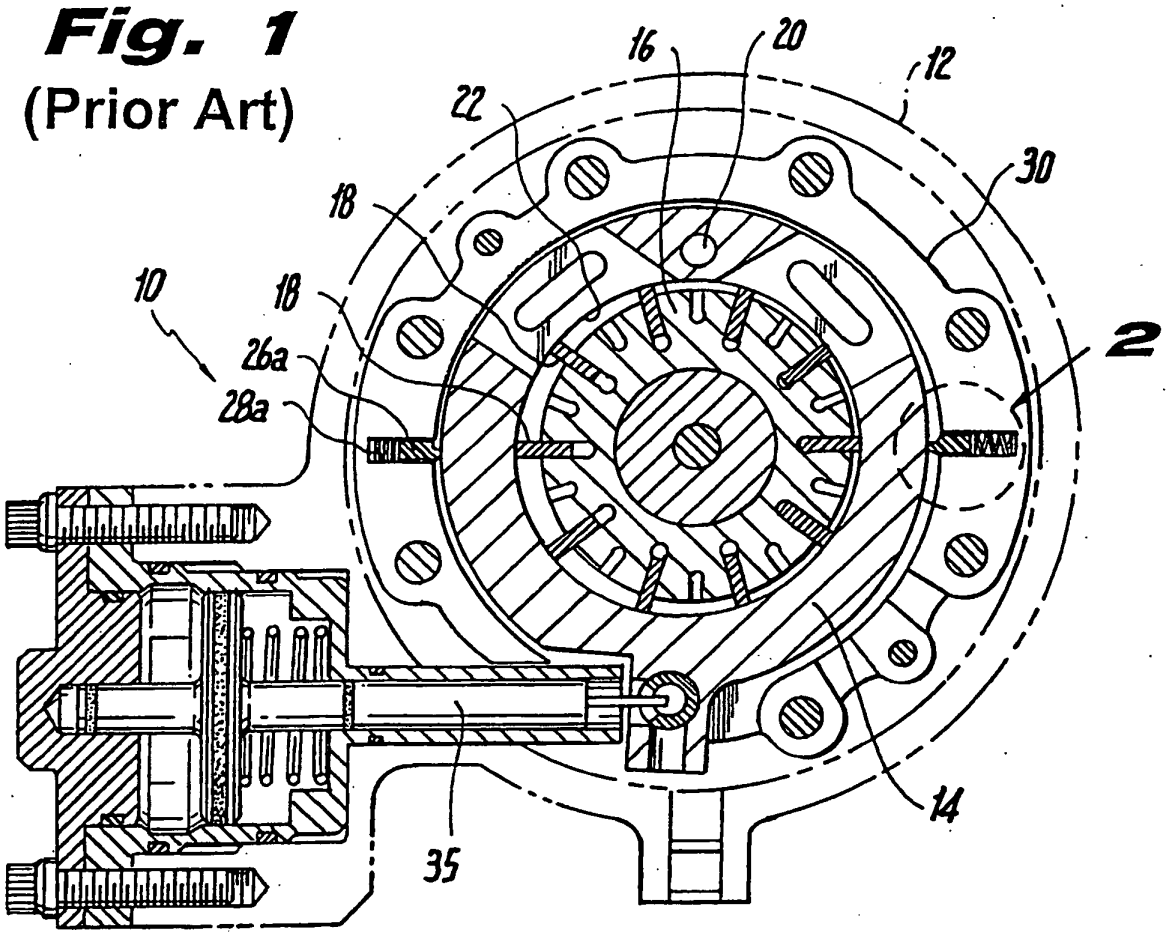
dication 1, dans laquelle la corde de l'arc de came s'étend parallèlement et est située sous la ligne centrale horizontale de la chambre intérieure.

4. Pompe à ailettes à cylindrée variable selon l'une quelconque des revendications 1 à 3, dans laquelle les joints de came (126a, 126b) sont supportés par une entretoise (130) montée entre des plaques latérales opposées (140, 142).

5. Pompe à ailettes à cylindrée variable selon l'une quelconque des revendications 1 à 4, comprenant en outre des moyens (135, 145) pour ajuster la position de l'élément à came (114) relativement à l'élément de rotor (116).

6. Pompe à ailettes à cylindrée variable selon la revendication 1, dans laquelle la chambre de came (125) définit une surface de came continue (124) entrant en contact avec les surfaces de pointe extérieures des éléments à ailettes (118) pendant la rotation de l'élément de rotor (116) et les zones d'étanchéité (114a, 114b) ont des surfaces d'étanchéité arquées (115a, 115b) définissant des segments d'un arc de came à travers lequel l'élément à came (114) pivote autour du pivot (120) relativement à l'élément de rotor (116) ; et dans lequel la pompe à ailettes à cylindrée variable comprend en outre des joints de came statiques (126a, 126b) supportés dans la chambre intérieure du logement de pompe (112) et orientés sur chaque extrémité d'une corde de l'arc de came, chaque joint de came (126a, 126b) étant sollicité dans une position de contact continu avec une surface d'étanchéité adjacente (115a, 115b) de l'élément à came (114).

Fig. 1
(Prior Art)



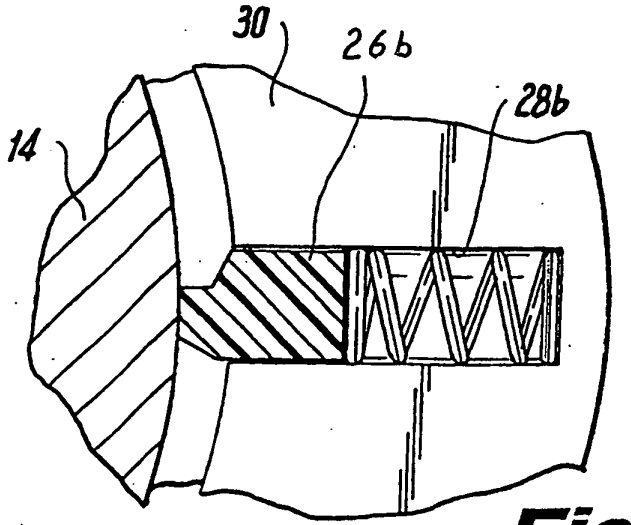


Fig. 2
(Prior Art)

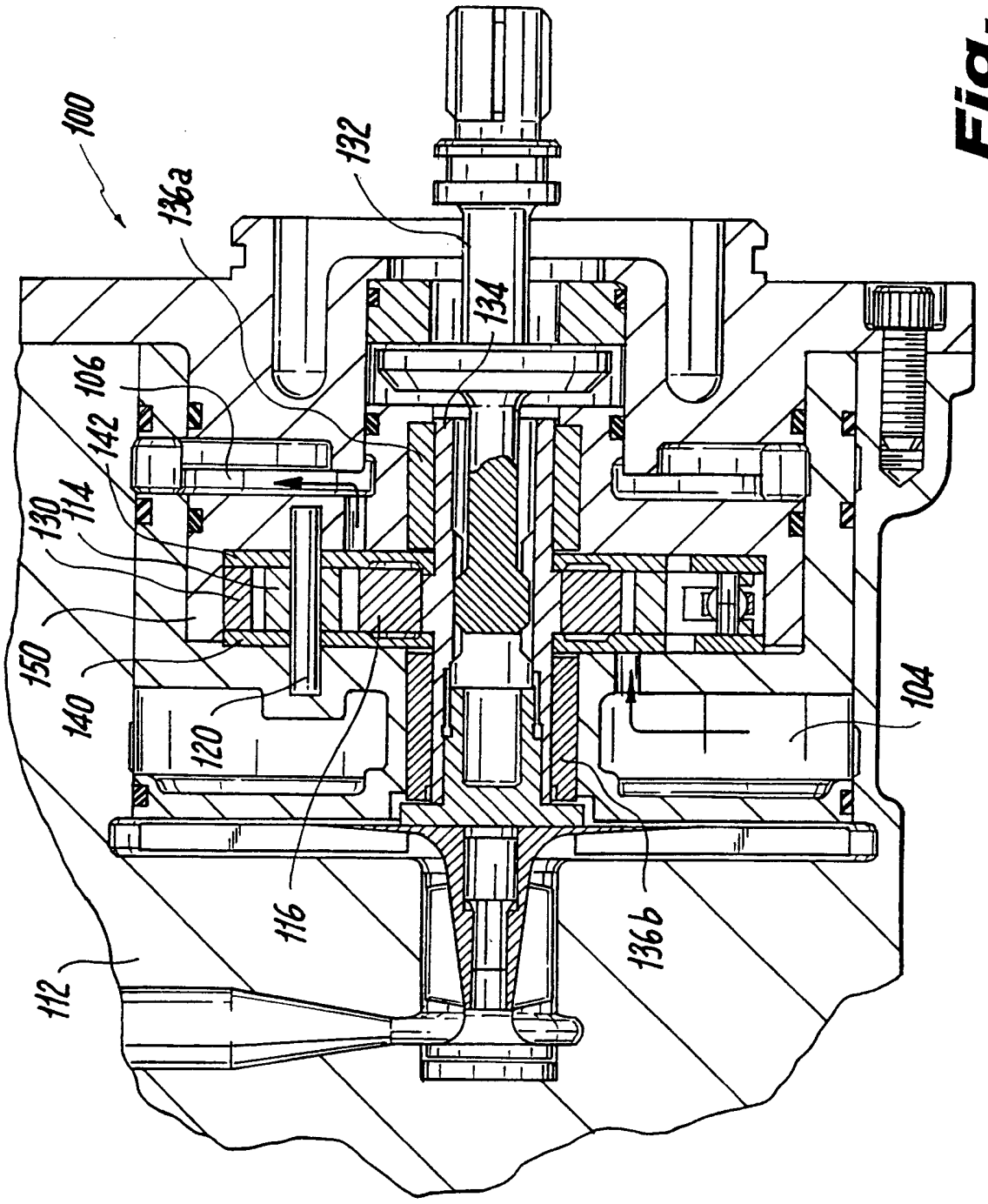


Fig. 3

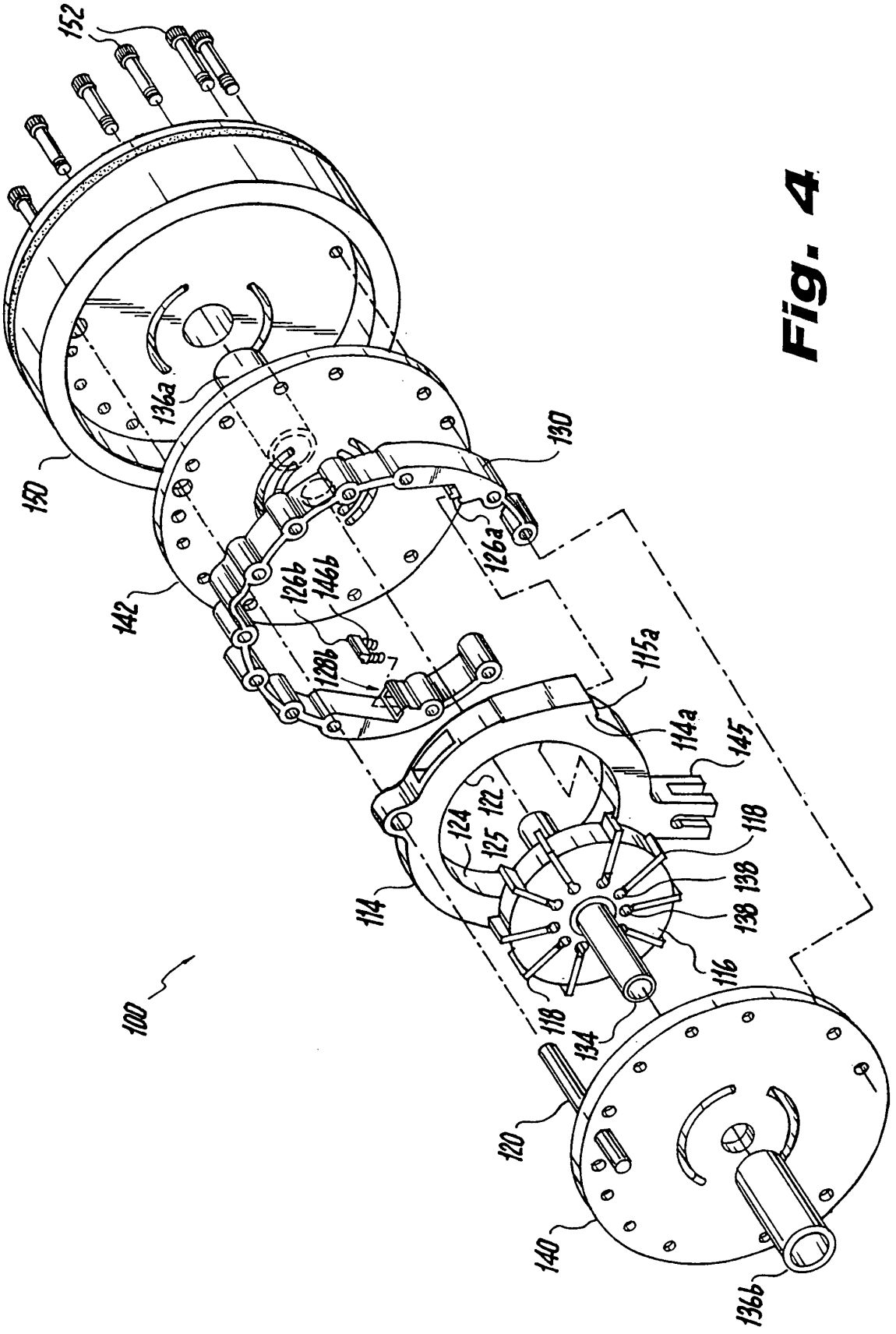

152
136a
190
130
126a
142
126b
146b
128b
115a
114a
145
122
124
125
118
138
114
116
100
134
120
140
136b

Fig. 4

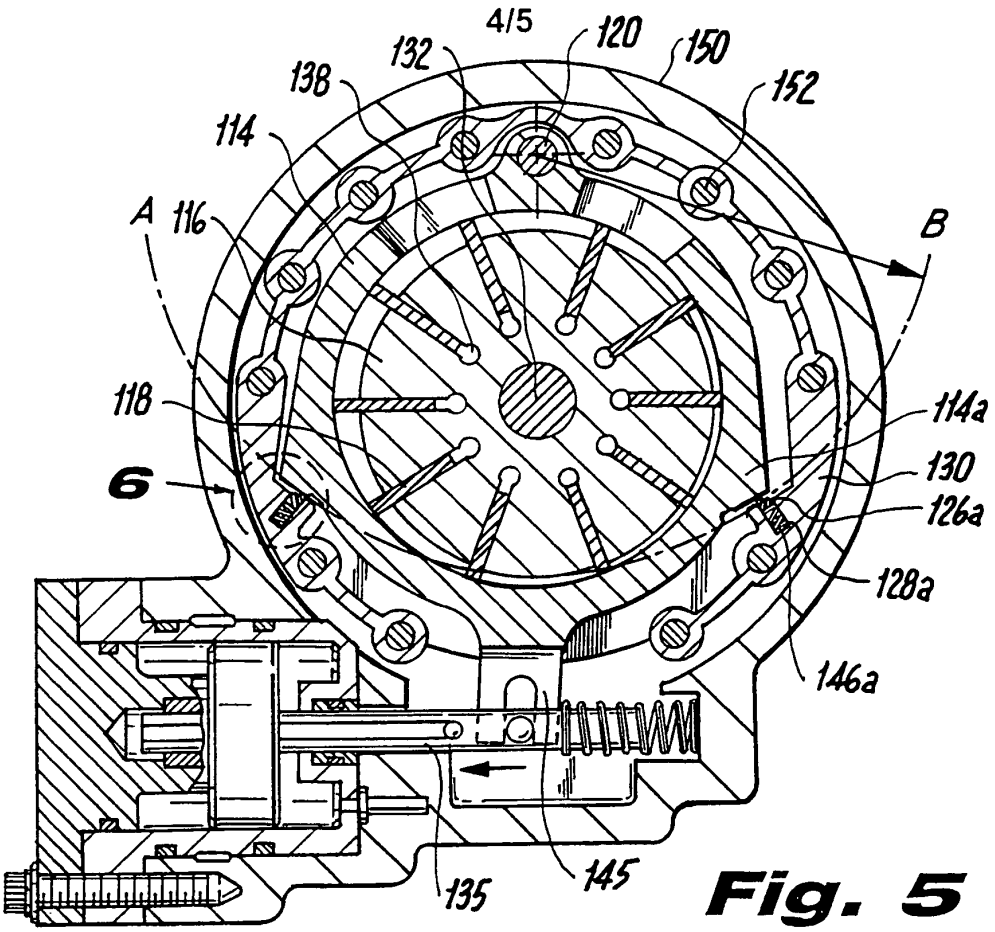
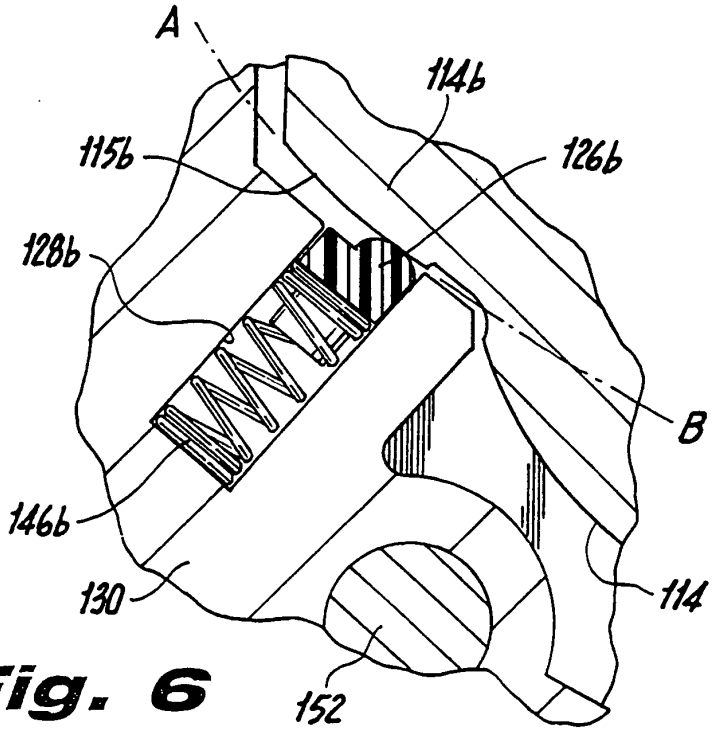

132
120
150
138
152
114
A
116
B
118
114a
6
130
126a
128a
146a
135
145

Fig. 5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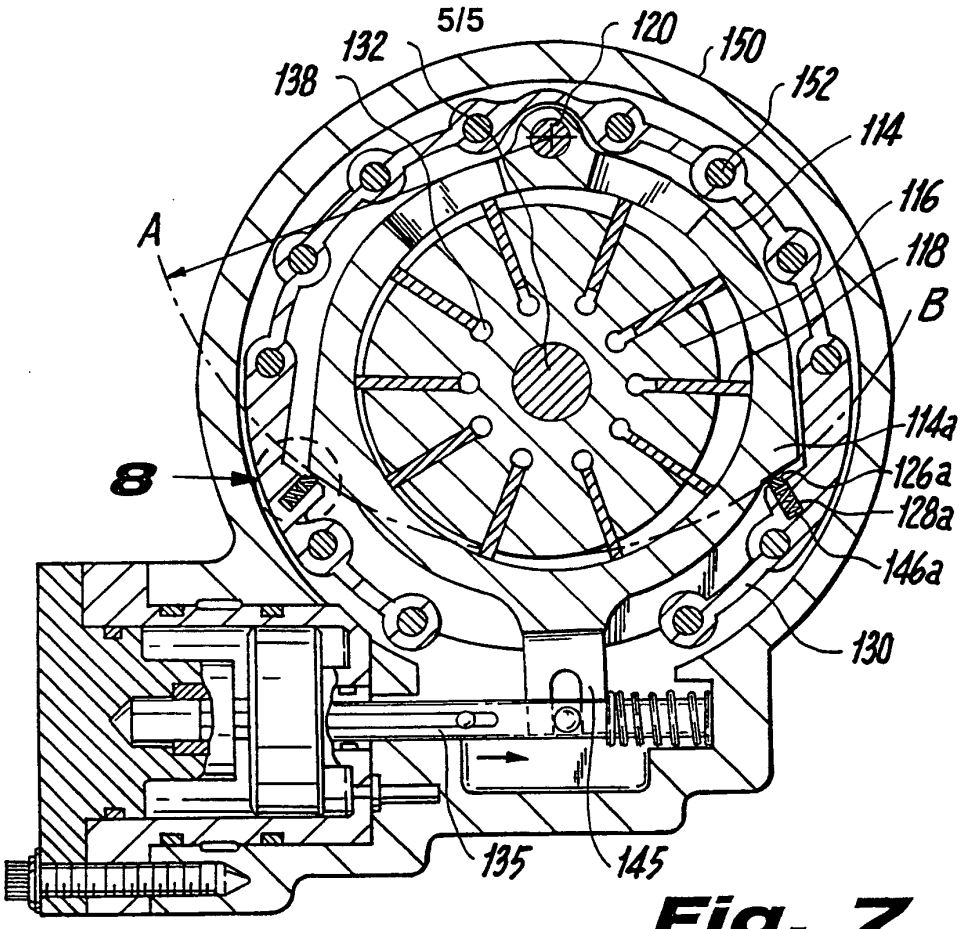
114b
115b
126b
128b
B
146b
130
114
152

Fig. 6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120
150
138
152
114
116
A
118
B
114a
8
126a
128a
146a
130
135
145

Fig. 7

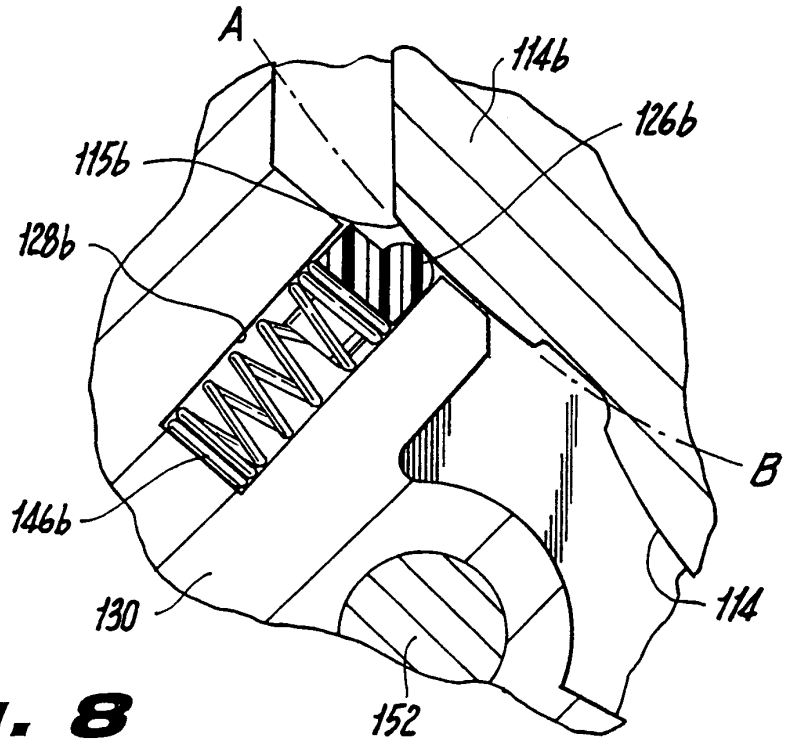
A
114b
126b
115b
128b
B
146b
114
130
152

Fig. 8

REFERENCES CITED IN THE DESCRIPTION

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