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(54) **Interfitting mechanism of spiral elements for scroll type fluid displacement apparatus.**

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Description

This invention relates to fluid displacement apparatus, and more particularly, to a mechanism for adjusting the angular relationship between scroll elements of a scroll type fluid displacement apparatus.

Scroll type fluid displacement apparatus are well known in the prior art. For example, U.S. Patent No. 801,182 (Creux) disclose a device including two scroll members each having a circular end plate and a spiroidal or involute spiral element. These scroll members are maintained angularly and radially offset so that both spiral elements interfit to make a plurality of line contacts between their spiral curved surfaces, thereby to seal off and define at least one pair of fluid pockets. The relative orbital motion of the two scroll members shifts the line contacts along the spiral curved surfaces and, therefore, the fluid pockets change in volume. Since the volume of the fluid pockets increases or decreases dependent on the direction of the orbiting motion, the scroll type fluid displacement apparatus can be used to compress, expand or pump fluids.

In comparison with conventional compressors of the piston type, a scroll type compressor has certain advantages, such as fewer parts and continuous compression of fluid. However, scroll type compressors have the problem that adjusting the angular relationship between the spiral elements is a difficult operation. If the angular relationship between the spiral element is in error, radial sealing between the two spiral elements is lost and fluid leakage occurs. As a result of this fluid leakage, the efficiency of the compressor is significantly reduced. One solution to the problem of achieving the proper angular relationship between the scroll element is to reduce the permissible manufacturing tolerances of the component parts. The manufacturing of scroll compressor components, however, is already complicated and reducing tolerance would greatly increase manufacturing costs. Another proposed solution is to increase the tolerance of the angular relationship between the spiral elements. Such a solution has not proved satisfactory.

EP—A—61698 (Sanden) discloses an orbiting piston type fluid displacement apparatus having fixed and orbiting fluid displacement members, a driving mechanism connected to the orbiting member to drive the member in an orbital motion, and a rotation preventing/thrust bearing means for preventing rotation of the orbiting member. The rotation preventing/thrust bearing means includes an orbital portion which is secured to the orbiting member, a fixed portion which is secured to a housing of the apparatus and a series of ball elements which are located between the orbital and fixed portions. The fixed and orbital portions each include a ring formed with a plurality of holes or pockets and each ball element is engaged in one of the holes or pockets in the ring of the fixed portion and one of the holes or pockets in the ring of the orbital portion.

During the assembly of a compressor which has a rotation preventing/thrust bearing means including a series of ball elements, a relative angular offset occurs between the scroll members, due to the following problems;

(1) a relative angular offset between the fixed scroll element and the housing;

(2) a relative angular offset between the main part of the housing and a front end plate;

(3) a relative angular offset between the front end plate and a fixed ring of the rotation preventing/thrust bearing means;

(4) a relative angular offset caused by the difference between the inner diameter of each hole formed in the fixed ring of the rotation preventing/thrust bearing means and the outer diameter of each ball;

(5) a relative angular offset caused by the difference between the outer diameter of each ball and the inner diameter of each hole formed in an orbital ring of the rotation preventing/thrust bearing means; and

(6) a relative angular offset between the movable ring of the rotation preventing/thrust bearing means and the orbiting scroll member.

In order to solve these problems, one technique to adjust the angular relationship is to provide a hole on the end wall surface of the spiral element of one scroll member, and to form a hole through the front end plate of the housing opposite to the hole in the scroll member. The adjusting of the angular relationship between both scroll elements is effected by an angle adjusting member inserted into the holes from outside of the front end plate.

However, the above technique can solve only the above-mentioned problems of the relative angular offsets (1)—(3), the remaining problems of the relative angular offsets (4)—(6) cannot be solved.

EP—A—99740 (Sanden), which is part of the state of the art according to Article 54(3) and (4) EPC, discloses a scroll type fluid displacement apparatus wherein a bore of predetermined depth is formed in a fixed scroll member and a front end plate of a housing is formed with a hole which extends through the plate. When assembling the apparatus, an adjustment member is inserted into the bore via the hole, thereby to set the angular relationship between the scroll members.

It is a primary object of this invention to provide an efficient scroll type fluid displacement apparatus.

It is another object of this invention to provide a scroll type fluid displacement apparatus wherein the angular relationship between both scroll members is easily and exactly established.

It is still another object of this invention to realize the above objects with a simple construction and assembly technique.

According to the present invention there is provided a scroll type fluid displacement apparatus including a first scroll member having a first end plate from which a first spiral element extends, a second scroll member having a second end plate from which a second spiral element extends, said

first and second scroll members interfitting at an angular and radial offset to make a plurality of line contacts to define at least one pair of sealed off fluid pockets, a driving mechanism operatively connected to said second scroll member to effect orbital motion of said second scroll member while rotation of said second scroll member is prevented by a rotation preventing/thrust bearing mechanism, whereby the fluid pockets change volume, characterised by said first scroll member being formed with a bore having a predetermined depth, said second end plate of said second scroll member being formed with a penetrating hole, and a hole extending completely through a front end plate of a housing and being brought into substantial alignment with said bore and said penetrating hole by an adjusting member inserted into said bore and said penetrating hole through said hole in said front end plate during assembly of the apparatus, thereby to set the angular relationship between the scroll members.

According to the invention there is also provided a method for assembling a scroll type fluid displacement apparatus as set forth in the preceding paragraph comprising the steps of

(a) fixing a fixed scroll member having a circular end plate, from which a first wrap extends, within a casing having at least one opening portion;

(b) assembling a driving mechanism, rotation preventing/thrust bearing mechanism and an orbiting scroll member which is operatively connected to the driving mechanism on a front end plate;

(c) placing the front end plate in the opening portion of the casing;

(d) inserting an adjusting member having an engaged portion through a hole in the front end plate and through a penetrating hole in the circular end plate of said orbiting scroll member into a bore in said fixed scroll member thereby to substantially align the holes with the bore and to establish a predetermined angular relationship between the fixed and orbiting scroll members, wherein each of a plurality of ball elements is held adjacent the edge of one of a plurality of holes formed in a fixed ring and one of a plurality of holes in an orbital ring of said rotation preventing/thrust bearing mechanism;

(e) rotating the front end plate in a direction opposite to the driving direction of the apparatus until the front end plate is prevented from movement;

(f) rotating the drive shaft in the driving direction of the apparatus at a predetermined torque;

(g) securely fixing the front end plate to the casing;

(h) removing the adjusting member from the hole in said front end plate, from said penetrating hole in said end plate of said orbiting scroll member and from the bore in said fixed scroll member; and

(i) closing an open portion of the hole in said front end plate.

The invention will now be described, by way of

example, with reference to the accompanying drawings, in which:—

Figure 1 is a vertical sectional view of a scroll type compressor according to one embodiment of this invention;

Figure 2 is an exploded perspective view of a driving mechanism for an orbiting scroll used in the compressor of Figure 1;

Figure 3 is an exploded perspective view of a rotation preventing/thrust bearing mechanism for an orbiting scroll used in the compressor of Figure 1;

Figure 4 is a diagrammatic view of fixed scroll illustrating the position of indentation.

Referring to Figure 1, an embodiment of a scroll type fluid displacement apparatus in accordance with the present invention, in particular as scroll type refrigerant compressor is shown. The compressor includes a compressor housing 10 having a front end plate 11 and a cup shaped casing 12 fastened on the rear end surface of front end plate 11. An opening 111 is formed in the center of front end plate 11 for penetration or passage of a drive shaft 13. An opening portion of cup shaped casing 12 is covered by front end plate 11, and mating surface between front end plate 11 and cup shaped casing 12 is sealed by an O-ring 14. Front end plate 11 has an annular sleeve 15 projecting from the front end surface thereof which surrounds drive shaft 13 and defines a shaft seal a cavity.

Drive shaft 13 is rotatably supported by sleeve 15 through a bearing 16 located within the front end of sleeve 15. Drive shaft 13 has a disk shaped rotor 131 at its inner end which is rotatably supported by front end plate 11 through a bearing 17 located within opening 111 of front end plate 11.

A number of elements is disposed within the interior of cup shaped casing 12 including a fixed scroll 20, an orbiting scroll 21, a driving mechanism for orbiting scroll and a rotation preventing/thrust bearing mechanism 22 for orbiting scroll 21. The interior of cup shaped casing 12 is defined between the inner wall of cup shaped casing 12 and the rear end surface of front end plate 11.

Fixed scroll 20 includes a circular end plate 201, a wrap or spiral element 202 affixed to or extending from one side surface of circular end plate 201 and a plurality of internally threaded bosses 203 axially projecting from the other side surface of circular end plate 201. An axial end surface of each bosses 203 is seated on the inner surface of end plate 121 of cup shaped casing 12 and is fixed to end plate 121 by bolts 23. Fixed scroll 20 is thus fixed within cup shaped casing 12. Circular end plate 201 of fixed scroll 20 partitions the inner chamber of cup shaped casing 12 into two chamber, such as discharge chamber 24 having bosses 203, and a suction chamber 25 in which spiral element 202 is located. A seal ring 26 is placed between the outer peripheral surface of circular end plate 201 and the inner surface of cup shaped casing 12 to secure the sealing therebetween. A hole or discharge port 204 is formed

through circular end plate 201 of fixed scroll 20 at a position near the center of spiral element 202; hole 204 is connected between the fluid pocket of the spiral elements center and discharge chamber 24.

Orbiting scroll 21, which is disposed in suction chamber 25, comprises a circular end plate 211 and a wrap or spiral element 212 affixed to or extending from one side surface of end plate 211. The spiral element 212 of orbiting scroll 21 and spiral element 202 interfit at an angular offset of 180° and predetermined radial offset to make a plurality of line contacts. Therefore, at least one pair of sealed off fluid pockets are defined between their spiral elements 202 and 212. Orbiting scroll 21 is connected to the driving means and rotation preventing/thrust bearing means 22. These last two means effect the orbital motion of orbiting scroll 21 by rotation of drive shaft 13.

Referring to Figures 1 and 2, the driving mechanism of orbiting scroll 21 will be described. Drive shaft 13 is formed with a disk shaped 131 at its inner end and is rotatably supported by sleeve 15 through a bearing 16 which is disposed within sleeve portion 15. Disk shaped portion 11 through bearing 17.

A crank pin or drive pin 132 projects axially from an end surface of disk portion 131 and is radially offset from the center of drive shaft 13. Circular plate 211 of orbiting scroll 21 is provided with a tubular boss 213 axially projecting from an end surface opposite to the side thereof from which spiral element 212 extends. A discoid or short axial bushing 27 is fitted into boss 213, and is rotatably supported therein by a bearing, such as a needle bearing 28. Bushing 27 has a balance weight 271 which is shaped as a portion of a disk or ring and extends radially outward from bushing 27 along a front surface thereof. An eccentric hole 272 is formed in bushing 27 radially offset from the center of bushing 27. Drive pin 132 is fitted into the eccentrically disposed hole 272 within which a bearing 29 may be applied. Bushing 27 is therefore driven by the revolution of drive pin 132 and is permitted to rotate by needle bearing 28.

Referring to Figure 3, the rotation preventing/thrust bearing device 22 will be described. Rotation preventing/thrust bearing device 22 is disposed between the rear end surface of front end plate 11 and the end surface of circular end plate 211 of orbiting scroll 21 on the side opposite spiral element 212. Rotation preventing/thrust bearing device 22 includes a fixed portion, an orbital portion and a bearing element, such as a plurality of spherical balls.

The fixed portion includes an annular fixed race 221 having one end surface fitted against the axial end surface of an annular projection of front end plate 11, and a fixed ring 222 fitted against the other axial end surface of fixed race 221. Fixed race 221 and fixed ring 222 are attached to the axial end surface of annular projection by pins 223.

The orbital portion also includes an annular

orbital race 224, which has one end surface fitted against an axial end surface of circular end plate 221, and an orbital ring 225 fitted against the other axial end surface of orbital race 224 to extend outwardly therefrom and cover the other axial end surface of orbital race 224. A small clearance is maintained between the end surface of fixed ring 222 and the end surface of orbital ring 225. Orbital race 224 and orbital ring 225 are attached to the end surface of circular end plate 211 by pins 226. Alternatively, rings 222, 225 may be formed integral with races 221, 224, respectively.

Fixed ring 222 and orbital ring 225 each have a plurality of holes or pockets 222a and 225a in the axial direction, the number of holes or pockets in each of rings 222 and 225 being equal. The holes or pockets 222a on fixed ring 222 correspond to or are a mirror image of the holes or pockets 225a on orbital ring 225; i.e., each pair of pockets facing each other have the same size and pitch, and the radial distance of the pockets from the center of their respective rings 222 and 225 is the same; i.e., the centers of the pockets are located the same distance from the center of rings 222 and 225. Thus, if the centers of rings 222 and 225 were aligned, which they are not in actual operation of the rotation preventing/thrust bearing device 22, the holes or pockets 222a and 225a would be identical or in alignment. Bearing elements, such as balls 227, are placed between facing generally aligned pairs of pockets 222a and 225a of fixed and orbital rings 222, 225 with the rings 222, 225 facing one another at a predetermined clearance.

In this construction of scroll type compressor, fixed scroll 20 is at least provided with a projection 205 projecting from the outer surface of spiral element 202, and preferably integral with it. A round bore 206, which has a predetermined depth, is formed in projection 205 of fixed scroll 20. As shown in Figure 4, round bore 206 is placed on a line drawn through a center of generating circle of the spiral element which has a predetermined angle relative to a line connected through a plurality of line contacts A, B between the spiral element 202 and 212. Circular end plate 211 of orbiting scroll 21 is formed with a penetrating hole 214. Front end plate 11 is also formed with a round hole 113. Hole 113 is designed to be aligned with bore 206 and penetrating hole 214, in a manner described hereinafter. A part of fixed ring 221 of rotation preventing/thrust bearing mechanism 22 which extends over the end of annular projection to cover hole 113 may be formed with a cut portion 221C. Hole 113 has a diameter larger than the diameter of bore 206 and penetrating hole 214.

Assembly of the compressor in accordance with the present invention is accomplished in the following manner. Fixed scroll 20 is secured within the interior of cup-shaped casing 12 by bolts 23. Orbiting scroll 21, with orbital ring 225 and orbital race 224 attached to end plate 211 and needle bearing 28 carrying bushing 27 engaging tubular boss 213, is then inserted within cup-

shaped casing 12 as shown in Figure 1. Balls 227 may then be placed in holes 225a of orbital ring 225. The driving mechanism for orbiting scroll 21 and annular fixed race 221 and fixed ring 22 of rotation preventing/thrust bearing device 22 are assembled on front end plate 11 along with angular sleeve 16 and drive shaft 13. As shown in Figure 2, drive shaft 13 also includes disk-shaped rotor 131 with crank pin 132. Crank pin 132 engages bearing 29 which in turn engages hole 272 formed in bushing 27. Front end plate 11 is then placed over and in engagement with the open portion of cup-shaped casing 12. Prior to end plate 11 being secured in place adjustment member 40 is then inserted through hole 113 and hole 214 into bore 206 to bring holes 113 and 214 into alignment with bore 206.

After the adjustment member 40 has been inserted, the front end plate 11 is rotated slightly in the reverse direction (i.e. opposite to the drive direction) of the apparatus to secure the engagement of the balls 227 between facing holes 222a and 225a. There is some play between the adjustment member 40, the holes 113 and 214 and the bore 206. Thus, the end plate 11 may be rotated slightly back and forth. Since, during operation of the apparatus, the balls 227 of the rotation preventing/thrust bearing device 22 usually interact between the edges of the holes 222a and 225a, without a gap, to prevent rotation of the orbiting scroll, the proper angular relationship between the fixed scroll 20 and the orbiting scroll 21 can then be established. Drive shaft 13 is then rotated in the drive direction of the apparatus so as to push the spiral element 212 of the orbiting scroll 21 against the spiral element 202 of the fixed scroll 20. During this operation, the orbiting scroll 21 is able to move around the adjustment member 40. Therefore, after the spiral element 212 has been fitted against the spiral element 202 of the fixed scroll 20, the orbiting scroll 21 is further rotated around the adjustment member 40 by rotation of the drive shaft. Because the orbiting ring 225 is fixed on the end plate 211 of the orbiting scroll 21, the orbiting ring 225 is rotated about the adjustment member 40 due to the rotating motion of the orbiting scroll 21. Since the balls 227 of the rotation preventing/thrust bearing mechanism 22 are securely held between the edges of both holes 222a and 225a, the fixed ring 22, together with the front end plate 11, is rotated in the drive direction following the rotation of the orbiting scroll 21. Thus, the proper relationship between both scrolls 20, 21 and the rotation preventing mechanism 22 and the orbiting scroll 21 can be established for ideal operation of the scroll. After the proper relationship is established, the end plate 11 can be secured to the cup-shaped casing 12.

The angular relationship between both scrolls, can therefore be adjusted and set by above-mentioned operation. After the predetermined desired offset between the scrolls has been obtained, the adjustment member 40 is removed from the compressor unit. The offset between the scrolls is fixed by tightening the fastening means.

A plug 41 is screwed into a screw portion 113a of the hole 113, and the seal ring 42 is disposed within an annular depression 113b formed at end portion of hole 113 to form a seal between the plug 41 and the hole 113 to seal off the inner chamber of cup-shaped casing 12.

This invention has been described in detail in connection with a preferred embodiment, but this embodiment is merely for example only.

Claims

1. A scroll type fluid displacement apparatus including a first scroll member (20) having a first end plate (201) from which a first spiral element (202) extends, a second scroll member (21) having a second end plate (211) from which a second spiral element (212) extends, said first and second scroll members (20, 21) interfitting at an angular and radial offset to make a plurality of line contacts to define at least one pair of sealed off fluid pockets, a driving mechanism operatively connected to said second scroll member (21) to effect orbital motion of said second scroll member (21) while rotation of said second scroll member (21) is prevented by rotation preventing/thrust bearing mechanism (22), whereby the fluid pockets change volume, characterised by said first scroll member (20) being formed with a bore (206) having a predetermined depth, said second end plate (211) of said second scroll member (21) being formed with a penetrating hole (214), and a hole (113) extending completely through a front end plate (11) of a housing (10) and being brought into substantial alignment with said bore (206) and said penetrating hole (214) by an adjusting member (40) inserted into said bore (206) and said penetrating hole (214) through said hole (113) in said front end plate (11) during assembly of the apparatus, thereby to set the angular relationship between the scroll members (20, 21).

2. A scroll type fluid displacement apparatus as claimed in claim 1, wherein said bore (206) and penetrating hole (214) each has a diameter smaller than the diameter of said hole (113) in said front end plate (11).

3. A scroll type fluid displacement apparatus as claimed in claim 1, wherein said bore (206) is placed in a line drawn through the center of a generating circle of said spiral element (202) and making a predetermined angle with a line passing through a plurality of line contacts defined between said spiral elements (202, 212).

4. A method for assembling a scroll type fluid displacement apparatus according to any one of claims 1 to 3 comprising the steps of:

(a) fixing a fixed scroll member (20) having a circular end plate (201), from which a first wrap (202) extends, within a casing (12) having at least one opening portion;

(b) assembling a driving mechanism, rotation preventing/thrust bearing mechanism (22) and an orbiting scroll member (21) which is operatively connected to the driving mechanism on a front end plate (11);

(c) placing the front end plate (11) in the opening portion of the casing (12);

(d) inserting an adjusting member (40) having an engaged portion through a hole (113) in the front end plate (11) and through a penetrating hole (214) in the circular end plate (211) of said orbiting scroll member (21) into a bore (206) in said fixed scroll member (20) thereby to substantially align the holes (214, 113) with the bore (206) and to establish a predetermined angular relationship between the fixed and orbiting scroll members (20, 21), wherein each of a plurality of ball elements (227) is held adjacent the edge of one of a plurality of holes formed in a fixed ring and one of a plurality of holes in an orbital ring of said rotation preventing/thrust bearing mechanism (22);

(e) rotating the front end plate (11) in a direction opposite to the driving direction of the apparatus until the front end plate (11) is prevented from movement;

(f) rotating the drive shaft (13) in the driving direction of the apparatus at a predetermined torque;

(g) securely fixing the front end plate (11) to the casing (12);

(h) removing the adjusting member (40) from the hole (113) in said front end plate (11), from said penetrating hole (214) in said end plate (211) of said orbiting scroll member (21) and from the bore (206) in said fixed scroll member (20); and

(i) closing an open portion of the hole (113) in said front end plate (11).

Patentansprüche

1. Fluidverdrängungsmaschine vom Spiraltyp mit einem ersten Spiralelement (20) mit einer ersten Endplatte (201), von der sich ein erster Spiralteil (202) erstreckt, einem zweiten Spiralelement (21) mit einer zweiten Endplatte (211), von der sich ein zweiter Spiralteil (212) erstreckt, wobei das erste und zweite Spiralelement (20, 21) mit einer winkelmäßigen und radialen Versetzung zum Herstellen einer Mehrzahl von Linienkontakten zum Abgrenzen von mindestens einem Paar von abgeschlossenen Fluidtaschen ineinandergreifen, einem betriebsmäßig mit dem zweiten Spiralelement (21) verbundenen Antriebsmechanismus zum Bewirken der umlaufenden Bewegung des zweiten Spiralelementes (21), während die Rotation des zweiten Spiralelementes (21) durch einen Rotationsverhinderungs-/Druckaufnahmemechanismus (22) verhindert wird, wodurch die Fluidtaschen Volumina ändern, dadurch gekennzeichnet, daß das erste Spiralelement (20) mit einer Bohrung (206) von einer vorbestimmten Tiefe gebildet ist, daß die zweite Endplatte (211) des zweiten Spiralelementes (21) mit einem durchgehenden Loch (214) gebildet ist, und daß sich ein Loch (113) vollständig durch eine vordere Endplatte (11) eines Gehäuses (10) erstreckt und in eine wesentliche Ausrichtung mit der Bohrung (206) und dem durchgehenden Loch (214) gebracht wird durch

ein Justierteil (40), das in die Bohrung (206) und das durchgehende Loch (214) durch das Loch (113) in der vorderen Endplatte (11) während des Zusammenbaues der Maschine eingesteckt ist, wodurch die winkelmäßige Beziehung der Spiralelemente (20, 21) eingestellt wird.

2. Fluidverdrängungsmaschine vom Spiraltyp nach Anspruch 1, bei der die Bohrung (206) und das durchgehende Loch (214) je einen Durchmesser aufweisen, der kleiner als der Durchmesser des Loches (113) in der vorderen Endplatte (11) ist.

3. Fluidverdrängungsmaschine vom Spiraltyp nach Anspruch 1, in der die Bohrung (206) auf einer Linie plaziert ist, die durch das Zentrum eines erzeugenden Kreises des Spiralteiles (202) gezogen ist und einen vorbestimmten Winkel mit einer Linie einschließt, die durch eine Mehrzahl von Linienkontakten geht, die zwischen den Spiralteilen (202, 212) definiert sind.

4. Verfahren zum Zusammenbau einer Fluidverdrängungsmaschine vom Spiraltyp gemäß einem der Ansprüche 1 bis 3 mit den Schritten:

(a) Befestigen eines festen Spiralelementes (20) mit einer kreisförmigen Endplatte (201), von der sich ein erstes Spiralteil (202) erstreckt, innerhalb einer Ummantelung (12) mit mindestens einem Öffnungsabschnitt;

(b) Zusammenbau eines Antriebsmechanismus, Rotationsverhinderungs-/Druckaufnahmemechanismus (22) und eines umlaufenden Spiralelementes (21), das betriebsmäßig mit dem Antriebsmechanismus auf einer vorderen Endplatte (11) verbunden ist;

(c) Anbringen der vorderen Endplatte (11) in dem Öffnungsabschnitt der Ummantelung (12);

(d) Einführen eines Justierteiles (40) mit einem angreifenden Abschnitt durch ein Loch (113) in der vorderen Endplatte (11) und durch ein durchgehendes Loch (214) in der kreisförmigen Endplatte (211) des umlaufenden Spiralelementes (21) in eine Bohrung (206) in dem festen Spiralelement (20), wodurch die Löcher (214, 113) im wesentlichen mit der Bohrung (206) ausgerichtet werden und eine vorbestimmte winkelmäßige Beziehung zwischen dem festen und dem umlaufenden Spiralelement (20, 21) aufgestellt wird, worin je eine Mehrzahl von Kugelementen (227) benachbart zu dem Rand eines einer Mehrzahl von Löchern, die in einem festen Ring gebildet sind, und eines einer Mehrzahl von Löchern in einem umlaufenden Ring des Rotationsverhinderungs- / Druckaufnahmemechanismus (22) gehalten wird;

(e) Drehen der vorderen Endplatte (11) in eine Richtung entgegengesetzt zu der Antriebsrichtung der Maschine, bis die vordere Endplatte (11) an der Bewegung gehindert wird;

(f) Drehen der Antriebswelle (13) in die Antriebsrichtung der Maschine mit einem vorbestimmten Drehmoment;

(g) sicheres Befestigen der vorderen Endplatte (11) an der Ummantelung (12);

(h) Entfernen des Justierteiles (40) von dem Loch (113) in der vorderen Endplatte (11), von

dem durchgehenden Loch (214) in der Endplatte (211) des umlaufenden Spiralelementes (21) und von der Bohrung (206) in dem festen Spiralelement (20); und

(i) Schließen eines offenen Abschnittes des Loches (113) in der vorderen Endplatte (11).

Revendications

1. Appareil à déplacement de fluide de type à volutes comprenant un premier élément de volute (20) muni d'une première plaque d'extrémité (201) sur laquelle fait saillie un premier élément de spirale (202), un second élément de volute (21) muni d'une seconde plaque d'extrémité (211) sur laquelle fait saillie un second élément de spirale (212), les premier et second éléments de volutes (20, 21) s'emboîtant avec un décalage angulaire et radial pour former un certain nombre de lignes de contact permettant de définir au moins une pair de poches à fluide étanches, un mécanisme d'entraînement relié en fonctionnement au second élément de volute (21) pour produire le mouvement orbital du second élément de volute (21) tandis que la rotation de ce second élément de volute (21) est empêchée par un mécanisme antirotation/palier de butée (22), ce qui permet ainsi aux poches à fluide de changer de volume, appareil caractérisé en ce que le premier élément de volute (20) est muni d'un trou borgne (206) de profondeur prédéterminée, en ce que la seconde plaque d'extrémité 211 du second élément de volute (21) est percée d'un trou de pénétration (214), et en ce qu'un trou (113) traverse complètement la plaque d'extrémité avant (11) d'un carter (10) de manière à venir en alignement exact avec le trou borgne (206) et le trou de pénétration (214) grâce à un élément de réglage (40) s'introduisant dans le trou borgne (206) et le trou de pénétration (214) en passant par le trou (113) de la plaque d'extrémité avant (11) pendant le montage de l'appareil, ce qui permet ainsi de régler la relation angulaire entre les éléments de volutes (20, 21).

2. Appareil à déplacement de fluide de type à volutes selon la revendication 1, caractérisé en ce que le trou borgne (206) et le trou de pénétration (214) présentent chacun un diamètre plus petit que le diamètre du trou (113) traversant la plaque d'extrémité avant (11).

3. Appareil à déplacement de fluide de type à volutes selon la revendication 1, caractérisé en ce que le trou borgne (206) est placé sur une droite passant par le centre du cercle générateur de

l'élément de spirale (202) et formant un angle prédéterminé avec une droite passant par les différentes lignes de contact définies entre les éléments de spirales (202, 212).

4. Procédé pour monter un appareil à déplacement de fluide de type à volutes selon l'une quelconque des revendications 1 à 3, procédé caractérisé en ce qu'il comprend les différentes étapes consistant à:

(a) fixer un élément de volute fixe (20) muni d'une plaque d'extrémité circulaire (201) sur laquelle fait saillie un premier enroulement (202), dans un boîtier (12) comportant au moins une partie d'ouverture;

(b) monter un mécanisme d'entraînement, un mécanisme anti-rotation/palier de butée (22) et un élément de volute orbitale (21) relié en fonctionnement au mécanisme d'entraînement, sur une plaque d'extrémité avant (11);

(c) placer la plaque d'extrémité avant (11) dans la partie d'ouverture du boîtier (12);

(d) introduire un élément de réglage (40) dont une partie s'engage dans un trou (113) de la plaque d'extrémité avant (11) et dans un trou de pénétration (214) de la plaque d'extrémité circulaire (211) de l'élément de volute orbitale (21), dans un trou borgne (206) de l'élément de volute fixe (20) pour aligner ainsi exactement les trous (314, 113) avec le trou borgne (206) et établir une relation angulaire prédéterminée entre les éléments de volutes fixe et orbitale (20, 21), de façon que chacun d'un certain nombre d'éléments de billes (227) soit maintenu contre le bord de l'un d'un certain nombre de trous formés dans un anneau fixe et dans l'un d'un certain nombre de trous formés dans un anneau orbital du mécanisme anti-rotation/palier de butée (22);

(e) faire tourner la plaque d'extrémité avant (11) en sens inverse du sens d'entraînement de l'appareil jusqu'à ce que la plaque d'extrémité avant (11) ne puisse plus tourner;

(f) faire tourner l'arbre d'entraînement (13) dans le sens d'entraînement de l'appareil avec un couple prédéterminé;

(g) fixer solidement la plaque d'extrémité avant (11) au boîtier (12);

(h) retirer l'élément de réglage (40) du trou (113) de la plaque d'extrémité avant (11), du trou de pénétration (214) de la plaque d'extrémité (211) de l'élément de volute orbitale (21), et du trou borgne (206) de l'élément de volute fixe (20); et

(i) fermer la partie ouverte du trou (113) de la plaque d'extrémité avant (11).

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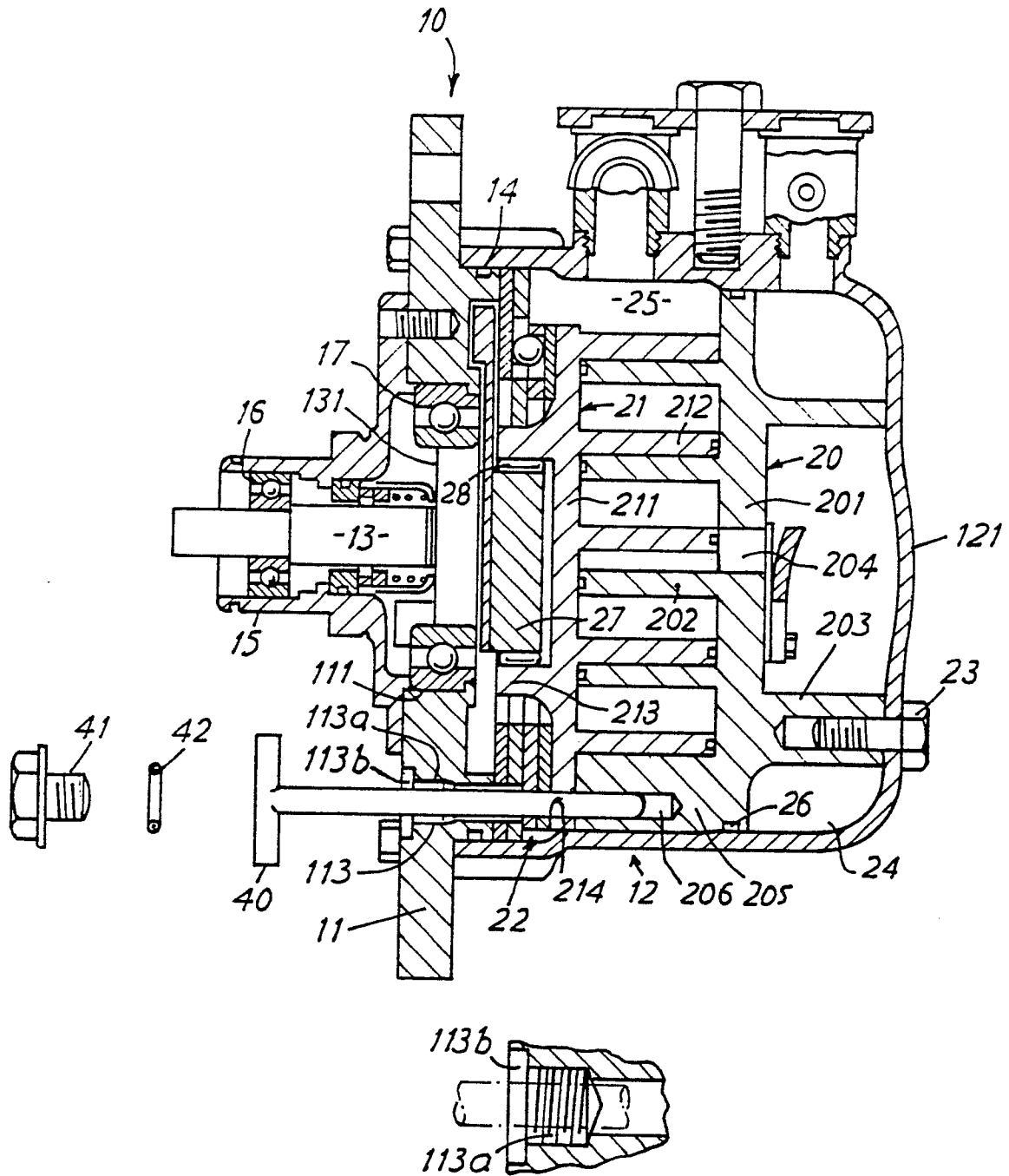


FIG. 1

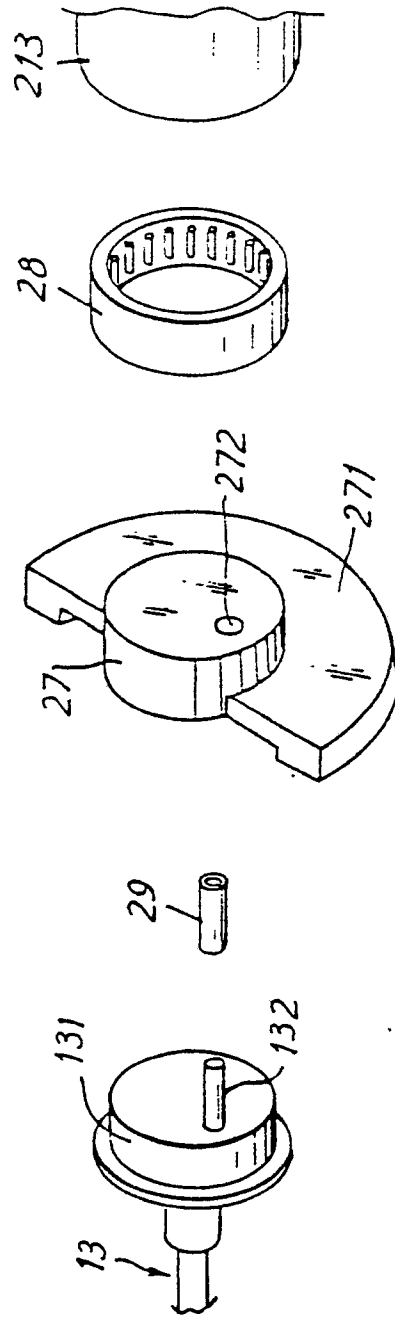
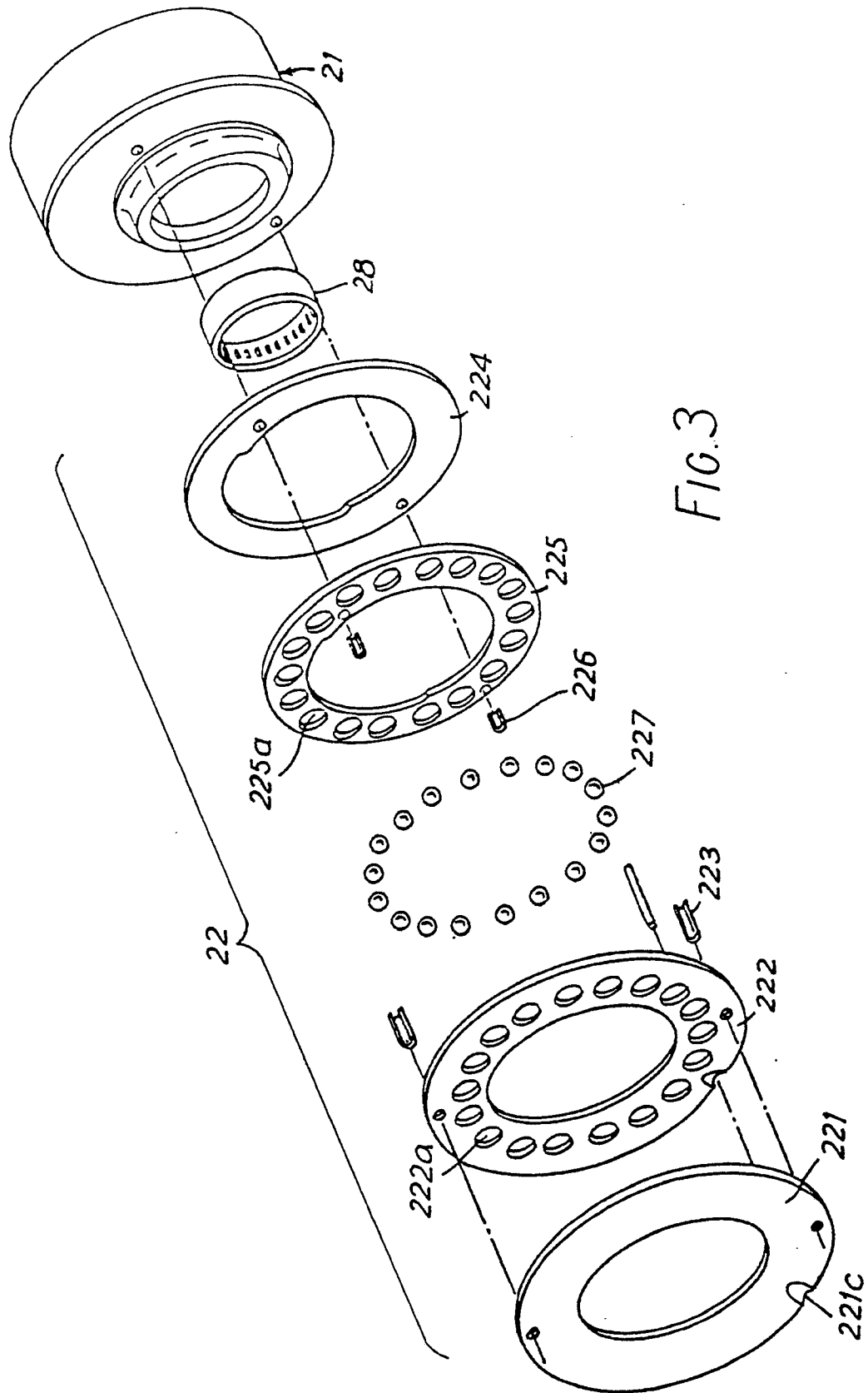


FIG. 2



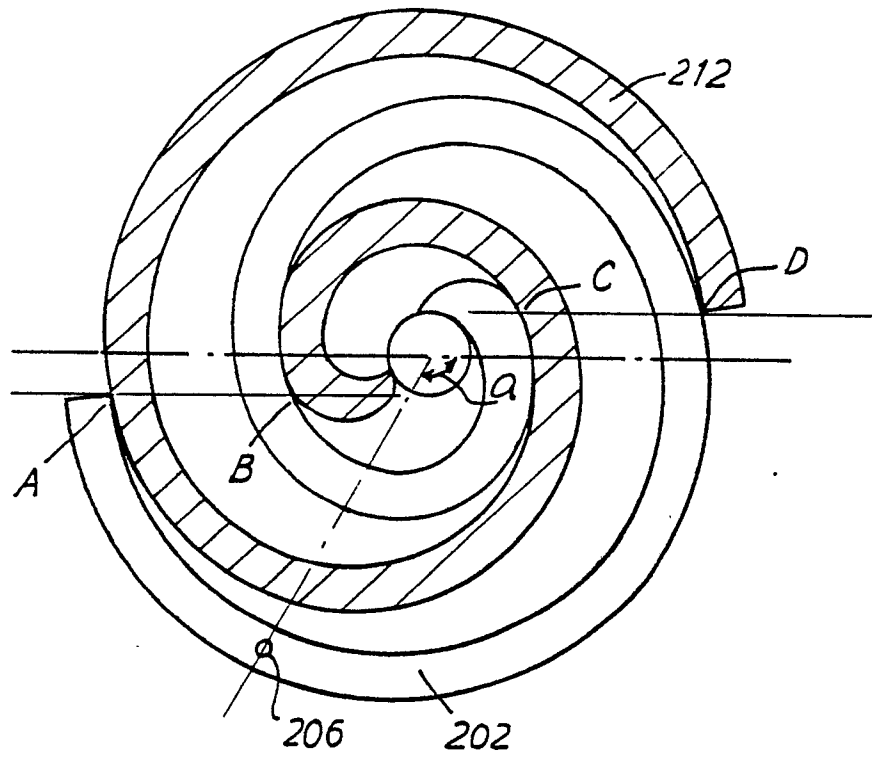


FIG.4