

Description

This invention relates to orbiting piston type fluid displacement apparatus.

There are several types of fluid displacement apparatus which utilize an orbiting piston or fluid displacing member driven by a scotch-yoke-type shaft at its end surface.

One of the well-known types of machine is disclosed in U.S.—A—1.906.142 to John Ekelöf, which is a rotary machine including an annular and eccentrically movable piston adapted to act within an annular cylinder and driven by a crank shaft. The annular cylinder has a radial transverse wall, one end of the wall of the cylinder being fixedly mounted and the other end consisting of a cover disk connected with the annular piston.

Another type of fluid displacement apparatus is a scroll-type apparatus which is well-known from prior art such as U.S.—A—801.182, and 3.560.119.

Though the present invention applies to either type of fluid displacement apparatus, the description of the invention will be hereinafter made in connection with a scroll-type compressor for simplification of the description.

Scroll-type apparatus have been well-known in the prior art. For example, U.S.—A—801.182 discloses a device including two scroll members each having an 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 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 contact along the spiral curved surfaces and, therefore, the fluid pockets change in volume. The volume of the fluid pockets increases or decreases dependent on the direction of the orbital motion. Therefore, the scroll-type apparatus is applicable to compress, expand or pump fluids.

Typically, a drive shaft receives and transmits a rotary driving force from external power source. The drive shaft is rotatably supported by a bearing means disposed within a housing. In particular, as shown in U.S.—A—3.874.827, the drive shaft is rotatably supported by two bearing means disposed within the housing.

As hereinafter described with reference to Figure 9 of the drawings, one known shaft supporting construction has a shaft formed with a disk portion at its inner end and rotatably supported by a first bearing means disposed within a sleeve projecting from a front plate of the housing. The disk portion is also rotatably supported by a second bearing means disposed within the sleeve or housing. A crank pin or drive pin axially projects from an end surface of the disk portion and is radially offset from the center of the drive shaft. The drive pin is connected to an orbiting scroll member for transmitting orbital motion from the shaft to the scroll member. The scroll member is provided with a rotation preventing means, whereby the member is allowed

to undergo orbital motion when the drive shaft is rotated.

With this form of shaft supporting construction, a load F_d , caused by a reaction force to the compression of fluid during operation of the apparatus, acts on a further bearing means which rotatably supports the orbiting scroll member. This load F_d is transmitted to the driving shaft and, as hereinafter described, causes loads FB_2 and FB_1 to be applied to respective first and second bearing means.

As hereinafter described, the axial distance between the first bearing means and the center of the disk portion should be increased to reduce the forces FB_1 and FB_2 . However, a shaft seal assembly is assembled on the drive shaft within the sleeve or front end plate and is placed axially outwardly of and against the first bearing means. Therefore, if the above-mentioned distance is increased, the total length of the apparatus will be increased.

A scroll-type fluid apparatus is suited for use as a refrigerant compressor of an automobile air-conditioner. Generally, the compressor is coupled to a magnetic clutch for transmitting the output of the engine to the drive shaft of the compressor. The magnetic clutch comprises a pulley, magnetic coil, hub and armature plate. The pulley, which is usually rotated by the output of the engine, is rotatably supported by the sleeve through a bearing means disposed on the outer surface of the sleeve, and the magnetic coil is fixed on the outer surface of the sleeve.

The sleeve, which supports the pulley and magnetic coil, extends from an end surface of the housing and is cantilevered. Accordingly, the sleeve requires mechanical strength. Because the tensile force of the belt which connects the pulley and the engine for transmitting the rotary motion is transmitted to the sleeve through the pulley and the bearing means, there is a lower limit to the thickness of the sleeve, so that the diameter of the bearing means which supports the pulley cannot be decreased. The outer diameter of compressor unit itself is thereby increased.

U.S.—A—2.634.904 discloses a vane-type rotary compressor in which a rotor plate is mounted on a shaft for rotation about an axis laterally spaced from a longitudinal axis of a housing. A series of vanes extend radially outwards from the periphery of the rotor plate with each vane slidable in a radial direction relative to the plate and maintained in engagement with an inner wall of the housing as the rotor plate is rotated.

A drive shaft for the rotor is supported by two axially spaced bearings between which there is a shaft seal assembly. One of the bearings is disposed in a sleeve portion of a front end plate of the housing. A second bearing is disposed in an opening in a fixed cylinder member which is disposed axially inwardly of the front end plate and is connected thereto by a connecting sleeve.

In U.S.—A—2.634.904 the sleeve portion of the front end plate extends in a direction inwardly of



the housing from a flange at an outer end thereof. The arrangement of one of the bearings in this sleeve portion and the second bearing in the fixed cylinder member and the provision of the connecting sleeve between the front end plate and the fixed cylinder member adds to the overall length of the apparatus and results in a waste of space within the housing. Finally, the sleeve portion of the front end plate cannot be used to support a rotational force transmitting means, such as an electromagnetic clutch, for driving the drive shaft. Instead, a drive pulley is mounted at one end of the drive shaft, which projects axially outwardly from the front end plate and therefore adds to instability.

It is an object of this invention to provide an orbiting piston type fluid displacement apparatus with an improved stable support of the drive shaft and improved durability and/or reliability of the bearing means which support the drive shaft, with insuring readiness of repair of the shaft seal assembly. Further objects are to reduce radial and axial dimensions of the apparatus and to minimize whipping or precession of the drive shaft.

According to the present invention there is provided an orbiting piston type fluid displacement apparatus including a housing having a cylindrical casing and a front end plate member mounted on an open front end of said casing, said front end plate member having a sleeve portion extending therefrom in a direction outwardly of the housing, a fixed cylinder member fixedly disposed relative to said housing, an orbiting piston member disposed within said housing to compress or pump fluid upon orbital motion thereof in relation to said fixed cylinder member, a driving means for effecting the orbital motion of said orbiting piston member and including a drive shaft, said drive shaft penetrating said front end plate member through said sleeve portion and being rotatably supported, and a rotational force transmitting means mounted on said sleeve portion for selectively transmitting a rotational force from an external driving power source to said drive shaft, characterised in that said front end plate member has a front end plate portion and a separately formed, outwardly extending, sleeve portion, said front end plate portion is formed with an opening through which said drive shaft extends, said sleeve portion is removably fixed to a front end surface of said front end plate portion so as to extend forwardly from said front end plate portion and to surround said drive shaft so that the space inside said sleeve portion and the opening in said front end plate portion form a continuous hollow portion, said drive shaft extending through said hollow portion is rotatably supported by respective first and second bearing means which are disposed within said front end plate member, said first bearing means is disposed in said space inside said separate sleeve portion, said second bearing means is disposed axially inwardly of said first bearing means, and a shaft seal assembly is assembled

within said hollow portion between said first and second bearing means on said drive shaft.

According to a preferred embodiment of the invention, a scroll-type fluid displacement apparatus includes a housing having a cylindrical casing and a front end plate member mounted on an opening end of the casing. A fixed scroll member is fixedly disposed relative to the housing and has an end surface from which a first wrap means extends into the interior of the housing. An orbiting scroll member has an end plate means from which a second wrap means extends. The first and second wrap means interfit at an angularly offset to make a plurality of line contacts to define at least one pair of sealed off fluid pockets. A driving means including a drive shaft which penetrates the front end plate member and is rotatably supported thereby, effects the orbital motion of the orbiting scroll member by the rotation of the drive shaft while the rotation of the orbiting scroll member is prevented, whereby the fluid pockets change volume by the orbital motion of the orbital scroll member. The front end plate member comprises a front end plate portion and an annular sleeve portion formed separate from the front end plate portion. The front end plate portion is formed with an opening for penetration of the drive shaft, and the annular sleeve portion is removably fixed onto the front end surface of the front end plate portion to extend frontwardly for surrounding the drive shaft. The drive shaft is rotatably supported by two bearing means within the front end plate member. One of the bearing means is disposed within the annular sleeve portion and the other bearing means is disposed axially inward of the first one. A shaft seal assembly is also assembled on the drive shaft within the front end plate member but between the two bearing means. A rotational force transmitting means is mounted on the sleeve portion for transmitting the rotational force from an external driving power source to the drive shaft.

The invention will now be described, by way of example, with reference to the accompanying drawings, in which:—

Fig. 1 is a vertical sectional view of a compressor unit type of fluid displacement apparatus according to one embodiment of this invention;

Fig. 2 is a perspective view of the fixed scroll member in the embodiment of Fig. 1;

Fig. 3 is an exploded perspective view of the driving mechanism in the embodiment of Fig. 1;

Fig. 4 is a sectional view taken generally along line VI—VI in Fig. 1;

Fig. 5 is an explanatory diagram of the motion of the eccentric bushing in the embodiment of Fig. 1;

Fig. 6 is an exploded perspective view of a rotation preventing/thrust bearing mechanism in the embodiment of Fig. 1;

Fig. 7 is a diagrammatic sectional view illustrating the spiral elements of the fixed and orbiting scroll members;

Fig. 8 is a vertical sectional view of a main portion of drive shaft supporting mechanism in the embodiment of Fig. 1; and

Fig. 9 is a vertical sectional view of a main portion of drive shaft supporting mechanism of the prior art.

Referring first to Fig. 9, which shows a prior art shaft supporting construction, a drive shaft 13' is formed with a disk portion 15' at its inner end portion and is rotatably supported by a first bearing means 19' disposed within a sleeve 17' projecting from a front end plate 11'. Disk portion 15' is also rotatably supported by a second bearing means 16' disposed within sleeve 17' or housing 10'. A crank pin or drive pin 151' axially projects from an end surface of disk portion 15', and is radially offset from the center of drive shaft 13'. Drive pin 151' is connected to an orbiting scroll member for transmitting orbital motion from drive shaft 13' to the orbiting scroll member, and the orbiting scroll member is connected to a rotation preventing means, therefore orbiting scroll member is allowed to undergo the orbital motion by the rotation of drive shaft 13'.

In the above described shaft supporting construction, a load F_d , caused by a reaction force so the compression of fluid during the operation of the apparatus, acts on a bearing means 34' which rotatably supports the orbiting scroll member. Therefore, since drive shaft 13' is connected to the bushing 33' through the drive pin 151', this load F_d is transmitted to the shaft 13' which is rotatably supported by the two bearing means 16', 19' disposed within the sleeve 17' or front end plate 11'. At this time, the load FB_1 and FB_2 acting on the two bearing means 16' and 19' are given by:

$FB_1 = F_d + FB_2$, since the illustrated upwardly directed force is equal to the sum of the downwardly directed forces; and

$FB_2(X_2) = F_d(X_1)$, since these oppositely directed moments are equal.

Therefore, if the distance X_2 is made greater, the load FB_1 and FB_2 acting on the two bearing means would be decreased and thereby the durability and/or reliability of these bearing means would be improved. However, in the general construction of the apparatus, a shaft seal assembly 20' is assembled on the drive shaft 13' within the sleeve 17' or front end plate 11' and placed outwardly of and against the bearing means. Therefore, if the distance X_2 is made greater, the total length of apparatus will be increased.

Referring to Fig. 1, a fluid displacement apparatus in accordance with the present invention, in particular a refrigerant compressor unit 1 of an embodiment of the present invention is shown. The unit 1 includes a compressor housing 10 comprising a front end plate member 11, and a cup shaped portion 12 which is formed by press working of steel plate or aluminum die castings and is disposed to an end surface of front end plate member 11.

In this embodiment as shown in Fig. 1, front

end plate member 11 comprises a front end plate portion 11a which is, for example, is formed of aluminum or aluminum alloy, and an annular sleeve portion 11b projecting from the front end surface of front end plate portion 11a. An opening 111 is formed in center of front end plate portion 11a for the penetration or passage of a drive shaft 13. An annular projection 112, which projects concentric with and radially spaced from opening 111, is formed in the rear end surface of front end plate portion 11a facing to the cup shaped portion 12. Cup shaped portion 12 has a flange portion 121 which extends radially outward along an opening portion thereof. An inner surface of the opening portion of cup shaped portion 12 is fitted to an outer peripheral surface of annular projection 112, and end surface of flange portion 121 is fitted to the rear end surface of front end plate portion 11a and fixed to front end plate portion 11a by a fastening means, for example, bolt-nut means. The opening portion of cup shaped portion 12 is thereby covered by front end plate portion 11a. A sealing member, such as an O-ring 14 is placed between front end plate portion 11a and flange portion 121 of cup shaped portion 12 to thereby form a seal along the mating surfaces of the front end plate portion 11 and the cup shaped portion 12.

Sleeve portion 11b is formed of steel and is separate from front end plate portion 11a. Therefore, sleeve portion 11b is removably fixed to the front end surface of front end plate portion 11a by screws, one of which is shown as a screw 18. A hollow space of sleeve portion 11b forms a continuation of opening 111 of front end plate portion 11a. A shaft seal assembly 20 is assembled on drive shaft 13 within opening of front end plate portion 11. But it is not necessary for the shaft seal assembly 20 to be disposed within the opening of end plate portion 11, it may be disposed within the hollow space of sleeve portion 11b.

A pulley 22 is rotatably supported by a bearing means 21. The bearing means 21 is disposed on the outer surface of sleeve portion 11b. An electromagnetic annular coil 23 is fixed to the outer surface of sleeve portion 11b by a supporting plate 159 and is received in an annular cavity 160 of pulley 22. An armature plate 24 is elastically supported on the outer end of drive shaft 13 which extends from sleeve portion 11b. A magnetic clutch comprising pulley 22, magnetic coil 23 and armature plate 24 is thereby formed. Thus, drive shaft 13 is driven by an external drive power source, for example, a motor of a vehicle, through a rotation force transmitting means such as the magnetic clutch.

A fixed scroll member 25, an orbiting scroll member 26, a driving mechanism of orbiting scroll member 26 and a rotation preventing mechanism of orbiting scroll member 26 are disposed in an inner chamber of cup shaped portion 12. The inner chamber is formed between an inner surface of cup shaped portion 12 and front end plate 11a.

Fixed scroll member 25 includes a circular end plate 251 and a wrap means or spiral elements 252 affixed to or extending from one major side surface of circular plate 251. Circular plate 251 of fixed scroll member 25 is formed with a plurality of legs 253 axially projecting from a major end surface opposite to the side of the plate 251 from which spiral elements 252 extend or are affixed. In the embodiment of this invention, as shown in Fig. 2, a wall portion 257 is formed in the area between each leg 253 for reinforcing the legs 253. An end surface of each leg 253 is fitted against the inner surface of a bottom plate portion 122 of cup shaped portion 12 and is fixed to bottom plate portion 122 of cup shaped portion 12 by screws 27 which screw into legs 253 from the outside of bottom plate portion 122. A first seal ring member 28 is disposed between the end surface of each leg 253 and the inner surface of bottom plate portion 122, to thereby prevent leakage along screw 27. Referring to Fig. 2, the end surface of each leg 253 are formed a tapped hole 254 for receiving screw 27 and an annular groove 255 for receiving seal ring 28. A groove 256 is formed on the outer peripheral surface of circular plate 251, and a second seal ring member 29 is disposed therein to form a seal between the inner surface of cup shaped portion 12 and the outer peripheral portion of circular plate 251. Thus, the inner chamber of cup shaped portion 12 is partitioned into two chambers by circular plate 251, such as a rear chamber 30 and a front chamber 31. Front chamber 31 is contained orbiting scroll member 26, driving mechanism, rotation preventing mechanism and spiral element 252 of fixed scroll member 25. Rear chamber 30 contains the plurality of legs 253.

Cup shaped portion 12 is provided with a fluid inlet port 35 and a fluid outlet port 36, which respectively are connected to the front and rear chambers 31, 30. A hole or discharge port 258 is formed through the circular plate 251 at a position near to the center of spiral element 252 and is connected to the fluid pocket of spiral element center and rear chamber 30.

Orbiting scroll member 26 is disposed in front chamber 31. Orbiting scroll member 26 also comprises a circular end plate 261 and a wrap means or spiral element 262 affixed to or extending from one side surface of circular end plate 261. Spiral element 262 and spiral element 252 of fixed scroll member 25 interfit at angular offset of 180° and a predetermined radial offset. Fluid pockets are thereby defined between spiral elements 252, 262. Orbiting scroll member 26 is connected to the driving mechanism and to the rotation preventing/thrust bearing mechanism. These last two mechanisms effect orbital motion of the orbiting scroll member 26 at a circular radius Ro by rotation of drive shaft 13, to thereby compress fluid passing through the compressor unit.

Generally, radius Ro of orbital motion given by:

$$\frac{(\text{pitch of spiral element}) - 2 (\text{wall thickness of spiral element})}{2}$$

2

As seen in Fig. 7, the pitch (P) of the spiral elements can be defined by $2\pi \cdot r_g$, where r_g is the involute generating circle radius. The radius of orbital motion Ro is also illustrated in Fig. 7, as a locus of an arbitrary point Q on orbiting scroll member 26. Spiral element 262 is placed radially offset from spiral element 252 of fixed scroll member 25 by the distance Ro. Thereby, orbiting scroll member 26 is allowed to undergo the orbital motion of radius Ro by the rotation of drive shaft 13. As the orbiting scroll member 26 orbits, line contacts between both spiral elements 252 and 262 shift to the center of the spiral elements. Fluid pockets defined between spiral elements 252 and 262 move to the center with a consequent reduction of volume, to thereby compress the fluid in the pockets. Fluid inlet port 35 is connected to front chamber 31 and fluid outlet port 36 is connected to rear chamber 30. Therefore, fluid or refrigerant gas, introduced into front chamber 31 from an external fluid circuit through inlet port 35, is taken into fluid pockets formed between both spiral elements 252 and 262 from outer end portion of the both spiral elements. As scroll member 26 orbits, fluid in the fluid pockets is compressed and the compressed fluid is discharged into rear chamber 30 from the fluid pocket of the spiral element center through hole 258, and therefrom, discharged through the outlet port 36 to an external fluid circuit, for example, a cooling circuit.

Referring to Fig. 1 and Fig. 3, the driving mechanism of orbiting scroll member 26 will be described. Drive shaft 13 is formed with a disk rotor 15 at its inner end portion and is rotatably supported by sleeve portion 11b through bearing means, such as grease-contained sealed ball bearing 19 which is disposed within sleeve portion 11b and placed outside of shaft seal assembly 20. Disk rotor 15 is also rotatably supported by front end plate portion 11a through bearing means, such as ball bearing 16 disposed in the inner peripheral surface of annular projection 112.

A crank pin or drive pin 151 projects axially from an end surface of disk rotor 15 and, hence, from an end of drive shaft 13, and is radially offset from the center of drive shaft 13. Circular plate 261 of orbiting scroll member 26 is provided with a tubular boss 263 axially projecting from an end surface opposite to the side thereof from which spiral element 262 extends or is affixed. A discoid or short axial bushing 33 is fitted into boss 263, and is rotatably supported therein by bearing

means, such as a needle bearing 34. Bushing 33 has a balance weight 331 which is shaped as a portion of a disk or ring and extends radially from bushing 33 along a front surface thereof. An eccentric hole 332 is formed in bushing 33 radially offset from the center of bushing 33. Drive pin 151 is fitted into the eccentrically disposed hole 332 within which a bearing means 32 may be applied. Bushing 33 is therefore driven by the revolution of drive pin 151 and permitted to rotate by needle bearing 34.

Respective placement of center Os of drive shaft 13, center Oc of bushing 33, and center Od of hole 332 and thus drive pin 151, is shown in Fig. 4. In the position shown in Fig. 4, the distance between Os and Oc is the radius Ro of orbital motion, and when drive pin 151 is placed in eccentric hole 332, center Od of drive pin 151 is placed, with respect to Os, on the opposite side of a line L1, which is through Oc and perpendicular to a line L2 through Oc and Os, and also beyond the line through Oc and Os in the direction of rotation A of drive shaft 13.

In this construction of the driving mechanism center Oc of bushing 33 is permitted to swing about the center Od of drive pin 151 at a radius E2, as shown in Fig. 5. Such swing motion of center Oc is illustrated as arc Oc'-Oc'' in Fig. 5. This permitted swing motion allows the orbiting scroll member 30 to compensate its motion for changes in radius Ro due to wear on the spiral elements 252 and 262 or due to other dimensional inaccuracies of the spiral elements. When drive shaft 13 rotates, drive force is exerted at center Od of drive pin 151 to the left and reaction force of gas compression appears at center Oc of bushing 33 to the right, both forces being parallel to line L1. Therefore, the arm Od-Oc can swing outwardly by creation of the moment generated by the two forces. The spiral element 262 of orbiting scroll member 26 is thereby forced toward spiral element 252 of fixed scroll member 25, and the center of orbiting scroll member 26 orbits with the radius Ro around center Os of drive shaft 13. The rotation of orbiting scroll member 26 is prevented by a rotation preventing/thrust bearing mechanism, described more fully hereinafter, whereby orbiting scroll member 26 orbits while maintaining its angular orientation. The fluid pockets move because of the orbital motion of orbiting scroll member 26, to thereby compress the fluid.

Referring to Fig. 8, drive shaft 13 is rotatably supported by the two bearing means 16, 19 which are axially spaced. One of bearing means 19 is disposed within sleeve portion 11b and is placed outside of shaft seal assembly 20. Therefore, drive shaft 13 is securely and stably supported without whipping or precession of shaft. The axial distance X2 is made greater without adding to the length of housing 10 because the bearing 19 is disposed outside, rather than inside of the shaft seal assembly 20. This increase of the distance X2 reduces the load acting on the two bearing means. Therefore, the outer radius of outside

bearing 19, and therefore, the outer radius of sleeve portion 11b can be reduced without reduction of thickness, or without reduction of mechanical strength, of sleeve portion 11b. This makes it possible to use clutch bearing 21 and pulley 22 of reduced diameters. As a result, the compressor operates at an increased speed by an engine output, and is low at cost, light in weight and small in size.

Furthermore, since sleeve portion 11a can be removed from the front end plate portion 11a by loosening screws 18, shaft seal assembly 20 can be readily subjected to its repairing operation, even if it is disposed between the two bearing means 16 and 19 in front end plate member 11.

Moreover, lubrication oil is enclosed in the housing and may leak into the hollow space of sleeve portion 11b through shaft seal assembly 20, it is feared that the leaked oil could have a detrimental influence upon the bearing means 19. Therefore, a felt member 40 is disposed within the hollow space of sleeve portion 11b to absorb the leaked oil. Alternatively, a hole 41 is formed through the sleeve portion 11b and connects the hollow space of sleeve portion 11b with the exterior of the apparatus for the escape of leaked oil.

Referring to Fig. 6 and Fig. 1, a rotation preventing/thrust bearing means 37 will be described. Rotation preventing/thrust bearing means 37 is disposed to surround boss 263 and is comprised of a fixed ring 371 and a sliding ring 372. Fixed ring 371 is secured to an end surface of annular projection 112 of front end plate 11 by pins 373, one of which is shown in Fig. 1. Fixed ring 371 is provided with a pair of keyways 371a and 371b in an axial end surface facing orbiting scroll member 26. Sliding ring 372 is disposed in a hollow space between fixed ring 371 and circular plate 261 of orbiting scroll member 26. Sliding ring 372 is provided with a pair of keys 372a and 372b on the surface facing fixed ring 371, which are received in keyways 371a and 371b. Therefore, sliding ring 372 is slidable in the radial direction by the guide of keys 372a and 372b within keyways 371a and 371b. Sliding ring 372 is also provided with a pair of keys 372c and 372d on its opposite surface. Keys 372c and 372d are arranged along a diameter perpendicular to the diameter along which keys 372a and 372b are arranged. Circular plate 261 of orbiting scroll member 26 is provided with a pair of keyways (in Fig. 6 only one of keyways 261a is shown, the other keyway is disposed diametrically opposite to keyway 261a) on a surface facing sliding ring 372 in which are received keys 372c and 372d. Therefore, orbiting scroll member 26 is slidable in a radial direction by guide of keys 372c and 372d within the keyways of circular plate 261.

Accordingly, orbiting scroll member 26 is slidable in one radial direction with sliding ring 372, and is slidable in another radial direction independently. The second sliding direction is perpendicular to the first radial direction. Therefore, orbiting scroll member 26 is prevented from

rotating, but is permitted to move in two radial directions perpendicular to one another.

In addition, sliding ring 372 is provided with a plurality of pockets or holes 38 which are formed in an axial direction. A bearing means, such as balls 39, each having a diameter which is longer than the thickness of sliding ring 372, are retained in pockets 38. Balls 39 contact and roll on the surface of fixed ring 371 and circular plate 261. Therefore, the axial thrust load from orbiting scroll member 26 is supported on fixed ring 371 through bearing means 39.

Claims

1. An orbiting piston type fluid displacement apparatus including a housing (10) having a cylindrical casing and a front end plate member (11) mounted on an open front end of said casing (12), said front end plate member (11) having a sleeve portion extending therefrom in a direction outwardly of the housing, a fixed cylinder member (25) fixedly disposed relative to said housing (10), an orbiting piston member (26) disposed within said housing (10) to compress or pump fluid upon orbital motion thereof in relation to said fixed cylinder member (25), a driving means for effecting the orbital motion of said orbiting piston member (26) and including a drive shaft (13), said drive shaft (13) penetrating said front end plate member (11) through said sleeve portion and being rotatably supported, and a rotational force transmitting means (21—24) mounted on said sleeve portion for selectively transmitting a rotational force from an external driving power source to said drive shaft (13), characterised in that said front end plate member (11) has a front end plate portion (11a) and a separately formed, outwardly extending, sleeve portion (11b), said front end plate portion (11a) is formed with an opening (111) through which said drive shaft (13) extends, said sleeve portion (11b) is removably fixed to said front end plate portion (11a) so as to extend outwardly from said front end plate portion and to surround said drive shaft (13) so that the space inside said sleeve portion (11b) and the opening (111) in said front end plate portion (11a) form a continuous hollow portion, said drive shaft (13) extending through said hollow portion is rotatably supported by respective first and second bearing means (16, 19) which are disposed within said front end plate member (11), said first bearing means (19) is disposed in said space inside said separate sleeve portion (11b), said second bearing means (16) is disposed axially inwardly of said first bearing means (19), and a shaft seal assembly (20) is assembled within said hollow portion between said first and second bearing means (16, 19) on said drive shaft (13).

2. A scroll-type fluid displacement apparatus as claimed in claim 1, wherein said fixed cylinder member is a fixed scroll member (25) fixedly disposed relative to said housing (10) and having an end surface (251) from which a first wrap

means (252) extends into the interior of said housing (10), said orbiting piston member is an orbiting scroll member (26) having an end plate means (261) from which a second wrap means (262) extends, and said first and second wrap means (252, 262) interfit at an angular offset to make a plurality of line contacts to define at least one pair of sealed off fluid pockets.

3. An apparatus as claimed in claim 1, wherein said first bearing means (19) is a grease-contained sealed bearing.

4. An apparatus as claimed in claim 1, wherein said shaft seal assembly (20) is disposed within the opening (111) in said front end plate portion (11a).

5. An apparatus as claimed in claim 1, wherein said shaft seal assembly (20) is disposed within the space inside said sleeve portion (11b).

6. An apparatus as claimed in claim 4 or 5, wherein an oil absorption member (40) is disposed within the space inside said sleeve portion (11b).

7. An apparatus as claimed in claim 4, wherein said sleeve portion (11b) is formed with a hole (41) which allows the escape of leaked oil from the space inside the sleeve portion outwardly of said sleeve portion (11b).

8. An apparatus as claimed in claim 1, wherein said front end plate portion (11a) is formed of aluminium material and said sleeve portion (11b) is formed of steel.

9. An apparatus as claimed in claim 1, wherein said rotation force transmitting is an electromagnetic clutch which comprises a pulley (22) which is rotatably supported by a third bearing means (21) disposed on the outer surface of said sleeve portion (11b), an armature plate (24) which is elastically supported on the outer end of said drive shaft (13), and a magnetic annular coil (23) which is fixedly mounted on the outer surface of said sleeve portion (11b).

10. A scroll-type fluid displacement apparatus comprising:

a housing (10) having a front end plate member (11);

a drive shaft (13) which extends through and is rotatably supported by said front end plate member (11);

said front end plate member (11) comprising a front end plate portion (11a) in which is formed an opening (111) through which said drive shaft (13) extends, and a sleeve portion (11b) extending from a front end surface of said front end plate portion (11a) and surrounding said drive shaft (13), said sleeve portion being formed separately from said front end plate portion (11a) and being removably fixed on a front end surface of said front end plate portion (11a);

a fixed scroll member (25) fixedly disposed relative to said housing (10) and having an end surface (251) from which a first wrap means (252) extends into the interior of said housing (10);

an orbiting scroll member (26) having an end plate means (261) from which a second wrap means (262) extends, said first and second wrap

5

10

15

20

25

30

35

40

45

50

55

60

65

7

rotating, but is permitted to move in two radial directions perpendicular to one another.

In addition, sliding ring 372 is provided with a plurality of pockets or holes 38 which are formed in an axial direction. A bearing means, such as balls 39, each having a diameter which is longer than the thickness of sliding ring 372, are retained in pockets 38. Balls 39 contact and roll on the surface of fixed ring 371 and circular plate 261. Therefore, the axial thrust load from orbiting scroll member 26 is supported on fixed ring 371 through bearing means 39.

Claims

1. An orbiting piston type fluid displacement apparatus including a housing (10) having a cylindrical casing and a front end plate member (11) mounted on an open front end of said casing (12), said front end plate member (11) having a sleeve portion extending therefrom in a direction outwardly of the housing, a fixed cylinder member (25) fixedly disposed relative to said housing (10), an orbiting piston member (26) disposed within said housing (10) to compress or pump fluid upon orbital motion thereof in relation to said fixed cylinder member (25), a driving means for effecting the orbital motion of said orbiting piston member (26) and including a drive shaft (13), said drive shaft (13) penetrating said front end plate member (11) through said sleeve portion and being rotatably supported; and a rotational force transmitting means (21-24) mounted on said sleeve portion for selectively transmitting a rotational force from an external driving power source to said drive shaft (13), characterised in that said front end plate member (11) has a front end plate portion (11a) and a separately formed, outwardly extending, sleeve portion (11b), said front end plate portion (11a) is formed with an opening (111) through which said drive shaft (13) extends, said sleeve portion (11b) is removably fixed to said front end plate portion (11a) so as to extend outwardly from said front end plate portion and to surround said drive shaft (13) so that the space inside said sleeve portion (11b) and the opening (111) in said front end plate portion (11a) form a continuous hollow portion, said drive shaft (13) extending through said hollow portion is rotatably supported by respective first and second bearing means (16, 19) which are disposed within said front end plate member (11), said first bearing means (19) is disposed in said space inside said separate sleeve portion (11b), said second bearing means (16) is disposed axially inwardly of said first bearing means (19), and a shaft seal assembly (20) is assembled within said hollow portion between said first and second bearing means (16, 19) on said drive shaft (13).

2. A scroll-type fluid displacement apparatus as claimed in claim 1, wherein said fixed cylinder member is a fixed scroll member (25) fixedly disposed relative to said housing (10) and having an end surface (251) from which a first wrap

means (252) extends into the interior of said housing (10), said orbiting piston member is an orbiting scroll member (26) having an end plate means (261) from which a second wrap means (262) extends, and said first and second wrap means (252, 262) interfit at an angular offset to make a plurality of line contacts to define at least one pair of sealed off fluid pockets.

3. An apparatus as claimed in claim 1, wherein said first bearing means (19) is a grease-contained sealed bearing.

4. An apparatus as claimed in claim 1, wherein said shaft seal assembly (20) is disposed within the opening (111) in said front end plate portion (11a).

5. An apparatus as claimed in claim 1, wherein said shaft seal assembly (20) is disposed within the space inside said sleeve portion (11b).

6. An apparatus as claimed in claim 4 or 5, wherein an oil absorption member (40) is disposed within the space inside said sleeve portion (11b).

7. An apparatus as claimed in claim 4, wherein said sleeve portion (11b) is formed with a hole (41) which allows the escape of leaked oil from the space inside the sleeve portion outwardly of said sleeve portion (11b).

8. An apparatus as claimed in claim 1, wherein said front end plate portion (11a) is formed of aluminium material and said sleeve portion (11b) is formed of steel.

9. An apparatus as claimed in claim 1, wherein said rotation force transmitting is an electromagnetic clutch which comprises a pulley (22) which is rotatably supported by a third bearing means (21) disposed on the outer surface of said sleeve portion (11b), an armature plate (24) which is elastically supported on the outer end of said drive shaft (13), and a magnetic annular coil (23) which is fixedly mounted on the outer surface of said sleeve portion (11b).

10. A scroll-type fluid displacement apparatus comprising:

a housing (10) having a front end plate member (11);

a drive shaft (13) which extends through and is rotatably supported by said front end plate member (11);

said front end plate member (11) comprising a front end plate portion (11a) in which is formed an opening (111) through which said drive shaft (13) extends, and a sleeve portion (11b) extending from a front end surface of said front end plate portion (11a) and surrounding said drive shaft (13), said sleeve portion being formed separately from said front end plate portion (11a) and being removably fixed on a front end surface of said front end plate portion (11a);

a fixed scroll member (25) fixedly disposed relative to said housing (10) and having an end surface (251) from which a first wrap means (252) extends into the interior of said housing (10);

an orbiting scroll member (26) having an end plate means (261) from which a second wrap means (262) extends, said first and second wrap



means (252, 262) interfitting at an angular offset to make a plurality of line contacts to define at least one pair of sealed off fluid pockets;

driving means including said drive shaft (13) operatively connected to said orbiting scroll member (26) to effect orbital motion of said orbiting scroll member (26) upon rotation of said drive shaft (13), whereby said fluid pockets change volume;

a rotational force transmitting means disposed on the outer surface of said annular sleeve portion (11b) and operatively connected to said drive shaft (13) for transmitting a rotational force from an external driving power source;

first and second bearing means (16, 19) rotatably supporting said drive shaft (13) and disposed within said front end plate member (11), said first bearing means (19) being disposed within said sleeve portion (11b), and said second bearing means (16) being disposed axially inwardly of said first bearing means (19); and

a shaft seal assembly (20) assembled on said drive shaft (13) within said front end plate member (11) between said first and second bearing means (19, 16).

11. An apparatus as claimed in claim 10, wherein said drive shaft seal assembly (20) is disposed within the opening (111) in said front end plate portion (11a).

12. An apparatus as claimed in claim 10, wherein said shaft seal assembly (20) is disposed within the space inside said sleeve portion (11b).

13. An apparatus as claimed in claim 10, wherein said front end plate portion (11a) is formed of aluminium material, and said sleeve portion (11b) is formed of steel material.

Patentansprüche

1. Umlaufkolben-Fluidverdrängervorrichtung mit einem Gehäuse (10) mit einer zylindrischen Hülle und einem an einer offenen Stirnseite der Hülle (12) befestigten Frontstirnplattenelement (11), das einen davon in einer Richtung vom Gehäuse nach außen erstreckenden Hülsenbereich aufweist, einem relativ zum Gehäuse (10) feststehend angeordneten festen Zylinderelement (25), einem umlaufenden Kolbenelement (26), das im Gehäuse (10) zum Verdichten oder Pumpen von Fluid bei seiner Umlaufbewegung relativ zum festen Zylinderelement (25) angeordnet ist, einer Antriebsvorrichtung zum Bewirken der Umlaufbewegung des umlaufenden Kolbenelementes (26) mit einer Antriebswelle (13), die das Frontstirnplattenelement (11) durch den Hülsenbereich durchdringt und drehbar gelagert ist, und einer Drehkraftübertragungsvorrichtung (21—24), die am Hülsenbereich zum wahlweisen Übertragen einer Drehkraft von einer externen Antriebskraftquelle auf die Antriebswelle (13) befestigt ist, dadurch gekennzeichnet, daß das Frontstirnplattenelement (11) einen Frontstirnplattenbereich (11a) und einen separat ausgebildeten und sich nach außen erstreckenden Hülsenbereich (11b) aufweist,

wobei der Frontstirnplattenbereich (11a) mit einer Öffnung (111), durch die sich die Antriebswelle (13) erstreckt, ausgebildet ist und der Hülsenbereich (11b) am Frontstirnplattenbereich (11a) derart lösbar befestigt ist, daß er sich vom Frontstirnplattenbereich nach außen erstreckt und die Antriebswelle (13) derart umgibt, daß der Raum innerhalb des Hülsenbereiches (11b) und der Öffnung (111) im Frontstirnplattenbereich (11a) einen zusammenhängenden hohlen Bereich bildet, daß die Antriebswelle (13), die sich durch den hohlen Bereich erstreckt, mittels entsprechender erster und zweiter Lager- vorrichtungen (16, 19), die innerhalb des Frontstirnplattenelementes (11) angeordnet sind, drehbar gelagert ist, wobei die erste Lager- vorrichtung (19) in dem Raum innerhalb des getrennten Hülsenbereiches (11b) und die zweite Lagervorrichtung (16) axial von der ersten Lager- vorrichtung (19) nach innen angeordnet ist, und daß eine Wellendichtungsanordnung (20) innerhalb des hohlen Bereiches zwischen der ersten und der zweiten Lagervorrichtung (16, 19) auf der Antriebswelle (13) montiert ist.

2. Spiralf Fluidverdrängervorrichtung nach Anspruch 1, bei dem das feste Zylinderelement ein festes Spiralelement (25) ist, das relativ zum Gehäuse (10) feststehend angeordnet ist und eine Stirnfläche (251) aufweist, von der sich ein erstes Hüllelement (252) in das Innere des Gehäuses (10) hinein erstreckt, daß das umlaufende Kolbenelement ein umlaufendes Spiralelement (26) ist, das eine Stirnplattenvorrichtung (261) aufweist, von der sich ein zweites Hüllelement (262) erstreckt, und daß das erste und das zweite Hüllelement (252, 262) mit einer winkelmäßigen Versetzung ineinandergreifen, um eine Mehrzahl von Linienkontakten zum Umgrenzen von zumindest einem Paar von abgedichteten Fluidtaschen zu bilden.

3. Vorrichtung nach Anspruch 1, wobei die erste Lagervorrichtung (19) ein abgedichtetes, Fett enthaltendes Lager ist.

4. Vorrichtung nach Anspruch 1, wobei die Wellendichtungsanordnung (20) innerhalb der Öffnung (111) in dem Frontstirnplattenbereich (11a) angeordnet ist.

5. Vorrichtung nach Anspruch 1, wobei die Wellendichtungsanordnung (20) innerhalb des Raumes im Hülsenbereich (11b) angeordnet ist.

6. Vorrichtung nach Anspruch 4 oder 5, wobei ein Ölabsorptionsteil (40) innerhalb des Raumes im Hülselement (11b) angeordnet ist.

7. Vorrichtung nach Anspruch 4, wobei der Hülsenbereich (11b) mit einem Loch (41) ausgebildet ist, der das Entweichen von Lecköl vom Raum im Hülsenbereich nach außen vom Hülsenbereich (11b) erlaubt.

8. Vorrichtung nach Anspruch 1, wobei der Frontstirnplattenbereich (11a) aus Aluminiummaterial und der Hülsenbereich (11b) aus Stahl ausgebildet ist.

9. Vorrichtung nach Anspruch 1, wobei die Drehkraftübertragungsvorrichtung eine elektromagnetische Kupplung ist, die eine Riemen-



scheibe (22), welche über eine auf der Außenoberfläche des Hülsenbereiches (11b) angeordnete dritte Lagervorrichtung (21) drehbar gelagert ist, eine am Außenende der Antriebswelle (13) elastisch befestigte Ankerplatte (24) und eine Ringmagnetspule (23), die an der Außenoberfläche des Hülsenbereiches (11b) feststehend befestigt ist, aufweist.

10. Spiralfliuidverdrängervorrichtung mit einem Gehäuse (10) mit einem Frontstirnplattenelement (11);

einer Antriebswelle (13), die sich durch das Frontstirnplattenelement (11) hindurcherstreckt und in diesem drehbar gelagert ist;

wobei das Frontstirnplattenelement (11) einen Frontstirnplattenbereich (11a), in dem eine Öffnung (111), durch die sich die Antriebswelle (13) erstreckt, ausgebildet ist, und einen Hülsenbereich (11b), der sich von der Frontstirnfläche des Frontstirnplattenbereiches (11a) weg erstreckt und die Antriebswelle (13) umgibt, aufweist, wobei der Hülsenbereich getrennt von dem Frontstirnplattenbereich (11a) ausgebildet ist und an einer Frontstirnfläche des Frontstirnplattenbereiches (11a) lösbar befestigt ist;

einem feststehenden Spiralelement (25), das relativ zum Gehäuse (10) feststehend angeordnet ist und eine Stirnfläche (251) aufweist, von der sich ein erstes Hüllelement (252) in das Innere des Gehäuses (10) hineinerstreckt;

einem umlaufenden Spiralelement (26) mit einer Stirnplattenvorrichtung (261), von der sich ein zweites Hüllelement (262) erstreckt, wobei das erste und das zweite Hüllelement (252, 262) mit einer winkelmäßigen Versetzung ineinandergreifen, um eine Mehrzahl von Linienkontakten zum Umgrenzen von zumindest einem Paar von abgedichteten Fluidtaschen zu bilden;

einer Antriebsvorrichtung, die die Antriebswelle (13) umfaßt und mit dem umlaufenden Spiralelement (26) zum Bewirken einer Umlaufbewegung des umlaufenden Spiralelementes (26) bei Rotation der Antriebswelle (13), so daß die Fluidtaschen ihr Volumen verändern, wirkungsmäßig verbunden ist;

einer Drehkraftübertragungsvorrichtung, die auf der äußeren Oberfläche des ringförmigen Hülsenbereiches (11b) angeordnet und mit der Antriebswelle (13) zum Übertragen einer Drehkraft von einer äußeren Antriebskraftquelle wirkungsmäßig verbunden ist;

einer ersten und einer zweiten Lagervorrichtung (16, 19), die die Antriebswelle (13) drehbar lagern und innerhalb des Frontstirnplattenelementes (11b) angeordnet sind, wobei die erste Lagervorrichtung (19) innerhalb des Hülsenbereiches (11b) und die zweite Lagervorrichtung (16) axial von der ersten Lagervorrichtung (19) nach innen angeordnet ist; und

einer Wellendichtungsanordnung (20), die auf der Antriebswelle (13) innerhalb des Frontstirnplattenelementes (11) zwischen der ersten und der zweiten Lagervorrichtung (19, 16) montiert ist.

11. Vorrichtung nach Anspruch 10, wobei die

Antriebswellendichtungsanordnung (20) innerhalb der Öffnung (111) im Frontstirnplattenbereich (11a) angeordnet ist.

12. Vorrichtung nach Anspruch 10, wobei die Wellendichtungsanordnung (20) innerhalb des Raumes im Hülsenbereich (11b) angeordnet ist.

13. Vorrichtung nach Anspruch 10, wobei der Frontstirnplattenbereich (11a) aus Aluminiummaterial und der Hülsenbereich (11b) aus Stahlmaterial gebildet ist.

Revendications

1. Appareil de déplacement de fluide de type à piston orbital, comprenant un carter (10) muni d'un boîtier cylindrique et d'un élément de plaque d'extrémité avant (11) monté sur l'extrémité avant ouverte de ce boîtier (12), cet élément de plaque d'extrémité avant (11) comportant une partie de manchon partant de celle-ci dans une direction dirigée vers l'extérieur du carter, un élément de cylindre fixe (25) monté de façon fixe par apport au carter (10), un élément de piston orbital (26) disposé dans le carter (10) pour comprimer ou pomper le fluide en effectuant son mouvement orbital par rapport à l'élément de cylindre fixe (25), des moyens d'entraînement destinés à produire le mouvement orbital de l'élément de piston orbital (26) et comprenant un arbre d'entraînement (13), cet arbre d'entraînement (13) pénétrant dans l'élément de plaque d'extrémité avant (11) par l'intermédiaire de la partie de manchon, et se trouvant supporté en rotation, et des moyens de transmission d'effort de rotation (21 à 24), montés sur la partie de manchon, pour transmettre sélectivement à l'arbre d'entraînement (13) une force de rotation provenant d'une source de puissance motrice extérieure, appareil caractérisé en ce que l'élément de plaque d'extrémité avant (11) comporte une partie de plaque d'extrémité avant (11a) et une partie de manchon dirigée vers l'extérieur (11b) formée séparément, la partie de plaque d'extrémité avant (11a) est percée d'une ouverture (111) par laquelle passe l'arbre d'entraînement (13), la partie de manchon (11b) est fixée de manière amovible sur la partie de plaque d'extrémité avant (11a) de manière à faire saillie vers l'extérieur à partir de cette partie de plaque d'extrémité avant, et à entourer l'arbre d'entraînement (13) de façon que l'espace compris à l'intérieur de la partie de manchon (11b), et l'ouverture (111) percée dans la partie de plaque d'extrémité avant (11a), forment une partie creuse continue, l'arbre d'entraînement (13) passant dans cette partie creuse est supporté en rotation par des premier et second moyens de paliers respectifs (16, 19) montés dans l'élément de plaque d'extrémité avant (11), le premier moyen de palier (19) est monté dans l'espace situé à l'intérieur de la partie de manchon séparée (11b), le second moyen de palier (16) est monté axialement vers l'intérieur du premier moyen de palier (19), et un ensemble d'étanchéité d'arbre (20) est monté dans la partie creuse comprise



entre les premier et second moyens de paliers (16, 19), sur l'arbre d'entraînement (13).

2. Appareil de déplacement de fluide de type à spirale selon la revendication 1, caractérisé en ce que l'élément de cylindre fixe est constitué par un élément de spirale fixe (25) monté de façon fixe par rapport au carter (10), et comportant une surface d'extrémité (251) d'où part un premier dispositif d'enroulement (252) pénétrant à l'intérieur du carter (10), en ce que l'élément de piston orbital est un élément de spirale orbitale (26) comportant une plaque d'extrémité (261) d'où part un second dispositif d'enroulement (262), les premier et second dispositifs d'enroulements (252, 262) s'emboîtant avec un certain décalage angulaire de manière à former un certain nombre de lignes de contact définissant au moins une paire de poches à fluide étanches.

3. Appareil selon la revendication 1, caractérisé en ce que le premier moyen de palier (19) est un palier étanche auto-lubrifiant.

4. Appareil selon la revendication 1, caractérisé en ce que l'ensemble d'étanchéité d'arbre (20) est monté dans l'ouverture (111) percée dans la partie de plaque d'extrémité avant (11a).

5. Appareil selon la revendication 1, caractérisé en ce que l'ensemble d'étanchéité d'arbre (20) est monté dans l'espace situé à l'intérieur de la partie de manchon (11b).

6. Appareil selon l'une quelconque des revendications 4 et 5, caractérisé en ce qu'un élément d'absorption d'huile (40) est placé dans l'espace situé à l'intérieur de la partie de manchon (11b).

7. Appareil selon la revendication 4, caractérisé en ce que la partie de manchon (11b) est percée d'un trou (41) permettant à l'huile de fuite provenant de l'espace situé à l'intérieur de la partie de manchon, de s'échapper vers l'extérieur de cette partie de manchon (11b).

8. Appareil selon la revendication 1, caractérisé en ce que la partie de plaque d'extrémité avant (11a) est réalisée en aluminium, et en ce que la partie de manchon (11b) est réalisée en acier.

9. Appareil selon la revendication 1, caractérisé en ce que le dispositif de transmission de force de rotation est un embrayage électromagnétique comprenant une poulie (22) supportée en rotation par un troisième moyen de palier (21) monté sur la surface extérieure de la partie de manchon (11b), une plaque d'armature (24) montée élastiquement sur l'extrémité extérieure de l'arbre d'entraînement (13), et une bobine magnétique annulaire (23) montée de façon fixe sur la surface extérieure de la partie de manchon (11b).

10. Appareil de déplacement de fluide de type à spirale, comprenant:

- un carter (10) muni d'un élément de plaque d'extrémité avant (11);
- un arbre d'entraînement (13) traversant et se montant en rotation dans l'élément de plaque d'extrémité avant (11);

— cet élément de plaque d'extrémité avant (11) comprenant une partie de plaque d'extrémité avant (11a) dans laquelle est percée une ouverture (111) à travers laquelle passe l'arbre d'entraînement (13), et une partie de manchon (116) partant de la face d'extrémité avant de la partie de plaque d'extrémité avant (11a) et entourant l'arbre d'entraînement (13), cette partie de manchon étant formée séparément de la partie de plaque d'extrémité avant (11a), et se fixant de manière amovible sur la surface d'extrémité avant de la partie de plaque d'extrémité avant (11a);

— un élément de spirale fixe (25) monté de façon fixe par rapport au carter (10), et comportant une surface d'extrémité (251) d'où part un premier dispositif d'enroulement (252) pénétrant à l'intérieur du carter (10);

— un élément de spirale orbitale (26) comportant une plaque d'extrémité (261) d'où part un second dispositif d'enroulement (262), les premier et second dispositifs d'enroulements (252, 262) s'emboîtant avec un certain décalage angulaire pour former un certain nombre de lignes de contact permettant de définir au moins une paire de poches à fluide étanches;

— des moyens d'entraînement comprenant l'arbre d'entraînement (13) relié en fonctionnement à l'élément de spirale orbitale (26) pour produire le mouvement orbital de l'élément de spirale orbitale (26) lorsqu'on fait tourner l'arbre d'entraînement (13), ce que permet ainsi de faire varier le volume des poches à fluide;

— des moyens de transmission de force de rotation placés sur la surface extérieure de la partie de manchon annulaire (11b) et se reliant en fonctionnement à l'arbre d'entraînement (13) pour transmettre une force de rotation provenant d'une source de puissance motrice extérieure;

— un premier et un second moyens de paliers (16, 19) supportant en rotation l'arbre d'entraînement (13) et se montant dans l'élément de plaque d'extrémité avant (11), le premier moyen de palier (19) étant disposé dans la partie de manchon (11b), et le second moyens de palier (16) étant disposé axialement vers l'intérieur du premier moyen de palier (19); et

— un ensemble d'étanchéité d'arbre (20) monté sur l'arbre d'entraînement (13), à l'intérieur de l'élément de plaque d'extrémité avant (11), entre les premier et second moyens de paliers (19, 16).

11. Appareil selon la revendication 10, caractérisé en ce que l'ensemble d'étanchéité d'arbre d'entraînement (20), est monté dans l'ouverture (111) de la partie de plaque d'extrémité avant (11a).

12. Appareil selon la revendication 10, caractérisé en ce que l'ensemble d'étanchéité d'arbre



19

(20) est monté dans l'espace compris à l'intérieur de la partie de manchon (11b).

13. Appareil selon la revendication 10, caractérisé en ce que la partie de plaque d'extrémité

avant (11a) est réalisée en aluminium, et en ce que la partie de manchon (11b) est réalisée en acier.

5

10

15

20

25

30

35

40

45

50

55

60

65

11

