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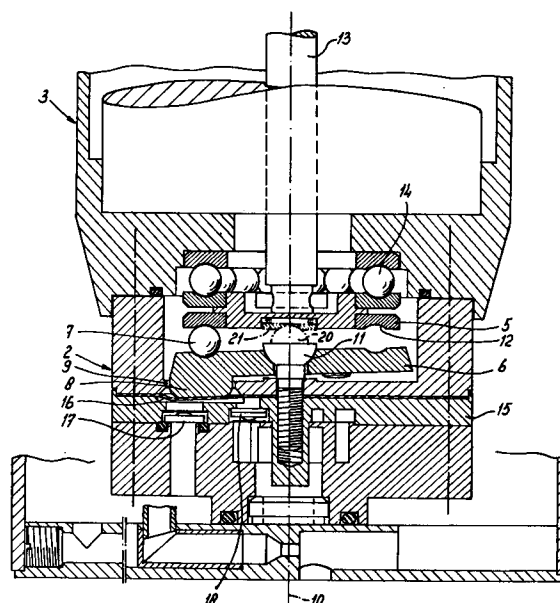
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NL-2502 LS 's-Gravenhage(NL)(54) **Swash-plate pump.**

(57) Swash-plate pump with a driving first plate (5) provided with a bearing track (12) and a second plate (6) which is driven by it and which is also provided with a bearing track. The second plate is connected to at least one piston part (8) acting in the cylinder part (9) of the pump, while swash-plate bearing means (11) are present in the centre of rotation (10) of the second plate (6). A one-part body of rotation (7) is present in the space bounded between the bearing tracks. Through the rolling movement of this body of rotation, a transmission ratio of 2:1 between the driving first plate (5) and the second plate or pump plate (6) driven by it is provided.

fig-2

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The present invention relates to a swash-plate pump according to the preamble of Claim 1.

Such a swash-plate pump is known from US-A-2,402,244. In it the bearing is a rolling bearing. The inner race thereof is connected to the driving element, which is made pin-shaped for that purpose. The outer race acts upon the pump plate. Bodies of rotation, such as needles, cones or balls, are fitted between the inner and outer race. On one rotation of the driving element the pump plate will carry out a complete movement, i.e. the pistons present will carry out a complete inward and outward stroke.

The motors used in the case of such swash-plate pumps are often of the high-speed type. In order to reduce the speed of rotation of the pump, reducers are often fitted between the motor and the pump. For, slower rotation of the pump is often desired, on account of limiting the noise produced by the pump, the time necessary for closing and opening the various valves in the pump, the type of pumped liquid, and from the point of view of fatiguing of the different parts present in the pump. The height of the pump is also increased by the height of the rolling bearing. If a motor of the same capacity which is suitable for a lower speed of rotation is used, this motor will have to be made larger.

The object of the present invention is to provide a swash-plate pump which does not have the above-mentioned disadvantages.

This object is achieved with a swash-plate pump of the above-mentioned type with the features specified in the characterizing part of Claim 1.

A transmission ratio of 2:1 between driving element and the movement of the swash plate is achieved by making the driving element as drive plate or first plate and providing it with a bearing track, while the pump plate or second plate is also provided with a bearing track, with a body of rotation inserted between them. In this way it is possible to make do with a smaller motor with a high speed of rotation, while reducing the speed of movement of the swash plate. As a result, the noise in the pump will decrease, the load of the different valves will not have to meet such high standards, there will be more possibilities for pumping all kinds of liquid, in particular types of liquid which tend to evaporate in a vacuum, and the fatigue problems are limited.

Although the body of rotation can be a conical or cylindrical element, according to a preferred embodiment the body of rotation is a ball. In this way a rotating slanting part can be obtained particularly cheaply. Although it is possible for the race for the bearing of the first plate to be at an angle relative to the axis of rotation, it is preferable

for it to be perpendicular. In this way the economic benefits achieved by the invention can be maximized.

The swash-plate bearing means can comprise a spherical cap pin. It is also possible to place a ball between the first and the second plate.

According to a further advantageous embodiment, various pistons can be connected to the second plate. These pistons are preferably integral with the plate and, in order to provide the optimum seal between the piston and cylinder, a shut-off diaphragm upon which the piston can act can be fitted.

The invention is explained in greater detail below with reference to an example of an embodiment shown in the drawing.

In it:

Fig. 1 shows schematically and partially in cross-section a swash-plate pump according to the invention fitted in a housing fixed in a tank, and

Fig. 2 shows a detail in cross-section of the pump according to Fig. 1.

The pump according to the invention is indicated in its entirety by 1 in Fig. 1. It is accommodated in a housing 4 fixed to an only partially shown tank 19. This tank can be, for example, an LPG tank if the pump is being used for pumping such a material. Fig. 2 shows a detail of the pump indicated by 1 in Fig. 1, and in particular of the pump casing 2 and the motor 3. Motor 3 rotates about an axis indicated by 10. Connected to motor shaft 13 is a first plate 5 provided with a race 12, and also provided with bearing means 14. Pump casing 2 contains a second swash plate 6, which is held in place by a spherical cap pin 11. Plate 6 is provided with three pistons (one piston 8 is shown in the drawing). A bearing 7 comprising a single ball is fitted between the plates 5 and 6. Piston 8 acts upon a diaphragm 16 fitted between pump casing 2 and valve cover. If piston 8 is not fixed to the diaphragm 9, it is important for piston 8 to undergo pre-tensioning in the direction of the first plate 5. In the example of an embodiment shown this is achieved by the pressure difference over the diaphragm, the pressure at the pump side always being higher than that at the drive side. An inlet valve 17 and an outlet valve 18 are also present in pump casing 2.

The device described works as follows:

When shaft 13 rotates about axis 10, the first plate 5 will carry out the same movement. In this case race 12 lies essentially at right angles to axis 10. Since only one ball 7 is present, the second plate 6 will be pressed downwards at the ball in Fig. 2, and piston 8 will work. The tilting movement of plate 6 is limited by the presence of spherical cap pin 11, which takes up the force with which the

second plate 6 tends to be driven towards the second plate 5. In this way only two bearing points exist, namely at the spherical cap pin 11 and ball 7. The result is that considerably less energy is lost in bearing friction than in the case of the conventional pump. This means that the heat development is lower, with the result that, on the one hand, it is possible to make do with simpler lubrication or no lubrication at all and, on the other, a lower-capacity motor can be used while having the same pump output. This is particularly important in the case of automobile applications.

It is possible instead of spherical cap pin 11 to use a ball 20, which is indicated by dashed lines, and which in turn rests on a bearing 21. Through use of the ball 7 as the "slanting element" the stroke speed of the pump is halved compared with the speed of rotation of shaft 13. This is because ball 7 moves at half the speed of shaft 13. Through the up and down movement of piston 8, inlet valve 17 and outlet valve 18 will be opened and closed at a suitable point in time in the manner known in the state of the art. Since piston 8 is integral with the second plate 6, and therefore does not carry out a precise up and downward movement, it is necessary to provide a seal, which in this case is provided by diaphragm 16. When ball 7 is turned away from the place opposite piston 8, piston 8 will be pressed upwards through the pressure difference over diaphragm 16. When diaphragm 16 is moved away, partial vacuum occurs in the pump chamber, as a result of which one-way valve 17 is opened and fluid can flow inwards out of tank 19. Outlet 18 then remains closed, and is not opened until there is overpressure in the pump chamber, i.e. during the working stroke of piston 8.

Although the invention is described above with reference to two preferred embodiments, it must be understood that numerous modifications can be made to it. For instance, the bearing ring between the two plates 5 and 6 can be composed of a larger number of bodies of rotation. It is possible here to fit two balls 7 directly beside each other. It is also possible to fit different bodies of rotation distributed along the periphery, in which case their diameter cannot be the same if the effect envisaged by the invention is to be achieved. Fixing of the second plate 6 relative to the pump casing can also be carried out in all kinds of other ways known in the state of the art, such as with a film hinge.

Claims

1. Swash-plate pump, comprising a driving element and a pump plate (6) driven by it, with a bearing (7) which is fitted between them and which is in contact with the pump plate (6) at one point and through displacement over the

pump plate (6) provides the wobble movement thereof, while the pump plate is connected to at least one piston part (8) acting in the cylinder part (9) of the pump, and swash-plate bearing means (11) are present in the centre of rotation (10) of the pump plate (6), characterized in that the driving element comprises a drive plate, at the side facing the pump plate (6) provided with a bearing track (12), in that the pump plate (6) at the side facing the drive plate (5) is provided with a bearing track, and in that a one-piece body of rotation (7) is provided in the space bounded by the bearing tracks.

2. Swash-plate pump according to claim 1, in which the swash-plate bearing means (11) are designed to take up a force which drives the second plate (6) towards the first (5).
3. Swash-plate pump according to any of the preceding claims, in which the bearing (7) is a ball.
4. Swash-plate pump according to any of the preceding claims, in which the running face (12) for the bearing (7) of the first plate (5) lies at right angles to the axis of rotation.
5. Swash-plate pump according to any of the preceding claims, in which the swash-plate bearing means (11) comprise a spherical cap pin.
6. Swash-plate pump according to any of Claims 1 - 5, in which the swash-plate bearing means comprise a ball (15) placed between the first (5) and second plate (6).
7. Swash-plate pump according to any of the preceding claims, in which various pistons (8) are connected to the second plate (6).
8. Swash-plate pump according to any of the preceding claims, in which the pistons (8) are integral with the second plate (6).
9. Swash-plate pump according to any of the preceding claims, in which a valve diaphragm (16) on which the piston (8) can act is fitted in at least the one cylinder (9).

fig - 1

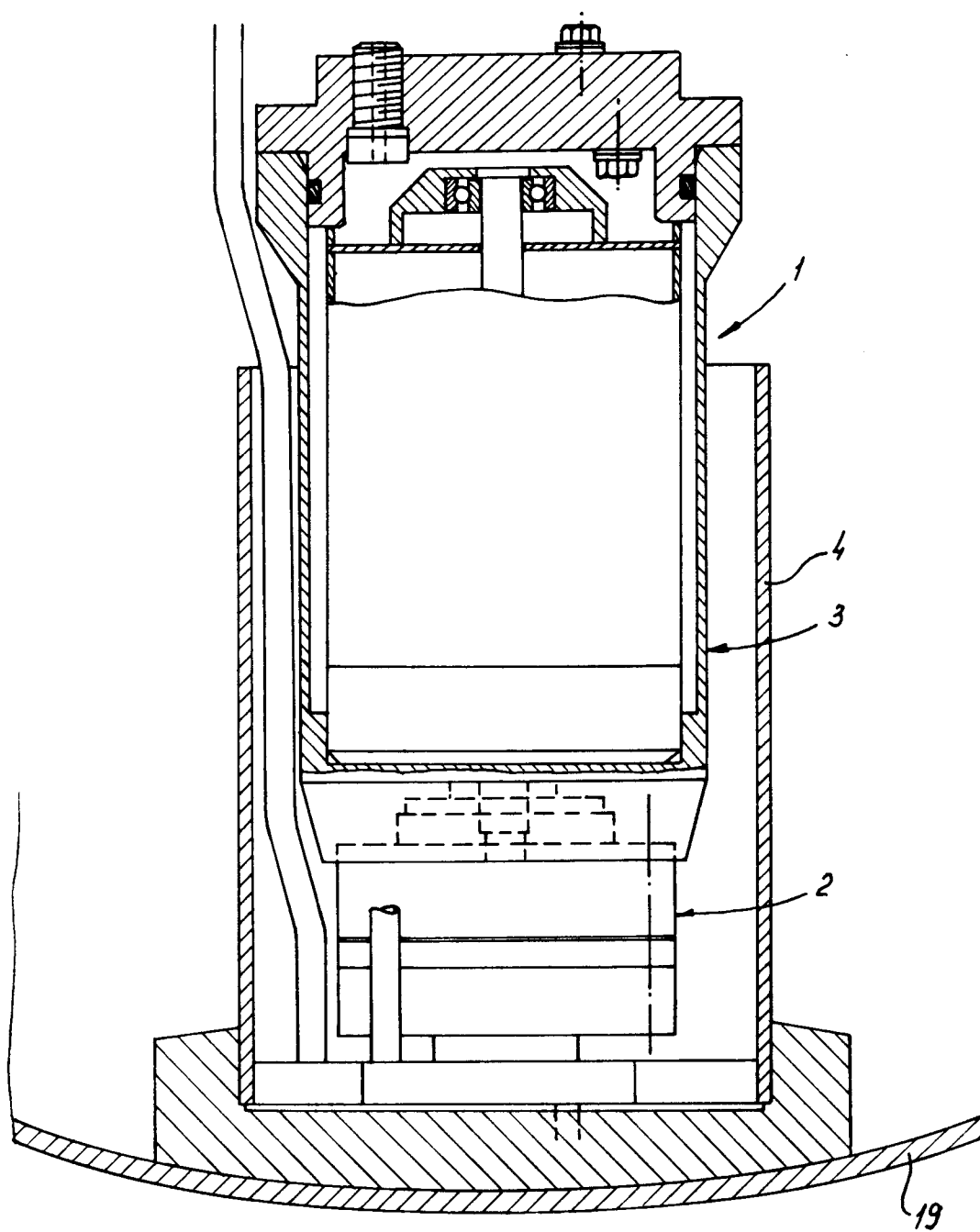
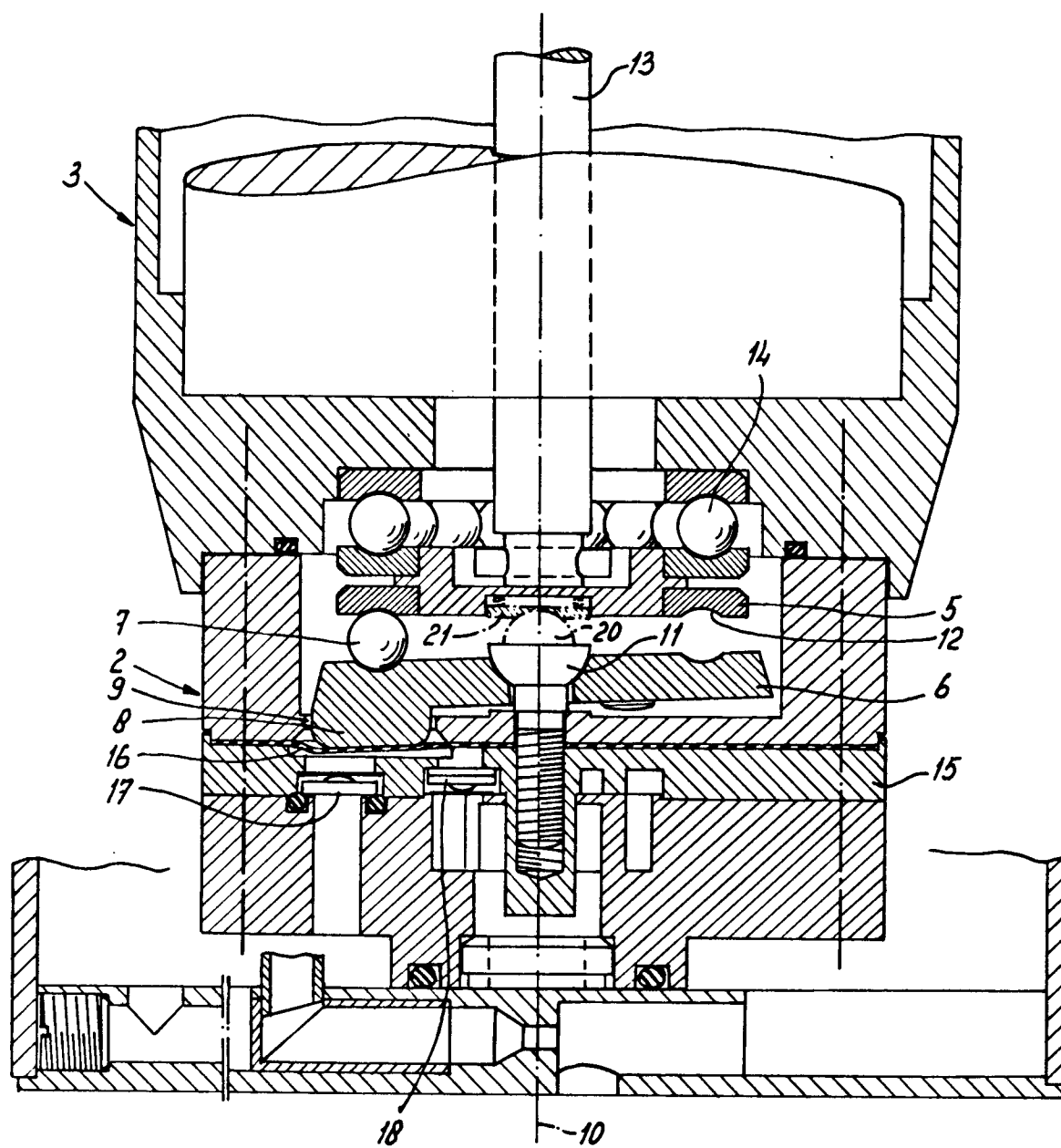


fig-2





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EUROPEAN SEARCH REPORT

Application Number

EP 91 20 1400

DOCUMENTS CONSIDERED TO BE RELEVANT

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
D,A	US-A-2 402 244 (ELBERTY) * column 2, lines 17 - 39; figure 1 * - - -	1-5,8-10	F 04 B 43/02 F 04 B 1/14
A	DE-A-2 944 652 (ROSER) * page 10, paragraph 2 - page 11, paragraph 1; figures 1, 2 * - - -	1,4	
A	EP-A-0 297 731 (HARTLEY) * column 4, lines 19 - 35; figure 1 * - - -	1,9	
A	DE-C-468 113 (BARMER MASCHINENFABRIK A.G.) * page 1, lines 41 - 69; figure * - - - - -	1,10	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. Cl.5) F 04 B
Place of search		Date of completion of search	Examiner
The Hague		13 August 91	VON ARX H.P.
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