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Hansen

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[54] **LIQUID PUMP, PARTICULARLY A FUEL-OIL PUMP**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **417/357,** 418/61, 418/161
[51] **Int. Cl.** **F04b 17/00**
[58] **Field of Search** 418/166, 61; 417/357

[56] **References Cited**

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Primary Examiner—C. J. Husar

[57] **ABSTRACT**

The invention relates to a pump assembly which may be utilized as a fuel oil pump and which has constructional features which minimize the possibility of air binding. The assembly has a rotating casing member in which pumping elements are housed and which is surrounded by a casing so as to form a suction chamber which surrounds the rotating casing member. The rotation of the casing member causes liquid in the suction chamber to also rotate and form a ring of liquid. The rotating casing member has an eccentrically positioned inlet which passes through the ring of liquid so formed once during each cycle of rotation and this insures the introduction of liquid, as distinguished from only air, into the inlet.

3 Claims, 2 Drawing Figures

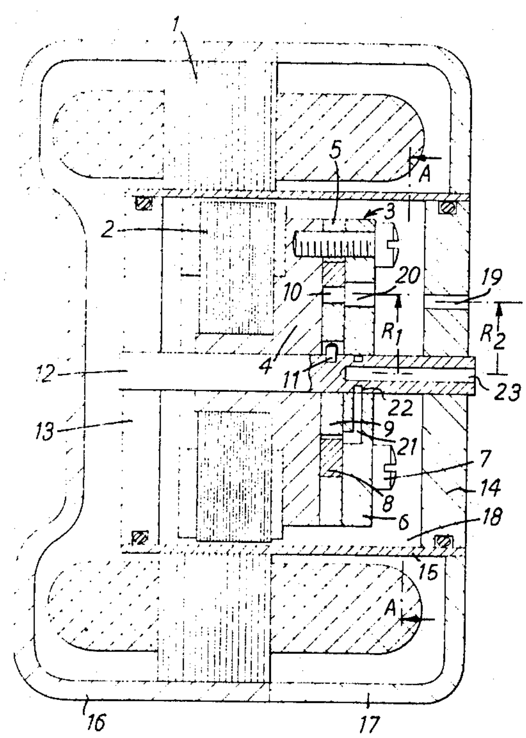

FIG. 1.

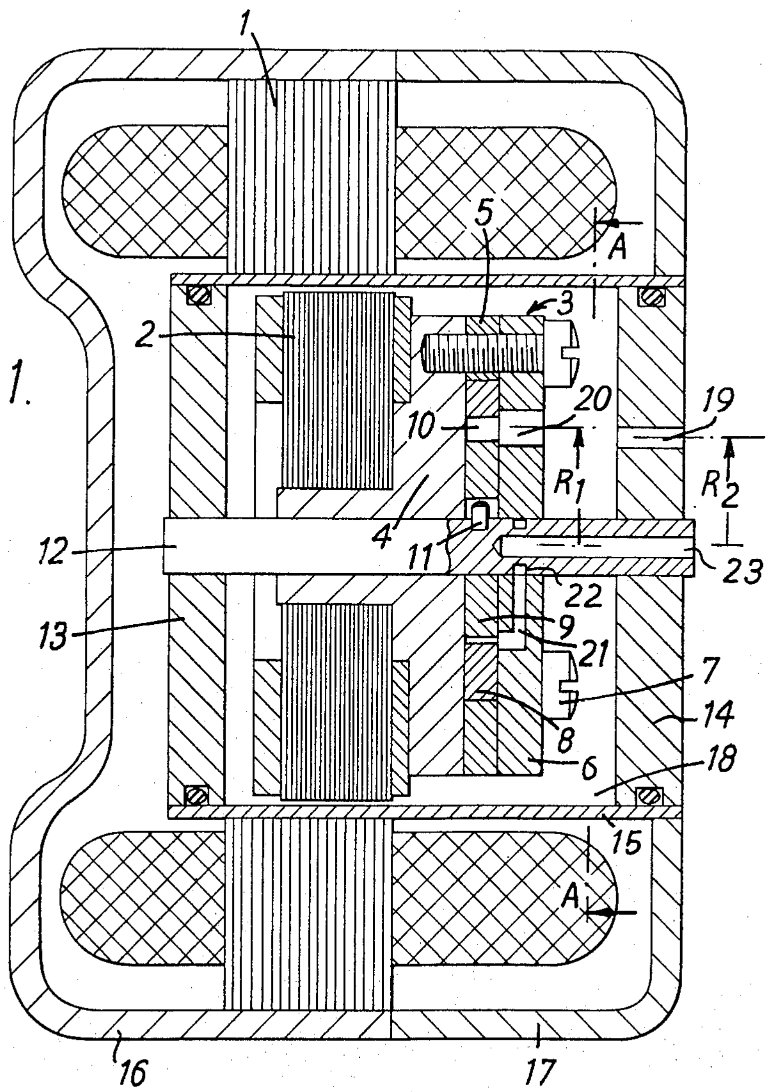
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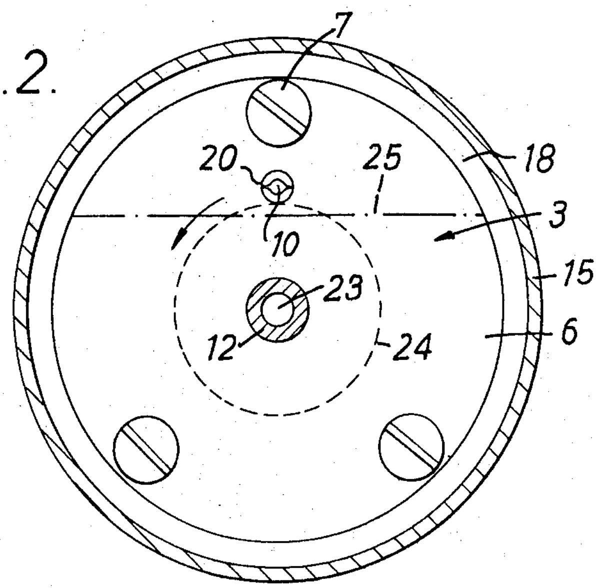
FIG. 2.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LIQUID PUMP, PARTICULARLY A FUEL-OIL PUMP

The invention relates to a liquid pump, particularly a fueloil pump, having a suction chamber on the input side and an eccentric intake orifice in the pump casing.

With many pump systems it is not possible to prevent the liquid from picking up air. This air tends to collect in the suction chamber. If the air-cushion becomes too great, the pump no longer delivers liquid, but air. The situation is particularly aggravated if at the moment of start-up there is so much air in the suction chamber that the intake orifice is no longer covered by liquid, since then no oil is delivered during the start-up period and thus there is possibility of the full delivery pressure not being reached.

A further difficulty is that liquid pumps are mounted in a very large variety of positions. If the pump has an eccentric intake orifice, permitting the use of a relatively short suction passage which therefore offers little resistance to flow, then there exists the possibility that the intake orifice will be disposed at the top in the case of a pump having a horizontal shaft. This means that even when only a little air passes into the suction chamber, the intake orifice lies entirely above the level of the oil. It is therefore known to provide the intake orifice in the middle or at least in the middle zone of the pump in order to ensure that the intake orifice is covered with liquid at the moment of start-up, irrespective of the position in which the pump is installed.

It is also known practice continuously to deliver part of the air with the liquid during operation of the pump. For this purpose a plate containing openings or passages is fitted on the input side of the intake orifice, some of these openings or passages terminating in the liquid chamber and some in the air chamber. This arrangement however increases the resistance to suction.

The object of the invention is to provide a liquid pump of the initially described kind which enables an eccentric intake orifice to be used but which nevertheless permits the full delivery pressure to be reached in a short start-up period and in any position in which the pump is installed, and which also makes it possible for the intake opening to terminate directly in the suction chamber while achieving proper discharge of air during normal operation of the pump.

According to the invention, this object is achieved by providing, in the suction chamber, a circulating element which rotates the liquid contained in the suction chamber and which rotates with the pump drive.

The liquid caused to rotate forms a circle inside which air is located. Generally, an annular intermediate zone containing a mixture of air and liquid is also formed. If the radius of the air chamber or of the transition zone exceeds the eccentricity of the intake orifice, then the pump continuously draws off some air in addition to the liquid. The position in which the pump is installed does not affect the situation since even when the eccentric intake orifice is not covered at all by liquid at the moment of start-up, then after a few revolutions of the circulating element the liquid is distributed in such manner that the pump can take in liquid.

In a preferred embodiment, the circulating element is constituted by the pump casing. This results in a very simple construction. Furthermore, the intake orifice moves over a circular path. Even if it should lie in the air chamber during start-up of the pump, then after the casing has rotated over a short distance the intake orifice becomes immersed in the liquid and the pump can start to deliver.

It is also expedient if the inlet orifice to the suction chamber has a smaller radial clearance than the intake orifice. In an arrangement of this kind the liquid is driven by centrifugal force even when on its way from the inlet orifice to the intake orifice. The pump therefore acquires a greater suction capacity.

Additionally, the pump casing may be profiled to improve rotation. For example, screws which are otherwise sunk into the casing may project by their heads into the suction chamber.

Advantage accrues if the suction chamber extends in known manner over the periphery of the pump casing. Then the peripheral surface of the pump casing also contributes towards rotating the liquid in a positive manner.

In another arrangement, the rotor of the electric drive motor may be part of the pump casing and the latter may be mounted on a stationary shaft upon which a gearwheel of the pump is secured. This results in a pump of very simple construction.

In particular, the suction chamber may be bounded at its ends by two walls in which the shaft is held, and along its periphery by a wall extending through the gap between the rotor and stator of the motor. In this way, there is provided a very large circulating element which quickly sets the liquid in rotation. Furthermore, the rotating parts of the motor are cooled by the liquid.

Also, the pressure duct can extend outwardly through the shaft. This obviates the need for a gland between the motor and the pump.

The invention will now be described in more detail by reference to an embodiment illustrated partially schematically in the drawing, in which:

FIG. 1 is an axial section through a liquid pump according to the invention, and

FIG. 2 is a cross-section along the line A—A of FIG. 1.

The liquid pump embodies a drive motor comprising a stator **1** and a rotor **2**. The latter is part of the pump casing **3** since a rotor element **4**, a ring **5** and an end plate **6** are joined together by means of screw-bolts **7**. The ring has an eccentric opening in which a toothed ring **8** rotates. This, together with a toothed wheel **9** constitutes pump chambers **10** which intermittently increase and decrease in size. The toothed wheel **9** is secured to a shaft **12** by means of a pin **11** so that it cannot rotate relatively to the shaft which is secured in two end walls **13** and **14**. The end walls are interconnected by a peripheral wall **15** which extends through the gap between the stator and the rotor of the motor. The pump is also enclosed by two casing parts **16** and **17**.

The walls **13, 14** and **15** define a suction chamber **18**. This has an inlet orifice **19**. The liquid contained in the suction chamber flows around the entire pump casing **3** and also flows over the rotor **2**. Provided in the end plate **6** is an off-centre intake orifice **20** which is located at the same level as the chamber **10** formed by teeth. An outlet passage **21** in the end plate **6** leads by way of an annular groove **22** to an axial bore **23** in the shaft **12** through which bore pressurized liquid can be drawn off. The radius R_1 of the intake orifice **20** is greater than the radius R_2 of the inlet orifice **19**.

When the pump is set in motion, the casing **3** rotates in the suction chamber **18**. The oil contained therein is forced outwards by centrifugal force, the entire surface of the pump casing **3**, including the profiled portions formed by the heads **7** of the screws, becoming effective. The air contained in the suction chamber passes into the interior of the circle of liquid. As soon as the interface between the air and the liquid moves across the circle **24**, part of the air is discharged through the suction orifice **20** with the liquid. Since in practice there is no well-defined interface between the liquid and the air, but a transition zone in which there is a mixture of air and liquid, air is discharged in a still more uniform manner.

If it is assumed that the intake orifice **20** is positioned at the uppermost point at the moment of start-up and the suction chamber **18** contains so much air that an interface occurs **25**, then the intake orifice **20** moves to below the level of the liquid even after the pump casing **3** has rotated over a short distance, and the pump begins to deliver liquid.

However, even in the case in which the intake orifice **20** remains stationary and only the liquid is caused to rotate, the circle of liquid shown in the drawing would be created after a few revolutions and this would ensure the supply of liquid to the intake orifice **20**.

I claim:

1. A pump assembly comprising a casing member rotatable about a fixed axis, a casing surrounding said casing member and forming a suction chamber therebetween, said casing member having an inlet eccentrically spaced relative to said axis, said casing has an intake orifice eccentrically spaced relative to said axis, said inlet being spaced a greater distance from said axis than said intake orifice.

2. A pump assembly according to claim **1** wherein said casing member has a profiled surface to aid the rotation of liquid in said suction chamber.

3. A pump assembly according to claim **1** including a centrally disposed shaft in fixed relation to said casing, an electric drive motor having a rotor and a stator, said rotor being attached to said casing for rotation therewith.

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