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Petersen et al.

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

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[58] Field of Search.....**418/15, 39, 166, 170, 171**

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[57] **ABSTRACT**

The invention relates to a pump of a type commonly used for oil burners having kidney shaped inlet and exhaust passages formed in a wall adjacent the pumping elements of the pump. Based on the discovery that air pockets are formed in the suction inlet when there is an appreciable decrease in the velocity of the liquid being sucked through the inlet passage or passages, inlet passage means are provided having nondecreasing cross sections so as to maintain nondecreasing velocities of liquids flowing therein.

3 Claims, 2 Drawing Figures

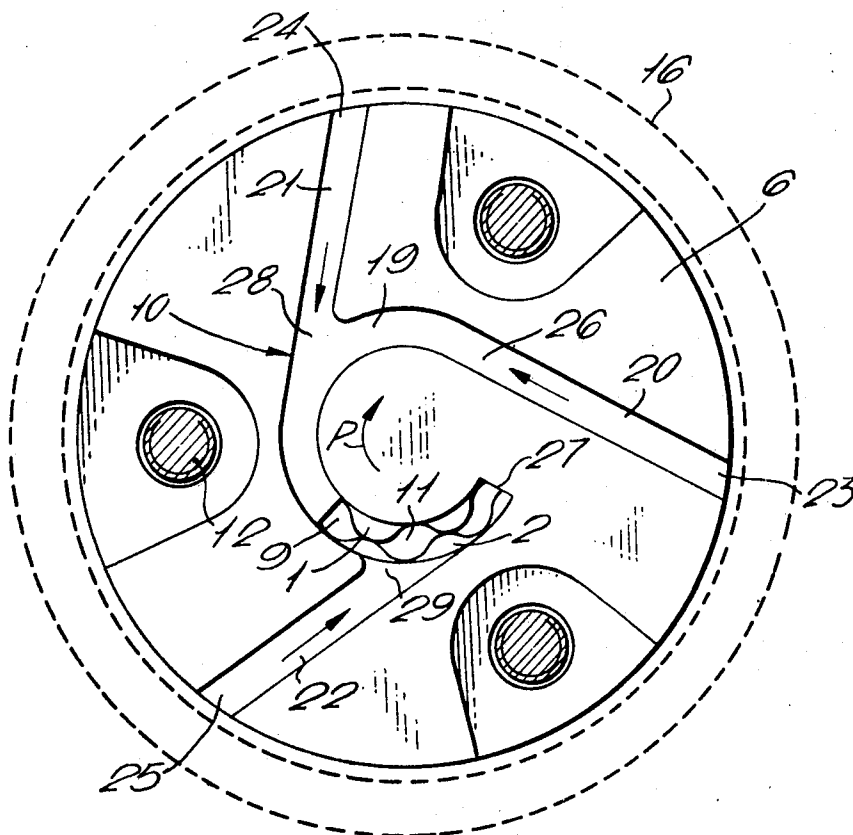


Fig. 1.

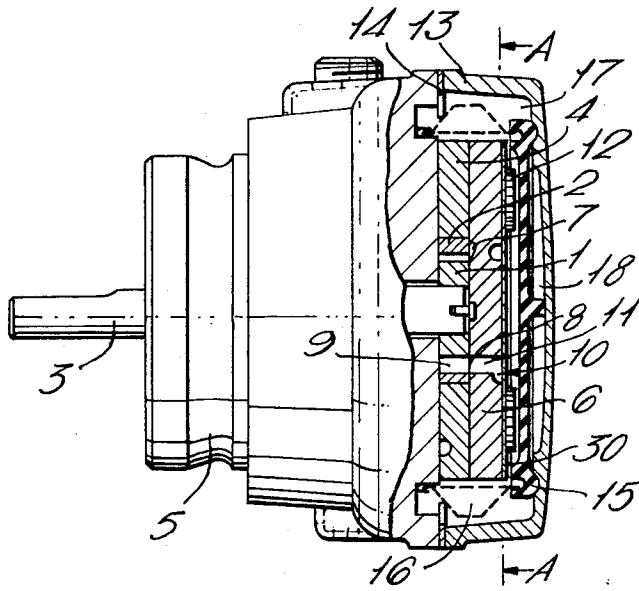
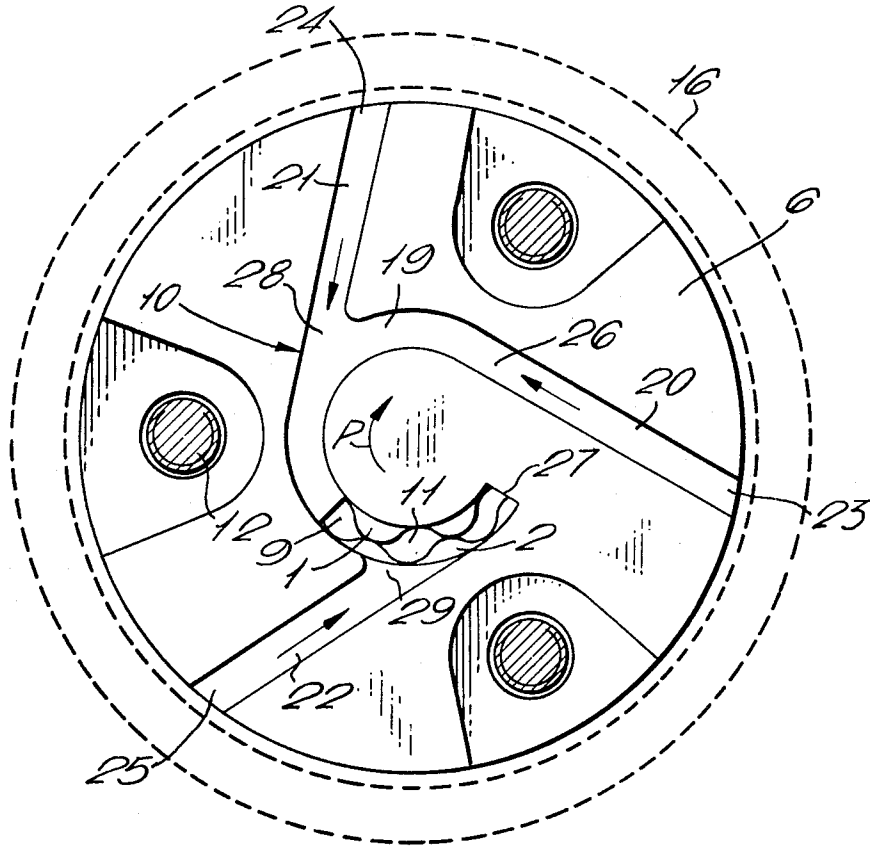


Fig. 2.



LIQUID PUMP, PARTICULARLY A FUEL-OIL PUMP

The invention relates to a liquid pump, particularly a fuel oil pump, in which a suction system is provided in front of the intake orifice, said system comprising at least two passages extending inwardly from a suction chamber and, optionally, an ante-chamber at their ends.

With liquid pumps, and particularly fuel-oil pumps, there exists the problem of air being separated in the suction chamber. If the intake orifice of the pump is disposed in this air-pocket, the pump delivers only air for a time. This leads to cavitation noises in the gearwheels of the pump and to numerous other disadvantages in the system connected on the output side of the pump.

A liquid pump is known in which a suction system is provided in front of the intake orifice, which system is formed between the end wall of the pump and a cover-plate applied to said end wall. The suction system consists of three passages which extend radially inwards and are offset from each other at the same angular distances, these passages terminating at a circular ante-chamber, which in turn communicates with the off-center suction orifice. In this arrangement, whenever air is drawn in through one of the passages, oil is drawn in through at least one of the other passages, so that there never occurs an operating condition in which the pump delivers air exclusively. In this way, noise can be very considerably reduced. A further advantage resides in the fact that the pump can be installed in virtually any position, if the pump-shaft is approximately horizontal, since even when the pump housing is turned, the mouth of at least one passage is submerged in the oil and the mouth of at least one further passage is immersed in any air that may be present.

It has been found however that noise can only be partially eliminated by the uniform discharge of air. In certain operating conditions, there arise oscillations of such low frequency that even mechanical oscillations can occur in the connected pipework. The object of the invention is to eliminate as far as possible the cause of these oscillations and to suppress noise.

In the case of the initially described liquid pump, this object is achieved in accordance with the invention by so dimensioning the cross-sections of the suction system that the drawn-in liquid undergoes no appreciable reduction in velocity as compared with the velocity at which it enters the passages.

This arrangement is based on the surprising discovery that the troublesome noise and oscillations are caused by the formation of air-pockets which are suddenly created in the drawn-in liquid when the latter undergoes an appreciable reduction in velocity. This is the case for example when the liquid-air mixture passes through a small inlet orifice into a passage of greater cross-section, or when passages of limited cross-section terminate in an ante-chamber of large cross-section. If however the mean velocity of the liquid containing air is not appreciably reduced as compared with the velocity upon entry, and if said mean velocity even rises, then no air-separation occurs and no bubbles or pockets are formed. If however this reason for the oscillations is not present, the associated noise or mechanical oscillations do not occur either.

A number of constructional steps are available for putting the principle of the invention into effect, and some of these will now be described.

Advantageously, the ante-chamber is constituted by a passage which takes the form of part of an annulus. Compared with an ante-chamber of circular form, the annular form offers the advantage that the cross-section is limited. The form consisting of part of an annulus enables a definite direction of flow and a definite velocity to be imparted to the liquid.

It is particularly advantageous if the intake opening is located at the end of the passage of part-annular form. The liquid then flows through said passage to its end and is there received by the suction orifice. No reversal of direction or stagnation are therefore to be expected.

Also of particular advantage is an arrangement of the suction system in which the direction of flow in the part-annular passage is the same as that in which the pump rotates. In this way, the change in the direction of flow of the liquid is kept at a low level; in particular, the passage of part-annular form can run very closely alongside the pump, e.g. in the end-plate of the pump itself.

It is furthermore expedient if the passages enter the part-annular passage tangentially. This prevents a sudden change of direction in the flow of the liquid and thus the associated change in velocity. Advantageously, the first passage enters the part-annular passage at its beginning and the second passage enters at a point before the intake orifice. The increase in velocity occurring near the second passage-mouth is permissible.

In a preferred embodiment, the suction orifice is of arcuate form, and a further passage terminates at a point roughly midway along the arc. The arcuate form of the suction orifice results in a large cross-section which enables the liquid to pass into the pump chambers with relatively little flow-resistance. The large cross-section however means that a drop in pressure and velocity would occur in the part-annular passage towards the end of the arc. This is compensated by the liquid passed in by the further passage. Manufacture is very considerably simplified by the shape of the suction orifice being substantially the same as a portion of the part-annular passage, and by its length being substantially the same as the length of the suction groove normally present in geared pumps.

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

FIG. 1 shows part of a longitudinal section through a fuel-oil pump in accordance with the invention, and

FIG. 2 shows, on a greater scale, a plan view of the end-plate of the pump on the line A—A of FIG. 1.

The fuel-oil pump illustrated has an externally toothed inner wheel 1 and an internally toothed ring 2 having one tooth more than the toothed wheel 1. The toothed wheel 1 is driven by a shaft 3. The toothed ring 2 can rotate freely in the circular cut-away portion in a pump plate 4. The pump is fitted at the end-face of a housing 5, which contains a stuffing box for the shaft 3 and further devices (valves, connections etc.) suitable for operating a fuel-oil pump. The parts 1, 2 and 4 are covered by an end-plate 6, which has an arcuate pressure groove 7 and suction groove 8 normal to geared pumps. The end-plate is provided on its opposite side

with a suction system 10 which is connected to the pump through an intake orifice 11. The suction system 10, which will be described in more detail in connection with FIG. 2, is closed by a cover plate 30. The cover-plate 30, the end-plate 6 and the pump plate 4 are secured to the housing by means of screw-bolts 12.

The entire arrangement is covered by a cover-plate 13 which bears against the housing 7, a sealing ring 14 being interposed; the cover-plate 13 is secured by means of screw-bolts not illustrated. The cover-plate 13 also presses a filter ring 16 against the housing, a rubber disc 15 being interposed, and the filter ring thus surrounds the pump arrangement. The filter ring is contained in a suction chamber 17 which is connected to the oil-feed system in such manner that the drawn-in oil arrives outside the filter ring and can enter the suction system 10 inside the filter ring. An air-filled cavity 18, capable of damping the pressure oscillations in the oil-filled part, is formed between the rubber disc and the cover-plate.

The suction system 10 is shown in more detail in FIG. 2. It consists of a part-annular passage 19 and three passages 20, 21 and 22 which are connected tangentially to the part-annular passage 19 and extend inwards from orifices 23, 24 and 25 respectively on the outer periphery of the end-plate 6. The passages are formed by channels in the end-plate 6 which channels are closed off by the cover-plate 30 as far as the orifices 23 - 25 and the intake orifice 11. The part-annular passage 19 begins at the mouth 26 of the first passage 20; its end 27 coincides with the intake orifice 11. The mouth 28 of the second passage 21 is located between the mouth 26 and the intake orifice 11. The mouth 29 of the third passage 22 is located midway along the arcuate intake orifice 11. In the present embodiment, the intake orifice 11 is formed by a hole in the suction groove 8 of the pump extending to the part-annular passage 19. The shaft 3 rotates in the direction in-

dicated by the arrow P.

Assuming that the end-plate 6 is fitted in the position illustrated in FIGS. 1 and 2, then this ensures that oil is introduced into the part-annular passage 19 through the passages 20 and 22, and oil or an oil-air mixture is introduced therein through the passage 21. The velocity of flow remains substantially the same as the velocity of entry into the passages or increases in the zone between the mouth 28 and the intake orifice 11. Rotation of the pump housing through 90° or 180° is permissible, since one of the passages 20, 21 and 22 always projects so far upwards that air together with oil can be drawn in through it.

We claim:

1. A pump comprising a casing, fluid pumping elements rotatably mounted in said casing and having a suction inlet region, wall means adjacent said fluid pumping elements and having a recess adjacent to and in fluid communication with said suction inlet region, said casing defining a suction chamber, passage means in said wall means extending from said suction chamber to said recess, said passage means having substantially nondecreasing cross sections throughout to maintain nondecreasing velocities of fluids travelling from said suction chamber to said suction inlet region said passage means including a partial annular passage and three linearly extending sections in tangential relation thereto, said linearly extending sections being symmetrically arranged in equiangularly spaced relation to each other.

2. A pump according to claim 1 wherein said recess and said partial annular passage are in overlapping relation to each other.

3. A pump according to claim 1 including a drive shaft connected to one of said elements, said partial annular passage being positioned so that the fluid flow therethrough is in the same direction of rotation as said drive shaft.

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