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VANE-TYPE ROTARY PUMP

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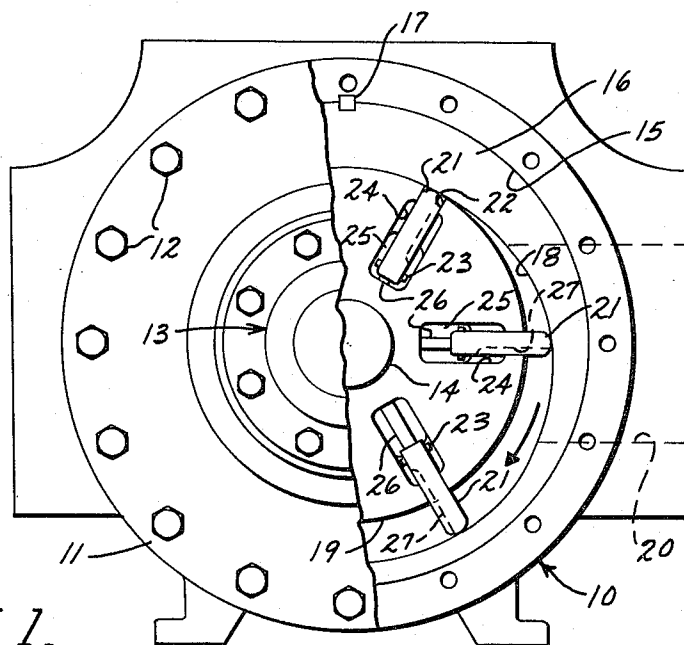


Fig. 1.

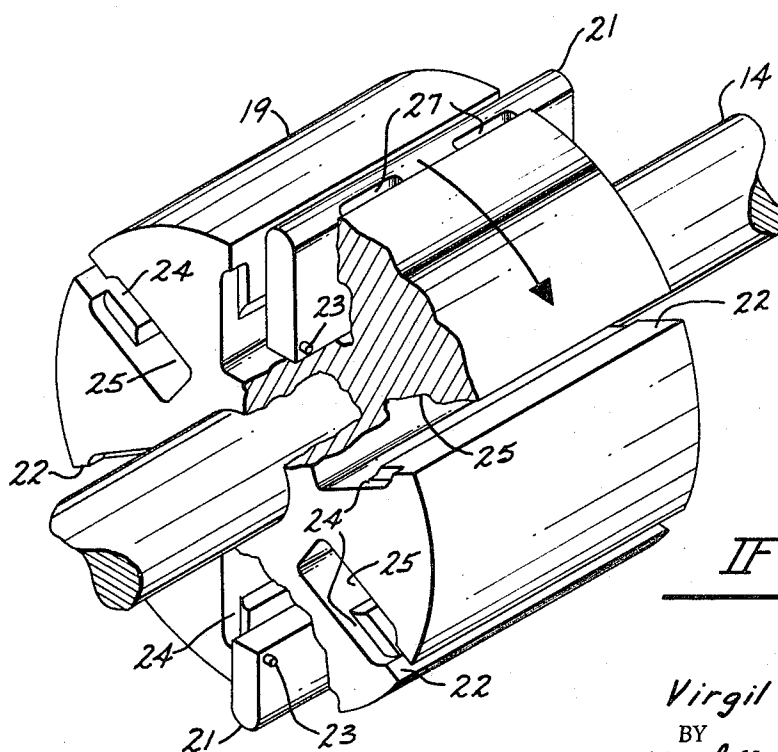


Fig. 2.

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1

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VANE-TYPE ROTARY PUMP

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3 Claims. (Cl. 103-136)

This invention relates to a vane-type rotary pump which is suitable for handling liquids containing abrasive materials.

Rotary positive displacement pumps of the vane type are capable of delivering large volumes of liquid under relatively high pressure and are widely used. However, difficulty is encountered when such pumps are used to handle liquids containing abrasive materials, because the abrasive materials cause the vanes to wear down gradually as they wipe around the periphery of the pump chamber. Also, in the case of a rotary vane pump in which a stationary cam is used to control the movement of the vanes, the wear caused by abrasive materials at the points where the vanes contact the stationary cam causes loss of control of the movements of the vanes.

The principal object of the invention is to provide a vane-type rotary pump by means of which liquids containing abrasive materials can be handled efficiently during long periods of service without serious damage to the pump.

More specific objects and advantages are apparent from the following description, in which reference is had to the accompanying drawings illustrating a preferred embodiment of the invention.

FIG. 1 is a side elevation of a pump embodying the invention, with a portion of the side plate broken away.

FIG. 2 is a perspective view of the rotor of the pump.

These specific drawings and the specific description that follows are intended to disclose and illustrate and not to limit the invention.

The pump shown in the drawings comprises a casing 10 to which a pair of side plates 11 are secured by means of screws 12. Mounted on each of the side plates 11 is a bearing 13 suitable for supporting a shaft 14 by means of which the pump is driven. The interior of the housing 10 consists of a circular cylindrical bore 15 in which is fitted an insert 16 that is held in proper position by a key 17. The interior of the insert 16 constitutes a rotor chamber 18. A circular cylindrical rotor 19 is fixed upon the shaft 14.

As shown in FIG. 1, the upper portion of the chamber 18, consisting of approximately one-sixth of the periphery of the chamber, fits closely around the periphery of the rotor 19. Thus this upper portion of the chamber 18 is concentric with the axis of the shaft 14. The lower one-sixth of the chamber 18 also is concentric with the axis of the shaft 14, but at a larger radius. An inlet port 20 extends through the housing 10 and the insert 16 to communicate with the chamber 18, and a diametrically opposed outlet port (not shown) extends through the housing 10 and the insert 16 on the opposite side of the pump.

Each of six vanes 21 has a sliding fit in a radial slot 22 provided in the rotor 19. At the two inner corners of each vane, two pins 23 are fixed in two holes drilled transversely through the vane. Adjacent to each end of each vane, a groove 24 is formed in each side of the slot 22 to provide clearance for the corresponding pin 23.

Each of the slots 22 terminates in a longitudinal passage 25, to provide clearance for the pins 23 so as to permit each vane to be disassembled by removing it longitudinally from the rotor 19.

Three rods 26 are slidably mounted in three spaced holes which are drilled through the rotor 19 and the

2

shaft 14 to connect each pair of diametrically opposed passages 25.

During operation of the pump the vanes 21 are held outward by centrifugal force and wipe around the periphery of the chamber 18. As each vane traverses the upper one-sixth of the chamber 18, it remains substantially stationary relative to the rotor, in its innermost position. Then as the vane travels downward across the inlet port 20, it moves radially outward relative to the rotor while continuing to wipe against the periphery of the chamber 18 and pushing liquid ahead of it. As each vane travels across the lower one-sixth of the chamber 18, it remains stationary relative to the rotor 19, in its outermost position. Then as the vane travels upward across the outlet port, the vane moves back to its innermost position.

It will be evident upon inspection of FIG. 1 that the grooves 24 provide clearance for the pins 23 so as to permit the vanes 21 to move farther outward relative to the rotor as the vanes are worn down by abrasive materials in the liquid. Thus as the vanes are worn down, they continue to wipe around the periphery of the chamber 18 so as to maintain the efficiency of the pump.

It will be noted also that the grooves 24, which extend radially outward to permit the vanes 21 to move outward as they are worn down, terminate short of the periphery of the rotor 19. Thus when a vane becomes fully worn, its pins 23 will contact the outer ends of the grooves 24 each time the vane travels through the lower portion of the chamber 18. When the pins 23 thus strike against the outer ends of the grooves 24, they cause a clicking noise which warns the operator that the vanes are worn out and need to be replaced.

The pins 23, which are accommodated by the grooves 24, perform an important function. Without the pins 23, a vane would wear down until it would finally leave the slot 22 and fall into the chamber 18, thus causing serious damage to the pump.

Until the vanes become so severely worn that the pins 23 begin to strike against the outer ends of the grooves 24, the vanes 21 are self-compensating for wear and continue to wipe around the periphery of the chamber 18 under the influence of centrifugal force. When the time comes to overhaul the pump by replacing the vanes 21, a worn insert 16 also may be replaced.

The rods 26 function to maintain the vanes 21 in proper positions relative to one another during start-up of the pump, although the action of the rods 26 becomes less precise as the vanes wear down.

As seen in FIG. 2, the grooves 24 are only wide enough to accommodate the pins 23. The main portion of each slot 22 extends unbroken from the passage 25 to the periphery of the rotor 19 and thus provides firm lateral support for the vane.

A pair of shallow grooves 27 are provided on the front surface of each vane to permit liquid to flow inward past the vane as the vane is moving radially outward relative to the rotor 19, so as to prevent the formation of a vacuum which would impede the outward movement of the vane.

Having described the invention, I claim:

1. A wear-compensating vane-type rotary pump comprising, in combination, a rotor chamber having a peripheral inlet, and a peripheral outlet angularly displaced from the inlet, a rotor eccentrically mounted in the chamber, having radial slots, vanes which are radially movable in the slots over a distance sufficient to permit the vanes to run in contact with the periphery of the chamber, and which after being shortened substantially by wear are radially movable in the slots over a further substantial distance sufficient to permit the vanes to be held in contact with the periphery of the chamber by centrifugal force,

3

stops on the vanes for limiting the furthestmost distance to which the vanes are movable after they have been shortened substantially by wear, and a shoulder on the rotor located to engage each of such stops upon outward movement of the vane to such furthestmost distance, the initial length of the vanes being great enough so that after being moved to such furthestmost distance they are still firmly supported in the slots.

2. A wear-compensating vane-type rotary pump according to claim 1 wherein the stops consist of lateral projections adjacent the inner ends of the vanes, and the rotor provides clearance for free radial movement of the projections within the limit determined by the shoulders on the rotor.

4

3. A wear-compensating vane-type rotary pump according to claim 2 wherein each of the slots terminates at its inner end in an axial passage which provides clearance for the projections on the vane so as to permit the vane to be disassembled by removing it axially.

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