

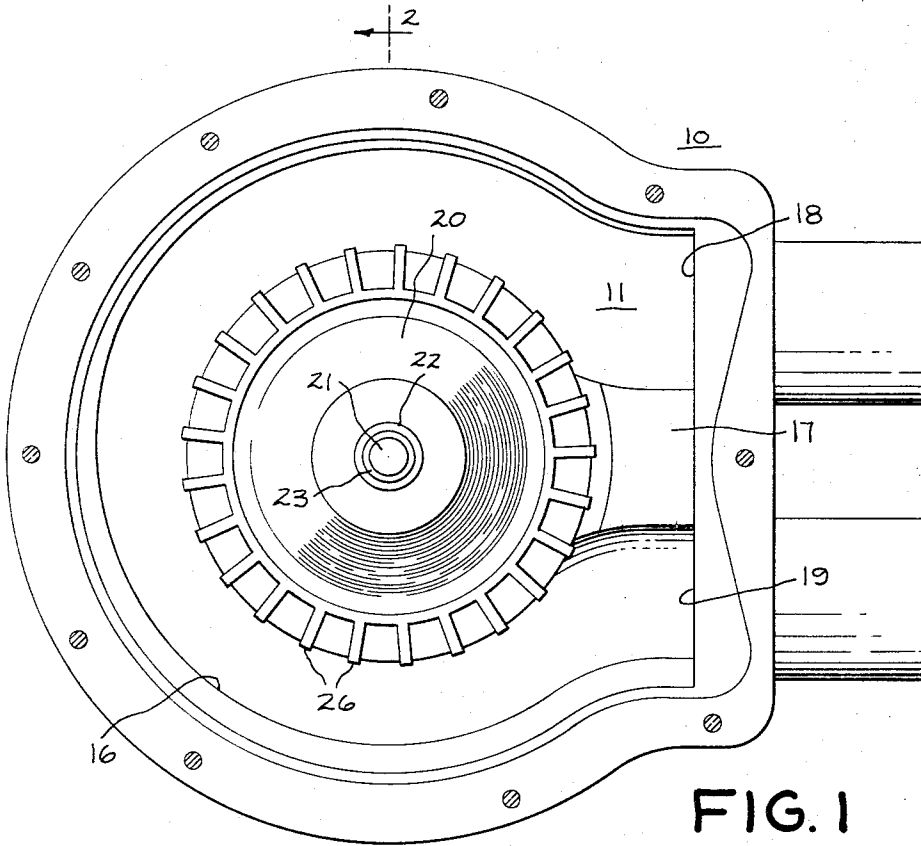
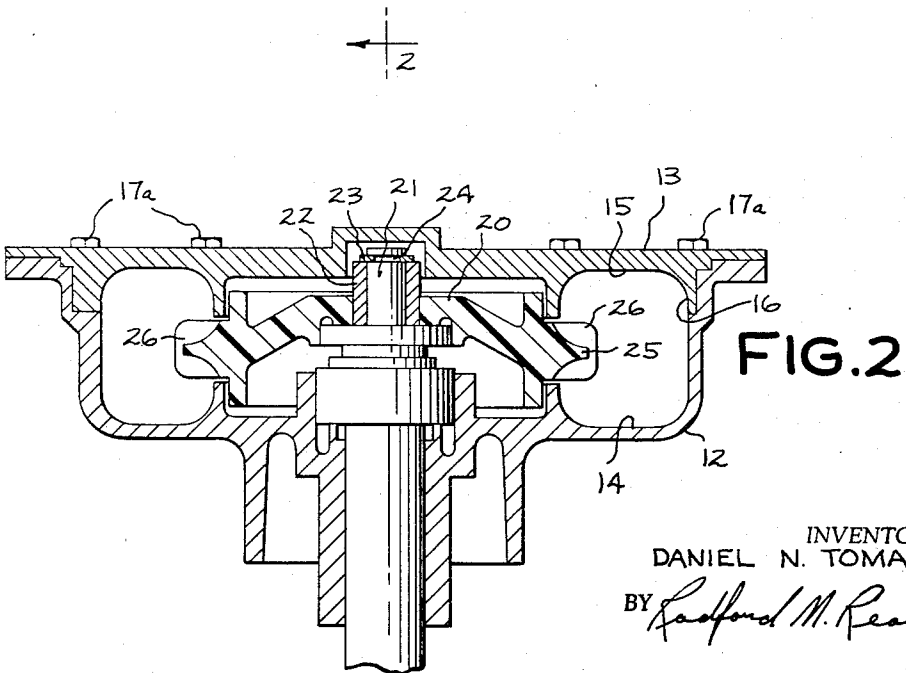
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TURBINE PUMP

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TURBINE PUMP

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ABSTRACT OF THE DISCLOSURE

A turbine pump is provided with a generally annular chamber having a pair of openings for ingress and egress of fluid. A turbine impeller is mounted for reversible rotation within the chamber to pump fluid in one opening and out the other. The clearance between the impeller and the circumferential wall of the chamber is at a minimum adjacent one opening and continuously increases toward the other opening.

Turbine pumps move a fluid along a generally annular path within a casing, from an inlet to an outlet. The direction of pumping may be reversed simply by reversing the direction of rotation of the impeller. In many applications of reversible turbine pumps it is desirable for the pump to have a higher flow rate and head in one direction than in the other; however, the usual turbine pump delivers essentially the same flow rate and head in both directions of rotation. Prior art means for altering the flow rate head for different directions of impeller rotation have been costly to incorporate, complicated in operation, and often subject to failure.

An object of this invention is to provide an improved turbine pump having different flow rates, dependent upon the direction of impeller rotation.

Another object of this invention is to provide such a pump which requires no extra parts.

Briefly stated, in accordance with one aspect of my invention, I provide a turbine pump wherein the casing forms a generally annular pumping chamber and defines a pair of openings in the periphery of the chamber for ingress and egress of fluid. A turbine impeller is mounted for reversible rotation within the chamber to pump fluid in one opening and out the other opening. The casing includes a circumferential wall for the chamber which is spiral in shape, being closest to the impeller in the area adjacent one opening and progressively more distant from the impeller toward the other opening.

With this structure, when the impeller is driven in a direction to pump fluid out of the opening adjacent which the circumferential wall is closest to the impeller the flow rate and head will be substantially less than when the impeller is rotated in the other direction, to pump fluid out of the opening adjacent the area in which the circumferential wall is farthest from the impeller.

The subject matter which I regard as my invention is particularly pointed out and distinctly claimed in the concluding portion of this specification. The invention itself, however, both as to organization and method of operation, together with further advantages thereof, may best be understood by reference to the following description taken in conjunction with the accompanying drawing.

In the drawing, FIGURE 1 is a plan view, partly broken away of one embodiment of the present invention; and FIGURE 2 is a sectional elevational view taken along line 2—2 of FIGURE 1.

Referring now to the figures of the drawing it may be seen that a pump embodying the present invention has a casing 10 which defines a generally annular pumping chamber 11. The casing 10 may be formed from a body element 12 and a cover plate 13 to facilitate assembly and any needed maintenance. Body element 12 and cover

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plate 13 form spaced side walls 14 and 15 respectively for the annular pumping chamber 11. Additionally, they cooperate to form a generally annular, circumferential wall 16 so that the circumferential wall 16 together with the side walls 14 and 15 form the annular pumping chamber 11. Body element 12 and cover plate 13 are held in assembled relationship by any suitable means such as bolts 17a. A pair of openings 18 and 19 are provided for ingress and egress of fluid and a dam 17 is provided between the openings to prevent leakage of fluid therebetween.

Within the casing, a turbine impeller 20 is mounted for reversible rotation about the axis of a shaft 21 by means of a collar 22 and is held on the shaft by split ring 23 received in a groove 24 in the shaft 21. The impeller 20 is generally disk-shaped, with a circumferential web 25. A series of spaced, radially disposed peripheral vanes 26 are formed at the edge of the impeller and extend from the web 25. Each vane 26 includes substantially identical, opposed fluid impelling faces for pumping fluid in either direction of impeller rotation.

It will be noted that the cross-sectional area of the generally annular pumping chamber is different adjacent each of the openings 18 and 19. It has its smallest dimension in the area adjacent opening 19 and becomes progressively larger toward opening 18. This results from the fact that the general annular circumferential wall 16 is spiral in shape, being closest to the impeller 20 in the area adjacent the opening 19 and becoming progressively more distant from the impeller toward opening 18. The change in the cross-sectional area of the pumping chamber is most important to the performance of my new and improved turbine pump.

As the impeller is rotated within the pumping chamber 11 the vanes 26 provide a shearing action on the fluid within the chamber and cause the fluid to execute a toroidal or vortex type flow in which fluid is forced outwardly by one vane, curves around in its flow, returns to the impeller and is forced outwardly again by the next vane. In all turbine pumps there is some tendency for a portion of the fluid to slip, that is not to follow the vortex or toroidal flow. This results from the fact that the turbine impeller vanes occupy only a small portion of the cross-sectional area of the pumping chamber and thus directly contact only a relatively small portion of the fluid.

When the impeller 20 of my new and improved pump is rotating in the counterclockwise direction (as seen in FIGURE 1) the vortex flow is continuously trying to force the fluid through progressively smaller and smaller areas. This enhances the tendency of the fluid to slip and thus reduces the effectiveness of the pump, that is, less fluid flow and head will be obtained. On the other hand, when the impeller is rotating in the clockwise direction as seen in FIGURE 1) the vortex flow created by the impeller directs the fluid into a progressively increasing area. Therefore, there is less tendency for the fluid to slip and the effectiveness of the pump is substantially greater than in the counterclockwise direction so that a larger flow rate and head are obtained.

The progressive alteration of the cross-sectional area of annular pumping chamber 11 may be accomplished in a number of ways. For instance, the spacing between side walls 14 and 15 may be varied or the impeller may be mounted eccentrically within the chamber, as well as providing the spiral circumferential wall described herein. Additionally a combination of these configurations could be used. However, a spiral circumferential wall is the preferred means for obtaining this progressively increasing cross-sectional area from one of the pump openings to the other.

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Thus, while this invention has been described with reference to a particular embodiment, it is to be understood that numerous modifications may be made therein by those skilled in the art without departing from the spirit of my invention. It is, therefore, the purpose of the appended claims to cover all such variations as come within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A turbine pump comprising a casing having spaced apart side walls and a generally annular circumferential wall defining a generally annular pumping chamber, said casing further defining a pair of openings for ingress and egress of fluid, and a turbine impeller mounted for reversible rotation within said chamber, said impeller including radially-disposed peripheral vanes, each vane having substantially identical, opposed fluid impelling faces for pumping fluid in one opening and out the other opening dependent upon the direction of impeller rotation, the clearance between said impeller and said circum-

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ferential wall being a minimum the area adjacent one of said openings and continuously increasing toward the other of said openings so as to form a generally spiral fluid flow path, the fluid flow for one direction of impeller rotation and toward said other opening being of increased rate and head with respect to the rate and head for fluid flow for the other direction of impeller rotation and towards said one opening.

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