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TURBINE PUMP

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FIG. 1

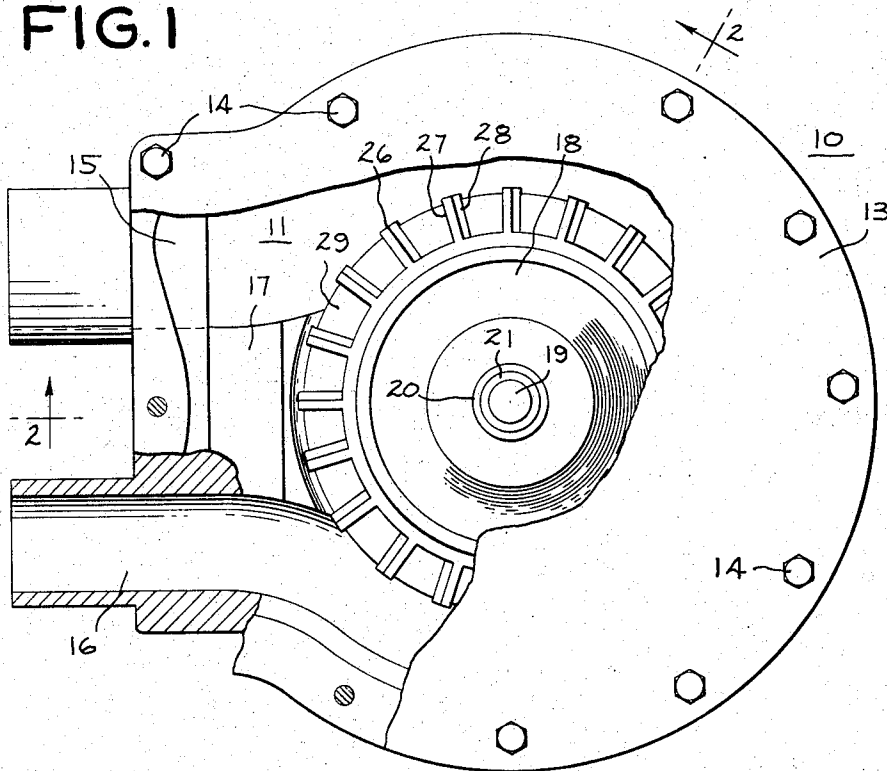


FIG. 2

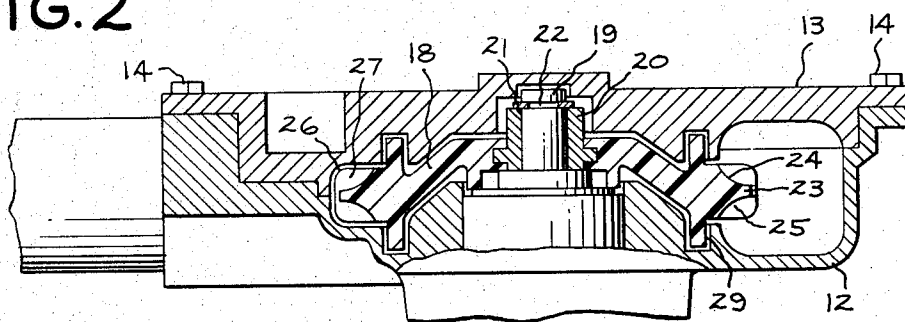
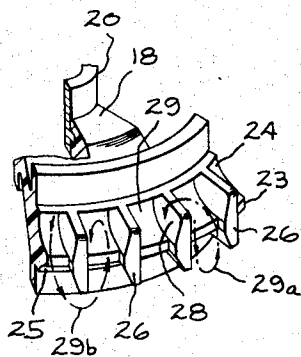


FIG. 3

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TURBINE PUMP

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ABSTRACT OF THE DISCLOSURE

In a reversible turbine pump wherein the impeller includes a circumferential web and spaced peripheral vanes extending from the web; one face of each vane is disposed in a plane radial to the axis of impeller rotation and the other face of each vane is disposed at an angle to the first face.

Turbine pumps move a fluid along an 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 or 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 and 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 on 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 an 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 and includes a circumferential web. Spaced, peripheral vanes extend from the web for entraining fluid within the chamber. One face of each vane is disposed in a plane radial to the axis of impeller rotation and the other face of each vane is disposed at an angle to the first face.

With this structure, when the impeller is driven in a first direction so that the first face of each vane provides a shear action on the fluid within the chamber to cause the fluid to be pumped, the slanted second faces interfere with the vortex action of the fluid. This substantially reduces the pumping action of the impeller and thus provides a substantially reduced fluid flow and head. When the impeller is rotated in the other direction, the slanted faces create a vortex action which is only a slightly less than that created by the radial faces and the radial faces do not interfere with the fluid flow. Therefore, the flow rate and head is only slightly less than a turbine pump of comparable size wherein the vanes have opposed faces which essentially are parallel and in planes radial to the axis of impeller rotation.

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 its organization and method of operation, together with further advantages thereof, may best be understood by references to the following description taken in conjunction with the accompanying drawings.

In the drawings:

FIGURE 1 is a plan view, partly broken away, of one embodiment of the present invention;

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FIGURE 2 is a sectional elevational view, taken along the line 2-2 of FIGURE 1; and

FIGURE 3 is a fragmentary, perspective view illustrating details of the impeller utilized in the pump of FIGURES 1 and 2.

Referring now to FIGURES 1 and 2 of the drawing, it may be seen that a pump embodying the present invention has a casing 10 which defines an 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. These two elements are held in an assembled relationship, by any suitable means, such as by bolts 14. A pair of openings 15 and 16 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, an impeller 18 is mounted for reversible rotation about the axis of a shaft 19 by means of a collar 20 and is held on the shaft by a split ring 21 received in a groove 22 in the shaft 19. The impeller 18 has a generally disk-like shape, with a circumferential web 23. The sides of the web are sloped as indicated at 24 and 25 to aid in increasing the vortex flow of fluid within the chamber 11. On the upper and lower sides of web 23 (as seen in FIGURE 2) are formed a series of spaced, peripheral vanes 26. The vanes extend both upwardly and downwardly from the web (as seen in FIGURES 2 and 3) and may extend outwardly also and join so that each pair of upper and lower vanes in effect forms a unitary vane structure. Each vane is formed with a pair of oppositely disposed faces or surfaces 27 and 28. The face or surface 27 of each vane is disposed in a plane which is radial with respect to the axis of shaft 19. The face of surface 28 of each vane is disposed at an angle with respect to the face 27 of the same vane so that the vane structures have their smallest thickness at the upper end and lower edges and their greatest thickness adjacent the web 23. Thus, the fluid impelling buckets 29, formed between circumferentially adjacent pairs of vane structures are relatively narrow adjacent the web and then become wide as they progress away from the web.

When the impeller is rotated in the counter clockwise direction, as seen in FIGURE 1, the faces 27 of the vanes 26 have a shearing action on the fluid. This tends to cause the fluid to form two complementary toroidal or vortex flows. That is, the fluid in the upper portion of pumping chamber 11 (as seen in FIGURE 2) will flow in one toroid while the fluid in the lower portion of the pumping chamber will flow in another toroid. The sloping surfaces 24 and 25 of the web 23 aid in establishing the toroidal flow. This toroidal flow tends to cause the fluid to progress around the pumping chamber 11 in a spiral motion from the inlet, in this case opening 15, to the outlet, in this case opening 16. The fluid is impelled outwardly by one bucket, curves around, comes back, is received by the next bucket and again is impelled outwardly. (This mode of fluid flow is indicated by arrow 29a in FIGURE 3.) However, with the construction of my new and improved pump the slanted faces 28 interfere with this toroidal flow as the fluid is returned to the buckets 29 and causes turbulence in the fluid. This turbulence substantially reduces the fluid flow rate and head of the pump so that, when the impeller is rotating in the counter clockwise direction, the flow rate is substantially less than a similar turbine pump having vanes with parallel, radial faces.

When the impeller is rotated in the other direction, that is, clockwise, as seen in FIGURE 1, the shear action creating the vortex or toroidal flow is provided by the slanted faces 28 of the vanes 26 (this mode of fluid

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flow is indicated by arrow 29b in FIGURE 3). Because of their slanted configuration they provide slightly less shear action than radially disposed faces would; however, since the trailing faces in this mode of operation are the radial faces 27 there is no interference or turbulence caused by the trailing faces. Therefore, the pumping action in the clockwise direction is substantially greater than the pumping action in the counter clockwise direction of the impeller rotation and in fact is almost as great as a similar pump in which the vanes have parallel, radially disposed faces.

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 which 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) a casing defining an annular pumping chamber,
- (b) said casing further defining a pair of openings to said chamber for ingress and egress of fluid,
- (c) a turbine impeller mounted for reversible rotation within said chamber,
- (d) said impeller including a circumferential web and spaced, peripheral vanes extending from said web for entraining fluid within said chamber,

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(e) each of said vanes including a first face disposed in a plane radial to the axis of rotation of said impeller and a second face disposed at an angle to said first face so that the effectiveness of said pump is different dependent upon the direction of impeller rotation.

2. A turbine pump as defined in claim 1 wherein the spacing between circumferentially adjacent vanes is at a minimum adjacent said web.

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