

# United States Patent

[19]

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[54] JET PROPULSION PUMP ASSEMBLY

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277/137

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[58] Field of Search..... 415/501, 174;  
277/137; 60/200, 221, 222

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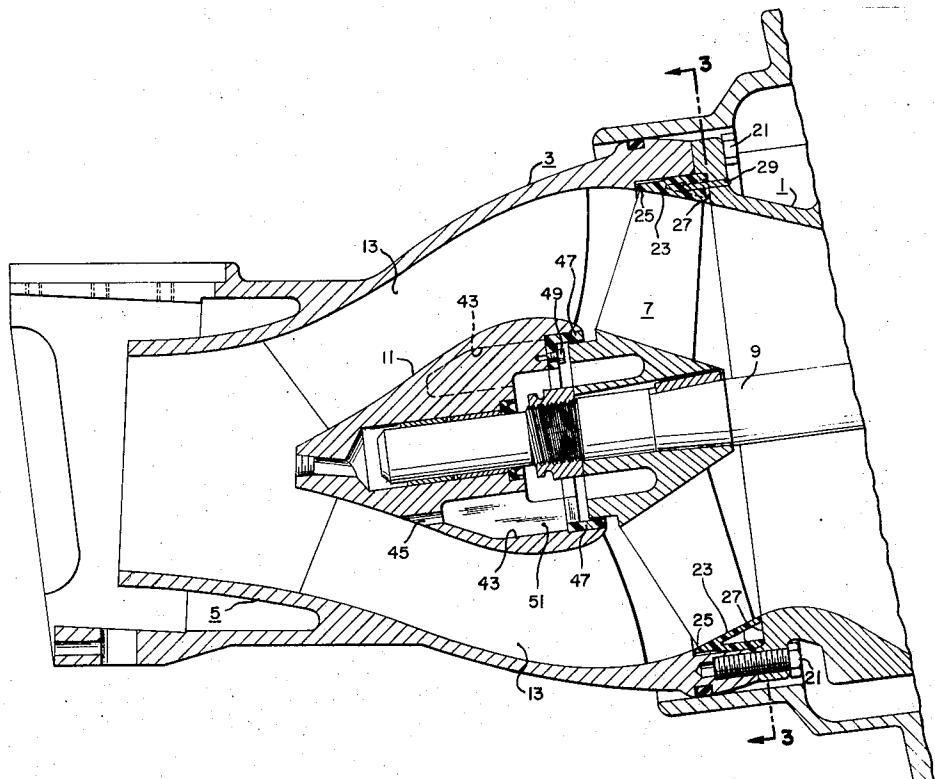
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[57]

## ABSTRACT

A jet propulsion pump assembly is provided with wearing of non-metallic material such as plastic, the wearing being installed so as to be worn in by rotation of the impeller when under load. Provision is made for reducing thrust on the impeller.

4 Claims, 4 Drawing Figures



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SHEET 1 OF 2

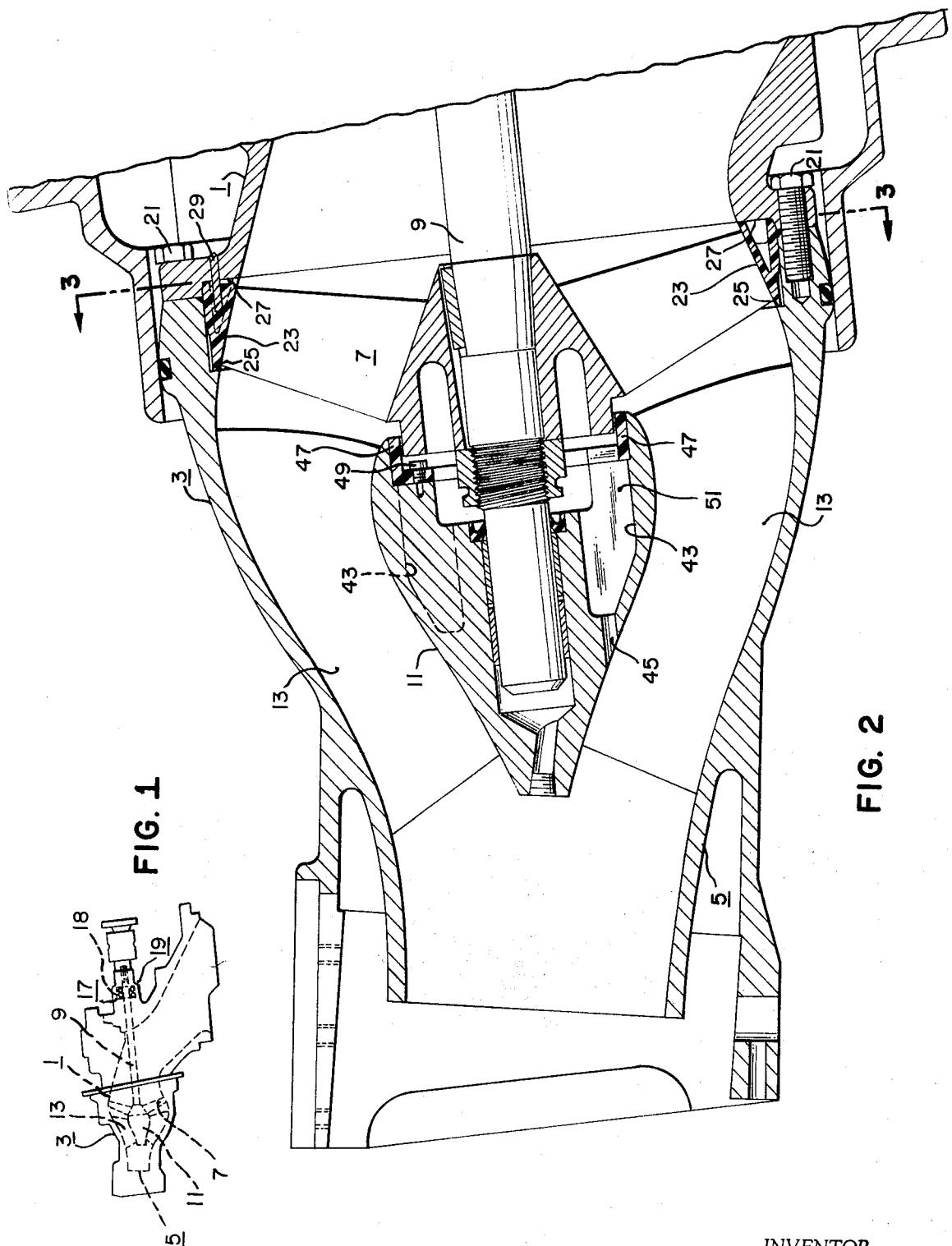


FIG. 2

FIG. 1

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3,756,741

SHEET 2 OF 2

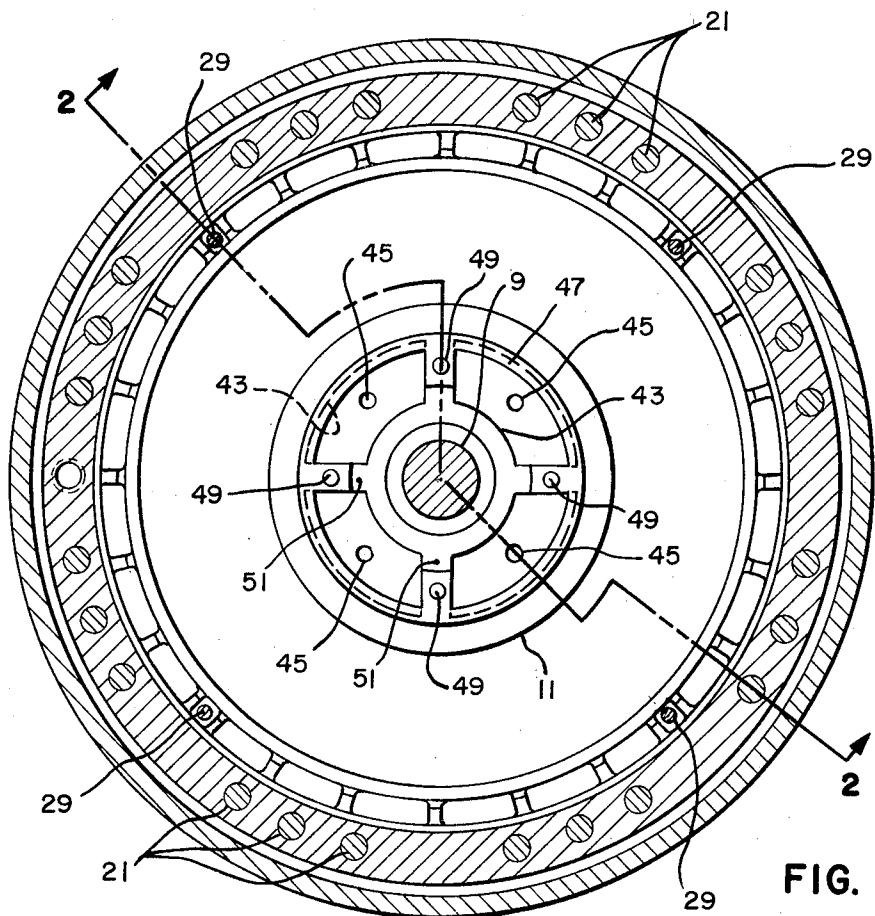


FIG. 3

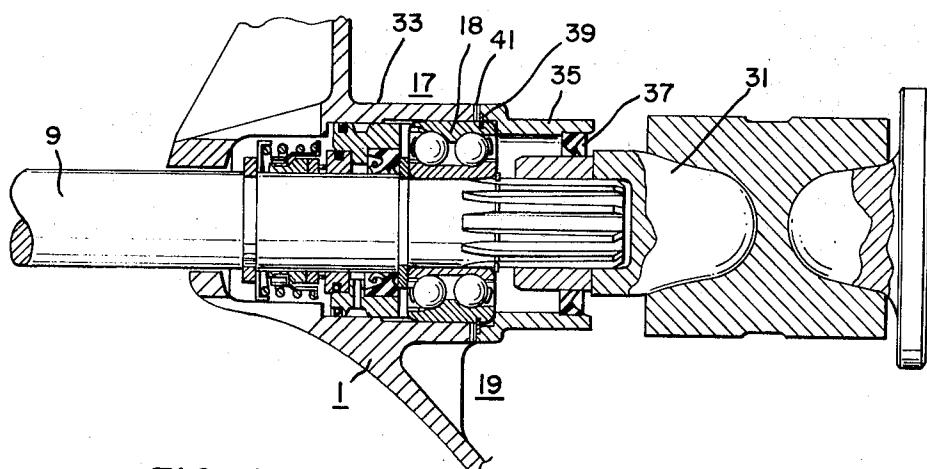


FIG. 4

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## JET PROPULSION PUMP ASSEMBLY

The invention relates to jet propulsion pump assemblies and more particularly to wear problems connected therewith.

Jet propulsion pump assemblies have previously embodied a suction piece, a bowl, and a wear-ring installed between the suction piece and bowl by fasteners, the wear-ring facing the impeller within the bowl and having an internal surface contoured to the surface generated by the peripheral edges of the impeller blades.

During operation of the pump, the impeller blades become loaded, by reason of which, a certain degree of deflection occurs. Accordingly, a slight initial spacing between the edges and the wear-ring during a quiescent condition of the pump, may not be adequate enough to allow for such deflection during loading, with the result that the wear-ring might gall or ball up, or the impeller could conceivably jam or freeze, particularly should a stone or large gravel find its way into the pump.

Further, the manner of installing the wear-ring into the pump assembly by use of fasteners, created a problem of replacement of the wear-ring, when and if such replacement became necessary.

The loading of the impeller during operation, furthermore, results in a thrust which thrust is taken up by a thrust bearing. Such thrust has, to a degree, been reduced in the past, by providing a passage through the impeller from the suction side to the pressure side, which passage thereby exposed the high pressure side of the impeller to the low pressure on the suction side. A simpler solution toward reducing such thrust is desirable.

Among the objects of the present invention are:

1. To provide a novel and improved jet pump assembly;
2. To provide a novel and improved jet pump assembly in which galling or balling up of the wear-ring is effectively eliminated;
3. To provide a novel and improved jet pump assembly wherein reduction of thrust on the discharge end of the impeller is achieved in a novel manner;
4. To provide a novel and improved jet pump assembly wherein the wear-ring may be installed or replaced simply and quickly;
5. To provide a novel and improved wear-ring for a jet pump assembly; and
6. To provide a novel and improved method of installing a wear-ring in a jet pump assembly.

Additional objects of the invention will be brought out in the following description of a preferred embodiment of the same, taken in conjunction with the accompanying drawings wherein,

FIG. 1 is a general view in phantom through a jet pump assembly in which the present invention is incorporated;

FIG. 2 is an enlarged view in section through the impeller and nozzle portion of the jet pump assembly of FIG. 1, taken in the planes 2-2 of FIG. 3;

FIG. 3 is a view in section taken in the plane 3-3 of FIG. 2, with the impeller removed; and

FIG. 4 is a view in section taken through the thrust bearing region of the jet pump assembly of FIG. 1.

Referring to the drawings for details of the invention in its preferred form the jet pump assembly depicted in FIG. 1, involves a suction piece 1, a bowl 3 bolted

thereto and terminating in a jet nozzle 5, the suction piece curving downwardly to the bottom of the boat in which it is to be installed, where it is exposed to the water beneath the boat for intake to the pump.

5 An impeller 7 within the bowl is mounted on a shaft 9 which is supported at the discharge side of the impeller in a generally conical shaped hub 11 symmetrically located in the bowl and nozzle by radial vanes 13 which serves the added function of stabilizing flow of water 10 from the impeller to the nozzle.

At its other end, the impeller shaft is supported in a thrust bearing assembly 17 installed in a housing 19 formed on the outer wall of the suction piece, said bearing assembly including a bearing 18.

Where the suction piece and the bowl are joined, as by a plurality of peripheral bolts 21, these two components are internally recessed to provide for reception of a wear-ring 23, and a pair of opposing shoulders 25, 27, between which the wear-ring may be clamped as the suction piece and bowl are bolted together.

15 To facilitate installation of the wear-ring and assure proper alignment, the wear-ring is provided with a plurality of peripherally spaced dowels 29, preferably in the surface facing the suction piece, the dowels to be received in a corresponding number of holes similarly spaced about the periphery of the suction piece.

20 Of considerable importance to the present invention, is the fact, that the wear-ring, instead of being fabricated of metal, in accordance with prior practice, is now fabricated of non-metallic material, and preferably molded from plastic, such for example, as polypropylene, as it has been discovered that, should the blade edges of an impeller engage a wear-ring when made of such material, the material will either give or wear or 25 both give and wear, and will not gall or ball up.

It has also been discovered that, when using such material, the accidental introduction of a stone or large gravel between the peripheral edge of an impeller and the wear-ring, will not cause the impeller to stall or 30 freeze, as might conceivably be the case, were the wear-ring made of metal.

In a prior art conventional jet pump propulsion assembly, the edges of the impeller blades angle toward the intake side, and the suction piece and bowl in the 35 region of the impeller, will have their internal surfaces correspondingly angled. Consequently the wear-ring will be molded with its inner surface contoured to the substantially conical surface generated by the peripheral edges of the impeller blades when in rotation.

40 Because the impeller can now rotate without galling or balling up of the wear-ring when in contact with the wear-ring, the wear-ring is so dimensioned and the impeller is initially adjusted as to position, that, when rotating under load, it will engage the wear-ring and wear 45 it in.

50 To provide for such adjustment of the impeller, the proximate end of the impeller shaft is slidably splined into a rotatably supported socket 31, and the thrust bearing housing 19 comprises a portion 33 integral with the suction piece and an end portion 35 overlapping the socket, with the intervening space closed off by a seal 37, permitting limited longitudinal adjustment of this end portion. A retaining ring 39 installed in the outer race of the bearing 18 extends between the two 55 portions of the housing.

60 By adding shims 41 between the fixed portion of the bearing housing and the retaining ring, the impeller

shaft and impeller can be adjustably shifted to the right as viewed in FIGS. 2 and 4.

With an arrangement as described, the impeller is initially adjusted by installing the number of shims necessary to effect a wearing in of the wear-ring. In view of the nature of the wear-ring material the initial adjustment should suffice, but should a subsequent adjustment be deemed necessary, additional shims may be added to accomplish such subsequent adjustment.

To reduce thrust on the thrust bearing via the impeller, the hub 11 is recessed adjacent the pressure side of the impeller, such recess joining a plurality of cavities 43 formed in the hub, with each cavity flow connected with a low pressure region in the nozzle by a connecting flow passage 45 formed in the hub.

In the hub recess is disposed a shallow cup 47 of plastic or other suitable non-metallic material, such shallow cup being secured by machine screws 49 into the hub partitions 51 formed between the cavities.

The hub of the impeller is dimensioned to rotatably fit into this shallow cup, thrust pressure being developed along the edge of the cup. Due to the flow connection established between the inside of the shallow cup and the low pressure region of the nozzle, a pressure differential will develop across that portion of the impeller hub entering the shallow cup. Inasmuch as the fit between the impeller hub and the shallow cup is a rotational fit and not a leak tight joint, a limited flow of water will occur from the impeller hub to the nozzle via the chambers 43, thereby reducing the thrust against the impeller hub, with a consequent reduction in thrust against the thrust bearing.

While I have described the invention in its preformed form and in considerable detail, the same is subject to alteration and modification without departing from the underlying principles involved, and I accordingly do not desire to be limited in my protection to the details

set forth except as may be necessitated by the appended claims.

I claim:

1. In a jet propulsion pump assembly having a suction piece and a bowl terminating in a nozzle, a conical shaped hub support for an impeller assembly disposed axially of said bowl and connected to said bowl by a plurality of vanes to determine passages to said nozzle, a thrust bearing supported within said suction piece, an impeller assembly in said bowl supported by and between said hub support and said thrust bearing, said impeller assembly including an impeller having blades with their remote edges such as to generate a substantially conical surface at an angle to the axis of said impeller, a wear-ring installed between said suction piece and bowl in line with said blade edges, said wear-ring having an interior surface contoured to the surface generated by the remote edges of said impeller blades, and means for clamping said wear-ring between said suction piece and said bowl with said interior surface in proximity to said blade edges, said clamping means being independent of said wear-ring.

2. In a jet propulsion pump assembly in accordance with claim 1, characterized by said wear-ring being of a non-metallic material.

3. In a jet propulsion pump assembly in accordance with claim 1, characterized by said wear-ring having a plurality of dowels extending therefrom in matching relationship to a plurality of holes in an adjacent component of said pump assembly, whereby said wear-ring may readily be assembled thereto, and removed therefrom for replacement upon unclamping of said independent clamping means.

4. In a jet propulsion pump in accordance with claim 1, characterized by said wear-ring being of plastic.

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