IMPELLER RUNNING CLEARANCE
ADJUSTMENT DEVICE

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ABSTRACT
A centrifugal pump assembly including a housing and an impeller rotatable on a shaft and within the housing to form clearance therewith at the eye side of the impeller, the shaft defining an axis, in which there is provided (a) yieldable means acting to urge the impeller in one direction along the axis and tending to reduce the clearance, and (b) adjustable means acting to block displacement of the impeller in that direction.

6 Claims, 4 Drawing Figures
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IMPELLER RUNNING CLEARANCE ADJUSTMENT DEVICE

BACKGROUND OF THE INVENTION

The invention relates generally to adjustment of the running clearance between a pump impeller and housing; more specifically, it concerns the mounting of an impeller on a shaft in such manner that the running clearance may be easily altered through a very simple axial adjustment.

In the past, flat washer shims were used to axially locate the impeller. If correction of the running clearance was required, it was necessary to disassemble the pump, add or subtract shims, and then re-assemble the pump. The clearance was then re-measured, and if incorrect the disassembly and assembly steps had to be repeated along with shim addition or subtraction. There has, accordingly, existed a need for a simple method of adjusting running clearance in a pump, that does not require tedious dis-assembly and reassembly, as described, and wherein ball bearings are not employed.

SUMMARY OF THE INVENTION

It is a major object of the invention to overcome the above problems and meet the described need through the provision of impeller mounting structure accommodated to simple running clearance adjustment. Basically, the invention is embodied in an assembly that includes yieldable means acting to urge the impeller in one direction along the shaft axis and tending to reduce the running clearance; and, adjustable means acting to block displacement of the impeller in that direction. As will appear, advantage is thereby taken of the tendency of the impeller to move toward the suction side of the pump, so that it does not inadvertently shift to compress the yieldable means.

More specifically, the yieldable means may advantageously comprise one or more Belleville washers confined on the shaft at the side of the impeller opposite the suction side thereof; and the adjustable means may comprise an axially adjustable nut assembly against which the impeller is urged by the Belleville washer or washers, the nut assembly allowing running clearance adjustment and being lockable as will be described.

These and other objects and advantages of the invention, as well as the details of an illustrative embodiment, will be more fully understood from the following description and drawings, in which:

DRAWING DESCRIPTION

FIG. 1 is a side elevation, taken in section, to show details of the invention, prior to locking;
FIG. 2 is a fragmentary section taken in elevation to show adjustment of clearance, and locking;
FIG. 3 is a section taken on lines 3—3 of FIG. 2; and FIG. 4 is a perspective showing of a tab washer seen in FIGS. 1—3.

DETAILED DESCRIPTION

The centrifugal pump assembly 10 seen in the drawings includes a pump housing or body 11 containing a cavity 12 in which centrifugal impeller 13 is rotatable by shaft 14 on which the impeller is 13 mounted. A key 15 extends in the ways 16 and 17 extending axially in the shaft reduced terminal portion 14a, and in the impeller hub 13a, respectively. The mounting is such as to allow the impeller to move axially on the shaft, i.e. in the direction of axis 18, and between limits as will be described.

Impeller blades 19 form clearance 20 with the housing or body 11, which may include internal protective shroud or lining 11a (as for example plastic); however, such lining is not required by the invention. Fluid or liquid is drawn into the pump cavity "eye" 12a and forced outwardly by the impellers for increasing the pressure thereof prior to discharge at 21 into a suitable scroll or other passage, not shown.

In accordance with the invention, yieldable means is located to urge the impeller in one direction (to the left in FIG. 1) along the axis 18, tending to reduce clearance 20; and, adjustable means acts to block such displacement of the impeller in that one direction. The construction is such that advantage is taken of the tendency of the impeller to be drawn, during operation, to the left in FIG. 1, as a result of suction production at the suction or "eye" side of the impeller, the yieldable means biasing the impeller in that direction against the stop imposed by the adjusting means, so that the adjusted clearance is not "opened up" during operation despite the actual capability for the impeller to be yieldably deflected relatively to the right. Thus, under load there is no tendency of the impeller to slide to the right along the shaft, consequently the spring-biasing to the left will not result in impeller chatter.

As shown in the drawings, the yieldable means may, with unusual advantage, comprise at least one dished or "Belleville" washer as at 22, two of these being illustrated and having their outer peripheries in engagement at 22a. The inner periphery of one washer engages the shaft step shoulder 23, and the inner periphery of the second washer engages the impeller at 27, the washers being compressed axially toward one another to develop force urging the impeller to the left. Other form of yieldable means may alternatively be used, provided that the advantages of the invention are realized.

Leftward thrust exerted by the impeller due to spring and fluid developed loading is taken by the adjustable means located at a side of the impeller opposite the Belleville washers, and typically comprising an axially adjustable lock nut assembly 24. The latter is shown to include a pair of nuts 24a and 24b having threaded engagement with the shaft threaded end 14b. In use, the pump is assembled as shown in FIG. 1, with a lock washer 25 confined between the nuts. The clearance 20 is then measured, and the nut assembly rotated until desired clearance is achieved. Then, nut 24b is tightened and tabs 25a and 25b on the washer are deformed into the recesses 26a and 26b in the respective castellated nuts 24a and 24b, as seen in FIGS. 2 and 3. Other tabs 25c—25f may be deformed into other recesses 26c—26f, as is clear from FIG. 3.

Keyway 16 extends to the end of the shaft, as shown, and key 15 is sized to allow endwise play of the impeller on the shaft.

I claim:

1. In a centrifugal pump assembly including a housing and an impeller rotatable on a shaft and within the housing to form clearance therewith at the eye side of the impeller, the shaft defining an axis, the combination comprising

a. yieldable means carried for relative axial movement on the shaft and acting to urge the impeller
the impeller and shaft while accommodating relative axial movement thereof.
5. In a centrifugal pump assembly including a housing and an impeller rotatable on a shaft and within the housing to form clearance therewith at the eye side of the impeller, the shaft defining an axis, the combination comprising
a. yieldable means comprising at least one Belleville washer carried on the shaft opposite the eye side of the impeller and acting to urge the impeller in one direction along the axis and tending to reduce said clearance, and
b. adjustable means acting to block displacement of the impeller in said direction comprising an axially adjustable lock nut assembly located at the eye side of the impeller said assembly comprising a pair of castellated nuts both threaded on the shaft, and a lock washer interengaged with said nuts.

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