United States Patent [19]

Schiller

[11] **3,771,927**

[45] **Nov. 13, 1973**

[54] **IMPELLER RUNNING CLEARANCE ADJUSTMENT DEVICE**

[75] Inventor: **Teddy M. Schiller,** Huntington Beach, Calif.

[73] Assignee: **Purex Corporation,** Lakewood, Calif.

[22] Filed: **Mar. 15, 1972**

[21] Appl. No.: **234,851**

[52] **U.S. Cl.** **415/131,** 415/140, 415/213

[51] **Int. Cl.** **F01d 5/12,** F01d 5/30

[58] **Field of Search** 415/34, 109, 131, 415/141, 140, 213

[56] **References Cited**

UNITED STATES PATENTS

1,566,340	12/1925	Myers	415/140
2,010,525	8/1935	McHugh	415/140
2,438,442	3/1948	Holt	415/140
2,689,528	9/1954	Rainbow	415/34
2,875,696	3/1959	Von Zborowski	415/109
3,499,388	3/1970	Eberharolt	415/132
3,696,913	10/1972	Anders	416/176

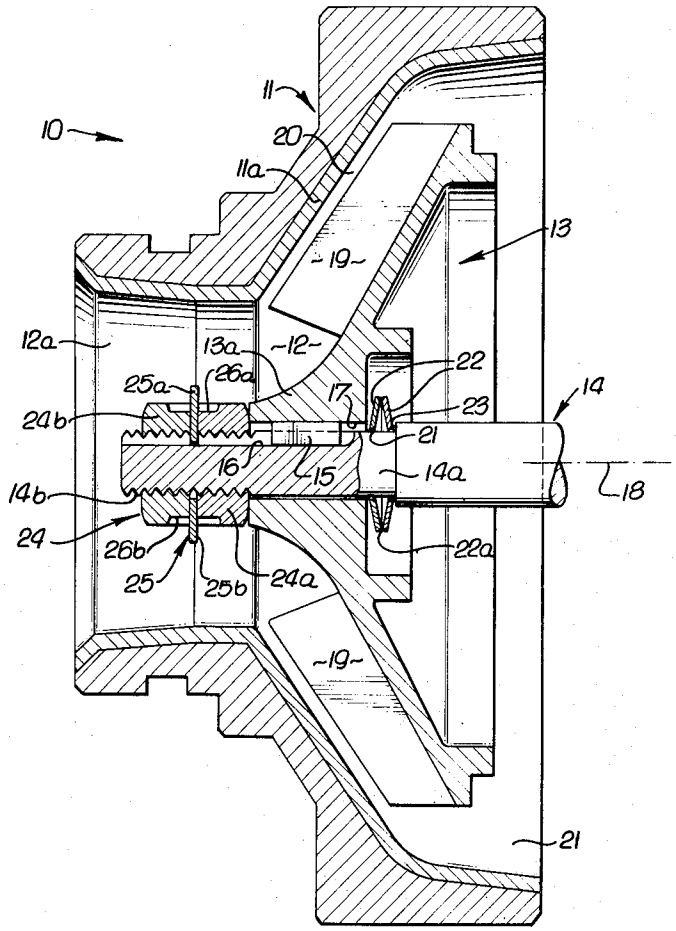
Primary Examiner—Henry F. Raduazo

Attorney—White, Haefliger and Bachand

[57] **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



PATENTED NOV 13 1973

3,771,927

FIG. 1.

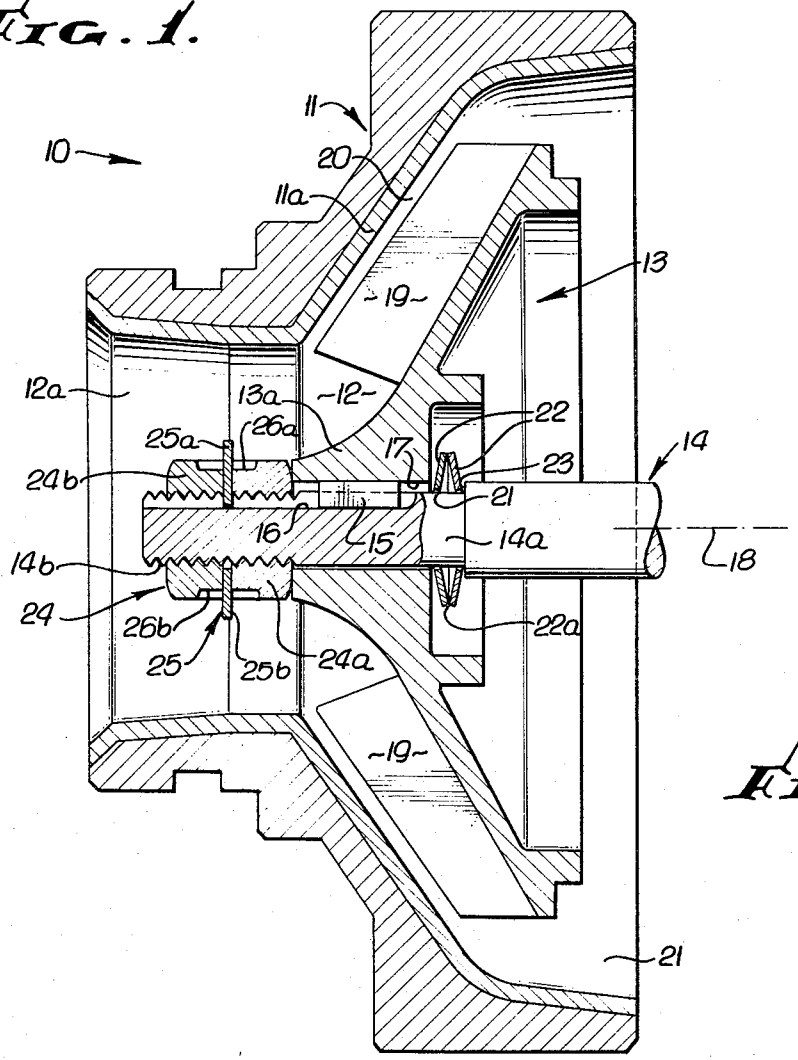


FIG. 2.

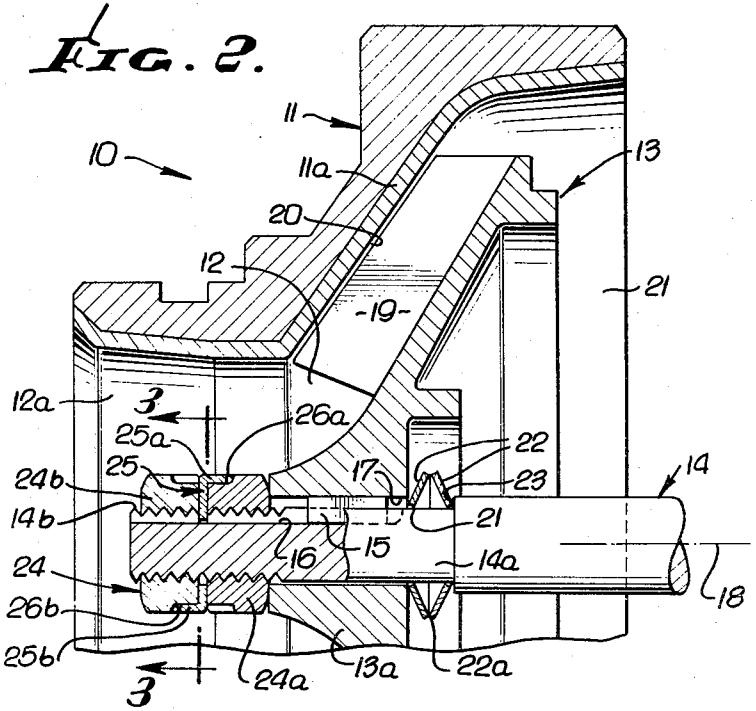


FIG. 3.

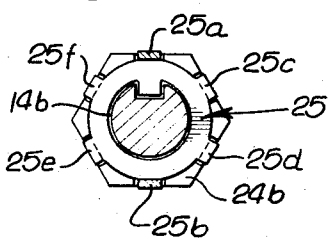
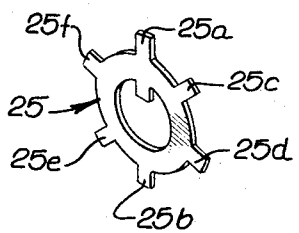


FIG. 4.



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 **14***a*, and in the impeller hub **13***a*, 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 **11***a* (as for example plastic); however, such lining is not required by the invention. Fluid or liquid is drawn into the pump cavity "eye" **12***a* 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 interengagement at **22***a*. 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 **24***a* and **24***b* having threaded engagement with the shaft threaded end **14***b*. 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 **24***b* is tightened and tabs **25***a* and **25***b* on the washer are deformed into the recesses **26***a* and **26***b* in the respective castellated nuts **24***a* and **24***b*, as seen in FIGS. **2** and **3**. Other tabs **25***c*–**25***f* may be deformed into other recesses **26***c*–**26***f*, 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

in one direction along the axis and tending to reduce said clearance, and

b. lock nut assembly threaded on the shaft at the eye side of the impeller opposite the yieldable means, said assembly being axially movable for adjusting the impeller clearance in the housing cooperatively with said yieldable means and acting in adjusted relation to block displacement of the impeller in said direction.

2. The combination of claim **1** wherein said impeller is carried by and movable axially relative to the shaft.

3. The combination of claim **2** wherein said yieldable means comprises at least one Belleville washer carried on the shaft.

4. The combination of claim **2** wherein said yieldable means comprises multiple Belleville washers carried for relative axial movement on the shaft.

5. The combination of claim **4** including radially aligned keyways on the shaft and impeller hub, and a key in said keyways sized to block relative rotation of the impeller and shaft while accomodating relative axial movement thereof.

6. 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.

* * * * *