Oct. 16, 1956 F. K. BAYLESS 2,766,699

IMPELLER ASSEMBLY

Filed Dec. 24, 1954

Fig. 1.

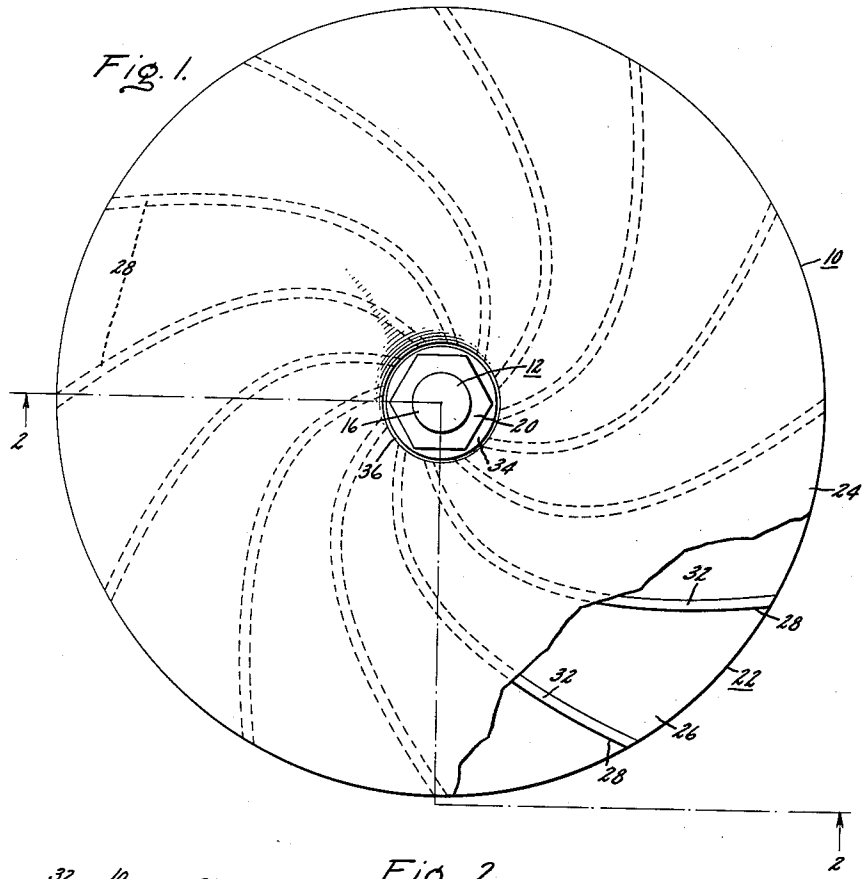
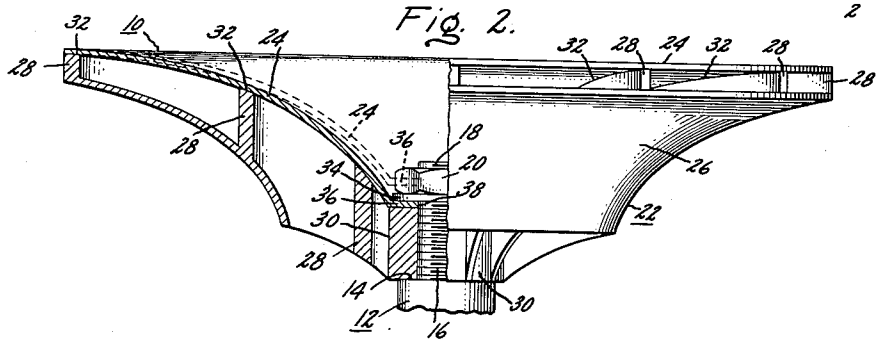


Fig. 2.



Inventor:
Frank K. Bayless,
by Armand Cifelli
His Attorney.

United States Patent Office 2,766,699 Patented Oct. 16, 1956

2,766,699

IMPELLER ASSEMBLY

Frank K. Bayless, Cleveland, Ohio, assignor to General Electric Company, a corporation of New York

Application December 24, 1954, Serial No. 477,488

9 Claims. (Cl. 103—115)

This invention relates to an improvement in an impeller construction.

Known impeller constructions, particularly those which are used in pumps or compressors, and the like, are extremely expensive to manufacture. These impellers usually include a plurality of impeller blades, or vanes, a hub for mounting the impeller on a power shaft, and a disk-like, covering plate on each side of the blades. One of the covering plates ordinarily has a central opening to permit fluid to pass therethrough, and the assembly is usually circumferentially open at the periphery of the covering plates for the same purpose. With an impeller constructed, in this manner, upon rotation of the impeller, air flows axially into the opening and radially outwardly through the circumferential openings.

In practice, several of the enumerated impeller components are formed integrally, usually all except one of the covering plates, and thereafter the remaining component, usually the separate covering plate, is secured to the integral unit. Ordinarily, the separate covering plate is secured to the integral unit by forming projections or bosses on the blades which pass through openings in the covering plate and are peened over; or by riveting, welding or brazing the separate covering plate to the integral unit. Any one of these methods is likely to cause some of the impeller components to warp. Even if warpage does not occur, these methods are difficult, time consuming and, therefore, expensive.

It is an object of this invention to provide an improved impeller construction which is simple in construction and inexpensive to manufacture.

It is another object of this invention to provide an improved impeller assembly wherein the rotation of the impeller assembly is utilized to assist in maintaining the parts in secure assembled relationship.

The objects of this invention are achieved in one form by making several of the impeller components in a rigid, integral unit, and by securing the remaining component, a flexible covering plate, by a single retaining nut. This may be the one which is necessarily employed otherwise for the purpose of mounting the impeller assembly on a power shaft.

The above and other objects of my invention and further details of that which I believe to be novel and my invention will be clear from the following description and claims taken with the accompanying drawings wherein:

Figure 1 is an end elevation view of my improved impeller assembly with portions broken away for the sake of clarity.

Figure 2 is a side elevation view of my improved impeller construction with portions broken away and shown in section for the sake of clarity; stated differently, Fig. 2 is a view taken substantially on line 2—2 of Fig. 1.

In the drawings my improved impeller construction is generally designated by reference numeral 10, and it is illustrated as being mounted on a power shaft 12. Power shaft 12 is operatively connected to any conventional

source of rotational power. If it is associated with an electric motor, the power shaft 12 may be part of the motor armature shaft.

Power shaft 12 includes the shoulder 14 and reduced portion 16 which has a threaded end 18. In known impeller constructions, the impeller assembly is mounted on the reduced portion with its forward portion contacting the shoulder 14, and a retaining nut is threaded on the threaded end 18 to tightly mount the impeller assembly to the power shaft so that they will rotate in unison. In the instant construction, the retaining nut 20 is employed to mount the impeller assembly 10 on the power shaft 12; however, it performs a very important, additional function; namely, that of retaining the impeller assembly components in a tight assembled relationship. This will become clear as the description of the impeller construction proceeds.

The impeller assembly 10 generally comprises two parts: an integral rigid unit 22, which may be cast or molded, and a rear covering plate or shroud 24, which may be of flexible sheet material. Unit 22 comprises the curved, front covering plate 26, the impeller blades or vanes 28, and the mounting hub 30. By reference to Fig. 1 it will be observed that the blades 28 are curved but generally disposed radially. All of the blades 28 are identical, and their rearward edges 32 are disposed in a common surface which is described by revolving a line that is coincident with the rearward edge of one of the blades about the axis of the power shaft 12. To assemble the impeller, the unit 22 is mounted on the power shaft 12 by sliding the hub 30 onto the reduced portion 16 until the forward portion of the hub contacts the shoulder 14. In this stage of assembly, when viewed axially from the rear, the unit 22 presents a recess with the curved edges 32 of the blades 28 facing the viewer.

Prior to being mounted on the reduced portion 16 and assembled with the unit 22, the shroud 24 has the shape outlined in dotted lines on the left-hand side of Figure 2. The shroud is an apertured, disk-like plate that is curved into a shallow cone and has a central, flat mounting flange 36 surrounding its aperture. It will be observed that the radius of curvature of the curved portions of shroud 24 prior to being mounted into assembled position is greater than that of the surface in which all of the edges 32 of the blades 28 are disposed. Stated differently, the curved portions of the shroud 24 prior to assembly have less dish than that of the surface in which the rear edges 28 of the blades 24 are disposed.

To assemble the parts, the mounting flange 36, which surrounds aperture 38 of shroud 24, is slid onto the reduced portion 16, the washer 34 placed onto the reduced portion 16 and the retaining nut 20 threaded tightly against the washer until the shroud is forced against the unit 22 and the impeller assembly as a whole is tightly secured to the power shaft 12. After this has occurred, the shroud 24 assumes the position shown in full lines on the left-hand side of Figure 2. The space which existed between the central portion of the forward side of the shroud 24 and the central portions of the rearward edges 32 of the blades 28 when the shroud was slid onto the reduced portion 16 until the periphery of the shroud contacted the unit 22, no longer exists. In forcing the mounting flange 36 of the shroud against the rearward portion of the hub 30, the shroud 24 is distorted from its initial configuration (shown in dotted lines in Figure 2) to its assembled configuration (shown in full lines in Figure 2). Due to the shroud's inherent flexibility, the axial force of the retainer nut 20 is transmitted throughout the shroud 24 into forces which cause the curved portions of the shroud to press against and closely engage the rearward edges 32 of the blades 28.

When mounted in assembled position, the shroud 24

is stressed into and tightly retained in assembled relationship with the unit **22** solely by the use of a single element; namely, the retainer nut **20**. When it is realized that retainer nut **20** would have to be employed to mount any impeller assembly on the power shaft **12** in any event, the full significance of the advance made by my invention is realized. With my improved impeller construction, it is not necessary to secure the shroud to the unit by providing projections or bosses on the blades and openings in the shroud, and to peen over the projections or bosses, not to rivet, weld or braze the parts together. All that is necessary in assembling the parts of my improved impeller construction is to slide the integral unit **22**, shroud **24** and washer **34** onto the reduced portion **16**, and tightly thread the nut **20** into position. A simple, effective, inexpensive method of assembly and arrangement of parts is provided which is superior to the prior art arrangements in that none of the portions of the impeller assembly are deleteriously warped or distorted in the assembling process.

My novel impeller construction has the additional advantage of utilizing the centrifugal force created when the impeller assembly is rotated to supplement and strengthen the connection between the shroud **24** and the unit **22**. By reference to Figure 2, it will be observed that the centrifugal force created when the impeller assembly is rotated by the power shaft **12** will exert radially outward forces on the rear side of the shrould **24**. Due to the curvature and flexibility of shroud **24**, these forces further aid and assist in maintaining the parts securely in assembled relationship by pressing the shroud **28** against the rear edges **32** of the blades **28**. This feature of utilizing the centrifugal force created by the rotation of the impeller assembly is in the nature of a safety factor, i. e., it supplements the forces created when the shroud is stressed into position by the nut **20**.

As will be evident from the foregoing description, certain aspects of my invention are not limited to the particular details of construction of the example illustrated, and I contemplate that various and other modifications and applications will occur to those skilled in the art. It is therefore my intention that the appended claims shall cover such modifications and applications as do not depart from the true spirit and scope of the appended claims.

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

1. An impeller assembly comprising a unit and a shroud, said unit comprising a hub, a plurality of blades and a covering plate, said blades being disposed on one side of said plate and extending axially therefrom to a common surface which is defined by revolving a line coincident with the free axial edge of one of the blades about the axis of said hub, said surface defining a curved recess on one axial side of said unit, said shroud being a flexible disk-like plate that is curved similarly to but of less curvature than said surface prior to being assembled with said unit, said shroud being adapted to assume the same as said surface and contact the free edges of said blades when assembled with said unit, and means for assembling said shroud with said unit.

2. A device as defined in claim 1 wherein said means comprises a nut.

3. A device as defined in claim 1 wherein said assembly is mounted on a shaft and secured in position by a retainer nut, and said means comprises said retainer nut.

4. An assembly adapted to be mounted on a shaft having means for positioning said assembly and means for locking said assembly in position, comprising a rigid bladed unit and a separate flexible plate, said plate adapted to be assembled with the said unit to complete the assembly, said unit presenting a recess to said plate, said recess being disposed within the periphery of said unit symmetrically about the axis of said shaft and being axially deepest in its central area, said plate being shaped similarly to said recess but having a central portion that is spaced from said unit when the plate is positioned within said recess with portions of its periphery in contact with the periphery of said unit, said locking means adapted to force said central portion against said unit to thereby force the entire plate tightly against said unit, whereby on rotation of said shaft, said plate is forced into tighter contact with said unit by the effect of centrifugal force.

5. A device as defined in claim 4 wherein said recess and plate are conical, and said plate is shallower than said recess.

6. A device as defined in claim 4 wherein said positioning means comprises a shoulder and reduced portion on said shaft, said assembly is mounted on said reduced portion in contact with said shoulder, and said locking means comprises a threaded portion on said shaft and a retaining nut.

7. An impeller assembly adapted to be mounted on a shaft having means for positioning said assembly and means for locking said assembly in position, comprising a unit and a shroud, said unit comprising a hub, a plurality of blades and a covering plate, said blades being disposed on one side of said plate and extending axially therefrom to a common surface which is defined by revolving a line coincident with the free axial edge of one of the blades about the axis of said sub, said surface defining a curved recess on one axial side of said unit, said shroud being a flexible, disk-like plate that is curved similarly to but of less curvature than said surface prior to being assembled with said unit, said shroud being adapted to assume the same shape as said surface and contact the free edges of said blades when assembled with said unit, and said locking means being adapted to maintain said shroud in assembled relationship with said unit.

8. A device as defined in claim 7 wherein said recess and shroud are conical, and said shroud is shallower than said recess.

9. A device as defined in claim 8 wherein said positioning means comprises a shoulder and a reduced portion on said shaft, said assembly is mounted on said reduced portion in contact with said shoulder, and said locking means comprises a threaded portion on said shaft and a retaining nut, whereby said nut maintains the shroud in assembled relationship with unit and maintains the assembly on said shaft.

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