

May 19, 1964

H. HEERENS ETAL

3,133,505

IMPELLER WHEEL

Filed Nov. 17, 1960

3 Sheets-Sheet 1

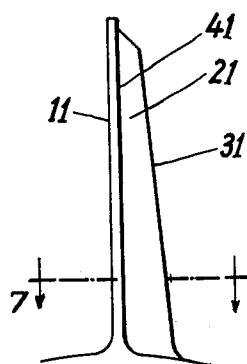


Fig. 1

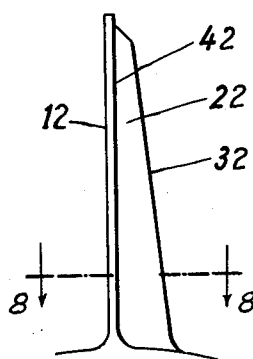


Fig. 2

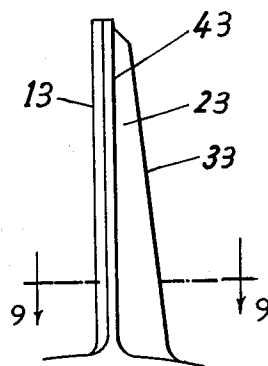


Fig. 3

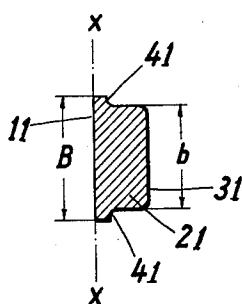


Fig. 7

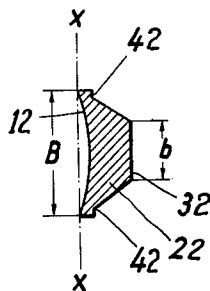


Fig. 8

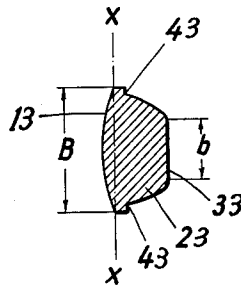


Fig. 9

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FIG. 1A.

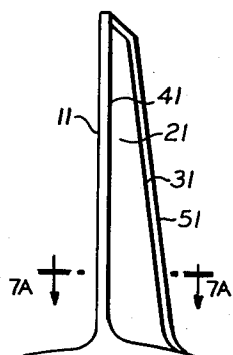


FIG. 2A.

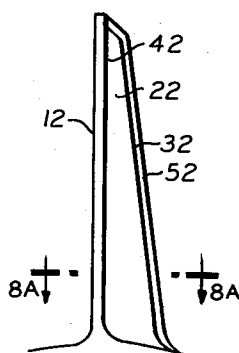


FIG. 3A.

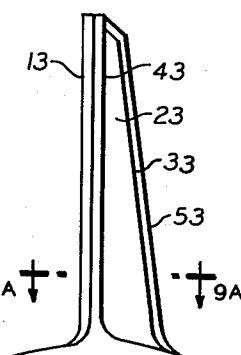


FIG. 7A.

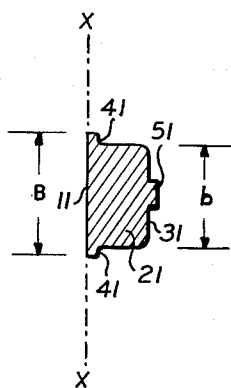


FIG. 8A.

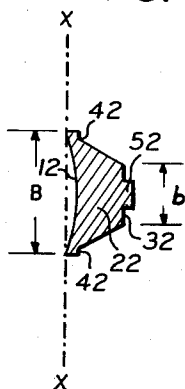
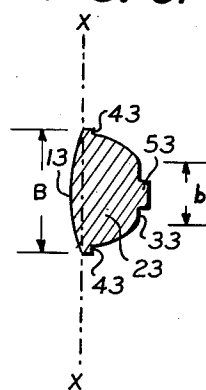


FIG. 9A.



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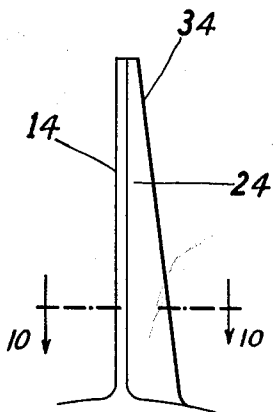


Fig. 4

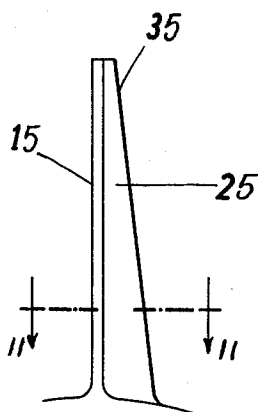


Fig. 5

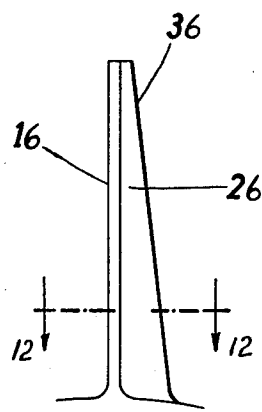


Fig. 6

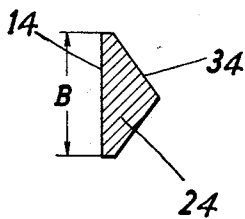


Fig. 10

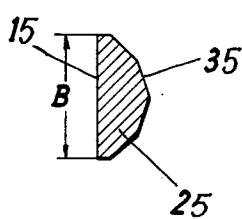


Fig. 11

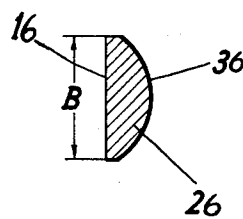


Fig. 12

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IMPELLER WHEEL

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Claims priority, application Germany Dec. 1, 1959

4 Claims. (Cl. 103—96)

This invention relates to an impeller wheel, open on both sides, for a partially impinged-on rotary pump.

The shape of the blades of such wheels may differ very widely. For reasons of strength a blade must have a certain amount of thickness, but it is desirable that at the edges of the blade it should be narrow, so as to minimize the flow losses occurring at these edges. It has also been found desirable to make the leading side of the blade straight or only slightly curved.

In order to fulfill all these requirements, with known impeller wheels the trailing side of the blade is given a triangular, cambered or quadrilateral section, such that in a cross section through the blade there is a corner of the triangle or quadrilateral in the centre of the trailing side of the blade.

With the usual methods of production for these impeller wheels (casting methods, die casting or pressing methods) it is impossible to avoid a slight seam or prominence or bevel being left in the centre of the impeller wheel, as these wheels have to be produced in sections. The seam has to be ground away during the finished machining of the wheel and if during this grinding process with wheels of known type only a fraction of a millimeter too much is ground away on the trailing side of the blade, this changes the blade trailing side profile and thus affects the output of the pump.

The known type blades also have the disadvantage that they are very sensitive to inaccuracies in machining, that is, small deviations from the prescribed dimensions, and alterations of the profile of the blade cause relatively large alterations in output of the pump.

It is an object of the present invention to provide an impeller wheel in which small machining inaccuracies will not substantially affect the impeller wheel profile and hence the pump output.

According to the invention therefore with these impeller wheels open on both sides, whose blade thickness diminishes to the side edges of the blade there is provided on the trailing side of the blade a surface whose width is at least a third of the blade width and whose position is such that when viewed in cross section through the blade perpendicular to the longitudinal axis of the blade, the cutting edge of said surface on the trailing side of the blade extends substantially parallel to a line through the edges of the leading side of the blade.

The seam caused by casting or pressing is located substantially in the centre of this surface. If during the machining of the impeller wheel the grinding tool used in grinding away the seam also grinds away some of the trailing side of the blade a small defect at this point will hardly affect the blade profile itself and hence will not affect the pump output either.

A further measure to make such an impeller wheel insensitive to small machining, casting or pressing defects consists of making the wheel blank such that a narrow rim offering a uniform narrow blade thickness extends on each lateral outer edge of the blade in the finished wheel.

Impeller wheels are also machined in known manner on the side surfaces and hence at these points machining additions to the cast blank, in the form of small cast on elements, are provided which usually extend with con-

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stant thickness along the lateral blade edges. If in the course of machining these edges of constant thickness are completely ground away, as is common with known impeller wheels, the danger arises of cutting into the blade trailing side profile particularly when because of inaccuracies in casting or pressing a slight deformity is produced in the blade profile. Such a cutting away of the blade profile however affects the profile form and hence also the pump output to a considerable degree. If however, a narrow rim of uniform blade thickness extends, as proposed in accordance with the invention, at the lateral blade edges, that is to say with the same thickness as the cast on machining additions, then it is no longer possible for any damage to occur to the trailing side profile in the course of machining.

It may also further be desirable to reinforce the blade by a rib, particularly when a profile has been selected which is not very thick. With a blade of the kind in accordance with the invention it is possible to arrange for such reinforcing ribs or a reinforcing shoulder to be left projecting from the plain surface on the trailing sides of the blade without difficulty, without thereby affecting the advantages according to the invention of the new blade form. Researches have shown that it does not exert any influence on the output of the pump if the height of the shoulder in the machined wheel deviates from the prescribed dimension by some tenth of a millimeter. Differences in height of the shoulder of the order of ± 0.2 millimeter only cause in the output of the pump differences lying within the usual limits of tolerances.

The invention will be described in more detail by way of example with reference to the accompanying drawings in which:

FIGURE 1 is a side elevational view of one form of impeller wheel blade embodying this inventive concept.

FIG. 1A is a view of a blade similar to FIG. 1 but disclosing a modified form of the invention incorporating a reinforcing rib.

FIG. 2 is a side elevational view of a modified form of impeller blade embodying this inventive concept.

FIG. 2A is a view of a blade similar to FIG. 2 but showing a modification including a reinforcing rib.

FIG. 3 is a side elevational view of a still further modified form of blade incorporating the instant invention.

FIG. 3A is a view of a blade similar to FIG. 3 but disclosing a reinforcing rib as a modification thereof.

FIGS. 4, 5 and 6 are side elevational views of conventional impeller blades by way of contrast.

FIGS. 7, 8 and 9 are sectional views taken along the lines 7—7, 8—8 and 9—9 of FIGS. 1, 2 and 3 respectively as viewed in the direction indicated by the arrows.

FIGS. 7A, 8A and 9A are sectional views taken along the lines 7A—7A, 8A—8A and 9A—9A of FIGS. 1A, 2A and 3A respectively as viewed in the direction indicated by the arrows.

FIGS. 10, 11 and 12 are sectional views taken along the lines 10—10, 11—11 and 12—12 of FIGS. 4, 5 and 6 respectively as viewed in the direction indicated by the arrows.

In the embodiment of the invention disclosed in FIGS. 1 and 7, the blade comprises a pressure face 11 and a profile 21 on the suction face 31 of the blade, which profile presents a surface whose width b is at least a third of the width B of the blade pressure face and which when viewed in cross section, as seen in FIG. 7, extends parallel to a line $x-x$ through the side edges of the blade pressure face 11. A rim 41 of uniformly narrow thickness extends along the lateral outer edges of the blade. The blade pressure face is plane and the profile of the suction face is rectangular.

FIGS. 1A and 7A disclose a blade identical to that of

FIGS. 1 and 7 with the exception of the fact that a reinforcing rib or shoulder 51 is provided on the blade suction face.

FIGS. 2 and 8 disclose a modified form of the invention including a pressure face 12, and a profile 22 on the suction face 23, the width b of which is again, at least a third of the width B of the blade pressure face 12 extending parallel to a line $x-x$ through the edges of the blade pressure face 12. In this case the blade pressure face 12 is slightly concave and the profile on the suction face is markedly trapezoidal.

FIGS. 2A and 8A disclose a blade substantially identical to that of FIGS. 2 and 8 but which is provided with a reinforcing rib 52.

In FIGS. 3 and 9 a still further modified form of blade is disclosed wherein the blade pressure face 13 is slightly convex and the profile 23 on the suction face 33 is trapezoidal. A rim 43 similar to rims 41 and 42 is also provided. The profile surface width b is again at least one third of the width B of the pressure face.

FIGS. 3A and 9A show a form of the invention identical to FIGS. 3 and 9 except that here again a reinforcing rib 53 is formed on the suction face 33.

It will be seen that in each case small machining errors on the surfaces 31, 32 and 33 or on the edges of the blades will have practically no effect on the profile of the blade and hence the pump output remains substantially unaffected by such machining errors.

By way of contrast FIGURES 4, 5 and 6 show known blade forms of the types most frequently used with open impeller wheels, which include plane blade pressure faces 14, 15 and 16 respectively.

FIGURES 4 and 10 show a blade with a triangular profile 24 on the trailing side 34. FIGURES 5 and 11 show a blade with a quadrilateral profile 25 on the trailing side 35, and FIGURES 6 and 12 show a blade with a hemi-spherical profile 26 on the trailing side 36. It will be seen that in each case the profile on the trailing side will be markedly altered by any errors in machining on the trailing side profile or on the edges of the blade,

while this does not occur with the blade forms as shown in FIGURES 1 to 3 and 7 to 9, and 1A to 3A and 7A to 9A.

Of course, the blade forms shown in the drawings only represent examples.

We claim:

1. A blade for use with an impeller wheel for rotary pumps including a hub and a plurality of elongated blades having longitudinal axes radiating therefrom, said blade having a radial pressure face and an inclined suction face and decreasing in thickness from the hub toward the tip, the width of said faces being constant, said suction face having a plane rear surface the width of which is less than that of the pressure face but at least one third of the width of the pressure face on a plane perpendicular to the longitudinal axis of the blade, said plane rear surface extending substantially parallel to a line through the two side edges of the pressure face of the blade, and a narrow rim of uniform thickness extending in perpendicular relation to said line at each lateral side of said pressure face.

2. A blade as defined in claim 1 wherein the pressure face is concave in transverse cross section.

3. A blade as defined in claim 1 wherein the pressure face is convex in transverse cross section.

4. An impeller wheel blade as claimed in claim 1, wherein a rib extends substantially in radial direction from the plane surface on the suction face of the blade.

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