

June 30, 1964

M. AMIRAUT ET AL

3,139,034

IMPELLER FOR CENTRIFUGAL PUMP

Filed March 1, 1962

2 Sheets-Sheet 1

Fig.1.

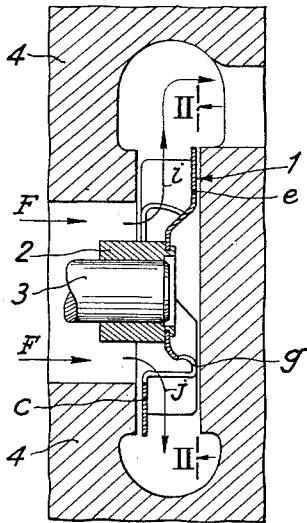


Fig.2.

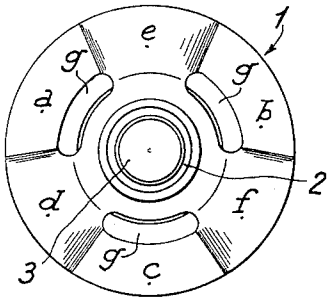


Fig.3.

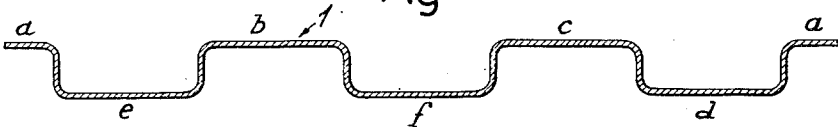


Fig.4.

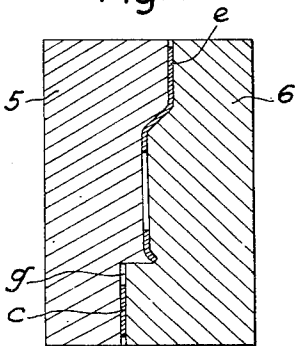
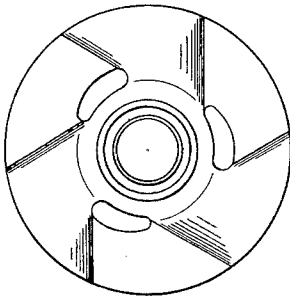


Fig.5.



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Fig.6.

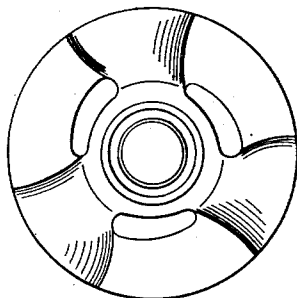


Fig.7.

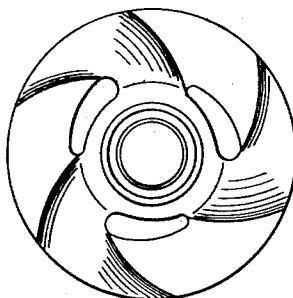


Fig.8.

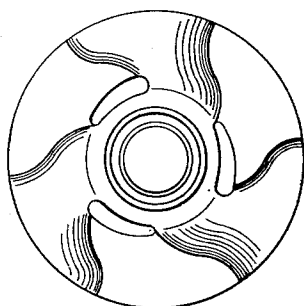


Fig.9.

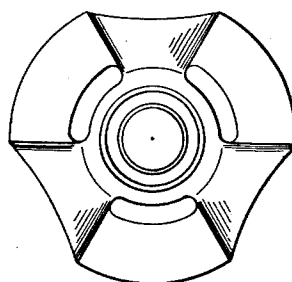


Fig.10.

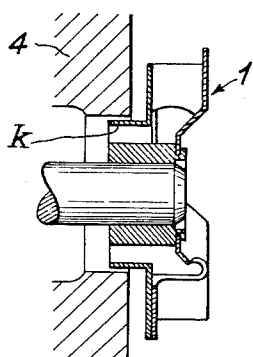
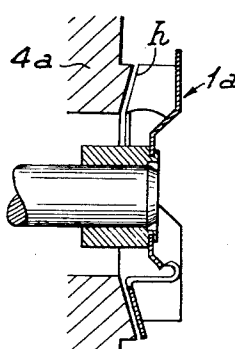


Fig.11.



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## IMPELLER FOR CENTRIFUGAL PUMP

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4 Claims. (Cl. 103—115)

This invention relates to improvements in the design and methods of manufacturing impellers or turbines of fans or centrifugal pumps with a view to improve the efficiency of these apparatus while reducing their cost.

These improvements are intended more particularly for small pumps manufactured on a relatively large scale, such as those utilized for circulating water in the cooling system of automobiles or in laundry washers. In pumps of this type it is current practice to manufacture the impellers by pressing relatively thin sheet metal blanks. These parts are very economical to manufacture but the efficiency of hitherto known designs is not particularly good, notably in the case of large-diameter impellers driven at high rotational speeds.

It is the essential object of this invention to avoid this drawback by providing an impeller designed and constructed with a view, for the same impeller dimensions and velocity of rotation, to yield a higher pressure, a greater output, a lower power consumption and the suppression of vibration caused by cavitation phenomena.

The impeller or turbine according to this invention consists of a relatively thin sheet or disc formed with a central aperture for mounting the impeller on a shaft and with substantially radial corrugations about said aperture to provide alternate projecting sectors and hollow sectors on both faces, and is characterized in that the sectors forming cavities on one of the faces which is to constitute the downstream face are formed with arcuate apertures surrounding said central aperture.

The impeller is mounted with this downstream face registering with the pump outlet or delivery side of the pump, and said arcuate apertures, while practically suppressing the bottoms of the vane-forming hollow sectors which are concentric with the impeller axis, provide about the pump shaft a passage for the circulation of fluid through these sectors of which the solid peripheral portions counteract this flow.

The specific features and advantages of this invention will appear more completely from the following description of a few typical embodiments thereof which are given by way of example with reference to the accompanying drawings in which:

FIGURE 1 is an axial section illustrating diagrammatically a centrifugal pump equipped with the impeller or turbine of this invention;

FIGURE 2 is a front elevational view of the impeller as seen in the direction of the arrows II—II of FIG. 1;

FIGURE 3 is a sectional development of the outer peripheral portion of the impeller;

FIGURE 4 is a diagrammatical axial section showing a typical tool for pressing from a punched or cut blank the impeller of FIGS. 1 to 3;

FIGURES 5 to 9 are views similar to FIG. 2 but showing alternate embodiments of the impeller of this invention; and

FIGURES 10 and 11 are views similar to FIG. 1 showing other possible embodiments of the impeller.

The centrifugal pump impeller or turbine illustrated in FIGS. 1 to 3 of the drawing comprises a flange 1 secured on a hub 2 rigid in turn with the pump shaft 3. The flange 1 consists of a relatively thin sheet metal blank pressed to form on either side vanes *a*, *b*, *c* and *d*, *e*, *f* of which the peripheral development is illustrated in

FIG. 3. At the bottom of vanes *a*, *b* and *c*, on the side opposite to the fluid inlet as shown by the arrow *F*, apertures *g* are formed to permit the passage of the fluid therethrough. Under the influence of the centrifugal force developed by the rotation of the impeller the fluid is attracted both by the vanes *d*, *e* and *f* on the side *F* along the path shown by the arrow *i*, and by the vanes *a*, *b* and *c* formed on the other side, the fluid penetrating into each vane through its aperture *g* as shown by the arrow *j*.

Experience proves that the operation of this impeller having a double operating face is very satisfactory in that its output and pressure efficiency is extremely high and that it does not vibrate, and requires less power for its operation. Another substantial advantage of the impeller according to this invention is its very low cost. In fact, the flange may be manufactured very easily by pressing a blank that can be cut without difficulty from relatively thin metal-sheet stock, although thermosetting plastic materials may also be used with satisfactory results. Furthermore, this part can be moulded from any suitable material such as metal, Bakelite, natural and synthetic rubber, injection-moulded or sheet plastics, etc., by using a mould consisting of only two sections, shells or halves. In fact, the inner edge of the apertured vanes has a diameter equal to or slightly greater than the aperture formed in the flange so that a two-section pressing or moulding tool 5, 6 can be used without difficulty, as shown in FIG. 4. In this figure it is assumed that the impeller is manufactured by pressing a pre-cut blank in which the central aperture and the spaced arcuate apertures *g* are formed beforehand. If it is desired to manufacture the part by moulding a suitable plastic material, the contacting surfaces of the two halves 5, 6 of the tool or mould are simply modified accordingly, so that these surfaces may interfit exactly and contact each other inside the contour of these apertures.

The impeller described hereinabove is formed with radial vanes but it will be readily understood by anybody conversant with the art that other shapes may be imparted thereto without departing from the spirit and scope of the invention, for example by inclining the vanes in relation to the radial direction, as shown in FIG. 5, or imparting thereto a curved configuration in one or the other direction, as shown in FIGS. 6, 7 or 8, with a view to improve the pressure or the output, or for reducing the power consumption. It will be noted that the impeller illustrated comprises only three vanes, but this number is given only by way of example to simplify the drawing for 2, 4, 5, 6 or more vanes may be provided without departing from the spirit and scope of the invention. The vanes illustrated have also the same contour and capacity on both sides and on the two opposite faces of the flange, but it would not constitute a departure from the basic principles of this invention to provide vanes having different characteristics either from one another on the same face or from one face to the other. It may also be noted that the impeller illustrated in FIGS. 1 and 2 is of the type adjustable laterally against the pump body 4, but as shown in FIG. 10 it is also possible to fit on one or both faces of the impeller a collar-forming flange *K* to permit a cylindrical fitting. Still within the scope of this invention, an impeller of the type illustrated in FIG. 11 may be provided wherein the flange 1*a* is formed on one face with a frusto-conical marginal portion *h* registering with a corresponding face of the pump body 4*a*.

According to an alternate embodiment of this invention, the apertures may extend symmetrically as shown in FIGS. 2 and 9, or asymmetrically, according to the direction of rotation, in order to facilitate the passage of fluid along the surface of the vanes located on the side opposite to the fluid inlet, as in the cases illustrated in FIGS. 5

to 8, but other shapes may also be used if desired. To the same end, and without departing from the spirit and scope of the invention, it is also possible to provide apertures having their edges coincident with the vanes on a diameter considerably smaller than that of the edge located on the other face of the flange. With this arrangement the moulding operation is more difficult than in the preceding case, but this increased difficulty is compensated by a substantial improvement in the over-all efficiency of the impeller.

The hub formed or not integrally with the flange may also be an integral part of another element, for example a fluid seal; besides, the flange may also be secured directly on the shaft.

Although the present invention has been described in conjunction with preferred embodiments, it is to be understood that modifications and variations may be resorted to without departing from the spirit and scope of the invention, as those skilled in the art will readily understand. Such modifications and variations are considered to be within the purview and scope of the invention and appended claims.

What we claim is:

1. A centrifugal pump impeller having an upstream face and an opposite downstream face and causing, when rotatably driven, a fluid to flow axially from said upstream face to said downstream face, said impeller being particularly suitable for a pump of relatively small size and consisting of a circular plate having formed therethrough a central circular mounting aperture and arcuate slots disposed at spaced intervals around a circle concentric to said circular aperture, said circle bounding in the plate a central flat portion and an outer portion comprising a first series of sectors extending radially from said slots and another series of sectors interlocked with the sectors of the first series, the sectors of one series being axially shifted in a direction from the central flat portion of the circular plate and the sectors of the other series being axially shifted in the opposite direction at the same distance from the central flat portion of the circular plate, the plate face from which the sectors of the first series protrude relative to the central flat portion forming the upstream face of the impeller and the sectors of the other series forming the downstream face of the impeller.

2. A centrifugal pump impeller having an upstream face and a downstream face and causing, when it is rotatably driven, the axial flow of a liquid from said upstream face to said downstream face, said impeller consisting of a circular plate formed with a central hole bounded by a circular edge and comprising an inner annular zone ex-

tending around the circular edge of said central hole up to an intermediate circle concentric to said central hole and an outer circular zone extending around said intermediate circle, said circular plate being further formed with slots in the form of circular arcs disposed at spaced intervals along said intermediate circle, the ends of the adjacent slots forming along said intermediate circle solid gaps having the same angular amplitude as said slots, said inner circular zone being of frustoconical configuration opening into the downstream face with a relatively wide angle, said intermediate circle being therefore disposed with an axial downstream shift in relation to the circular edge of said central hole, said outer circular zone comprising upstream sectors extending radially beyond said arcuated slots and said intermediate downstream sectors, the upstream sectors being shifted axially upstream in relation to the downstream sectors, said downstream sectors extending in the plane of said intermediate circle and said upstream sectors merging into said downstream sectors through radial planes coincident with the ends of said slots.

3. A pump impeller as set forth in claim 2, wherein said upstream axial shift of said upstream sectors in relation to said downstream sectors is twice the axial shift of said downstream sectors in relation to the circular edge of said central hole.

4. A pump impeller as set forth in claim 2, used in combination with a rotary shaft and a casing having flat inner walls extending at right angles to said shaft, said impeller being rigidly mounted on said shaft by means of its central hole in the space available between said two flat inner walls of said casing, wherein said upstream axial shift of said upstream sectors in relation to said downstream sectors is slightly inferior to the relative spacing of said flat inner walls of said casing.

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