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J. M. DOWNER

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NOZZLE DIAPHRAGM

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Fig. 1.

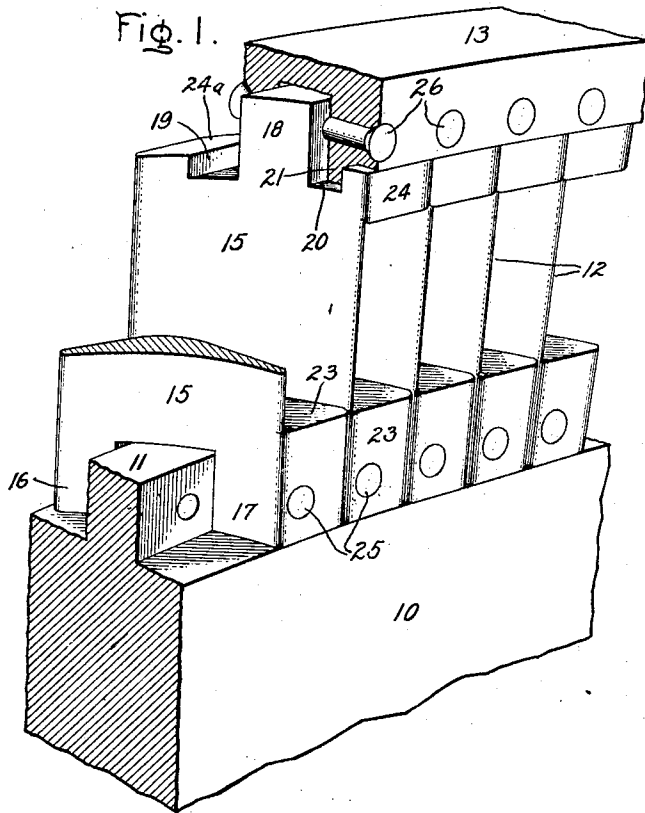


Fig. 3.

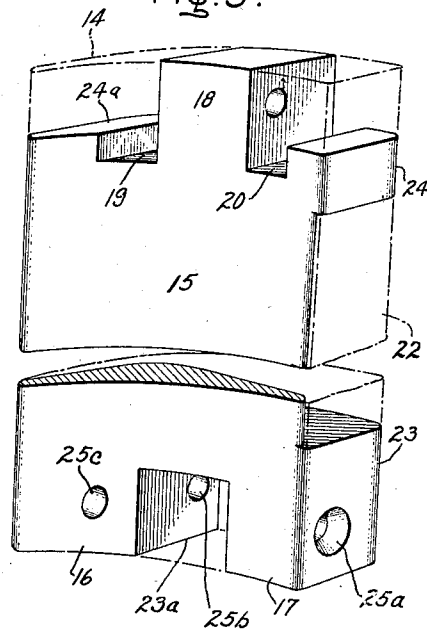


Fig. 2.

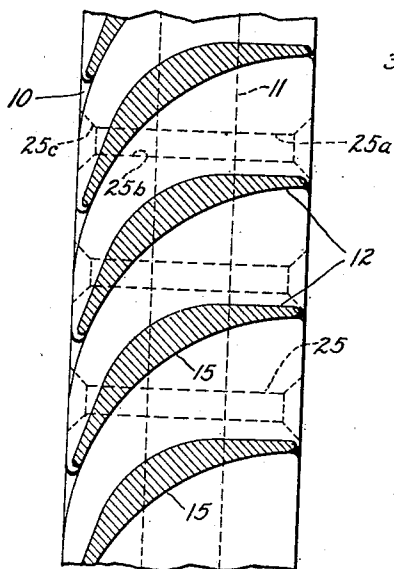


Fig. 4.

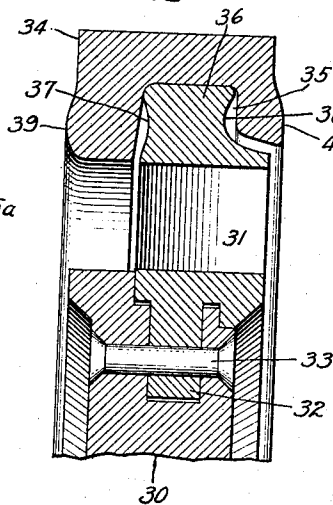
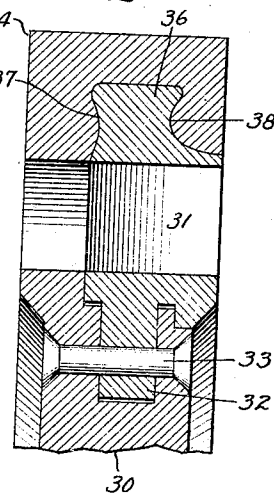


Fig. 5.



Inventor:
John M. Downer,
by *Harry E. Dunham*
His Attorney.

UNITED STATES PATENT OFFICE

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NOZZLE DIAPHRAGM

John M. Downer, Schenectady, N. Y., assignor to
General Electric Company, a corporation of
New York

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2 Claims. (Cl. 253—78)

The present invention relates to nozzle diaphragms such as are used in elastic fluid turbines for properly directing elastic fluid discharged from the outlet side of one turbine wheel into the inlet of another turbine wheel. These nozzle diaphragms usually comprise an inner disk to which a plurality of blades, defining nozzle openings between them, are fastened and an outer ring for holding the outer ends of the blades together and for supporting the diaphragm on the stationary turbine casing.

One object of my invention is to provide an improved construction of nozzle diaphragms of the type above specified forming a rigid and safe structure which can be manufactured at comparatively low cost.

Another object of my invention is an improved method of manufacturing such nozzle diaphragms.

For a consideration of what I believe to be novel and my invention, attention is directed to the following specification and the claims appended thereto in connection with the accompanying drawing which forms a part of my specification.

In the drawing, Fig. 1 illustrates a perspective view of a nozzle diaphragm, partly broken away, in accordance with my invention; Fig. 2 is a development of a sectional view through the nozzles of the arrangement shown in Fig. 1; Fig. 3 shows a perspective view of the nozzle blade; and Figs. 4 and 5 show two steps in the manufacture of a modified form of my invention.

The nozzle diaphragm illustrated in Figs. 1 and 2 comprises an inner disk 10 which may be made of rolled plate or other material and is provided with an annular projection or rim 11. This projection may be formed by machining the circumferential portion of the disk or other desirable method. A plurality of blades 12 are fastened to the disk which at their outer ends are held together by means of an outer ring 13. The intermediate portions of the blades are spaced apart to define nozzle openings through which elastic fluid to be conducted from one turbine stage into a lower turbine stage passes. In the manufacture of the blades I form a bar of rolled material, as indicated in dotted lines 14 in Fig. 3. The front face 15 of the block is curved in accordance with the curvature of the blade. The lower end of the block is recessed to define two legs 16 and 17 which when assembled straddle the projection 11 on the disk. The upper end of the blade is also recessed to define a central projection 18 which when assembled enters an

annular groove in the ring 13. In addition, the upper portion is provided with grooves 19 and 20 adjacent the projection 18. Projections 21 formed adjacent the groove of the ring 13 enter the grooves 19 and 20 respectively. A portion 22 on the rear side of the block is removed to provide a nozzle opening. It will be readily seen that the recess and removed portions define lugs 23 and 24 at one side and lugs 23a and 24a at the other side. These lugs act as spacing members between adjacent blades.

In the arrangement shown in Figs. 1 to 3 the blades are rigidly secured to the disk and the ring by means of rivets 25 and 26 respectively. Each inner rivet 25 projects through a rivet hole 25a of the lug 23, through the rim 11, through a rivet hole 25b of the lug 23a and finally through a rivet hole 25c in the forward edge portion of an adjacent partition. The rivets thereby do not only secure the blades to the rim of the disk but they also fasten the blades directly to each other.

Whereas I have shown in Figs. 1 to 3 an arrangement in which the blades are fastened to the disk and the rim by means of rivets, I have illustrated in Figs. 4 and 5 another arrangement in which the blades are fastened to one of said members by another method which will be presently described. The arrangement in Figs. 4 and 5 comprises an inner disk 30, a plurality of blades 31 having projections 32 located in an annular recess in the disk and fastened thereto by means of rivets 33, and an outer ring 34 having a recess 35 for receiving a projection 36 of each blade. Before assembly, as shown in Fig. 4, the outer projections 36 have recessed or concave side faces 37 and 38 respectively, and the ring has outwardly curved or convex side faces 39 and 40 respectively. The ring is fastened to the projections 38 by forcing or pressing its sides inwardly into engagement with the concave faces of the projections 37, as shown in Fig. 5. This process of uniting the parts is usually termed cold-pressing or forming.

Having described the method and the apparatus according to my invention, I wish to have it understood that changes may be made in both the apparatus and the method without departing from the spirit of my invention and the scope of the appended claims.

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

1. In a nozzle diaphragm, a disk, a plurality of blades defining nozzles and being fastened to the disk, each blade having inner and outer lugs integrally formed with the blade and engaging an

adjacent blade, an outer ring having a groove receiving a projection of each blade, and rivets for securing each blade to the disk and to an adjacent blade, each rivet projecting through a 5 lug of a blade, a portion of the disk and a portion of an adjacent blade.

2. In a nozzle diaphragm, a disk, a plurality of blades defining nozzles, means for fastening

the blades to each other and to the disk, each blade having inner and outer lugs integrally formed with the blade and engaging an adjacent blade, and an outer ring having a groove receiving a projection of each blade and being fastened 5 to the blades by a forming process.

JOHN M. DOWNER.