

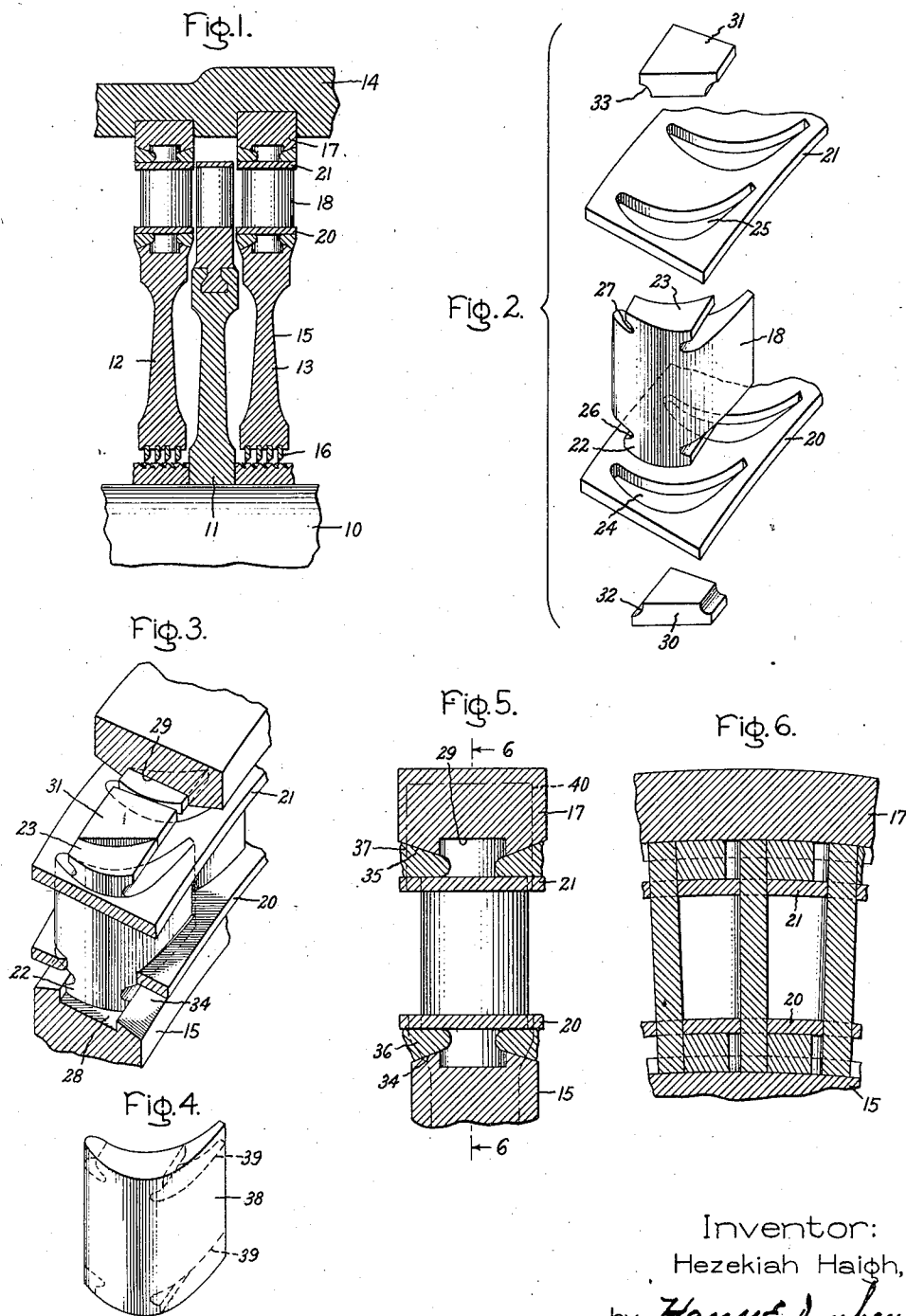
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ELASTIC FLUID TURBINE DIAPHRAGM

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ELASTIC FLUID TURBINE DIAPHRAGM

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4 Claims. (Cl. 253-78)

The present invention relates to elastic fluid turbine diaphragms for conducting elastic fluid to turbine bucket wheels. More specifically, the invention relates to the type of diaphragms which comprises a nozzle structure having a plurality of spaced nozzle blades or partitions secured to inner and outer bands with the inner band secured to and acting as a support for a disk and the outer band secured to an outer ring.

The object of my invention is to provide an improved construction and arrangement of diaphragm which has great rigidity and may be produced at relatively low cost.

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

In the drawing Fig. 1 illustrates a sectional view of a part of an elastic fluid turbine embodying my invention; Fig. 2 is an exploded perspective view of the nozzle structure of Fig. 1; Fig. 3 is a perspective view showing various elements of the diaphragm assembled; Fig. 4 is a perspective view showing a diaphragm blade in a certain stage of manufacture; Fig. 5 is a section of the diaphragm in the state prior to the final machining; and Fig. 6 is a section along line 6-6 of Fig. 5.

The elastic fluid turbine shown in Fig. 1 comprises a rotor having a shaft 10 with a bucket wheel 11 secured to the shaft. Diaphragms 12 and 13 are provided on opposite sides of the bucket wheel 11 and are supported on a casing 14. During operation, elastic fluid is conducted by the diaphragm 12 to the bucket wheel 11 and the fluid discharged from the bucket wheel 11 is conducted by the diaphragm 13 to another bucket wheel, not shown. Each diaphragm comprises a nozzle structure secured at its radial inner edge to a disk 15 sealed to the shaft by means of a labyrinth type packing 16 and secured at its radially outer edge to a ring 17 located in a groove of and supported on the turbine casing 14. The nozzle structure itself comprises a plurality of circumferentially spaced, radially disposed blades or partitions 18 secured at their inner ends to a band 20 and at their outer ends to a band 21. Each diaphragm may be made in known manner in two halves joined along a horizontal plane through the center of the shaft. The ends of the blades or partitions 18, according to my invention, form projections 22 and 23 projecting through openings 24 and 25 in the inner and outer bands 20 and 21 respectively. The sides of the

projections 22 and 23 are undercut to form grooves 26 and 27 respectively. When assembled, as shown in Fig. 3, the ends of the blades 18 fill substantially the openings 24, 25 of the inner and outer bands 20 and 21 respectively while the projections 22 and 23 of the blades are located on the sides of the bands facing away from the nozzle spaces formed between adjacent blades. The disk 15 has a circumferentially extending groove 28 for receiving end portions of the projections 22 and the outer ring 17 has a similar groove 29 for receiving part of the end portions 23 of the blades. Filler blocks 30 and 31 are provided between the end portions of the projections 22 and 23 respectively of adjacent blades. The filler blocks 30, 31 are shaped to fill substantially the space formed between the end portions 22 and 23 respectively in the grooves 28 and 29. Filler blocks 30 and 31 have cutaway or recessed edges 32 and 33 respectively which upon assembly conform to the grooves 26 and 27 respectively so that the undercut grooves 26 and 27 and the corresponding cutaway edges 32, 33 of the filler blocks form substantially smooth, continuous channels.

The disk 15 has chamfered or conical surfaces 34 adjacent the groove 28 forming smooth continuations of the channel defined by the grooves 26 of the blades and the cutaway edge portions 32 of the filler blocks 30. Similarly, the outer ring 17 has inclined or conical surfaces 35 adjacent the groove 29 and forming smooth continuations of the channel defined by the grooves 27 of the blades and the cutaway edge portions 33 of the outer filler blocks 31.

Relatively large channels are thus formed between the inner band 20 and the disk 15 and the outer band 21 and the ring 17. These channels upon assembly are filled with welding material 36 and 37 to fuse the several elements together and thus to form a rigid, unitary structure. Part of the welding material filling the grooves 26 and 27 locks the blades to the inner and outer bands 20, 21.

During manufacture the openings 24 and 25 of the bands 20, 21 may be formed by a punching process. The portions of the opening for receiving the thin edge portions of the blades are preferably made somewhat wider than the thin edge portions of the blades in order to facilitate punching of the openings. The blades 18 are preferably made from a stock of properly shaped and machined material cut into individual pieces 38, as shown in Fig. 4. The ends of these pieces are machined, as indicated by dotted lines 39, in

order to form the undercut projections 22, 23 on the blades 18. The filler blocks 30 and 31 may be cut from a strip of material properly machined to form the cutaway edge portions 32, 33 of the filler blocks 30 and 31 respectively.

Upon completion of the separate elements of the diaphragm the blades 18 are assembled with the inner and outer bands 20 and 21 so that the outer end faces of the blades proper are flush with the outer surface of the band 21 and the inner end faces of the blades proper are flush with the inner surface of the inner band 20. Thereupon the inner and outer filler blocks 32, 33 are inserted between adjacent end portions 22 and 23 of the blades to complete the nozzle structure. This structure then is assembled with an inner member or disk 12 and an outer member or ring 29, as shown in Fig. 3. The structure then is fused together by filling the channels with welding material 37. Thereupon the diaphragm is subject to a final machining operation, removing the material along the dash-dotted lines 40 indicated in Fig. 5.

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

1. Elastic fluid turbine diaphragm comprising spaced inner and outer bands each having a plurality of spaced openings, a plurality of spaced partitions having end portions located in and substantially filling the openings, and projections on the end portions having sides with undercut grooves, a disk having an outer groove for receiving part of the inner projections and defining therewith and with the inner band channels on opposite sides of the disk, an outer ring having a groove for receiving part of the outer projections of the blades and forming therewith and with the outer band channels on opposite sides

of the ring, and welding material filling the channels and fusing the partitions to the blades and to the disk and ring respectively.

2. Elastic fluid turbine diaphragm comprising a plurality of spaced curved blades each having an end portion with a projection forming grooves on opposite sides, a band having spaced openings conforming to the shape of the end portions and being substantially filled by said end portions, a member having a groove accommodating part of the projections, said member and the grooves of the projection and the band forming channels on opposite sides of the member, and welding material filling said channels.

3. Elastic fluid turbine diaphragm comprising a plurality of spaced blades curved in cross section and having end portions with undercut projections, spaced bands each having spaced openings for receiving the end portions of the blades, inner and outer members each having a groove for accommodating part of the projections and defining therewith and with the undercut grooves channels, and welding material filling the channels.

4. Elastic fluid turbine diaphragm comprising an inner and outer band each having spaced openings, a plurality of spaced blades having end portions located in the openings, each end portion having a projection, filler blocks located between the projections of adjacent blades, a disk having a groove for receiving the inner projections and defining a channel therewith, an outer ring having a groove for receiving the outer projections and defining a channel therewith, and welding material filling the channels and fusing the blades to the bands and the disk and the ring.

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