

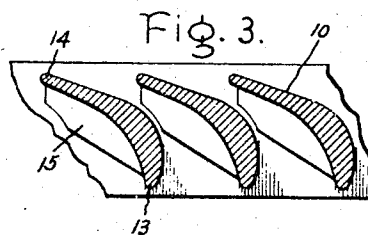
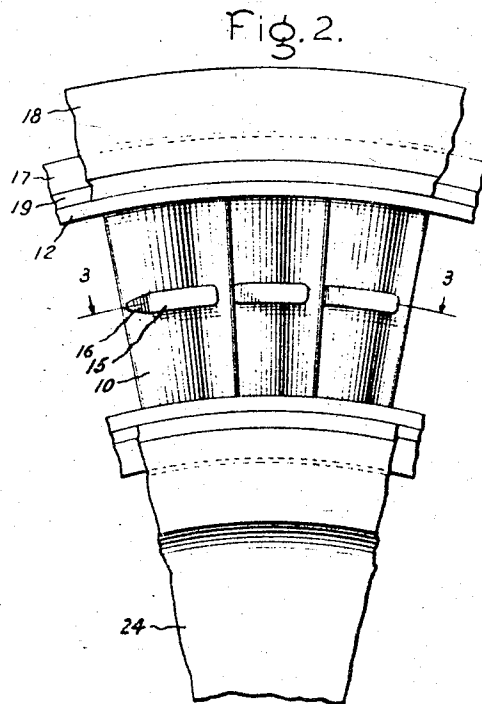
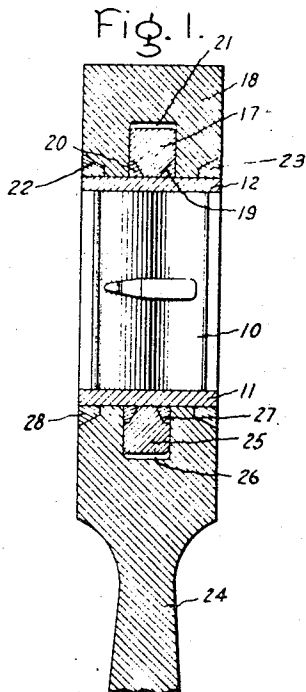
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ELASTIC FLUID TURBINE DIAPHRAGM

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ELASTIC FLUID TURBINE DIAPHRAGM

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3 Claims. (Cl. 253—78)

The present invention relates to elastic fluid turbine diaphragms having nozzles for conducting elastic fluid discharged from the bucket wheel of one stage to the bucket wheel of another stage. More specifically the invention relates to the type of diaphragms which include a nozzle structure in the form of a row or ring of spaced partitions or blades with inner and outer ends projecting into openings of inner and outer bands respectively and secured thereto by welding material. The outer band of such structure is usually securely fastened to a massive ring for supporting the diaphragm on a casing, while the inner band is secured to and acts as a support for a disk. To facilitate assembling and dismantling of a turbine, the diaphragms are made up of two halves suitably joined together and supported on the turbine casing. A diaphragm of this type is disclosed, for example, in the patent to H. A. Lacey No. 1,932,278, issued on October 24, 1933, and assigned to the same assignee as the present application.

In modern high pressure, high temperature turbines it is important that the inner and outer bands of the nozzle or partition structure are securely fastened to or united with the outer ring and the disk respectively in order to attain the utmost rigidity necessary to withstand stresses set up due to high temperature changes and the impact of high velocity elastic fluid.

The object of my invention is to provide an improved construction and arrangement of elastic fluid turbine diaphragms whereby the nozzle structure may be securely united with such outer band and disk at comparatively low cost, and whereby accurate nozzle area and shape are maintained by reduced amount of welding.

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 section of a diaphragm, partly broken away, embodying my invention; Fig. 2 is a front view of Fig. 1; and Fig. 3 is a section along line 3—3 of Fig. 2.

The diaphragm comprises a nozzle structure having a plurality of circumferentially spaced partitions or blades 10 with inner ends secured to an inner band 11 and outer ends secured to an outer band 12. Each partition has walls curved in cross-section, as best shown in Fig. 3, with relatively thick inlet edges 13 and thin outlet edges 14. The thin outlet edges of the partitions or blades are subject to considerable bending

forces during operation. In order to reduce the bending of the outlet edges by elastic fluid impinging thereon, I provide in accordance with my invention each partition or blade with a reinforcing fin or web 15 integrally formed with the blade and uniting the thick inlet edges 13 with the thin outlet edges 14. These reinforcing fins extend axially from a point near the inlet edge 13 and about midway of the radial height of the partition to a point near the outlet edge 14 and circumferentially from the inner surface of the partition to points near the outer surface of the adjacent partition, thus forming a small clearance between the outer surface of the partition and the reinforcing fin of an adjacent partition. A portion 16 of the reinforcing fin of the partition is gradually reduced in thickness towards the outlet edge to permit substantially uniform discharge of elastic fluid from the nozzles formed by adjacent partitions. The fins of the partitions act as stiffenings helping to resist creep, reduce stresses and to raise the nozzle frequency. In addition they act in directing elastic fluid to the bucket wheel and thereby to reduce impact onto the inner surface of the outer cover of the buckets of such wheel.

The nozzle structure, as pointed out before, has bands secured to an outer ring and a disk, all of these elements being made in two halves joined along a diameter of the disk. The outer ring in accordance with my invention is made up of two rings, an inner ring 17 and an outer ring 18. The inner ring and adjacent portions of the outer band 12 form grooves 19 on opposite sides which are filled with welding material 20 whereby the ring 17 which may comprise a plurality of segments is securely united with the band 12. The outer ring 18 has a groove 21 enclosing the inner ring 17, and the outer ring 18 together with the outer band 12 form grooves 22 which are filled with welding material 23 whereby the outer ring is securely united with the outer band 12.

During manufacture the inner ring 17 is first united with the band 12 by filling the aforementioned grooves 19 with the welding material 20 and thereupon the outer ring is placed over the inner ring 17 and in contact with the outer surface of the outer band 12 and united therewith by filling the aforementioned grooves 22 with the welding material 23. In some cases it may be desirable to heat the outer ring 18 prior to its assembly with the nozzle structure and the inner ring 17 in order thereby to procure a lateral shrinking fit between the inner and outer rings 17 and 18.

The connection between the inner band 11 and the disk is similar, that is, the disk is made up of two parts, a disk proper 24 and a ring 25 disposed within a groove 26 of the disk proper 24. The ring 25 is fused to the inner band 11 by welds 27 corresponding to the welds 20 with regard to the outer ring, and the disk proper 24 is fused to the inner band 11 by welds 28 filling grooves on opposite sides of the disk.

From another viewpoint, a diaphragm according to my invention comprises a nozzle structure with a plurality of circumferentially spaced partitions having ends projecting into and fused to inner and outer bands respectively. Each partition has relatively thin outlet edges which are stiffened by axially and circumferentially extending fins integrally formed on the midway portion of the partition. Inner and outer rings 25 and 17 respectively are welded to central portions of the inner and outer bands. Another outer ring with a circumferential groove in its inner surface encloses the first-mentioned outer ring and is welded to the outer band. A disk with a circumferential groove in its outer surface encloses said inner ring and is welded to the inner band.

The provision of an outer ring in the form of two parts separately welded to the outer band and similarly of a disk made up of two parts in the form of a disk proper and a ring separately welded or fused to the inner band results in great rigidity of the diaphragm and moreover may be produced at comparatively low cost. The low cost is mainly due to the relatively small amount of welding material needed for connecting the bands with the ring and the disk. A small amount of welding causes little distortion, which is one of the most difficult troubles to overcome, with heavy welding. For example, the amount of welding material for filling the four grooves formed between the outer band and the outer ring is considerably less than would be needed

if such outer ring were made solid, that is, of one part, and had to be secured to the band 12 by large grooves formed between them as shown for example in the aforementioned patent. In case of integral, outer rings, such large grooves are necessary because it is essential that they extend substantially near the central portion of the band. The same is true with regard to the saving in welding material accomplished by making the disk in two parts as described above.

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

1. Elastic fluid turbine diaphragm comprising a nozzle structure with a plurality of partitions and an inner and an outer band connecting the ends of the partitions, a disk secured to the inner band, a ring welded to a central portion of the outer band and another ring with a groove engaging opposite sides of the first-mentioned ring and welded to outer portions of the outer band.

2. Elastic fluid turbine diaphragm comprising a nozzle structure with a plurality of partitions and an inner and an outer band connecting the ends of the partitions, an outer ring welded to the outer band, an inner ring welded to a central portion of the inner band, and a disk with a circumferential groove in its outer surface accommodating the inner ring and welded to outer portions of the inner band.

3. Elastic fluid turbine diaphragm comprising a nozzle structure with a plurality of partitions and an inner and an outer band connecting the ends of the partitions, rings on central portions of the inner and outer bands, an outer ring having a groove accommodating the ring on the outer band and being united with edge portions of the outer band, and a disk having a groove accommodating the ring on the inner band and being united with edge portions of the inner band.

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