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1,932,278

METHOD OF MANUFACTURING NOZZLE DIAPHRAGMS AND THE LIKE

Filed March 25, 1932

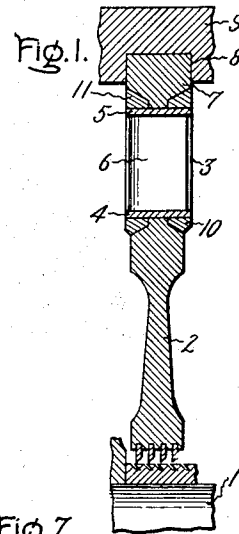
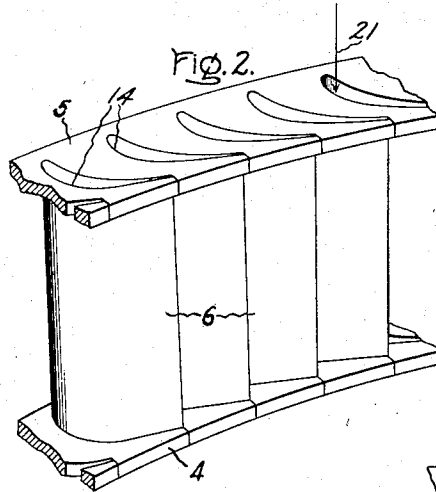


FIG. 3.

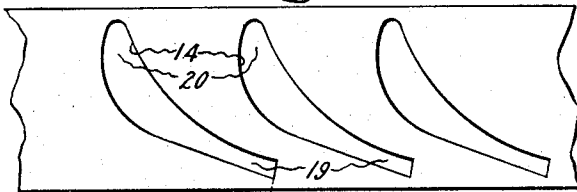


FIG. 4.

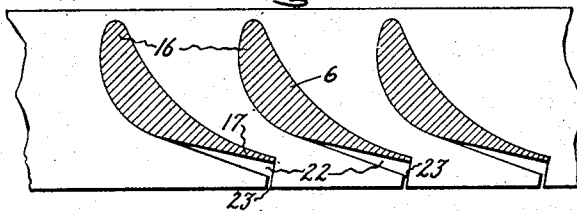


FIG. 5.

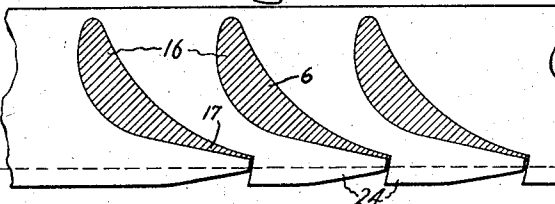


FIG. 6.

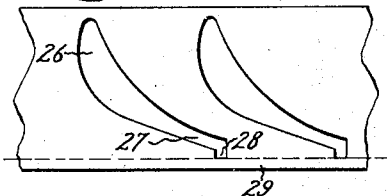
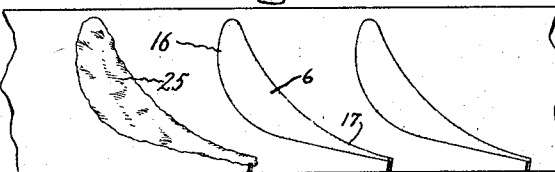


FIG. 8.

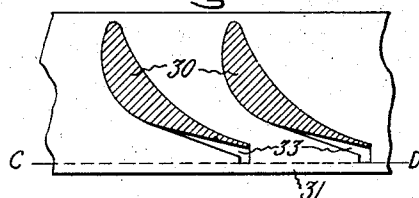


FIG. 9.

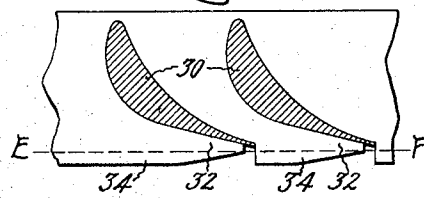
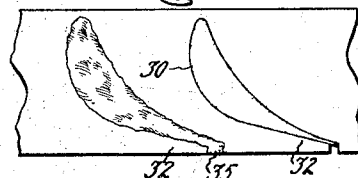


FIG. 10.



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METHOD OF MANUFACTURING NOZZLE
DIAPHRAGMS AND THE LIKEHarry A. Lacey, Schenectady, N. Y., assignor to
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Application March 25, 1932. Serial No. 601,176

3 Claims. (Cl. 29—156.8)

The present invention relates to the method of manufacturing nozzle diaphragms and the like, that is, structures or articles comprising a plurality of partition members or blades which are held by and securely fastened to inner and outer holding members, bands, or rings.

The invention relates more particularly to nozzle diaphragms used in elastic fluid engines as stationary means for directing a stream of elastic fluid to rotary bucket wheels although it is not necessarily limited thereto. The invention is an improvement over the method disclosed in the copending application of E. D. Dickinson, Serial No. 601,182, filed March 25, 1932.

The object of my invention is to provide an improved method for the manufacture of turbine diaphragms and like structures whereby the manufacturing cost is reduced.

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 the drawing, Fig. 1 illustrates by way of example a nozzle diaphragm in combination with the shaft and the outer casing of an elastic fluid turbine; Fig. 2 represents a portion of the nozzle diaphragm enlarged and embodying my invention; Figs. 3 to 6 inclusive show different steps in the manufacture of nozzle diaphragms embodying my invention and Figs. 7 to 10 illustrate consecutive steps of a modified method embodying my invention; Figs. 4, 5, 8 and 9 show the nozzles in section, and Figs. 6 and 10 are top views of a nozzle structure.

In Fig. 1, where I have shown an application of my improved structure in combination with a diaphragm for an elastic fluid turbine, 1 represents a rotary turbine shaft, 2 indicates an annular disk to which is welded a structure 3 embodying my invention. This structure comprises inner and outer ring members generally termed shroud rings 4 and 5 respectively and a row of partitions or blades 6 arranged in definite relation to each other between shroud rings 4 and 5 and securely fastened thereto. 7 is a ring member held in position in a groove 8 of the outer turbine casing 9. Structure 3 comprising elements 4, 5 and 6 is welded on one side to disk 2 as indicated at 10 and on the other side to ring member 7 as indicated at 11. It is well known to those skilled in the art that blades 6 and rings 4 and 5 define nozzles and serve for conveying a stream of elastic fluid passed through a turbine from one stage to the succeeding stage.

In Fig. 2, where I have shown a perspective

view of my structure, 4 is the inner band which may be of any desired form, straight or curved as in case of a turbine, 5 is the outer band of the same shape as band 4. Each band is provided with a plurality of openings or holes 14. 6 designates the blades or partitions; each blade or partition having its ends projecting into corresponding holes 14 of bands 4 and 5 respectively.

Before considering the present invention more specifically, attention is directed to the particular form or shape of blades or partitions as are used in diaphragm structures and the like. Referring to Fig. 4, where I have shown a plurality of blades 6 in cross section, each blade comprises a comparatively wide head portion 16 and a narrow, tapered tail portion 17.

In carrying out one step of my invention I provide bands, strips or rings of metal within their confines with a plurality of holes by a punching process. As it would be difficult to punch holes of the same shape as those of the blades, that is, with a comparatively thin, tapered tail portion, I form these holes according to the method of my invention with tail portions 19 (Fig. 3) which are wider than the corresponding tail portions of the blades. The head portions 20 of the holes have, according to my invention, substantially the same shape and size as the head portions 16 of the blades.

For assembling the blades or partitions and the inner and outer band or ring I arrange the bands or rings in spaced relation, as shown in Fig. 2, and hold them in this relation by any suitable means, not shown. The blades or partitions are then assembled by inserting them lengthwise through the holes of one band until the inserted end of each blade projects into a corresponding hole of the other band. In cases where the bands form rings I preferably insert the blades through the outer ring in the direction of arrow 21 in Fig. 2. It will be noted that the entire end portions of each blade project into the holes in bands 4 and 5 respectively.

Fig. 4 represents a top view of my structure with the blades inserted. The arrangement is such that tail portions 17 of the blades and those of the holes define clearances 22. In order to eliminate these clearances I provide saw-cuts 23 through the edges of the bands near the thin portion of the blades which in the present instance are located near one end of the holes. A further step, according to my invention, is shown in Fig. 5 according to which the edge portions defined adjacent the cuts are forced inwardly to engage or abut the side walls of the blades. To

provide a straight edge of the band I remove, preferably by turning portions 24 below the dotted lines A—B in Fig. 5.

Fig. 6 represents a top view of a structure after the turning operation. The blades and bands may be welded together as indicated at 25 in Fig. 6.

It will be noted in connection with Fig. 4 that in the case of the manufacturing of a turbine diaphragm a great number of saw-cuts of the order of 100 have to be made. The step of providing these saw-cuts is eliminated, or at least simplified, according to the modification of my invention, as shown in Figs. 7 to 10.

Referring to Fig. 7, I have shown a blade provided with holes having head portions 26 corresponding to head portions 20 of Fig. 3 and tail portions 27 corresponding to tail portions 19 of Fig. 3. According to the modification of my invention the tail portion has an extension 28 towards the edge 29 of the band. This extension which serves to eliminate the saw-cuts 23 may be termed a cut portion. With bands thus provided with holes as shown in Fig. 7 I arrange two bands in spaced relation and insert the blades as described above.

Fig. 8 shows a top view of a band with blades 30 inserted. Whereas with the method above described it was necessary to provide a plurality of saw-cuts, with the modified method according to my invention it is only necessary to turn off the edge portion 31 below line C—D of Fig. 8 whereby the extending hole portions 33 define open cuts. Thereafter edge portions 32 can be forced towards the side walls of the blades as shown in Fig. 9. After this operation portions 34 of the edge are removed, along line E—F, preferably by turning, to provide a straight, smooth surface, as shown in Fig. 10. The blades or partitions thereafter are welded to the band and the remaining cuts may also be filled with welding material as indicated at 35 in Fig. 10.

Whereas according to the method of the above mentioned copending application a part only of the end portions of the partitions is inserted in the holes of a band, I insert according to my invention the entire end portions of the partitions in the holes of the bands. Furthermore, whereas in the copending application the partitions are welded at one end to a disk and provided at their other ends only with a band, I provide such band for both ends of the partitions. This permits an easy assembly of the nozzle structure for the diaphragm.

With my invention I have accomplished a simple and rigid structure which is particularly suited for nozzle diaphragms of elastic fluid turbines. The partitions for blades used in my

structure are of standard form. The provision of an inner and an outer shroud ring permits the manufacture of the nozzle structure as a separate unit. This may be accomplished as indicated above by providing two concentric rings and preferably inserting the partitions through the outer ring so that each partition has its entire end portions projecting into corresponding holes formed in the inner and outer ring respectively. No spacing members for the partitions are necessary with my invention as the correct relation of the partitions is determined by the holes in the shroud rings.

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

1. Method of manufacturing a structure comprising an outer and an inner band and a plurality of partitions, said method including punching holes within the confines of the bands such that each hole has a portion fitting a corresponding portion of a partition and another portion wider than another corresponding portion of a partition, inserting the entire end portions of each partition lengthwise into corresponding holes in the bands and eliminating the clearances defined between each partition and an edge of each band.

2. Method of manufacturing a structure comprising an outer and an inner band and a plurality of partitions, said method including forming holes in the bands such that each hole has a portion fitting a corresponding portion of a partition and another portion wider than another corresponding portion of a partition, inserting the entire end portions of each partition into corresponding holes in the bands, cutting one edge of each band near the thin portion of each partition, forcing at least one edge portion adjacent each cut against the thin portion of the corresponding partition, removing a part of the cut edge portion of each band and integrally uniting the bands and the partitions.

3. Method of manufacturing a structure comprising an outer and an inner band and a plurality of partitions, said method comprising punching holes within the confines of the bands, each hole having an extension towards one edge of the corresponding band and another portion wider than a corresponding portion of a partition, assembling the partitions and the bands, removing a portion of one edge of each band so that the extending hole portions define open cuts, forcing the edge portions adjacent the cuts inwardly to abut the sides of the corresponding partitions and welding the partitions to the bands.

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