June 11, 1929. E. GOTTSCHALK 1,717,203

BLADED TURBINE STRUCTURE

Filed Dec. 2, 1926

Fig. 1.

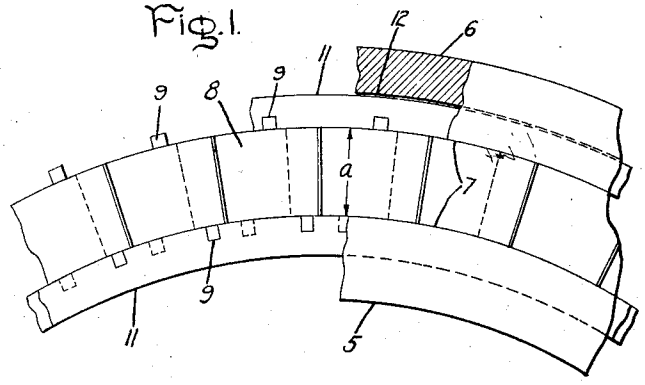


Fig. 2.

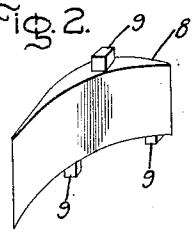


Fig. 4.

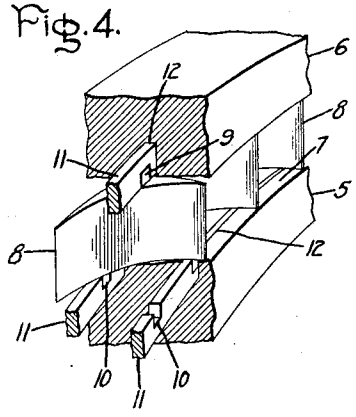
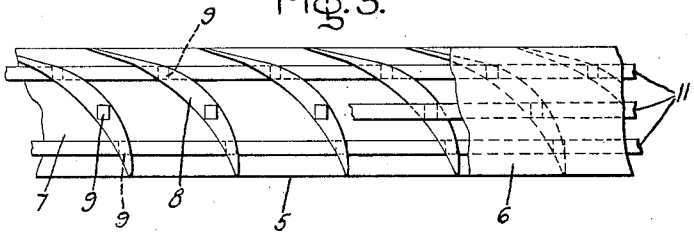


Fig. 3.



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UNITED STATES PATENT OFFICE.

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BLADED-TURBINE STRUCTURE.

Application filed December 2, 1926, Serial No. 152,269, and in Germany February 20, 1926.

The present invention relates to elastic-fluid turbines, and more particularly to multiple bladed structures which are used therein for directing elastic fluid and which are built-up from parts initially held in assembled relation and united to provide a unitary structure by fusion of metal processes, such as brazing.

The object of the invention is to provide an improved bladed structure of this character having parts which are more easily and economically manufactured, assembled and united, and an improved method of making such a structure.

The invention is particularly applicable to the manufacture of diaphragm nozzle structures in which, as is well known, the fluid directing elements are usually in the form of spaced guide blades or vanes, mounted in an annular opening in what is in substance a partition member, and in the present application it is particularly illustrated and described in this connection. It will be understood, however, that the invention is not necessarily limited to this particular construction, but may be embodied in other bladed turbine parts to which it may be found applicable.

For a consideration of what is believed to be novel, and the invention, attention is directed to the accompanying drawing, the following description thereof and the appended claims.

In the drawing, Fig. 1 is a side view, partly in section, of a portion of a turbine diaphragm showing a nozzle structure embodying the invention; Fig. 2 is a view in perspective of a blade element of Fig. 1; Fig. 3 is a plan view of the structure shown in Fig. 1, and Fig. 4 is a view in perspective of a portion of the structure shown in Figs. 1 and 3.

Referring to the drawing, 5 and 6 are concentric rings or supporting members providing the nozzle carrying portion of a turbine diaphragm and represent any suitable nozzle carrying elements for a diaphragm. The rings are radially spaced a distance substantially equal to the radial depth a desired for the nozzles. The latter are formed by the adjacent spaced faces 7 of the rings which provide fluid-guide surfaces, and nozzle partitions or blades 8 held between the rings, the faces of the blades forming the side walls thereof. The blades represent any suitable fluid-guide members and are equally spaced circumferentially and lie substantially radially in one direction and obliquely in the other in edgewise contact with surfaces or faces 7. The nozzles formed thereby are, in the usual manner, adapted to receive elastic fluid from one stage and direct it against moving parts of a succeeding stage. In this arrangement inner ring 5 may be considered to represent the main portion of the diaphragm or the diaphragm proper. The partitions or blades are provided at intervals along their radially inner and outer edges with projecting lugs or tenons 9 which engage in notches 10, Fig. 4, of corresponding shape provided in arc-shaped strips 11, the tenons on any one blade being staggered on opposite edges, as indicated in Fig. 2. The strips lie in annular grooves 12 in the adjacent faces of rings 5 and 6 substantially flush with said faces and the tops of the grooves, and are notched in such a manner and at such intervals along these exposed edges that the blade projections, engaging with the notches, serve to hold the blades in the desired spaced relation and at the desired oblique angle after the manner indicated in Fig. 3 in which assembled relation they are united with the spacing and holding means by the subsequent fusion of metal.

In order that the blades may be rigidly held and properly maintained in spaced relation while being united with the other parts, a plurality of the mounting strips are provided, and are located in suitable spaced grooves in both the inner and outer ring faces, as indicated in Fig. 4. In the present example three mounting strips are provided, of which two are located in the face of the inner ring and one in the adjacent face of the outer ring. It will be seen from an inspection of Figs. 3 and 4 that the blades are, by this arrangement, securely held at three spaced and staggered points as each tenon engages with a notch in a separate strip. To provide this arrangement the grooves lie in spaced substantially parallel planes thereby holding the strips in the same relation to each other.

Any desired number of projections may, however, be provided and at any suitable points if the mounting strips in suitable numbers are correspondingly notched and provided with suitable located grooves in the rings, the present number and arrangement being shown only by way of example, as rep-

resenting what is at present considered sufficient to rigidly hold the blades in spaced assembled relation prior to and during the uniting process.

The tenons 9 on the blades are preferably integral therewith, as indicated in the drawing, and may be formed in any suitable manner as by milling off the ends of said blades between the tenons. In any case the tenons are preferably all of the same size, that is, of the same cross-section, as indicated in Fig. 3, and length, as indicated in Fig. 1, whereby the spacing or mounting strips 11 may be notched by a common means such as a punch. Furthermore, in order that the punching may be made at a right angle to the side of the strip thereby producing transverse, parallel notches, which is most advantageous, the tenons on the blades are made transverse and parallel, and in the present example rectangular in section with opposite faces arranged to lie flush with the faces of the spacing strips with which they engage when the blades are in the desired assembled relation substantially, as indicated in Figs. 3 and 4.

The above-described arrangement not only simplifies the operation of notching the spacing strips regardless of the thickness or shape of the blades or partitions since the projecting tenons or lugs are made of uniform size and parallel with corresponding faces lying in parallel planes but also provides a rigid mounting for the blades which at the same time eliminates spacing blocks and the like ordinarily required between the partitions or blades to hold the same for the brazing or uniting process. Moreover, the spacing strips are easily manufactured as they are flat, arc-shaped strips which require merely punching operations and need not be adapted to the blade shape itself.

As is well understood the diaphragm rings are not continuous and together with the spacing strips may be considered to be diametrically divided as is the usual practice with annular turbine elements, so that the nozzle structure of the present invention may be assembled by inserting the blade tenons in the notches in the inner spacing strips after the latter have been placed in the grooves in the inner half ring or diaphragm proper. The radially outer spacing strip is then placed on the radially outer projecting tenons, thereby connecting the blades, and the outer ring is then placed on the outer spacing strip with the latter seating in the groove provided for it. With a greater number of spacing strips the method of assembly is the same.

The entire assembly is then ready to be united by any suitable process involving fusion of metal such as soldering, welding or brazing, for example, as the parts are held in spaced relation by the strips. The bladed structure thus formed possesses great strength without involving complicated and costly parts or expensive assembly operations.

The guide blades and strips may be quickly inserted between the fluid guide surfaces of the parts which are intended to hold them, and the assembly is then completed without fitting of parts or other unnecessary delay, and it will be noted that no further finishing or dimensioning of the parts is required after assembly. When united by the fusion of the blades with the strips and the strips with the bodies in which the grooves are formed, the blades are firmly held laterally and circumferentially and are accurately positioned and spaced. The means by which the blades are initially spaced and held are then included in the structure so that the necessity for the subsequent removal of a holding means is obviated.

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

1. In a built-up alloy-united bladed structure for an elastic-fluid turbine, a pair of concentric radially spaced members, having adjacent annular faces provided with a plurality of grooves, a plurality of flat, arc-shaped strips which lie edgewise in said grooves flush with the tops thereof, whereby one edge of each strip is exposed, said strips having a plurality of spaced transverse parallel notches in the exposed edges thereof, and a plurality of elastic fluid guide members located between said radially spaced members, said guide members having a plurality of projecting parallel tenons corresponding to said notches which engage the latter to initially hold the parts of said structure in assembled relation.

2. In a built-up alloy-united bladed structure for an elastic fluid turbine, a pair of concentric radially spaced ring members having adjacent annular faces provided with a plurality of grooves, a plurality of flat, arc-shaped strips which lie edgewise in said grooves flush with the tops thereof, whereby one edge of each strip is exposed, said strips having a plurality of spaced notches in the exposed edges thereof and a plurality of elastic fluid guide members located between said ring members in direct contact therewith, said guide members having a plurality of projecting tenons corresponding to said notches which engage the latter to initially hold the parts of said structure in assembled relation.

In witness whereof, I have hereunto set my hand this 13th day of November, 1926.

ERNST GOTTSCHALK.