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J. H. DORAN

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TURBINE BUCKET WHEEL AND THE LIKE

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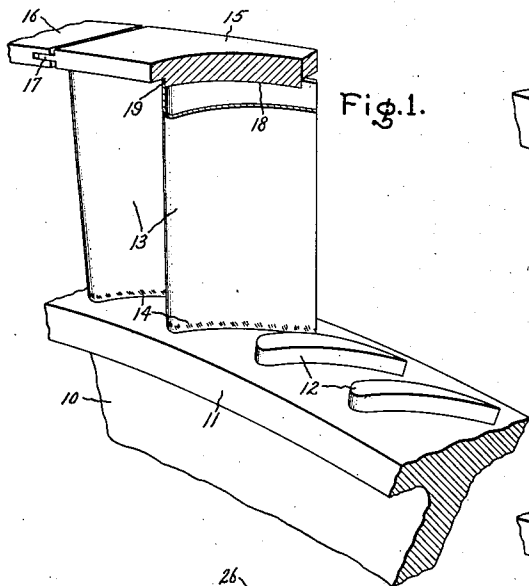


Fig. 1.

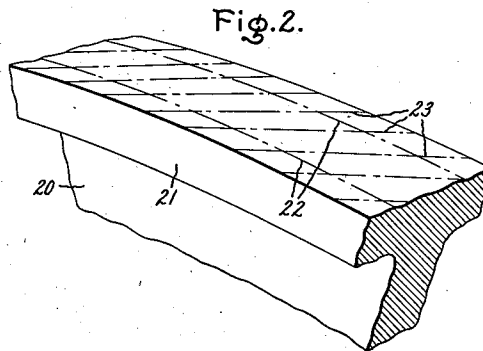


Fig. 2.

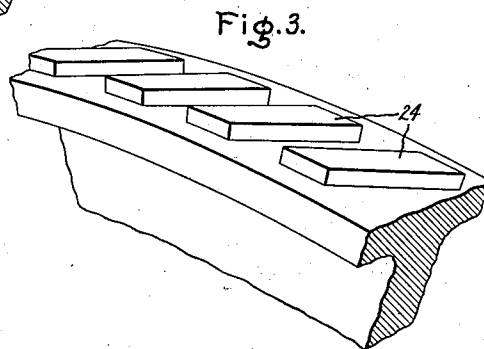


Fig. 3.

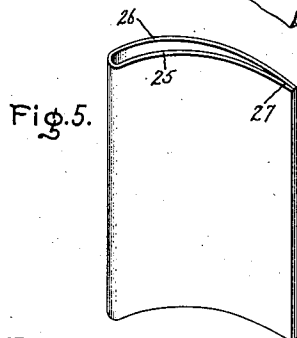


Fig. 4.

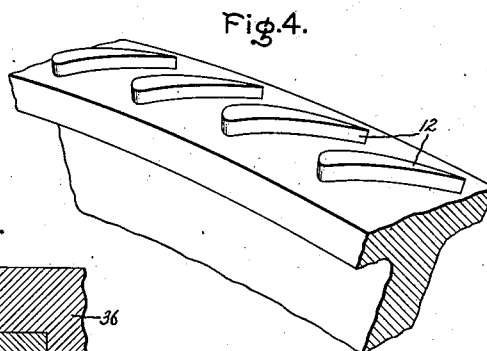


Fig. 5.

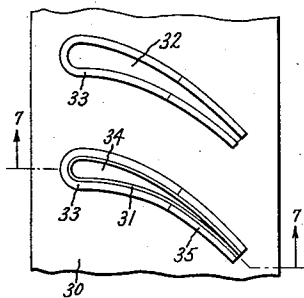


Fig. 6.

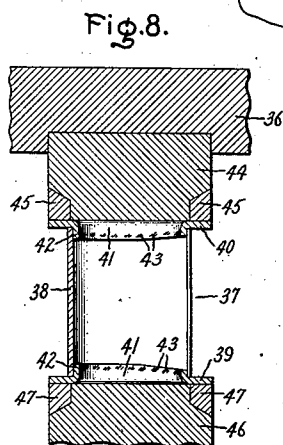


Fig. 7.

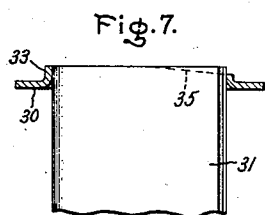


Fig. 8.

Inventor:
John H. Doran,
by *Harry E. Buchanan*
His Attorney.

UNITED STATES PATENT OFFICE

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TURBINE BUCKET WHEEL AND THE LIKE

John H. Doran, Scotia, N. Y., assignor to General Electric Company, a corporation of New York

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7 Claims. (Cl. 253-77)

The present invention relates to turbine bucket wheels and like bladed bodies used as wheels and diaphragms in elastic fluid turbines and compressors. More specifically the invention relates to the type of bladed bodies in which a plurality of circumferentially spaced blades, vanes or partitions have inner ends rigidly secured to the rim of a disk while the outer ends of the radial blades may be free when used as a rotary wheel in compressors or secured together by an outer ring or shroud when the bladed body is used as a bucket wheel or diaphragm in elastic fluid turbines.

One object of my invention is to provide an improved construction and arrangement of the type of bladed bodies above specified, and another object of my invention is to devise an improved method of manufacturing such bodies.

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 bladed body, partly broken away, embodying my invention; Figs. 2, 3, 4 and 5 illustrate several steps in the manufacture of such bladed body in accordance with my invention; Fig. 6 shows a modification according to my invention; Fig. 7 is a section along lines 7-7 of Fig. 6; and Fig. 8 shows another modification according to my invention.

The bladed body shown in Fig. 1 comprises a disk 10 with a rim 11 having an outer cylindrical surface with a plurality of circumferentially spaced radial projections 12 integrally formed therewith. These projections ordinarily are crescent or airfoil-shaped. A plurality of circumferentially spaced, curved, hollow blades or partitions 13 are secured to the projections 12. Each projection 12 fits into the hollow end of a blade or partition and is preferably fused thereto by stitch or spot-welding, as indicated at 14. The outer ends of the blades or partitions 13 are connected by a ring which in the present instance has a plurality of circumferentially spaced sections 15, 16 with ends 17 rabbeted together. Each section 15, 16 has a plurality of circumferentially uniformly spaced projections 18 formed on its inner surface. Each projection 18 fits into the hollow end of a blade or partition 13 and is secured thereto, preferably by a spot or stitch-welding, as indicated at 19.

During the process of manufacture of such bladed body a disk 20 (Fig. 2) with a rim 21 is formed. The cylindrical surface of the rim 21 is

machined along the lines 22 and 23 to produce on said rim a plurality of circumferentially spaced lands 24 (Fig. 3) inclined towards the axis of the disk. The lands 24 then are partly cut away and shaped on a known type of milling and copying machine to produce projections 12, as illustrated in Figs. 4 and 1. The blades are produced from thin sheet steel by a forming and pressing operation. The inner half 25 and the outer half 26 of each blade may be produced from a single piece of sheet metal by a forming and pressing operation. The adjacent edge portions 27 of said halves may be fused together and subsequently machined. The sections 15, 16 of the outer ring or shroud may be manufactured in the same manner as the disk. The projections 18 on said sections 15, 16 are also formed by a milling operation. In case the outer ring is formed from a straight strip of metal, the projections 18 may be produced prior or subsequent to the bending of such strip.

While in the arrangement shown in Fig. 1 the outer band or shroud 15, 16 is provided with projections 18 formed by a machining operation, such projections may also be produced by a punching and forming process. Such an arrangement is disclosed in Figs. 6 and 7. This arrangement comprises a shroud or band 30 secured to the outer ends of buckets or partitions 31. The shroud has a plurality of circumferentially spaced openings 32 with raised edges or projections 33 formed around the openings. These projections may be produced by a simple punching and forming operation. Each projection is fused to an end portion of a blade. In the present example the end portions of the blades or partitions 31 project into the opening formed by the raised portions or projections 33 and are fused thereto by stitch-welding or brazing. The raised portions or projections 33 are of uniform height only around the wide portions 34 of the openings and taper gradually towards the thin end portions of the openings. The tapered portions 35 in certain instances may be eliminated altogether.

In Fig. 8 I have shown a turbine casing 36 and a diaphragm 37 supported thereon. The diaphragm includes a nozzle structure having a plurality of circumferentially spaced partitions 38 with ends secured to an inner band 39 and an outer band 40 respectively. Each band 39, 40 has a plurality of circumferentially spaced openings 41 with raised edge portions 42 around the openings or at least along the wide portions of these openings. The raised edge portions 42 project into the ends of the hollow partitions

38 and are fused thereto by stitch-welds 43. The outer band 40 of the nozzle structure is secured to a ring 44 by welds 45 and the inner band 39 of the nozzle structure is secured to a disk 46 by means of welds 47.

Having described the method of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, I desire to have it understood that the apparatus shown is only illustrative and that the invention may be carried out by other means.

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

1. Bladed body comprising a disk having a rim with a plurality of circumferentially spaced curved projections integrally formed thereon, a plurality of circumferentially spaced hollow blades each having an end portion enclosing and fused to one of the projections, and an outer ring connected to the outer ends of the blades, said ring having a plurality of circumferentially spaced projections, each projection extending into and being fused to the hollow end of a blade.

2. Bladed body comprising a disk having a rim, a plurality of circumferentially spaced blades secured to the rim, each blade having a hollow end portion, and a cover having a plurality of circumferentially spaced projections fused to and extending into the hollow end portions of the blades.

3. Bladed body comprising a band having a plurality of spaced curved openings with projections along the edge portions of the openings,

and a plurality of hollow blades, each blade having an end portion fused to a projection.

4. Bladed body comprising a band having spaced curved openings and a projection formed around part of the opening only, and a plurality of hollow blades, each having an end portion projecting into an opening and fused to a projection.

5. A turbine nozzle structure comprising inner and outer bands each having a plurality of spaced curved openings with a projection along the edge of each opening, the projections of one band facing the projections of the other band, and a plurality of spaced blades, each blade having end portions surrounding and fused to corresponding projections of the inner and outer bands.

6. Bladed body comprising a band having a plurality of spaced curved openings with projections along the edge portions of the openings, and a plurality of blades each having an end portion telescoping a projection and being secured thereto.

7. A turbine nozzle structure comprising inner and outer bands each having a plurality of spaced curved openings and a projection along the edge of each opening, the projections of one band facing the projections of the other band, and a plurality of spaced blades each having an end portion telescoping and secured to corresponding projections of the bands.

JOHN H. DORAN.