

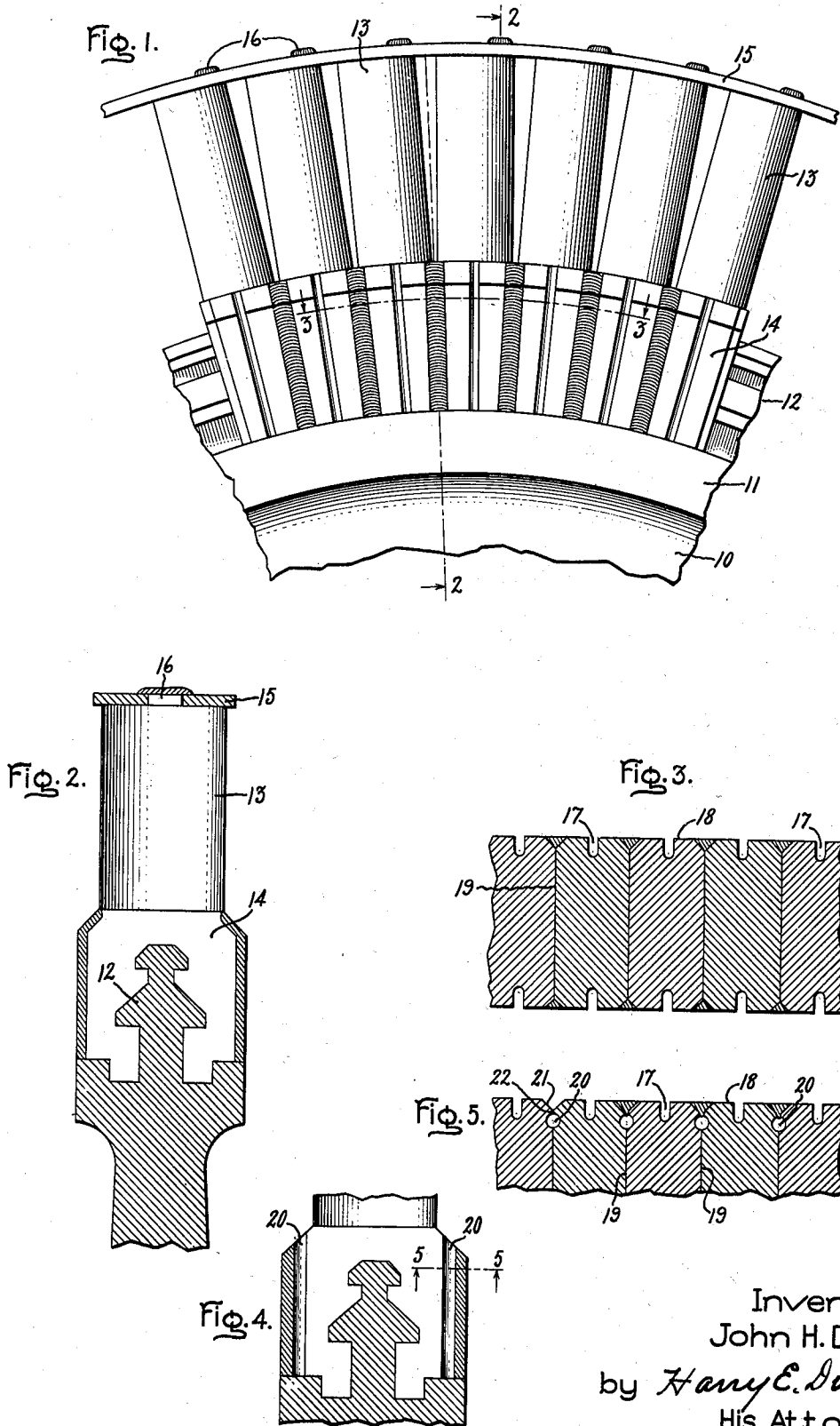
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J. H. DORAN

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ELASTIC FLUID TURBINE BUCKET WHEEL

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Inventor:
John H. Doran,
by *Harry C. Dunham*
His Attorney.

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ELASTIC FLUID TURBINE BUCKET WHEEL

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

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The present invention relates to elastic fluid turbines, particularly to bucket wheels and arrangements for securing the buckets against movement on the rim of the wheel.

5 In elastic fluid turbines designed for high admission pressures of operating fluid, there is a tendency for each bucket, particularly in the high pressure stages, to be slightly displaced from its normal radial position as it passes each nozzle to a position slightly inclined in the radial plane. This repeated rocking movement of the buckets on the rim may result in the breaking of the bucket cover or of the tenons. The degree of inclination of the buckets depends, among other factors, upon the closeness of the fit between the cooperating dovetails of the bucket bases and the wheel rim. Due to the narrowness of the bucket bases, the movement of the buckets is accompanied by a relative sliding motion between the faces of the adjacent bucket bases. By securing a number of the bucket bases together, the sliding motion between adjacent buckets is precluded and hence also the rocking of the individual buckets relative to the rim. Special precautionary measures must be taken in securing the adjacent bucket bases together in order that the juncture may withstand the severe stresses imposed.

It is an object of the present invention to provide an improved arrangement and method for fastening the buckets by uniting the edges of the bases of adjacent buckets together in such a manner that the buckets will be held substantially immovable with respect to the rim and capable of withstanding severe operating conditions.

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 taken in connection with the accompanying drawing.

In the drawing, Fig. 1 is a side elevation of a portion of a bucket wheel embodying my invention; Fig. 2 is a radial-sectional view thereof taken along the line 2-2; Fig. 3 is a cross-sectional view through the bases of the assembly shown in Fig. 1 taken along the line 3-3; Fig. 4 is a radial-sectional view of a portion of a bucket wheel illustrating a second modification of the invention; and Fig. 5 is a fragmentary cross-sectional view taken through the bases of a plurality of adjoining buckets as that shown in Fig. 4 along the line 5-5.

Referring to the drawing, 10 indicates the web of the wheel or rotor and 11 the grooved rim thereof which on opposite sides is provided with

annular shoulders defining a dovetail portion 12 for retaining the buckets 13 thereon. The bucket bases 14 are provided with a grooved slot defining an inverted dovetail for cooperatively fitting over the rim dovetail 12 substantially as shown. The buckets are assembled on the rim in the usual manner, one or more filling slots (not shown) being provided in the rim as is well understood. The bucket cover or shroud band 15 may be suitably secured onto the bucket ends as by means of the riveted tenons 16.

The bucket fastening means described forms what is commonly termed the inverted dovetail type of fastening and in itself is well-known in the art. It may be taken as typical of a suitable type of fastening means in connection with which my invention may be carried out.

According to my invention, I secure the turbine buckets against tilting or rocking in the radial plane on the wheel rim by fastening together the bases of adjacent buckets in a suitable manner such as by welding. The adjacent edges of the bases are preferably preliminarily beveled over substantially the entire length of the bases in order to provide a deep fusion of metal between adjacent bases of considerable length capable of withstanding the severe shearing stresses. To prevent undue internal stressing of the bucket bases due to the expansion and contraction of the surfaces thereof during the welding operation, I provide grooves 17 extending lengthwise of the bucket bases in the outer side walls thereof. If desired, a plurality of such grooves may be provided extending parallel with the edges of the bases to be welded and spaced a suitable predetermined distance from the welding groove. It is preferred that the grooves have a depth at least equal to the depth of the V-shaped welding bevels or as deep as it is intended for the edges to be fused. The weld shrinks when cooling, causing heavy stresses in the weld if not relieved. The groove 17 allows the necessary relief by opening slightly and permitting bending of the projections 18 that are welded together. Thus, a strong weld is formed leaving a minimum of internal stresses in either the weld metal or the base blocks.

As shown in Fig. 3, the bottom of the welds terminate at the cracks 19 defining the surfaces of the abutting bases. To preclude these cracks from initiating fissures in the metal of the welds during the operation of the machine, I prefer to weld the bucket bases together in the manner according to the second modification of this invention illustrated in Figs. 4 and 5. According to

this modification of my invention, I provide the adjacent faces of the bucket bases with semi-circular or other suitably shaped grooves 20 parallel with and displaced a predetermined slight distance inwardly from the edge of the welding bevel 21, as shown best at the left in Fig. 5. Upon the assembly of the buckets on the wheel, the grooves 20 are aligned to form suitably shaped passages which extend through the bases and spaced slightly beneath the edges to be welded together. During the welding operation, the relatively thin wall 22 between the bottom of the bevel groove 21 and the passage formed by the grooves 20 is fused so that there will not be a crack at the bottom of the weld. The danger of weld failure due to fissures developing from the cracks 19 is thus effectively negated and a juncture of great strength is provided.

It is understood, of course, that all of the buckets on the wheel rim may be welded together, or they may be welded together in groups, two or more adjacent buckets comprising each group.

Having described the principle 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. In an elastic fluid turbine having a rotor with buckets having bases dovetailed thereon, said bucket bases being provided on the opposite outer side walls with expansion grooves extending lengthwise of the bases and substantially parallel with the edges thereof, the adjoining edges of adjacent bucket bases being welded together along the length of said bases.

2. In an elastic fluid turbine having a rotor with buckets fastened individually to the rim of said rotor, the abutting faces of the bucket bases being provided with aligned grooves along opposite sides forming passages substantially parallel to and spaced a predetermined distance from the outer side walls of said bucket bases, the portions of said bases between said passages and said outer side walls being welded together.

3. In an elastic fluid turbine, a rotor with

buckets having bases removably attached thereto, the faces of adjacent bucket bases abutting tightly against each other, the outer adjoining edges only of said bucket bases being welded together along substantially the full length thereof, means for substantially precluding the development of fissures through said welded portions including grooves in said bucket bases extending parallel to and adjacent said welded portions.

4. In an elastic fluid turbine, a rotor with buckets having bases removably secured thereto, the faces of adjacent bucket bases abutting tightly against each other, the outer adjoining edges only of said bucket bases being welded together along substantially the full length thereof, means for substantially precluding the development of fissures through said welded portions including a passage formed by grooves provided in said base faces communicating with the inner extremity of said welded portions throughout the full length thereof.

5. An axial flow elastic fluid turbine bucket having a blade and a base secured to the lower end of the blade for connection to a disk, the base being substantially rectangular in cross-section and having four cut-away corner portions to form together with adjacent blades grooves along the entire length of the base for receiving welding material, the faces of the base being formed with grooves parallel with and in close proximity to the corner portions.

6. An elastic fluid bucket wheel comprising a disk having a rim, a row of buckets each having a blade and a base secured to the lower end of the blade and forming a dovetail connected to the rim, adjacent bases abutting each other and each base having four corner portions cut away along the entire length of the base to form together with adjacent bases grooves, welding material filling the grooves along the entire length of the bases, each of the four faces of each base being formed with grooves parallel with and in close proximity to the cut-away corner portions whereby the bases of the buckets are integrally united and excessive stresses in the welded corner portions are prevented.

JOHN H. DORAN.