

Oct. 14, 1930.

J. H. DORAN

1,778,066

ELASTIC FLUID TURBINE

Filed April 25, 1929

Fig. 1.

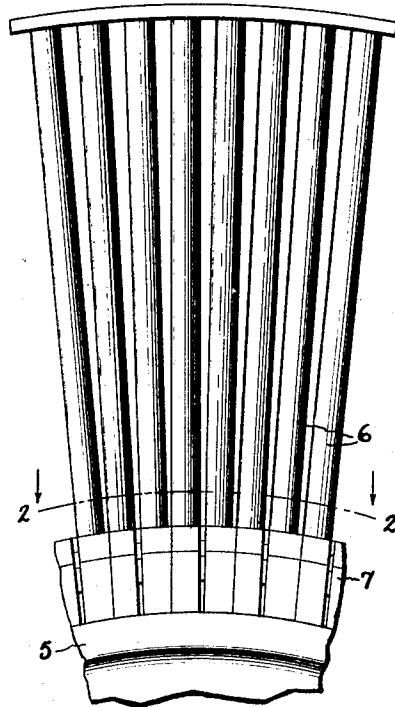


Fig. 2.

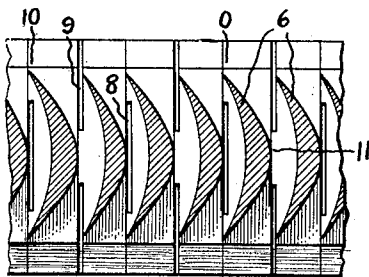
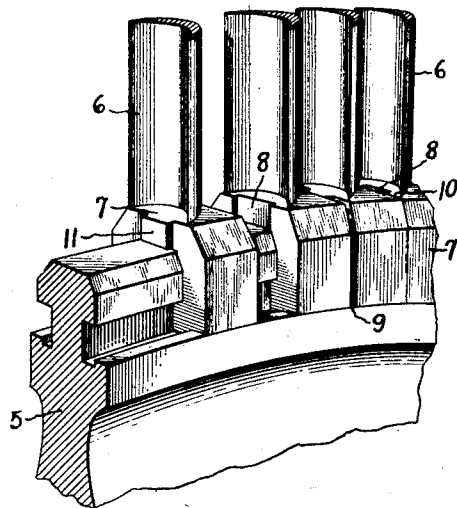


Fig. 3.



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## UNITED STATES PATENT OFFICE

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## ELASTIC FLUID TURBINE

Application filed April 25, 1929. Serial No. 358,122.

The present invention relates to elastic-fluid turbines and particularly relates to a construction of bucket dovetail attaching means which provides for heat expansion.

5 In turbine practice it is essential to obtain a rigid construction of the bucket bases and wheels which will withstand not only the stresses set up due to centrifugal action, but also those which occur due to substantial temperature changes which are continuously going on in the turbine by virtue of changing conditions of such factors as load and vacuum. Hot steam entering the turbine may cause the ring of bucket bases to increase in circumference much faster than the wheel due to the more direct contact of the buckets with the steam. The bucket bases, as temperature conditions are varied, expand radially, laterally, and endwise. The radial and lateral expansions are not material since only single short dimensions are involved. However, the endwise expansion of the bucket bases is accumulative and constitutes the circumferential expansion of the ring or annulus of bases. The endwise dimension involved is the circumference of the ring and as this is large the endwise expansion of several hundred buckets which make up a ring becomes very material. Where the bucket bases form a tight fit there is no room for expansion to take place. As the bucket bases are restricted from expanding circumferentially they produce heavy forces on the dovetail connections in a radial direction, tending to break the bucket bases or the dovetail lug of the wheel. Breakages usually occur at or near stages where hot steam may initially enter the turbine.

According to my invention I provide an improved structure and arrangement in a fastening or connecting means for the bucket bases which will make allowance for the expansion of the buckets.

15 In the drawing, Fig. 1 is a side elevation of a part of the turbine wheel with the bucket bases fastened in accordance with my invention; Fig. 2 is an enlarged sectional view taken on line 2—2 of Fig. 1, and Fig. 3 is a perspective view of the bucket base and wheel assembly.

Referring to the drawing, 5 indicates a turbine wheel carrying buckets 6. The base members of the buckets are indicated at 7. They are formed with slits which provide legs which straddle the rim of the wheel and engage in grooves in the sides of the rim. This is a known bucket fastening means termed usually an inverted dovetail connection.

According to my invention I provide base members 7 with cut-away portions 8 and 9 as shown in the drawing. The cut-away portions 8 are disposed adjacent the center of one end surface of alternate bucket bases 7 forming marginal lugs 10 thereon. The cut-away portions 9 are disposed adjacent to the outer edges of one end surface of the remaining bucket bases forming central lugs 11 thereon.

With the foregoing arrangement, when temperature changes take place during starting or changes of vacuum or load conditions the bucket bases expand into the cut-away portions and also may bow slightly to allow further expansion to take place without breakage. The bases having the cut-away portion disposed adjacent the center of its end surface would bow in the direction of that surface. The remaining bases 7 would bend in the opposite direction.

It is obvious that other means may be employed in carrying out the present invention such as any provision of bucket bases susceptible of yielding or elastic material in or between said bases.

I therefore do not desire that my invention shall be construed as limited to the specific structural details that are illustrated since they may be modified without departing from the spirit and scope of the invention as set forth in the appended claims.

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

1. In an elastic fluid turbine, a wheel, a row of buckets having bases attached to the wheel, one-half of said bucket bases being provided with centrally located circumferentially projecting lugs and the other half of said bucket bases being provided with marginal circumferentially projecting lugs, said lugs serving to define spaces between the

bases whereby heat expansion of said bases may occur in a circumferential direction.

2. In an elastic fluid turbine, a wheel, a row of buckets having bases attached to said wheel by an inverted dovetail joint, lugs defining spaces between said bases, said lugs comprising central circumferentially projecting base lugs which define one-half of said spaces, and marginal circumferentially projecting base lugs which define the other one-half of said spaces whereby expansion of said bases may occur in a circumferential direction.

3. In an elastic fluid turbine, a wheel with a row of buckets fastened thereon, and lugs disposed intermediate the bases of said buckets, said lugs defining centrally disposed spaces between alternate adjacent base sides and marginally disposed spaces between the remaining adjacent base sides whereby expansion of said bases may take place in a circumferential direction.

In witness whereof, I have hereunto set my hand this 24th day of April, 1929.

JOHN H. DORAN.