No. 874,993. PATENTED DEC. 31, 1907.

W. F. RICE.

BUCKET FOR TURBINES.

APPLICATION FILED JULY 9, 1906.

Fig. 1.

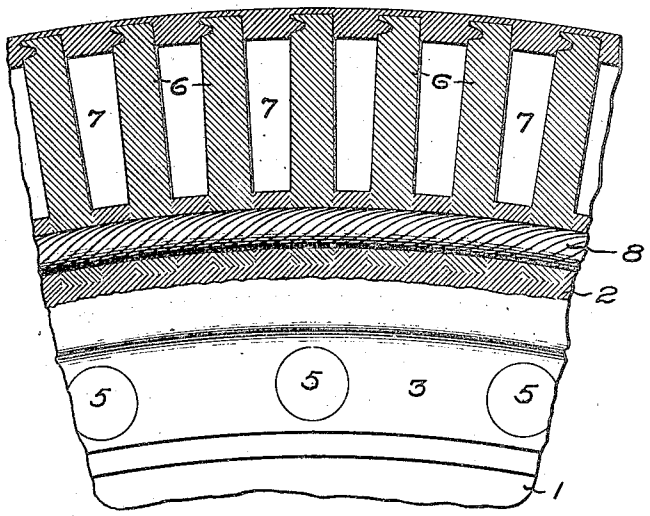


Fig. 2.

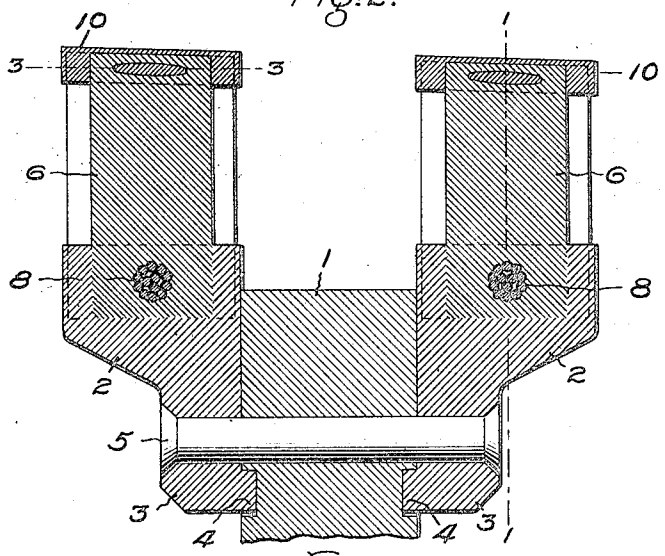
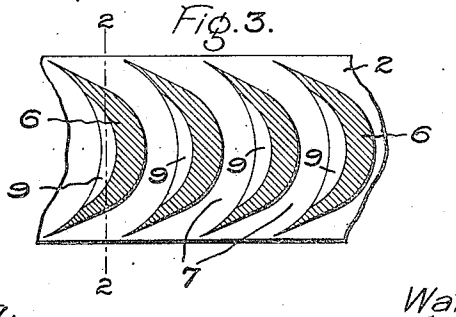


Fig. 3.



Witnesses:
Marcus L. Byng.
Alex. F. Macdonald.

Inventor:
Walter F. Rice,
by Albert G. Davis
Atty.

UNITED STATES PATENT OFFICE.

WALTER F. RICE, OF QUINCY, MASSACHUSETTS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

BUCKET FOR TURBINES.

No. 874,993. Specification of Letters Patent. Patented Dec. 31, 1907.

Application filed July 9, 1906. Serial No. 325,219.

To all whom it may concern:

Be it known that I, WALTER F. RICE, a citizen of the United States, residing at Quincy, county of Norfolk, State of Massachusetts, have invented certain new and useful Improvements in Buckets for Elastic-Fluid Turbines, of which the following is a specification.

This invention relates to elastic fluid turbines, and one object thereof is to provide an improved mode of uniting separately formed buckets to a suitable base or support, either movable or stationary.

A further object is to unite said buckets to the cover, which incloses their outer ends to guide the motive fluid and also to prevent leakage thereof. It has been proposed to connect buckets to their base or other support by casting the latter about the shanks of the buckets, so that the two parts will be fused together. By my invention I not only fuse the buckets to their base or other support, but I also connect them mechanically in order to guard against the possibility of a bucket getting loose because it has been imperfectly fused.

Owing to the thinness of the cover, it is impracticable to effect a fusion with the buckets when it is cast thereon. I, therefore, provide for a mechanical interlock between the cover and the buckets when the casting is done. This is effected by grooving, slotting, recessing, perforating, or otherwise treating the outer ends of the buckets so as to form shoulders or abutments transverse to the longitudinal axis of the bucket, whereby when the cover is cast the molten metal will flow under said shoulders or abutments and form a mechanical interlock therewith when it cools.

In the accompanying drawing, Figure 1 is a section of a portion of a bucket-wheel and buckets embodying my invention, taken in a plane of revolution on the line 1—1, Fig. 2; Fig. 2 is a section in an axial plane on the line 2—2, Fig. 3; and Fig. 3, is a cross-section on the line 3—3, Fig. 2, the cover being absent.

The bucket wheel or other support carries one or more segmental bases 2, which have flanges 3 fitting against the sides of the wheel, and provided with lips and entering appropriate grooves in said wheel to resist the centrifugal force developed at high speeds. The bases are secured to the wheel by rivets 5 which pass through the flanges on the other wheel and have their heads counter-sunk flush with the surface of the flanges to reduce rotation losses.

The buckets 6 are of the customary shape, being lune-shaped in cross-section and spaced apart to leave a passageway 7 between them for the steam to flow through. The inner ends of the buckets are perforated or slotted, and the perforations or slots are all alined so that a connector, such as a rod or cable 8, can be threaded through them. The outer ends of the buckets are provided with a shoulder, formed, for example, by a groove, slot or recess 9. The buckets are made of a selected alloy and preferably formed by extruding said alloy through a die. After being cut to the proper length, finished, bored or slotted at the base, and slotted or recessed or otherwise shouldered at the outer end, a plurality of them is threaded on a connector of suitable length and placed in a mold, where they are carefully and accurately spaced by suitable devices. Molten metal, preferably an alloy similar to that from which the buckets are made, is then poured into the mold, forming the segmental base or other support 2 and a cover 10. The metal of the base or support extends outwardly along the buckets to a point beyond the connector 8, enters the holes in the inner ends of the buckets and fills the space between the walls of said holes and the connector. A cable is preferred as a connector because the helical grooves between the strands afford an excellent opportunity for the molten metal to pass through the holes. The ends of the buckets enveloped by the melted metal are fused so that when properly done a perfect union is formed between the buckets and the base or support. Should the fusion be faulty from some unforeseen or unpreventable reason, the connector will hold the bucket in place, its shearing strength being far in excess of any strain tending to pull the bucket from its place. As a usual thing, the connector itself is partly or wholly fused to the base and to the buckets.

The metal forming the cover is not sufficient in quantity to effect a complete fusion of the buckets therewith, but it enters the grooves, slots or other shoulder-forming portions of the bucket, and thus insures a firm mechanical interlock between said cover and the buckets. The cover is made unusually

thick and strong, having plenty of stock for machining in the operation of truing up the completed wheel. The base and the cover project slightly beyond the buckets, so as to protect the sharp edges of the latter when the parts are handled in assembling, and also to guard them from rubbing against the intermediates or other stationary elements of the machine when it is running. It is evident that the cover may be secured to the buckets by a connector, in addition to the shouldered interlock, if desired and also that the shouldered interlock may be used to assist in holding the bucket to the base, as an additional precaution in case of faulty fusion.

A cast-on cover affords several points of advantage in economy and ease of construction. When a separate cover strip is used, tenons must be cut on the buckets, and the strip must be punched to receive these tenons, and this work must be very accurately done to avoid springing the buckets out of place when the cover strip is fitted on. The tenons must be headed down, and it is difficult to do this evenly and regularly. Moreover, as above pointed out, the cast-on cover can be made much thicker and stronger than the punched sheet metal cover. The casting and fusing process results in a bucket segment in which the base, buckets and cover are practically an integral solid structure.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can 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, the combination with separately formed buckets, of a connector passing through the same, and a mass of metal cast on said buckets.

2. In an elastic fluid turbine, the combination with separately formed buckets, of a connector passing through the same, and a mass of metal cast on said buckets and fused thereto.

3. In an elastic fluid turbine, the combination with separately formed buckets, of a connector passing through the same, and a mass of metal cast on said buckets and fused thereto and to said connector.

4. In an elastic fluid turbine, the combination with separately-formed buckets, of a connector passing through their ends, and a mass of metal cast thereon and extending beyond said connector.

5. In an elastic fluid turbine, the combination with separately formed buckets, of a cable passing through their ends, and a support cast thereon and enveloping said ends and said cable.

6. In an elastic fluid turbine, the combination with separately formed buckets, of a base and a cover both cast thereon, and a connector passing through said buckets.

7. In an elastic fluid turbine, the combination with separately formed buckets, of a base and a cover both cast thereon, and a connector passing through said buckets and enveloped by the cast metal.

8. In an elastic fluid turbine, the combination with separately formed buckets, of a cover cast thereon and mechanically interlocked therewith.

9. In an elastic fluid turbine, the combination with separately formed buckets, of a cover cast thereon and mechanically interlocked therewith, and a base cast on and fused to said buckets.

10. In an elastic fluid turbine, the combination with separately formed buckets having shouldered ends, of a cover cast thereon and interlocking with said shoulders.

11. In an elastic fluid turbine, the combination with separately formed buckets, of a connector passing through them near one end, a base cast on and fused to said buckets and enveloping said connector, and a cover cast on and mechanically interlocked with said buckets.

In witness whereof, I have hereunto set my hand this 5th day of July, 1906.

WALTER F. RICE.

Witnesses:

CARL C. THOMAS,

SAMUEL T. MACQUANIE.