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O. JUNGGREN.

INTERMEDIATE BUCKET AND SUPPORT FOR TURBINES.

APPLICATION FILED FEB. 18, 1904.

Fig.1.

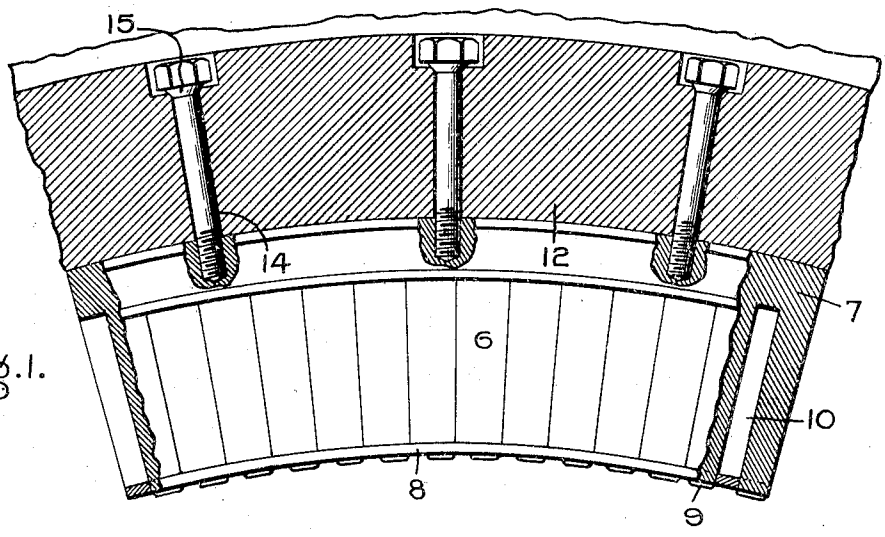


Fig.2.

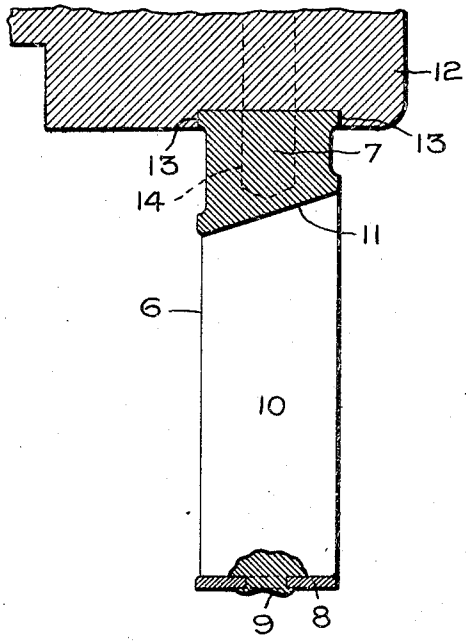
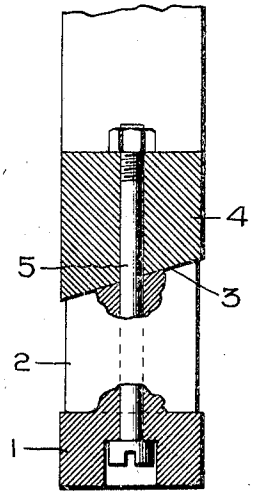


Fig.3.



Witnesses:

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No. 792,659. Patented June 20, 1905.

UNITED STATES PATENT OFFICE.

OSCAR JUNGGREN, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

INTERMEDIATE BUCKET AND SUPPORT FOR TURBINES.

SPECIFICATION forming part of Letters Patent No. 792,659, dated June 20, 1905.

Application filed February 18, 1904. Serial No. 194,204.

To all whom it may concern:

Be it known that I, OSCAR JUNGGREN, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Intermediate Buckets and Their Supports for Elastic-Fluid Turbines, of which the following is a specification.

The present invention relates to intermediate turbine-buckets which are situated between the rows of wheel-buckets and are employed to reverse the direction of the fluid stream or streams and discharge it or them at the proper angle against the adjacent row of wheel-buckets. The intermediate buckets are stationary and are separated from the wheel-buckets or some part of the wheel by a very small clearance, which clearance to a very great degree affects the economy of the machine. The smaller it is the greater will be the economy, because the leakage of the motive fluid is correspondingly reduced. The clearance is frequently as low as .02 of an inch and varies from that to .05 of an inch. In order to efficiently transform the energy of the motive fluid into useful work, it is necessary to have a relatively high bucket speed, and it is common practice to operate turbines with a bucket speed of four miles per minute and above. Owing to the high peripheral speed of the wheel and to the distortion of the parts due to unequal expansion, the support for the intermediates becomes an important consideration because of the liability of injury due to contacting of the relatively movable parts. Another thing to be taken into account is the expansion in a radial direction of the working passage between the buckets.

Prior to my invention it was the practice to cut the intermediate on the convex side of a segmental piece of stock by means of a bucket-cutting machine, it being the only way that buckets can be cut on the machines with which I am familiar. This meant that in order to get the desired gradual expansion of the passage it was necessary to bevel the outer ends of the buckets, which engage with a fixed support carried by the casing. Bolts for securing the parts in place were arranged to extend through the segment on which the buckets were formed and also through the buckets themselves into the support. This construction is open to the serious objection that when the securing-bolts are tightened they have a tendency to cause the intermediates to shift bodily in the direction of the bevel on the ends of the buckets. Any clearance whatever around the body of the bolt such as is usually provided will permit the buckets to shift laterally by that amount. This tendency to sidewise movement is enhanced by reason of the smooth surface on the support, which is necessary to prevent eddy-currents in the motive fluid. The alternate heating and cooling of the parts has a tendency to loosen the buckets, so that even if the buckets were correctly set the first time they may shift later. It is also objectionable to be obliged to use bolts which pass through the buckets, because they are necessarily limited in cross-section. Moreover, it is difficult to drill holes lengthwise through long thin buckets having a tapered end. When the intermediates extend around or largely around the wheel and are made in several sections, the difficulty of adjusting all of the sections exactly right is apparent.

My invention has for its object to improve and simplify the construction of intermediate buckets and their support, whereby the cost is reduced and the buckets may be quickly and accurately set.

In carrying out my invention I cast the buckets integral with a segmental base or support located at their outer ends, the inner ends adjacent to the wheel being disconnected. Some or all of the buckets are provided with integral tenons by which a thin cover forming one part of the bucket-spaces is attached. The segmental support is beveled between buckets to give the necessary enlargement toward the exhaust, the thin cover being straight, or substantially so. The periph-

ery of the segmental support is finished in any suitable manner and is seated in a close-fitting groove in the wheel casing or support. Bolts of substantial size are arranged to pass through the casing and secure the parts in place.

One of the distinguishing features of my invention is that the segmental base-piece on which the buckets are formed is located at the point of greatest diameter, whereas with the old construction it was located at the point of least diameter.

In the accompanying drawings, which illustrate one embodiment of my invention, Figure 1 is a detail sectional view of a set of segmental buckets. Fig. 2 is a sectional view taken at right angles to that shown in Fig. 1; and Fig. 3 is a longitudinal section of an intermediate bucket, illustrating the old construction.

Referring to Fig. 3, 1 represents the segmental base-piece adjacent to the wheel and having buckets 2 formed integrally therewith. These buckets are cut from the solid stock by a suitable bucket-cutting machine and radiate from a common center. The outer ends of the buckets are beveled, as indicated at 3, and these beveled ends engage with the correspondingly-beveled surfaces on the support 4. The buckets and support are drilled to receive the retaining-bolts 5, which radiate outwardly from a common center. In other words, the head of the bolt is located adjacent to the wheel and the nut at a point adjacent to the wheel-inclosing casing. When the nut is tightened, it has a tendency to move the buckets bodily to the right, owing to the inclination of the surface 3. There is always some space around the body of the bolt which is sufficient to throw the buckets out of their proper alinement.

In Figs. 1 and 2 is shown a construction by means of which I obviate the objections referred to in connection with the old style of bucket shown in Fig. 3. This represents a plurality of radial or substantially radial buckets 6, which are cast integral with a base-piece 7, which is preferably although not necessarily made up in segments. This depends largely on whether the buckets are to cover a small or great angular portion of the wheel. The base portion is formed at the outer ends of the buckets where the diameter is greatest. The inner ends of the buckets where the diameter is least are disconnected, and a detachable sheet-metal cover 8 is provided therefor, which is held in place by tenons 9, formed integrally with the inner ends of the buckets. This cover presents a smooth inner surface to the motive fluid passing through the bucket-space 10. The plane of the cover can be parallel to the wheel-axis, as shown, or at an angle thereto if it be desired to change the cross-sectional area of the bucket-spaces. In order to compensate for the increased volume of the motive fluid, it is necessary to expand the bucket-spaces in the direction of the exhaust. It is preferable to make this expansion gradual, and in the present instance I obtain this expansion by beveling or cutting away the space between the adjacent buckets, as indicated at 11. It is to be noted that the beveled surface extends from one side of the bucket to the other, which insures a gradual expansion of the cross-sectional area of the passage. The periphery of the base-piece 7 is finished in any suitable manner in order that it may be securely mounted in the wheel-casing 12 or other support. In the present instance the base-piece is provided with a smooth peripheral surface and side walls 13, which are parallel with each other and extend at right angles to the peripheral surface. The walls 13 are arranged to engage with the side walls of a groove formed in the support or casing 12. The base-piece is tapped at a number of points to receive the retaining-bolts 14, the latter being of substantial size and accessible from the outside of the casing. Between the head and the body of each bolt is a tapered portion 15, which engages with a conical seat formed on the support or casing 12 and which prevents the escape of any steam or other motive fluid around the body of the bolt.

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 of a casing, a plurality of radial or substantially radial buckets, a base which is formed integral with the buckets and located at the point of greatest diameter, the said buckets being unconnected at their inner ends, means for securing the base which are accessible outside of the casing, a cover for the buckets which is located at the point of least diameter, and means for mounting the base in place.

2. In an elastic-fluid turbine, the combination of a grooved casing or support, a segmental base-piece having a finished periphery which fits into the groove, integral buckets which extend inwardly toward a common point of lesser diameter, and cut-away portions which increase the cross-sectional area of the spaces between buckets, a cover for the inner ends of the buckets, and bolts for retaining the buckets in place, which pass through the support into the segmental base-piece.

3. As an article of manufacture, an intermediate for an elastic-fluid turbine, comprising a base-piece, buckets formed integral with the base at their outer ends or point of greatest diameter, and having separate inner ends, the working passages between the buckets ex-

panding toward the exhaust, a separable cover for the inner ends of the buckets, which is curved on a smaller radius than the base-piece, and means passing through holes in the cover for securing it in place.

4. As an article of manufacture, an intermediate for an elastic-fluid turbine, comprising a segmental base having a finished outer surface for engagement with a support, and cut-away portions to increase the area of the bucket-spaces, a plurality of integral buckets extending inwardly toward a point of lesser diameter, and a sheet-metal cover which is attached to the inner ends of the buckets.

In witness whereof I have hereunto set my hand this 12th day of February, 1904.

OSCAR JUNGGREN.

Witnesses:
GEO. L. TOWNSEND,
N. P. ZECK.