H. J. HANZLIK.

TURBINE BUCKET CONSTRUCTION.

APPLICATION FILED SEPT. 28, 1916.

1,310,864. Patented July 22, 1919.

Fig. 1

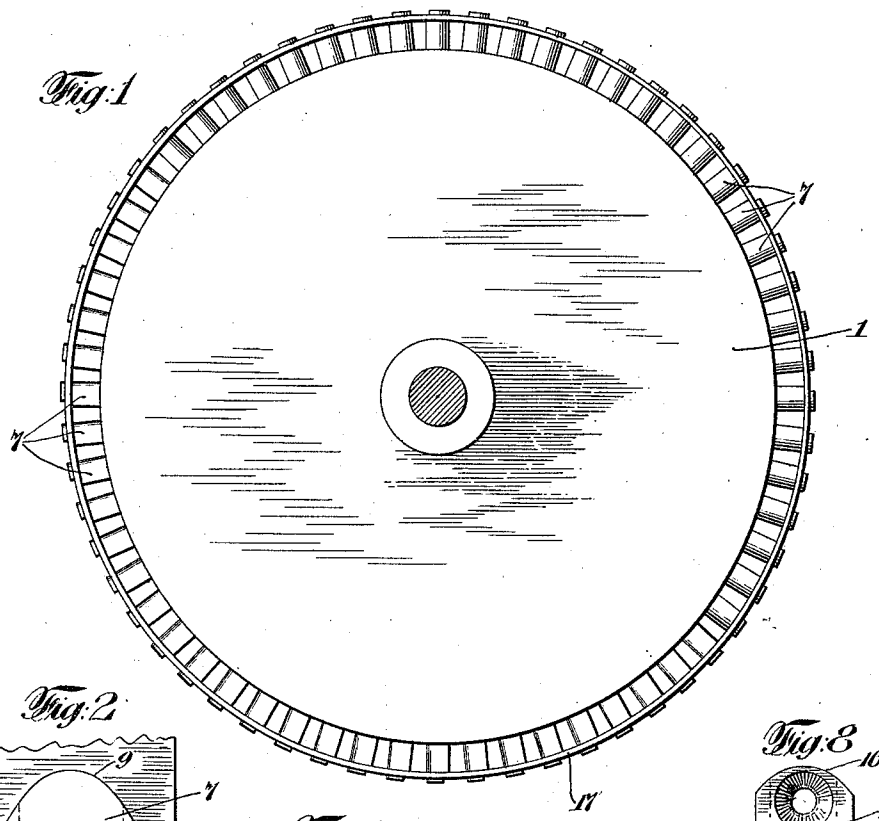



Fig. 2

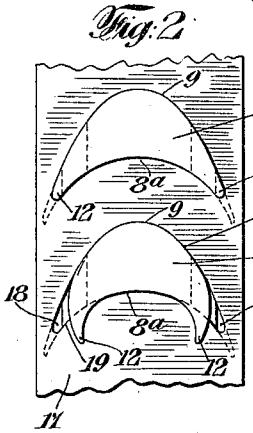



Fig. 4

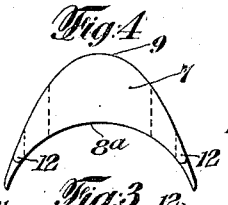



Fig. 3

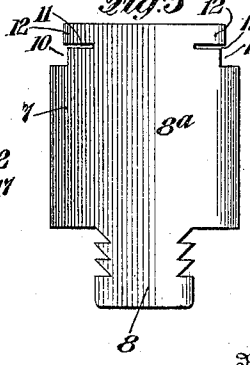



Fig. 5

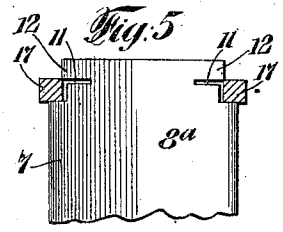



Fig. 6

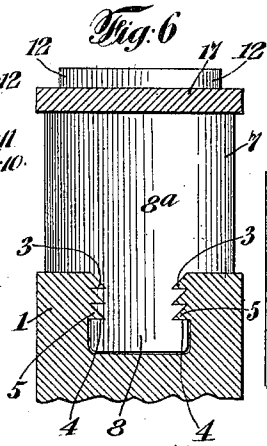



Fig. 8




Fig. 7

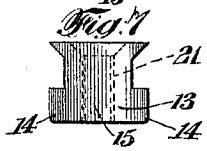
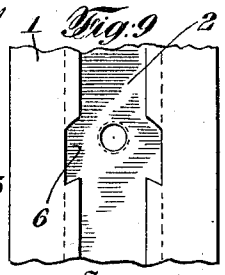



Fig. 9




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# UNITED STATES PATENT OFFICE.

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## TURBINE-BUCKET CONSTRUCTION.

1,310,864. Specification of Letters Patent. Patented July 22, 1919.

Application filed September 28, 1916. Serial No. 122,612.

*To all whom it may concern:*

Be it known that I, HENRY J. HANZLIK, a citizen of the United States, and a resident of Wellsville, in the county of Allegany, and in the State of New York, have invented a certain new and useful Improvement in Turbine-Bucket Construction, and do hereby declare that the following is a full, clear, and exact description thereof.

My invention relates particularly to turbines, and especially the mode of attaching buckets and shroud rings to the bucket wheels therein.

The object of my invention is to provide a construction of this character, in which shroud rings are applied in such a way as to prevent the breaking thereof in the operation of the turbine, by constructing the shroud ring in such a manner that it is stretchable. A further object is to provide a shroud ring which is securely held in place on the ends of the buckets in a convenient manner. A further object is to provide an advantageous manner of securing the buckets to the turbine wheel, whereby the buckets may be readily assembled on the wheels, while, at the same time they are securely held in place against any radial movement.

While my invention is capable of embodiment in many different forms, for the purpose of illustration I have shown only one form thereof in the accompanying drawings, in which—

Figure 1 is a side elevation of a turbine bucket wheel made in accordance with my invention;

Fig. 2 is a fragmental plan view of the same;

Fig. 3 is a front elevation of one of the buckets showing the bucket before the shroud ring is applied;

Fig. 4 is a plan view of the same;

Fig. 5 is a fragmental vertical section, showing the shroud ring applied before it is locked in position.

Fig. 6 is a fragmental vertical section showing the parts after the shroud ring has been locked in place;

Fig. 7 is a front elevation of one of the spacers;

Fig. 8 is a plan view of the same, and

Fig. 9 is a plan view of a portion of the bucket wheel, showing the portion thereof where the buckets and spacers are inserted.

In the drawings, I have shown a bucket wheel 1, having a peripheral groove 2, at each side of which there are a plurality of ribs 3, having cylindrical faces 4 and conical faces 5. Said groove 2 is provided also with an insertion opening 6, where the projections 3 are omitted. The groove 2 is designed to carry a plurality of buckets 7, having tongues 8 which fit in the groove 2. Each of the buckets 7 has a front curved face $8^a$ and a rear curved face 9. At its top, the bucket 7 has lateral recesses 10, in which there are located slots 11, so as to form bendable projections 12 for a purpose to be hereinafter described. Between the buckets 7 there are spacers 13, having lateral extensions 14 at the base thereof, to fit in the base of the groove 2. Each of these spacers 13 has a front curved face 15, and a rear curved face 16, which fit against the adjacent curved faces $8^a$ and 9 of the buckets. The spacers 13, except the one which is to be finally located at the opening 6, do not contain any screw hole, as shown in Figs. 8 and 9; but the final spacer inserted opposite the opening 6 does contain such screw hole. A screw is provided for maintaining the last spacer in place in the opening 6. A shroud ring 17 having openings 18 provided with front curved faces 19 and rear curved faces 20, is applied to the wheel so that said shroud ring fits in recesses 10 on the buckets 7, but leaving the extreme ends of the openings 18 unfilled by the buckets 7. The shroud ring 17 is applied in the form of a broken or interrupted circle, and the free ends thereof are afterward joined by being soldered or brazed together.

In the operation of my invention, the buckets 7 are inserted in the groove 2 through the opening 6, one after another, with spacers 13 alternating between the same, until the grove 2 is entirely filled, whereupon the last spacer 13 is secured in the opening 6 by means of the screw above referred to. The shroud ring 17, in the form of an interrupted circle, is then applied by inserting the upper portions of the buckets 7 into the openings 18, and the projections 12 are thereafter bent laterally so as to secure the shroud ring 17 in place. The free ends of the shroud ring are then soldered or brazed together. When the wheel constructed in this manner is rotated, any tension placed upon the shroud ring

will merely cause the shroud ring to elongate or stretch at the narrow portions thereof, between the openings 18 and the edges of the shroud ring, and owing to the great number of such openings 18, and their uniform distribution, around the shroud ring, the elongation will be uniformly distributed along the shroud ring. In this way the breaking of the shroud ring, due to expansion of the parts of the assembled wheel under the influence of heat, and other causes, will be avoided.

While I have described my invention above in detail, I wish it to be understood that many changes may be made therein without departing from the spirit of my invention.

I claim:—

1. A shroud ring having bucket receiving openings and connecting portions which separate said openings from the edges of the ring and are sufficiently narrow to permit variation in the length of the ring incidental to normal operation to occur without distortion of the ring.

2. A turbine wheel having buckets and a shroud ring provided with narrow connecting portions along the same, said buckets having bendable projections to secure the shroud ring in place.

3. A turbine wheel having buckets and a shroud ring provided with narrow connecting portions uniformly distributed along the same, said buckets having bendable projections to secure the shroud ring in place.

4. A turbine wheel having buckets and a shroud ring provided with bucket receiving openings provided with narrow connecting portions along the same, located between the bucket receiving openings, and the edge of the shroud ring, said buckets having bendable projections to secure the shroud ring in place.

5. A turbine wheel having buckets and a shroud ring provided with bucket receiving openings provided with narrow connecting portions uniformly distributed along the same, located between the bucket receiving openings, and the edge of the shroud ring, said buckets having bendable projections to secure the shroud ring in place.

6. A turbine wheel having buckets and a shroud ring provided with narrow connecting portions along the same, said buckets having bendable projections to secure the shroud ring in place, said wheel having a peripheral recess in which the buckets are secured.

7. A turbine wheel having buckets and a shroud ring provided with narrow connecting portions uniformly distributed along the same, said buckets having bendable projections to secure the shroud ring in place, said wheel having a peripheral recess in which the buckets are secured.

8. A turbine wheel having buckets and a shroud ring provided with bucket receiving openings provided with narrow connecting portions along the same, located between the bucket receiving openings, and the edge of the shroud ring, said buckets having bendable projections to secure the shroud ring in place, said wheel having a peripheral recess in which the buckets are secured.

9. A turbine wheel having buckets and a shroud ring provided with bucket receiving openings provided with narrow connecting portions uniformly distributed along the same, located between the bucket receiving openings, and the edge of the shroud ring, said buckets having bendable projections to secure the shroud ring in place, said wheel having a peripheral recess in which the buckets are secured.

10. In combination, a shroud ring having a curved slot therein, a bucket received in said slot having notches in its sides to provide shoulders on which the shroud ring rests, the portion of the bucket projecting beyond the shroud ring being bent parallel to the shroud ring to engage the walls of the shroud ring slot.

11. A turbine wheel having on its periphery a bucket, an integral shroud ring having a slot, the sides of said bucket being slotted to provide bendable portions on said bucket projecting over the shroud ring and being bent laterally to lock said ring in place.

12. In combination, a turbine wheel, a bucket mounted thereon, and a shroud ring having an aperture engaged by said bucket, the cross-section of said ring at said aperture being so reduced as to permit readily expansion or contraction of the ring incidental to normal operation, to occur without distortion of the ring.

In testimony that I claim the foregoing I have hereunto set my hand.

HENRY J. HANZLIK.

Witnesses:

PAUL B. HANKS,

HAROLD DEIGHTON.

**Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."**