No. 894,659. PATENTED JULY 28, 1908.

E. KALLBERG.

BUCKET WHEEL FOR TURBINES.

APPLICATION FILED DEC. 29, 1906.

Fig. 1.

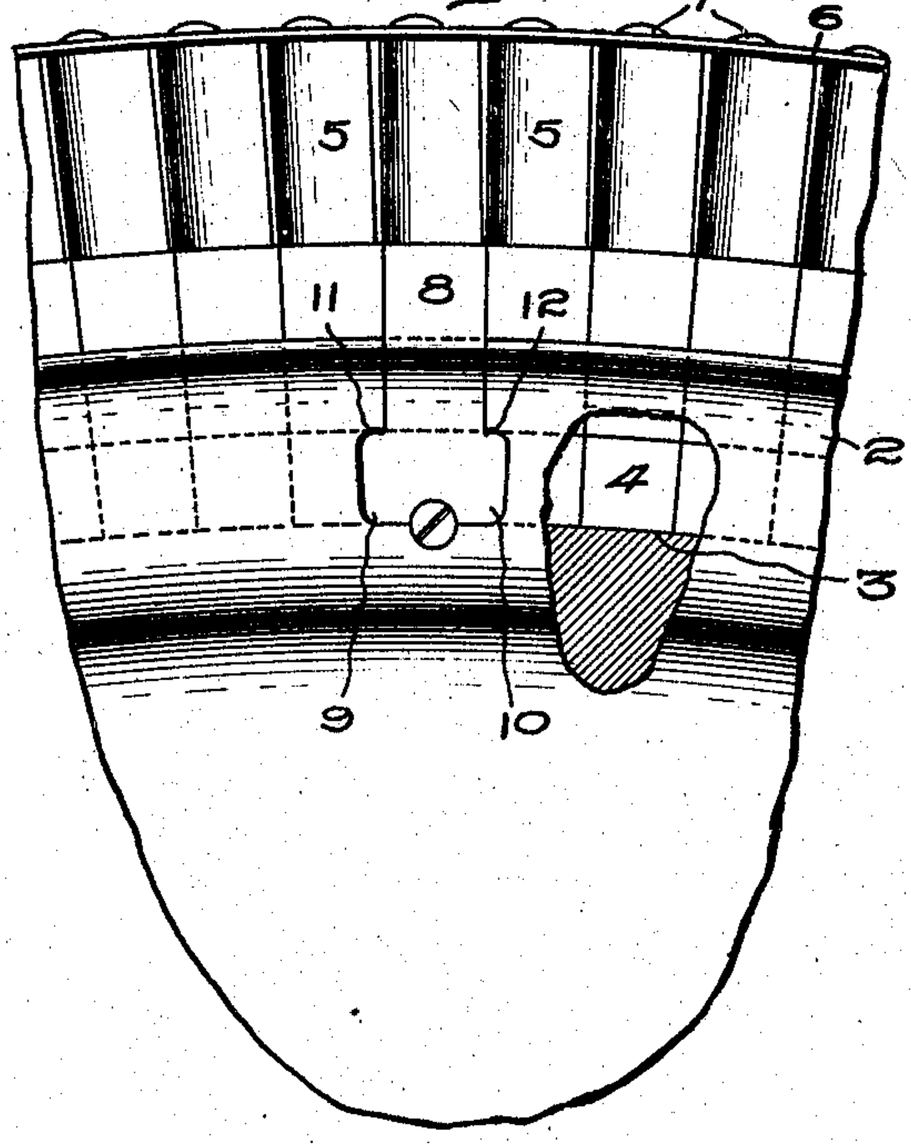


Fig. 2.

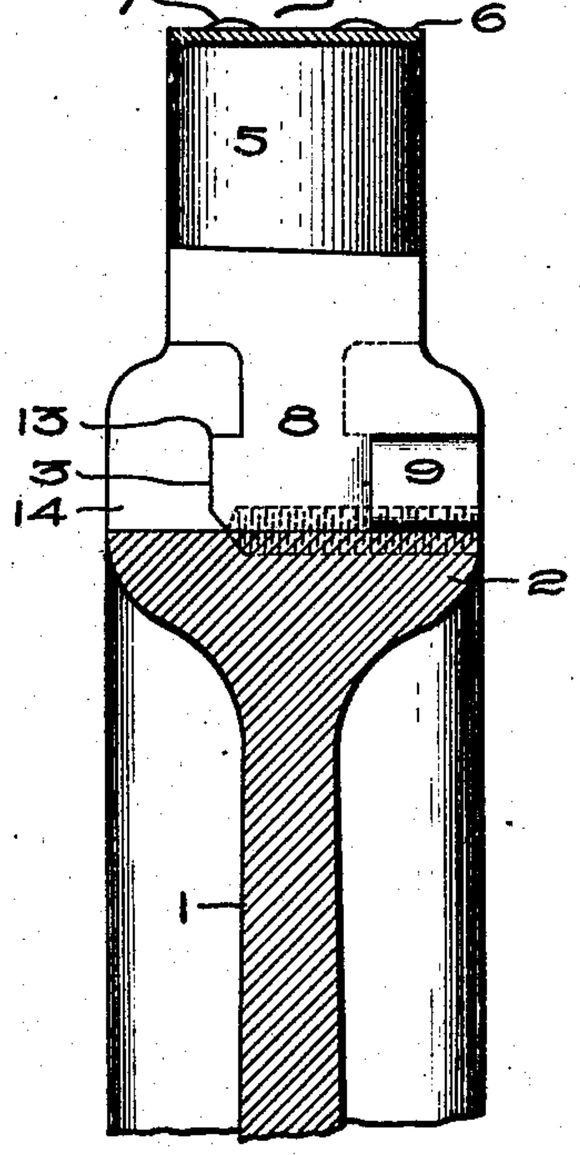


Fig. 3

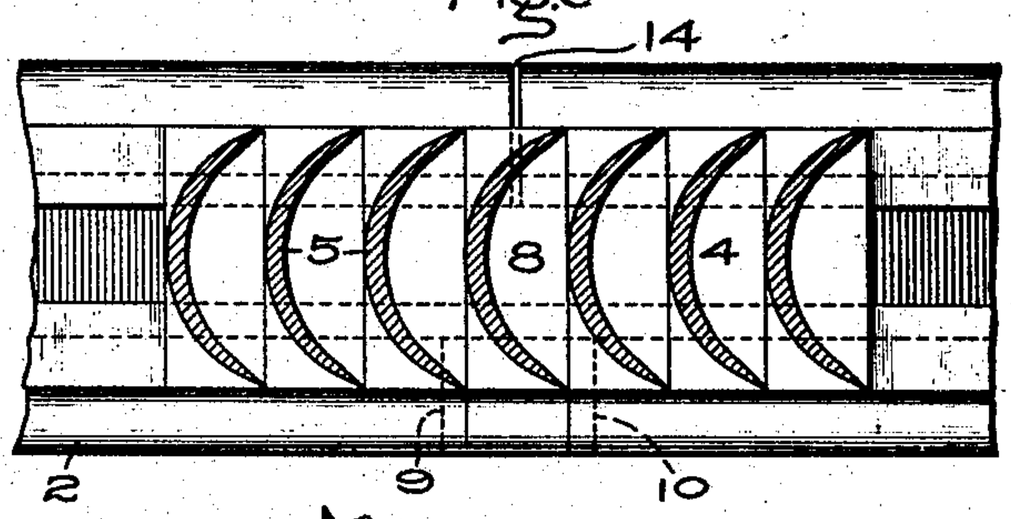
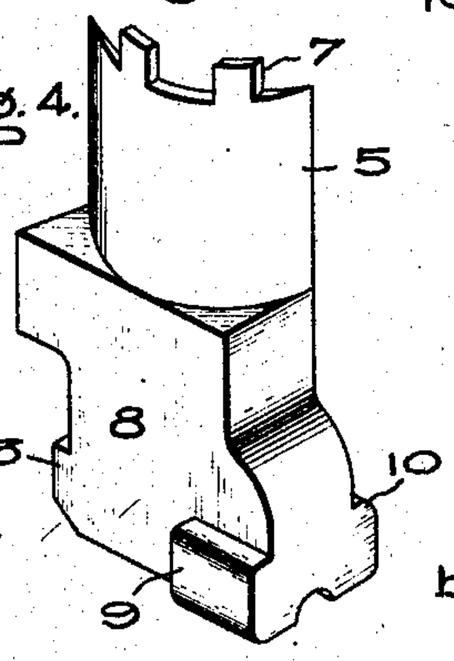


Fig. 4.



Witnesses:

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UNITED STATES PATENT OFFICE.

ERNST KALLBERG, OF BERLIN, GERMANY, ASSIGNOR TO GENERAL ELECTRIC COMPANY A CORPORATION OF NEW YORK.

BUCKET-WHEEL FOR TURBINES.

No. 894,659. Specification of Letters Patent. Patented July 28, 1908.

Application filed December 29, 1906. Serial No. 350,024.

To all whom it may concern:

Be it known that I, ERNST KALLBERG, a subject of the Emperor of Austria-Hungary, residing at Berlin, Germany, have invented certain new and useful Improvements in Bucket-Wheels for Turbines, of which the following is a specification.

The present invention relates to the construction of bucket wheels for turbines and more especially to those intended to be operated at high bucket speeds.

Certain types of bucket wheels with which I am familiar are provided with a peripheral groove of dove-tail or T-shaped cross section arranged to receive the bases of individual buckets mounted thereon. For the purpose of inserting the buckets into the groove an axially extending filling recess is provided that cuts away a certain section of metal from one side of the rim, which recess is large enough to permit the insertion of a bucket base and is of a depth the same or substantially the same as that of the groove.

I have discovered that the internal stresses in the metal of which the wheel is composed are such that cutting the filling recess in the rim of the wheel throws the latter out of true, no matter how true it may have been before. This is more noticeable when the wheel is running, and is particularly objectionable where the rotating buckets travel at a high rate of speed and are separated from the stationary parts by a clearance of only a few hundredths of an inch. I have discovered that this objectionable distortion of the wheel can be obviated by making a thin narrow slot in the side of the rim opposite the filling recess. I prefer to make as many of these slots as there are filling recesses. When the wheel is large the number of filling recesses and therefore of these narrow slots is greater than where the wheel is small.

In the accompanying drawing, which illustrates one of the embodiments of my invention, Figure 1 is a view in elevation of a part of a wheel; Fig. 2 is an axial section; Fig. 3 is a plan view of a part of the wheel; and Fig. 4 is a perspective of a locking bucket or filling piece.

1 represents the web of the wheel having a rim 2 of suitable section and containing a groove 3 arranged to receive the bases 4 of the buckets 5. The groove 3 may have any suitable shape, as for example a dove-tail or T-shape. The latter shape is preferable since there will be no horizontal component tending to spread the sides of the rim when the wheel is revolving. The ends of the buckets may or may not be provided with a cover 6 as desired. I find it desirable, when a cover is used, to secure it in place by means of tenons 7 formed integral with the ends of the buckets, and which project through the cover and are riveted over at the ends. Each bucket may be provided with one of these tenons or more as desired. In order to introduce the buckets into the groove 3, an axially extending recess is provided having the same shape in elevation as the base of the locking buckets.

Referring to Fig. 4, 8 represents the base of the locking bucket, which is of a width sufficient to close the recess, and is provided with lugs 9 and 10 on opposite sides that engage shoulders 11 and 12 formed in the side walls of the recess. 13 indicates a shoulder formed on the base of the locking bucket that engages with and is secured by the shoulder forming a part of the T-shaped bucket-receiving groove. In the side of the wheel rim opposite to the recess is a thin, narrow slot 14, the object of which is to neutralize the effects of internal stresses in the rim occasioned by the cutting of the recess. The dimensions of the slot 14 can be varied to suit the requirements. In general practice I have found that it is satisfactory to form this slot with an ordinary saw or milling cutter and of a depth the same or substantially the same as that of the filling recess. By actual test I have demonstrated that, no matter how much the wheel is out of true after the recess is made, it will be brought back to true just as soon as the thin slots 14 are cut, and will remain true at the speed at which it is normally intended to run.

I have shown my invention in connection with a wheel having buckets provided with a fairly large base so that the base of one bucket engages with that of another, and the two act as separators to maintain the pitch distance of the buckets. I may, instead of this arrangement, form the T or dove-tail directly on the bucket itself, and between each two buckets insert a space-block of suitable shape that is retained by the walls of the T-shaped or other groove.

The piece for filling the recess is shown as forming a part of one of the buckets, but it is evident that I may make the filling piece

or pieces separate from the bucket or buckets. It is also evident that I may change the position of the slot or slots to equalize the internal stresses to suit the requirements.

The locking bucket or filling piece is prevented from working out by the screw 15, the threads of which engage those in the filling piece and also those in the rim.

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. A turbine wheel having a bucket-receiving groove, a recess through which buckets are inserted into the groove, buckets mounted in the groove and retained therein, and a slot of less width than the recess for equalizing the stresses in the wheel caused by the formation of the recess.

2. A turbine wheel having a bucket-receiving and retaining groove of suitable cross-section, one or more recesses in the side of the wheel rim through which the buckets are inserted into the groove, buckets mounted in the groove, a filling means for said recess, and one or more slots having parallel sides formed in the rim on the side opposite the said recess or recesses for equalizing the stresses in the wheel caused by the formation of the said recess or recesses.

3. A turbine wheel having a bucket-receiving groove, a lateral recess through which the buckets are inserted, and a slot of less width than the recess located opposite it to relieve the stresses in the wheel, buckets mounted in the groove and retained by the walls thereof, and a means for filling the recess.

4. A turbine wheel having a rim with a bucket-receiving groove, a lateral recess through which the bases of the buckets are inserted into the groove, and a slot of less width than the recess to relieve the stresses in the rim, buckets, bases for the buckets which are situated in the groove and retained by the walls thereof, and a locking means for the buckets which fills said recess.

5. A turbine wheel having a rim with a bucket-receiving groove, a filling recess, and a narrow slot having parallel sides to relieve stresses in the rim, buckets mounted in the groove, a filling or locking piece for closing the recess, and interlocking shoulders between the said piece and the wheel rim for retaining the piece against centrifugal force.

6. A turbine wheel having a rim with a bucket-receiving groove, a filling recess, and a slot to relieve stresses in the rim, buckets mounted in the groove, a filling or locking piece for closing the recess, a shoulder between a side of the said piece and the rim, and a shoulder between the end of the piece and the wall of the groove, the said shoulders coöperating to secure the locking piece against centrifugal strains.

7. A turbine wheel having a rim provided with a groove for receiving the bases of the buckets, a recess in one side of the rim through which the bases of the buckets are inserted into the groove, a slot in the opposite side of the rim to relieve stresses therein, and a filling or locking piece which is inserted in the recess and extends across the groove into engagement with the side thereof opposite said recess.

8. A turbine wheel having a rim provided with an undercut groove for receiving the bases of the buckets, a recess in one side of the rim through which the bases of the buckets are inserted into the groove, a narrow slot having parallel sides located in the opposite side of the rim to relieve stresses in said rim, and a locking piece in the recess which extends across the groove into engagement with the overhanging side wall thereof opposite said recess.

9. A turbine wheel having a rim provided with an undercut groove for receiving the bases of the buckets, a lateral recess through which the bases of the buckets are inserted into the groove, a slot in the rim opposite the recess to relieve stresses in said rim, and a locking piece which engages the walls of the recess and extends across the groove into engagement with the overhanging wall thereof adjacent said slot.

In witness whereof, I have hereunto set my hand this 4th day of December, 1906.

ERNST KALLBERG.

Witnesses:

JULIUS RUMLAND,

ALFRED WOLF.