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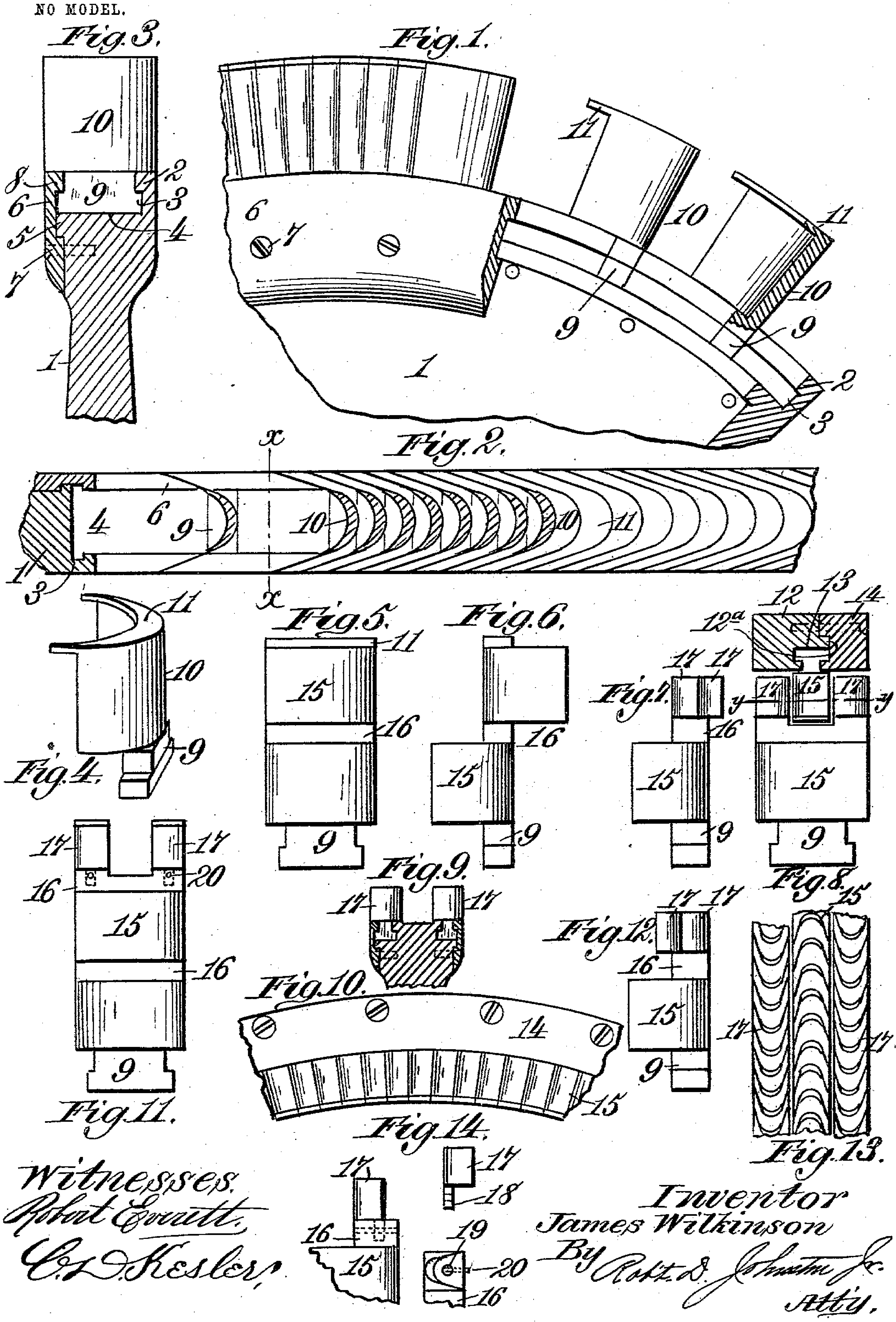
J. WILKINSON.

TURBINE WHEEL.

APPLICATION FILED JULY 31, 1903.

NO MODEL.



No. 753,111. Patented February 23, 1904.

UNITED STATES PATENT OFFICE.

JAMES WILKINSON, OF BIRMINGHAM, ALABAMA, ASSIGNOR TO THE WILKINSON STEAM TURBINE COMPANY, A CORPORATION OF ALABAMA.

TURBINE-WHEEL.

SPECIFICATION forming part of Letters Patent No. 753,111, dated February 23, 1904.

Application filed July 31, 1903. Serial No. 167,733. (No model.)

To all whom it may concern:

Be it known that I, JAMES WILKINSON, a citizen of the United States, residing at No. 1212 North Seventeenth street, Birmingham, in the county of Jefferson and State of Alabama, have invented certain new and useful Improvements in Turbine-Wheels, of which the following is a specification.

My invention relates to improvements in the construction of bucket-wheels or rotors for elastic-fluid turbines with a view to providing them with detachable vanes or buckets in the simplest and most economical manner.

It is the object of my invention to adapt a turbine rotating element, whether a wheel, drum, or cone, to receive a series of overlapping concavo-convex vanes, either simple or compound, and to retain them securely in place against pressure or centrifugal force by a retaining-ring, which can be easily manufactured and attached but when in place holds the vanes firmly and rigidly in place.

My invention is also applicable for use in connection with the stationary blades or intermediates mounted within the turbine-casing.

The construction and arrangements of parts embodying my invention and hereinafter more fully explained are illustrated in the accompanying drawings, in which—

Figure 1 is a side view of a turbine-wheel with the locking-ring partly broken away and several vanes separated sufficiently to illustrate their construction. Fig. 2 is a plan view of a wheel, showing part of the vanes in section and the rest in plan. Fig. 3 is a transverse section through line *x x*, Fig. 2. Fig. 4 is a detail view of one of the vanes or buckets of the single or simple type. Figs. 5 and 6 illustrate a compound vane for reversing turbines. Figs. 7 and 8 show a reversing-vane adapted to operate at half-speed in one direction. Fig. 9 illustrates the manner of attaching a double row of vanes to a wheel. Fig. 10 is a view of the turbine-casing with a series of fixed blades, as shown in Fig. 8, held in place. Fig. 11 is another form of a compound vane capable of a reversing and a half-speed action in one direction, while in Fig. 12 the vane is constructed for a full and half speed action in the same direction. Fig. 13 is a section through line *y y* of Fig. 8. Fig. 14 illustrates a method of securing the small half-speed vanes of a compound vane element.

The rotor-wheel 1 is provided with a flange 2, undercut or rabbeted at 3 and circumferentially disposed around one side of its periphery or rim 4. The other side of the wheel's rim is cut away to form an annular shoulder 5, which is engaged by an annular recessed ring 6, securely bolted to the rim by screws 7. This ring extends above the periphery 4 to a height corresponding with flange 2 and is undercut by an annular groove leaving shoulder 8 similar to 3 and being sufficiently wide to engage shoulder 5 on the rim for the purpose of increasing its retaining strength. When secured in place, this ring forms, with the flange 2, an inverted-**T**-shaped peripheral recess for the reception of the base-blocks 9 of the vanes 10, which conform in shape with this recess and are held securely in place by its undercut sides.

The vanes or buckets 10 correspond in width with the wheel-rim and are arranged so that both ends of each vane symmetrically overlap the convex portion of the adjacent vane. The vanes would therefore be of greater width than their base-blocks 9, and it is obvious that even considering these base-blocks sufficiently thick to serve as spacers the ends of the vanes must necessarily extend beyond them in a forward direction the same distance that they overlap the adjacent vanes. These blocks are preferably formed integral with the vanes and are joined to their thickened central portions, while the end portions of the vanes extend to either side and forward of them.

The main difficulty which would naturally be encountered in mounting vanes of this character having integral spacer base-blocks would be the inserting of the last vanes of the row. This is obviated by first assembling the desired number of vanes required to form a complete circular row, for which purpose a mandrel or frame of any suitable construction may be used, and then collectively mounting them around the rim and securing them in place by the ring 6. When it is necessary to replace a vane, they can all be readily removed and reinserted after the vane has been replaced in the mandrel. This arrangement, however, is only necessary when the base-blocks serve also as spacers, for if separate spacing-blocks be used the vanes could all be inserted separately through a recess in one of the flanges, which would then be formed integral with the rim and the spacing-blocks introduced afterward. In this case a segment only of ring 6 would be used to close the insertion-recess in the flange. I prefer to use spacer base-blocks as furnishing a firmer support for the vanes 10, whose outer ends have crescent-shaped flanges or abutments 11 so arranged that when the vanes are assembled they engage the convex sides of adjacent vanes and close the outer ends of the vane-compartments in the same manner as a tire or annular band commonly in use and for the same purpose. This is also a source of additional strength, for the vanes are braced against each other at both ends, which makes them capable of standing a pressure strain much greater than ordinary independent vanes. The base-blocks are firmly held between the recessed flange and ring, which are made amply strong to withstand lateral and centrifugal strain.

The annular channel formed by the flange and ring may be wedge-shaped or dovetailed in cross-section, or it may have any other conformation calculated to hold the vanes securely in place.

In Figs. 8 and 10 I show the inner periphery of the turbine shell or casing 12 provided with an annular undercut groove or channel 13 and a recessed ring 14, engaging a shoulder 12^a on the shell, to which the ring is bolted in the same manner as in the case of the wheel. A row of stationary guide-vanes or intermediates 15 are mounted in said channel by their base-blocks and have end flanges or abutments 11.

The periphery 4 of the wheel-rim may be undercut on each side of the center and two retaining-rings used if it be desired to dispose two rows of vanes around the wheel, as shown in Fig. 9.

My improved retaining means are particularly adapted for use with any of the several compound vanes which may be readily assembled and inserted in the wheel. Thus in Figs. 5 and 6 I have illustrated a compound vane for reversing at the same speed in both directions, while in Figs. 7 and 8 either the forward or reversing motion is reduced to half-speed by employing two rows of small vanes 17 with a stationary row of intermediates 15 to fractionally abstract the velocity of the fluid. According to Fig. 11 the vane is adapted to drive the turbine forward at two speeds, either full or half, and to reverse at full speed, while in Fig. 12 it will drive at a full or half speed in a forward direction. By increasing the number of rows of small vanes 17 the turbine could be given any desired fractional rate of the full speed, which could be used in a two-speed forward, reversing, or combined forward and reversing vane.

Between the several buckets of the compound vanes I interpose spacer-blocks 16, preferably of an equal depth with the base-blocks, which brace the vanes at their outer ends and form by abutting against each other continuous dividing-rings between the rows of buckets. These blocks may be made slightly larger than the base-blocks to compensate the radial disposition of the vanes. In Fig. 14 I have illustrated a manner of securing the small speed-reducing vanes 17 in the abutments 16. Thus one of each pair of vanes will have a shank 18, which enters an opening 19 in block 16 and is secured therein by a transverse pin 20 passing through said shank and the hole or opening in said block. The other vanes may be formed integral with the block, by which arrangement I avoid the difficulty experienced in drilling such small overlapping vanes out of the solid steel.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an elastic-fluid turbine, a vane-bearing element, in combination with a row of compound overlapping vanes detachably mounted in said element.

2. In an elastic-fluid turbine, a vane-bearing element, in combination with a row of compound two-speed vanes detachably mounted in said element.

3. In an elastic-fluid turbine, a vane-bearing element, in combination with a row of compound two-speed and reversing vanes detachably mounted in said element.

4. In an elastic-fluid turbine, a vane-bearing element, a plurality of compound vanes detachably secured therein, each comprising a plurality of concavo-convex buckets, a spacer base-block, and abutments between said buckets.

5. In an elastic-fluid turbine, a vane-bearing element, a plurality of compound vanes detachably secured therein, each comprising a plurality of buckets of varying dimensions.

6. In an elastic-fluid turbine, a vane-bearing element, a plurality of compound vanes detachably secured therein, each comprising a plurality of buckets some of which are detachably mounted in said compound vane.

7. In an elastic-fluid turbine, a vane-bearing element having a row of circumferential vanes around its periphery, and an outer row of vanes detachably mounted on the vanes of said first-mentioned row.

8. In an elastic-fluid turbine, a vane-bear-

ing element, a row of full-speed vane elements peripherally mounted thereon, and a plurality of rows of fractional-speed vanes detachably mounted on the elements of said first-mentioned row.

9. In an elastic-fluid turbine, a row of compound vanes detachably mounted in a vane-bearing element, each comprising reversely-disposed buckets whose sides overlap the sides of adjacent buckets in their respective rows, integral spacer-blocks interposed between said buckets, and a base-block.

10. In an elastic-fluid turbine, a vane-bearing element, a row of compound reversing-vanes peripherally mounted thereon, two rows of small vanes mounted in parallelism on said compound vanes, and stationary intermediates between said rows of small vanes.

11. In an elastic-fluid turbine, a vane-bearing element, vanes having oppositely-disposed buckets peripherally mounted thereon, head-blocks on the outer ends of said vanes, small vanes mounted on said blocks and disposed to form two parallel circumferential rows, and a row of stationary intermediates between said parallel rows.

In testimony whereof I affix my signature in presence of two witnesses.

JAMES WILKINSON.

Witnesses:

R. D. JOHNSTON,

VASSAR L. ALLEN.