No. 814,757. PATENTED MAR. 13, 1906.

J. WILKINSON.

TURBINE BUCKET WHEEL.

APPLICATION FILED MAY 5, 1905.

Fig. 1.

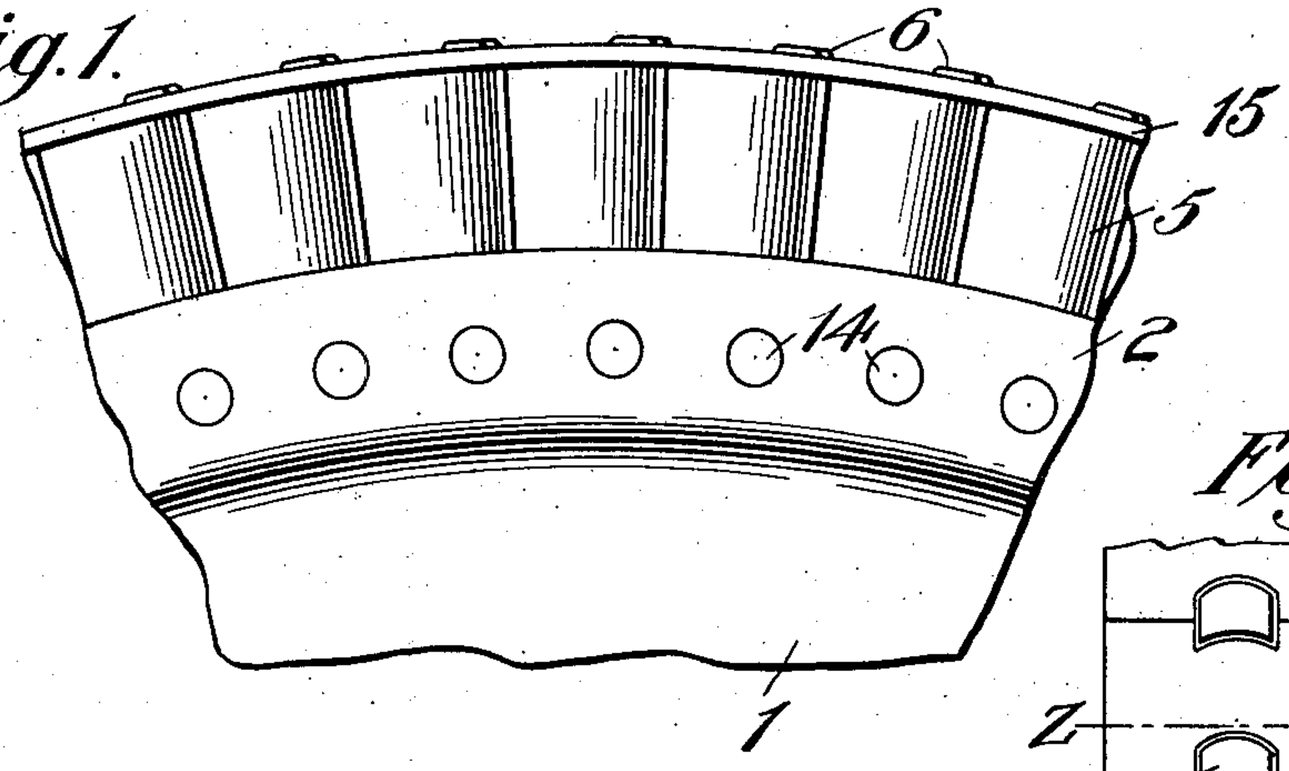


Fig. 9.

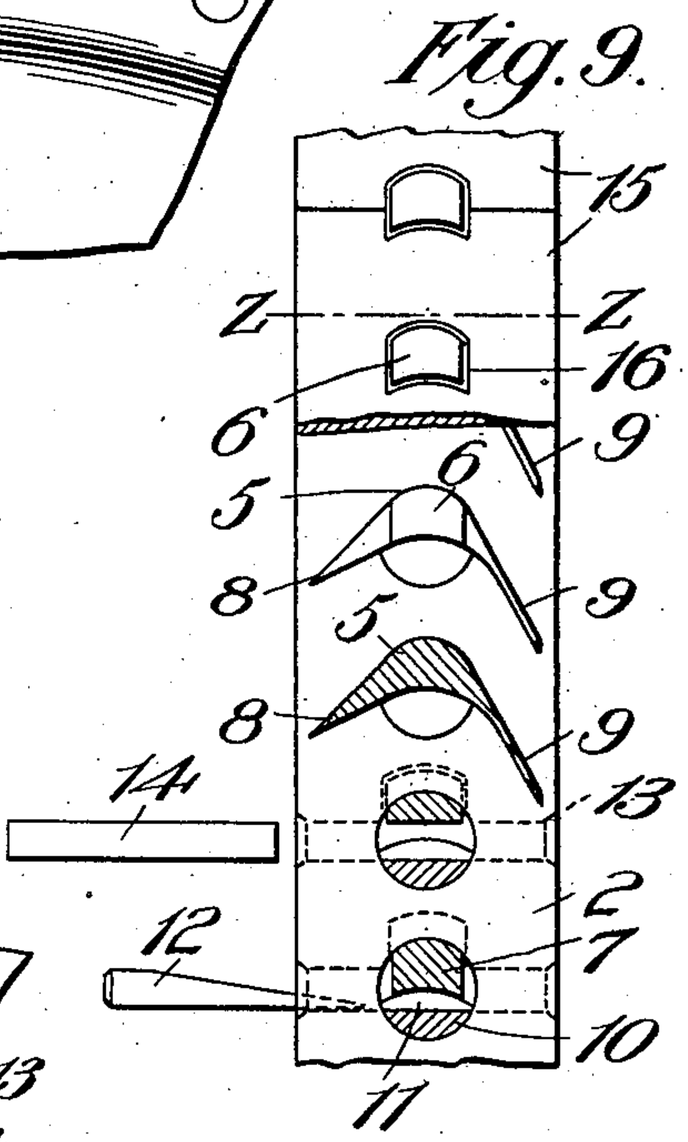


Fig. 6.

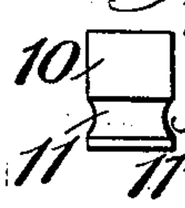


Fig. 8.

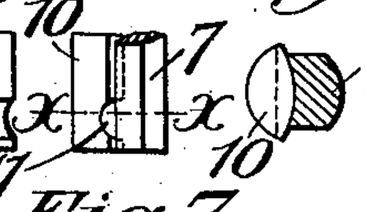


Fig. 3.

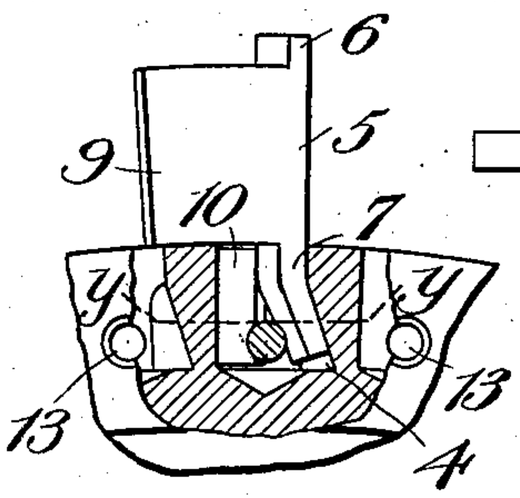


Fig. 7.

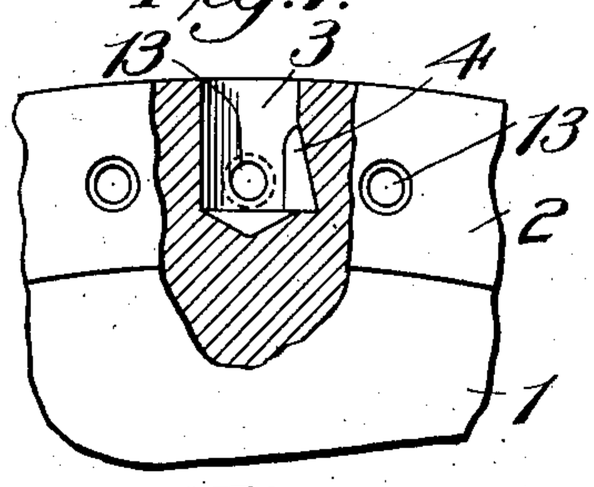


Fig. 2.

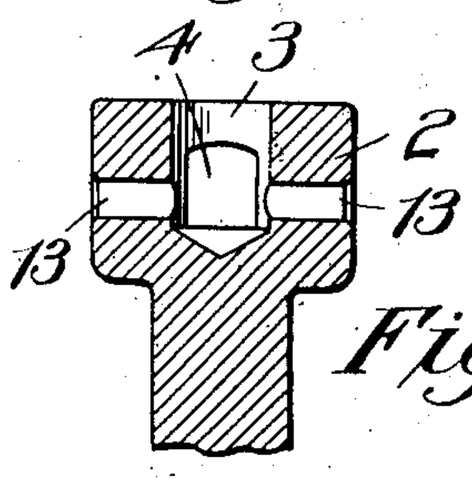


Fig. 4.

Fig. 5.

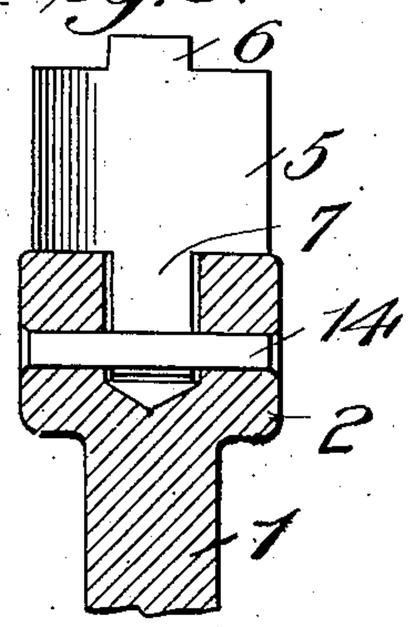


Fig. 10.

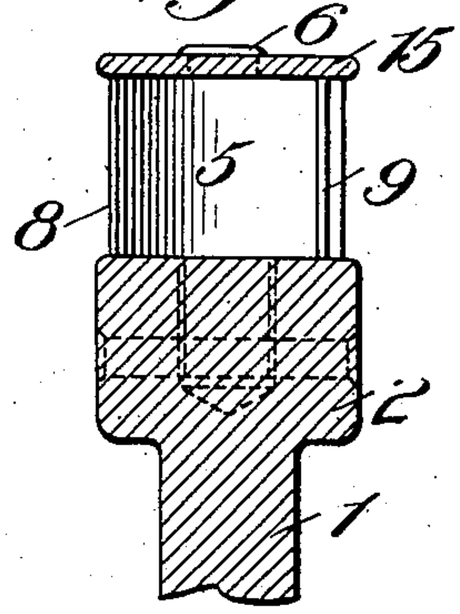
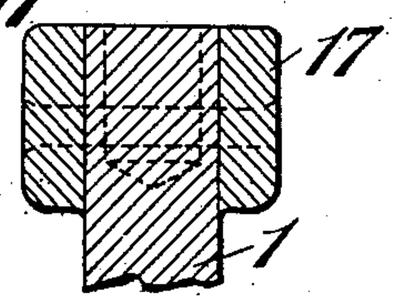


Fig. 11.



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UNITED STATES PATENT OFFICE.

JAMES WILKINSON, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR TO WILKINSON TURBINE COMPANY, A CORPORATION OF ALABAMA.

TURBINE-BUCKET WHEEL.

No. 814,757. Specification of Letters Patent. Patented March 13, 1906.

Application filed May 5, 1905. Serial No. 258,969.

To all whom it may concern:

Be it known that I, JAMES WILKINSON, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented new and useful Improvements in Turbine-Bucket Wheels, of which the following is a specification.

My invention relates to improvements in the construction of turbine-buckets and the manner of separately attaching them to a bucket wheel or drum.

It is the object of my invention to provide a bucket-wheel which can be manufactured at a comparatively low cost and at the same time possess the same strength and durability as if the buckets had been cut or machined from the solid wheel-rim.

My invention contemplates the provision of a rotatable bucket-support provided with a plurality of openings in which buckets or shank portions thereof are inserted and thereafter engaged by transverse pins or wedges, which act to flex or bend the buckets or shanks in such a manner as to lock them under tension in said opening.

In carrying my invention into practice in its preferred form I propose to cut the individual buckets from a steel strip which has been rolled to possess the proper cross-sectional shape. These buckets will each be provided with an integral shank and top lug. I take a wheel or drum and around its periphery bore a plurality of radial circular openings, spaced the distance it is desired to set the buckets. Each bucket-opening is undercut at one side or recessed near its inner end, so that the shank of the bucket may be bent into the recess by the insertion of a key or bolt transversely of the wheel-hub, whereby the bucket is held therein with greater strength than the shearing strain of its key. The buckets are preferably so disposed relatively to the recess in the bucket-opening that the action of the key in bending the bucket-shank into the recess has the effect of drawing the wings of the buckets firmly against the rim of the wheel. This is one advantage of my construction, for by holding the whole bucket firmly against the wheel the danger of leakage of steam between bucket and wheel will be minimized, thus materially preserving the life of both parts from injury due to the cutting action of the steam.

I prefer to insert a block designed to complement the bucket-shank in filling the opening and between which and the lower end of the shank the key or bolt is adapted to be inserted, a wedge-key for starting the bending of the shank into the recess being first inserted and preferably driven on through the wheel-rim by the key or bolt which follows it and is riveted in place. Since the shank and wedge-block fit tightly in the entrance to the bucket-shank opening in the wheel, it is obvious that the bucket cannot become displaced so long as the key is in place. It is also true that the bending of the shank gives a spring tension to the bucket, which holds it with great firmness in place; but, if desired, the block inserted with the bucket-shank may be driven or calked in place to insure against the bucket's rattling.

I desire to protect such variations in the construction and arrangements of parts as come within the scope of my invention, it being understood that the bucket-shank may be partly bent before insertion into the wheel-opening and also that any equivalent means may be substituted for the blocks above referred to, or the latter may be dispensed with in certain cases.

In describing an illustrative means for carrying my invention into effect, reference will be had to the accompanying drawings, which form a part of this specification, and in which—

Figure 1 is a side view of a turbine-wheel broken away. Figs. 2 and 3 are similar views, partly in section, to illustrate, respectively, the bucket-shank opening and the manner of locking the shank in its opening. Figs. 4 and 5 are transverse vertical sectional views through Figs. 2 and 3. Fig. 6 is a detail view of a wedge-block which is inserted with each bucket-shank into the wheel-openings. Fig. 7 is a side view of the block and shank in position in the wheel before being bent to position shown in Fig. 3. Fig. 8 is a top view of Fig. 7. Fig. 9 is a view looking down on the wheel, its parts being broken away to illustrate the successive steps in the mounting of the buckets therein. Fig. 10 is a sectional view along the line *z z*, Fig. 9. Fig. 11 illustrates a modification of my invention, in which the wheel is formed from a plate having rings secured on each side of its periphery-rim by the rivets that lock the buckets in place.

Similar reference-numerals refer to similar parts throughout the drawings.

In illustrating a preferred form of my invention for use in impact turbines I have shown a wheel 1, having a rim 2, into which are bored a plurality of circular openings 3. After forming these openings by means of a suitable tool an undercut recess 4 is cut or milled near the inner end of and at a corresponding point in each opening. These openings 3 are spaced equidistant around the wheel-rim, the distance apart being that at which it is desired to set the buckets 5. These buckets are preferably stamped from a strip of metal rolled so that its cross-sectional contour corresponds with that of the bucket. The buckets when stamped from the strip have an integral top lug 6 and shank 7. The bucket itself is formed with wings 8 and 9, the former of which tapers from a point to the thickened body portion of the bucket, while the latter projects forward, so as to overlap the preceding bucket, being of equal thickness throughout the major portion of its length. This construction reduces the friction of the jet of steam as it is discharged against the wings 8 of the buckets and also reduces the reactive effect of the steam as it is discharged from the wings 9 of the buckets by reason of the fact that the passage-way formed between the wings 9 is of equal cross-sectional area throughout. Though I have described th's bucket construction as a preferred form, it is, however, to be understood that any other form of bucket may be used w thin the scope of my invent on.

In fastening the buckets in place on the wheel in accordance with my preferred construction a bucket-shank 7 is inserted into an opening 3 in the wheel, the lower end of the shank being disposed opposite to the recess 4 in the opening. A block 10, having a transverse groove 11 at its lower end, is then inserted into the opening and driven or calked therein in a manner to hold the upper portion of the bucket-shank firmly in place in the opening. The block is curved in cross-section to correspond with the opening 3, and the block and shank when in position substantially fill this opening. The face of the block engaging the shank is convex to correspond with the concave of the shank, as is shown in Fig. 8. The block and shank will now be in the position shown in Fig. 7, it being noted that the groove 11 is of sufficient depth to permit the interposition of a tapering pin or spreader 12 between the block and the lower end of the shank. This spreader is inserted through a transverse opening 13 through the rim of the wheel, the opening being placed at a point in alinement with the groove 11 in the block when the latter is in position. The manner in which the spreader is inserted between the block and shank is illustrated in Fig. 9, where in the case of the lower bucket-opening the shank and bucket are shown in cross-section along the line $x\,x$ of Fig. 7. The taper ng point of the spreader will be passed through the open ng 13 and into the groove 11, and as it is driven through it acts to bend the shank into the recess 4 in the opening 3. The parts will then take the position shown in connection with the second bucket in Fig. 9 and corresponding with a sectional view along the line $y\,y$ of Fig. 3. I prefer to drive the spreader 12 through the opening 13 by a rivet 14, which is of the same size as the head of the spreader. In Fig. 3 the rivet is shown in position, its head being spread in the usual manner, as seen in Fig. 5. According to this construction there is no shearing strain upon the rivet, but only a crushing strain, and the shearing strain upon the shank is comparatively small.

It will be noted that the tail-wing of each bucket is bent in an opposite direction to that in which its wings 8 and 9 are disposed. From this it follows that the action of the spreader in bending the shank will act directly to force the wings 8 and 9 against the wheel-rim. The spring action of the bent shank will hold these wings and the whole bucket with great firmness and under tension against the wheel-rim, so that there will be no leakage of fluid between the bucket and wheel. In this connection it may be noted that the lower faces of the wings 8 and 9 of the buckets are stamped out on an arc corresponding substantially with the arc of the rim, so that this bending of the shank will have equal effect along the whole length of the wing to hold it against the wheel-rim.

To prevent the spill of the motor fluid radially between the ends of the buckets, I provide a rim formed of a number of sections 15, which are provided with openings 16, through which the top lugs 6 of the buckets project. When the buckets are in place, these lugs 6 are spread or swaged, as shown in Fig. 10, and this serves to firmly hold the rim-sections in place.

To further reduce the cost of construction and enable the bucket-wheel to be formed from plate or sheet metal, I utilize the rivets 14 to secure in place around the periphery of the wheel two annular rings 17. These rings when in place form a rim for the wheel which corresponds in cross-section with the rim of the wheel shown in the other figures, the openings 13 being provided in this construction as in that shown in Fig. 4.

I have thus described an illustrative form of my invention, the construction shown being capable of various modifications within the scope of my present invention.

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

1. In a turbine-bucket wheel, a rim portion provided with a plurality of undercut open-

ings of less width than said rim, a plurality of buckets adapted to be inserted into said openings and held against lateral displacement between the side walls thereof, and means to lock said buckets in place comprising wedging devices adapted to be inserted through transverse openings in the rim and to engage and bend said bucket-shanks into the undercut portions of said openings to lock the buckets in position.

2. A turbine-bucket wheel comprising a rim provided with a plurality of radially-disposed openings therein of less width than the rim, said openings being undercut, a plurality of buckets having integral shanks of less width than the buckets and adapted to be inserted in the openings, transverse openings in the wheel-rim, and locking devices inserted through these transverse openings and passing through the radial openings, said devices being adapted to hold said shanks in engagement with the undercut portions of said openings to prevent the radial displacement of the buckets.

3. In combination with a plurality of buckets stamped from a rolled strip of metal which is curved in cross-section and tapers from the center to the sides, shanks integral with said buckets and cut from the thick central portions of said strip, a bucket element provided with radial openings into which said shanks are adapted to be inserted and which conform to the curved rear face of the shanks, said openings being undercut opposite the rear face of said shanks, and transversely-disposed locking-pins which hold said shanks in engagement with the undercut wall of said openings and prevent radial displacement of the buckets.

4. In a turbine-bucket wheel, a rim portion having a plurality of radially-disposed circular openings undercut at one side, a plurality of buckets having bent shanks disposed within the undercut portions of said openings and locking-pins, inserted transversely of said rim, which engage said shanks and lock them in said openings.

5. In combination, a rotatable bucket element, a plurality of openings bored therein, said openings being of greater area at their inner than their outer ends, buckets adapted to be inserted in said openings, blocks for substantially filling the openings at their outer ends after the insertion of the buckets, and means, adapted to be inserted between said block and bucket near the inner end of said openings, which bend the bucket for the purposes described.

6. In combination, a bucket-wheel for turbines having a plurality of openings bored radially into its periphery, said openings being formed with an undercut recess, buckets, shanks integral with said buckets and adapted to enter said openings, and means engaging the said undercut recesses to lock the buckets in place.

7. In a bucket-wheel, a rim portion provided with a plurality of circular radial openings in its periphery, said openings being provided with an undercut recess, a plurality of transverse bolt-openings intersecting said circular openings near their inner ends, in combination with a plurality of buckets having integral shanks adapted to be inserted into said peripheral openings and disposed opposite said undercut recesses, blocks adapted to be inserted into said openings and substantially conforming in cross-sectional area with that portion of the outer end of the circular openings not filled by the bucket-shanks, and means adapted to be inserted through said bolt-openings and between said block and shank to bend the shank into said recess and lock it in its bent position, and means to lock said locking means in place in the wheel.

8. In a bucket-wheel having peripheral openings, buckets having integral shanks, blocks adapted to be inserted with said shanks into said openings to substantially fill the same, a groove in the face of said block which abuts against said shank, an opening in the wheel opposite said groove in the block, when the latter is in position, a tapering device adapted to be inserted through said opening and into said groove, and to spread said shank into a recess in the wheel-opening, and means to lock said shank in its bent position, substantially as described.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

JAMES WILKINSON.

Witnesses:
ALLAN P. REYNOLDS,
JOHN J. DEVENISH.