March 10, 1953 T. L. SWANSEN 2,631,004

TURBINE ROTOR

Filed July 9, 1948

Fig. 1

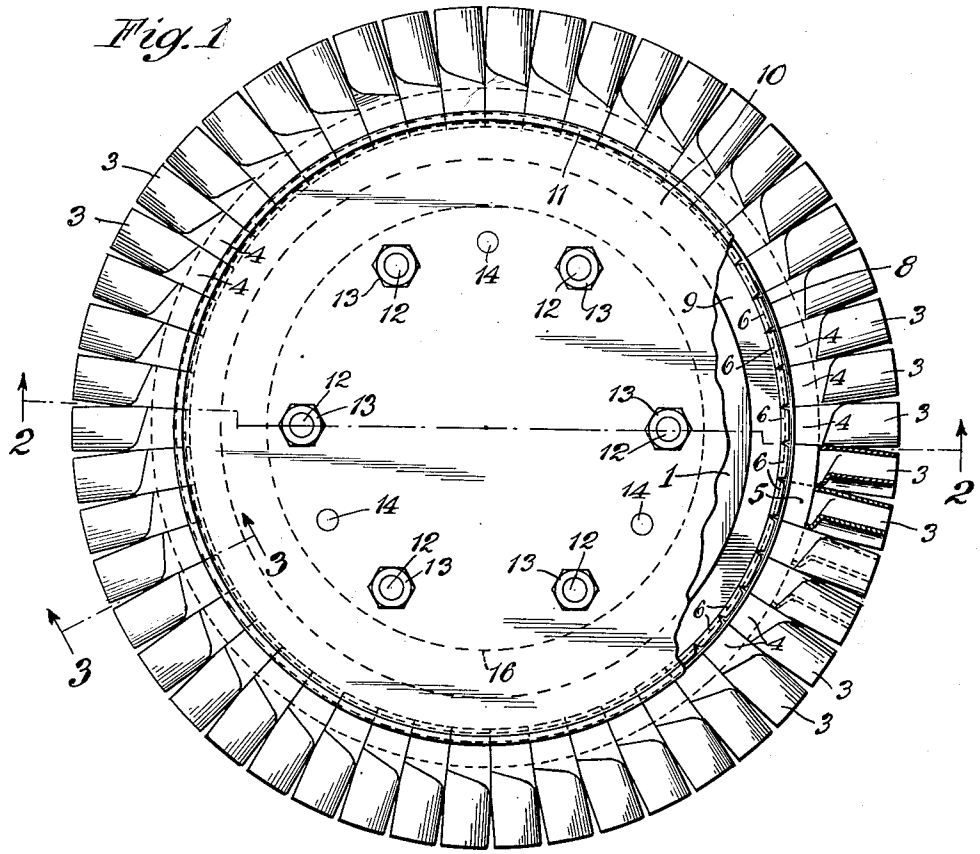

Fig. 2

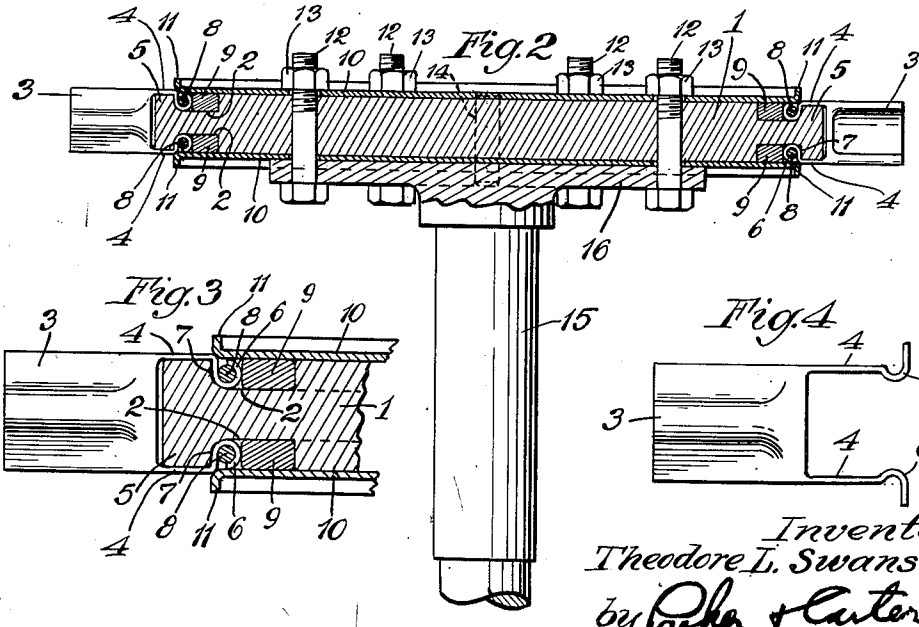

Fig. 3

Fig. 4

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Patented Mar. 10, 1953

2,631,004

UNITED STATES PATENT OFFICE

2,631,004

TURBINE ROTOR

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Application July 9, 1948, Serial No. 37,799

6 Claims. (Cl. 253—39)

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This invention relates to a turbine wheel or rotor and particularly to the method of constructing the wheel and to the application of buckets to a wheel. It has for one object to provide means for retaining the buckets in place.

Another object is to provide means affected by centrifugal force for adding to the holding effect on the buckets when the rotor is in rotation.

Another object is to provide means for constructing a turbine rotor including buckets and to provide members in the wheel or rotor so shaped and disposed that they act under centrifugal force to increase the holding effect on the buckets when centrifugal action would tend increasingly to displace the buckets.

Other objects will appear from time to time throughout the specification and claims.

This invention is illustrated more or less diagrammatically in the accompanying drawings, wherein:

Figure 1 is a plan view with parts broken away and parts in section, illustrating one form of the invention;

Figure 2 is a transverse section taken at line 2—2 of Figure 1;

Figure 3 is a sectional detail taken on an enlarged scale at line 3—3 of Figure 1; and

Figure 4 is a side elevation of one form of bucket which may be used in the rotor.

Like parts are indicated by like characters throughout the specification and the drawings.

As shown, the rotor comprises a central disc-like member 1 which is provided with oppositely placed grooves 2, 2 preferably adjacent its outer edge. Buckets 3, 3 are provided with wheel engaging parts 4, 4. The buckets and the parts are so shaped that they can fit over the peripheral enlargement 5 of the disc 1. The member 5 is referred to as an enlargement because it is thicker than that portion of the disc 1 in which the grooves 2 are formed. Actually as shown the peripheral portion 5 is of substantially the same thickness as the main body of the disc 1, although it might be of different thickness.

In assembling the rotor the members 4 of the buckets 3 are preferably inwardly bent, as at 6, and they are slipped or sprung over the peripheral member 5.

The buckets may be of any design. As shown, they are formed of tubular members which are shaped and cut to provide the bucket portion and the members 4. The invention is not limited to any particular type or construction of bucket. Whatever the shape or construction of the bucket, it will, however, be provided with members comparable to or the equivalent of the portions 4, so that the bucket when in position will straddle the edge or peripheral enlargement 5 of the rotor 1, and the portions 6 will be engaged behind the shoulder 7 which is formed by the grooves 2. After the buckets are in place, the portion 6 is

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forced into the position shown in Figures 2 and 3 to lie against the inner face of the grooves 2. Thereafter retainer rings 8, which may be formed of wire and may or may not be endless, are fitted in place. They lie within the grooves 2 and engage the portions 6 of the bucket parts 4. The portions 6 are then bent or wrapped around the members 8 and occupy the position and shape shown in Figures 2 and 3.

Thereafter pressure rings 9 are positioned in each groove 2. These rings are free within the assembly—that is to say, they are not positively fastened in place. They are merely dimensioned to fit within the grooves and preferably to fit with some snugness.

There are thereafter applied to the rotor retaining plates 10, 10. These plates may, if desired, be peripherally flanged as at 11. They are held in place by bolts 12 and nuts 13. If desired, they might be riveted in place. Positioning dowels 14 may be used, if desired. A shaft 15 is provided with a hub-like member 16 which is engaged by the bolts 12 or by the rivets or other fastening means which may be used. The structure thus includes the shaft and the member 16 upon which the rotor assembly is mounted.

Although I have shown an operative form of my invention, it will be recognized that many changes in the form, shape and arrangement of parts can be made without departing from the spirit of the invention, and my showing is, therefore, to be taken as, in a sense, diagrammatic.

The use and operation of this invention are as follows:

With the parts assembled as shown, the rotor is positioned in a turbine or elsewhere and is contacted by the driving fluid. Suitable nozzles which form no part of the invention direct the fluid against the buckets. Rotation of the rotor under the influence of the driving fluid sets up centrifugal effects which would tend to displace the buckets from the wheel. The buckets are initially held in place by their shape and are engaged by the wire members 8. The wires act as fillers about which the ends 4 of the buckets are bent. By their shape they provide a convenient radius about which to bend the members 4. The wires 8 may or may not be continuous.

As rotation increases, the tendency of the buckets to be displaced is increased. The buckets could be displaced only by breakage of the members 4 or by successively bending them about the retainer 8 as the buckets slip or fly outwardly.

As centrifugal force is developed, the pressure rings 9, which are not positively fastened in place, swell or enlarge and consequently exert a constantly increasing pressure upon the members 4—particularly upon the portions 6 of those members which are in place about the wire retainers 8, and thus as centrifugal force is increased and as the tendency of the buckets to be dislodged is

increased, a counter effect is set up. This counter effect is set up by centrifugal force and is effective in causing the pressure rings 9 to bear upon the bucket parts 6 and to hold them more and more tightly and positively in place as the centrifugal force is increased.

I claim:

1. In combination in a turbine rotor, a wheel member formed with a plurality of concentric, oppositely positioned annular, inwardly facing shoulders in its exterior inward of its periphery, a plurality of buckets, each bucket provided with a pair of attaching members, said buckets being placed on the periphery of said wheel member, with their attaching members positioned on each side of said wheel member and positioned one against each of said shoulders, filler pieces about which the bucket attaching members are wrapped and a plurality of centrifugally responsive pressure members positioned one radially inward of each of said shoulders and inwardly of and in contact with the bucket attaching members, and retaining members positioned one on each side of said wheel member laterally outward of said shoulders in position to retain said pressure members in place with relation to said shoulders said pressure members being free to move radially outwardly under the influence of centrifugal force to exert pressure on the bucket attaching members to clamp them securely against said shoulders.

2. In combination in a turbine rotor, a wheel member formed with a plurality of concentric, oppositely positioned inwardly facing shoulders in its exterior inward of its periphery, a plurality of buckets, each bucket provided with a pair of attaching members, said buckets being placed on the periphery of said wheel member, with their attaching members positioned on each side of said wheel member, and positioned one against each of said shoulders, and a plurality of relatively massive concentric ring members positioned one adjacent each of said shoulders and completely inward of and in contact with the bucket attaching members, said ring members being free to move with increasing pressure against said bucket attaching means under the influence of centrifugal force, to clamp them against said shoulders, and retaining members positioned one on each side of said wheel member laterally outward of said shoulders in position to retain said pressure members in position.

3. In combination in a turbine rotor, a wheel member formed with a plurality of concentric, oppositely positioned inwardly facing shoulders in its exterior inward of its periphery, a plurality of buckets, each bucket provided with a pair of identical, symmetrically placed attaching members, said buckets being placed on the periphery of said wheel member, with their attaching members positioned on each side of said wheel member, and positioned one against each of said shoulders, and a plurality of centrifugally responsive pressure ring members positioned one adjacent each of said shoulders and entirely inward of the bucket attaching members, said ring members being free to move with increasing pressure against said bucket attaching members under the influence of centrifugal force, to clamp them against said shoulders, and retaining members positioned one on each side of said wheel member laterally outward of said shoulders in position to retain said pressure members in position.

4. In combination in a turbine rotor, a wheel member having a pair of shoulders oppositely positioned, one on each side of said wheel member, a plurality of buckets, each formed with a pair of wheel-engaging members, said wheel-engaging members positioned against said shoulders, and filler means positioned against said wheel-engaging members and inwardly of said shoulders, said wheel-engaging members being positioned in part about said filler means, and pressure members positioned one adjacent and inwardly of each wheel-engaging member, and free for radial movement under the influence of centrifugal force, and means for retaining said pressure members within said turbine rotor.

5. In combination in a turbine rotor, a wheel member having a pair of grooves oppositely positioned inwardly of its periphery, one on each side of said wheel member, a plurality of buckets, each formed with a pair of wheel-engaging members, said wheel-engaging members extending into said grooves, and filler means positioned one within each groove, said wheel-engaging members being positioned in part about said filler means, and pressure members positioned inwardly of said filler means and one within each groove, and free for radial expansion and radial movement under the influence of centrifugal force, and means for retaining said pressure members within said turbine rotor.

6. In combination in a turbine rotor, a wheel member shaped near its periphery to form a pair of annular cavities the radially outer walls of which define inwardly-facing annular shoulders, said cavities being positioned one on each side of said wheel member, one wall of each cavity being formed by a pair of disc members positioned on either side of said wheel member laterally outward of said shoulders, said disc members being shaped to provide narrow annular openings communicating with said cavities, said annular openings being located substantially at the major diameter of said cavities and adjacent the radially outer walls of said cavities, a plurality of buckets positioned on said wheel member, each of said buckets having a pair of wheel engaging members positioned one on each side of said wheel member and extending within the respective cavities, said wheel engaging members being bent to engage the radially outer walls of said cavities, a pair of relatively massive ring members positioned freely within each of said cavities so that each may bear with increasing pressure against said wheel engaging members under the influence of centrifugal force, and means for holding the disc members and wheel member together.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
905,460	Rice	Dec. 1, 1908
1,035,543	Dake	Aug. 13, 1912
1,891,948	Rice	Dec. 27, 1932
2,484,274	Eastman	Oct. 11, 1949
2,559,013	Eastman	July 3, 1951

FOREIGN PATENTS

Number	Country	Date
873,700	France	Apr. 7, 1942