No. 841,650. PATENTED JAN. 15, 1907.

O. JUNGGREN.

MEANS FOR DECREASING LEAKAGE IN TURBINES.

APPLICATION FILED JUNE 30, 1906.

Fig. 1.

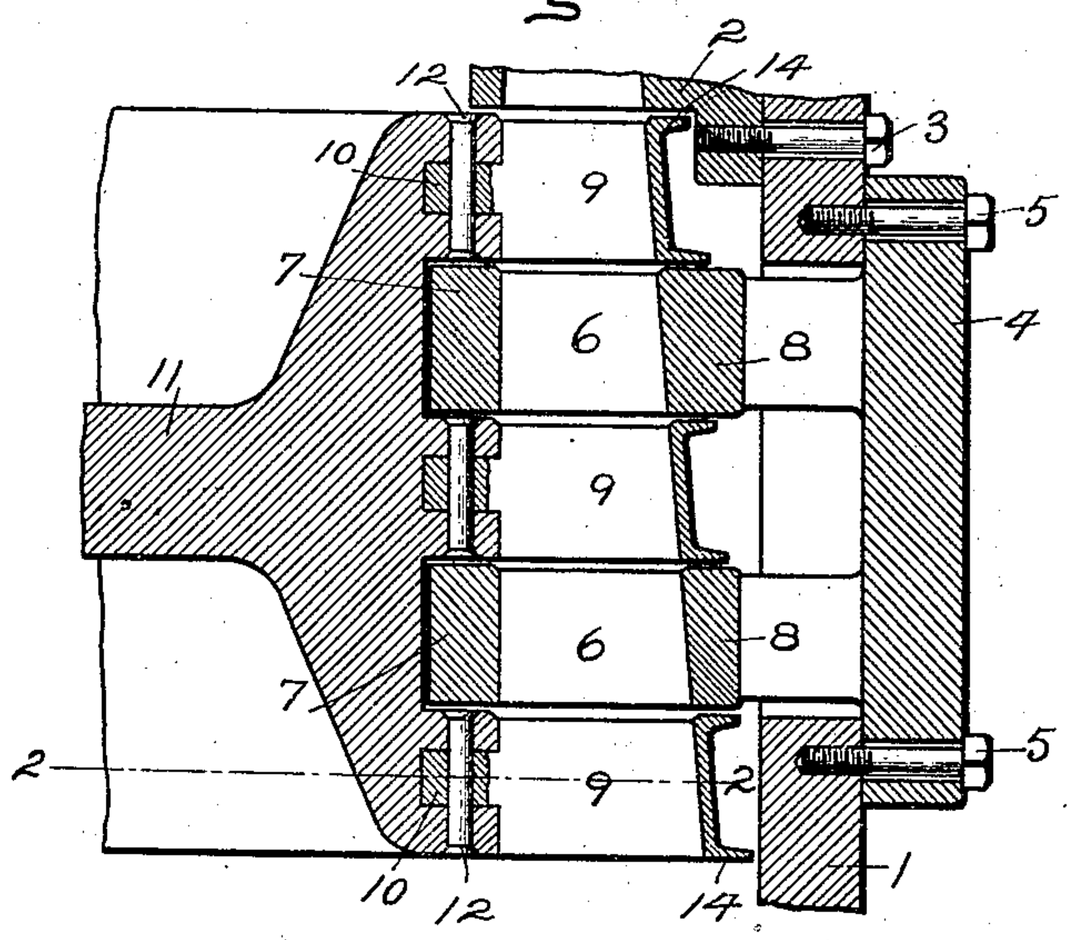
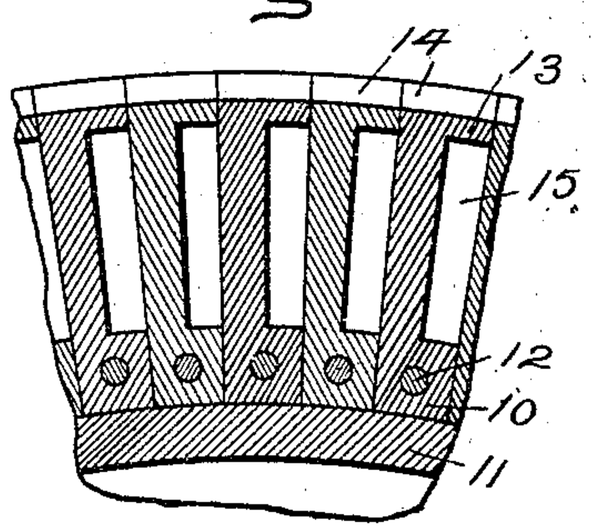


Fig. 2.



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UNITED STATES PATENT OFFICE.

OSCAR JUNGGREN, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

MEANS FOR DECREASING LEAKAGE IN TURBINES.

No. 841,650. Specification of Letters Patent. Patented Jan. 15, 1907.

Original application filed April 29, 1903, Serial No. 154,888. Divided and this application filed June 30, 1906. Serial No. 324,238.

To all whom it may concern:

Be it known that I, OSCAR JUNGGREN, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Means for Decreasing the Leakage in Elastic-Fluid Turbines, of which the following is a specification.

This application is a division of my pending application, filed April 29, 1903, Serial No. 154,888.

In elastic-fluid turbines it is customary to provide a cover for the outer ends of the wheel-buckets in order to confine the motive fluid to the passages between the buckets. Situated between the wheel-buckets are stationary or intermediate buckets which receive the motive fluid from one set of wheel-buckets and discharge it at the proper angle against a second set of wheel-buckets. Manifestly there must be a clearance more or less great between the relatively moving buckets, and through this clearance considerable steam or other motive fluid leaks. The amount of this leakage is also governed by the difference in pressure between the column of steam actually performing work and that in the surrounding casing or shell. The greater the difference in pressure, other things being equal, the greater the leakage.

My invention has for its object to decrease the leakage at the clearances, and to accomplish this I provide a means whereby a high resistance or opposition is offered to the leakage or escape of motive fluid.

The covers ordinarily employed on the wheel-buckets are very thin, varying in thickness from one-eighth to three-sixteenths of an inch. Owing to the thinness of the cover, the surface friction opposing the escape of steam is very small.

In carrying out my invention I provide the bucket-covers with thickened edges, taking the form of circumferential flanges formed integral therewith. The extended surfaces of the thickened edge of the cover and the support for the intermediates offer a considerably higher resistance to the escape of motive fluid than does the normal passage between the buckets. The opposition or resistance to leakage is not so great, however, as to prevent the water of condensation and expansion from being discharged under centrifugal force. The amount that the flange or flanges project beyond the cover varies with the character and size of the turbine.

For a fuller consideration of what I believe to be novel and of my invention attention is called to the description and claims appended thereto.

In the accompanying drawings, which illustrate one embodiment of my invention, Figure 1 is a partial axial section of a turbine. Fig. 2 is a sectional view of a wheel, taken on the line 2 2 of Fig. 1.

1 represents the turbine casing or shell, and secured thereto is an adjustable nozzle 2, which may be of the expanding or non-expanding type, as is desired. In the particular illustration it is intended to convert the pressure of the elastic fluid into velocity and deliver it in the form of a jet to the buckets; but my invention is not limited thereto. The nozzle is secured in place by bolts 3 and is adjustable toward and away from the wheel in a plane parallel to its axis. The side of the casing or shell is provided with an opening through which projects the segmental support for the intermediate buckets. The support is provided with a flange 4 of somewhat greater area than the opening, which is secured to the outside of the casing by bolts 5. Between the bodies of the bolts and the flange is a space, so that the intermediates can be adjusted in an axial plane for the purpose of changing the clearances between them and the wheel-buckets.

The intermediate buckets 6 may be of any suitable shape and form and are secured to their support in any ordinary manner. The intermediate buckets are provided with covers 7, which are slightly wider than the buckets themselves measured in an axial plane. The portion 8 of the support adjacent to the wheel-bucket cover is also somewhat wider than the buckets measured in an axial plane, so as to reduce the leakage and prevent the sharpened edges of the buckets from rubbing.

The wheel-buckets 9 are each provided with a shank 10, formed integral therewith at the inner end, and these shanks are fitted into a circumferential groove formed in projections on the periphery of the wheel 11. The buckets are retained in place by pins 12, which extend from one side to the other of

the said projection or raised portion formed on the wheel periphery. The pins, being somewhat shorter than the distance between the projections, can readily be slipped into place and the ends peened over afterward. The sides of the projection are in close proximity to the cover 7 of the intermediate buckets, so as to reduce the circumferential or cross leakage at this point. The buckets may be formed by drop-forging or casting, as desired, and each bucket is provided with a cover 13, sometimes called a "fitting and baffling strip," which cover has two thickened edges formed integral therewith, which in the present illustration take the form of circumferential flanges 14. In cross-section the cover has the shape of a channel-beam. The clearance, measured in an axial plane, between the thickened edges or flanges 14 of the bucket-cover and the stationary parts, such as the nozzle and the portion 8 of the intermediate support, is made as small as possible consistent with good operation. Through this clearance the water due to expansion and condensation can be discharged; but the resistance or opposition to the passage of elastic motive fluid at this point is high. This is owing to the fact that the flange presents an extended surface to the stationary part, and the frictional resistance offered to the outward passage of steam at this point is considerably greater than the resistance offered to the passage of steam through the normal or working passages between the buckets. In other words, two paths are provided for the steam or other elastic fluid—one of low resistance and the other of relatively high resistance—and owing to the fact that the jet is traveling at high velocity due to the nozzle only a very small amount of steam will be permitted to escape through the circumferential clearance. The water due to expansion and condensation also has a tendency to decrease the leakage by wetting the adjacent surfaces of the moving and stationary parts. As the intermediate buckets usually extend around only a small portion of the wheel, the brake action due to the water can be disregarded. Under ordinary conditions of operation, however, the clearance would be great enough to prevent this brake action from taking place, at least to any substantial degree.

The flange 14 has considerable depth measured in a radial plane, and this depth varies with different turbines. As a general proposition, it may be stated that the greater the difference in pressure between the fluid stream and fluid within the shell or casing the greater will be the depth of the flange, because the tendency of the steam to escape at this point is correspondingly increased.

Referring to Fig. 2, it will be seen that the shank 10 on each bucket is tapered and engages with similar shanks on adjacent buckets and that the cover 13 of each bucket is also slightly tapered and engages with the cover-sections of adjacent buckets. In this manner the steam or other motive fluid is confined to the working passages 15.

The baffling of the motive fluid may take place at the side flanges of the fitting and baffling strip or cover 13, as shown in connection with the intermediate bucket-supports 8, or the edges of the flanges on said strip may be utilized for the purpose, the structure being the same in either case. The said strip can serve as a baffling means on both the side and edge at the same time, as shown in the upper right-hand corner of Fig. 1.

The baffler disclosed herein possesses important advantages over prior arrangements in the way of better baffling effects and in the way of greatly-decreased cost of manufacture. It is also well adapted to meet the condition of accidental rubbing of the parts. By making the strips out of solid stock with flanges at right angles thereto it is a simple and inexpensive matter to turn or finish the face or faces to the required dimensions. Moreover, such a construction renders it possible to utilize workmen of ordinary skill.

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 in other ways.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In an elastic-fluid turbine, the combination with a casing, of a wheel having buckets attached thereto, each bucket having an integrally-formed cover with outwardly-projecting flanges.

2. In an elastic-fluid turbine, the combination with a casing, of a wheel having buckets attached thereto, each bucket having an integrally-formed cover with outwardly-projecting flanges, and a stationary element having a surface in close proximity to one of said flanges.

3. In an elastic-fluid turbine, the combination with a casing, of a wheel having buckets attached thereto, each bucket having an integrally-formed cover with outwardly-projecting flanges, and an intermediate bucket-support situated in line with and in close proximity to one of said flanges.

4. In an elastic-fluid turbine, the combination with a casing, of a wheel having buckets attached thereto, each bucket having an integrally-formed cover with outwardly-projecting flanges, and a stationary element having surfaces in close proximity to the side and edge of one of said flanges.

5. In an elastic-fluid turbine, the combination with a casing, of a wheel having buckets attached thereto, each bucket having an in-

tegrally-formed cover with outwardly-projecting flanges, which are slightly wider than the buckets to protect the sharp edges of the latter from rubbing.

6. In an elastic-fluid turbine, the combination with a casing, of a wheel having buckets attached thereto, each bucket having an integrally-formed cover in the shape of a channel-beam.

7. In an elastic-fluid turbine, the combination with a casing, of a wheel having buckets attached thereto, each bucket having an integrally-formed cover in the shape of a channel-beam and stationary intermediate bucket-supports having flat surfaces situated in close proximity to the sides of said channel-beam cover.

8. In an elastic-fluid turbine, the combination with a wheel having on its periphery a plurality of circumferentially-grooved projections, of a plurality of buckets, each having a shank that enters the groove, a retaining-pin for each bucket passing through the shank and a projection, and an integral cover for each bucket formed in the shape of a channel-beam.

9. In an elastic-fluid turbine, the combination with a wheel having on its periphery a plurality of circumferentially-grooved projections, of a plurality of buckets, each having a shank that enters the groove, a retaining-pin for each bucket passing through the shank and a projection, and an integral cover for each bucket formed in the shape of a channel-beam, said covers fitting closely together to form a smooth continuous surface around the entire wheel.

In witness whereof I have hereunto set my hand this 29th day of June, 1906.

OSCAR JUNGGREN.

Witnesses:
BENJAMIN B. HULL,
HELEN ORFORD.