

E. W. RICE, JR.  
 TURBINE BUCKET.  
 APPLICATION FILED JUNE 28, 1909.

980,563.

Patented Jan. 3, 1911

Fig. 1.

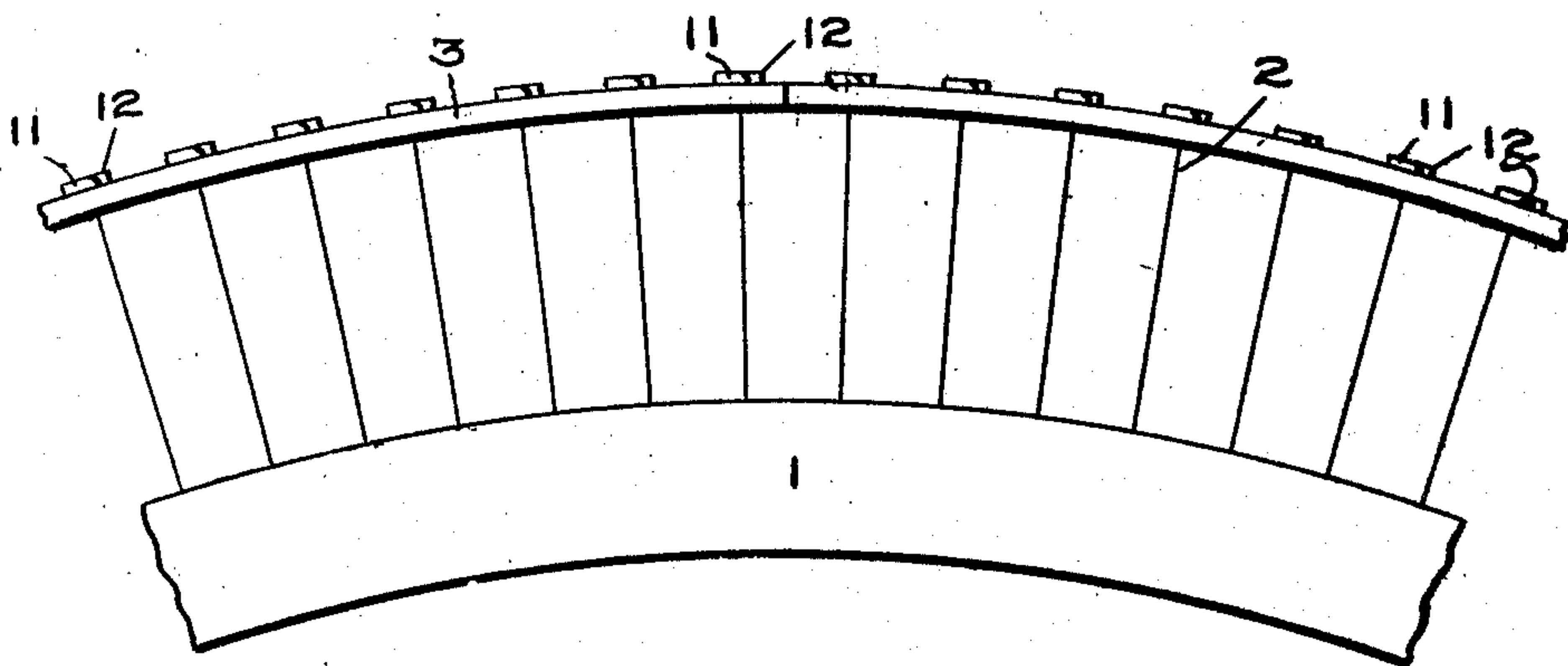


Fig. 2.

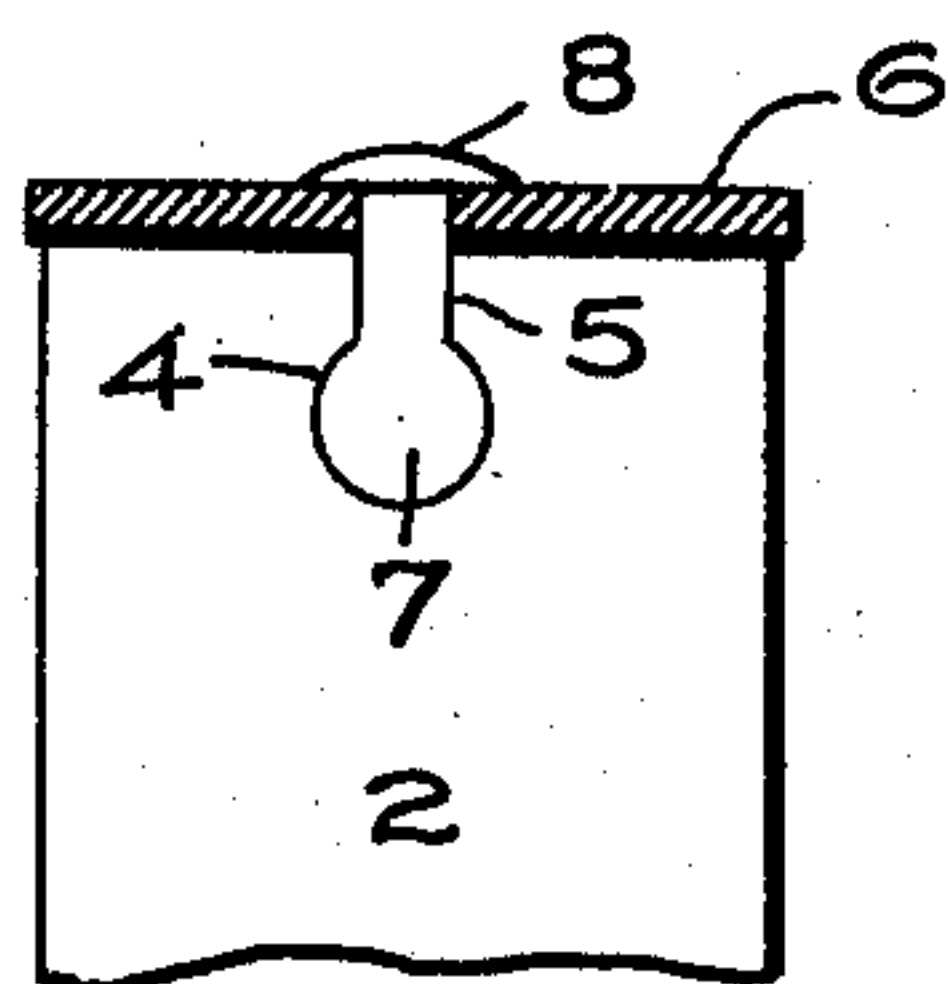


Fig. 3.

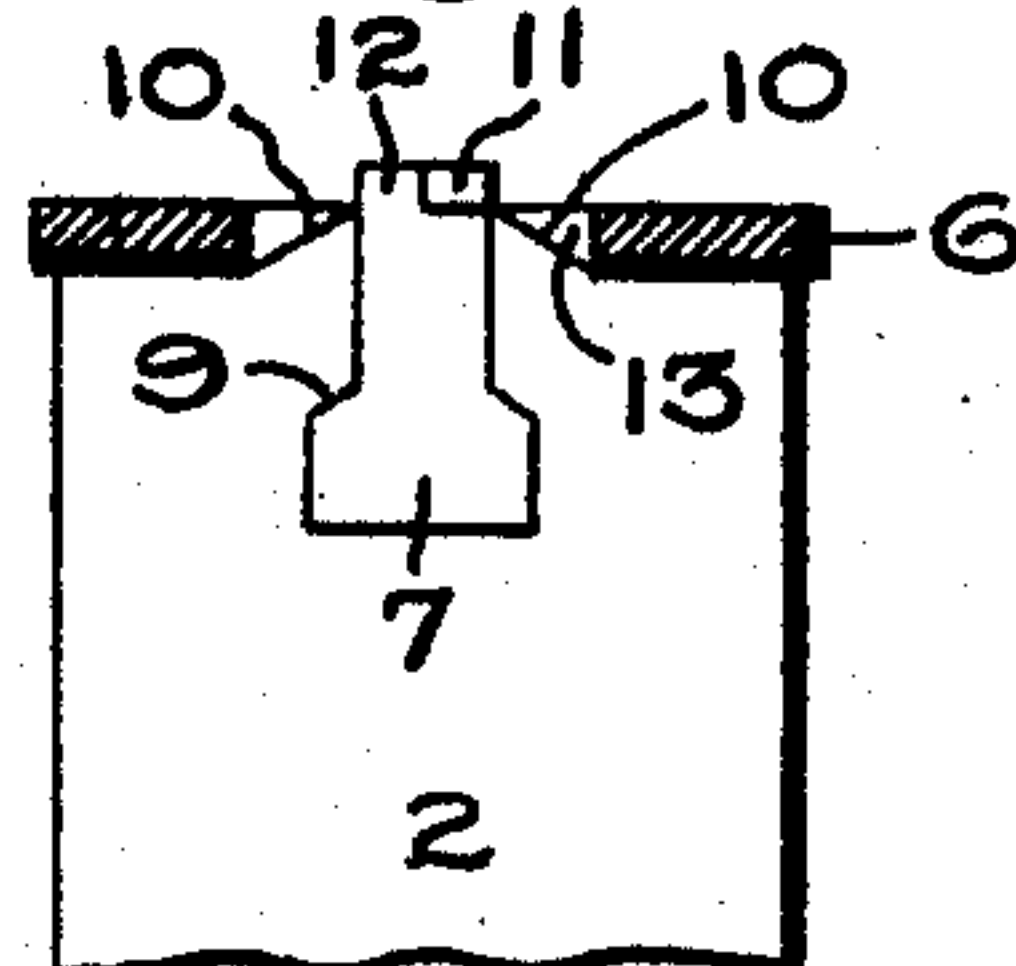
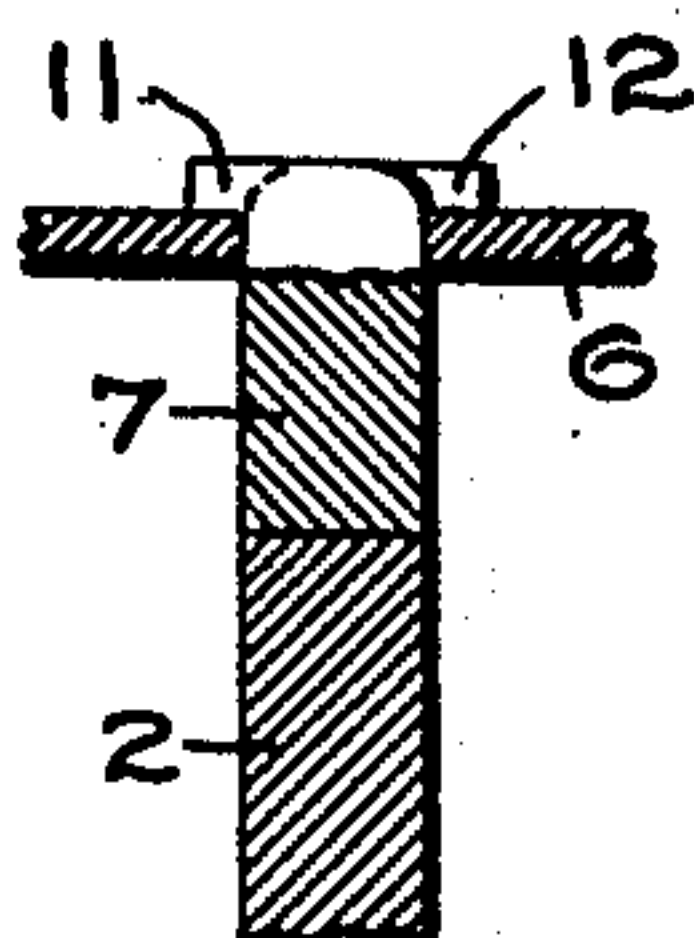


Fig. 4.



Witnesses:  
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Inventor:  
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 by *Wm. S. Davis*  
 Att'y.

# UNITED STATES PATENT OFFICE.

EDWIN W. RICE, JR., OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

## TURBINE-BUCKET.

980,563.

Specification of Letters Patent.

Patented Jan. 3, 1911.

Application filed June 28, 1909. Serial No. 504,640.

*To all whom it may concern:*

Be it known that I, EDWIN W. RICE, Jr., a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Turbine-Bucket Construction, of which the following is a specification.

The present invention relates to turbine bucket construction and has for its object to provide an improved means for securing a cover or shroud to the free ends of the buckets.

For a consideration of what I believe to be novel and my invention, attention is directed to the accompanying specification and the claims appended thereto.

In the accompanying drawing which is illustrative of my invention, Figure 1 is a view in side elevation of a bucket segment; Fig. 2 is a detail view showing the means for uniting the buckets and the cover or shroud; Fig. 3 is a detail view partly in section of a slightly modified form of cover securing means; and Fig. 4 is a sectional view of the structure shown in Fig. 3, the section being taken at right angles thereto.

My invention is applicable to impulse and reaction turbines or to a combination of both types. It is applicable also to the stator as well as the rotor buckets. The buckets may be mounted on a wheel, disk, drum, casing or other part. The particular means whereby they are secured at their roots is immaterial so long as they are securely anchored in place.

Referring to the drawing, 1 indicates a support or carrier having a plurality of radial buckets 2, whose outer or free ends are covered by the sectional cover or shroud 3. This cover or shroud will ordinarily be made in relatively short lengths although this is a matter that depends somewhat upon the character of the turbine and the buckets to be covered.

I have shown the buckets occupying radial positions for use in an axial flow machine, but where the invention is used in a radial flow machine they would extend parallel to the shaft.

Referring to Fig. 2, 2 indicates one of the buckets which at its outer or free end is provided with a recess comprising an enlarged portion 4 and a restricted portion 5. By reason of this arrangement a shoulder is

formed to anchor the cover securing device. The said recess, where the buckets are separate and individually applied, will be machined before the buckets are mounted in place. Where the buckets are formed integral with the support or carrier, it may be formed either before or after the buckets are cut. In either event the recesses extend from side to side or in other words from the front to the back face of the buckets. The retaining devices will preferably present smooth surfaces that lie in and form a continuation of the bucket surfaces acted upon by the steam or other motive fluid. Mounted on the top or free ends of the buckets is a perforated cover or shroud 6 which in addition to forming one wall of the steam space between the buckets, acts to tie the buckets together and increase their rigidity. Located within each recess and extending through a registering opening in the cover or shroud is a retaining device 7. This device has an enlarged head and, preferably, completely fills the recess and makes a tight fit therein. It is finished on the front and back and is flush with the bucket surfaces so that in effect it forms a part of the bucket surface. The outer end of the retaining device is riveted or headed over at 8 to hold the bucket cover in place. In those cases where the centrifugal stresses are high, it is preferable to provide each of the buckets with a recess and cover or shroud retaining device, but where the centrifugal stresses are relatively low, I may omit the recess and retaining device from a portion of the buckets. It is preferable, however, to make all of the buckets alike.

In assembling, the buckets if made separately are mounted on the support 1, one after the other, with suitable space blocks between them, and the buckets and blocks are retained by any suitable means. Previous to inserting the buckets in the support, each will usually be provided with a cover or shroud securing device 7. After the buckets are mounted in place with the said devices in position, the cover or shroud is placed over the ends of the buckets and the holes therein caused to register with the cover securing devices, after which the ends of the devices are riveted over by pneumatic hammers or other means.

Referring to Fig. 3, I have shown a modification of my invention wherein the shape



of the recess in the bucket for receiving the retaining device 7 is changed. The lower portion of the recess is approximately rectangular and shoulders 9 are provided to prevent the retaining device from being withdrawn in the direction of its length. Where the buckets are relatively long and thin and they have a tendency to spring or move sidewise in the plane of the row, it is necessary to provide means to prevent such tendency. Such means is found in the beveled projections 10 that are formed on the free end of the bucket. These projections will be made at the time the free end of the bucket is machined or dressed. Instead of riveting over the outer end of the retaining device as in Fig. 2, I split it approximately in its center so as to form two lugs 11 and 12. After the cover or shroud 6 is mounted in place, one of the lugs is bent in one direction and the other in the opposite direction as shown in Fig. 4. This arrangement possesses certain advantages over that shown in Fig. 2 in that less depends upon the relative skill of the workman, it being an easy matter to see whether or not the lugs properly engage the surface of the cover or shroud. Further, the amount of stock turned over will be determined by calculation and test and little or nothing will be left to the judgment of the workman. In this case, the cover or shroud is provided with openings 13 that in one dimension correspond to that of the retaining devices 7 as shown in Fig. 4, but in the other dimension are made somewhat longer to receive the beveled or inclined projection or shoulders 10 of the bucket. When the lugs are properly bent over by hammering or otherwise to form a head, the cover or shroud will be seated on the ends of the buckets and the projections 10 will engage the side walls of the recess in the bucket which arrangement prevents the bucket from moving in any direction from the normal.

In carrying out my invention the ends of the buckets and the recesses therein will be made by special machinery and the retaining devices may also be similarly made, thereby dispensing with hand work as far as possible. This has the advantage of reducing the cost and also of making the parts interchangeable. The bucket covers will be made of relatively thin sheet metal cut to or approximately to the proper width after which the openings to receive the securing device will be made by a punch-press operation. If for any reason it becomes desirable to remove a section of the cover or shroud, it can readily be done by cutting off the lugs 11 and 12 with a cold chisel, after which the retaining devices 7 may be removed and new ones substituted. The old cover section or a new section can then be applied in the manner set forth above. This is of mate-

rial advantage in case the bucket cover has been permitted to rub on some stationary part and has been thereby injured. By making shoulders on the retaining devices the centrifugal strains are transmitted by them to the buckets, the whole resulting in a strong and substantial construction.

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. In a turbine the combination of a plurality of buckets having shouldered recesses, a cover or shroud therefor, and shouldered devices separate from the buckets and anchored in their recesses for securing the cover to the buckets.

2. In a turbine, the combination of a plurality of buckets having recessed ends, a perforated cover or shroud therefor, the said perforations registering with said recesses, and means separate from the buckets, anchored in the recesses and extending through the perforations for securing the cover or shroud in place.

3. In a turbine, the combination of a plurality of buckets having recessed outer ends, the said recesses having an enlarged portion and a restricted opening communicating therewith, a perforated cover or shroud, and retaining devices each of which fits into a recess and conforms in shape thereto, extends through a perforation and is headed at its outer end to secure the cover in place.

4. In a turbine, the combination of a plurality of buckets having recessed outer ends, the said recesses being shouldered and extending through the buckets from side to side, a perforated cover or shroud, retaining devices that are located in the recesses and extend through the said perforations, each of said devices being provided with a head that engages the shoulder of the recess and is headed at its outer end to secure the cover in place.

5. In a turbine, the combination of a plurality of buckets each having a shouldered recess in its outer end, a perforated cover or shroud therefor, and retaining devices that are located in the said recesses and are anchored by the shoulders, the outer ends of said devices extending through the said perforations and being bent over to secure the cover in place.

6. In a turbine, the combination of a plurality of buckets that have shouldered recesses in their outer ends, a perforated cover or shroud, and retaining devices that extend through the perforations, each of which has



a head on its inner end that engages the shoulder and a split outer end, the parts of which are bent over to engage and secure the cover in place.

5 7. In a turbine, the combination of a plurality of buckets that have shouldered recesses in their outer ends, a perforated cover or shroud, means for preventing the buckets and cover from moving independently, 10 and cover securing means having heads at their inner ends that engage the shoulders and heads at their outer ends to engage and hold the cover.

15 8. In a turbine, the combination of a plurality of buckets arranged in a row and having shouldered recessed ends, a cover or shroud therefor, devices separate from the buckets and anchored in the said recesses for securing the cover, and means for interlock- 20 ing the buckets and shroud to prevent the buckets from moving in the plane of the row independently of the cover.

9. In a turbine, the combination of a plurality of buckets, a cover or shroud therefor, and devices for securing the cover to the 25 buckets, each of said devices comprising a double-headed member arranged in line with the bucket, one of said heads being embedded in the body of the bucket and the other being outside of and engaging the sur- 30 face of the cover.

10. In a turbine, the combination of a plurality of buckets, a cover or shroud therefor, and devices which are anchored in the buckets and hold the cover in place, the said de- 35 vices forming a part of the surface of the bucket upon which the motive fluid acts.

In witness whereof, I have hereunto set my hand this 26th day of June, 1909.

EDWIN W. RICE, JR.

Witnesses:

BENJAMIN B. HULL,  
HELEN ORFORD.