No. 868,419. PATENTED OCT. 15, 1907.

W. L. R. EMMET.

TURBINE BUCKET.

APPLICATION FILED MAY 18, 1905.

2 SHEETS—SHEET 1.

Fig. 1.

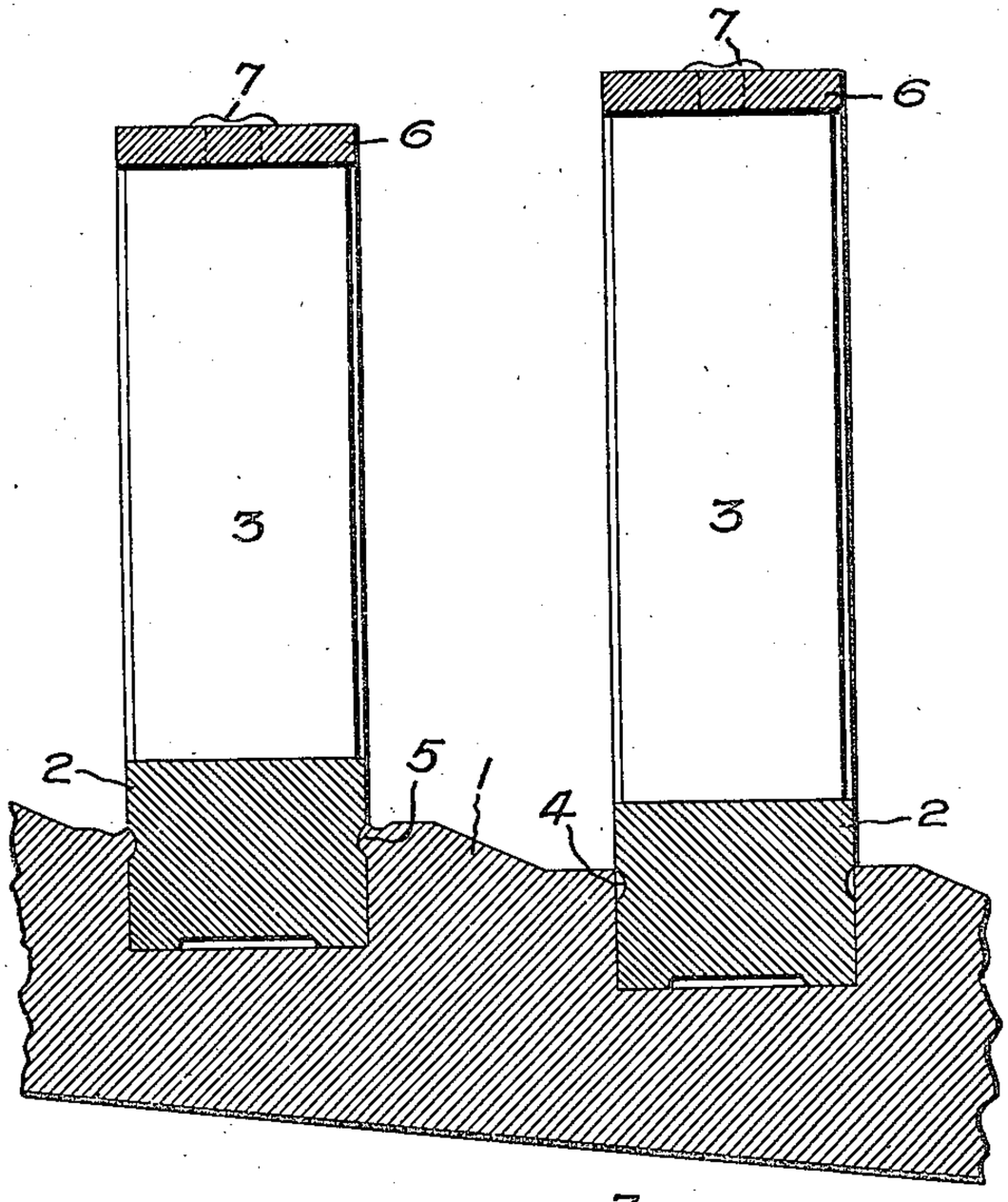
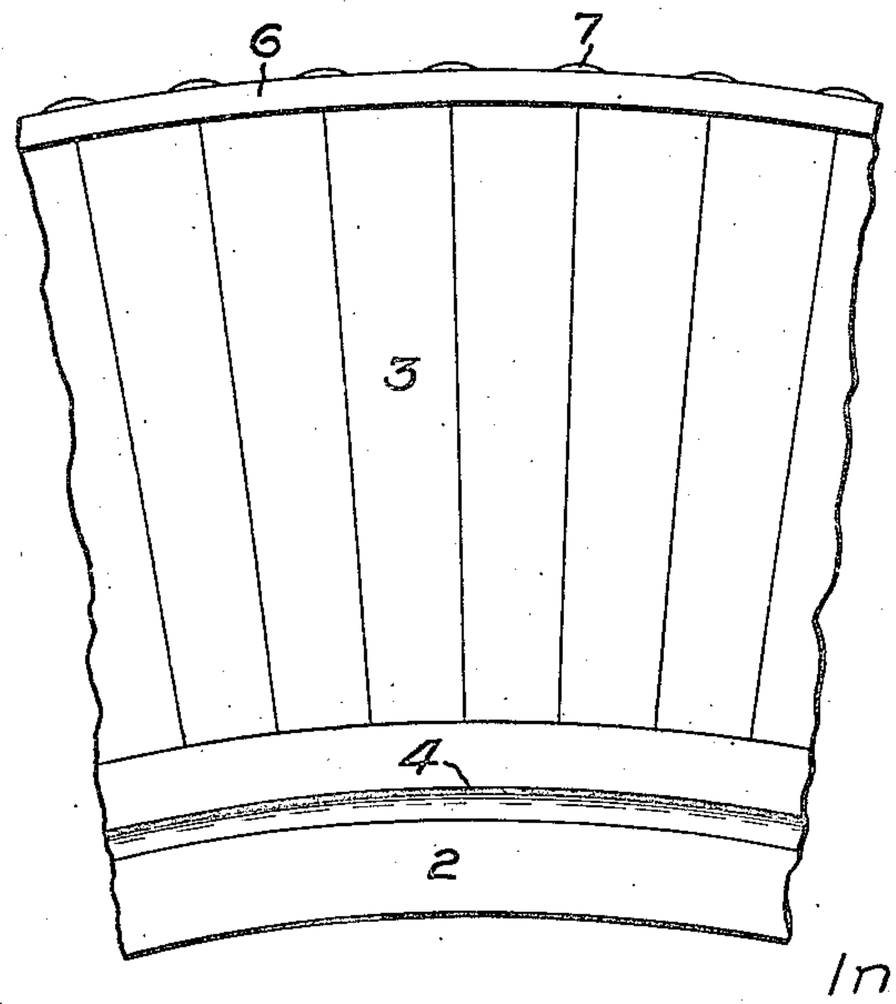


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

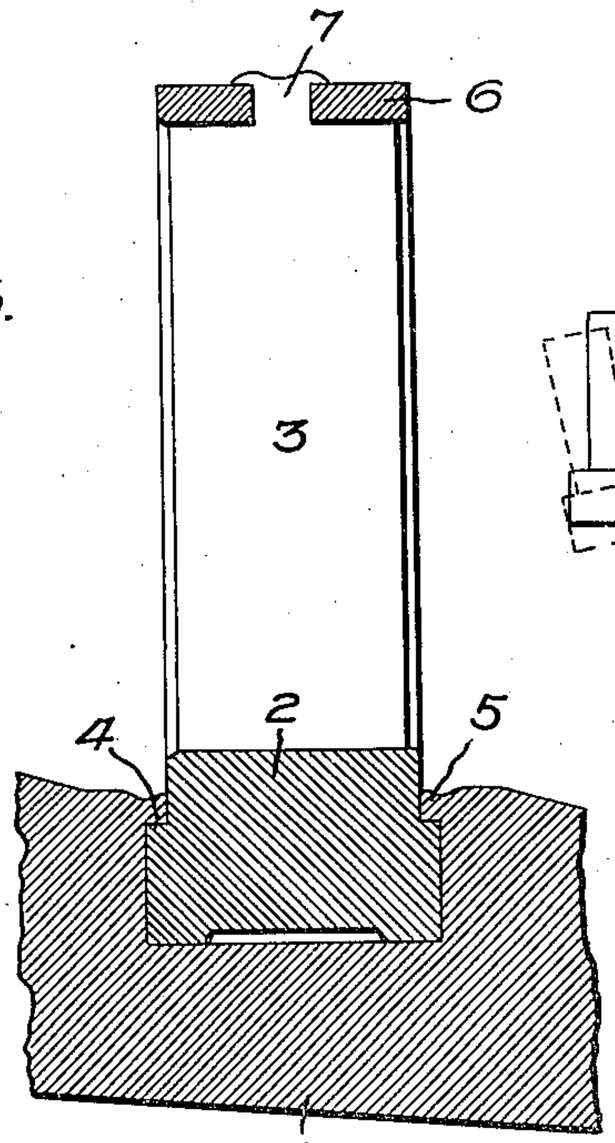


Fig. 7.

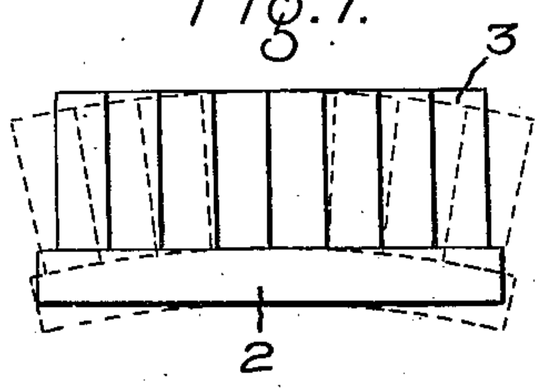


Fig. 6.

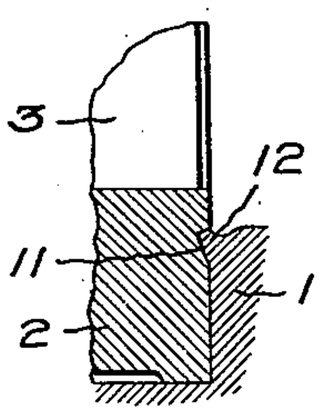


Fig. 4.

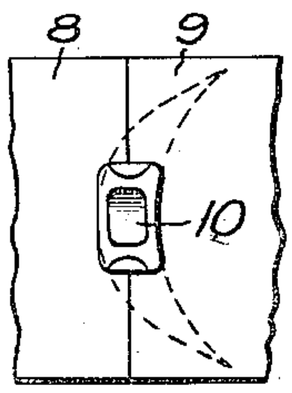
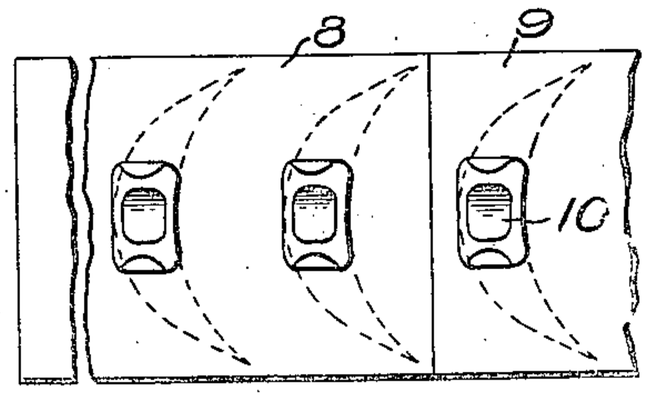


Fig. 5.



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UNITED STATES PATENT OFFICE.

WILLIAM L. R. EMMET, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

TURBINE-BUCKET.

No. 868,419. Specification of Letters Patent. Patented Oct. 15, 1907.

Application filed May 18, 1905. Serial No. 260,961.

To all whom it may concern:

Be it known that I, WILLIAM L. R. EMMET, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Means for Attaching Turbine-Buckets, of which the following is a specification.

At the present time great difficulty is experienced in fastening the buckets of turbines of the reaction type in place, and many machines have been wrecked owing to buckets separating or tearing away from their supports due to centrifugal strains, thus entailing great expense and delay. This is due in large part to the enormous number of buckets required to be supported in a limited area, and to the character of the bucket carrier, the latter usually being a drum which is exceedingly long compared to its diameter, thus precluding any construction involving retaining devices which pass through the carrier.

The object of my invention is to overcome the objection set forth and to provide a cheap, simple means for effectively securing the buckets in place.

In carrying out my invention the buckets either for the stationary or rotary part are cast into, welded to, or otherwise formed as an integral part of a base piece or portion. The base pieces are divided into segments of suitable length to be manufactured and handled conveniently. The sides of the base pieces are provided with one or more shoulders which may be internal or external as desired. When two or more shoulders are formed on each base piece they are preferably located on opposite sides. The drum or support carrying the buckets is provided with grooves into which the base pieces fit snugly. Ordinarily these grooves are made rectangular in cross-section, as are also the base pieces of the buckets, but the parts can take other forms or shapes if desired. By using a rectangular formation, side walls of generous area may be provided which serve to accurately aline and hold the buckets before they are finally secured in place. The base pieces may be made of any suitable metal which will readily unite with the buckets. The drum will ordinarily be made out of steel. The buckets may be provided with covers at their ends or not as conditions of service demand. The covers are desirable because they stiffen the buckets and assist in supporting them. When covers are employed, securing tenons are formed integral with some or all of the buckets which extend through registering openings in the cover and are riveted over by a suitable tool. The cover sections or segments preferably are of the same length as the segmental base portions, so that the planes of division will be coincident. The end of each cover section may be provided with an end notch which partially encircles a tenon, so that one tenon suffices to secure the ends of adjacent cover sections in place. I may however so arrange the joint that it is located between two tenons. This construction, while not as good as the former in certain respects, has this advantage, that each segment comprising a base portion, buckets and cover, is independent of every other segment. After the bucket segments or sections are finished and the grooves turned in the steel drum, the former are inserted in the latter and by means of a suitable tool the metal of the drum is forced over the shoulders formed on the base portion, thus forming lips or bodies of metal for firmly securing the parts in place. The metal of the drum can be forced over the shoulders by means of a suitable calking tool and hammer, or it may be rolled over the shoulder by subjecting it to heavy pressure and at the same time turning the drum. The latter method is preferable because it is quicker and insures better and more uniform work. Since these lips are continuous and on both sides of the base it follows that the latter will be firmly secured at every point.

In case of injury to some of the buckets the metal in the drum which retains the base portion of the buckets in place can be forced back by suitable tools and the damaged bucket segment or segments removed. In order to facilitate this work, a shallow groove is turned either in the drum or base of the bucket-carrying segment or both, into which a tool can be inserted to pry up the segment. This can be done, of course, only after one segment has been cut out or removed wholly or in part. Ordinarily it is simplest to cut out one bucket segment, after which the others can be removed without special difficulty. The use of the groove also decreases the area of the surfaces which must be carefully finished.

In the accompanying drawings, which are illustrative of my invention, Figure 1 is a partial longitudinal section of a bucket-carrier with buckets mounted thereon; Fig. 2 is a partial side elevation of the same; Fig. 3 shows a slight modification of the construction; Fig. 4 is a detail plan view showing the arrangement of the joint between the cover sections or segments, with means for securing the sections in place; Fig. 5 is a detail view showing the joint between the cover sections or segments located intermediate the buckets; Fig. 6 is a detail view showing a slight modification in the form of retaining shoulder; and Fig. 7 shows the buckets made in a straight strip which is afterwards bent.

1 represents a steel drum or other carrier for the buckets, and is provided with grooves of rectangular cross-section to receive the base portion 2 of the buckets 3. A plurality of these buckets are carried by each of the

segmental base portions 2 which ordinarily extend completely round the carrier. The opposite sides of the base portion are provided with internal shoulders 4 which are adapted to receive the lips or bodies of metal 5 which are integral with the carrier and are formed by forcing the metal over the shoulders. The shoulders are located at a point between the roots of the buckets and the bottom of the base portion. The buckets are provided with a sectionalized or segmental cover 6 which is secured in place by tenons 7 formed integral with the buckets.

Where the ends of the buckets are intended to run in close proximity to a casing or drum, it is preferable to omit the cover 6, in which case the end of the bucket is made straight instead of being provided with a tenon. Such an arrangement is shown in Fig. 7.

In Fig. 3 is shown a slight modification. The shoulders 4 for retaining the buckets and base-piece in place, instead of being made internal as in Figs. 1 and 2, are made external. The buckets are secured in place by forcing the metal of the carrier over the shoulder, which metal forms a lip 5.

In Fig. 4, 8 and 9 represent adjacent cover sections or segments, and the plane of division between them coincides with about the central portion of the tenon 10. By means of this construction one tenon suffices to secure the ends of two cover sections or segments.

In Fig. 5 I have shown a further modification wherein the plane of division between adjacent cover sections 8 and 9 is located between two buckets. When this construction is employed, it is possible to remove a segmental bucket base and the attached buckets and covers without interfering with the covers or buckets of an adjacent section. In this arrangement each cover section is made rectangular in form with smooth sides and ends and has a plurality of tenon-receiving openings which correspond in shape and pitch to the tenons on the buckets. In the present figure as many tenons are shown as there are buckets, but it is within the scope of my invention to employ a less or greater number of tenons than buckets. The tenons are preferably provided with two straight sides and curved ends, the curved ends conforming to the curvature of the buckets. By reason of this construction any tool employed to finish the buckets can also face the curved portion of the tenon. The straight or side portion of the tenons can be finished in any well-known way, as for example turned in a lathe.

In Fig. 6 the base portion of the buckets is provided with a shoulder having a relatively long inclined surface 11 which is engaged by the lip 12 on the drum or other support. This arrangement affords a relatively long bearing surface to retain the buckets in place.

In Fig. 7 the base portion of the buckets is made straight so as to simplify the construction, especially where the parts are cast, after which the said base portion is bent to conform to the curvature of the drum or other support or carrier. As the base portion is bent suitable means may be provided to insure the proper radial positions of the buckets.

In accordance with the provisions of the patent statutes, I have shown 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 carrier having one or more grooves therein, a bucket-supporting base or element mounted therein, a retaining shoulder between the base and carrier elements, and a lip or body of metal for securing the buckets in place, which is made by forcing an integral part of one of the elements into engagement with the shoulder after the base is mounted in place.

2. In a turbine, the combination of a carrier, one or more grooves therein, a bucket-supporting base mounted in a groove, a shoulder formed on the side of the base, and a lip or body of metal for securing the buckets and their bases in place, which is made by forcing an integral part of the carrier over the shoulder after the base is mounted in place.

3. In a turbine, the combination of a carrier, one or more grooves therein, a plurality of buckets, a segmental base united to the buckets and located in a groove, retaining shoulders formed on opposite sides of the base, and lips or bodies of metal for securing the buckets which are made by forcing integral parts of the carrier over the shoulders after the base is mounted in place.

4. In a turbine, the combination of a carrier, one or more grooves therein, a segmental supporting base united with the buckets and located in a groove, one or more shoulders formed on the base, a segmental cover for the buckets, tenons for securing the cover in place, and one or more lips or bodies of metal which are made by forcing integral parts of the carrier over the shoulders for securing the buckets after the base is mounted in place.

5. In a turbine, the combination of a carrier, one or more grooves therein, bucket-supporting bases united with the buckets and located in a groove, a shoulder on the base, a lip or body forming a part of the carrier which is forced over the shoulder after the base is mounted on the carrier, and a groove formed between the base and the carrier to receive a tool when it is desired to remove the buckets.

6. An article of manufacture comprising a plurality of turbine buckets which are united to a common base, with one or more shoulders formed on the base at a point between the roots of the buckets and the bottom of the base.

7. As an article of manufacture, a cover section for turbine buckets, comprising a rectangular strip of metal having smooth sides and ends, and a plurality of openings between the ends adapted to register with the buckets.

8. In a turbine, the combination of a carrier having one or more grooves therein with buckets mounted in the groove or grooves and a shoulder between the buckets and carrier, the said buckets being held in place by changing the relative distribution of the metal of the carrier and the buckets.

In witness whereof, I have hereunto set my hand this 17th day of May, 1905.

WILLIAM L. R. EMMET.

Witnesses:
BENJAMIN B. HULL,
HELEN ORFORD.