H. J. HANZLIK & R. E. HELLMER.

ELASTIC FLUID TURBINE.

APPLICATION FILED JAN. 22, 1908.

922,581. Patented May 25, 1909.

Fig. 1.

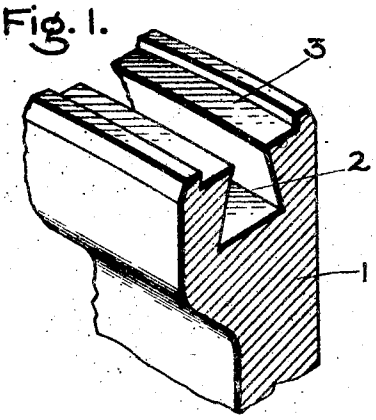


Fig. 2.

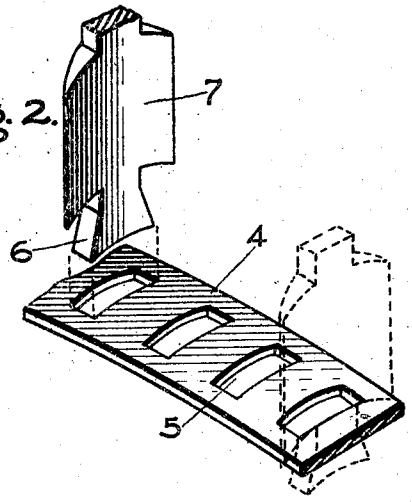


Fig. 3.

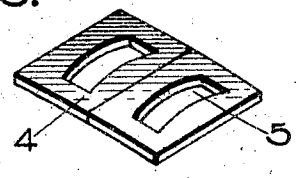


Fig. 4.

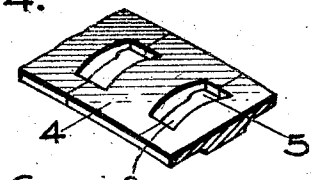


Fig. 5.

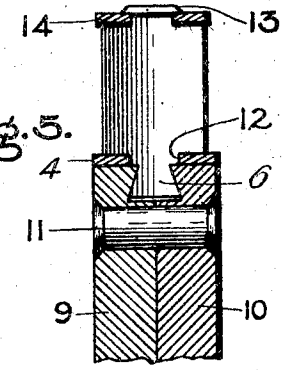


Fig. 6.

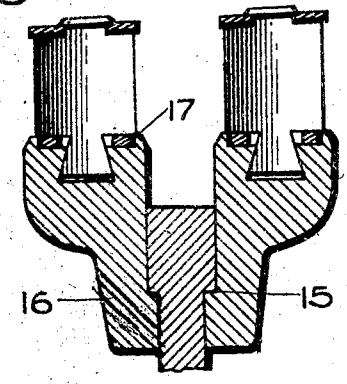
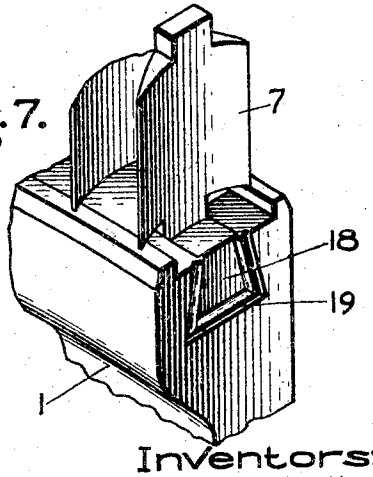


Fig. 7.



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UNITED STATES PATENT OFFICE.

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ELASTIC-FLUID TURBINE.

No. 922,581. Specification of Letters Patent. Patented May 25, 1909.

Application filed January 22, 1908. Serial No. 412,047.

To all whom it may concern:

Be it known that we, HENRY J. HANZLIK, a citizen of the United States, and RALPH E. HELLMER, a subject of the Emperor of Austria-Hungary, both residing in Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Means for Spacing and Supporting Buckets in Elastic-Fluid Turbines, of which the following is a specification.

The present invention relates to the construction of bucket carriers for elastic fluid turbines wherein a slot or groove is provided, the walls of which engage the bases of the buckets and hold the same in place against endwise movement, due to centrifugal force or otherwise. In order to form steam spaces or passages between the buckets, it is necessary to separate the buckets one from the other by a space more or less great. This has been customarily done by inserting space blocks within the grooves which blocks have their sides shaped to conform to the side walls of the grooves and their ends to the curved faces of the adjacent buckets. The under side of each block rests on the bottom of the groove while the top is flush with the mouth of the groove. When the buckets of the turbine are large with a substantial space between them, the space blocks while comparatively small, are not particularly hard to manufacture, but where the buckets are small and the pitch fine, as is the case with turbines of small power, these space blocks cost a good deal to manufacture on account of the large amount of time required to fit them to the walls of the grooves and to the curved surfaces of the base of the buckets.

Our invention has for its object, to overcome the objections above pointed out and to provide a bucket spacing means of improved construction combined with a suitable bucket support or carrier.

In carrying out our invention the support or carrier for the buckets, which may be stationary or rotary as desired, is grooved circumferentially to receive the bases of the buckets. The groove may be of dovetail, inverted T or other shaped section, the object being to so shape the walls of the groove and the bases of the buckets that the said walls will firmly secure the buckets against the effects of centrifugal or other forces. The bases of the buckets are so shaped that they closely fit the side walls of the grooves and by properly finishing them the desired entrance and exit angle of the buckets can be obtained. In order to provide spaces or passages between the buckets, it is necessary to separate the buckets by a distance more or less great. This we accomplish by means of a punched strip of sheet metal containing orifices therein having the desired pitch and through which the bases of the buckets pass. This strip determines and maintains the pitch of the buckets and preferably rests on the carrier. In those cases where the carrier is rotatable it will be found desirable to secure the strip to the carrier. This may be done in a variety of ways, as for example; by welding the carrier and strip together by means of an acetylene oxygen flame or by turning a groove in the carrier and staking the walls of the groove over the strip.

The spacing strip may be made in a variety of ways, and may be arranged to receive a plurality of buckets or to recive only one, or it may be made in short pieces, each piece having notches on opposite sides that are of a shape and size to partly surround the bases of adjacent buckets. In any event, these spacing devices may be made by a punch-press operation, thus doing away with all machining and hand-fitting which is so expensive in previous constructions. Where the spacing strip is of considerable length, it will be found desirable to give it the same curvature as that of the carrier before the buckets are inserted in place. Where the strips are short as for example to receive one or two buckets, they may be curved at the same time they are punched out.

In some cases, the free or unattached ends of the buckets may be left uncovered. Ordinarily we prefer to provide them with a sheet metal shroud or cover, that is held in place by tenons formed integrally with the buckets, the said tenons projecting through openings of corresponding shape and size in the cover or shroud and which are riveted over to secure the same in place. The length of these cover sections may be greater or less, as desired.

In the accompanying drawings which are illustrations of our invention, Figure 1 is a perspective view of a part of a carrier; Fig. 2 is a perspective view showing the relation of the buckets to the spacing device; Fig. 3 is a perspective view of a section of the spacing strip; Fig. 4 is a detail view of a slight modi-

fication of said strip; Fig. 5 is a detail view showing the buckets mounted in place on the carrier; Fig. 6 is a sectional view of the carrier adapted to receive two rows of buckets, and Fig. 7 shows the fastening means at the ends of the segments of a carrier.

1 indicates the carrier having a dovetail slot or groove 2 to receive the bases of the buckets. It is also grooved at 3 to receive the spacing strip 4. The spacing strip is provided with a plurality of orifices 5 of predetermined pitch which correspond in shape and size to the end of each base 6 of a bucket 7. In Fig. 2, one of these buckets is shown directly above one of the openings in the spacing strip, and the bucket is shown in dotted lines in its final position.

In Fig. 3 is shown a spacing strip having two bucket receiving orifices 5, the line of division between the sections passing between the orifices.

In Fig. 4, is shown a further modification wherein each section is provided with two end notches 8, the side wall of one being concave and the other convex. The joint between the sections registers with the bucket receiving opening 5. In assembling this type of spacing device with the buckets, a bucket 7 will first be inserted in the groove 2, then a section of the spacing device laid in the groove 3 and pressed up against the bucket, then a second bucket inserted, then a spacing device, and so on.

In Fig. 5 the carrier is shown as being made of two principal parts 9 and 10, the line of division being perpendicular to the shaft axis. The line of division also passes through the center of the bucket retaining groove 2. The elements of the carrier are united by a plurality of rivets 11. Each of the buckets 7 is provided with a dovetail projection 6 and a shoulder 12 that makes a snug fit in the orifice formed in the spacing strip 4. In this case, the spacing strip rests directly on the peripheral surface of the carrier, and is held in place by the dovetail projections 6 on the buckets. The buckets are provided with integral tenons 13 that are riveted over at their ends to secure the cover 14 in place.

In Fig. 6 the carrier 1 is provided with shoulders 15 on opposite sides with which projections on the bucket receiving segments 16 engage. These segments may be of any suitable length and are secured in place by rivets or equivalent means. Their construction is the same as that shown in Fig. 1, and the spacing strip 4 is secured in place within the groove 3 either by staking over the projections 17, or welding the spacing strip to the projections. The fastening of the spacing strip has this advantage that it relieves the bucket bases of a considerable amount of strain due to centrifugal force, when the structure is rotated.

In Fig. 7 is shown the means for securing the parts against longitudinal movement within the groove in a segment. At each end of the bucket segment the groove is filled with type metal 18 or some other equally good material and the end of the segment around the groove is upset as at 19 to hold the same in place.

Our construction possesses many advantages over the prior constructions wherein space blocks are provided which are fitted into the groove receiving the bases of the buckets. It uses less stock and what is used is of a less expensive character. There is a decrease in weight. Hand work on the spacing means is done away with. Since the spacing means is punched by machine greater accuracy of pitch is secured than where dependence is placed wholly or in part on hand work. With spacing blocks located in grooves it is necessary to taper the ends because the buckets occupy radial positions. This is unnecessary with our improved construction because the spacing device is thin, measured in a radial direction.

We prefer to divide the spacing means as shown in Fig. 4, since by so doing less stock has to be cut out to receive the bucket base thus giving greater strength. In this case a spacing device is slipped into place after a bucket is mounted in the groove 2, hence the opening does not have to be large enough to receive the lower end of the base but only to receive the neck or reduced portion of the base. Further the ends of the buckets will extend over the joint between parts and prevent said parts from bending outwardly due to centrifugal strains. With this construction the spacing device need only engage the curved part of the buckets, thus greatly decreasing the cost of assembling. The construction is also one that enables the parts to be disassembled for the purpose of making repairs or otherwise.

In accordance with the provisions of the patent statutes, we have described the principle involved in our invention together with the apparatus which we now consider to represent the best embodiments thereof, but we desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

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

1. In combination, a carrier, individual buckets mounted thereon and separately secured, and a means separate from the carrier that forms the sole spacing medium for the buckets and through which the latter extend.

2. In combination, a longitudinally grooved carrier, individual buckets having bases that enter the groove and are restrained against lengthwise movement only by the walls thereof, and a means separate from the car-

rier which engages the buckets is located outside of the groove, and determines and maintains the pitch relation of the buckets.

3. In combination, a longitudinally grooved carrier, individual buckets having bases that enter the groove and are restrained against lengthwise movement only by the walls thereof, and a punched metallic strip located outside of the groove and having orifices through which the supporting ends of the buckets pass, the walls of said orifices determining and maintaining the pitch of the buckets.

4. In combination, a circumferentially grooved carrier, individual buckets which enter the groove and are restrained by the walls thereof against lengthwise movement, and a circumferentially extending metal strip located between the mouth of the groove and the main body of the buckets, the said strip preventing the buckets from moving toward and away from each other within the groove.

5. In combination, a carrier having a circumferential bucket retaining groove, individual buckets having bases that enter the groove and are held by the walls thereof, a divided perforated metal spacer through which the buckets pass, and a cover that is secured to the free ends of the buckets.

6. In combination, a carrier having a longitudinal retaining groove, individual buckets, the base ends of which are held against longitudinal movement only by the walls of the groove, a spacing strip located outside of the groove and having orifices to receive the buckets, the walls of said orifices acting to space the buckets apart, and a cover for the free ends of the buckets, the said strip and cover forming the end walls of the fluid conveying spaces between the buckets.

7. In combination, a carrier having a longitudinal dovetail groove, individual buckets having dovetail bases that enter the groove and are held by the walls thereof, shoulders on the buckets located outside of the groove, and a sheet metal spacing device having orifices, the walls of which engage the shoulders and preserve the pitch relation of the buckets.

8. In combination, a carrier having a longitudinal dovetail groove, individual buckets having dovetail bases that enter the groove and are held by the walls thereof, and a sheet metal device that is divided into pieces corresponding in length to the pitch of the buckets, the said pieces serving to space the buckets apart within the groove, cover the groove and form a wall for the fluid conveying space between the buckets.

In witness whereof, we have hereunto set our hands this tenth day of January, 1908.

HENRY J. HANZLIK.
RALPH E. HELLMER.

Witnesses:
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