J. E. SNYDER.

BLADE MOUNTING MEANS.

APPLICATION FILED MAY 16, 1908.

943,480.

Patented Dec. 14, 1909.

2 SHEETS—SHEET 1.

Fig. 3.

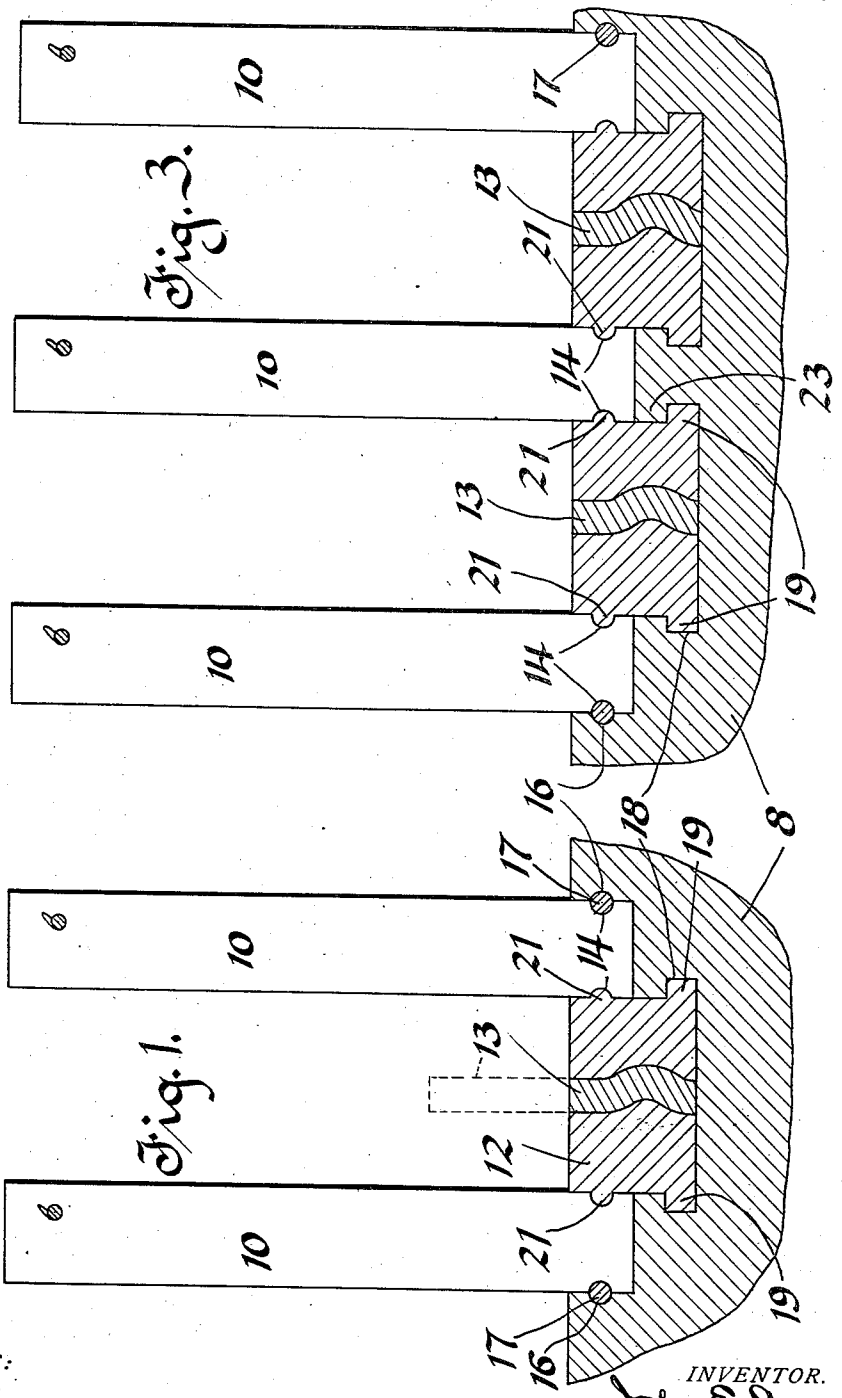

Fig. 1.

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2 SHEETS—SHEET 2.

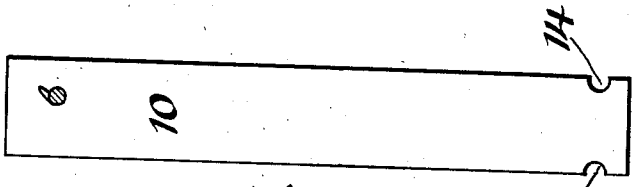

Fig. 5.

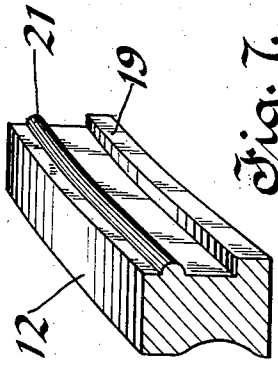

Fig. 7.

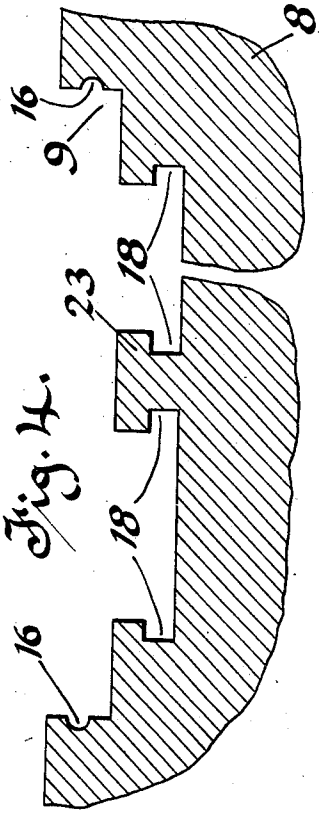

Fig. 4.

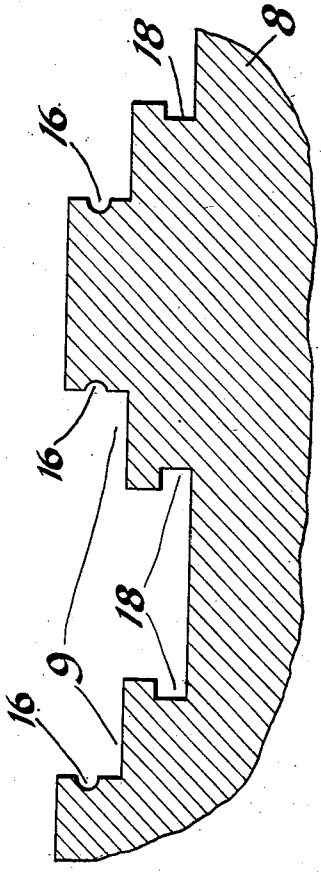

Fig. 2.

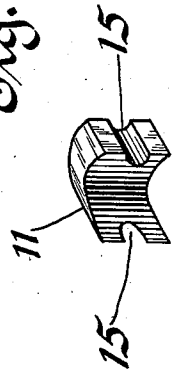

Fig. 6.

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JOHN E. SNYDER, OF SWISSVALE, PENNSYLVANIA, ASSIGNOR TO THE WESTINGHOUSE MACHINE COMPANY, A CORPORATION OF PENNSYLVANIA.

BLADE-MOUNTING MEANS.

943,480. Specification of Letters Patent. Patented Dec. 14, 1909.

Application filed May 16, 1908. Serial No. 433,250.

To all whom it may concern:

Be it known that I, JOHN E. SNYDER, a citizen of the United States, and a resident of Swissvale, in the county of Allegheny and State of Pennsylvania, have made a new and useful Invention in Blade-Mounting Means, of which the following is a specification.

This invention relates to elastic fluid turbines and more particularly to blading means for turbines.

An object of this invention is the production of simple, effective and relatively cheap means for blading turbines.

Two methods of blading turbines have heretofore been generally employed. In each method the blades are secured into blade-mounting slots provided in the blade-carrying elements and adapted to receive but one row of blades. The method most generally utilized employs separate calking or spacing pieces which are located between adjacent blades of a row and which are transversely expanded by a calking pressure and caused to grip the exposed faces of the blades and the walls of the slot and to thereby secure the blades to the blade-carrying element. The other method contemplates assembling the blades in segmental or blade-mounting rings and then securing the ring into the blade-mounting slot. Various means have been employed for securing the segmental rings or strips in place, but the most commonly used is a metallic calking strip which is inserted into the slot between the segmental ring and an adjacent wall of the slot. The calking strip is then subjected to a transverse calking pressure and is thereby transversely expanded and forced, on one side into gripping contact with the adjacent wall of the slot and on the other side into gripping contact with one face of the blade-mounting ring and also forces the blade-mounting ring into gripping contact with the other wall of the slot.

My invention contemplates an entirely new method of mounting blades which, while it is unlike either of the two methods described, is, in some respects, similar to both of them. I contemplate providing the blade-carrying element with blade-mounting slots which are adapted to receive two or more rows of blades. The blades of each row are spaced in the mounting slot by means of separate spacing pieces which are located between adjacent blades. The spacing pieces and the blades are then secured in place by means of a segmental ring, the segments of which are common to several blades and intermediate pieces, and which are secured in place by means of a calking strip.

In the drawings accompanying this application and forming a part thereof: Figure 1 is a fragmental transverse section of a blade-carrying element embodying my invention; Fig. 2 is a fragmental section of the blade-carrying element shown in Fig. 1, with the blades removed, and discloses the blade-mounting slot; Fig. 3 is a fragmental section of a blade-carrying element and discloses a modification of my invention; Fig. 4 is a fragmental section of the blade-carrying element shown in Fig. 3 with the blades removed; Fig. 5 is a modification of a blade employed in carrying out my invention; Fig. 6 is a perspective view of an intermediate spacing piece; and Fig. 7 is a perspective view of a segment of a blade-holding ring embodied in my invention.

Throughout the specification and in the claims I will utilize the word "blade" in its broadest sense; that is, to mean either the moving or stationary blades and in so doing I wish it to be understood that the blade-carrying element also means either the rotating or stationary blade-carrying element.

Referring to the drawings and particularly to Figs. 1 and 2: The blade-carrying element 8 is provided with a blade-mounting slot 9, which is adapted to receive two rows of blades 10. Intermediate spacing pieces 11 are located between adjacent blades of each row and these spacing pieces, with the blades, are secured in place by means of a segmental blade-holding ring 12, which is located in an undercut depression 10 formed in the bottom of the slot 9. Each row of blades mounted within the blade-mounting slot 9 is provided with a blade-holding ring 12 and the two rings mounted in each slot 9 are located back to back and are secured in place by means of a calking strip 13 which is calked into the spacing between the rings. Each blade 10 is provided with notches 14 cut in each edge of the blade near one end. The spacing pieces 11 are so constructed that their top and bottom faces are parallel to each other and plain. The lateral faces are also parallel to each other and are at right

angles to the top and bottom faces. One end face is concave and conforms in contour to the contour of the convex face of the blades and the other end face is convex and conforms in contour to the concave face of the blades. Each lateral face of the spacing pieces is provided with a longitudinally-extending slot 15, which is adapted to register with the notches 14 of adjacent blades when the blades and the piece are mounted in place within the blade-mounting slot 9. A longitudinally-extending slot is provided in each side wall of the blade-mounting slot 9 and each slot is adapted to coöperate with the notches 14 and the slots 15, formed respectively on one side of the blades and spacing pieces assembled in one row, in securing in place a longitudinally-extending wire 17 which, when the blades are assembled in the blade-mounting slot, acts as a key to secure them to the blade-carrying element. The depression 10 in the bottom of the blade-mounting slot 9 is undercut on each side at 18 and each blade-holding ring 12 is provided, near its base, with a longitudinally-extending flange 19 which, when the ring is in place within the blade-mounting slot, projects into one of the slots provided at 18 and is effective in positively locking the blade-holding ring to the blade-carrying element. Each ring is also provided with a longitudinally-extending bead 21 which is located on the same side of the ring as the flange 19 and which is adapted to project into the groove formed by the notches and slots 14 and 15, formed respectively on one side of the individual blades and pieces.

In assembling the blades and securing them to the blade-carrying element the following method is preferably employed: The blade-holding rings 12 are cut into relatively short segments, which subtend at least five blades 10 and intermediate spacing pieces 11. The wire 17, which, if desirable, may also be cut into short sections, is located in the notch 17 and a few blades and intermediate spacing pieces of each of the two rows, which mounting slot 10 is adapted to receive, are located in place so as to hold the wire 17 in place in the recess formed by the slot 16 and the notches and slots 14 and 15. A segment of the blade-holding ring for each row of blades is then introduced into the slot and secured in place either temporarily or permanently by means of the calking strip 13. This method is pursued until all of the blades are assembled within the slots. The back face of each blade ring 12 is preferably a concave-convex surface and the surfaces are so formed on each ring relative to the surface of the adjacent or coöperating ring that the intermediate space between the rings has a section corresponding somewhat to a section of a distorted rectangle. These grooved faces are provided merely to insure that the calking strip 12 will remain permanently in place and will not be dislodged by centrifugal or other dislodging forces. When the blade-holding rings are secured in place the blades of each row are secured to the blade-holding element and positively locked in place by means of the locking wire 17 and the bead 21. The blade-holding rings are positively secured to the blade-carrying elements by the coöperating flanges 19 and the undercut portions of the blade-mounting slot, so that with this construction the blades are all rigidly and positively secured to the blade-carrying element.

In Figs. 3 and 4 I have shown a modification of my invention. The blade-mounting slot 9 in this instance is arranged to receive three rows of blades instead of two. A third and intermediate row is mounted upon an annularly-extending flange 23, which is formed integrally with the blade-carrying element and which extends coaxially with the blade-mounting slot. The flange 23 divides the slot 9 into two similar parts and coöperates with each wall of the slot in forming the undercut depression 10 in which the blade-mounting rings 12 are secured in place. The mounting of the blades within the blade-mounting slot is, with the exception of the intermediate row of blades, substantially similar to the method employed in securing the blades of the blade-mounting element shown in Figs. 1 and 2. The blades of the intermediate row are supported by the flange 23 and are secured in place within the slots 10 by means of the two blade-mounting rings 12, which are located on each side of them. Each blade 10, as disclosed in Fig. 1, is provided with the notches 14 and each intermediate spacing piece 11 is provided with the longitudinally-extending slots 15. The grooves formed on each side of the intermediate blade row by the coöperating slots and notches 14 and 15 coöperate, in holding the blades in place, with the beads 21 provided on the adjacent blade-holding rings. This disclosure will make it evident to one skilled in the art that the blade-mounting slots 9 may be constructed to receive and secure in place any number of rows of blades.

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 believe 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 is:

1. In combination with a blade-carrying element provided with a slot, a plurality of rows of blades, spacing pieces between the

rows of blades and calking pieces between the spacing pieces.

2. In combination with a blade-carrying element provided with a slot, a plurality of rows of blades, spacing pieces, the adjacent edges of which are irregular, and a calking piece interposed between the irregular adjacent faces of said spacing pieces.

3. In combination with a blade-carrying element provided with a slot, a plurality of rows of blades in the slot spacing pieces between the rows of blades and having irregular faces and a distortable calking piece interposed between the irregular faces of the spacing pieces to secure the spacing pieces and the blades to the blade-carrying element.

In testimony whereof, I have hereunto subscribed my name this 12th day of May, 1908.

JOHN E. SNYDER.

Witnesses:

CHARLES W. MCGHEE,

E. W. MCCALLISTER.