

J. S. GREEN.
BLADING FOR ELASTIC FLUID TURBINES.
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950,803.

Patented Mar. 1, 1910.

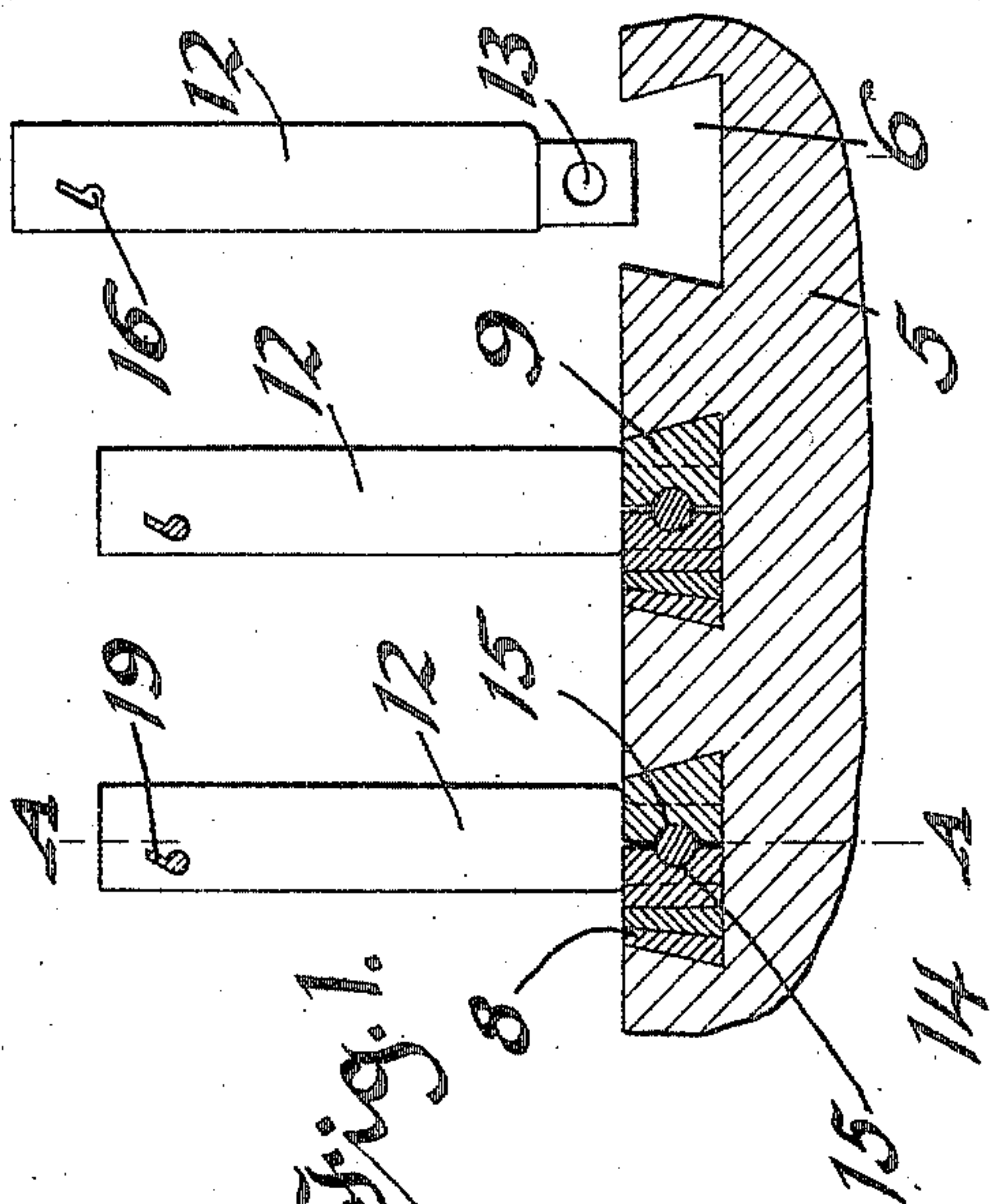


Fig. 1.

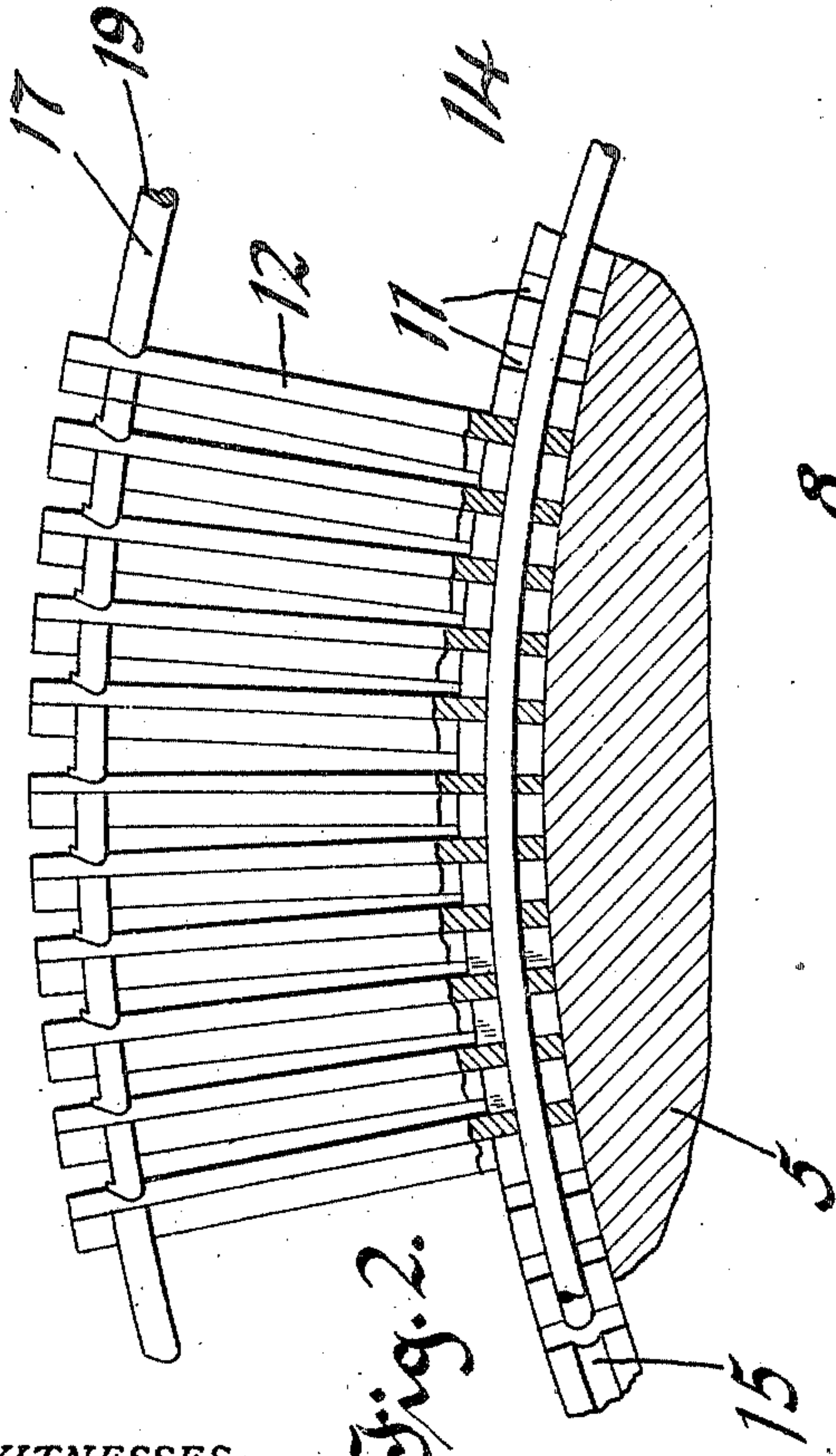


Fig. 2.

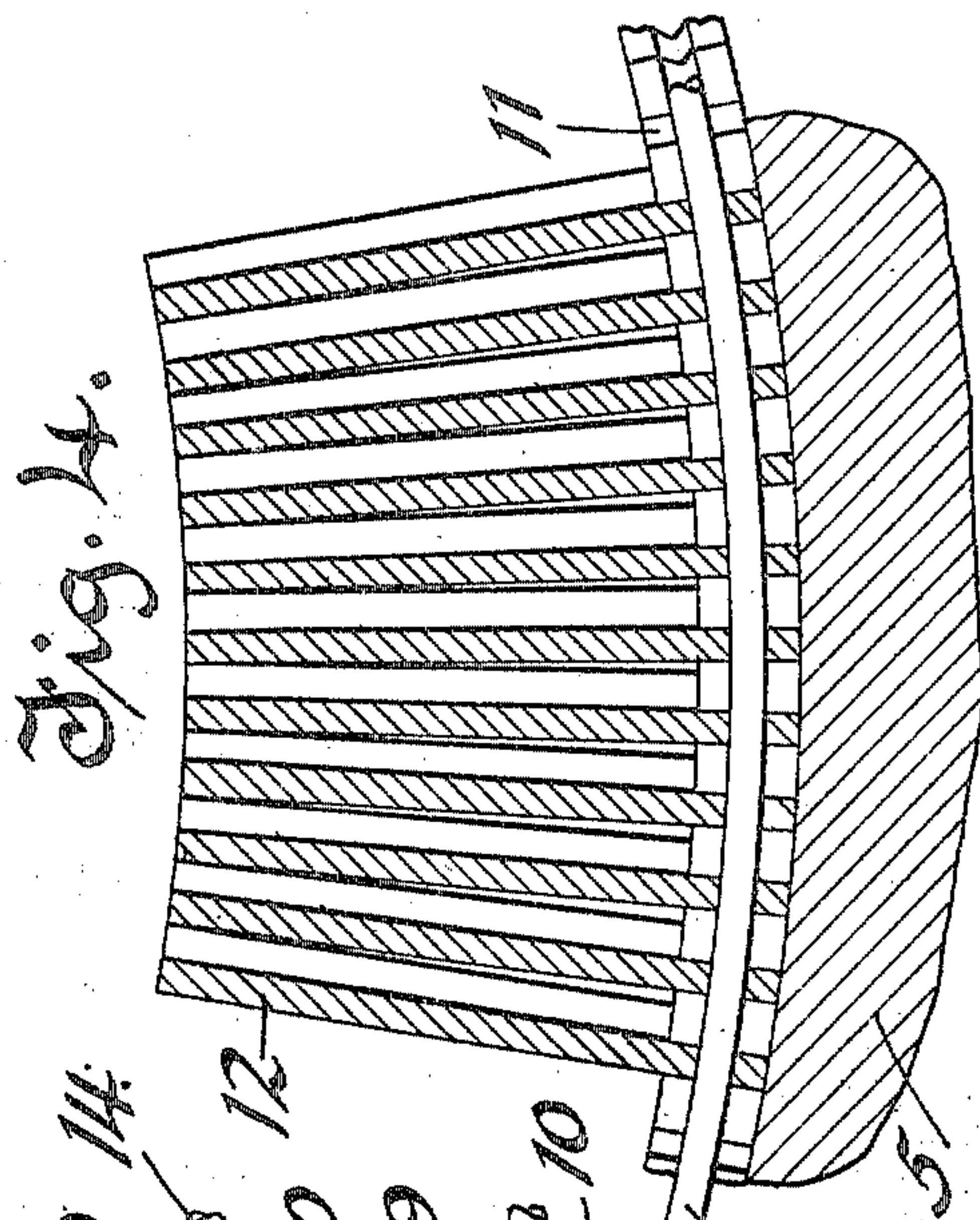


Fig. 4.

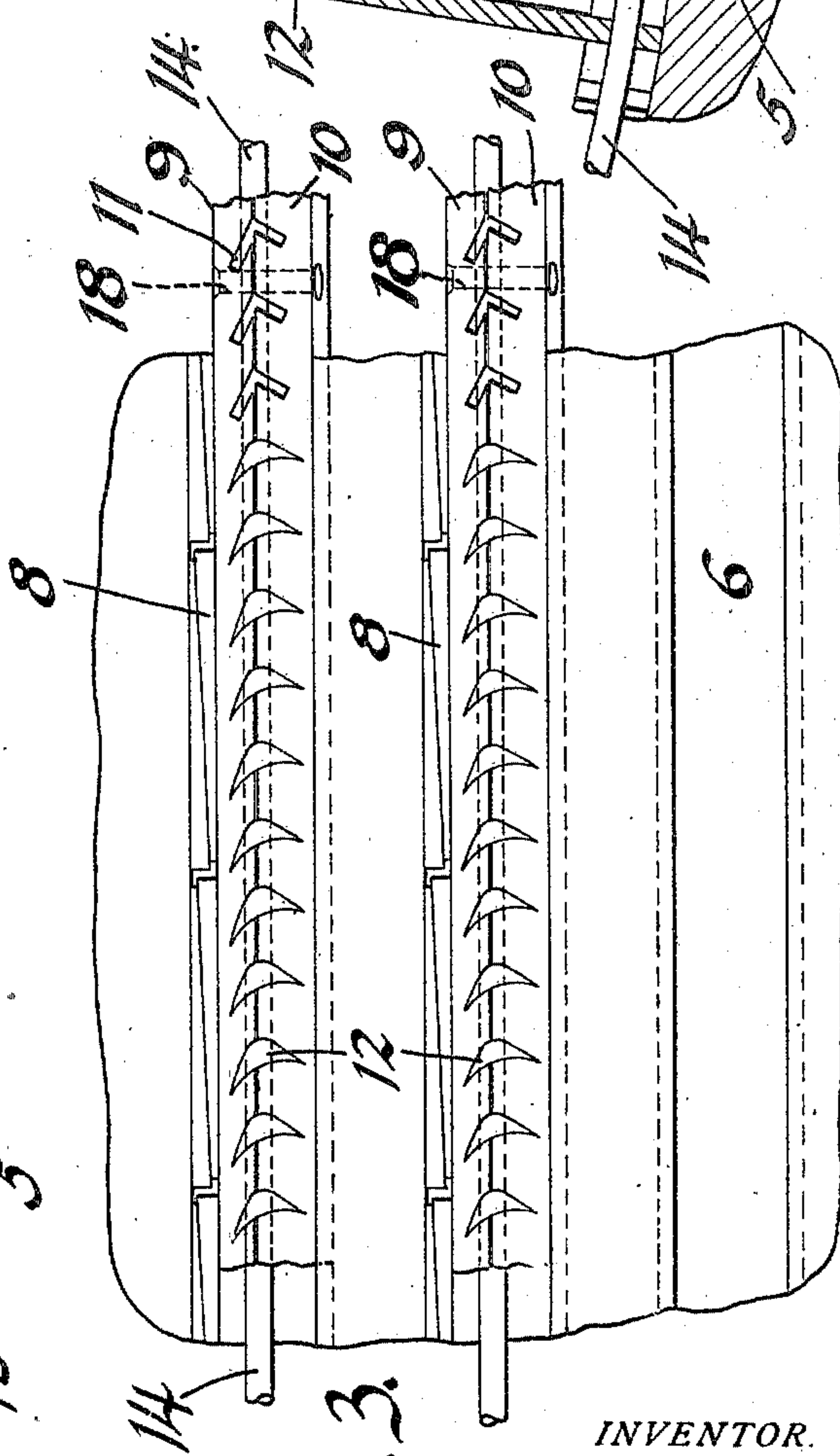


Fig. 3.

WITNESSES:

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UNITED STATES PATENT OFFICE.

JONATHAN S. GREEN, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO THE WESTINGHOUSE MACHINE COMPANY, A CORPORATION OF PENNSYLVANIA.

BLADING FOR ELASTIC-FLUID TURBINES.

950,803.

Specification of Letters Patent.

Patented Mar. 1, 1910.

Application filed August 6, 1908. Serial No. 447,228.

To all whom it may concern:

Be it known that I, JONATHAN S. GREEN, a citizen of the United States, and a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have made a new and useful Invention in Blading Means for Elastic-Fluid Turbines, of which the following is a specification.

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

An object of my invention is the production of simple and effective means for assembling turbine blades into blade segments. In the drawings accompanying this application and forming a part thereof: Figure 1 is a fragmental longitudinal section of a blade-carrying element of a turbine and illustrates an embodiment of my invention; Fig. 2 is a section along the line A—A of Fig. 1 and discloses a section of a rotating blade-carrying element in connection with blades shown partially in section and partially in elevation and mounted in accordance with my invention; Fig. 3 is a plan view of a fragment of a rotating blade-carrying element with blades mounted in accordance with my invention; and Fig. 4 is a fragmental section of a stationary blade-carrying element in connection with blades shown in section.

In carrying out my invention I contemplate assembling the turbine blades into a segmental blade ring and I accomplish this by providing a compound base strip for the blades, which is composed of two separate strips. Each separate strip is notched to receive the blades and one strip coöperates with the other and with a locking wire, which extends through holes provided in the blades, in positively securing the blades in place. I also provide means for permanently securing the separate strips of each base strip together and thereby permanently lock the blades in place.

Referring to the drawings: the blade-mounting element 5 is provided with undercut grooves 6 in each of which a segmental blade ring is secured by component wedges 8. Each blade ring is composed of blades 12, the bases of which are secured to a segmental base strip 9, each of which is composed of two strips 10. Each strip 10 is curved to conform to the curvature of the

blade mounting slot and is provided, across one face, with radially extending notches 11 so arranged and spaced that the notches in one strip coöperate with the adjacent notches in the other strip in securing the roots or bases of the blades 12 in place. The bases of the blades 12 are swaged or otherwise formed so as to more nearly fit the notches provided for their reception in the blade mounting strips. Each blade is also provided with a round hole 13, which extends transversely through its base and through which a cylindrical wire 14 extends. A slot 15 of semi-circular section is provided in each strip 10 and, extending longitudinally of the strip, intersects the notches 11 of the strip. The slot 15 of one strip coöperates with the slot 15 of the co-operating strip in receiving and securing in place the wire 14. One lateral wall of one of the strips 10, comprised in each compound base strip, is inclined to correspond to the inclination of the undercut walls of the mounting grooves 6. The corresponding wall of the other strip is vertical. The outer end of each blade is provided with a hole 16 which is comma-shaped in cross-section, and through which a wire 17 of comma-shaped cross-section is adapted to extend.

In assembling the blades and base strips into segmental blade rings, the blades are first threaded onto the locking wire 14, which, as has been said, is adapted to extend through the holes 13, and then on the binding wire 17, which is adapted to extend through the holes 16. The blades are then spaced along the wires and introduced into the notches 11 of one of the component strips of the base strip 7. The blades 12 and the wire 14 are then locked in place within the ring by bringing the notches 11 of the other strip of the base strip into engagement with the projecting portions of the bases of the blades. The two strips are then secured together by means of rivets 18 which are suitably spaced along the ring and located in countersunk holes extending through the strips. The rivets draw the component strips of each base strip together so that the bases of the blades are firmly clamped between them.

The outer or free ends of the blades, secured to a base strip, are properly spaced

and rigidly secured in their relative positions by shearing, adjacent to and on each side of each blade, and bending over, between adjacent blades, a longitudinally extending rib 19 which is formed on the binding wire 17. The shearing and bending over of the rib 19 forms separate spacing pieces between adjacent blades which positively lock the blades in their relative positions, and the body portion of the wire 17 acts as a binding wire in holding the separate pieces together and securing the outer ends of the blades together.

The base strips may be cut to convenient lengths and these secured into the blade-mounting grooves by any suitable means, but I preferably employ the compound tapered wedges 8. The base strips 7 are so introduced into their mounting groove 6 that their inclined faces contact with one of the undercut walls of the groove. The compound tapered wedges 8 are then introduced into the groove between the vertical face of the blade-mounting ring and the other undercut wall of the groove. The wedges are arranged in pairs and the two wedges of each pair are so constructed that, when driven home, one beside the other, they form a wedge-shaped key which is effective in securing the blade-mounting ring in the blade-mounting groove and which is prevented, by its shape and the shape of its component wedges, from being dislodged from the groove by centrifugal or any other dislodging force. The segments of each ring are so arranged at their ends that they may be located in the blade-mounting grooves end for end without destroying the spacing of the blades. A number of pairs of wedges are employed to secure each segment of the ring in a groove, and are preferably so spaced within the grooves that the component wedges of the one pair abut against the corresponding component wedges of the adjacent pairs. Such an arrangement prevents any possibility of the wedges becoming displaced or loosened in the grooves. The first and last pairs of wedges introduced into each groove are in some suitable way locked against longitudinal motion and thereby permanently secured into the groove.

Throughout the specification and claims I have utilized the word "blade" in its broadest sense, that is, to include both the rotating and the stationary blades, vanes or buckets of a turbine, and I have also employed the term "blade-carrying element" in its broadest sense, that is, to mean the rotating or

stationary blade or bucket carrying element of a turbine.

In accordance with the provisions of the patent statutes, I have described the principle 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 is:

1. In combination with a plurality of blades, a compound base strip adapted to receive the bases of the blades, and means located between the separate parts of said strip extending longitudinally thereof and through holes provided in the blades for positively locking said blades to said strip.

2. In combination with a plurality of blades, a compound base strip comprising two separate strips each provided with a plurality of blade-receiving notches and a locking piece extending longitudinally of said strip for positively locking said blades thereto.

3. In combination with a plurality of blades, a base strip formed in separate parts and adapted to receive said blades, and means extending through holes provided in the bases of said blades for positively locking said blades to said strip.

4. In combination with a plurality of blades, a blade strip formed in separate parts and adapted to receive said blades between the separate parts and a locking member extending through the blades and secured in place by said strip.

5. A base strip comprising two separate strips provided with cooperating notches adapted to receive the bases of blades, a locking member extending through holes provided in the bases of the blades and secured in place between said strips, and means for permanently securing said strips together.

6. In combination with a plurality of blades, a segmental blade mounting ring comprising two strips provided with cooperating notches for receiving the bases of said blades and a locking wire secured in place between said strips and extending through holes provided in the bases of said blades.

In testimony whereof, I have hereunto subscribed my name this 4th day of August, 1908.

JNO. S. GREEN.

Witnesses:

BIRNEY HINES,
GEO. W. WALKER.