G. WESTINGHOUSE.

ELASTIC FLUID TURBINE.

APPLICATION FILED JULY 28, 1909.

953,674.

Patented Mar. 29, 1910.

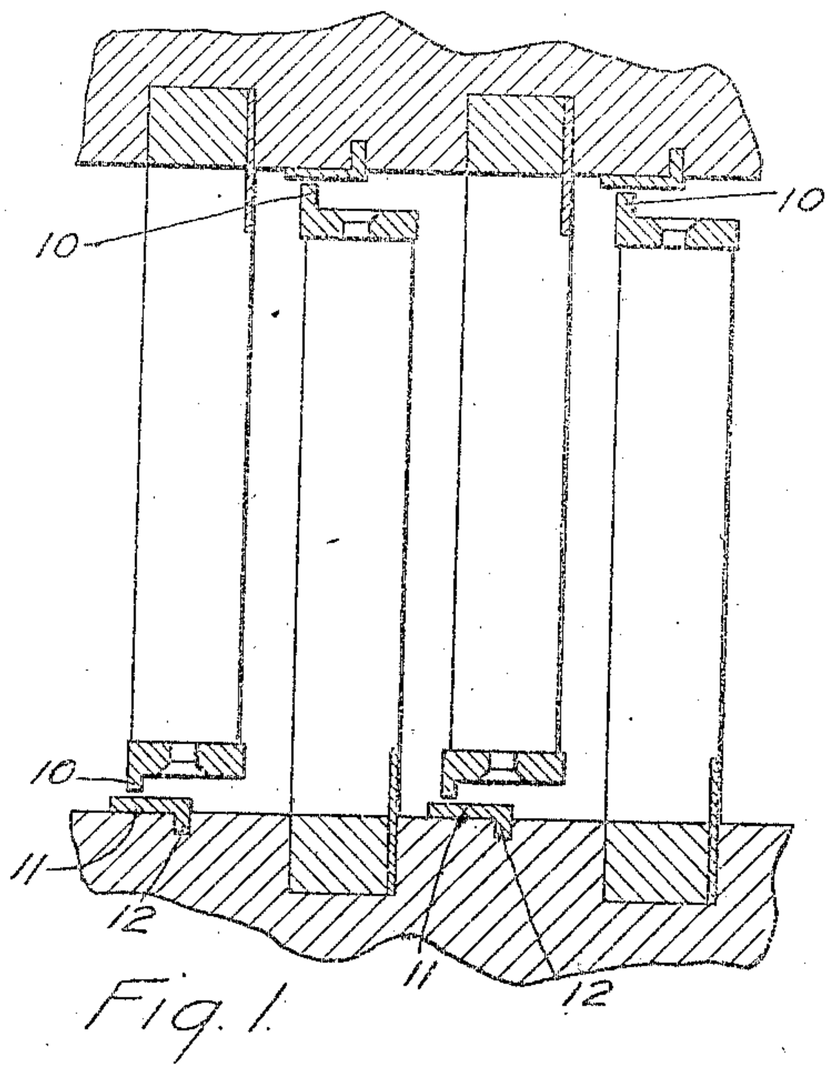

Fig. 1.

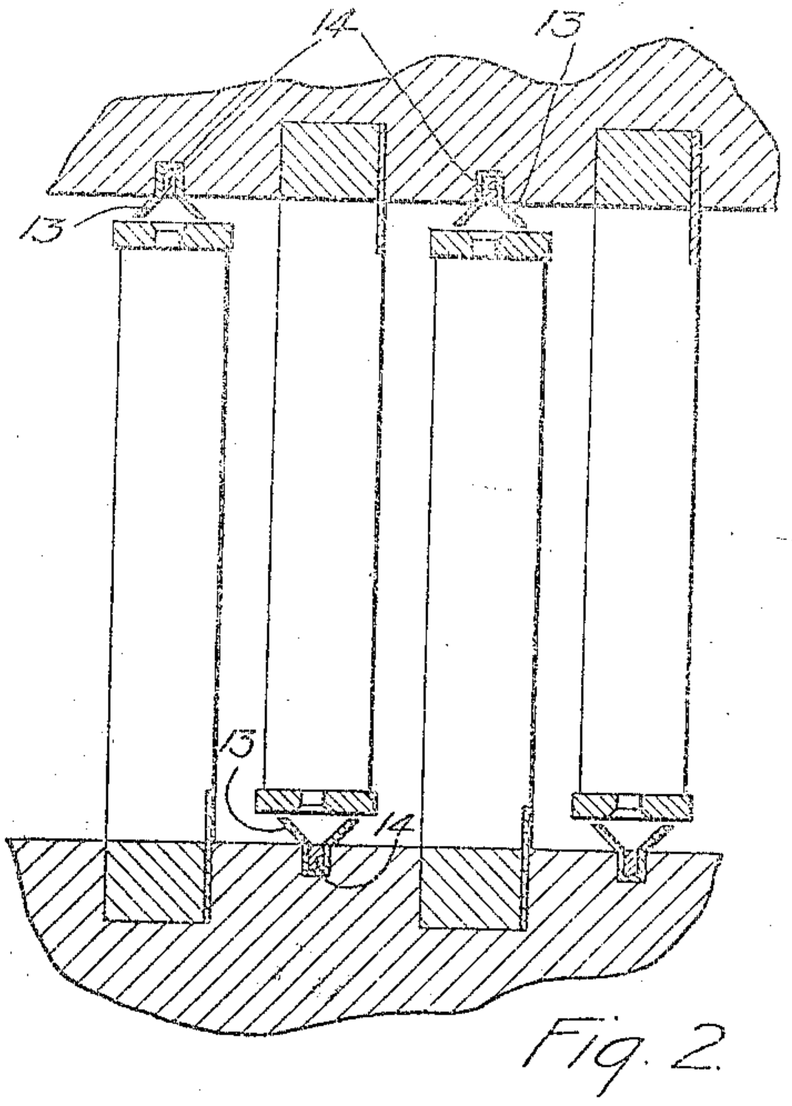

Fig. 2.

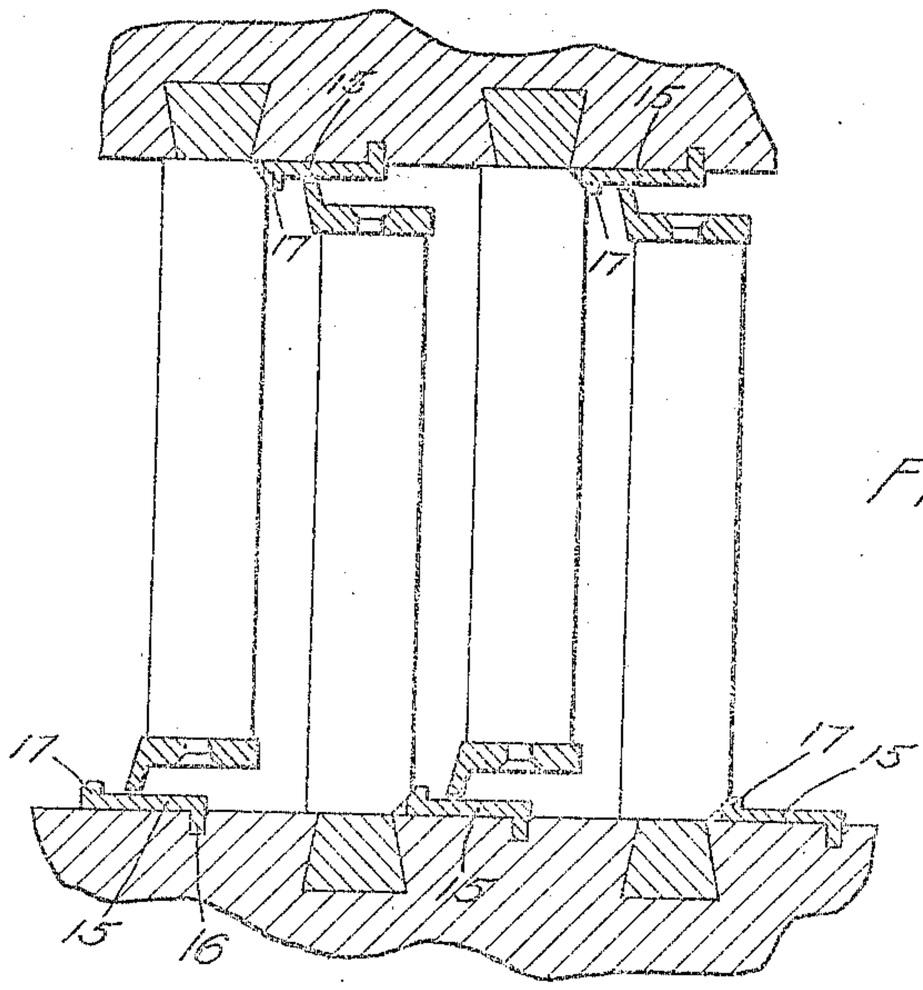

Fig. 3.

WITNESSES:

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HIS ATTORNEY IN FACT.

UNITED STATES PATENT OFFICE.

GEORGE WESTINGHOUSE, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO THE WESTINGHOUSE MACHINE COMPANY, A CORPORATION OF PENNSYLVANIA.

ELASTIC-FLUID TURBINE.

953,674. Specification of Letters Patent. Patented Mar. 29, 1910.

Original application filed May 2, 1905, Serial No. 258,485. Divided and this application filed July 28, 1909. Serial No. 510,077.

To all whom it may concern:

Be it known that I, GEORGE WESTINGHOUSE, 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 Elastic-Fluid Turbines, of which the following is a specification.

This invention relates to elastic fluid turbines.

The present application is a division of application No. 258,485, filed May 2, 1905.

The stators or casings of elastic fluid turbines distort from various causes. In most types of turbines the rotors thereof, after passing the critical speed rotate about their gravity axis instead of their geometric axis. On account of these conditions it has been found necessary in the multi-cellular type of turbines to leave clearances beyond the free ends of the blades and vanes sufficient to provide for a sufficient margin of safety. As these clearances are sources of loss in efficiency, means have been devised to reduce the clearances necessary. Shrouds in the form of channel irons have been riveted to the outer free ends of the turbine blades and vanes and these shrouds have been provided with outward extending flanges presenting thin wearing surfaces in close proximity to the rotor or stator, as the case may be. This method, however, is open to some very serious objections. The shrouds are usually riveted to the blades and vanes and when the flanges become worn through contact on account of distortion or from any other cause, the minimum clearance desired cannot be restored and the efficiency of the turbine is therefore lessened.

The object of this invention is to provide a renewable clearance piece or strip which will serve as a wearing strip for the ends of the turbine blades, whether the same are shrouded or unshrouded.

In the drawings, Figure 1 is a view in end elevation of a number of annular rows of turbine blades and vanes secured to their respective holding elements, as for example, the stator and rotor, and equipped with my invention, Fig. 2 is a similar view of a slightly modified form of the invention, and Fig. 3 is a like view of another modified form of my invention.

In Fig. 1 the blades and vanes are shown with shrouds riveted thereto and the shrouds which are formed in the nature of strips embracing a number of blades and vanes are provided with an outward extending flange 10. In line with this outward extending flange a wearing plate 11 is shown, which has a flange 12 calked into a slot formed therefor in the stator or rotor.

In Fig. 2 the clearance and wearing strip 13 is shown somewhat in the nature of a V in cross section; that is, the wings of the strip diverge from the edges of the slot into which it is secured by means of the metal strip 14. The metal strip 14 lies within the vertex of the strip and is spread transversely of the slot.

In Fig. 3 the wearing plates are shown as each being provided with a flange 16 calked in a slot in the stator or rotor and each wearing plate is provided with an outstanding bead or flange 17 engaging an undercut portion of an adjacent blade whereby the blade will assist in holding the wearing plate in place.

It will be seen that a minimum clearance may be had without the liability to trouble, for if the blades and vanes do contact with these wearing strips they may be worn away without tearing the blades or vanes because the wearing strips are made of softer metal than that of which the blades and vanes consist. In practice the strips will generally be thin so that heat generated by contact will be materially dissipated by radiation and conductivity.

In assembling the turbine the blades of the rotor, which may be either shrouded or unshrouded, may be ground off concentric to the turbine axis and the vanes on the stator may be bored out. Thus the turbine may be assembled without any clearances between the blades and vanes and the wearing strip, and the rotor revolved to grind their own clearances. In this manner it will be seen that the smallest clearance possible may be obtained. If for any reason these wearing strips become worn-out in use they may be readily replaced by new strips as they are easily inserted and secured within their slots.

Having thus described my invention, what I claim is:

1. In an elastic fluid turbine, a blade or vane-holding element provided with a plu-

rality of slots, a metal strip located between said slots and a flange provided on said strip for securing it to said element.

2. In an elastic fluid turbine, a blade or vane-holding element provided with a plurality of slots, a wearing plate located between adjacent slots and extending in close proximity to the surface of said element, and means for mounting said blades on said element.

3. The combination with a blade-carrying element of a turbine, of a metallic wearing plate rigidly secured to said element.

4. The combination with a blade-carrying element of a turbine provided with a plurality of slots, of blades mounted in said slots, metallic strips mounted between adjacent slots and means including said blades for securing said strips in place on said element.

5. In combination with a blade-carrying element of a turbine, means for securing a plurality of rows of blades thereto, strips located between adjacent rows of blades and extending in close proximity to the surface of said element, and a flange for securing said strip to said element.

6. In an elastic fluid turbine, the combination with an annular row of blades of a shroud provided with a clearance determining strip secured to the outer or free ends of said blades and a renewable wearing plate secured to the stator of said turbine in line with said clearance determining strip.

7. In an elastic fluid turbine, the combination with an annular row of rotor blades and the stationary casing therefor, of a shroud provided with the radially extending clearance determining strip secured to the outer or free end of such blades and a wearing strip secured to said stator in line with said clearance determining strip.

In testimony whereof, I have hereunto subscribed my name this 26th day of July, 1909.

GEO. WESTINGHOUSE.

Witnesses:
GEO. J. TAYLOR,
H. C. TENER.