F. HODGKINSON.

TURBINE CYLINDER LINING.

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994,680.

Patented June 6, 1911.

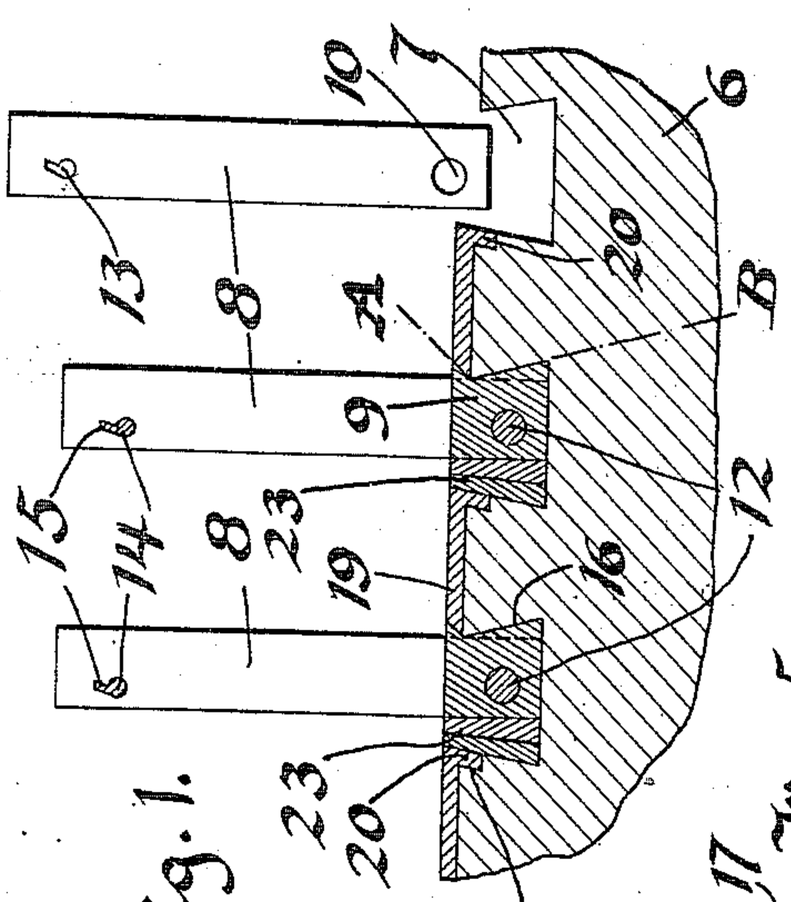

Fig. 1.

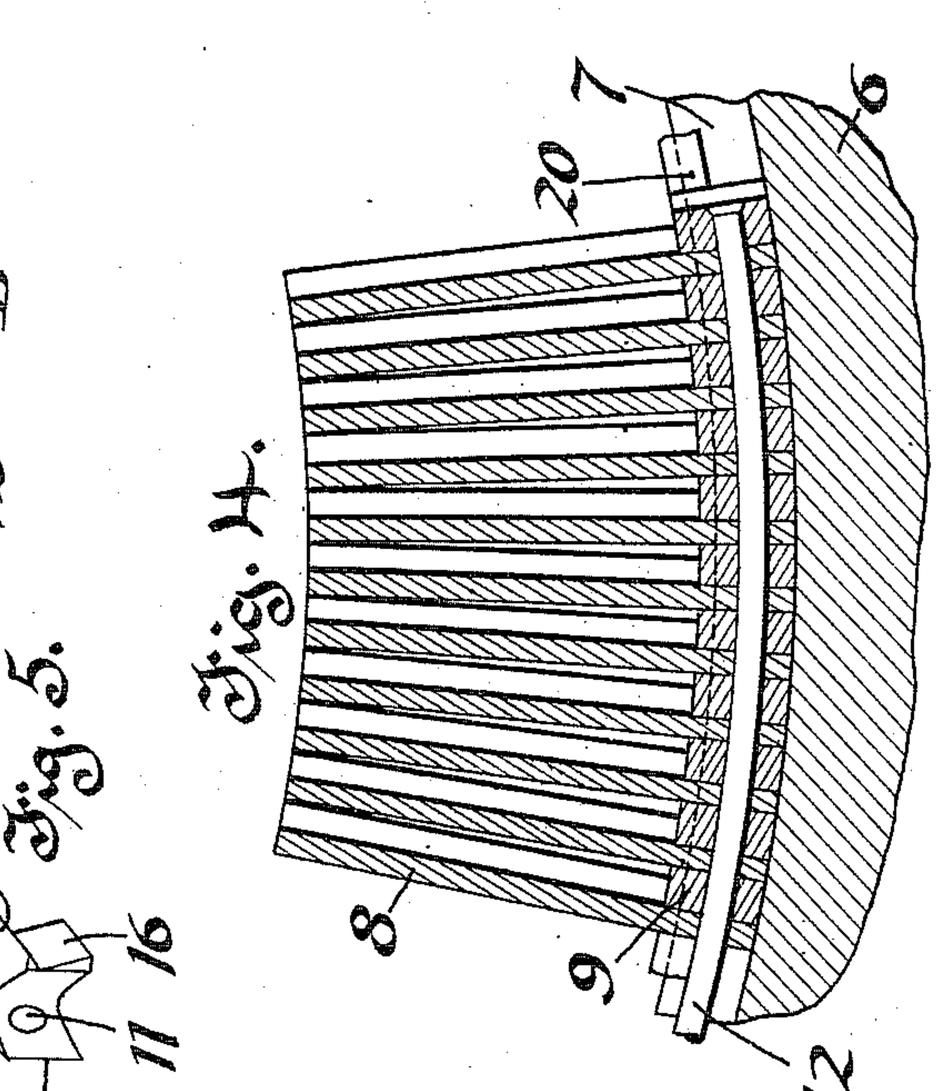

Fig. 4.

Fig. 5.

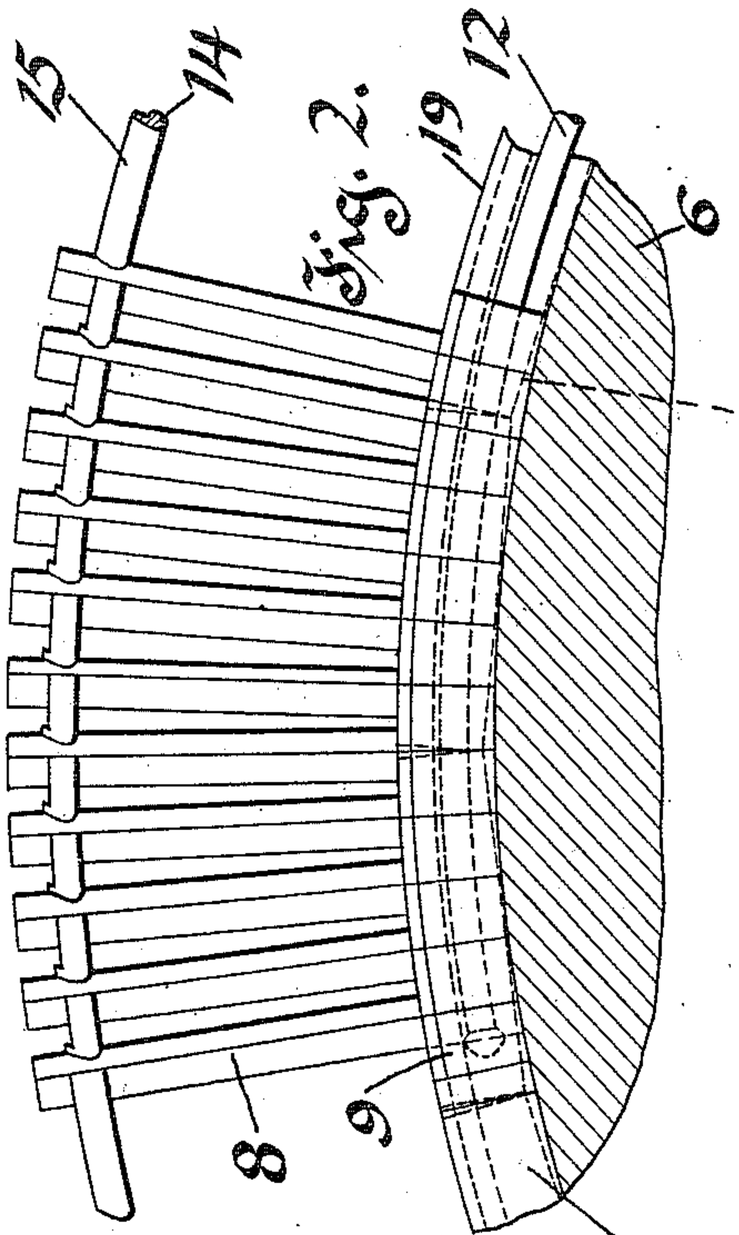

Fig. 2.

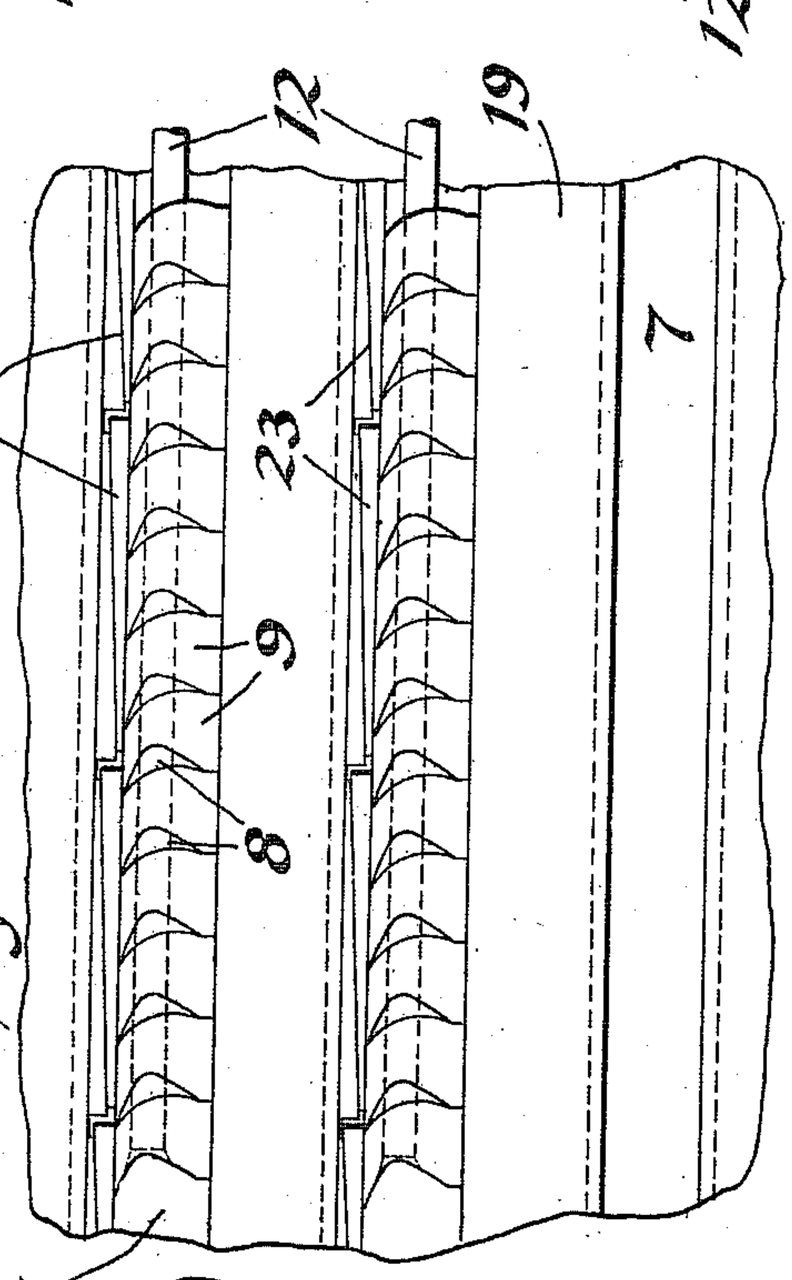

Fig. 3.

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UNITED STATES PATENT OFFICE.

FRANCIS HODGKINSON, OF EDGEWOOD PARK, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE COLONIAL TRUST COMPANY, TRUSTEE, OF PITTSBURG, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

TURBINE CYLINDER-LINING.

994,680. Specification of Letters Patent. **Patented June 6, 1911.**

Application filed June 12, 1908. Serial No. 438,163.

To all whom it may concern:

Be it known that I, FRANCIS HODGKINSON, a subject of the King of Great Britain and Ireland, and a resident of Edgewood Park, in the county of Allegheny and State of Pennsylvania, have made a new and useful Invention in Turbine Cylinder-Linings, of which the following is a specification.

This invention relates to blading means for elastic fluid turbines and also to means for protecting the working elements of the turbine from the corrosive and erosive action of the motive fluid.

An object of this invention is the production of simple and effective means for blading a turbine in connection with means for effectively securing a protective covering for the blade-carrying element in place on the element.

The erosive and corrosive action encountered in turbines may result from chemical impurities in the boiler feed water, such, for instance, as organic or inorganic acids, or it may result from the corrosive action of distilled water, that is, the water of condensation, and the erosive action of the motive fluid and the water of condensation in their passage through the turbine. Whatever the cause, the fact remains that the exposed surfaces of the working elements are at times and under certain conditions badly pitted and corroded. The cast iron casing is usually more actively attacked, but the rotor element is sometimes attacked and I, therefore, contemplate providing a protective covering which may be effectively secured to both the stationary casing and the rotating element.

In the drawings accompanying this application and forming a part thereof: Figure 1 is a fragmental section, taken longitudinally of the turbine, of a rotatable blade-carrying element; Fig. 2 is a partial section taken along the line A—B of Fig. 1; Fig. 3 is a plan view of the rotatable blade-carrying element of a turbine provided with blades and a protective covering secured in place in accordance with my invention; Fig. 4 is a fragmental section, taken longitudinally of the turbine, of a stationary blade-carrying element; and, Fig. 5 is a perspective view of a spacing piece which forms a detail of my invention.

My invention contemplates assembling the blades and the intermediate pieces located between the bases or roots of adjacent blades into segmental base strips and providing means for mounting the base strips and a protective strip on the blade-carrying element of the turbine.

Referring to the drawings: The blade-carrying element 6 of the turbine is provided with a plurality of undercut blade-mounting slots 7 in which blades 8 and intermediate spacing pieces 9 are secured. Each blade is provided in its base or mounting portion with a hole 10 which extends transversely through it and each spacing piece 9 is provided with a hole 11 which extends transversely through it and which is so located as to register with the hole 10 of an adjacent blade 8 when the blades and spacing pieces are assembled in a segmental strip.

The blades 8 and spacing pieces 9 are, before they are introduced into the blade-carrying slot 7, assembled into segmental strips or sections by mounting a number of alternately arranged blades and spacing pieces on a binder wire 12 which is adapted to be threaded through the holes 10 and 11 of respective blades and pieces. Any suitable method may be employed for assembling the blades and pieces on the wire and after they are in place, the ends of the binder wire may be riveted over to secure them together and to thereby form a rigid segmental blade strip.

The outer or free ends of the blades are each provided with a comma-shaped hole 13 through which a binding wire 14 of comma-shaped cross-section is adapted to extend. The binding wire is secured in place by shearing, on each side of each blade and bending over between adjacent blades, a longitudinally-extending rib 15 which is formed integrally with the wire 14. The bent-over portion of the rib forms spacing pieces which are secured to the main body portion of the wire 14 and which positively lock the outer ends of the blades permanently in their proper relative positions. The main body portion of the wire sets as a binder for the outer or free ends of the blades.

One lateral face 16 of each of the inter-

mediate pieces 9 is so inclined relative to the top and bottom faces of the piece as to correspond to the inclination of the undercut walls of the blade-mounting slots and is provided with a laterally-projecting lug 17 formed at or near the top of each piece and so located as to project beyond the walls of the slot and to overhang one wall when the piece is in place within the slot. The other lateral face 18 of each piece extends at right angles to the top and bottom faces of the piece.

Protective strips 19 are located on the peripheral face of the blade-carrying elements and are adapted to be secured in place between adjacent rows of blades. The strips are arranged to contact with the portion of the peripheral face of the blade-carrying element located between adjacent rows of blades and the strips are curved to conform to the curvature of the contacting face and are cut into sections of convenient length for handling and mounting in place. Each strip is L-shaped in cross-section, being provided with a laterally-projecting flange 20 which projects into an undercut recess 21 which is cut in the blade-carrying element and which removes the upper portion of one wall of each slot 7. The flange 20 of each strip is so constructed that it replaces the cutaway portion of the undercut wall of the slot 7 when the piece 19 is in place on the blade-carrying element and it is also so inclined to the major portion of the piece as to correspond to the inclination of the undercut wall of the recess 21.

After the blades and spacing pieces have been assembled in the segmental strips, the strips are secured in the blade-mounting slots and the protective strips are secured to the blade-carrying element by means of cooperating wedges 23 which are driven home in pairs, one wedge beside the other, between the segmental strips and one wall of the mounting slot and which coöperate with the flanges 20 of the protective strips 19. The segmental blade strips are so located in the undercut slots 7 that the inclined faces 16 of the pieces assembled in one strip contact with the undercut wall and the vertical face 18 of each piece stands opposite the recessed wall of the slot 7.

The wedges 23 are preferably compound tapered wedges and are so constructed that, when driven home, the two wedges of each pair conjointly form a wedge-shaped key which is effective in securing the blade strips into the blade-mounting slot and the flange 20 in the recess 21 and which is prevented, by its shape and the shape of its component wedges, from being dislodged from the slot by centrifugal or any other dislodging force.

Each base piece 9 when in place in a blade-mounting slot 7 extends beyond the walls of the slot an amount equal to the thickness of the protective strip 19 and the lugs 17 of each piece project from and overhang one wall of the slot.

Each protective strip is so constructed that when the flange 20 is in place within the recess 21, the major or body portion of the strip lies closely in contact with the peripheral face of the blade-carrying element and the outer or free edge abuts against and is secured in place between overhanging lugs 17 of the pieces 9 assembled in one base strip and located in an adjacent slot.

The wedges 23 are located in the blade-mounting slot adjacent to the recess 21 into which the flange 20 of each strip extends and secure the protective strip in place by locking the flange into the undercut recess and at the same time forcing the outer edges of the piece into locking engagement with the overhanging lugs 17 of the pieces located in the next adjacent slot. With such an arrangement each edge of the protective strip is locked in place and the strips are, therefore, securely held against distortion or displacement which might result from centrifugal force and are permanently secured to the blade-mounting element.

The segmental strips are of such length that two or more are required to make up an annular row of blades and they are so arranged at their ends that they may be inserted into the blade-mounting slots 7 end to end and maintain the spacing of the blades.

A number of pairs of compound wedges are employed to secure each segmental strip in a slot. The wedges are preferably so spaced within the slots that the component wedges of each pair abut one against the other. This arrangement prevents the component wedges of each pair from moving longitudinally and thereby becoming dislodged, it being understood that some suitable means is employed to secure the wedges of the first and last pairs introduced into the slot against longitudinal motion.

Throughout the specification and in the claims, I have employed the words "blade" and "blades" in the broadest sense; that is, to mean either the rotating or stationary blades or buckets of a turbine. I have also employed the term "blade-carrying element" in its broadest sense; that is, to mean the stationary or rotating blade or bucket carrying element of the turbine. I therefore desire it to be understood that I do not wish to limit this invention to either the stationary or rotating blades or blade-carrying element and that it is applicable to different and various blades or buckets and various kinds of turbines.

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 a turbine, an element provided with a slot, an offset recess in said slot, blade-holding means in the slot, a lining for the turbine element and means for securing the blade-holding means in the slot and a portion of the lining in the recess.

2. A turbine element having a slot with a recess in the wall of the slot near the opening end thereof, a blade-carrying means in the slot, a lining for the element having a portion in the recess and means for securing the blade-carrying means in the slot and the lining in the recess.

3. In a turbine, an element provided with slots and recesses running lengthwise of the slots and in the walls thereof near the surface of the element, blades mounted in said slots, lining members, parts of which are located between adjacent slots and parts in the recesses and means for holding the blades in the slots and the said parts in the recesses.

4. In a turbine, an element having slots one wall of which is cut away to form a shoulder, a lining on the surface of said element and having a portion fitting against the shoulder in the wall of the slot, blade-holding means in the slot and calking means interposed between the blade-holding means and a portion of the lining resting against the shoulder.

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

FRANCIS HODGKINSON.

Witnesses:
CHARLES W. MCGHEE,
E. W. MCCALLISTER.