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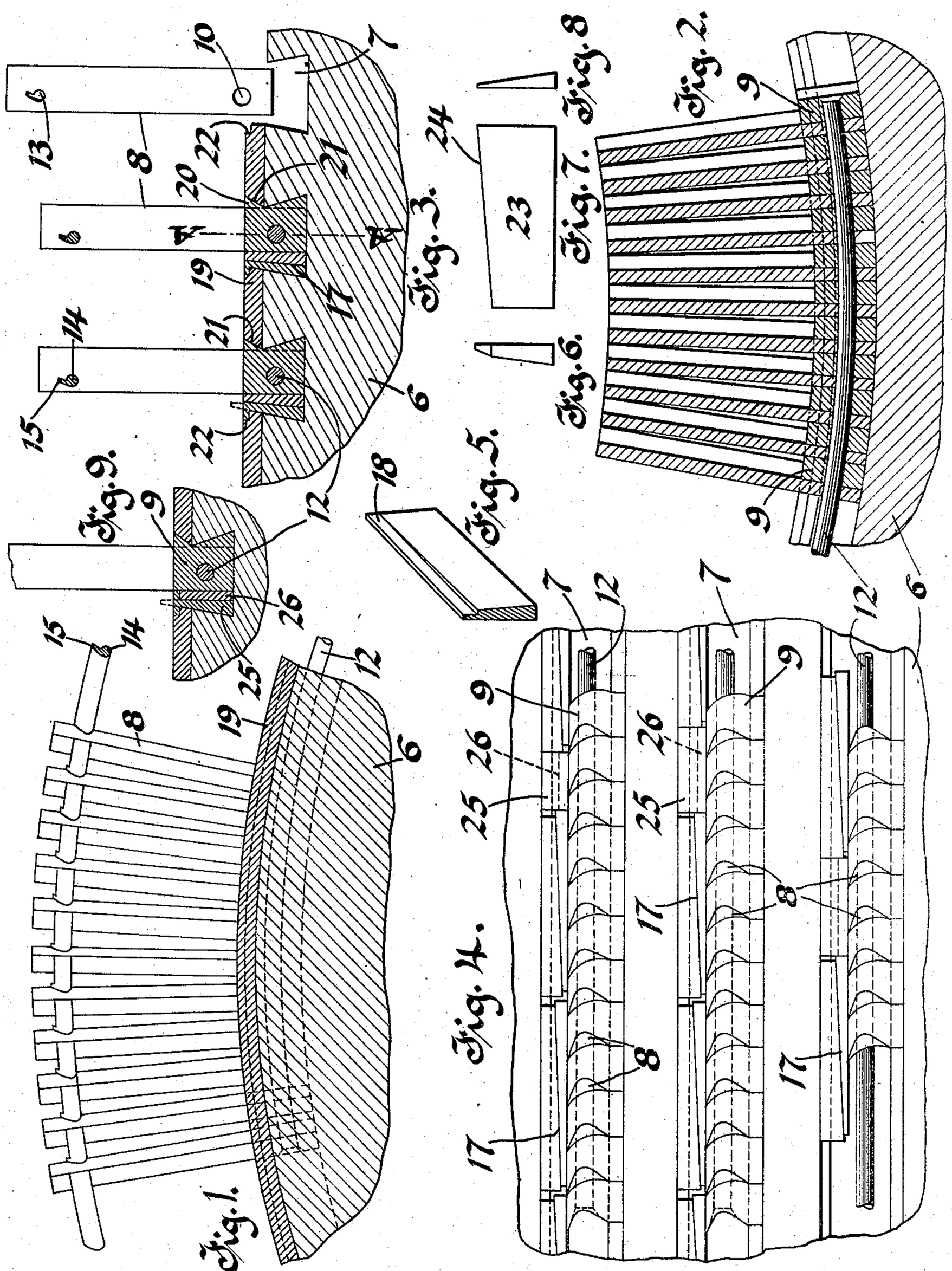
COVERING FOR BLADE CARRYING ELEMENTS.

APPLICATION FILED MAY 26, 1908.

930,858.

Patented Aug. 10, 1909.



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UNITED STATES PATENT OFFICE.

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COVERING FOR BLADE-CARRYING ELEMENTS.

No. 930,858. Specification of Letters Patent. Patented Aug. 10, 1909.

Application filed May 26, 1908. Serial No. 435,080.

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 Protective Covering for Blade-Carrying Elements, of which the following is a specification.

This invention relates to elastic fluid turbines and more particularly to means for protecting the exposed surfaces of the blade-carrying 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 securing a protective strip or cover in place within the working passages of the turbine so that it will protect the surfaces of the blade-carrying elements.

The corrosive and erosive action encountered in elastic fluid 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 the distilled water, that is the water of condensation, and the erosive action of the motive fluid and the water of condensation. Whatever the cause the fact remains that the exposed surfaces of the blade-carying elements are at times corroded and even badly pitted. The cast iron casing of the turbine (the stationary blade-carrying element) is usually more actively attacked and for this reason the primary object of my invention is to provide a protective lining for the casing, but I desire it to be understood that I contemplate providing a protective cover and means for securing it in place on the blade-carrying element which will be equally effective on the rotor or stator element.

Throughout this specification and in the claims I will employ the word "blade" in its broad sense; that is, to include both the rotating blades and the stationary blades.

In the drawings accompanying this application and forming a part thereof: Figure 1 is a fragmental section of a rotor or rotating blade-carrying element and discloses an embodiment of my invention; Fig. 2 is a fragmental section of the stator or stationary blade-carrying element of the turbine and is taken along the line A—A of Fig. 3; Fig. 3 is a fragmental longitudinal section of a portion of the stationary blade-carrying element; Fig. 4 is a plan view of an embodiment of my invention in connection with the rotor element; Fig. 5 is a perspective view of a detail of my invention; Figs. 6, 7 and 8 are respectively end, side and end elevations of a modified form of a detail of my invention; and, Fig. 9 is a fragmental longitudinal section of a blade-carrying element and discloses a method of locking the blades in the blade-mounting slots.

The blade-carrying element 6 of the turbine is provided with a plurality of blade-mounting slots 7 in which blades and intermediate spacing pieces 9 are secured. Each blade is provided near its base with a hole 10 which extends transversely therethrough and each spacing piece is provided with a corresponding hole, so located within the piece as to register with the hole 10 in the blade when located in the blade-mounting slot adjacent to the blade.

Blades and alternate spacing pieces are assembled in segmental strips or sections by mounting a number of the blades and intermediate spacing pieces on a binder wire 12, which is threaded through the holes provided in the base portions of the blades and spacing pieces. After the blades and spacing pieces are in place on the wire the ends of the wire may be riveted over to secure them in place and also to form a fairly rigid segmental strip.

The outer or free ends of the blades are provided with comma-shaped holes 13 through which a binding wire 14 of comma-shaped cross section extends. The binding wire is secured to the blades and is caused to space the outer or free ends of the blades by having the tail-shaped fin 15, with which it is provided, sheared and bent over between adjacent blades. This construction, together with the wires 12, forms rigid blade strips which may be assembled at any time prior to mounting them in the turbine and which may be handled without the danger of becoming damaged.

After the blades and the spacing pieces are assembled into the segmental strips, the strips are secured into the mounting slots 7 by means of coöperating wedges which are driven home, one beside the other, between the segmental strips and one wall of the mounting slot. The slots 7 are preferably

undercut and one lateral face of each spacing piece 9 is inclined to correspond to the inclination of the adjacent undercut wall of the slot. The other lateral face of each spacing piece is formed at right angles to the top and bottom faces of the piece.

A segmental strip is introduced into each slot and is so located within the slot that the inclined faces of the assembled spacing pieces 9 fit snugly against an undercut wall of the slot. The strip is then secured in place by means of compound tapered wedges 17 which are introduced into the slot between the vertical face of the spacing piece 9 and the other inclined or undercut wall of the slot. The wedges are arranged in pairs and are so constructed that when driven home the two wedges of each pair conjointly form a wedge-shaped key which effectively secures the blade strip in place, 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.

Several segmental strips are located in each blade-carrying slot and each strip is secured in place by a number of pairs of wedges 17. The wedges 17 are preferably so spaced within the slot that the wedges of one pair contact at each end with wedges of adjacent pairs.

One wedge of each pair is provided across its top with a projecting flange 18 which, throughout its length, is of the same thickness, the taper of the wedge having been cut away. The flange 18 provided on one of the wedges of each pair projects out of the blade-mounting slot 7 beyond the other wedge of the pair and is adapted by being peened over to secure in place a protective strip for the blade-carrying element.

Protective strips 19 are located between adjacent blade-mounting slots 7 and are secured in place at one edge by the flange 18 and at the other edge by an overhanging flange 20, which is formed on the base portion of each segmental blade strip. The overhanging flange 20 is composed of overhanging or laterally projecting lugs which are formed on each spacing piece 9. The spacing pieces are of such height that they project beyond the blade-carrying element an amount which is about equal to the thickness of the protective strip 19.

The individual protective strips 19 are mounted on the blade-carrying element after the blades of adjacent rows are secured in place. Each strip 19 is provided with a bevel edge 21 which abuts against and is secured in place by the overhanging flange 20. The other edge of each piece 19, while it may be beveled, is preferably provided with a shoulder 22, into which the projecting flange 18 of the wedge is peened. This construction secures the protective strips rigidly in place and prevents them from being dislodged by centrifugal or any other dislodging force. It is not always necessary to provide a flange 18 on one of the wedges of each pair. It is sometimes desirable to provide every second or fifth pair of wedges with the protecting flange, which is peened over to secure the protective strip.

A modified form of wedge is shown in Figs. 6, 7 and 8, and is adapted to replace the wedge shown in Fig. 5. The wedge 23 referred to is a compound tapered wedge and is provided with an inclined upper edge 24 which projects beyond the blade-mounting slot when the wedge is located in place within the slot. The edge 24 is so inclined that the thickest end of the wedge is of the least width and the thinnest end of greatest width, and the inclination is so proportioned to the taper of the wedge that an equal amount of metal per lineal unit longitudinally of the wedge projects from the blade-mounting slot. This projecting edge is peened or calked over to engage the shoulder 22 formed on the protective strip 19 and thereby secures the strip in place.

The segmental blade strips are of such length that a predetermined number of them completely fill one of the blade-mounting slots. The protective strips 19 may also, if desired, be cut in sections and secured in place section by section. The component wedges utilized to secure the blade-mounting strips in place are preferably so spaced within the slots that the ends of the wedges of one pair abut against the wedges of the next adjacent pair.

Since it is necessary to leave considerable space between the first and last pairs of wedges introduced into a blade-mounting slot, I have provided special means for securing the component wedges of these pairs in place and I have illustrated the same in Fig. 9. A simple wedge 25 and a rectangular key 26 are cut to such lengths as to fit into the blade-mounting slot between the wedges of the first and last pairs. The wedge 25 is introduced into the blade-mounting slot and is so located within the slot that its inclined face contacts with an undercut wall of the slot. The wedge is also of such width that it projects beyond the slot a predetermined amount. The key 26 is introduced into the slot between the wedges 25 and the segmental blade strip. The key and the wedge are then secured in place by peening or calking over the projecting edge of the wedge, so that the key 26 is locked in place by being enveloped by the wedge 25 and the segmental blade strip.

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 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, blades, blade-holding means in said slot, means for securing said blade-holding means in place within said slot, protector means for said element and means provided on the securing means for securing the protector means in place.

2. In a turbine, an element provided with a slot, a blade holder in said slot, means for securing the blade holder in the slot, a protector for the element and means on the first named means for securing the protector in place.

3. In a turbine, an element provided with a slot, a blade holder in said slot, a protector adjacent to the slot and means within the slot beside the blade holder for securing the blade holder in the slot and for engagement with the protector.

4. In a turbine, an element provided with a slot, a blade holder in said slot, wedges for securing the blade holder in the slot, an element protector and means on the wedges for engagement with the element protector.

5. In a turbine, an element provided with a slot, a blade holder in said slot, a lining strip adjacent to the slot and wedges in the slot having peening edges to engage the lining strip.

6. In a turbine, an element provided with a slot, a blade holder in said slot including spacers having portions entering a recess in the wall of the slot, a lining strip for the element and means for holding the spacers in engagement with the recess in the wall of the slot, said last named means having a portion projecting above the slot adapted to be peened over into engagement with the lining strip.

7. In a turbine, an element provided with a slot, a blade holder in said slot, means for securing the blade holder in the slot comprising locking wedges having oppositely inclined faces, and means on one of the locking wedges adapted to be bent over the edge of the slot and a lining strip adapted to be engaged by the bent-over portion.

8. In a turbine, an element provided with a slot, a blade holder in said slot and having an edge overlying the edge of the slot and locking means for holding said two edges in interlocking engagement, a lining strip and means on the last named means for engaging the lining strip.

9. In a turbine, an element provided with a plurality of slots, blade-holding strips located in said slots, wedges for securing said strips in said slots, lining strips for said element and means provided on one or more of said wedges for securing said lining strips in place.

10. In a turbine, a blade-carrying element, a plurality of slots in said element, blade-supporting strips in said slots, wedges in pairs within said slots for securing said strips in place, a lining strip between adjacent slots and wedge-supported means for securing said strip in place.

11. In a turbine, a blade-carrying element, blade-supporting strips for securing blades in a plurality of rows, a lining strip located between adjacent rows of blades and means provided on the blade strip on one row and on the mounting means of the next adjacent row for securing said lining strip in place.

12. In a turbine, an element provided with a plurality of slots, blade-supporting strips in said slots, locking elements for securing said strips within said slots, a lining strip for said blade-carrying element located between adjacent slots and means provided on the blade-supporting strip of one row and on a locking element of the next row for securing said lining strip in place.

In testimony whereof, I have hereunto subscribed my name this 16th day of May, 1908.

FRANCIS HODGKINSON.

Witnesses:

CHARLES W. MCGHEE,

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