F. HODGKINSON.

ELASTIC FLUID TURBINE.

APPLICATION FILED MAY 26, 1908.

943,349.

Patented Dec. 14, 1909.

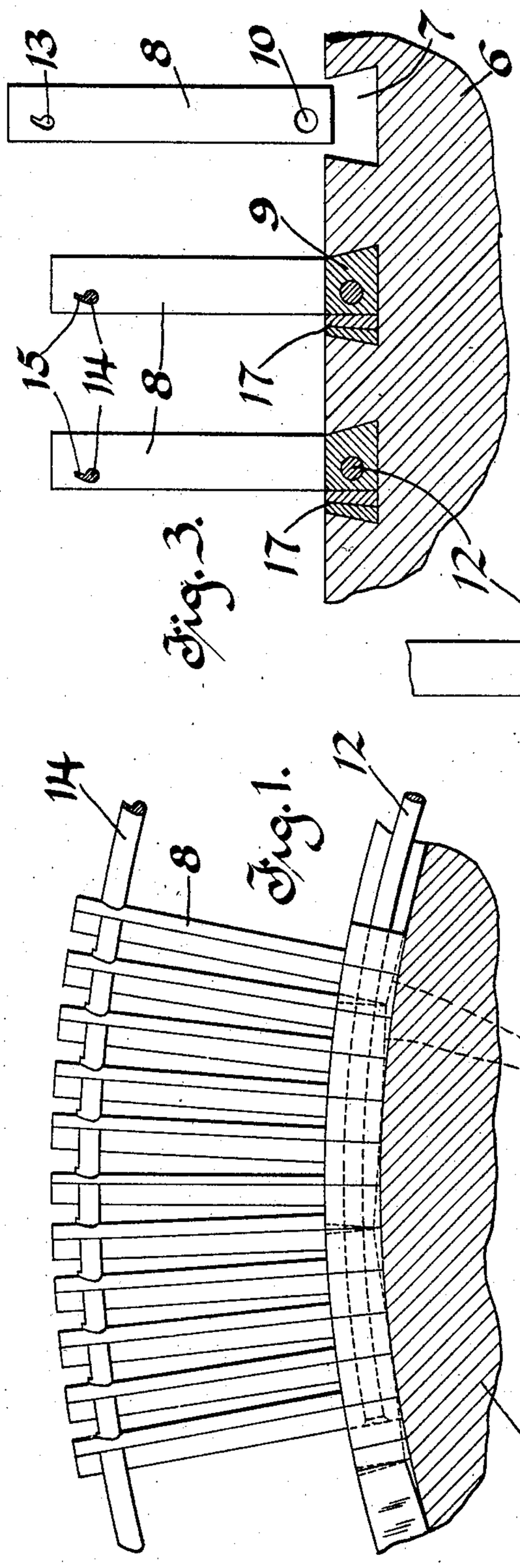

Fig. 3.

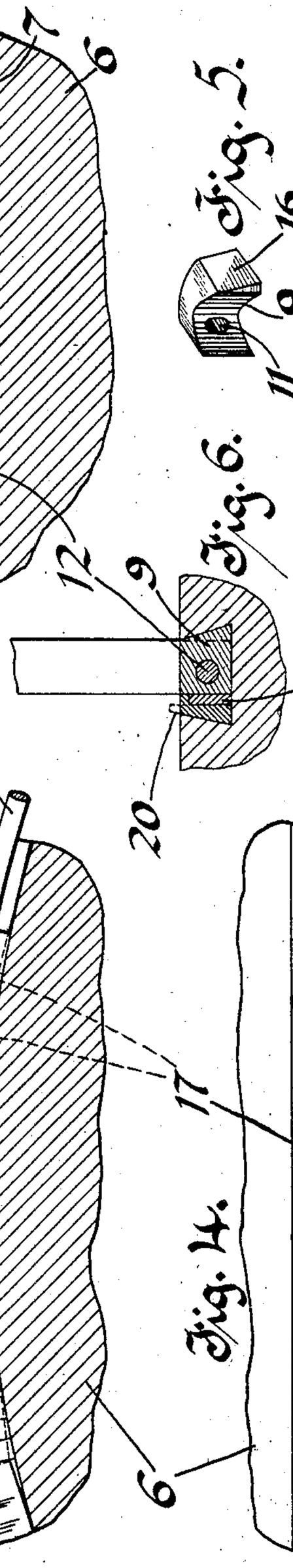

Fig. 6.

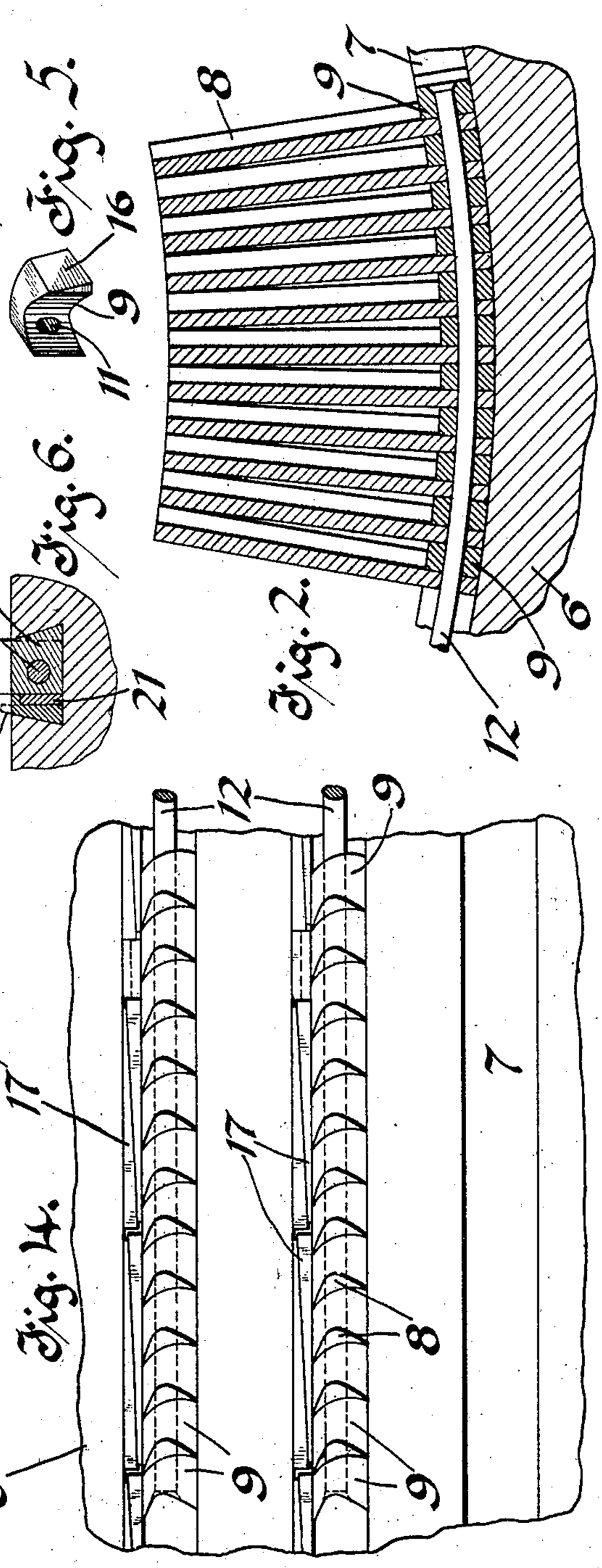

Fig. 2.

Fig. 1.

Fig. 4.

WITNESSES:

D. C. Lee.

E. M. McAllister.

INVENTOR.

Francis Hodgkinson

BY Jno. D. Lacey

ATTORNEY IN FACT.

UNITED STATES PATENT OFFICE.

FRANCIS HODGKINSON, OF EDGEWOOD PARK, PENNSYLVANIA, ASSIGNOR TO THE WESTINGHOUSE MACHINE COMPANY, A CORPORATION OF PENNSYLVANIA.

ELASTIC-FLUID TURBINE.

943,349. Specification of Letters Patent. **Patented Dec. 14, 1909.**

Application filed May 26, 1908. Serial No. 435,079.

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 Elastic-Fluid Turbines, of which the following is a specification.

This invention relates to blading for elastic fluid turbines and particularly to means for mounting the blades on the blade-carrying elements of the turbines.

An object of my invention is the production of blading means for turbines which is simple and effective and which renders the operation of renewing blades a simple matter.

A further object is the production of simple and effective means for assembling the blades in segmental strips and for mounting the strips in blade-mounting slots provided in the turbine blade-carrying element.

Various methods have been employed for securing the blades to the blade-carrying elements of the turbine. In one method, which is generally employed, the blades are secured in slots, provided in the blade-carrying elements, by means of separate calking pieces, which are located between adjacent blades and which are transversely expanded and caused to grip the walls of the slot and the adjacent faces of the blades and to thereby secure the blades to the blade-carrying element. A method which has also been used to some extent employs a base strip which is provided with slots for receiving the blades. Various means have been employed for securing the blades to the base strip and for finally securing the strip to the blade-carrying element of the turbine. The strip is usually secured by means of a calking strip into a slot or groove provided in the blade-carrying element. The calking strip is inserted into the slot with the base strip and is expanded transversely by a calking pressure so as to grip one wall of the slot and to force the base strip into gripping contact with the other wall of the slot.

My invention contemplates utilizing separate spacing pieces between the blades, assembling the blades and spacing pieces to form a segmental strip and securing the strip into a slot or groove provided for its reception in the blade-carrying element.

In the drawings accompanying this application and forming a part thereof: Figure 1 is a transverse section of a fragment of the rotor element of a turbine and discloses, in elevation, blades and spacing pieces located in a blade-mounting slot; Fig. 2 is a transverse section of a fragment of the stator or the stationary blade-carrying element of the turbine and discloses in section an embodiment of my invention; Fig. 3 is a longitudinal section of a portion of the rotor taken at right angles to the section in Fig. 1; Fig. 4 is a plan view of blades secured to a blade-carrying element and embodies my invention; Fig. 5 illustrates in perspective a detail of my invention; and, Fig. 6 illustrates, in fragmental section, a detail embodied in my invention.

The blade-carrying element 6 of the turbine is provided with a plurality of undercut mounting slots 7, in which blades 8 and intermediate spacing pieces 9 are mounted. Each blade is provided near its base with a hole 10, which extends transversely therethrough and each spacing piece is provided with a hole 11 which extends transversely through the piece.

The blades and spacing pieces are assembled in segmental strips or sections by mounting a number of them on a binder wire 12 which is threaded through the holes 10 and 11 respectively of the blades and pieces. The blades and pieces are assembled on the wire in any suitable manner and after they are in place on the ends of the wire are riveted over to secure them together and to form a fairly rigid segmental strip.

The outer or free end of each blade is provided with a comma-shaped hole 13 through which a binding wire 14 of comma cross-section extends. The binding wire is secured in place and is caused to space the outer ends of the blades by having its tail-shaped fin 15 sheared and bent over between adjacent blades.

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

The slots 7 are preferably undercut and one lateral face of each spacing piece 9 is inclined as shown at 16, Fig. 5, 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 bottom and top faces of the piece.

The segmental strips are secured into the undercut slots by means of double or compound tapered wedges 17. The wedges are inserted into the slot between the vertical faces of the spacing pieces and the adjacent undercut wall of the slot and 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 by the shape of its component wedges from being dislodged from the slot by centrifugal force.

In Fig. 2 I have shown my invention as applied to the stationary element of the turbine, while in Fig. 1 I have shown it as embodied in the rotor element. Throughout the entire specification I have utilized the term "blade" in the broad sense; that is, a sense which includes the rotating blades of the moving element of the turbine and also the stationary blades which are ordinarily termed "vanes".

The segmental strips are of such length that a predetermined number of them completely fill one of the blade-mounting slots 7 and they are so arranged at their ends that they do not destroy the spacing of the blades. Each segmental strip is secured into the slot by a number of pairs of wedges 17. The wedges are preferably so spaced within the slots that the ends of the wedges of one pair abut against the ends of the adjacent pairs.

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. 6. A simple wedge 20 and a rectangular key 21 are cut to such lengths as to fit into the blade-mounting slot between the wedges of the first and last pairs. The wedge 20 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 21 is introduced into the slot between the wedge 20 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 21 is locked in place by being enveloped by the wedge 20 and the segmental blade strip. Such an arrangement absolutely prevents the wedges becoming loose in the slots.

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 combination in an elastic fluid turbine, a blade-holding element provided with an undercut mounting slot, alternately arranged blades and spacing pieces located in said slot and compound tapered wedges located in said slot for securing said blades and spacing pieces in place.

2. In combination in an elastic fluid turbine, a blade-holding element provided with a blade-mounting slot, alternately arranged blades and spacing pieces located in said slot, a binding wire for said blades and spacing pieces and compound tapered wedges for securing said blades in place in said slot.

3. In combination in an elastic fluid turbine, a blade-holding element provided with an undercut slot, alternately arranged blades and spacing pieces located in said slot, means for securing said blades and said pieces together and wedges arranged in pairs for securing said blades in said slots.

4. A blade-mounting strip comprising blades provided at one end with a hole extending transversely therethrough, spacing pieces provided with an inclined and a vertical lateral face, and means extending through the holes provided in said blades and said pieces for securing said blades and said pieces together.

5. In combination with a blade-mounting element provided with blade-mounting slots, blades located in said slots and spacing pieces provided with one vertical and one inclined lateral face located between said blades.

6. In combination with a blade-mounting element provided with a blade-mounting slot, a blade strip, wedges located in said slot for securing said strip in place within the slot and means located between the ends of adjacent wedges for securing them in place.

7. In combination with a blade-carrying element provided with a blade-mounting slot, a blade-mounting strip located within said slot, wedges located within said slot for securing said strip in place and means calked within said slot for securing said wedges in place.

8. In combination with a blade-carrying element provided with a blade-carrying slot, a blade-mounting strip located within said slot, component wedges located within said slot for securing said strips in place, and a two-part key calked into said slot for securing said wedges in place.

9. In an elastic fluid turbine, a blade holding element provided with a slot, alternately

arranged blades and spacing pieces located in said slot, and wedges located within said slot between the sides of the spacing pieces and the sides of the slot for securing said blades and said spacing pieces in place.

10. In an elastic fluid turbine, a blade holding element provided with a slot, alternately arranged blades and spacing pieces located within said slot, means for securing said blades and said spacing pieces together and wedges for securing said blades and said spacing pieces in said slot, said wedges being between the sides of the spacing pieces and the sides of the slot.

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

FRANCIS HODGKINSON.

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