M. A. THIEL.

METHOD OF MANUFACTURING TURBINE BLADE STRIPS.

APPLICATION FILED JULY 9, 1907.

953,563. Patented Mar. 29, 1910.

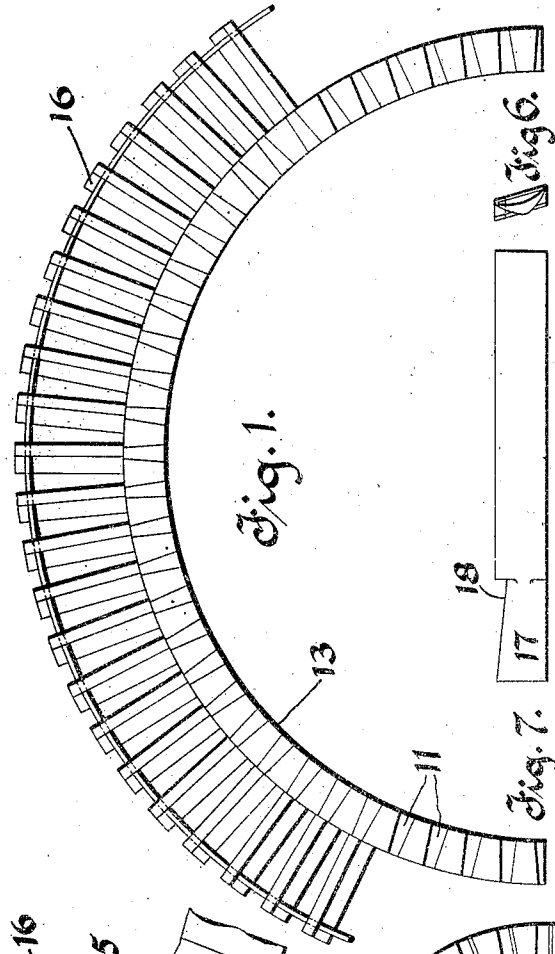

Fig. 1.

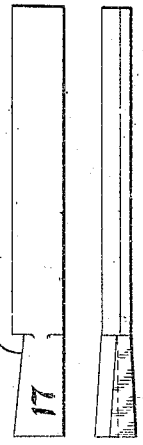

Fig. 6.

Fig. 7.

Fig. 8.

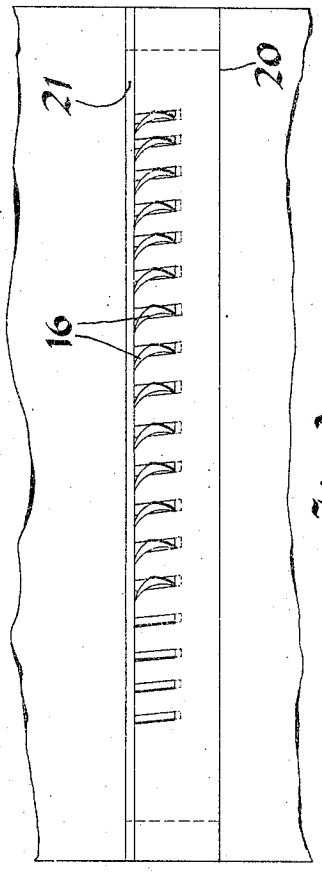

Fig. 4.

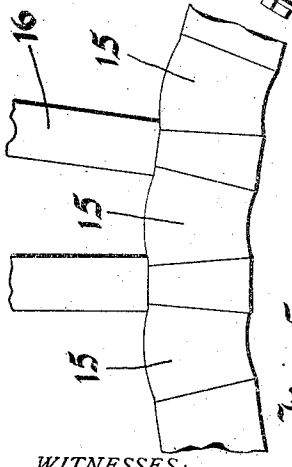

Fig. 5.

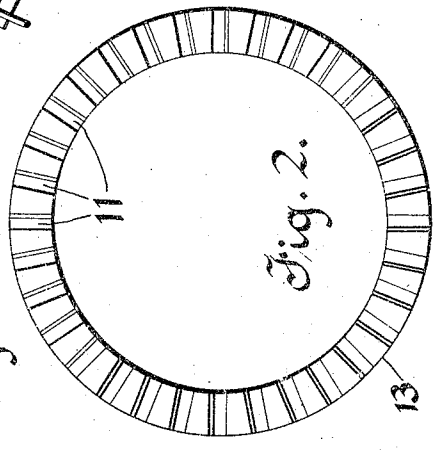

Fig. 2.

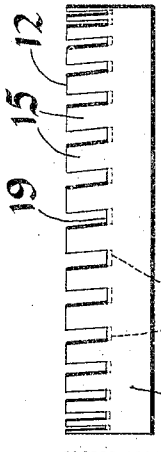

Fig. 3.

WITNESSES:

INVENTOR.

Martin A Thiel.

BY

his ATTORNEY in fact.

UNITED STATES PATENT OFFICE.

MARTIN A. THIEL, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO THE WESTINGHOUSE MACHINE COMPANY, A CORPORATION OF PENNSYLVANIA.

METHOD OF MANUFACTURING TURBINE-BLADE STRIPS.

953,563. Specification of Letters Patent. Patented Mar. 29, 1910

Application filed July 9, 1907. Serial No. 382,873.

To all whom it may concern:

Be it known that I, MARTIN A. THIEL, a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have made a new and useful Invention in Methods of Manufacturing Turbine-Blade Strips, of which the following is a specification.

This invention relates to elastic fluid turbines, and more particularly to a method of manufacturing turbine blade strips.

An object of this invention is the production of improved means for mounting the blades and vanes in which the blades or vanes are first mounted in a base ring, or ring segment, which is then secured in place in the turbine.

A further object is the production of a simple method of constructing the base ring or ring segments for blades and vanes.

These and other objects I attain by adhering to a method of operation embodying the successive steps herein described and illustrated.

In the drawings accompanying this application and forming a part thereof; Figure 1 is a side view of a segmental portion or blade mounting element with several of the blades attached; Fig. 2 is a plan view and Fig. 3 is a side view of the mounting element illustrating a step in its construction; Fig. 4 is a plan view of Fig. 1; Fig. 5 is an enlarged view of a portion of Fig. 1; and, Figs. 6, 7 and 8 are respectively, plan, end and side views of a blade embodied in my invention.

In carrying out my invention a suitable number of radially extending slots 11 are cut across a lateral face 12 of a ring or annular band 13. The slots 11 extend longitudinally into the ring at equal angles to its axis or center line and are deeper at the inner than at the outer peripheral face of the ring, as shown by the lines 14 in Fig. 3. After the slots 11 are cut, the ring is severed at a suitable point and expanded, by being shaped over a form, into a segment of a ring of larger diameter.

The operation of bending the ring 13 to a larger diameter compresses the metal of the ring adjacent to the outer peripheral surface as much as the metal adjacent to the inner peripheral face is expanded, and consequently the slots 11 are changed in form, being widened at the inner peripheral face and contracted at the outer peripheral face of the ring. The extending portions 15 between the slots are practically unstrained by the bending, and therefore maintain their original shape, and form arches between the slots 11, the radii of which are equal to the original radius of the ring 13.

The blades 16, which are crescent shaped in cross section are swaged at one end to form a base or mounting portion 17, which fits into the slots 11 of the mounting segment. The face 18 of the blade fits against the undercut face 19 of the slot and the lateral faces of the mounting portion are adapted to form a close fit with the lateral faces of the slots. After the blades are assembled in the segment 13, the segment is put in place in a slot 20, formed in the rotor element of the turbine, and rigidly secured thereto by driving a calking strip 21 between the slotted face 12 of the segment 13 and the adjacent face of the rotor slot. The calking strip 21 closes the lateral openings of the slots 11 and locks the blades 16 in place by causing the metal of the mounting portion to flow, in yielding to the strains induced by the calking, and thereby grip the blades and hold them securely in place. If any of the blades are found to be loose after the calking strip is in place, they can be tightened by flattening out the arched portion 15 of the segment 11 either on one or both sides of the loose blade, thereby driving the walls of the slot into more intimate contact with the blade and causing them to grip the blade more securely.

It is necessary in turbines, because of the different conditions encountered, to set the blades of the different rows at different angles to the axis of the rotor element, and with my invention the necessity of gaging or turning the blades to suit existing conditions after they are in place is overcome. Since the required position of the blades can be predetermined, the slots 11 can be cut at the necessary angle. The outer ends of the blades may be lashed together in any suitable manner, either before or after the sector 13 is secured in place.

The mounting pieces of the stationary vanes are formed by slotting, as described, a ring or segment of a ring of larger diameter than the mounting slot into which it is to be eventually mounted. The ring or ring

segment is then decreased in diameter by shaping it over a form, which is the diameter of the mounting slot. With a ring so constructed the extending portions 15 are arched by the slots and the mounting ring is to all practical purposes the same as the mounting ring of the blades.

Throughout the claims I have utilized the term blades with no idea of limiting the scope of the invention to blades, the word being used in its broader sense; that is, to include both the moving blades and stationary vanes.

What I claim is:

1. The method of manufacturing blade holding elements, which consists in cutting a number of notches in a substantially radial direction across the lateral face of a circular ring, which extend into the ring at an angle to its axis, severing the ring and bending it to form a segment of a circle of larger diameter.

2. The method of manufacturing blade holding elements, which consists in cutting a number of notches in a substantially radial direction across a lateral face of a circular band, and which extend into the ring at an angle to the axis, being deeper at one peripheral face of the ring than at the other, severing the ring and bending it to form a segment of a circle of larger diameter.

3. The method of manufacturing blade holding elements, which consists in cutting a number of substantially radial slots across a lateral face of a circular ring, which slots extend longitudinally of the ring at an angle to its axis, severing the ring and bending it to form part of a ring of different diameter.

4. The method of manufacturing base strips for blades, which consists in cutting a number of radially extending slots across the lateral face of a ring or ring segment, then bending the ring or ring segment to form a segment of a ring of different diameter of which the slotted face is a lateral face.

5. The method of manufacturing base strips for blades, which consists in cutting a number of radially extending slots across the lateral face of a metallic ring, which slots extend into the ring and are deeper at the inner peripheral face, then bending the ring to form a segment of different diameter of which the slotted face is a lateral face.

6. The method of manufacturing base strips for blades, which consists in cutting slots across a face of a strip and then bending the strips to form a ring or ring segment so that the slots are narrower at the outer peripheral face of the ring or ring segment.

In testimony whereof, I have hereunto subscribed my name this 6th day of July, 1907.

MARTIN A. THIEL.

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