

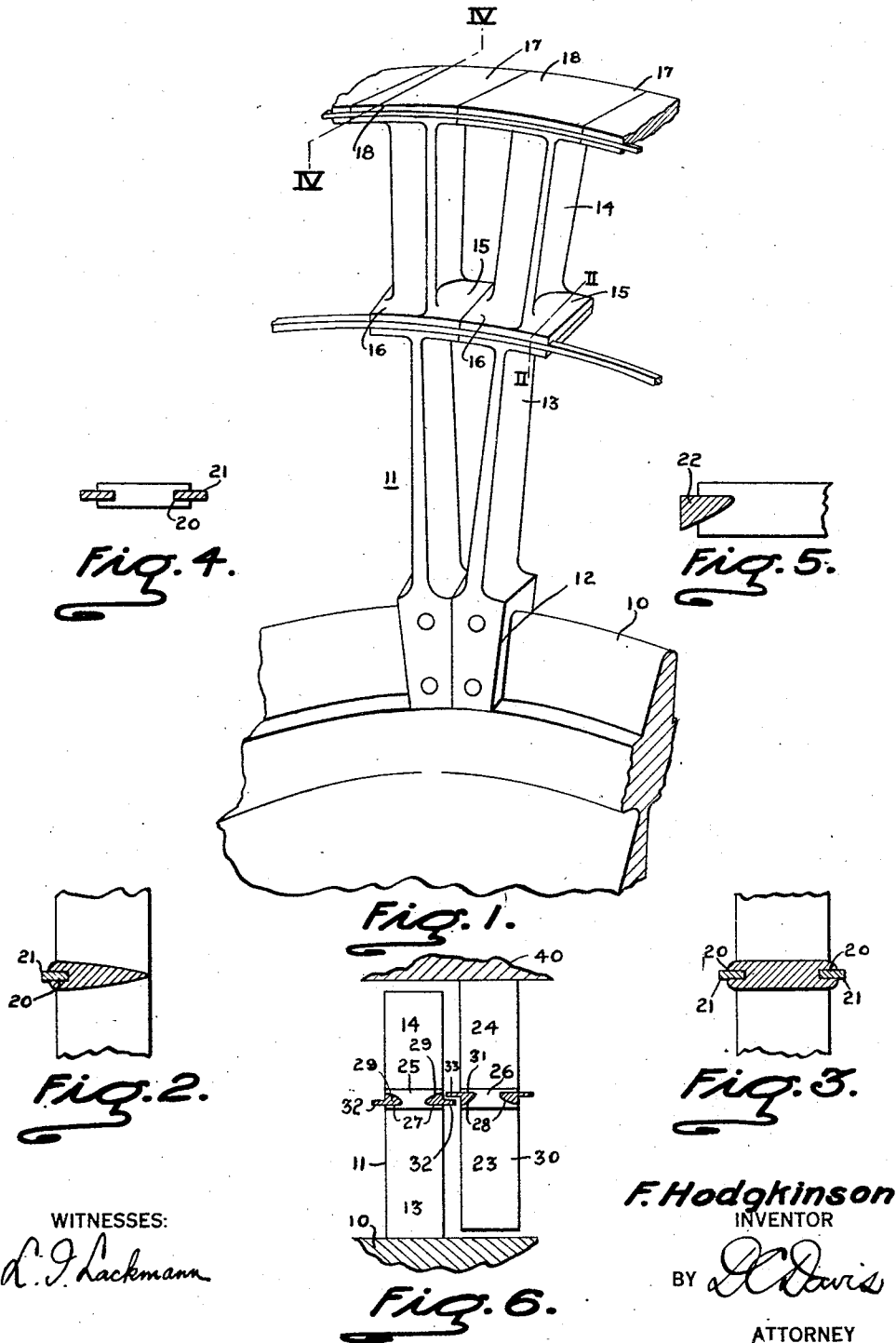
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TURBINE BLADE LASHING

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TURBINE-BLADE LASHING.

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To all whom it may concern:

Be it known that I, FRANCIS HODGKINSON, a subject of the King of Great Britain, and a resident of Swarthmore, in the county of Delaware and State of Pennsylvania, have invented a new and useful Improvement in Turbine-Blade Lashing, of which the following is a specification.

My invention relates to turbine blading of the type having intermediate partition or wall elements and it has for an object to provide lashing for blading of this character which shall serve the purposes of strengthening the blade structure and of minimizing blade vibration.

Another object of my invention is to provide lashing for the character of blading indicated which is effective both to strengthen the blade structure and to form a packing means between the inner and outer tiers of adjacent rows of moving and stationary blades.

My improved lashing is particularly applicable to turbine blading of the multiple-exhaust type, such as shown, described and claimed in the patent to Baumann, reissued April 26, 1921, No. 15,092, and assigned to the Westinghouse Electric and Manufacturing Company. I provide the partition or wall elements of blading of this type with lateral grooves to receive lashing members for the purposes aforesaid.

As is well-known in the art, in applying blade lashing, a suitable number of blades in a row are grouped together and lashed, leaving a joint between such grouping or segment and the adjacent group or segment to allow for expansion due to the different rate of heating of the rotor and the blading of the turbine. In applying my improved lashing I group a certain number of blades in the manner aforesaid, the number depending on their length. I make the lashing strip, say, one and one-half times the length of a blade. Different groupings would be made, however, according to the blade design.

Apparatus made in accordance with my invention is illustrated in the accompanying drawings, forming a part of this application, in which Fig. 1 is a detail view of multiple exhaust blades with my improved lashing means applied thereto; Fig. 2 is a sectional view taken along the line II—II of

Fig. 1; Fig. 3 is a sectional detail view showing a modified type of lashing for blading of this character; Fig. 4 is a sectional detail view along the line IV—IV of Fig. 1, showing my improved lashing construction applied to the blading shroud elements; Fig. 5 is a sectional view showing a modified form of my improved lashing and Fig. 6 is a sectional view showing a further modified form wherein the lashing forms a labyrinth packing to prevent leakage between the inner and outer tiers of blading.

Referring now to the drawing for a better understanding of my invention, I show in Fig. 1 a rotor 10 to which blades 11 of the multiple-exhaust type are secured by any suitable root connection 12.

In the drawing the blades 11 are shown provided with inner portions 13 and with outer portions 14, separated by partition or wall elements 15 and 16 carried, respectively, at the front and at the back of each blade. The blades are shown provided, at the tips, with shroud or wall elements 17 and 18 projecting, respectively, forwardly and rearwardly of each blade. The partition or wall elements 15 and 16 and the shroud or wall elements 17 and 18 are preferably made integral with the blades, and such elements are of such an extent that the partition or wall element 15 engages with the element 16 of the adjacent blade and the shroud or wall element 17 engages with the element 18 of the adjacent blade, when the blading is assembled, in order to form division walls for the blading and shrouding therefor, as shown in Fig. 1.

It must be understood, however, that the location of the partition or wall elements 15 and 16 and the shroud elements 17 and 18 as shown in the drawings, is for the purposes of illustration only. The enveloping shroud elements 17 and 18 may be omitted and the partition or wall elements 15 and 16 located at any desired point in the blade structure, forming a division means for the motive fluid between inner and outer tiers of the blading. In such a case, the outer tips of the blading may be lashed by any suitable means known in the art.

In accordance with my invention the partition or wall elements 15 and 16 and the shroud or wall elements 17 and 18 are provided at one or both sides with grooves in

which lashing strips are brazed, welded, or soldered. In Fig. 2, I show a groove 20 at one side to receive a lashing strip 21, which is secured in the groove in the manner referred to. In Fig. 3, I show partition or wall elements having grooves 20 at each side to receive lashing strips 21. The shroud elements may have similar lashing members secured in one or both sides thereof as indicated in Figs. 1 and 4.

From the foregoing, it will be apparent that I have provided multiple-exhaust blading which is securely fastened or lashed together in order to secure a blading structure which is strong and in order to minimize vibration thereof.

For ease of insertion, my improved lashing may be formed in any desired shape. For instance, in Fig. 5 I show a strip 22 triangular in cross-section fitting into a similar shaped recess in the partition or shroud element of the blade.

In Fig. 6 I show a moving blade 11 secured to the rotor 10 and a stationary blade 30 secured to the stator 40 of the turbine. The moving blade 11 is shown with a partition or wall 25 similar in construction to those shown in Fig. 1 dividing the blade into inner and outer tiers 13 and 14. The stationary blade 30 is divided by the partition 26 into inner and outer tiers 23 and 24.

In each side of the partitions 25 and 26 are grooves 27 and 28 in which my improved lashing is secured in the manner already outlined. The lashing strip applied to the moving blade 11 has a base 29, fitting into the groove 27 of the partition 25 and a flange portion 32 extending beyond the partition 25. The lashing applied to the stationary blade is similar in construction, having a base 31 fitting into the groove 28 of the partition 26, and a flange portion 33 extending beyond the partition 26. The lashing applied to the moving blade is inserted in an inverted relation with respect to that applied to the stationary blade so that the flange portions 32 and 33 overlap each other with only sufficient clearance between to prevent rubbing. In the manner indicated I form by means of my improved lashing a labyrinth packing preventing leakage of steam between the inner and outer tiers of blading.

While I have shown my invention in several forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as are specifically set forth in the appended claims.

What I claim is:

1. In a turbine, the combination of a row of stationary blades, a row of moving blades, wall-forming flange elements carried by each row of blades dividing it into inner and outer tiers, grooves in the lateral faces of the wall-forming flange elements and lashing strips fitting into the grooves, said lashing strips having overlapping flange portions forming packing means between the tiers.
2. A turbine blade lashing having a flange portion cooperating with the flange portion of the lashing of an adjacent row of blades to form a labyrinth packing.
3. In a turbine having a plurality of rows of tiered blading, partition members between the tiers, packing means between the partition members of adjacent rows, said packing means being effective to lash segments of a row of blading.
4. In a turbine, the combination of a row of moving tiered blading, a row of stationary tiered blading, partition members between the tiers, lashing strips secured in grooves along the lateral faces of partition members, said lashing strips having cooperating flange portions to form packing means between the tiers.
5. In combination, a turbine with rows of moving and of stationary blades, partition members dividing the moving and the stationary blades into tiers, lashing strips with laterally-extending flange portions secured in grooves along the sides of the partition members, the laterally extending flange portions of the lashing strips of one row of blades overlapping similar flange portions of adjacent lashing strips.

In testimony whereof, I have hereunto subscribed my name this 10th day of Sept., 1923.

FRANCIS HODGKINSON.