Oct. 21, 1958 G. F. ARKLESS 2,857,134

ASSEMBLY OF BLADES FOR TURBINES AND THE LIKE

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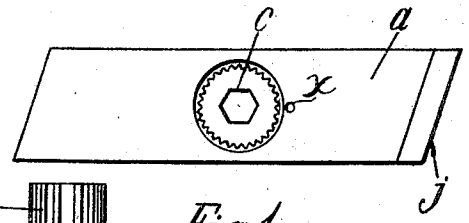

Fig. 1.

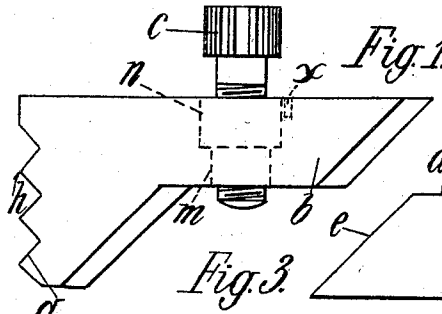

Fig. 3.

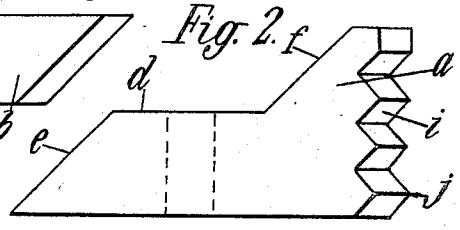

Fig. 2.

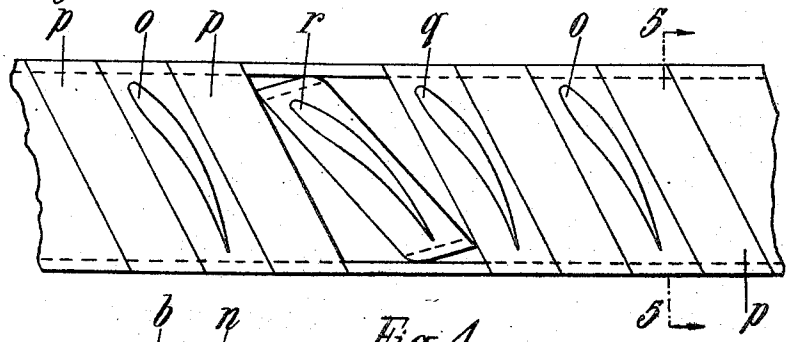

Fig. 4.

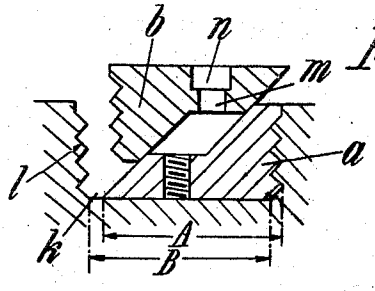

Fig. 6.

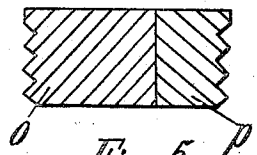

Fig. 5.

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ASSEMBLY OF BLADES FOR TURBINES AND THE LIKE

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3 Claims. (Cl. 253—77)

The invention relates to the improvements in and relating to assembly of blades for turbines and the like that is to say to turbine or compressor or fan blades and more specifically to those of the integral root type which are assembled in serrated circumferential grooves in a rotor, said blades being separated from each other in grooves by spacing or packing pieces of similar shape to the roots of the blades.

Blades of the type described above which have integral blade roots of a lozenge that is parallelepiped shape, are inserted in a circumferential groove turned in the rotor, the sides of the groove being serrated to hold the blades and packing pieces in position against the action of centrifugal force. In plan view both the blade root and packing piece are of a lozenge shape so chosen that a blade or packing piece may be turned into position in the groove. Both blade root and packing piece have serrations machined on their smallest two faces, these serrations matching and intermeshing with serrations on the side of the rotor groove.

With such an arrangement the completing or final packing piece, that is to say what may be called the closing packer of a row, cannot be inserted in the same manner as its predecessors. It is common practice to provide a milled-out pocket in the rotor adjacent to the groove and opposite to the position to be occupied by the closing packer and which enters into the circumferential blade groove. The depth of this pocket, or lantern space as it is comomnly termed, is the same as that of the blade groove: its width is aiso similar to that of the blade groove and its length in the peripheral direction is somewhat greater than one blade root pitch. Its three walls are serrated in a similar fashion to the blade groove.

When a lantern space is provided the closing packer is dropped into it and slid into position in the blade groove. The lantern space is then filled by fitting a steel strip, both sides of which are serrated into the lantern space adjacent to the closing packer, the serrated side in contact with the closing packer, also engaging with short lengths of the serrations of adjacent blades, and then peening copper or other ductile material into the remaining lantern space, the peened-in metal entering into the serrations in the said lantern space and free side of the steel strip so retaining itself in position against the action of centrifugal force.

The provision of the lantern space has certain disadvantages, in that it involves additional machining of the rotor, the rotor stress is increased due to the increased load on the remainder of the rim, and renewal of the blades is made difficult.

The object of the invention is to provide an improved closing packer for turbine or compressor blades of the integral root type which are assembled in serrated circumferential grooves in the rotor, free from the above mentioned disadvantages.

The invention consists in a closing packer for turbine or compressor blades of the integral root type which are

assembled in serrated circumferential grooves in the rotor, which is made in two parts in such a way that when the two parts are in position and secured, they form a closing packer identical in shape and outside dimensions with the normal blade packing pieces.

The invention also consists in a closing packer in accordance with the preceding paragraph in which each part has a hole drilled through it so located so that when the two pieces are brought together it is substantially midway between serrated edges, said hole in the part of the packer which is inserted in the groove first, that is the lower part, being tapped to accommodate a socket screw, the hole in the upper part being a clearance hole countersunk to accommodate the said socket screw and in closing packers as described below.

Referring to the accompanying diagrammatic drawings:

Figure 1 is a plan, and

Figure 2 an elevation of the lower part of a closing packer according to one form of the present invention;

Figure 3 is an elevation of the upper part of a closing packer for use with Figures 1 and 2;

Figure 4 shows the arrangement of blades and packing pieces in a typical blade row the last blade to be inserted being shown;

Figure 5 is a section on the line 5—5 of Figure 4 looking in the direction of the arrows;

Figure 6 shows the assembly of the closing packer in the rotor groove and is a section along a plane through the axis of the rotor.

Referring to the aforesaid accompanying diagrammatic drawings which illustrate the preferred form of the present invention, the closing packer consists of three parts *a*, *b* and *c*, the latter of which is a socket screw. The parts *a* and *b* when properly placed together have outside dimensions and shape identical with that of the normal blade packing pieces and the joint *d* between the two parts is of the form shown in Figure 2, the oblique faces *e* and *f* of the joint being parallel with the locally approximate plane surfaces of the lower side *g* of serrations *h* on one side of the packer and the upper side *i* of the serrations *j* on the other side. The position of the joint is so chosen that the distance A in Figure 6 is less than the distance B. This admits of the lower half *a* of the packer being dropped into a groove *k* and its serrations meshed with those *l* of the groove, the serrations of the two ends of the packer fitting into the circumferential serrations *l* of the side walls of the groove *k* as shown in the drawing.

The two halves of the packer are fastened together by means of the socket screw *c*, this being tapped into the lower half *a* of the closing packer and passing through a clearance hole *m* in the upper half *b* of the packer, the clearance hole *m* being slightly larger than the diameter of the screw *c* accommodated by it. The head of the screw *c* is countersunk into the upper half, the countersink *n* being of greater diameter than the head of the screw, and the hole *m* being of greater diameter than the shank of the screw above the threaded portion thereof, thus allowing limited relative movement to take place between the two halves.

To assemble, when a row has been fitted with blades indicated by the reference letter *o* in Figure 4 the packing pieces indicated by the reference letter *p* except for the final or closing packer, one or both of the obtuse corners of the last blade root being rounded off to permit of "turning" of this blade into position as shown in Figure 4, if necessary, the first blade inserted in the row having the reference letter *q* and the last blade having the reference letter *r*, the lower half *a* of the closing packer is dropped into the vacant space in the groove and pulled back so that its serrated side meshes with the serrations in the groove as shown in Figure 6. The top half *b* of

the packer can then be slid into position along the plane of the oblique faces *e* and *f* of the packer joint as in Figure 6 its serrations sliding into mesh with the groove serrations. The screw *c* is then placed in position and tightened. In doing this, due to the clearance which exists between the screw and the upper half *b* of the packer in directions radial to the screw, the two halves *a* and *b* of the packer can slide slightly on one another and tighten themselves into the groove serrations. Finally the screw can be locked, either by simply peening the metal surrounding the head into knurls provided on the side of the head of the socket screw or, as is preferred, by the expedient of drilling a small blind hole *x* in the top surface of the closing packer adjacent to the countersinking and swaging the thin wall of metal separating the blind hole from the countersink into the knurls. It is arranged that when the two parts are securely locked together, a small gap is left between the opposite faces, of each part on either side of the socket screw *c*, the planes of which are at right angles to the socket screw *c*; that is to say between face *d* of part *a* and the corresponding face of part *b*, to allow for effective tightening and wedge action on the diagonal faces in contact.

Whilst the invention is described with reference to an axial flow compressor the closing packer may be used in axial flow turbines, where the root circumferential pitch of the blades is sufficient to accommodate it.

I claim:

1. In a turbine or compressor rotor having a circumferential groove, the groove having circumferentially serrated side walls, and fan blades and packers fitted in the said groove, a packer comprising two parts having oppositely facing serrated edges for fitting the serrated side walls of the said groove of the rotor, the serrations of the said edges on one of the two said parts having substantially parallel surfaces, the two said parts having cooperating surfaces for fitting together, the said cooperating surfaces being parallel to the first said parallel surfaces, whereby one of the said parts may be placed in position in the said rotor groove and the other slid into position therein, and means for holding the two said parts of the packer together in assembled position within the said groove with the serrations on the edges of the said two parts of the packer engaged in the serrations of walls of the said groove.

2. A packer according to claim 1, in which the means holding the two said parts together comprises a screw passing through one of them and countersunk therein and threadably engaged in the other.

3. A packer according to claim 2, in which each of the two said parts have also an engaging surface adjacent to and substantially at right angles to the said screw.

References Cited in the file of this patent

FOREIGN PATENTS

639,320	Great Britain	June 28, 1950
659,592	Great Britain	Oct. 24, 1951