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METHOD OF MANUFACTURING BLADE RINGS FOR STEAM AND GAS TURBINES.
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1,101,645.

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Fig. 1.

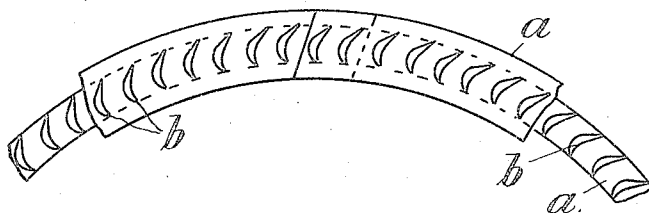


Fig. 2.

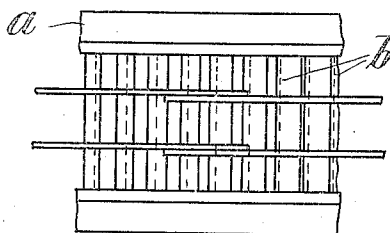


Fig. 7.

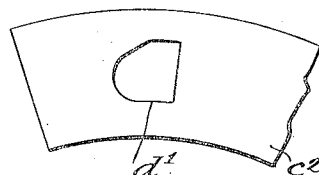


Fig. 8.

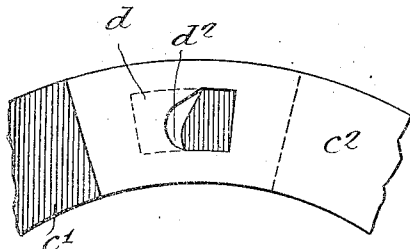


Fig. 6.

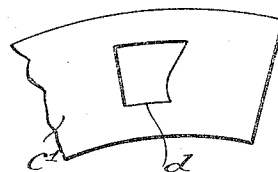


Fig. 3.

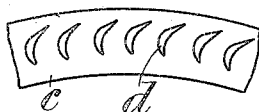


Fig. 4.

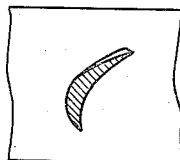
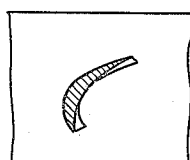


Fig. 5.



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METHOD OF MANUFACTURING BLADE-RINGS FOR STEAM AND GAS TURBINES.

1,101,645.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, FREDRIK LJUNGSTRÖM, a subject of the King of Sweden, residing at 2 Drottningholmsvägen, Stockholm, in the Kingdom of Sweden, have invented certain new and useful Improvements in Methods of Manufacturing Blade-Rings for Steam and Gas Turbines, of which the following is a specification.

In manufacturing blade rings for steam or gas turbines especially for radial turbines it is of great importance that the blades being attached at both ends to reinforcing rings are secured accurately in such manner that firstly the distance between the blades and secondly their outlet angle is properly determined.

In the methods now employed according to which the blades are guided at both ends there arise many difficulties and disadvantages, especially when the blades are secured by autogenous welding, because a high heating must be used just at those points, *i. e.* the ends where the blades are guided. Such heating causes a comparatively great deformation, not only the angle position of the blades being varied but even the blades being bent and the distance between the same being varied.

The present invention relates to a method adapted to avoid the said disadvantages. Further the invention has for its object to provide a guide for the blades between the ends of the same, whereby not only a bending of the blades during the securing is prevented but also the special guide at the ends can be dispensed with.

The method consists in rigidly combining the blades at their ends, by special devices during the securing, so that a relative displacement of the blades is prevented at the securing process. The said devices preferably consist of annular rings or the like through which the blades pass and which are inserted at one or more places between the ends of the blades, the rings being provided with holes, which are shaped so as to guide or support the blades in such a way that the blades will be prevented from turning or moving in relation to each other. Thus a displacement of the blades is prevented during the welding of the ends thereof.

An embodiment of the invention is shown in the accompanying drawing.

Figures 1 and 2 show a part of a blade ring in side elevation and in plan respectively. Fig. 3 shows a part of a guiding ring. Figs. 4 and 5 show different forms of the holes in the supporting rings. Fig. 6 represents a front elevation of the underlapping end *c'* of one of the rings *c*; Fig. 7 represents a similar view of the overlapping end of said ring; and Fig. 8 represents a similar view of these ends with the latter superposed on the former as in use, the underlapping end being shaded for distinction.

a indicates the reinforcing rings and *b* indicates the blades which pass through the guiding or supporting rings *c* of sheet iron or other suitable material. In the drawing only two such rings are shown. The number of rings can however be varied. The guiding or supporting rings can be formed as integral rings or consist of a plurality of ring parts or sections, the ends of which preferably overlap each other.

The holes *d* in the supporting rings can be shaped in conformity to the cross sections of the blades, as shown in Fig. 3. As it is very difficult, however, to stamp the thin points of the holes and as a correspondingly formed stamp, further, will not be strong enough, the holes are preferably shaped as shown in Figs. 4 and 5 that is to say in such a way that the edges of the holes abut against the points of the blades only at the one side of these latter. The holes can be made greater than the cross-sections of the blades, two rings being placed laterally of each other in such a manner that the holes are set somewhat out of line with each other. The blades then abut with the one side against the edge of a hole in the one ring, while the blades with their other side abut against the edge of a corresponding hole in the other ring. Figs. 6, 7 and 8 illustrate the end of the rings thus constructed and applied, having holes of different forms, chosen by way of example. The underlapping end *c'* of the ring (Figs. 6 and 8) has a hole *d'* of curvilinear border on one side, the other three borders being straight sides of a quadrilateral. The overlapping end *c''* of said ring (Figs. 7 and 8) has a hole *d''* with the curved border on the other side, the curvature being outward instead of inward and greater than the inward curvature before mentioned. When

the end c is laid upon the end c' , as shown in Fig. 8, the degree of overlapping may be so regulated as to leave uncovered only the left part of opening d' and the overlapping right part of opening d^2 , these two parts combining in one opening, approximately of crescent form, through both plates.

It will be clear that, if the rings consist of ring sections, the ends thereof may not necessarily overlap each other as shown in Figs. 1 and 2, but they may abut against each other. After the blade rings have been properly arranged the supporting rings are eliminated for instance by making a cut at each blade through the inner and outer edge of the supporting ring, or by employing supporting rings of an easily fusible metal which can be removed by melting.

I am aware that it is not broadly new to hold metallic parts in a clamp, to be brazed or welded and do not claim the same. I am also aware more particularly that this process or method of thus holding during such welding or brazing has been applied to the manufacture of reamers or milling tools and my claims are not intended to cover, and do not cover, the same. But

Having now described my invention, what

I claim and desire to protect by Letters Patent is:—

1. The process of manufacturing blade rings for steam turbines consisting in the following steps, first rigidly connecting the blades together near their ends by suitable parts adapted to hold a series of said blades in proper parallel position and prevent their relative displacement, secondly fitting said ends into holes in reinforcing rings, thirdly welding said ends to said rings and finally removing said parts which have previously held said ends together.

2. The process of manufacturing blade rings for turbines consisting in the following steps; first, rigidly connecting the blades together by temporary supporting rings adapted to hold them in proper position parallel to each other but to be easily cut away; secondly, fitting the ends of said blades into the permanent reinforcing rings; and finally cutting away said temporary supporting rings.

In testimony whereof I have affixed my signature in presence of two witnesses.

FREDRIK LJUNGSTRÖM.

Witnesses:

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