B. LJUNGSTRÖM.

VANE SERIES FOR TURBINES.

APPLICATION FILED MAY 10, 1907

911,663.

Patented Feb. 9, 1909.

2 SHEETS—SHEET 1.

Fig. 1

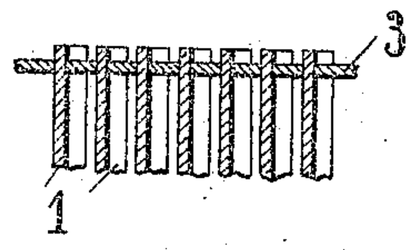


Fig. 3

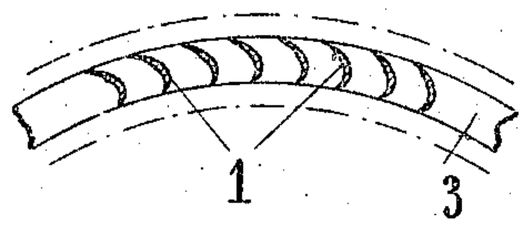


Fig 2

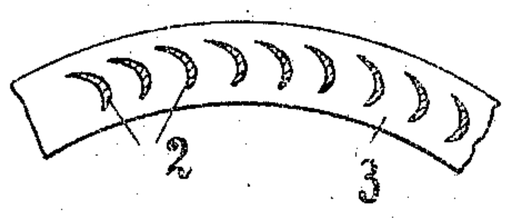


Fig. 4 Fig. 5

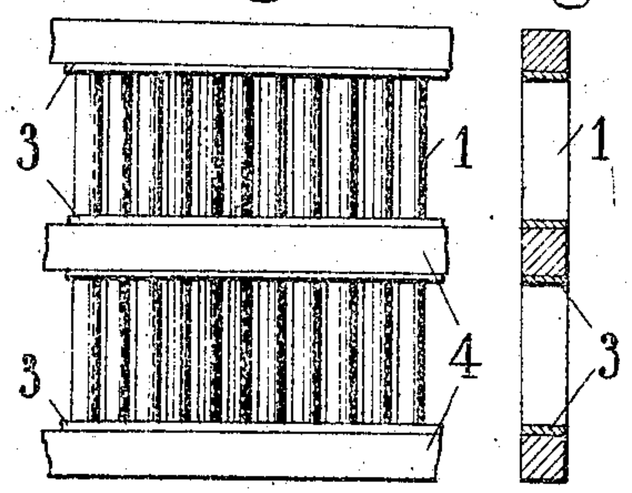


Fig. 6

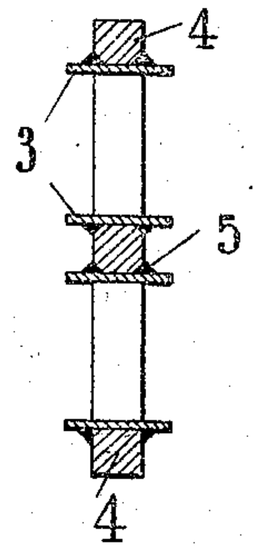
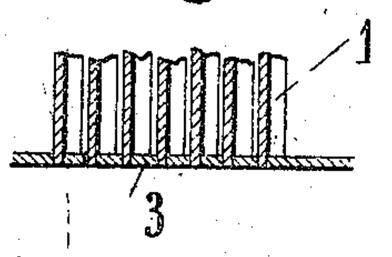


Fig. 7



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2 SHEETS—SHEET 2.

Fig. 8

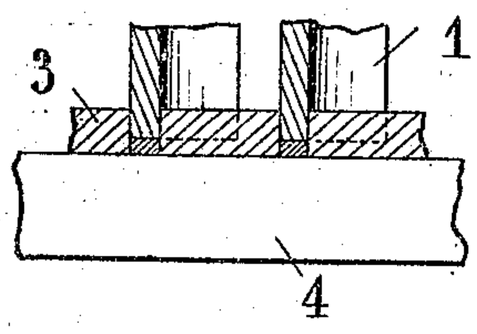


Fig. 11

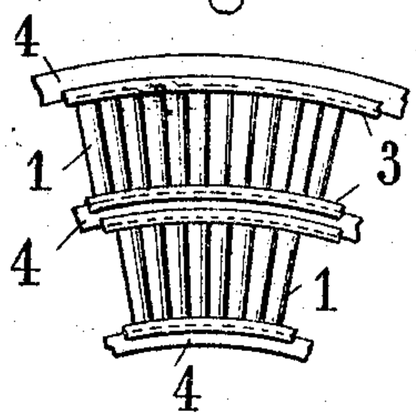


Fig. 9

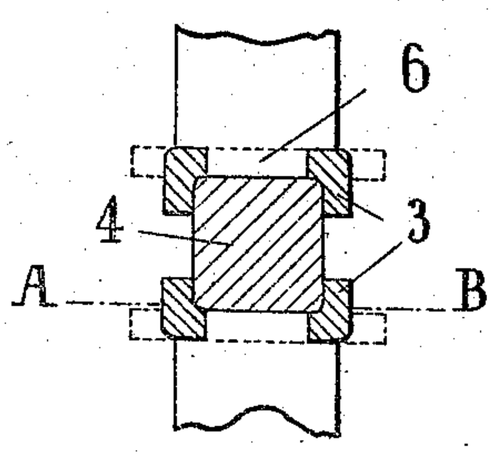
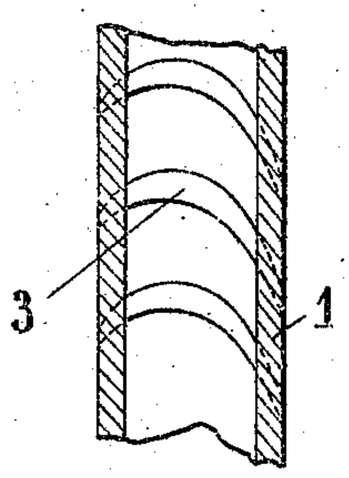


Fig. 10



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UNITED STATES PATENT OFFICE.

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VANE SERIES FOR TURBINES.

No. 911,663. Specification of Letters Patent. Patented Feb. 9, 1909.

Application filed May 10, 1907. Serial No. 372,994.

To all whom it may concern:

Be it known that I, BIRGER LJUNGSTRÖM, a subject of the King of Sweden, residing at Fleminggatan 8, Stockholm, Sweden, have invented certain new and useful Improvements in Manufacture of Vane Series for Gas-Turbines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

This invention relates to the manufacture of vane-series for gas turbines; my object herein being to produce, in a simple and efficient manner, a unitary vane structure of relatively great strength, which can be readily applied to or removed from the rotating or fixed parts of a turbine, as occasion may require.

In carrying out my invention the respective ends of the vanes or blades are joined with thin metallic supporting strips, and the latter are then rigidly seurced to stout stiffening rings, as will be hereinafter more particularly described and then duly claimed.

While the structure produced according to my invention is applicable to both radial and axial turbines, it is particularly useful in connection with the former, wherein, as is well understood, the speed of rotation and the resulting dimensions and economy of the apparatus depend upon the efficiency of the connection between the vanes and their ring-bonds, inasmuch as the centrifugal force due to the operation of the vanes is taken up entirely by such bonds.

In the annexed drawings, Figure 1 is a horizontal section through a portion of the thin supporting strip with several blades or vanes applied thereto, with projecting ends, the same being illustrative of the assembling operation. Fig. 2 is a vertical section through such blades or vanes showing the supporting strip therefor in elevation. Fig. 3 is a similar section showing the edges of the supporting strip reduced to the edges of the blades or vanes. Fig. 4 is a plan of a portion of the completed vane structure showing two series of assembled vanes with the stiffening rings combined therewith. Fig. 5 is a vertical section of Fig. 4. Fig. 6 is a similar section showing one mode of securing the stiffening rings to the supporting strips for the blades or vanes. Fig. 7 is a section similar to Fig. 1, showing the ends of the blades or vanes flush with the outer surface of the supporting strip. Fig. 8 is a like section, enlarged, showing the ends of the blades or vanes terminating within the supporting strip, and also showing the stiffening ring. Fig. 9 is a transverse section through the inner supporting strips of two series of blades or vanes and the interposed stiffening ring, showing the lateral edges of the supporting strips as flanged or bent into locking engagement with the stiffening ring. Fig. 10 is a horizontal section through one of the supporting strips with its blades or vanes, the section being taken on a plane immediately above the stiffening ring in Fig. 9. Fig. 11 is a view similar to Fig. 4, showing a vane structure designed for an axial turbine.

In the drawings, 1 indicates the blades or vanes; 3 the thin supporting strips in which the ends of the blades or vanes are mounted, and 4 the stout stiffening rings to which the said strips, with their blades or vanes, are rigidly affixed.

In the manufacture of vane series for radial turbines, the parts 3 are first made in straight strips with appropriate perforations, as 2, into which the ends of the blades or vanes are inserted and secured, which strips are thereupon bent into the desired circular or segmental form. The vane ends are then welded to the strips through the medium of a suitable blow-pipe or an electric voltaic arc. If desired, the vane ends may be caused to project slightly beyond the surface of the strip, as in Fig. 1, and be smelted thereto. The vane supporting strips are rigidly affixed to the thicker ring members 4, which constitute an effective stiffening and reinforcing bond for the structure. This being done, the projecting edges of the strips 3, and all other superfluous portions of the structure, may be removed by grinding, turning, or otherwise finishing the same, as indicated by the dotted lines in Fig. 3. The assembled blades or vanes may be affixed to the stiffening rings 4 by welding or soldering, in which case, as indicated in Fig. 6, the said rings may be conveniently provided with grooves or notches, as at 5, for the reception of the molten metal. Where

the vane series are affixed to the stiffening rings by soldering, the welding of the vane ends to their supporting strips, may be omitted, inasmuch as during the soldering operation the solder will flow into the holes of the supporting strips and envelop the vane ends therein. In that case, the vane ends, instead of projecting beyond the surface of the strip, should either be flush with the same, as in Fig. 7, or lie within the strip, as in Fig. 8.

It is not essential that the union of the vane series with the stiffening rings be effected by soldering or welding, as, in pursuance of my invention, I can effectually unite the contiguous supporting and stiffening rings by correspondingly reducing the width of the vane ends and the length of the openings in the supporting rings which receive the same (as at 6, Fig. 9) and then flanging or bending the laterally projecting edges of the supporting strips hard against the proximate stiffening rings, as indicated in Figs. 9 and 10.

In Fig. 11, is illustrated a plan of a portion of a vane series for an axial turbine, the same being constructed in accordance with my invention and embodying the characteristic supporting and stiffening ring features thereof.

I claim—

1. A unitary vane structure comprising a series of vanes, thin strips fixedly joining the ends of said vanes, and stiffening rings to which said strips are rigidly secured.

2. A unitary vane structure comprising a plurality of series of vanes, thin strips fixedly joining the ends of the respective series, and an interposed stiffening ring to which the strips of adjoining series are rigidly secured.

3. A unitary vane structure comprising a series of vanes, thin strips joining the ends of said vanes, and stiffening rings with which said strips are bent into locking engagement.

4. A unitary vane structure comprising a plurality of series of vanes, thin strips joining the ends of the respective series, and an interposed stiffening ring with which the strips of adjoining series are bent into locking engagement.

5. A unitary vane structure comprising a series of vanes, thin strips provided with perforations in which the ends of said vanes are entered and fixedly secured, and stiffening rings to which said strips are rigidly secured.

6. A unitary vane structure comprising a series of vanes, thin strips provided with perforations in which the ends of said vanes are entered and secured, and stiffening rings with which the edges of the strips are bent into locking engagement.

7. A unitary vane structure comprising a plurality of series of vanes, thin strips joining the ends of the respective series, said strips being provided with perforations in which the ends of the vanes are entered and secured, and an interposed stiffening ring with which the strips of adjoining series are bent into locking engagement.

8. A unitary vane structure comprising a series of vanes, thin strips to which the ends of the vanes are welded, said strips being provided with perforations which receive the ends of the vanes, and stiffening rings with which the said strips are bent into locking engagement.

9. A unitary vane structure comprising a plurality of series of vanes, thin strips to which the ends of the respective series are welded, said strips being provided with perforations which receive the ends of the vanes, and an interposed stiffening ring with which the strips of adjoining series are bent into locking engagement.

In testimony, that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

BIRGER LJUNGSTRÖM.

Witnesses:
CARL FRIBERG,
E. RÅBERG.