No. 832,083. PATENTED OCT. 2, 1906.

C. ROTH.

MANUFACTURE OF TURBINE VANES.

APPLICATION FILED DEC. 8, 1905.

Fig.1.

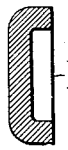


Fig.2.

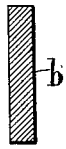


Fig.3.

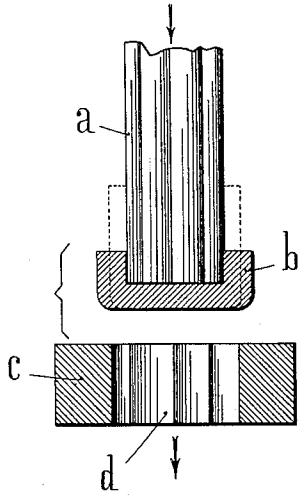


Fig.4.

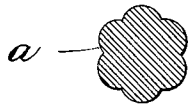


Fig.5.

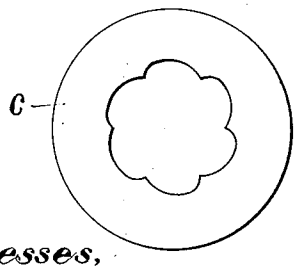


Fig.6.

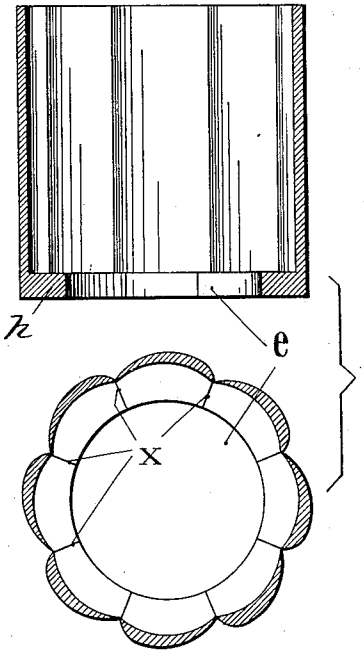


Fig.7.

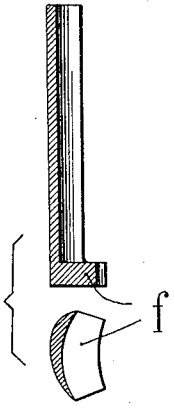
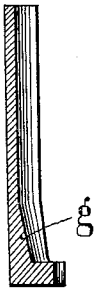


Fig.8.



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UNITED STATES PATENT OFFICE.

CARL ROTH, OF MUNICH, GERMANY, ASSIGNOR TO MELMS & PFENNINGER, GESELLSCHAFT MIT BESCHRÄNKTER HAFTUNG, OF MUNICH-HIRSCHAU, GERMANY.

MANUFACTURE OF TURBINE-VANES.

No. 832,083. Specification of Letters Patent. Patented Oct. 2, 1906.

Application filed December 8, 1905. Serial No. 290,897.

To all whom it may concern:

Be it known that I, CARL ROTH, engineer, a citizen of the Republic of Switzerland, and a resident of Munich, Mühlbauerstrasse 2, Bavaria, Germany, have invented a certain new and useful Improvement in the Methods of the Manufacture of Turbine-Vanes; 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 of reference marked thereon, which form a part of this specification.

My invention relates to the manufacture of turbine-vanes; and my improved method enables vanes of any desired shape to be manufactured with great accuracy, each vane being at the same time provided with a projection serving for securing it or as a distance-piece.

The accompanying drawings illustrative of the invention show in Figures 1 and 2 two forms of blanks used in the manufacture of the vanes. Fig. 3 shows a mandrel, blank, and die-ring. Figs. 4 and 5 show, respectively, a cross-section of the mandrel and plan view of the ring. Fig. 6 shows vertical and horizontal sections of the completed vanes before they are divided up. Figs. 7 and 8 show vertical sections of the finished vanes, the last three figures being on a large scale.

The blank used in the process is formed of metal pieces—for instance, cast or stamped and either plain or cup-shaped, as shown in Figs. 1 and 2. These disks are forced, by means of a suitably-shaped mandrel, through a die-ring of suitably-shaped cross-section. The inner sides of the vanes are formed by the mandrel according to its coutour, while at the same time the corresponding outer vane profiles are made by the inner ring-surface, as illustrated in Figs. 3, 4, and 5. The disk or blank *b* is placed on or under the mandrel *a*, and thereupon the mandrel is forced in the direction of the arrows, thus forcing the blank through the fixed die-ring *c*. The inner diameter *d* of the die is slightly smaller than the outer diameter of the blank. The blank is in this way compressed about the mandrel and shaped as indicated in dotted lines, Fig. 3, while at the same time the blank assumes the shape of the vane. This process can be repeated several times, a die-ring of smaller diameter being used at each operation until a sleeve of the length desired is obtained.

Fig. 6 shows a finished vane-sleeve, from which after a hole *e* has been bored or stamped out in the center of the base part *h* finished vanes can be obtained by cutting through on the lines *x*.

In Fig. 7 the projection *f*, formed from the base *h* and serving as a means for securing the vane or for use as a distance-piece, is shown.

By making the end of the mandrel of suitable shape the vanes can be made with a thickened "root" portion of any desired shape, as shown at *g* in Fig. 8.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent of the United States of America, is—

1. The method of manufacturing turbine-vanes consisting of forcing a metal blank, by means of a mandrel having a series of faces corresponding in shape to the desired contour of the inner surfaces of the vanes, through a suitably-shaped die-ring having inner faces corresponding to the outer surfaces of the vanes and finally cutting longitudinally through the cylinder so formed to produce a series of vanes corresponding in number to the faces on the mandrel substantially as set forth.

2. The method of manufacturing turbine-vanes consisting of forcing a metal blank, by means of a mandrel having a series of longitudinal curved surfaces, through a corresponding suitably-fluted die-ring and finally cutting longitudinally through the cylinder so formed to produce a series of vanes corresponding in number to the faces on the mandrel substantially as set forth.

3. The method of manufacturing turbine-vanes consisting of forcing a metal blank, by means of a mandrel having a series of faces corresponding in shape to the desired contour of the inner surfaces of the vanes, through a suitably-shaped die-ring having inner faces corresponding to the outer surfaces of the vanes, removing the central portion of the base of the cylinder of connected vanes so formed and finally longitudinally

through the cylinder to produce a series of vanes corresponding in number to the faces on the mandrel substantially as set forth.

4. The method of manufacturing turbine-vanes consisting of forcing a metal blank, by means of a mandrel having a series of longitudinal curved surfaces, through a corresponding suitably-fluted die-ring, removing the central portion of the base of the cylinder of connected vanes so formed and finally cutting longitudinally through the cylinder to produce a series of vanes corresponding in number to the faces on the mandrel substantially as set forth.

5. A connected assemblage of turbine-vanes formed from a metal blank stamped between a shaped mandrel and corresponding dies consisting of longitudinal curved sections connected together at their longitudinal edges in the form of a cylinder, and an inwardly-extending flange at the base of said cylinder substantially as set forth.

6. A connected assemblage of turbine-vanes formed from a metal blank stamped between a shaped mandrel and corresponding dies consisting of longitudinal curved sections connected together at their longitudinal edges in the form of a cylinder, thickened roots on said sections and an inwardly-extending flange at the base of said cylinder substantially as set forth.

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

CARL ROTH.

Witnesses:

ULYSSES J. BYWATER,

ABRAHAM SCHLESINGER.