

June 8, 1954

A. V. D. WILLGOOS

2,680,286

COINING BLADE FORGING

Filed Sept. 24, 1949

Fig. 1.

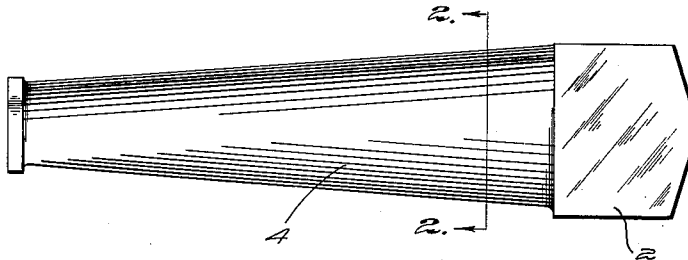


Fig. 2.

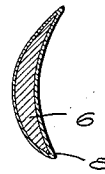


Fig. 3.

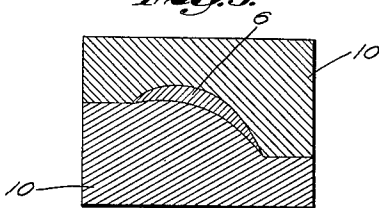


Fig. 5.

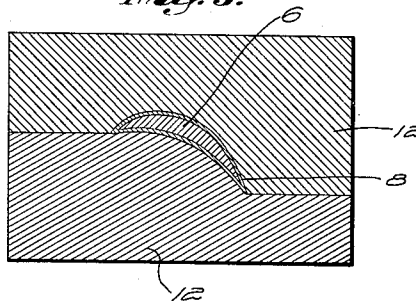
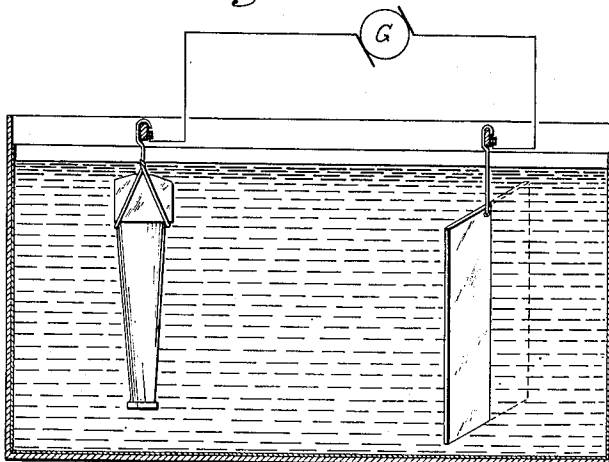


Fig. 4.



INVENTOR.
Andrew F. D. Willgoos Deceased
by The Hartford National Bank & Trust Co. Executor

Charles A. Warren
Attorney

UNITED STATES PATENT OFFICE

2,680,286

COINING BLADE FORGING

Andrew V. D. Willgoos, deceased, late of West Hartford, Conn., by Hartford National Bank and Trust Company, executor, Hartford, Conn., assignor to United Aircraft Corporation, East Hartford, Conn., a corporation of Delaware

Application September 24, 1949, Serial No. 117,572

1 Claim. (Cl. 29—156.8)

1

This invention relates to the manufacture of vanes for use particularly in compressors or turbines of gas turbine power plants.

Both the stationary vanes of compressors and turbines as well as the movable vanes or blades must be shaped to final size within relatively narrow limits. While some of the vanes are made from readily worked material, the blades and nozzle vanes of the turbine, which are subjected to very high temperatures, are preferably made from high temperature alloys which are difficult to forge or to machine. When the vanes are forged to size, the dies used in the forging process have lasted only a short time because of the difficulties in forging the material. A feature of this invention is a forming method by which to maintain the advantages of the forged vanes and at the same time increase the life of the dies used in the forming process.

The necessary close tolerances for stationary and rotary vanes in compressors and turbines frequently approach the limits of accuracy possible in forging even under favorable forging conditions. When the material of the vanes is difficult to forge, the required tolerances make almost impossible the forging of the vane to the desired finished dimension without the necessity for additional machining to the desired dimension. A feature of this invention is to relieve the forging operation of such close tolerances by forging the vane to a smaller-than-finished dimension and to tolerances readily obtainable by the forging operation, with the finished dimension obtained by a later process. Another feature of the invention is the coining of the vane to finished dimension, the outer surface of the vane being a material readily adapted for coining. Another feature is the forging of the vane to an undersized dimension and subsequently coining the vane after a coating has been applied.

Other objects and advantages will be apparent from the specification and claim and from the accompanying drawings which illustrate an embodiment of the invention.

Fig. 1 is a plan view of the finished blade.

Fig. 2 is a sectional view along line 2—2 of Fig. 1.

Fig. 3 is a sectional view through the blade and the initial forming dies.

Fig. 4 is a diagrammatic view of the blade coating operation.

Fig. 5 is a sectional view showing the coining operation diagrammatically.

The invention is shown in conjunction with a

2

turbine blade or vane adapted to be mounted on the turbine rotor although it will be understood that the invention is equally applicable to the stationary vanes or the blades of the turbine or the compressor. As shown in the drawings, the turbine vane has a root section 2 from which extends the effective blade or vane section 4 over which the gas flows in the power plant. In the arrangement shown, the entire vane has a core 6 made from a high temperature alloy to which a coating 8 has been applied. The coating is a material which is more readily workable than the material of the core so that the coating may be shaped to size between dies in producing a finished dimension and shape for the vane. The material of the coating 8 in addition to being more readily workable is also preferably a material resistant to the action of the ingredients in the power gas as it passes through the turbine. One material suitable for this purpose might be nickel.

In producing a vane in accordance with the invention, the core 6 is first forged between dies 10 to approximately the finished shape of the vane but to a dimension which is undersized from the desired finished dimension for the vane. It will be understood that the tolerances established for the dimensions of the core when forged are tolerances that are readily obtainable by the forging operation even though the material is one of the high temperature alloys which is difficult to forge. By forming the core in this manner and with liberal tolerances in dimension, it is possible to use the forging dies in producing a relatively large number of vanes before the dies become so inaccurate as to require replacement.

The core 6, having been forged, any flash thereon at the edges of the dies is removed and the coating 8 is then applied either by spraying the material on or by electroplating the core as shown in the drawing. The coating 8 which is applied is not necessarily the exact shape and dimension of the finished vanes and this coating is shaped by a forging process to precisely the desired shape and finished dimension of the vane. Although this forging process may be any one of several which will produce the desired dimension, the particular forging process shown is a coining process in which the dies 12, which are the finish dies, act to coin the material of the coating 8 and produce the exact shape and dimension with no excessive material that might produce a flash around the edge of the vane.

The coining process is selected since the material of the coating may be selected such that

3

it will be readily coinable without reference to its strength at high temperatures since the core can function as the load carrying part of the vane.

It is to be understood that the invention is not limited to the specific embodiment herein illustrated and described, but may be used in other ways without departure from its spirit as defined by the following claim.

What is claimed is:

In the manufacture of a vane for a compressor or turbine, the vane being of a high temperature material which is difficult to forge, the steps which involve forging the vane to the desired shape and to a slightly smaller than finished dimension, trimming any flash from the edges of said forged vane, coating said vane with a coinable material having corrosion resistant

4

characteristics, the coating being enough in quantity to produce the desired finished dimension of vane, and coining said vane to said finished shape and dimension, said coining operation leaving said vane free from flash.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,561,900	Becket	Nov. 17, 1925
2,058,841	Thomson	Oct. 27, 1936
2,293,768	Schaefer	Aug. 25, 1942
2,503,630	Norton	Apr. 11, 1950

FOREIGN PATENTS

Number	Country	Date
381,102	Great Britain	Sept. 29, 1932