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K. E. FRANSSON

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MOUNTING FOR HOLLOW TURBINE BLADES

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Fig. 1.

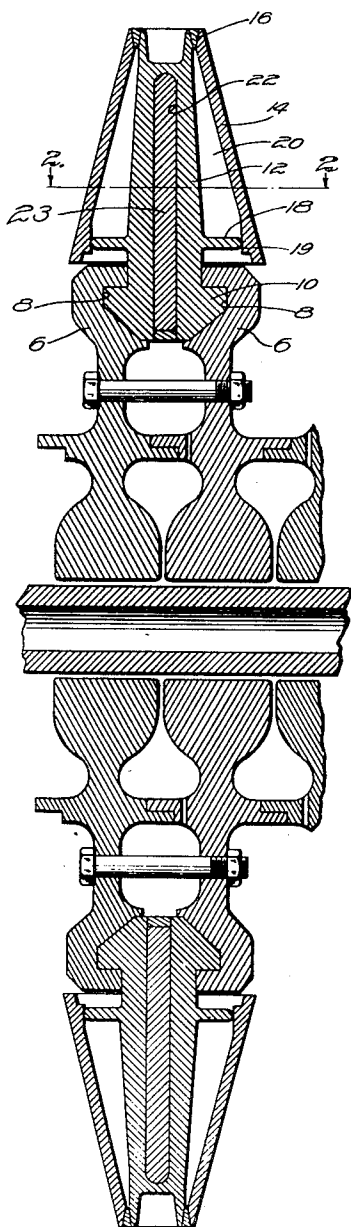


Fig. 2.

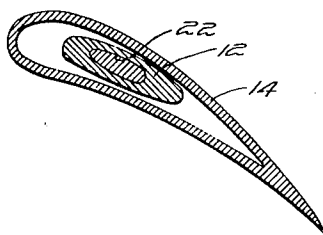
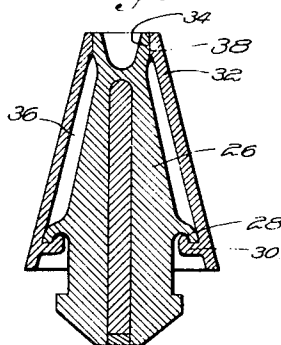


Fig. 3.



INVENTOR

Kenneth E. Fransson

BY

Charles H. Hansen

ATTORNEY

UNITED STATES PATENT OFFICE

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MOUNTING FOR HOLLOW TURBINE BLADES

Karl E. Fransson, Canton Center, Conn., assignor
to United Aircraft Corporation, East Hartford,
Conn., a corporation of Delaware

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5 Claims. (Cl. 253-77)

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This invention relates to an arrangement for mounting a hollow turbine blade on a turbine rotor. In the co-pending application of Buck, Serial No. 738,062, filed March 29, 1947, the turbine blade is positioned over a supporting post and is welded to the post at a point between its ends with the blade otherwise free from connection to the post. A feature of this application is an arrangement for mounting the hollow blade over a supporting post so that it will be free to expand radially with respect to the post but is supported against axial movement at spaced points. Another feature is an arrangement for positioning the turbine blade on the supporting post in such a manner that the loads on the blade, when the turbine is operating, will be compressive loads rather than tensile loads.

A feature of the invention is an arrangement of the rotor such that the blade-supporting post with the blade mounted thereon may be attached to the rotor without the necessity for mounting the blades on the posts while the latter are on the remainder of the rotor. Another feature is an arrangement for cooling the posts to retain the necessary strength on the post in spite of the high temperature of the gas flowing over the blade.

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

Fig. 1 is a sectional view through a turbine rotor showing the blade mounting.

Fig. 2 is a sectional view along the line 2-2 of Fig. 1.

Fig. 3 is a fragmentary sectional view similar to Fig. 1, showing a modification.

As shown in Figs. 1 and 2, the turbine rotor which may be a single or multistage axial flow turbine rotor, may be so constructed that each stage consists of a pair of discs 6 having lateral grooves 8 therein facing each other and in a position to engage with the root 10 of the post 12 which supports the hollow blade 14. The blade 14 which may be substantially airfoil shape in cross-section, as shown in Fig. 2, has a substantially uniform wall thickness to assure uniform heating and cooling of the blade. In the arrangement shown, the blade is fastened, as by a weld 16, to the outer end of the post 12 so that during rotation of the turbine rotor, the blade will be loaded substantially in compression as a result of the centrifugal forces acting on the blade. Adjacent the inner end of the blade, the post 12 carries a laterally projecting flange 18

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which pilots the blade, holding it in predetermined relation to the post without interfering with free radial movement of the blade to accommodate thermal expansion. The blade 14 may have a projecting rib 19 adjacent the flange 18, the elements of the inner surface of which are radial for engagement with the periphery of the flange regardless of relative thermal expansions.

Since the blade is loaded in compression, it will be apparent that it can withstand extremely high temperatures before failure; and since it is arranged so that it is out of contact with the post except at the weld 16, thereby providing an air space 20 surrounding the post, the latter is kept at a much cooler temperature than the blade itself. In addition, the blade may be cooled by providing a central passage 22 within the post which may be filled with sodium 23 or other material of high conductivity which preferably will be a liquid at the normal operating temperatures of the turbine. To increase the rate of heat transfer from the post 12 which carries the load of the blade, the space between the discs 6 may be supplied with a blast of cooling air 25 which will engage the inner surfaces of the roots of the posts.

With reference to Fig. 3, the post 26, comparable to the post 12, has in this arrangement a flange 28 adjacent its inner end which engages with a cooperating inwardly extending flange 30 on the blade 32 to support the blade against radial outward movement and thereby maintain the blade in predetermined relation to the post. At the outer end of the post, the blade 32 is supported by a ring 34 integral with the post which guides the blade in such a manner as to maintain its predetermined relation to the axis of the post but to permit radial movement of the outer end of the blade. The outer end of the blade may have an inwardly projecting rib 38 with the elements of its inner surface radial to assure contact between the ring 34 and the blade regardless of relative thermal expansions. In this arrangement the blade is spaced from the post except at its points of attachment to form an insulating air space 36.

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 claims.

I claim:

1. A turbine rotor having a number of radially-extending blade-supporting posts and a hollow blade positioned over each post, each blade hav-

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ing means for attaching it directly to the post at only one radial point, and means for piloting the blade on said post at another radial point spaced from the point of attachment, said blade being otherwise spaced from said post by an airchamber completely surrounding said post.

2. A turbine rotor having a number of radially-extending blade-supporting posts and a hollow blade positioned over each post, each blade having means for attaching it directly to the post at only one radial point, and means for piloting the blade on said post adjacent its inner end, said blade being otherwise spaced from said post by an airchamber completely surrounding said post.

3. A turbine rotor having a number of radially-extending blade-supporting posts and a hollow blade positioned over each post, each blade having means for attaching it directly to the post at only one radial point, and means for piloting the blade on said post adjacent the outer end thereby providing for free radial expansion of the blade with regard to the post, said blade being otherwise spaced from said post by an airchamber completely surrounding said post.

4. A turbine rotor having a number of radially-extending blade-supporting posts all in substantially the same plane, and a hollow blade positioned over each post, said blade having walls of substantially uniform thickness throughout and being substantially airfoil shape in cross-section, each blade having means for attaching it di-

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rectly to the post at only one radial point, and means for piloting the blade for radial movement on said post at another radial point spaced from the point of attachment, said blade being otherwise spaced from said post by an airchamber completely surrounding said post.

5. In a turbine rotor, a disk, a number of radially-extending blade-supporting posts having pieces positioned and held by said disk, and hollow blade elements mounted over each post, each of said blade elements having a relatively thin wall of substantially uniform thickness, each of said blade elements being directly attached to a post adjacent one end, and means on the post adjacent the other end of the blade element for guiding the blade element on the post without restricting radial movement of the blade relative to the post, said blade being otherwise spaced from said post by an airchamber completely surrounding said post.

KARL E. FRANSSON.

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