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LAMINATED INTERNAL FINNED AIR-COOLED
STRUT-SUPPORTED TURBINE BLADE
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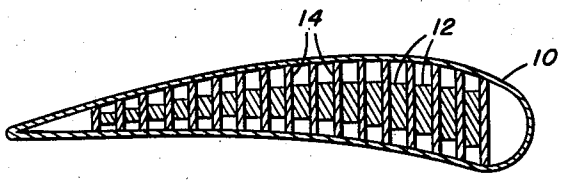


Fig. 1

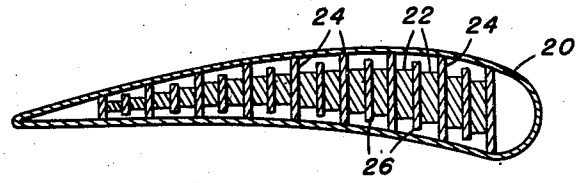


Fig. 2

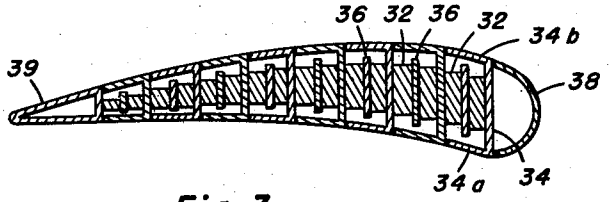


Fig. 3

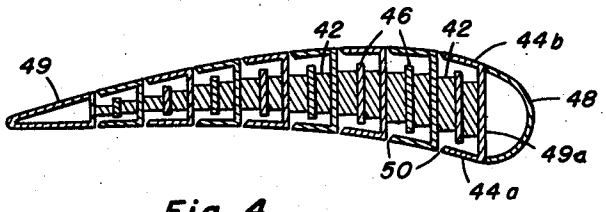


Fig. 4

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LAMINATED INTERNAL FINNED AIR-COOLED STRUT-SUPPORTED TURBINE BLADE

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Application May 31, 1955, Serial No. 512,355

3 Claims. (Cl. 253—77)

(Granted under Title 35, U. S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

The present invention relates to turbine blades and more particularly to laminated internally finned air-cooled strut-supported turbine blades.

In the prior art it is known to fabricate turbine blades using, generally, two main sub-assemblies, a finned strut and an airfoil shaped shell. Such a turbine blade is shown, for example, in Patent No. 2,648,520 to H. E. Schmitt, dated August 11, 1953. In this type of blade, the strut or core member is cooler than the airfoil shaped shell, and can thus withstand a much higher unit stress than the material of the blade shell. The cooler strut or core is secured to the turbine rotor and the shell is secured to the strut, so that there results a construction in which the cooler strut takes the major stress. The finned strut has heretofore been made of such methods as casting a strut with integral fins, or casting or forging a strut blank and then machining the fins therefrom. Such methods, while permitting the manufacture of a satisfactory blade, are objectionable as being costly and requiring extensive facilities.

The present invention provides turbine blades based on the concept of laminations formed from sheet metal.

An object of the present invention therefore is to provide a readily fabricated air-cooled turbine blade having an internally finned strut.

Another object is to provide such a turbine blade wherein all parts may be fabricated by methods lending themselves to fast, accurate production, such as sheet metal forming.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Fig. 1 is a cross section of one embodiment of a turbine blade made in accordance with the present invention;

Fig. 2 is a cross section of a second embodiment of invention;

Fig. 3 is a cross section of yet another embodiment of the invention, and

Fig. 4 is a cross section of still another embodiment.

Referring now to the drawings, wherein like reference characters designate like or corresponding parts throughout the several views, there is shown in Fig. 1 a turbine blade comprising an airfoil shaped shell **10** within which are a plurality of spacers **12** between which are a plurality of cooling fins **14** which extend to the interior surface of the shell **10**. The spacers **12** and fins **14** constitute a strut and are susceptible of being formed from sheet-metal flat or tapered stock, and are preferably so formed. After forming, the proper sized parts fins and spacers, are placed together in proper order, and a shell **10** placed over them. The shell **10**, spacers **12** and fins **14** are

joined, as by solder, to form an integral structure. As is known, the spaces provided permit cooling air to flow upwardly and outwardly, to cool the shell **10**, and this is true for each embodiment of the invention.

In Fig. 2 there is shown another embodiment of the invention comprising a shell **20**, spacers **22** and primary fins **24**, which latter extend to and contact the inner surface of shell **20**. The embodiment of Fig. 2 differs from that of Fig. 1 in that there are also provided in Fig. 2 secondary fins **26**, which are interspaced between alternate spacers **22**. These secondary fins **26** are also preferably formed from sheet metal flat stock, and are therefore easy to manufacture. The secondary fins **26** provide for additional cooling of shell **20**, as more space will be contacted by the cooling air.

A further embodiment is shown in Fig. 3 wherein there are provided spacers **32** and secondary fins **36**. In this embodiment there is no separate shell, but the shell is formed as an integral part of the primary fin. Thus, primary fin **34** is substantially in the form of a channel, with flanges **34***a* and **34***b* forming part of the shell. The tips of the flanges **34***a* and **34***b* abut against and are joined to, as by solder, the rear of the next primary fin in line and thus forms a complete blade. Appropriate formed nose piece **38** and tail piece **39** are soldered or otherwise joined to the assembly to complete the airfoil shape. As in the previous embodiments, all of the parts are formed from sheet metal, and cooling is effected in the known, stated manner.

The last embodiment is shown in Fig. 4, and secondary fins **46**, as well as channel shaped primary fins **49***a* having flanges **44***a* and **44***b*. As in Fig. 3 a nose piece **48** and tail piece **49** are used to complete the airfoil shape. However, this embodiment differs from Fig. 3 in that the tips of the flanges are not joined to the next primary fin in line, but instead fall short of the next fin, so that a plurality of span-wise extending slits **50** are provided in the blade. This construction permits additional cooling of the blade to be effected, still maintaining the ease of manufacture previously noted.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A turbine blade comprising a plurality of laminated interspaced spacers and primary and secondary fins, said secondary fins extending beyond said spacers and said primary fins being substantially channel shaped, the flanges of said channel shaped primary fins together constituting at least a part of the upper and lower chambers of said blade.

2. A turbine blade as in claim 1, the tips of the flanges of one channel shaped fin contacting the channel shaped fin next in line.

3. A turbine blade as in claim 1, the tips of the flanges of one channel shaped fin being spaced from the adjacent channel shaped fin.

References Cited in the file of this patent

UNITED STATES PATENTS

2,649,278	Stalker	Aug. 18, 1953

FOREIGN PATENTS

723,394	Great Britain	Feb. 9, 1955
852,786	Germany	Oct. 20, 1952
860,438	Germany	Dec. 22, 1952
992,645	France	July 11, 1951
1,007,303	France	Feb. 6, 1952

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,828,106 March 25, 1958

Wilson B. Schramm et al

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 53, for "upper and lower chambers" read -- upper and lower cambers --.

Signed and sealed this 11th day of November 1958.

(SEAL)
Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents