United States Patent

Anderson et al.

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[54] TURBOMACHINERY ROTORS

[72] Inventors: **Bernard J. Anderson,** Danvers, Mass.; **William E. Schoenborn,** Cincinnati, Ohio

[73] Assignee: **General Electric Company**

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[21] Appl. No.: **33,220**

[52] **U.S. Cl.** **416/219,** 416/244

[51] **Int. Cl.** **F01d 5/32,** F01d 5/02

[58] **Field of Search** 416/219, 244, 220, 221

[56] **References Cited**

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Primary Examiner—Everette A. Powell, Jr.
Assistant Examiner—Clemens Schimikowski
Attorney—Derek P. Lawrence, Frank L. Neuhauser, Oscar B. Waddell, Joseph B. Forman and Edward S. Roman

[57] **ABSTRACT**

A compressor rotor is disclosed having relatively thin angled platforms connected to the structural portion of a rotor disc by web means.

4 Claims, 4 Drawing Figures

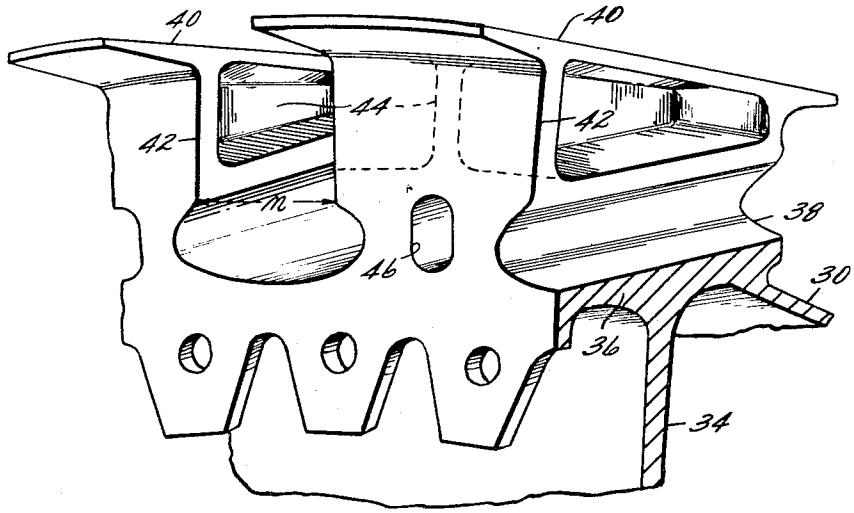


Fig 1

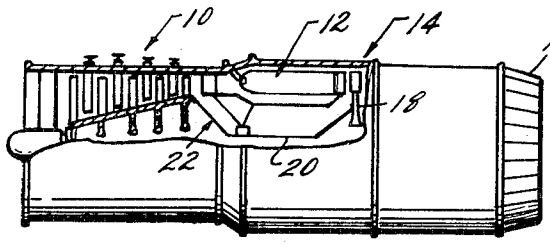
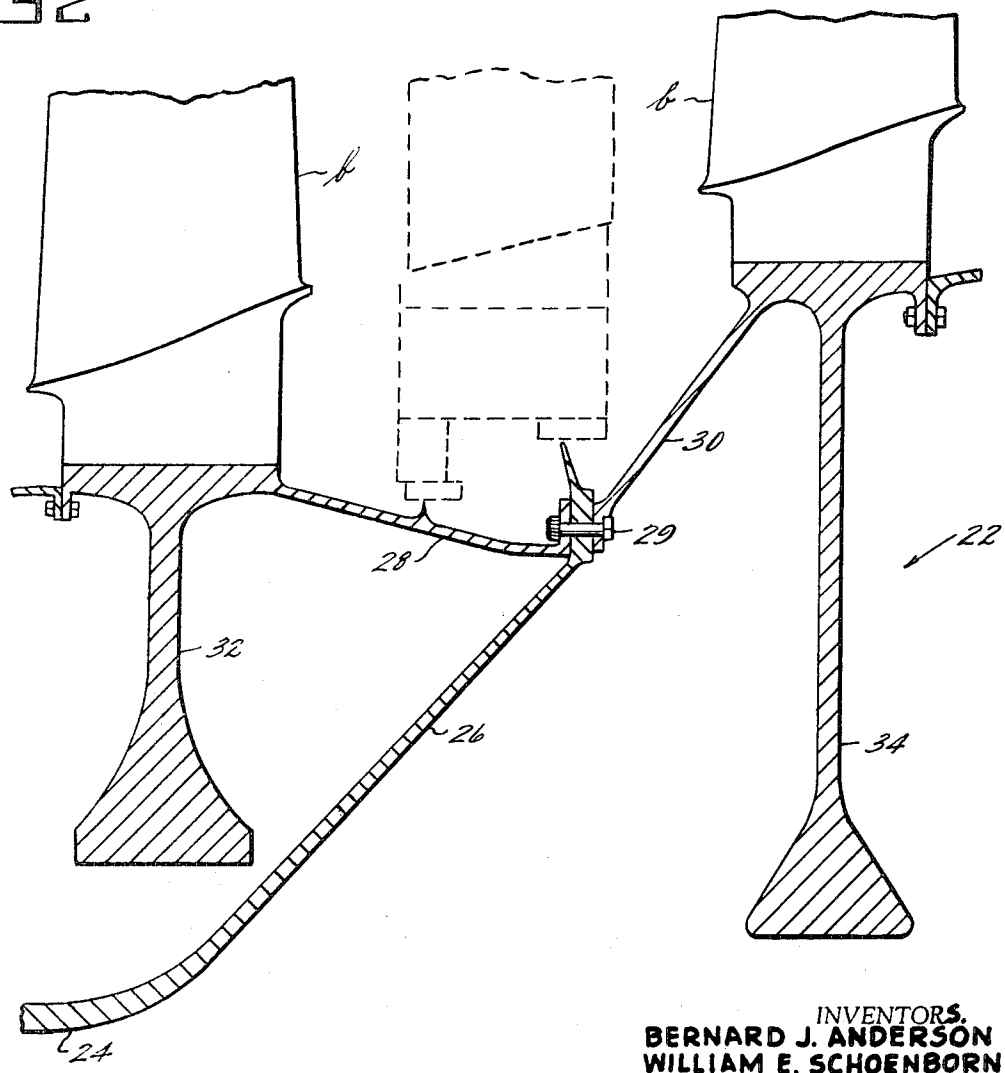


Fig 2



INVENTORS.
BERNARD J. ANDERSON
WILLIAM E. SCHOENBORN
BY
ATTORNEY

Fig 3

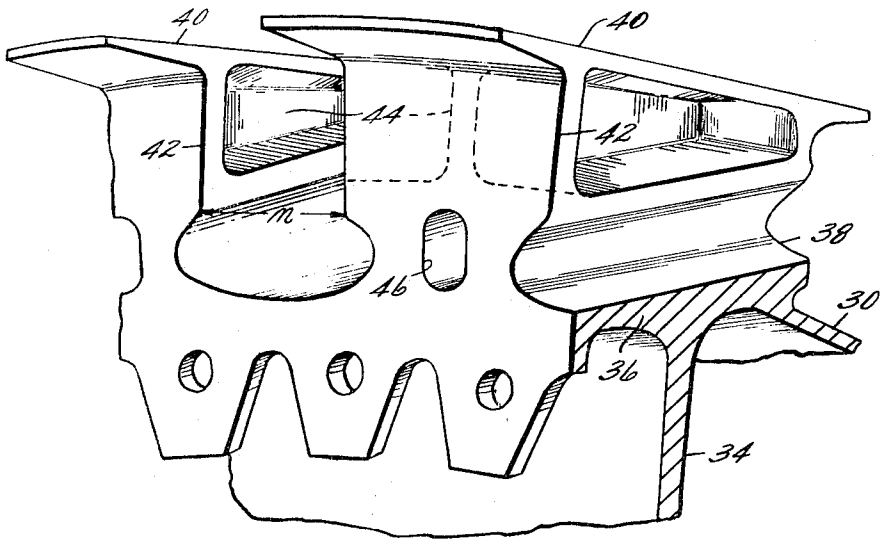
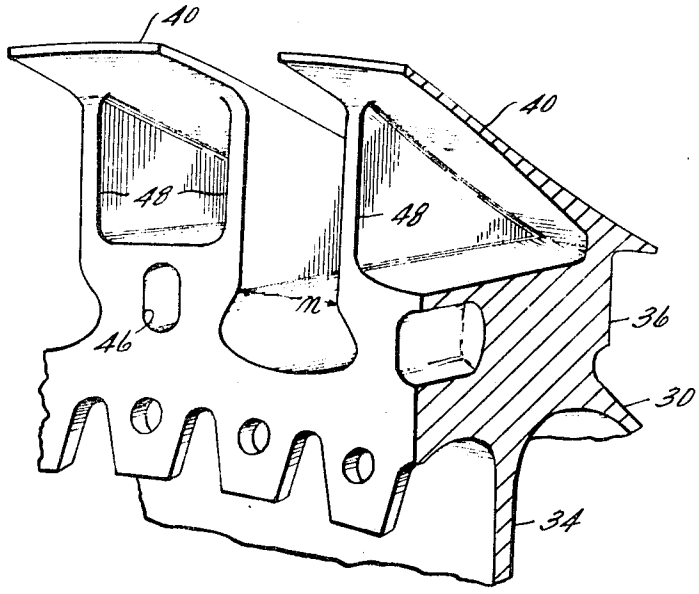


Fig 4



INVENTORS.
BERNARD J. ANDERSON
WILLIAM E. SCHOENBORN
BY
ATTORNEY

TURBOMACHINERY ROTORS

The invention described and claimed in the United States patent application herein resulted from work done under United States Government contract FA-SS-66-6. The United States Government has an irrevocable, non-exclusive license under said application to practice and have practiced the invention claimed herein, including the unlimited right to sublicense others to practice and have practiced the claimed invention for any purpose whatsoever.

The present invention relates to improvements in gas turbine rotors and more particularly to improvements in rotors which carry blades of an axial flow compressor or turbine incorporated on such engines.

Bladed rotors of axial flow turbomachinery provide a mounting means for the radially projecting blades. Generally, blade attachment is accomplished by tangs on the blades which are received in dovetail slots on the rotor. When the blades are assembled the composite rotor must have, between the blades, a smooth surface of revolution defining the inner bounds of the gas stream. Frequently oppositely projecting wings, referenced as platforms, are formed on the blades to provide the desired flow surface. It has been recognized that platforms formed on blades increase the "dead weight" loading of the tangs when the rotor is operating at high speeds. Platforms have also been formed integrally with rotors and as separate plates.

Platform weight, whether on the blades or on the rotor itself, increases the centrifugal forces on the rotor and results in increased rotor mass and weight to carry these forces without overstressing the rotor material. In aircraft propulsion engines weight is, of course, a critical factor.

Platform weight becomes most significant in rotors and comprising discs having dovetails spaced around their peripheries and a large change in platform diameter from the inlet side to the discharge side of the platforms.

The object of the invention is to provide an improved turbomachinery rotor of the type last referenced wherein platforms are provided with a minimum of weight and assured structural integrity.

These ends are attained by a turbomachinery rotor comprising a disc portion having integral periphery rim. Dovetail slots extend across the rim for the mounting of tanged blades thereon. The periphery of the structural portion of the rim terminates adjacent to and slightly outwardly of the necks of the dovetail slots. Relatively thin platforms are provided between each adjacent pair of slots. The platforms are angled outwardly from one side of the rim to the other and the inner portion of the platforms are integrally formed with one side of the rim. Relatively thin web means extend outwardly from the rim and integrally connect the remaining portions of each platform therewith.

Preferably the web means comprise a radially projecting web extending outwardly from the other side of the rim and an axial web extending from the radial web and from the rim to the inner side of the platform. Alternatively the web means can take the form of a pair of angularly spaced, axially extending webs projecting outwardly from the neck portions of the slots to said platforms throughout the width of the rim.

The above and other related objects and features of the invention will be apparent from a reading of the following description of the disclosure found on the accompanying drawings and the novelty thereof pointed out in the appended claims.

IN THE DRAWINGS

FIG. 1 is a schematic showing of a gas turbine engine;

FIG. 2 is a fragmentary longitudinal section of a rotor embodying the present invention;

FIG. 3 is a perspective view, with portions broken away and in section, of a rotor disc seen in FIG. 2, looking at the downstream side thereof; and

FIG. 4 is a perspective view, similar to FIG. 3, of an alternate embodiment of the invention.

Referencing FIG. 1, the illustrated gas turbine engine comprises an axial flow compressor **10** which pressurizes air discharged onto a combustor **12**. This air supports combustion of fuel in the generation of an annular hot gas stream. The hot gas stream drives a turbine **14** and then may be discharged from a nozzle **16** to generate a propulsive force. The turbine **14** comprises a rotor **18** which is connected by a shaft **20** to the compressor rotor **22** to power the latter.

A portion of the rotor **22** is shown in greater detail in FIG. **2**. A stub shaft **24** provides a mounting means for the forward end of the rotor. The stub shaft is integral with a cone portion **26** and connected by bolts **29** to two spacers **28** and **30**. The spacer **28** is integral with a first stage rotor disc **32** while conical spacer **30** is integral with a second stage disc **34**. The remainder of the rotor may be similarly fabricated with blades *b* projecting radially therefrom in circumferential rows or stages.

The second stage disc **34** is shown in greater detail in FIG. **3**. The disc has a rim **36** across which are machined dovetail slots **38**. The slots **38** receive correspondingly tapered tangs on the blades *b*. The high centrifugal, radial force loadings of the blades transition from the slots **38** into the rim **36** and then into the inner portions of the disc **34**. As a structural member carrying these radial loads, the rim **36** terminates above and closely adjacent to the necks *n* of the slots **38**. Between the slots **38** are relatively thin platform portions **40** which angle outwardly from the inlet side of the rim or disc to the discharge side thereof. The inlet sides of the platforms **48** are integrally formed and connected to the rim **36**. The discharge sides of the platforms **40** are connected to the rim **36** by relatively thin radial flanges **42**. The platforms **40** are also connected to the rim **36** by integrally formed webs **44** which extend in an axial direction centrally of the platforms.

Further, the rim may be lightened by axially extending cavities **46** intermediate each pair of slots **38**.

Alternately as shown in FIG. **4** the platform portions **40** may be connected to the rim **36** again having their inlet sides integrally formed with the rim **36** and with a pair of thin, axial webs **48** extending outwardly from the rim at the neck portions *n* of the slots **38**.

By minimizing the structural portions of the rim as described and by integrally connecting the platforms **40** with integral ribs, the desired flowpath function is provided across the bladed portion of the rotor with a minimum of centrifugal force loading on the disc and thus with a minimum of weight.

Having thus described the invention what is claimed as novel and desired to be secured by Letters Patent of the United States is:

1. A bladed turbomachinery rotor comprising:
- a disc portion,
- an integral peripheral rim formed on said disc,
- dovetail slots extending across said rim with their necks spaced below and closely adjacent to the outer periphery of the rim,
- platforms between each pair of slots, said platforms being relatively thin and angled outwardly from one side of the rim to the other, the inner portion of said platforms being integrally formed with one side of said rim, and
- relatively thin web means extending outwardly from said rim and integrally connecting the remaining portion of each platform therewith.

2. A rotor as in claim **1** wherein the web means take the form of a radially projecting web extending from between the neck portion of each slot outwardly from the other side of the rim to the platform and an integral axially extending web extending from said radial web and from the other side of the rim to the inner side of said platform, said axial web being disposed generally centrally of said platform.

3. A rotor as in claim **1** wherein the web means take the form of a pair of angularly spaced, axially extending webs projecting outwardly from the neck portion of said slots to said platforms throughout the width of said rim.

4. A rotor as in claim **1** wherein axially extending cavities are provided between each adjacent pair of slots.

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