# United States Patent [19]

**Violette**

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[54] **PLATFORM FOR COMPRESSOR OR FAN BLADE**


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[73] Assignees: **United Aircraft Corporation,** East Hartford, Conn.



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[52] **U.S. Cl.** ..... **416/220,** 416/248

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

[58] **Field of Search** ..... 416/219–221, 416/248, 215, 214, 193



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[57] **ABSTRACT**

The platform of a compressor or fan blade is fabricated into two complementary separate halves adapted to surround the root of each blade to define together with a plurality thereof a smooth aerodynamic surface and each half having depending arms at the ends adapted to fit into the dovetail of the blade disc transmitting the centrifugal load of the platform independent of the blade loads.


**8 Claims, 4 Drawing Figures**

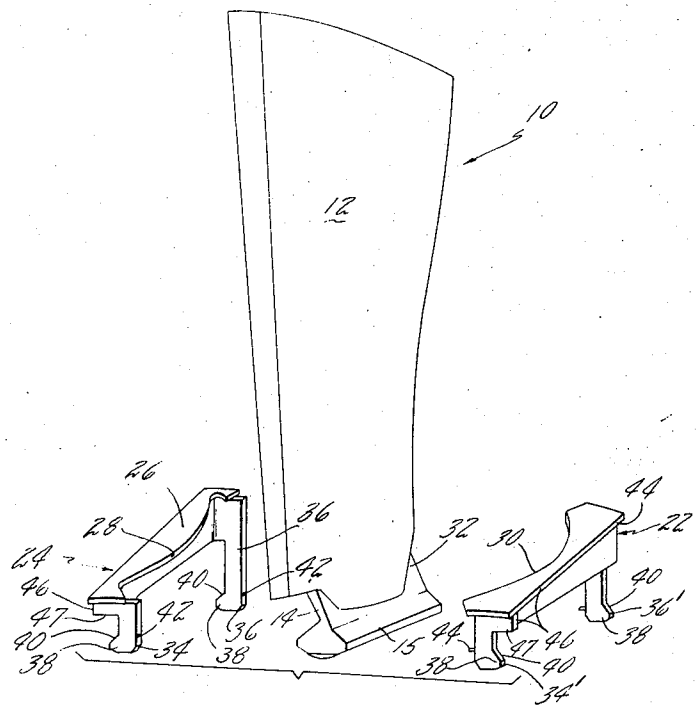


FIG. 1

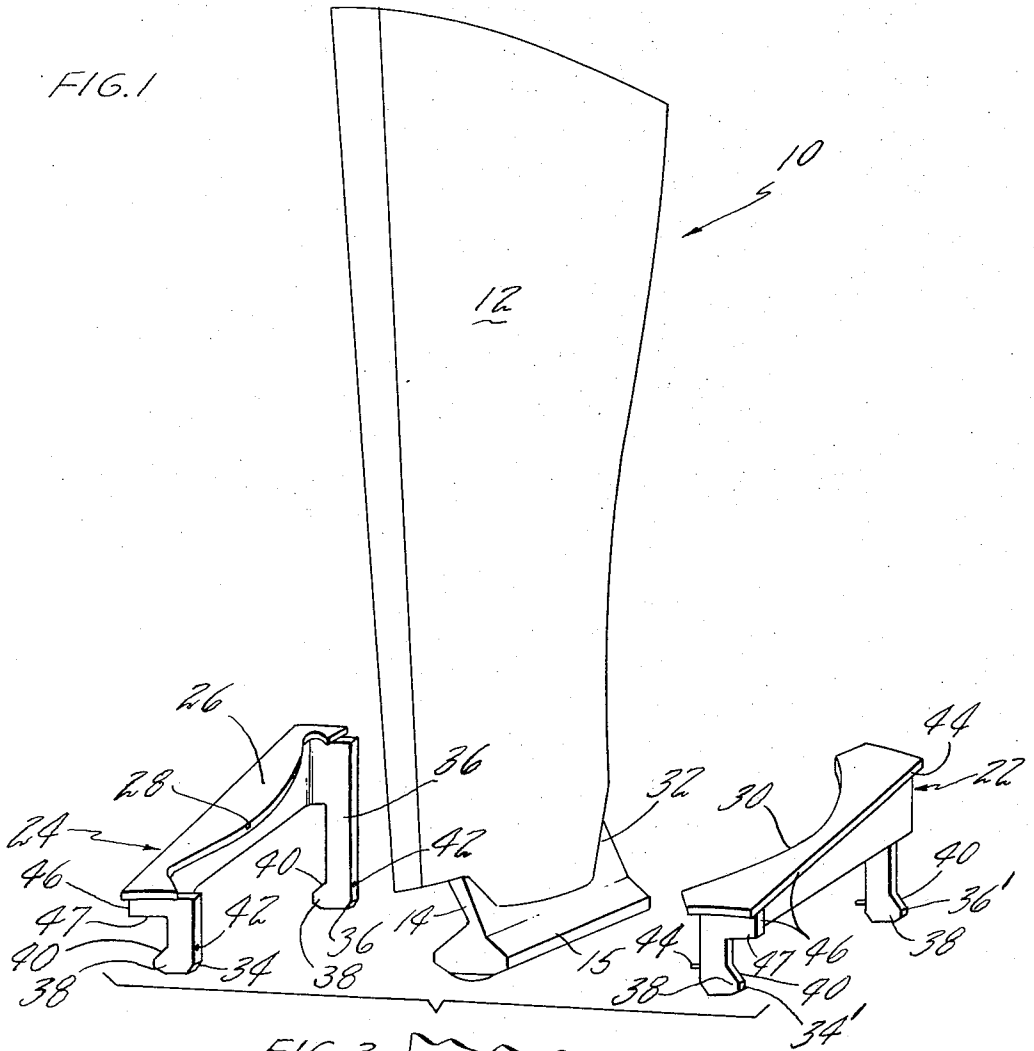



FIG. 3

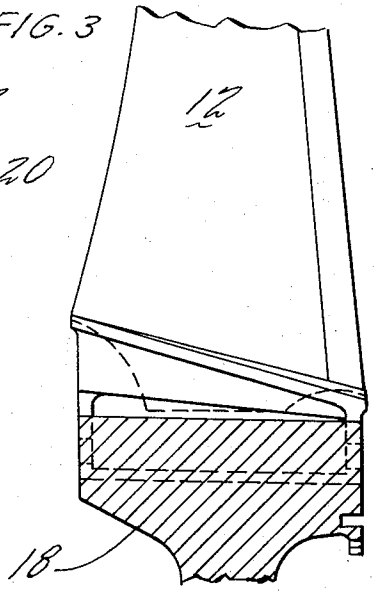



FIG. 2

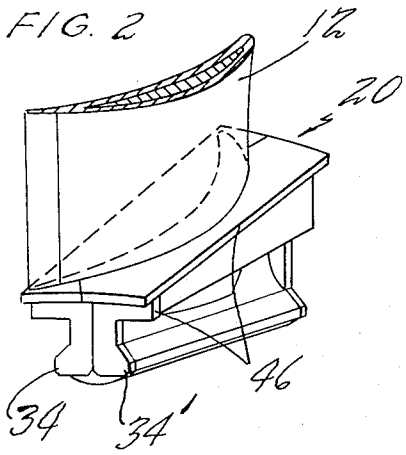
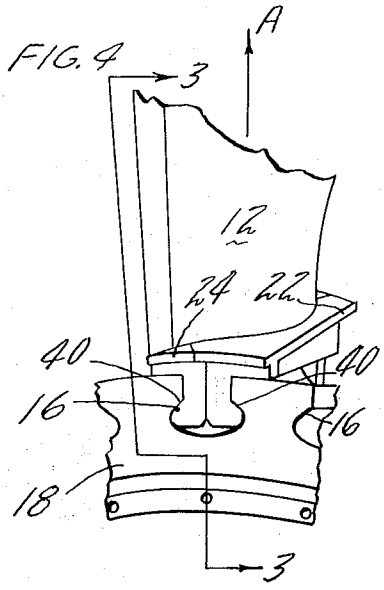



FIG. 4



# PLATFORM FOR COMPRESSOR OR FAN BLADE

## BACKGROUND OF THE INVENTION

This invention relates to the platform of a compressor and more particularly to an improved platform that serves the multi-functions of providing an aerodynamically smooth surface, seal and centrifugal load transmitting means.

As is well known in the art the compressor of a jet engine typically includes a platform formed adjacent the disc and in proximity to the blade root. The platform normally serves to define an aerodynamic smooth surface and seals the working medium at this junction point. Also, typically, the platform is formed integrally with the blade and is not a load carrying member. In the integral platform-blade configuration care must be taken in the manufacturing thereof so that sufficient strength at the point where the platform radiates from the blade is provided since this is a high stress point, where breakage from fatigue is likely. Thus, in certain applications this area of the blade and platform must be "beefed up." Additionally the sealing around the platform is generally accomplished by a seal extension machined integral with the disc which has proven to be a difficult and expensive operation.

I have found that not only can I obviate the stress problem of heretofore known compressor blades but in the case of a core-shell composite blade I can achieve greater dimensional latitude in the tab ending area. This is by virtue of my invention which contemplates fabricating the platform in a pair of mating halves to surround the blade at its tab ending. Additionally by providing properly shaped depending arms on the platform that fit into the dovetail slot of the disc, the platform can also serve the additional function of transmitting the centrifugal loads produced thereby to the disc and relieve this load which in some applications amounts to over one ton force from the platform. Furthermore, in accordance with my invention the complex and costly machine operation of forming the sealing structure on the disc is entirely eliminated.

## SUMMARY OF THE INVENTION

The primary object of this invention is to provide a platform for a compressor that is fabricated in separate halves that surround the compressor blade at its tab ending and carries depending arms adapted to fit into the dovetail slot of the disc in such a manner as to transmit thereto the certrifugal loads produced by the rotating platform.

A further object of this invention is to provide an improved compressor platform fabricated into separate complementary halves that reduces the tab ending stress, provides means for transmitting the centrifugal load to the compressor disc, eliminates the disc seal structure and is especially efficacious for compressor blades fabricated from composite materials.

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

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded perspective view of the blade and platform.

FIG. 2 is a partial view in perspective of the assembled blade and platform of FIG. 1.



FIG. 3 is a partial view partly in elevation and partly in section, taken along line 3—3 of FIG. 4, showing the platform-blade mounted in the dovetail slot of the compressor disc.

FIG. 4 is a partial view in elevation taken endwise of FIG. 3.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Reference is now made to FIGS. 1–4 illustrating the preferred embodiment of this invention as used on a compressor for a turbine type of power plant. The blade **10** comprises an airfoil shaped shell **12** which preferably is fabricated from a composite material such as boron epoxy or boron aluminum as described and claimed in a patent application entitled "Composite Fan Blade and Method of Construction" filed by E. Rothman on even date and assigned to the same assignee. The spar **14**, extends beyond shell **10** to form the root of the blade and defines a retention **15** that is adapted to fit into the dovetail slot **16** of compressor disc **18**. The compressor disc obviously carries a plurality of such slots for supporting a like number of blades to form the compressor rotor and only one being shown for the sake of clarity and simplicity.

The separable platform **20** is fabricated into two separate halves, the camber side half **22** and the face side half **24**. Preferably, the platform like the core is fabricated from a suitable metal such as titanium. The inner edge of the platform surface **28** of face-side half **24** and the inner edge **30** of the platform **32** are shaped to complement the face and camber sides of shell **12**.

Each platform half carries fore and aft depending arms **34, 34'** and **36, 36'** the primed referenced numerals refer to like reference numerals being mating arms and each pair of arms being dimensioned to overlie the edges or end faces of retention **15** and extend downwardly to be substantially coextensive therewith as can best be seen in FIG. **2**.

Each arm, **34, 34', 36** and **36'** has defined thereon at its lower outer extremity a lip **38** each being identically dimensioned and each having a load transmitting face **40**.

As can best be seen in FIG. **4** when retention **15** is inserted in the dovetail slot **16** of the disc **18**, the load transmitting faces **40** mate with a complementary face formed in the dovetail slot. These mating faces serve to transmit the centrifugal loads which tends to force the platform outwardly in the direction of arrow A produced by the rotation of the platform.

Dowel pins **44** may be incorporated in arms **34'** and **36'** to mate complementary holes **42** formed in arms **34** and **36** to align the halves of the platform. It is apparent from FIG. **2** that the platform when assembled extends above the tab portion and lower shell extremity portion of the blade. This provides a smooth transition of the blade shell and blade root when in the assembled position. It will also be apparent that no securing means are necessary to hold the halves in their relative positions.

The abutting edges **46**, those edges that abut the next adjacent platform in the disc **18** form an air seal when assembled so as to prevent flow of air between adjacent fan blades and surfaces **47** prevent flow of air to adjacent stages.

If necessary, the junction edges of the platform and shell in the assembled position may be treated with a

suitable plastic material such as silicone rubber to seal off the root of the blade from the air working surfaces. Additionally, this treatment serves to permit slight movement of the blade relative to the platform occasioned by vibrations at high speed.

What has been shown by this invention is a two-piece, separable platform with a connection directly to the disc dovetail slot, independent of the blade. This assembly not only reduces tab ending stresses but also alleviates the retention loading occasioned by the centrifugal loads by transmitting this load through the platform directly to the disc.

It should be understood that the invention is not limited to the particular embodiments shown and described herein, but that various changes and modifications may be made without departing from the spirit or scope of this novel concept as defined by the following claims.

I claim:

1. A compressor blade platform adapted to define a smooth aerodynamic surface when assembled in a compressor disc, said platform comprising for each blade supported by said compressor disc a pair of complementary elements each having a top platform surface which surfaces are contoured on one edge to closely accommodate the blade extending adjacent thereto, each blade having a root section having end faces extending into a slot formed in the compressor disc, each platform having depending members extending from the ends thereof into said slot adjacent to and in overlapping relation with said end faces of said root section, each of said depending members having means formed thereon for transmitting the load imposed by the rotation of said platform onto said disc independently of the compressor blade.

2. A compressor blade platform as claimed in claim 1 wherein said means includes a lip portion having a reaction surface bearing against a complementary surface adjacent said end faces of said root section formed in said compressor disc adjacent the slot formed therein and the root section transmits the load of the blade and said means transmits the load of the platform.

3. A compressor blade platform as claimed in claim 1 wherein said platform includes a side edge outwardly of said contoured edge adapted to engage the next adjacent platform supported in said compressor disc.

4. A compressor blade platform adapted to define a smooth aerodynamic surface when assembled in a compressor disc, said platform comprising a pair of complementary elements for each blade supported by said disc each having a top substantially flat platform surface which surfaces are contoured on an inner edge to closely accommodate the blade extending adjacent thereto, each platform having depending arms extending from the end thereof into a slot formed in the compressor disc, each of said arms having means formed thereon for transmitting the load imposed by the rotation of said platform onto said disc independently of the compressor blade, said blade having a retention portion having opposing side end faces formed at its root being supported in said slot formed in said compressor disc and said arms being disposed in overlying relation with said end faces.

5. A compressor blade platform as claimed in claim 4 wherein said depending arms are adjacent to and substantially coextensive with said end faces.

6. A compressor blade platform as claimed in claim 4 including lip portions having force reaction surfaces formed on the lower end of said depending arm, a complementary reaction surface formed on said disc in said slot for receiving the load transmitted by said arms when said platform is rotating.

7. In combination, a compressor blade, a compressor blade platform adapted to define a smooth aerodynamic surface when assembled in a compressor disc, said compressor blade having a retention formed at its root and supported in a slot formed in the compressor disc, said platform comprising a pair of complementary elements for each blade each having a top substantially flat platform surface which surfaces are contoured on an inner edge to closely surround the blade supported in said compressor disc and extending adjacent thereto, each platform having spaced depending arms substantially dimensioned the length of said retention and extending from the end of said platform into said slot formed in the compressor disc, each of said arms having means formed thereon for transmitting the load imposed by the rotation of said platform onto said disc independently of the compressor blade and each of said arms overlying the side faces of said root of the blade.

8. The combination as claimed in claim 7 wherein each of said depending arms carries rearwardly relative to said blade facing lip portion, a force reaction surface formed on the upper edge of said lip, a complementary reaction face formed in said disc engaging said reaction surface formed on said lip preventing said platform from moving radially outward with respect to the rotating center line when said platform rotates.

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