July 23, 1968 W. HARRISON 3,393,862

BLADED ROTORS

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Fig. 1.

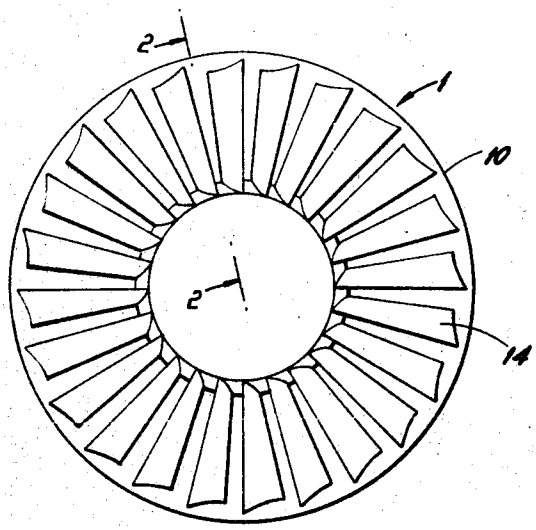
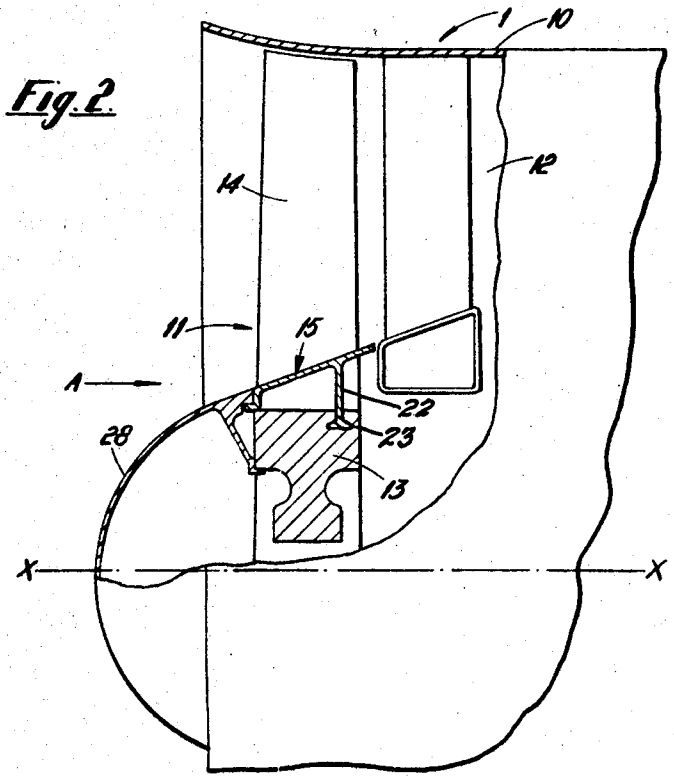


Fig. 2.



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Fig. 3

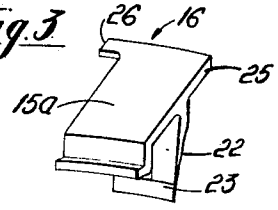


Fig. 4

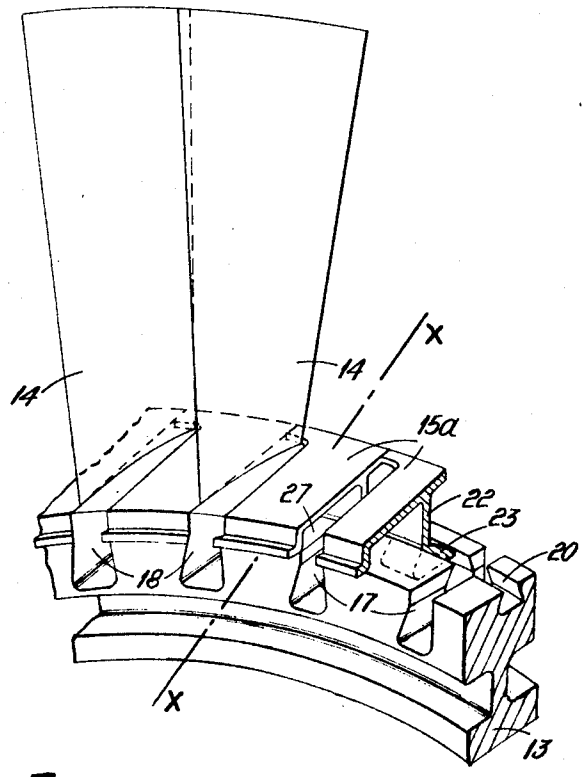
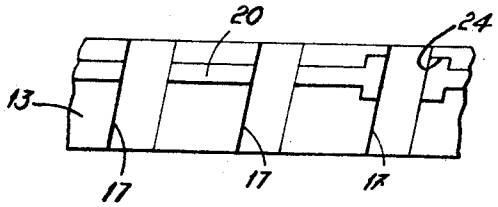


Fig. 5



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BLADED ROTORS

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11 Claims. (Cl. 230—134)

ABSTRACT OF THE DISCLOSURE

A bladed rotor assembly comprising a rotor disc and a separate annular blade platform, the rotor disc and blade platform being adapted to receive the root portions of the blades. The annular blade platform is made up of a plurality of platform segments, the segments defining therebetween a recess in which the blade fits. The recesses of the platform segments are opened at one axial side only of the rotor disc to permit the root portion of the blade entry from that side only. Each of the platform segments making up the annular platform is provided with a radially extending tongue which is engaged in a circumferentially extending keyway on the outer periphery of the rotor disc, the keyway and the tongue of the platform segment being so designed to retain each segment in position and fixed against radial and axial movement.

This invention concerns improvements in or relating to bladed rotors such as compressor rotors.

According to the present invention, in one aspect thereof, there is provided a bladed rotor assembly comprising a rotor disc, a plurality of blades and an annular blade platform having a plurality of angularly spaced apart recesses therein which accommodate respective blade roots, the blade platform comprising a plurality of platform segments secured to the disc, each platform segment being provided with a respective abutment member which is located in circumferentially extending abutment engaging means provided on the rotor disc to trap the segment against movement radially.

Preferably the abutment engaging means may comprise a keyway in the outer periphery of the rotor disc and the abutment member of each platform segment may comprise a tongue extending circumferentially in the keyway. Said tongues, and the keyway, may have respective radially inner ends which are enlarged in axial dimension, the keyway having an access portion with a circumferential extent substantially equal to that of each platform segment, through which access portion the tongues of the platform segments may be introduced singly into the keyway.

In a preferred embodiment the said blades have root portions located in recesses in the rotor disc, the said recesses in the blade platform being radially aligned with respective recesses in the rotor disc.

Preferably the number of platform segments is equal to the number of blades. The recesses in the blade platform may then be formed between the adjacent edges of abutting platform segments.

According to a preferred embodiment, the recesses in the rotor disc comprise slots extending across the periphery of the disc from one face to the other thereof, and the recesses in the blade platform comprise slots extending parallel to the slots in the rotor disc but closed at one end, whereby the platform permits entry of the blades from one face only of the rotor disc. The slots in the rotor disc and the platform preferably extend in a direction inclined to the axis of rotation of the rotor disc.

The invention finds particular applicability to the manufacture of rotor assemblies having synthetic resin components, since it has proved extremely difficult to make synthetic resin blades with integral platforms. Thus the blades and/or the platform segments of the rotor assembly according to the present invention may be formed of synthetic resin material.

The invention also includes a method of assembling the bladed rotor as hereinabove defined, in which the platform segments are first secured to the outer periphery of the rotor disc to form the blade platform and the root portions of the blades are then located in the recesses of the rotor disc and the blade platform.

The invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

FIGURE 1 is a front end view of an axial flow compressor having a first stage rotor assembly according to the present invention;

FIGURE 2 is an enlarged part-sectional view on the line 2—2 of FIGURE 1;

FIGURE 3 is a view of a platform segment from the direction of arrow A in FIGURE 2;

FIGURE 4 is a partially sectionalised perspective view of part of a rotor assembly according to the invention; and

FIGURE 5 is a developed view in a radially inward direction of part of the outer periphery of the rotor disc of the assembly shown in FIGURE 4.

FIGURES 1 and 2 show part of an axial flow compressor 1 of a gas turbine engine (not shown). The compressor 1 has an outer casing 10 within which a plurality of bladed rotor and stator stages are located. Thus the compressor 1 has a first stage rotor assembly 11 (FIGURE 2) and, immediately downstream of this, a first stage stator assembly 12, the remaining stages not being shown in FIGURE 2.

The rotor assembly 11 is constructed according to the present invention and comprises an annular rotor disc 13 mounted (by means not shown) for rotation about an axis X—X and having located in its outer periphery a plurality of blades 14 and an annular blade platform 15. The blade platform 15 extends between the blades 14 and defines part of the radially inner wall of the compressor duct. As illustrated in FIGURE 2, the blade platform is inclined in an axial plane to the axis of rotation X—X of the rotor disc 13.

The blade platform 15 comprises a plurality of platform segments 16 (FIGURE 3) which are separate from the blades 14 themselves and which abut each other circumferentially around the periphery of the rotor disc 13 to define the blade platform 15.

The location of the blades 14 and platform segments 16 on the rotor disc 13 to form the bladed rotor assembly 11 is illustrated in FIGURES 4 and 5. The outer periphery of the rotor disc 13 is provided with a plurality of blade-receiving recesses comprising parallel slots 17 extending from one face to the other of the rotor disc 13 and inclined at a small angle to the axis of rotation X—X thereof. Each of the slots 17 has a base which is enlarged in a circumferential direction (FIGURE 4) and each blade 14 has a root portion 18 with an enlarged radially inner end which corresponds with the shape of the blade-receiving slots 17. The outer periphery of the rotor disc 13 is also provided with a circumferentially extending keyway 20, the base of the keyway 20 being enlarged in axial dimension (FIGURE 4).

Each platform segment 16 has a radially inwardly extending tongue 22 (FIGURE 3), provided with an enlarged head 23 and extending in a circumferential direction. The size and profile of the head 23 in an axial plane is identical with that of the keyway 20, as illustrated by cut-away portion in FIGURE 4.

The keyway 20 is provided with an access portion 24

which has a uniform axial width equal to the width of the enlarged base of the keyway **20**, and a circumferential extent equal to the length circumferentially of the head **23** of each tongue **22**. The access portion **24** is provided in a portion of the keyway **20** which intersects one of the blade-receiving slots **17**.

Each platform segment **16** has a platform-defining portion **15***a* having a circumferential length equal to the circumferential spacing between adjacent blade-receiving slots **18**. The portion **15***a* has two parallel edges **25**, **26** which are arranged to be parallel to the direction of the blade-receiving slots **17** when the segments **16** are assembled to form the blade platform **15**.

The bladed rotor stage **11** is assembled by first introducing the head **23** of each platform tongue **22** into the keyway **20** of the rotor disc **13**, one at a time through the access portion **24**, until the full complement of platform segments **16**, equal in number to the number of blades **14** for which the rotor is designed, have been inserted. Edges **25** of the platform segments **16** abut edges **26** of adjacent platform segments **16**, so that the platform defining portions **15***a* thereof collectively define the blade platform **15**. The edge **26** of each platform segment is, however, provided with a recess having a uniform circumferential width equal to that of the radially outer end of the blade roots **18**, so that, when assembled, the blade platform **15** has a plurality of slots **27** (FIGURE 4) extending parallel to and radially aligned with the respective slots **17**. The recesses in the edges **26** of the platform segments **16** do not, however, extend fully across the platform-defining portion **15***a*, so that the slots **27** formed thereby are closed at their rearward ends.

The blades **14** are now placed in position, the root portions **18** being located in the respective slots **17**, as shown in FIGURE 4. It will be seen that the blade roots **18** are located circumferentially and radially by the slots **17**, and movement rearwardly of each blade root **18** is prevented by the respective platform segment **16**.

When the rotor stage **11** is finally positioned in the compressor casing **10** (FIGURE 2) the forward axially facing surfaces of the blade roots **18** and the blade platform **15** are engaged by a nose cone member **28**, so that the blades are then locked completely in the rotor disc **13**.

In the rotor assembly according to the invention, the rotor blades **14** and platform segments **16** are advantageously made of synthetic resin compositions, such, for example, as resin-bonded metal or glass fibres. The resultant blade assembly is then of comparatively low weight, an important consideration in the design of compressor components for gas turbine engines.

Although the rotor assembly of the present invention is particurarly decsribed with reference to a compressor rotor, it will be appreciated that the invention is applicable to rotor assemblies generally.

I claim:

1. A bladed rotor assembly comprising: a rotor disc having a plurality of angularly spaced apart recesses therein, a plurality of blades each having a root portion, an annular blade platform having a plurality of angularly spaced apart recesses therein, each root portion of said blades being received in one of said recesses of said rotor disc and one of said recesses of said platform, each of said recesses of said platform being open at one axial side only of said rotor disc to permit entry of said root portions of said blade from one side only of said rotor disc, said blade platform comprising a plurality of separate platform segments secured to the rotor disc, each of said platform segments having an abutment member, and said rotary disc having a circumferentially extending keyway in the outer periphery thereof which engages each abutment member to trap the respective platform segments against movement radially.

2. A rotor assembly as claimed in claim **1** wherein the number of platform segments is equal to the number of blades.

3. A rotor assembly as claimed in claim **2** wherein said recesses in the blade platform are formed between the adjacent edges of abutting platform segments.

4. A rotor assembly as claimed in claim **1** wherein the recesses in the rotor disc comprise slots extending across the periphery of the disc from one face to the other thereof, and the recesses in the platform comprise slots extending parallel to the slots in the rotor disc.

5. A rotor assembly as claimed in claim **4** wherein the slots in the rotor disc and the slots in the platform extend in a direction inclined to the axis of rotation of the rotor disc.

6. A rotor assembly as claimed in claim **1** in which the abutment member of each platform segment comprises a tongue extending circumferentially in the keyway.

7. A rotor assembly as claimed in claim **6** wherein the tongues of the platform segments, and the keyway, have respective radially inner ends which are enlarged in axial dimension, the keyway having an access portion with a circumferential extent substantially equal to that of each platform segment, to permit introduction of the platform segments singly into the keyway.

8. A rotor assembly as claimed in claim **7** wherein at least part of the access portion of the keyway is intersected by one of the root portion receiving recesses of the rotor disc.

9. A rotor assembly as claimed in claim **1** wherein the blade platform has an outer surface lying in an axial plane inclined to the axis of rotation of the rotor disc.

10. A rotor assembly as claimed in claim **1** wherein the blades are formed of synthetic resin material.

11. A rotor assembly as claimed in claim **1** wherein the platform segments are formed of synthetic resin material.

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