Sept. 12, 1967 F. B. MANNING 3,341,174

BLADE LOCK

Filed Feb. 27, 1967

FIG. 1

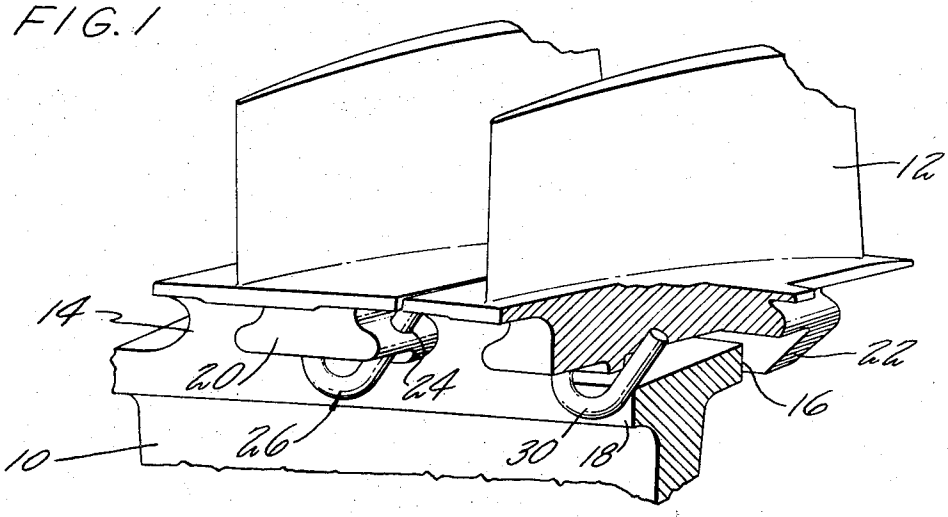


FIG. 3

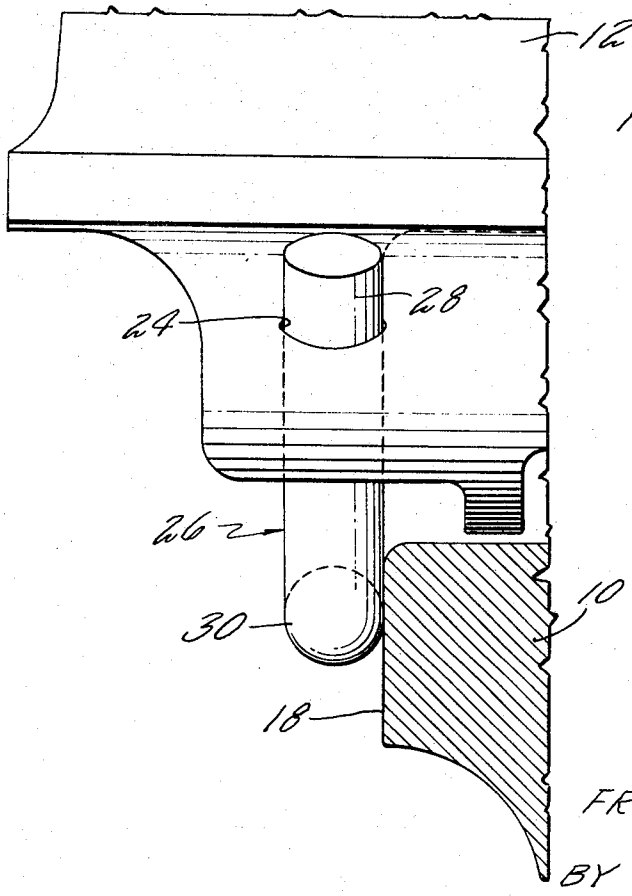
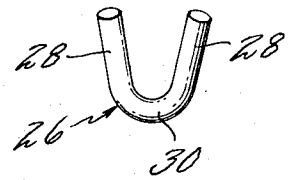


FIG. 2



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BLADE LOCK

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ABSTRACT OF THE DISCLOSURE

A turbomachine having a rotor assembly construction wherein a deformable blade lock is inserted into the blade root thereby preventing any axial movement of the blade in the rotor disc.

Background of the invention

This invention relates to a rotor assembly for use in a turbomachine and more particularly to a blade lock therein.

It is obvious that in a turbomachine some arrangement must be provided to hold or lock the blades in place in the rotor assembly. Probably the most common method of retaining blades in a turbine which is employed by the prior art is the use of a pin which extends in a generally radial direction through the wheel into the base of the blades. The most common method of retaining blades in a compressor which is employed by the prior art is the use of keys or tablocks which lie beneath the root of the blades at the bottom of the blade slots and are fixed to the wheel and blade.

While these and other similar locking devices provide adequate blade retention, they have a number of inherent disadvantages. For example, the pin-type locking device weakens the wheel at a point of very high stress with the result that the entire wheel must be made heavier than would otherwise be necessary, and this type of locking device tends to reduce the tangential blade tip wobble when the assembly is cold. The key or blade lock retention is weak in the axial direction with the result that the blades may walk out of the wheel slots.

Summary of invention

It is a primary object of this invention to provide a rotor assembly with a stronger and improved blade lock which is readily applied and removed while providing for the desired blade tip movement and not weakening the rotor disc.

The present invention relates to a deformable U-shaped blade lock. The rotor assembly which uses this blade lock contains a blade which when inserted in the rotor disc slot is prevented from moving axially in one direction by either stop means on the blade root or cooperating stop means on the blade and disc. After insertion of the blade, one end of the blade extends axially beyond the rotor disc. The blade root, at this end, contains two passages which extend in a plane generally parallel to the plane of the disc and these passages in the root are in generally abutting relationship to the rotor disc. These passages are oblique with respect to one another, the openings of the passages being chamfered to facilitate insertion of the U-shaped blade lock. As the U-shaped lock is inserted, the legs of the U are forced to follow the oblique passages, this deformation thereby preventing the blade lock from falling out. Once inserted, the U-shaped blade lock in cooperation with the stop means previously mentioned prevent any axial movement of the blade.

It is of significance that the U-shaped blade lock extends only into or through the blade root and not into the blade disc. This construction thereby permits removal or

insertion of the blade lock without any damage to the rotor disc. The blade lock described in this invention provides a much stronger blade lock because if the legs which are made to extend completely through the oblique passages as they normally are, then before the blade lock will fall out because of a failure, the blade lock has to be sheared off in four different locations.

Brief description of the drawings

FIGURE 1 is a fragmentary sectional view of a rotor assembly showing the device of the invention thereof.

FIGURE 2 is a view of the U-shaped blade lock in the nondeformed unassembled state.

FIGURE 3 is a fragmentary side view of a rotor assembly showing the device of the invention thereof.

Description of the preferred embodiment

Referring first to FIGURE 1 for a description of an illustrative embodiment of the invention, a compressor rotor **10** supports a series of radially extending blades **12** mounted in peripheral slots **14** extending from the rear or first face **16** of the rotor to its forward or second face **18** in a direction substantially axial with respect to the general disposition of the rotor.

Each blade **12** includes a root section **20** and in the embodiment illustrated, root section **20** has a radially inwardly extending flange **22** which abuts against first face **16**, thereby effectively preventing axial movement of the blade in one direction. The end of blade root opposite flange **22** contains two oblique passages **24**. Passages **24** are oblique with respect to one another and are positioned within blade root **20** such that the plane of passages **24** are generally parallel to the plane of rotor disc **10**. Passages **24** are positioned within root **20** such that when blade lock **26** is inserted in the passages, the extending portions of blade lock **26** abut against second face **18** of rotor disc **10**. FIGURE 3 clearly illustrates this description.

Blade lock **26** is a deformable U-shaped member and is illustrated in its nondeformed state in FIGURE 2. Legs **28** of the U-shaped member are inserted into passages **24** and as the legs are pushed through passages **24**, the U-shaped member deforms, this deformation then preventing the blade lock from falling out of the blade root **20**. Legs **28** preferably are made longer than passages **24** so that before the blade lock can fall out, as the result of a failure, blade lock **26** must shear in four separate places. Blade lock **26** when fully inserted into passages **24**, in cooperation with flange **22**, prevents axial movement of blade **12**. The arcuate portion **30** of the U-shaped member is used as the means for withdrawing blade lock **26** from passages **24**.

I claim:

1. A rotor assembly for a turbomachine comprising a disc having blade receiving slots in the periphery thereof extending generally axially from the first side of said disc to the second side, and removable blades including a root portion slidably mounted in said slots, wherein the improvement comprises:

one end of said root portion having stop means, the stop means abutting said first side of said disc, the root end remote therefrom extending axially beyond said slot, said axially extending end having at least two passages positioned obliquely with respect to one another, said passages extending generally parallel to the plane of said disc and being in abutting relationship to said second side of said disc;

and a deformable, substantially U-shaped member extending into said oblique passages, the portions of said U-shaped member which extend from said oblique passages beyond said root end abutting said

second side of said disc so that said blade cannot move axially after said U-shaped member is inserted.

2. A construction as in claim 1 in which:

the legs of said U-shaped member are longer than said oblique passages so that the arcuate portion of said U-shaped member and the ends of said legs abut against said second side of said disc.

3. A construction as in claim 1 in which:

the arcuate portion of said U-shaped member extends beyond said oblique passages so that said U-shaped member may be withdrawn from said oblique passages by applying a retracting means to said arcuate portion.

4. A construction as in claim 1 in which:

the legs of said U-shaped member extend in an outward direction relative to the center of said disc and the base of the U extends in an inward direction relative to the center of said disc.

5. A construction as in claim 1 in which:

said stop means comprises a radially inwardly extending projection, said projection abutting said first side of said disc.

6. A construction as in claim 1 in which:

the cross-section area of said oblique passages is substantially the same as the cross-section area of said legs of said U-shaped member.

7. A rotor assembly for a turbomachine comprising a disc having blade receiving slots in the periphery thereof extending generally axially from one face of the disc to the opposite face of said disc, and removable blades including a root portion slidably mounted in said slots, wherein the improvement comprises:

said root portion and said disc member having cooperating stop means to prevent axial movement in one direction, one end of said root portion extending axially beyond said slot, said axial extending end having at least two passages positioned obliquely with respect to one another, said passages extending generally parallel to the plane of said disc and being in abutting relationship to said disc; and

a deformable substantially U-shaped member extending into said oblique passages, the portions of said U-shaped member which extend from said oblique passages beyond said root end abutting said disc so that said blade cannot move axially after insertion of said U-shaped member.

8. A construction as in claim 7 in which:

the legs of said U-shaped member are longer than said oblique passages so that the arcuate portion of said U-shaped member and the ends of said legs abut against said disc.

9. A construction as in claim 7 in which:

the legs of said U-shaped member extend in an outward direction with respect to the center of said disc and the base of the U extends in an inward direction relative to the center of said disc.

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