

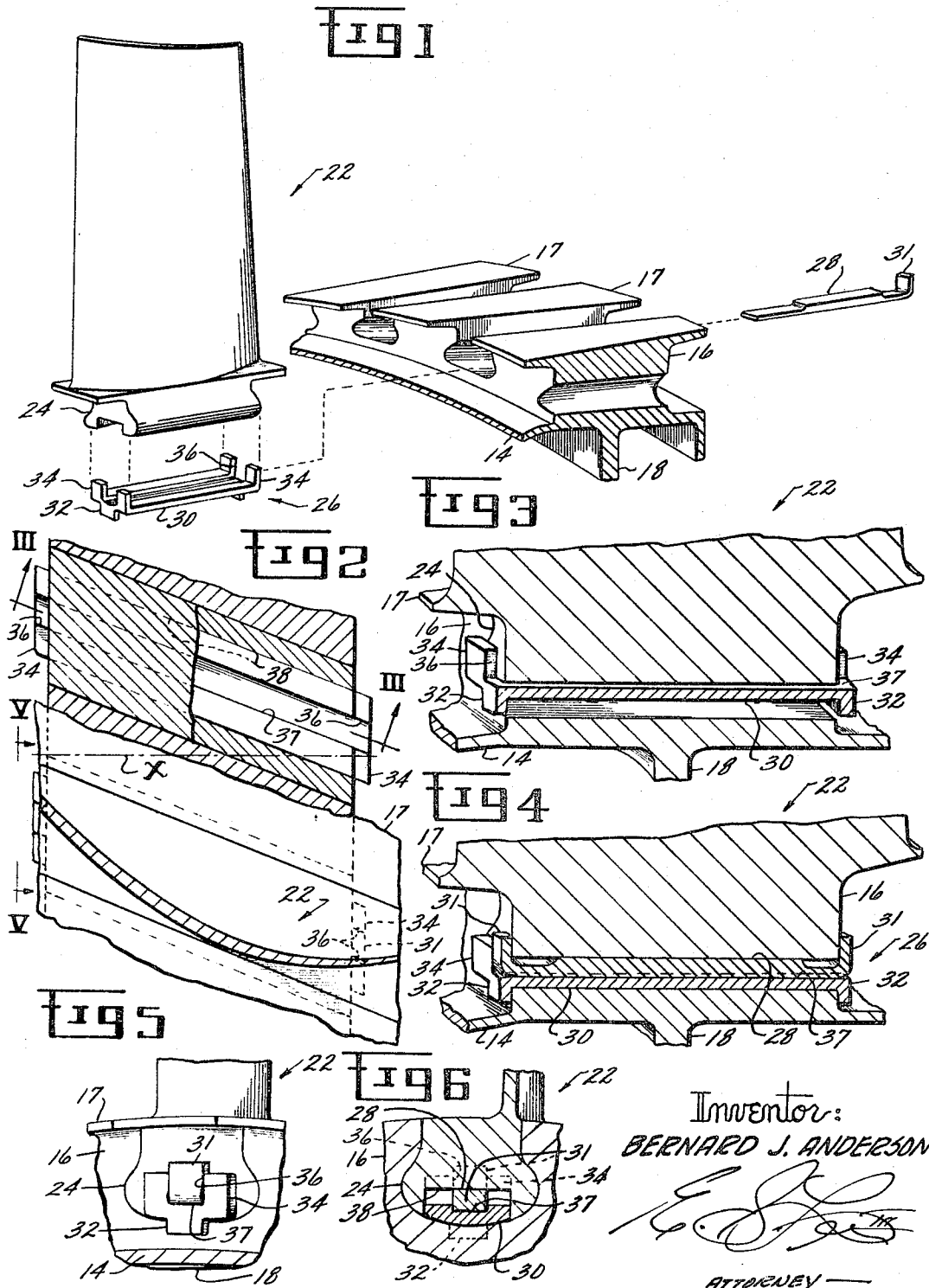
May 14, 1968

B. J. ANDERSON

3,383,095

LOCK FOR TURBOMACHINERY BLADES

Filed Sept. 12, 1967



Inventor:
BERNARD J. ANDERSON

ATTORNEY

1

3,383,095

LOCK FOR TURBOMACHINERY BLADES
 Bernard J. Anderson, Danvers, Mass., assignor to General Electric Company, a corporation of New York
 Filed Sept. 12, 1967, Ser. No. 667,169
 6 Claims. (Cl. 253—77)

ABSTRACT OF THE DISCLOSURE

The disclosure illustrates a fragmentary portion of a compressor rotor rim having tanged blades which are locked thereon by retainers lying between the bottoms of the tangs and slots in the rim. Each retainer comprises a bridge with legs at its opposite ends which embrace opposite ends of a tang and opposite sides of the rim. A keeper disposed between the tang and bridge maintains the retainer in its locking position. Absent the keeper, the retainer may be positioned in a slot in the bottom of the tang with its lower legs clear of the rim for assembly or removal of the blade.

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 turbomachinery rotors and, more specifically, to an improved mechanism for locking blades in place on such rotors.

In the manufacture of bladed turbomachinery rotors, it is common practice to mount the blades on the rotors through the use of tangs formed at the base of the blades which are received by corresponding slots formed across the peripheral face of the rotor. It has further been a commonly accepted practice, particularly in gas turbine engines for the propulsion of aircraft, to lock the blades in the rotor slots by use of retainers in the form of metal strips, which are slipped through the rotor slots and their ends bent so that they overlie both the tang and adjacent portions of the sides of the rotor. This is a simple arrangement which enables individual blades to be replaced as desired.

It has the disadvantage, however, that any relative movement between the blade and the rotor, in an axial sense, will be taken by a portion of the retainer which has been bent after assembly. While such a retainer can be designed to function satisfactorily, if an attempt is made to re-use it, or if it is not designed exactly as specified or used exactly as specified reliability problems can arise.

This problem has been recognized in the past, and, broadly speaking, it has also been recognized that the provision of a locking mechanism which eliminates axial loadings on a retainer which is bent in the process of assembly. However, proposals to eliminate an assembly-bent load-bearing retainer element have been either complicated, expensive, or not readily adaptable to all turbomachinery designs, as for example, wide base tangs and slots which are angled relative to the rotor axis.

The object of the invention is therefore to provide an improved lock for a blade mounted on a rotor and in doing so to eliminate any substantial axial loading on any portion of the lock which is bent on assembly, and, particularly, to do so in a manner suitable for blades which are mounted in slots angled relative to the rotor axis, as well as for wide base tangs.

2

To this end a turbomachinery rotor is employed with the usual circumferential rim having slots thereacross. Blades are mounted in these slots by means of tangs at their inner ends. A clearance is provided between the slot and the lower surface of the tangs. A blade lock comprising a retainer and a keeper are employed to maintain each blade in

similarly between the tab 31 and the body of the keeper 28.

As thus described, the retainer 26 would be positioned below the tang 24 and introduced into a groove 38 formed along the lower surface of the tang 24. The height of the groove 38 is sufficient so that when the bridge 30 is introduced therein, with the legs 34 embracing opposite end surfaces of the tang, the legs 32 are above the lower surface of the slot 20. This enables the tang with the keeper assembled thereon to be introduced into the slot 20, as illustrated in FIGURE 3. When the end faces of the tang 24 are aligned with the side faces of the rim 16, the keeper may then be shifted radially inwardly so that the legs 32 embrace the radial faces of the rim 16, while the legs 34 remain in engagement or embracing relation with the end faces of the tang 24 FIGURES 4 and 5.

The unbent portion of the keeper 28 may then be slid through one notch 36 through the groove 37, beneath the tang 24, and finally through the notch 36 at the opposite end of the retainer. The protruding end of the keeper is then bent upwardly, as illustrated in FIGURES 4 and 5 to form a tab 40 and thus positively lock the retainer in place. The retainer thus locks the blade relative to the rim 16 and any axial loadings tending to shift the blade in the slot 20 are taken by the legs 32, 34 and not by the bent tabs of the keeper 28. It will also be noted that it is preferred that the pre-bent tab 31 and the tab 42, bent upon final assembly, extend upwardly between the slotted portions of the legs 34 to minimize the profile of the locking device in an axial direction, and thus minimize windage effects as the rotor rotates.

Also the described locking device provides an effective seal preventing interstage air leakage through the tang and slot connection for mounting the blade.

In this connection it will be noted that the legs 32 extend from central portions of the bridge 30. This provides machining access to the lower marginal edge surfaces of the bridge so that they may be machined and better correspond to the profile of the slot. Further, this provides, in combination with groove 37 sufficient strength for both the bridge and the body portion of the keeper 28.

Various modifications of the disclosed embodiment will occur to those skilled in the art, and the scope of the present inventive concepts is therefore to be limited solely by the following claims.

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

1. In a turbomachinery rotor comprising a circumferential rim with slots thereacross and blades having tangs received by said slots wherein there is a clearance from one end to the other of the tang between the slot and at least a portion of the lower surface of the tang, a blade lock for each blade comprising,
 - a retainer having a bridge, disposed in said clearance, with outwardly and inwardly extending legs at its opposite ends respectively embracing the opposite ends of the tang and the opposite radial faces of the rim when in its locking position, and
 - a keeper also inserted into said clearance and maintaining the retainer in its locking position, at least one leg of said retainer being sufficiently short relative to said clearance that, absent the keeper, the retainer may be radially shifted in said clearance so that the one leg will be moved out of locking relation thereby providing for assembly and removal of the blades from the rotor.
2. A combination as in claim 1 wherein the lower surface of the tangs has a slot formed along its length to provide said clearance with said slot.
3. A combination as in claim 2 wherein the radial faces of the rim or disposed in planes normal to the axis of the rotor and the slots in said rim are angled relative to said rotor axis.
4. The combination as in claim 3 wherein the outwardly extending legs of the retainer have central aligned notches, and the keeper comprises a metal strip inserted through said notches between the bridge and the lower surface of the tangs and has its ends bent outwardly to secure the keeper in position.
5. A combination as in claim 4 wherein the inward

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,383,095

May 14, 1968

Bernard J. Anderson

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, line 24, "or" should read -- are --.

Signed and sealed this 7th day of October 1969.

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

WILLIAM E. SCHUYLER, JR

Commissioner of Patents