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BLADE PIN RETENTION

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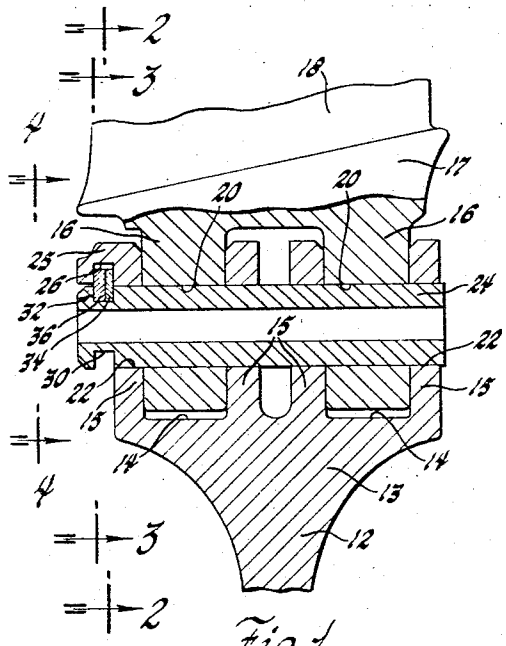


Fig. 1

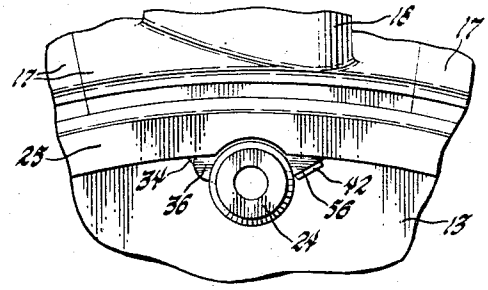


Fig. 4

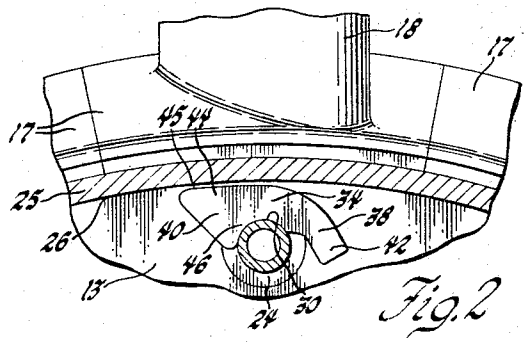


Fig. 2

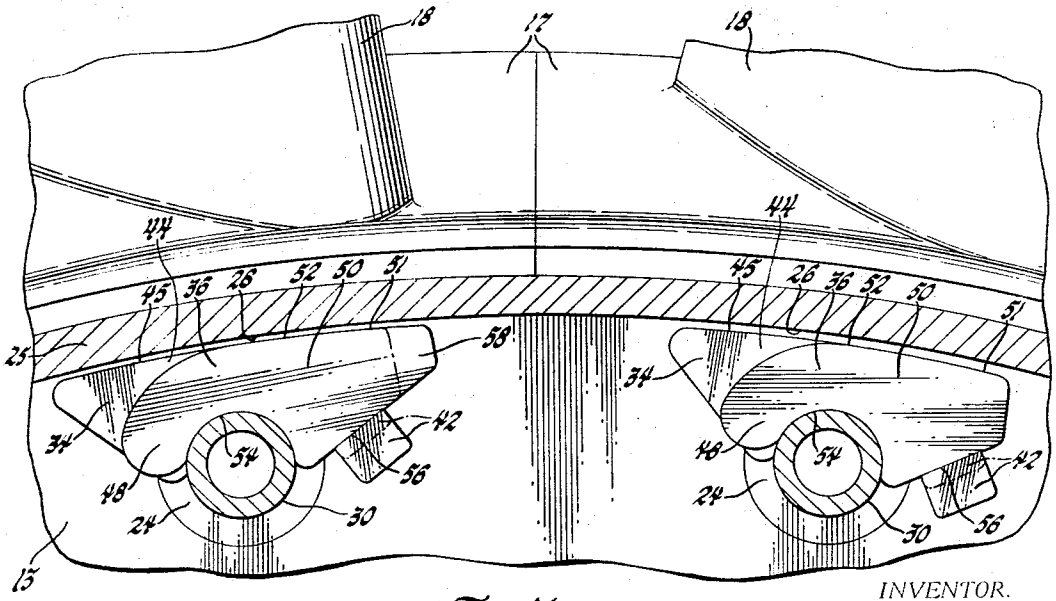


Fig. 3

INVENTOR.
Esten W. Spears, Jr.

BY

F. J. Fodale

ATTORNEY

United States Patent Office

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BLADE PIN RETENTION

Esten W. Spears, Jr., Indianapolis, Ind., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

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7 Claims. (Cl. 253—77)

My invention relates generally to the mounting of blades in a rotor and more specifically to a blade pin retainer for a pin-connected type of rotor blade mounting. Today nearly all of the bladed rotors used in turbomachinery comprise a rotor or wheel in which the blades are individually mounted on the periphery of the wheel. One of the general types of construction is that in which the blades have apertures in their roots which align with apertures in the rotor periphery so as to receive a pin which hinges the blades to the rotor. My invention is specifically directed toward means for retaining this pin in the aligned apertures. Such a retention means should incorporate the following desirable features. The retention means should be capable of two-way retention since the pin if unheaded is capable of withdrawal from either direction. It is also desirable that each of the pins be individually retained so that a single blade may be changed without disturbing the remainder of the blades. It is also desirable that no mounting apertures or other weakening types of modification be required for the rotor and that the retaining means be of relatively cheap manufacture and structural simplicity.

The object of my invention then is to provide a blade pin retainer which incorporates all of the above features.

Bladed rotors, like all rotating machinery, usually require static and dynamic balancing. Another object of my invention is to include means on the blade pin retainers for balancing the rotor. This feature integrates two functions into a single device, that is, blade retention and rotor balancing.

Other objects and advantages of this invention will be understood by reference to the following detailed description and the accompanying drawings wherein:

FIGURE 1 is an elevation view partially in cross section of a pin-connected bladed rotor provided with a blade pin retainer in accordance with my invention.

FIGURE 2 is a section taken substantially along the line 2—2 of FIGURE 1 and looking in the direction of the arrows.

FIGURE 3 is a section taken substantially along the line 3—3 of FIGURE 1 and looking in the direction of the arrows.

FIGURE 4 is a section taken substantially along the line 4—4 of FIGURE 1 and looking in the direction of the arrows.

Referring to FIGURE 1 in detail, I have shown a portion of a rotor **12** having an enlarged rim **13**. The rim **13** has a pair of spaced circumferential grooves **14** to define three lands **15**. As shown, the middle land **15** is bifurcated by a narrow groove but this is not necessary to the invention. The spaced grooves **14** are adapted to receive a pair of depending tangs **16** on a blade root **17**. The tangs **16** have aligned apertures **20** which are aligned with one set of a number of circumferentially spaced sets of aligned apertures **22** in the rotor **12** so as to receive a pin **24** to radially mount the blade **18** to the rotor **12**. The left land **15** has a flange **25** extending axially from the outer face of its periphery. The axial flange **25** has an inwardly opening groove **26** which is axially aligned with a circumferential groove **30** adjacent the left end of the pin **24**. A blade pin retainer indicated generally at **32** has marginal portions disposed in each of the grooves **26** and **30** and provides two-way retention of the pin **24** within the aligned apertures **20** and **22**. Each of the blade pin retainers **32** comprises a lock tab **34** and a retainer element **36**.

Referring now to FIGURE 2, the lock tab **34** is shown in greater detail. The lock tab **34** is a flat piece of soft metal having an insertable arcuate portion **38** at its right side. The maximum width or thickness of the arcuate insertable portion is no greater than the radial distance between the bottom axial wall of the groove **26** and the bottom axial wall of the pin groove **30**. The right hand end portion **42** of the insertable lock tab portion **38** is bendable. The left hand portion **40** of the lock tab **34** is enlarged and curves around and abuts a portion of the circumference of the pin groove bottom wall on the left side. This left hand portion **40** increases to a width which is greater than the radial distance between the bottom wall of the groove **26** and the bottom wall of the groove **30**. Thus the lock tab **34** is insertable from the left and prevented from withdrawal from the right. The radial outer marginal portion **44** of the lock tab is disposed in the rotor groove **26** while the radially inward marginal portion **46** is disposed in the pin groove **30**. An outer circumferential edge **45** of the marginal portion **44** adjacent the left end is adapted to abut the bottom wall of the rotor groove **26** to prevent the lock tab from rotating clockwise out of the position shown in FIGURE 2.

The retainer element **36** is best understood in reference to FIGURE 3. There are two retainer elements shown for purposes which will become evident later. The retainer elements are substantially identical so that only one need be described. The following description is in connection with the retainer shown on the right. Corresponding parts of the retainer shown on the left are identified by the same numbers.

The retainer element **36** is insertable between the pin groove **30** and the rotor groove **26** from the right since the arcuate left hand portion **48** has a maximum thickness or width no greater than the radial distance between the bottom walls of these grooves. One the other hand, the right hand portion **50** wraps around the circumference of the bottom wall of the pin groove **30** and increases in thickness so that the retainer element **36** may not be withdrawn circumferentially from the left. The retainer element **36** overlies the lock tab **34** with its radially outer marginal portion **52** lying in the rotor groove **26** and its radially inward marginal portion **54** lying in the pin groove **30**. An outer circumferential edge **51** of the radially outer marginal portion **52** adjacent the right end of the retainer element **36** is adapted to abut the bottom wall of the rotor groove to prevent the retainer element from rotating counterclockwise out of the position shown in FIGURE 3. The inner circumferential edge of the retainer element **36** adjacent the right end includes a locking surface **56** which is skewed with respect to the radius of the rotor **14** which passes through the center of the pin **26**. The function of the locking edge will be understood in the below described assembly of the blade pin retainer. The right hand ends of the retainer elements **36** may include additional material such as that shown by the portion **58** in the retainer shown at the left. By adding various amounts of material to one or more of the retainers as shown in the left, it is possible to balance the rotor should it be required.

The pin blade retainer is assembled in the following manner. The lock tab **34** is first inserted into the aligned grooves **26** and **30** circumferentially from the left until its inner circumferential ends abut the bottom wall of the pin groove **30**. It is then rotated slightly clockwise until edge **45** abuts the bottom wall of the rotor groove **26**. The retainer element **36** is then inserted circumferentially from the right so that it overlies the lock tab **34** and until its inner circumferential edge also abuts the bottom wall of the pin groove **30**. It is then rotated counterclockwise

until edge **51** abuts the bottom wall of the rotor groove **26** With both the lock tab **34** and the retainer element **36** in the position shown in FIGURE 3 the bendable portion **42** on the lock tab **34** is then bent up into the phantom line position where it engages the lock edge **56** on the right hand portion of the retainer element **36**. In the assembled position, the bent up end **42** prevents withdrawal of the retainer element **36** circumferentially from the right while its enlarged right hand portion **50** prevents withdrawal circumferentially from the left. Abutment edge **51** on the radially outer marginal portion **52** is adapted to abutment of the bottom wall of the rotor groove **26** so as to limit rotation of the retainer element **36** about the pin groove **30** in the counterclockwise direction. The end **42** being bent up to abut locking surface **56** prevents clockwise rotation.

In like manner, the abutment of the bent portion **42** on the lock tab **34** with the locking edge **56** on the retainer element **36** prevents circumferential withdrawal of the lock tab **34** from the left and counterclockwise rotation of the lock tab. The enlarged left hand portion **40** on the other hand prevents circumferential withdrawal from the right while the abutment edge **45** on the radial outer margin of the lock tab **34** engages the bottom wall of the rotor groove **26** to limit rotation of the lock tab **34** about the pin **26** in the clockwise direction. The lock tabs **34** and retainer elements **36** thus joined from a blade pin retainer which secures the pin **26** in the aligned apertures **20** and **22** of the rotor and blade roots, respectively. FIGURE 4 shows the blade pin retainer in its final assembled position. It is to be understood that both abutment surfaces do not necessarily have to actually abut the bottom wall of the rotor groove as the retainer may accommodate a slight rotational play.

For disassembly, each blade may be individually removed from the rotor **12** by merely bending down the end **14** of its lock tab **34**, rotating the retainer element **36** slightly, and withdrawing it circumferentially from the right. The lock tab **34** is then rotated counterclockwise slightly and withdrawn from the left. The pin may then be removed and blade **18** demounted from the rotor **12**. Preferably, a new lock tab will be used in reassembling the blade to the rotor.

Thus it can be seen that I have provided a blade pin retainer which provides two-way retention for the pin **24**. The retainer is designed so that each blade **18** may be individually mounted or demounted on the rotor **12**. The rotor **12** requires no mounting apertures or other weakening types of modification and the blade pin retainer is of relatively cheap manufacture and structural simplicity. Additional material may be added to the blade pin retainer to balance the rotor. Thus I have incorporated all of the features in my blade retainer as set forth above.

Various modifications are contemplated and may obviously be resorted to by those skilled in the art without departing from the spirit and scope of the invention as hereinafter defined by the appended claims, as only a preferred embodiment thereof has been disclosed.

I claim:

1. A blade pin retainer for a bladed rotor in which the blade roots are mounted on the rotor by axial pins disposed in aligned apertures in the blade roots and rotor and in which the rotor has a flange extending axially from a face thereof provided with a groove opening toward a groove adjacent an axial end of each of said pins, said pin grooves being aligned with said rotor groove, comprising, in combination, a lock tab for each of said pins having one end portion circumferentially insertable between said aligned grooves with a bendable portion on the end thereof, a retainer element for each of said pins overlying each of said lock tabs and having one end portion circumferentially insertable between said aligned grooves and a locking edge adjacent the opposite end thereof, said locking tabs and retainer elements being inserted from opposite sides of said pins and said bendable portions on said lock tabs being bent over said lock edges, whereby said lock tabs and said retainer elements are held in their operative positions to form said blade pin retainers, said blade pin retainers having a portion disposed in said rotor groove, and a portion disposed in said pin grooves whereby said pins are retained in said aligned apertures to mount said blades on said rotor.

2. The blade pin retainer as defined in claim **1** wherein the insertable end portions of said lock tabs and said retainer elements have a width no greater than the radial distance between the bottom walls of said rotor groove and said pin grooves and wherein portions adjacent the opposite ends of said lock tabs and said retainer elements have a width greater than said radial distance.

3. The blade pin as defined in claim **2** wherein each of said lock tabs has a radially outer marginal portion disposed in said rotor groove and a radially inner marginal portion disposed in said pin grooves and wherein each of said retainer elements has a radially outer marginal portion disposed in said rotor groove and a radially inner marginal portion disposed in said pin grooves.

4. The blade retainer as defined in claim **3** wherein said radially outer marginal portions on said lock tabs have an abutment edge adjacent their said opposite ends adapted to abut the bottom wall of said rotor groove to prevent rotation of said lock tabs about said pins in one direction and wherein said radially outer marginal portions on said retainer elements have an abutment edge adjacent their opposite ends adapted to abut the bottom wall of said rotor groove to prevent rotation of said retainer elements about said pins in an opposite direction, said bent up lock tab cooperating with said locking edge to prevent rotation of said lock tabs in said opposite direction and said retainer elements in said one direction.

5. The blade retainer as defined in claim **4** wherein said rotor flange is adjacent the outer circumferential edge thereof with said rotor groove opening radially inwardly.

6. The blade retainer as defined in claim **5** wherein each of said retainer elements has its opposite end selectively weighted to balance said rotor.

7. The blade retainer as defined in claim **1** wherein each of said retainer elements has its opposite end selectively weighted to balance said rotor.

No references cited.

MARTIN P. SCHWADRON, *Primary Examiner.*

E. A. POWELL, JR., *Assistant Examiner.*