June 19, 1962 C. E. HOCKERT 3,039,740

BLADE RETAINER

Filed Nov. 27, 1959

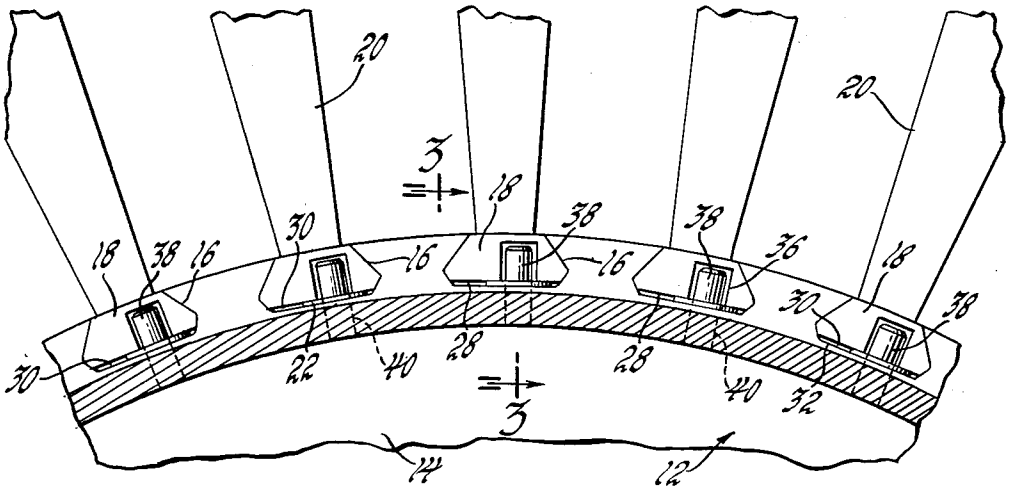


Fig. 1

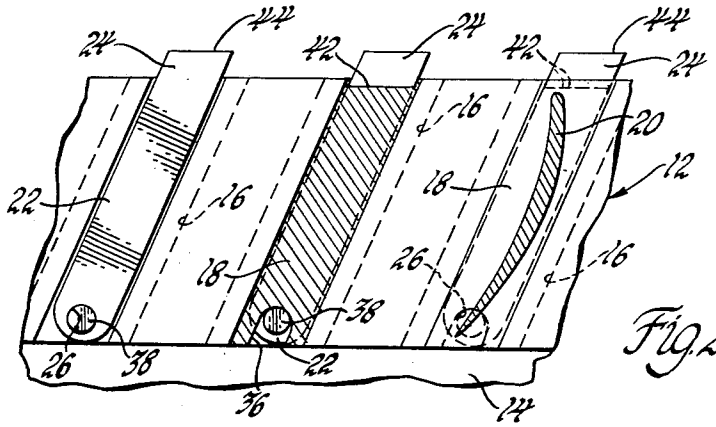


Fig. 2

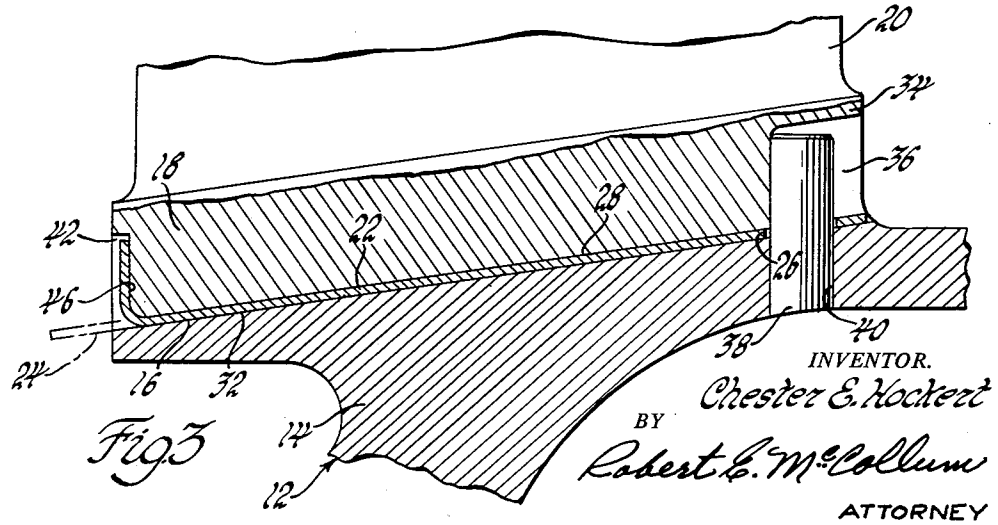


Fig. 3

INVENTOR.
Chester E. Hockert
BY
Robert E. McCollum
ATTORNEY

United States Patent Office 3,039,740 Patented June 19, 1962

3,039,740

BLADE RETAINER

Chester E. Hockert, Indianapolis, Ind., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Filed Nov. 27, 1959, Ser. No. 855,690
2 Claims. (Cl. 253—77)

This invention relates to a wheel assembly, and more particularly to an axial flow type wheel assembly provided with means to prevent axial movement of the blades with respect to the wheel.

The replacement of a rotor blade in a rotor assembly often necessitates total disassembly of the rotor, requiring a rebalancing of the entire rotor upon reassembly, which is expensive and time consuming. This invention is directed towards eliminating this objection by providing a blade retainer that is easy and economical to manufacture and permits an easy and quick assembly or disassembly of the blade with respect to the wheel.

Therefore, it is an object of this invention to provide a blade lock that permits the easy assembly or disassembly of a rotor blade with respect to the wheel of a rotating assembly.

Other features, objects and advantages will become apparent upon reference to the succeeding detailed description of the invention, and to the drawings illustrating the preferred embodiment thereof, wherein,

FIGURE 1 is an end cross sectional view of a portion of a wheel assembly embodying the invention,

FIGURE 2 is a top view of a portion of the wheel assembly of FIGURE 1 with parts broken away and in section, and

FIGURE 3 is an enlarged cross sectional view of a detail of FIGURE 1 taken on a plane indicated by and viewed in the direction of the arrows 3—3 of FIGURE 1.

Referring to the drawings, and more particularly to FIGURE 1, there is shown therein an arcuate portion of a wheel assembly **12** of the axial flow type for use preferably in an axial flow compressor rotor assembly, although the invention could be embodied also in a turbine assembly or similar installations without departing from the scope of the invention.

The wheel assembly **12** comprises an annular wheel or disc **14** having a number of circumferentially spaced transverse grooves or slots **16** of a dove-tail shape in the periphery thereof. Each of the slots **16** slideably receives therein a mating root **18** of an air foil type blade **20** formed integrally therewith or otherwise secured thereto, the mating root and slot preventing radial separation of the parts, while however permitting axial relative movement for assembly and other purposes. While the roots and slots have been shown as being dove-tailed to each other, a fir-tree type connection or other similar axial interfit could be used without departing from the scope of the invention.

As shown more clearly in FIGURES 2 and 3, the blade locking means for axially locating each of the blades with respect to the wheel includes a thin flat sheet metal flexible plate **22** adapted to be positioned in each of the grooves **16** along the length thereof and beneath the root **18** of each of the blades for cooperation therewith in a manner to be described to positively lock the blade and wheel against axial relative movement. The plates **22** extend transversely across the wheel **14** and therebeyond at one end **24** and are provided at their other ends with an opening or hole **26**, both constructions being for a purpose to be described.

The base portion **28** of each of the blade roots **18** is sheared or ground off to provide a radial clearance **30** between the root and the base **32** of the slot **16**, the clearance being substantially equal to the thickness of the plate **22**.

The blade roots **18** at their downstream edge **34** are each longitudinally grooved to provide a slot or recess **36** of a depth to abuttingly receive one end of a pin **38** insertable through the aperture or hole **26** in plate **22** and one of a plurality of circumferentially spaced holes **40** drilled in the wheel **14** beneath each slot **16**, each recess **36**, hole **26** and hole **40** being aligned upon assembly of the root, plate and wheel.

After the plates **22** are positioned in place, and each of the pins **38** is inserted in the holes **40**, the blade roots **18** are then slid axially in the slots **16** until they abut the pins **38**, thereby locking the blade from movement in the downstream axial direction. To prevent movement of the blade relative to the wheel in the other or upstream axial direction, the end **24** of plates **22** extending axially beyond the edges of the blade root is bent radially outwardly 90° from the position shown in phantom lines in FIGURE 3 to that shown in full lines into a circumferentially extending slot **42** milled across the end of the root, the slot being of depth slightly greater than the plate thickness. The blade is thus locked securely to the wheel against both axial and radial movement.

For assembly purposes, as shown in FIGURE 2, each of the end edges **44** of plate **22** is cut parallel to the edge of the wheel so that after bending the end 90° into the root recess **42**, the outer edge of the plate will be parallel with the outer radial portion of the slot.

As seen more clearly in FIGURE 3, the particular wheel assembly illustrated corresponds to the initial stages of a multi-stage axial flow type compressor, for example, wherein the blade-to-wheel connection is disposed at an angle with respect to the axis of rotation of the wheel to provide the most efficient path and direction for the flow of gas across the platform defined by the outer radial surfaces of the blade roots and wheel. Because of this angle and the fact that rotation of the wheel assembly creates a centrifugal force on the mass of the blade and root, the blade is normally urged in a downstream axial direction in an attempt to separate the root and wheel. Pins **38**, however, prevent this axial movement and therefore lock the blades to the wheel during normal running operation of the engine. The bent up end portions **24** of plates **22**, likewise, prevent separation of the blades from the wheel in the other axial direction due to gravitational forces thereon upon engine shut down. Therefore, under all conditions of operation and shut down, the blades are fixedly secured to the wheel against both radial and axial movement.

The assembly is therefore as follows; first, pins **38** are press fitted or otherwise fixed into each of the holes **40** in the wheel **14**. Flat plates **22** are then hooked over the pins **38** and positioned in place in grooves **16**. Each of the blade roots is then slid axially into place from the upstream side until it abuts the pin **38** in the groove **36**, and the opposite ends **24** of plate **22** are then bent outwardly 90° to the position shown in full lines in FIGURE 3 to position the end totally within recess **42** to abut edge **46** of the blade root, thereby securing the blade from any relative axial movement with respect to the wheel.

Assembly could also be accomplished in other suitable ways within the scope of the invention, such as positioning the plates in grooves **16** aligning holes **26** and **40** prior to insertion of the pins **38**, etc.

Disassembly of the unit to replace a blade is accomplished easily and efficiently by simply shearing off the bent end **36** of plate **22** and reversing the assembly process. A blade of equal weight and balance may therefore be inserted in place of the original blade without disturbing the assembly or balance of the wheel per se or the remainder of the rotor (not shown).

Therefore, it will be seen that this invention provides

a blade lock preventing axial relative movement of a plurality of blades with respect to a rotor wheel, as well as a blade lock that is economical to manufacture, and easy to assemble and disassemble.

While the invention has been illustrated in FIGURES 1–3 in its preferred installation, it will be clear to those skillled in the art to which this invention pertains that many changes and modifications may be made thereto without departing from the scope of the invention.

I claim:

1. A wheel assembly including a wheel axially slotted around the periphery thereof, a plurality of blades having roots secured to said wheel in said slots for a sliding axial movement therebetween, and means to prevent said sliding axial movement, said means including a longitudinally extending plate adapted to be inserted in each of said slots beneath the blade root, one end of said plate being apertured, said blade root being relieved at one edge to provide a groove extending axially from said edge to a position in line with said aperture, said wheel being apertured adjacent said plate aperture to thereby present an aligned set of openings upon assembly of said root, plate and wheel, stop means insertable through the wheel and plate apertures and root groove preventing axial relative movement therebetween in one direction by the abutment of said root against said stop means, and other means preventing axial relative movement of said root, plate and wheel in the opposite direction.

2. A wheel assembly including a wheel axially slotted around the periphery thereof, a blade having a root secured to said wheel in one of said slots for a sliding axial movement therebetween, and means to prevent said sliding axial movement, said means including a flat plate extending between opposite edges of said blade and positioned for cooperation with said blade root and wheel, one end of said plate being apertured, said wheel having an aperture therein aligned with said plate aperture upon assembly of said blade root, plate and wheel, stop means insertable through said apertures and extending beyond into engagement with said blade root, said blade root having a slot extending axially from one edge thereof to accommodate said stop means and permit sliding axial movement of said blade root relative to said wheel and plate in one direction until stopped by abutment against said stop means, and other means on said plate preventing axial relative movement between said blade root, plate and wheel in the opposite direction.

References Cited in the file of this patent

UNITED STATES PATENTS

2,595,829	Dean	May 6, 1952
2,761,648	Purvis	Sept. 4, 1956
2,928,651	Turnbull	Mar. 15, 1960
2,935,296	Hockert et al.	May 3, 1960

FOREIGN PATENTS

1,106,414	France	Dec. 19, 1955
1,165,560	France	Oct. 27, 1958