

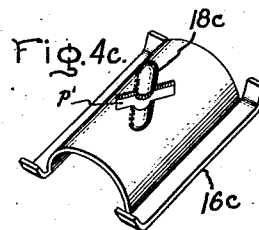
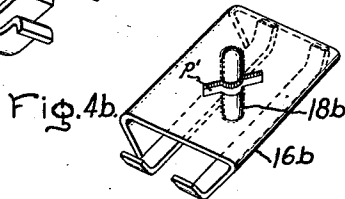
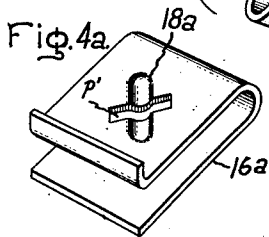
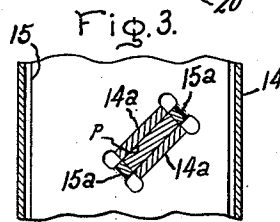
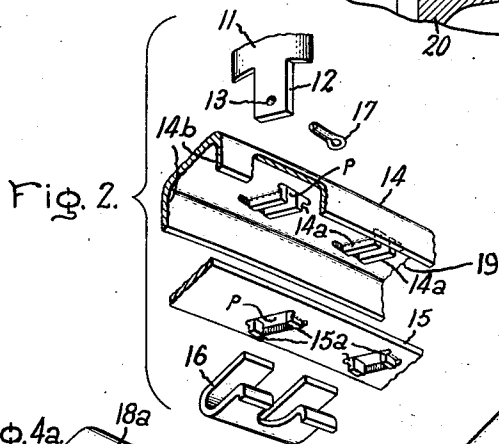
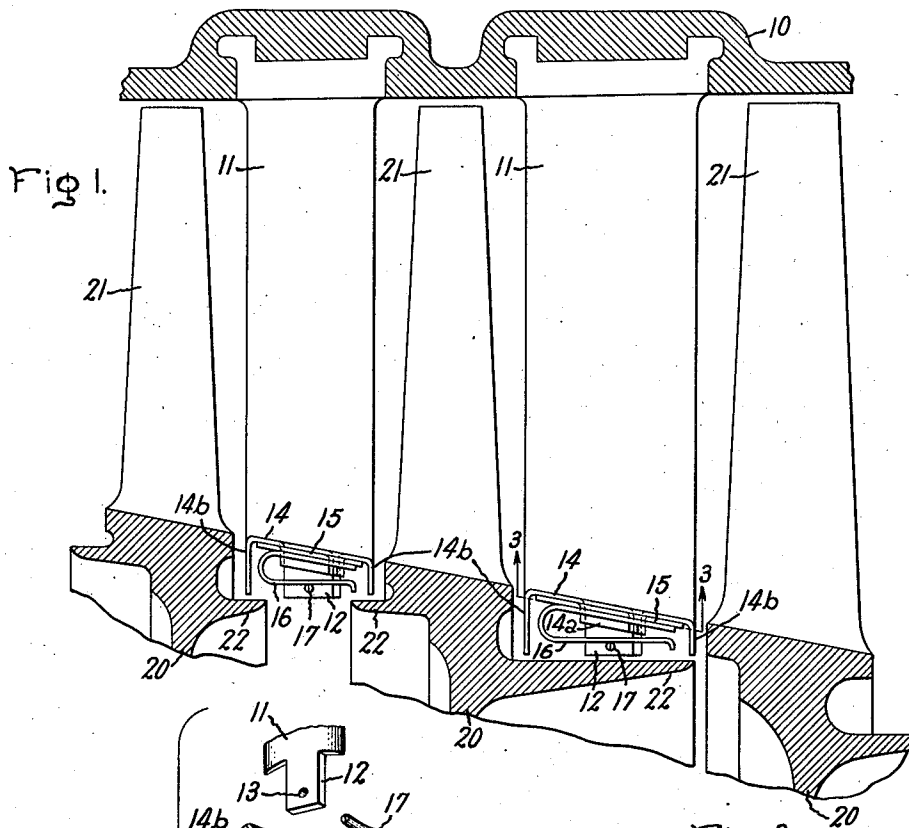
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SECURING MEANS FOR TURBO-MACHINE BLADING

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2,812,159

SECURING MEANS FOR TURBO-MACHINE BLADING

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3 Claims. (Cl. 253—78)

This invention relates generally to blading for turbo-machines and specifically to an improved means for securing the free ends of compressor stator blades for use in gas turbines, although it is not necessarily limited thereto.

Previous practice in turbo-machine construction has been to secure spacer rings between adjacent blade or bucket supporting disks in such a fashion so as to provide a smooth and relatively stiff drum-like structure. With such a construction, the free end portions of the blading were unsupported and in close clearance with turbo-machine structure between adjacent rows of blading.

Such a design has several shortcomings including (a) difficulty and cost of achieving close radial clearances due to the stack-up of tolerances in both axial and radial directions and to the axial differential thermal expansion between rotor and stator which necessitates increases in nominal clearances; and (b) very high vibrational and bending stresses, and resulting deflections, arising in unsupported, cantilevered blading requiring the use of high quality materials and costly processes to reduce blading failures. With the present arrangement, rotor stiffness is obtained by other means, and improved sealing and ruggedness are provided by my novel blading end structure.

Accordingly, it is an object of my invention to provide an improved means for strengthening a turbo-machine blading assembly.

It is another object of my invention to provide an improved sealing construction between stator blades and contiguous turbo-machine structure.

Still another object of my invention is to provide an improved sealing and securing means for the free ends of the stator blades.

It is another object of my invention to provide an improved turbo-machine blading structure wherein stator blade stresses and deflections are reduced permitting the use of lighter and less critical materials.

A further object of my invention is to reduce radial clearances in a turbo-machine and thus improve compressor performance.

A still further object of my invention is to provide a rigid securing means for the free ends of compressor stator blades utilizing portions of the securing means for improved sealing.

Another object of my invention is to accomplish the preceding in an inexpensive, simple manner with parts replaceable and deleterious effects minimized.

These and other objects of invention will become apparent upon a reading of the following description taken in conjunction with the disclosure of the drawing, which forms a part of this specification and in which:

Fig. 1 is a fragmentary sectional view of a portion of a turbo-machine embodying a preferred form of my invention;

Fig. 2 is an exploded sectional view showing the stator blade end in position for assembly with the outer and inner shroud bands and fastening means;

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Fig. 3 is an enlarged end view of the structure disclosed in Fig. 1 and taken along line 3—3 therein;

Figs. 4a, 4b, and 4c are isometric views of three different forms of spring clips that can be used in my invention.

The objects of my invention may be realized by the utilization of a U-shaped channel member together with fastening means to secure the free end portions of compressor stator blades thereby obtaining a more rigid structure and effective sealing between successive stages in a turbo-machine.

In the drawings, 10 designates an external turbo-machine casing member, composed of a plurality of parts and enclosing a rotor comprised of a plurality of rotor disks 20 rigidly connected to each other. This external casing member or stator 10 is provided with a plurality of guide blades 11, fixed in spaced relationship to fit between the rotor blades 21 carried by the rotor disks 20.

At the end of each guide blade 11 is a projection 12 having an opening 13 for fastening means. The free ends of these guide blades are rigidly joined together by a shrouding composed of an outer band or ring 14, having U-shaped channel configuration with a web 19, and an inner band or ring 15. Each of these bands or rings has a series of spaced slots or perforations P, located around its periphery so that each projection 12 on each of the guide blades 11 fits into a corresponding perforation therein without any deformation thereof.

The perforations on the outer ring are bounded by a pair of inwardly projecting, circumferentially spaced tangs, 14a, while those on the inner ring are bounded by inwardly projecting axially spaced tangs 15a. The spaced tangs 14a are to prevent circumferential movement of the turbine blade ends while spaced tangs 15a are to prevent axial movement, thereby decreasing the effect of chafing. The tanks prevent circumferential and axial movement by the larger surface area presented as compared to the thickness of the inner and outer bands. When applied to rotor blading, the tangs project outwardly because of the manner of application.

In order to fix the shroud bands to the ends of the stator blades, a spring clip and pin combination is used. As disclosed in the several figures of the drawing, the spring clips may take various forms, so long as proper vibration damping can be effectuated. A spring clip such as the double U-shaped member 16 is slipped around the projection or tongue 12 after insertion through the perforations in rings 14 and 15 and the assembly completed by the insertion of fastening means, such as a cotter pin 17 through projection openings 13. It is noted that the spring clips are compressed before the insertion of the cotter pin and are retained in a compressed condition after the pin is inserted.

The spring clips disclosed in Figs. 4a, 4b, and 4c, and indicated respectively as 16a, 16b, and 16c, are designed to fit between the flanges of the U-shaped outer band and in addition to the perforation P', to receive the projection of the guide blade. Each has a depression respectively indicated at 18a, 18b and 18c, for the reception of a plain pin fastener, although a cotter pin can be used. To install the spring clips 16a, 16b and 16c they are compressed to permit insertion of the pin 17. Upon release of the spring clips, the pin 17 will rest in the depression 18a, 18b or 18c. The pin 17 still retains the clips under compression so as to act as vibration dampeners. The resilience of the spring clip and the fit within the depression retains the pin in position.

The outer band of shrouding has inwardly extending flange portions 14b which, when the joining of the free ends of the stator guide blades is completed, coast with the cylindrical projections or rims 22 carried by the rotor

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disks 20 and serve as sealing means between the several turbine stages. These flange portions need not physically contact the rims or sealing lips 22 so long as they are substantially in close proximity therewith.

While my shroud ring may be applied interchangeably to the tips of either the stator or rotor blades or buckets, it is adapted particularly for use on the free ends of the blades carried by the stator.

It is to be understood that the disclosed embodiments of my invention are shown for purposes of illustration only and that the invention is not to be limited thereby as it can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a turbo-machine rotor the combination comprising at least two separate and distinct rotary disk members forming a plurality of stages and each having rim portions, at least one row of stator blades having unsecured end portions interposed between said rim portions, an improved sealing and securing means for the unsecured ends of the stator blades, said means comprising a band member having web and flange portions, a series of peripherally spaced perforations in said web receiving said unsecured ends, and means engaging said unsecured ends including a spring member and pin means, said spring member being biased between said band and pin, said spring member and pin securing said band member to said unsecured ends to act as vibration dampeners, said flange and rim portions co-acting to prevent leakage between the several stages.

2. In combination with an elastic fluid turbine having a row of blading with unsecured ends, means adjacent

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said unsecured ends for joining said ends comprising a pair of annular members each with matching peripherally spaced openings, one of said members comprising a web containing a series of said openings and a projecting flange, said matching spaced openings receiving said unsecured ends, and means securing said ends to said annular members, said last mentioned means comprising a spring member and a retaining pin, said spring member being biased between said pin and annular members and acting as vibration dampeners.

3. Securing means for the free end portions of blade members in a turbo-machine comprising, an assembly of a pair of circular bands fitting against each other, each of said bands having a like number of substantially equally peripherally spaced slots receiving said end portions of said blade members, the slots of the outer band bounded by tangs engaging the end portion of the blade members to prevent circumferential movement of said end portions of said blade members and the slots of the inner band overlapping said first mentioned tangs and being bounded by tangs engaging the end portions of the blade members to prevent axial movement of said end portions of said blade members, and means adjacent said bands fastening said bands to said end portions.

References Cited in the file of this patent

UNITED STATES PATENTS

764,452	Geisenhoner	July 5, 1904
784,670	Fullagar	Mar. 14, 1905
1,998,951	Downer	Apr. 23, 1935
2,640,679	Wheatley	June 2, 1953