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C. E. SPAETH

2,965,355

TURBINE DISC BURST INHIBITOR

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FIG. 1

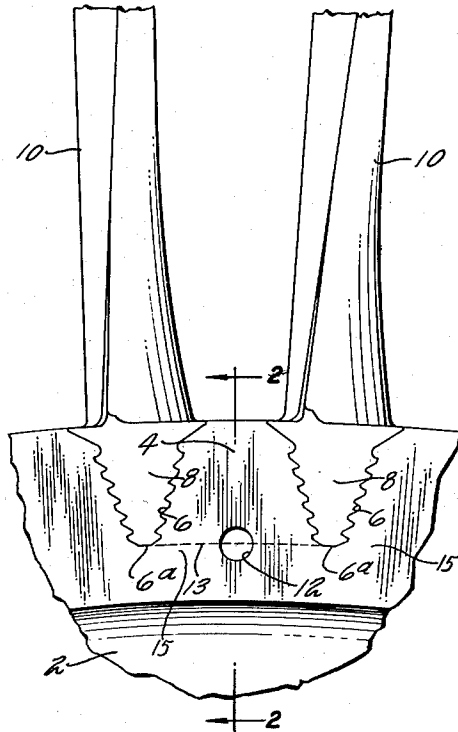


FIG. 2

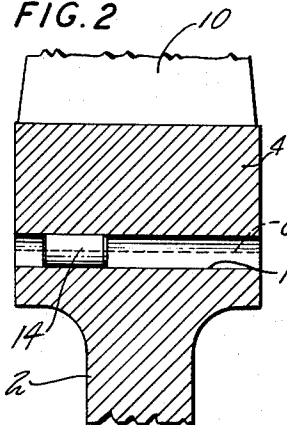


FIG. 3

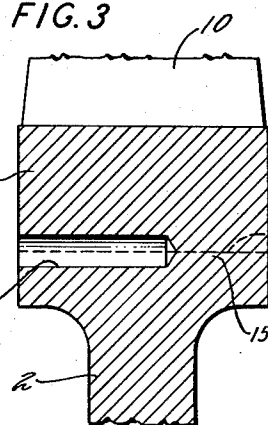
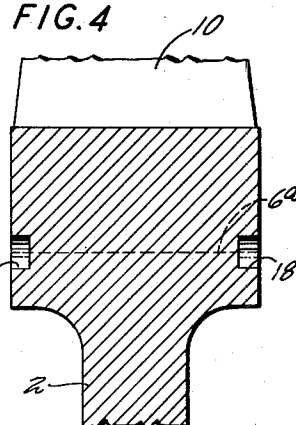


FIG. 4



INVENTOR
CHARLES E. SPAETH
BY *Charles A. Warren*
ATTORNEY

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TURBINE DISC BURST INHIBITOR

Charles E. Spaeth, East Hartford, Conn., assignor to
United Aircraft Corporation, East Hartford, Conn.,
a corporation of Delaware

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6 Claims. (Cl. 253-77)

This invention relates to rotors and particularly to the rotors used in axial flow compressors or turbines.

When a gas turbine power plant overspeeds, each rotor disc, which carries a row of blades on its periphery, is subjected to excessive loads as a result of the centrifugal loading on the blades and on the periphery of the disc. These loads may cause fracture of the disc with resultant damage to the surrounding casing and possibly additional damage to adjacent structures by reason of the energy in the parts breaking away. One feature of this invention is a rotor construction in which the area of fracture is accurately defined so that the blades will strip off of the rim without fracture of the main part of the disc. Another feature is the construction of a rotor disc such that it has lines of weakness along the base of the blade roots and the root receiving slots; the advantage of this location over other locations being that the rotor assembly retains substantially all of its original resistance to vibratory stresses.

Other objects and advantages will be apparent from the specification and claims, and from the accompanying drawings which illustrate an embodiment of the invention.

Fig. 1 is a side elevation of a rotor embodying the invention.

Fig. 2 is a fragmentary sectional view along the line 2-2 of Fig. 1.

Fig. 3 is a view similar to Fig. 2 showing a modification.

Fig. 4 is another view similar to Fig. 2 showing a further modification.

Referring first to Fig. 1, the rotor includes a disc 2, only a part of which is shown, which has projections 4 on the periphery defining, between adjacent projections, slots 6 to receive the roots 8 of a row of blades 10 which project radially from the periphery of the disc. The opposite sides of the slots are serrated to engage with serrations on the blade roots to hold the blades in position and prevent radial outward movement of the blades under the influence of centrifugal force as the disc rotates. This type of blade fastening is the well-known fir-tree type but obviously other types of interengaging root and slot arrangements may be substituted.

In accordance with the invention the projections 4 between adjacent blade roots are weakened, as by a hole 12 axially through the disc, with its axis along a circumferential line 13 approximately through the bases 15 of the projections 4 and through the bases 6a of the slots. This hole may be closed if it passes completely through the disc, as by a short plug 14 to prevent leakage through the disc.

With the disc weakened along this line the rotor assembly will still be adequately strong to stay together under normal operation and under a predetermined overload dependent upon the extent of the weakening. Obviously the amount of weakening will be determined by the diameter of the hole 12 and its location with respect to the base 15 of the projection 4 in which it is located. When

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the turbine disc overspeeds beyond the predetermined limit such that the disc is overloaded and would rupture, the holes 12 define a path of fracture and the projections 4 together with the blades and blade root are shed from the remainder of the disc. This form of fracture prevents the fracture of the main part of the disc which would provide large pieces of rotor that might well do much more damage than the individual blades and projections.

Instead of a hole 12 entirely through the disc, the line of fracture may be defined by holes 16, Fig. 3, which extend only partly through the disc. In this way plugging of the hole becomes unnecessary.

Alternatively, the line of fracture may be established by elongated holes in the form of circumferential grooves 18 which extend axially inward from the sides of the disc along a cylindrical line established by the bases 6a of the slots. In each modification the effect of the hole or the groove is to reduce the cross-sectional area of the projection at this point for weakening its holding effect.

It is to be understood that the invention is not limited to the specific embodiment herein illustrated and described, but may be used in other ways without departure from its spirit as defined by the following claims.

I claim:

1. In a rotor construction, a disc having a plurality of integral projections on its periphery defining between the projections axially extending slots open at the periphery of the disc, a row of blades extending radially outwardly from the periphery of the disc and having roots fitting within the slots, said slots and roots having interengaging surfaces to prevent radial outward movement of the blades and said slots having bases, and means reducing the cross-sectional area of each projection only at its connection with the disc and substantially along a circumferential line through the bases of the slots for weakening the holding effect of the projections, said area reducing means being located in the disc at each projection and defining the region of fracture of the projection from the disc.

2. In a rotor construction, a disc having a plurality of projections on its periphery defining between the projections axially extending slots open at the periphery of the disc, a row of blades extending radially outwardly from the periphery of the disc and having roots fitting within the slots, said slots and roots having interengaging axially extending surfaces to prevent radial outward movement of the blades and said slots having bases, and a passage at least partially through the disc only at the base of each projection substantially along a circumferential line through the bases of the slots for weakening the holding action of the projections along this line.

3. In a rotor construction, a disc having a plurality of integral projections on its periphery defining between the projections axially extending slots open at the periphery of the disc, a row of blades extending radially outwardly from the periphery of the disc and having roots fitting within the slots, said slots and roots having interengaging axially extending surfaces to prevent radial outward movement of the blades and said slots having bases, and means reducing the cross-sectional area of each projection only at its connection with the disc and substantially along a circumferential line through the bases of the slots to define the area of fracture of the projection from the disc if the disc is overloaded, said area reducing means being located in the disc at each projection.

4. In a rotor construction, a disc having a plurality of projections on its periphery defining between the projections axially extending slots open at the periphery of the disc, a row of blades extending radially outwardly from the periphery of the disc and having roots fitting within the slots, said slots and roots having interengaging surfaces

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to prevent radial outward movement of the blades and said slots having bases, and means reducing the area of each projection along a circumferential line through the bases of the slots for defining the region of fracture of each projection from the disc by reducing the strength of each projection only at its connection with the disc substantially along a circumferential line through the bases of the slots.

5. In a rotor construction, a disc having a plurality of axially extending slots in its periphery, said slots being circumferentially spaced apart and defining projections therebetween on the disc, a row of blades projecting radially outward from the disc and having roots engaging in the slots in the disc, said projections and roots having interengaging portions to hold said roots radially within the slots and said slots having bases, said disc having a row of holes therein, one hole being at the base of each projection, said holes being located only along a circumferential line passing substantially through the bases of the slots for reducing the cross-sectional area of each projection along this line thereby weakening each of said projections only along said circumferential line passing substantially through the bases of the slots.

6. In a rotor construction, a disc having a plurality of projections on its periphery defining between the pro-

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jections axially extending slots open at the periphery of the disc, a row of blades extending radially outwardly from the periphery of the disc and having roots fitting within the slots, said slots and roots having interengaging axially extending surfaces to prevent radial outward movement of the blades, and said slots having bases, and a hole at least partially through the disc in an axial direction and located only at the base of each projection substantially along a circumferential line through the bases of the slots for weakening the holding action of the projections along this line.

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