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BLADED ROTOR FOR A GAS TURBINE ENGINE

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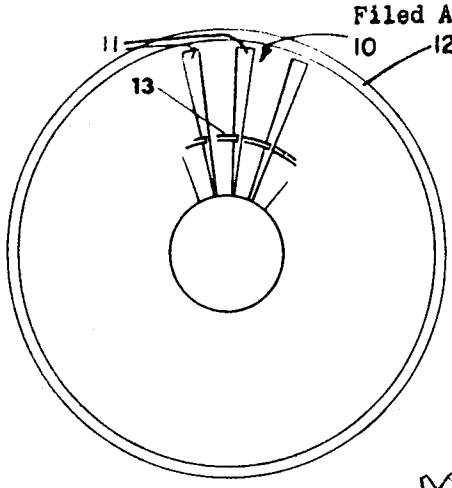

Fig. 1

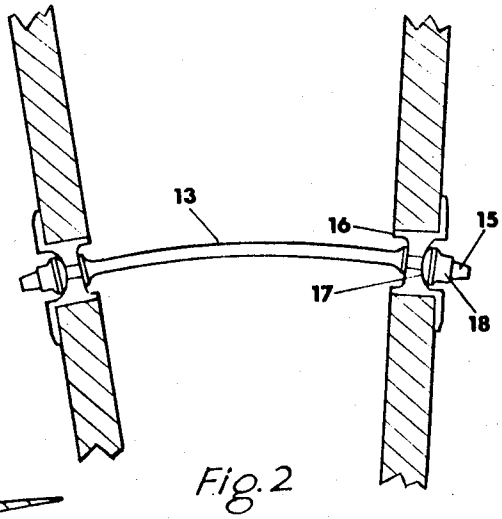

Fig. 2

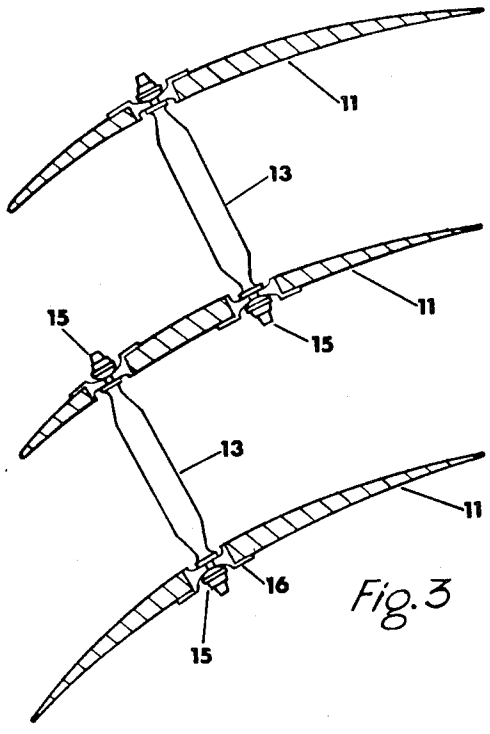

Fig. 3

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BLADED ROTOR FOR A GAS TURBINE ENGINE

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U.S. Cl. 416—196 5 Claims

ABSTRACT OF THE DISCLOSURE

A bladed rotor for a gas turbine engine has a row of blades, each blade having two part spherically faced depressions on opposite faces and holes through the blade thickness which lead into the depressions. Tie members extend between adjacent blades, the ends of the tie members passing through the holes and being retained by part spherically face nuts which engage in the part spherical depressions. The tie members are thus allowed to move relative to the blades and to take up the natural position without stressing the blade unduly.

This invention relates to a bladed rotor for a gas turbine engine.

It is sometimes necessary to support the blades of such a rotor by tying each blade to its next adjacent blades. When the rotor is intended to rotate at a high rotational speed it is difficult to design ties which can be supported in the high G environment while performing their function satisfactorily.

The present invention provides a bladed rotor having tie members which carry out this function in a simple fashion.

According to the present invention a bladed rotor for a gas turbine engine comprises a row of blades, each blade being connected to the next adjacent blade by an outwardly curved tie member attached to the blades by means of threaded extensions at each end of the tie member which pass through the respective blades and are retained by a spherically shaped convexly faced nut which co-operates with a spherically shaped concavely surfaced depression in the face of the blade opposite to the respective tie member.

Preferably the concavely surfaced depression is formed in a bushing which is sunk into the blade section.

Said tie members are preferably formed with a substantially aerofoil cross-section over at least part of their extent; thus the tie member may comprise a substantially cylindrical rod which is flattened over its central section.

Preferably the points of attachment of the ties to the blades are staggered so that under the effect of centrifugal force the tie members exert a force on the blades which acts against the tendency of the blades to untwist due to centrifugal effects.

The invention is particularly useful in the case of blades formed from fibre reinforced materials.

The invention will now be particularly described merely by way of example with reference to the accompanying drawings in which:

FIG. 1 is a frontal view of the fan of a gas turbine engine in accordance with the invention,

FIG. 2 is a section through two adjacent blades of the fan of FIG. 1, and

FIG. 3 is a section on the line 3—3 of FIG. 2.

In FIG. 1 there is shown a fan for a gas turbine engine

comprising a rotor 10 supporting a row of blades 11 which run in an annular shroud 12. The remainder of the engine and its drive to the fan is not shown, but is in accordance with conventional practice.

Under some circumstances it is desirable to tie the blades 11 together so that they are supported one against the other. This is carried out in the present invention by a plurality of tie members 13 which are shown generaly in FIG. 1 and in more detail in FIG. 2.

Each tie member 13 comprises a central outwardly curved portion 14 and a pair of threaded extensions 15 forming the ends of the curved portion.

The curved portion of the tie members is arranged to be of substantially aerofoil section. Thus in the present case the tie members are made from a rod which is flattened over its central portion, the flattened portion having its longest axis lying in the direction of the air flow. This has the effect of increasing the width of the tie member when seen in the FIG. 3 view. The remaining cylindrical portions are threaded to form two threaded extensions 15.

To attach the tie members 13 to the blades, the extensions 15 pass through flanged bushings 16 which are buried in the blade section. The bushes are provided with flanges to enable transfer of stresses into the blade section. Each bushing has a concave part spherical face as shown at 17, and the face 17 is engaged by the convexly part spherical face of a self-locking nut 18 which is engaged with the threaded extension 15. Thus when the nut is in position it retains the tie member in place by engagement of the spherical faces, while allowing the tie member to find its own angular position. The length of the tie member and its position are so arranged that tension in the tie counteracts centrifugal loads on the curved extent of the tie member.

As can be seen in FIG. 3 the tie members are fastened to the blades in a staggered fashion so that tension in the tie members cause a torque to be exerted on the blades, and it is arranged that the torque on the blades due to the tie members tends to counteract the torque due to the centrifugal loads on the blades which tend to untwist the blades.

It will be appreciated that the present invention provides a way in which adjacent blades of a row can be simply and easily tied together with a little aerodynamic interference and as little modification of the blade as is possible.

We claim:

1. A bladed rotor for a gas turbine engine comprising: a row of blades, each of said blades at least having an aerofoil shaped part made of a fiber reinforced composite material; and means for connecting adjacent blades to each other, said means comprising at least one outwardly curved tie member connecting one blade to the next adjacent blade, said tie member having threaded extensions at each end thereof which extend through the fiber reinforced parts of the adjacent blade, a bushing sunk into the fiber reinforced part of each blade and through which one threaded extension of one of the tie members extends, each of said bushings having a spherically shaped concave face remote from the tie member, and a nut member for each of the threaded extensions of each end of each tie member, each said nut member including a spherically shaped convex face cooperating with the respective concave face in said bushing.

2. A bladed rotor as claimed in claim 1 in which there are two of said bushings sunk into each fiber reinforced part of each blade, each of said bushings having a flanged end in which said concavely part-spherical surface is provided, one of said bushings having its concavely part-

spherical surface facing opposition of the concavely part-spherical surface of the other of said bushings.

3. A bladed rotor as claimed in claim 1 and in which each said tie member is formed with a substantially aerofoil cross-section over at least part of their extent.

4. A bladed rotor as claimed in claim 3 and in which each said tie member comprises a substantially cylindrical rod which is flattened over its central section.

5. A bladed rotor as claimed in claim 1 and in which the bushings of the adjacent blades are staggered so that upon rotation of the rotor centrifugal force causes the tie members to exert a force on the blades which acts against the tendency of the blades to untwist due to centrifugal effects.

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