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(56) Documents cited
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US 4170505 A

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(54) **Winding airfoil**

(57) In the manufacture of a three-dimensionally twisted airfoil of a rotor blade, a fibre strand 9 is continuously impregnated with resin material, pressed by roller 11 on to an airfoil surface 1 and immediately precured at 15. The method permits the fast, simple and fully automatic manufacture of airfoils. The precuring device 15 may be an infrared radiator. The strand may be looped around nipples on a blade root. The winding device may be a six-axis robot. The precured airfoil is cured in a mould.

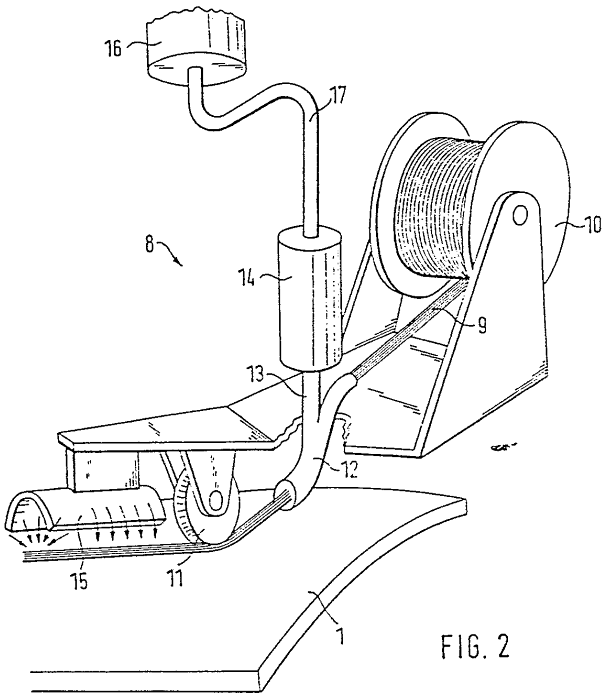

FIG. 2

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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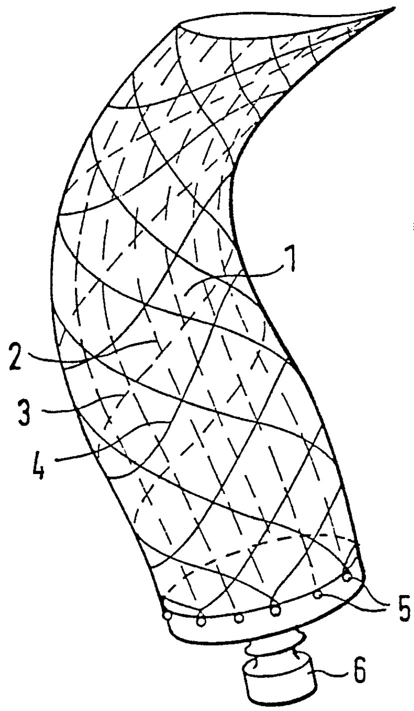

FIG. 1

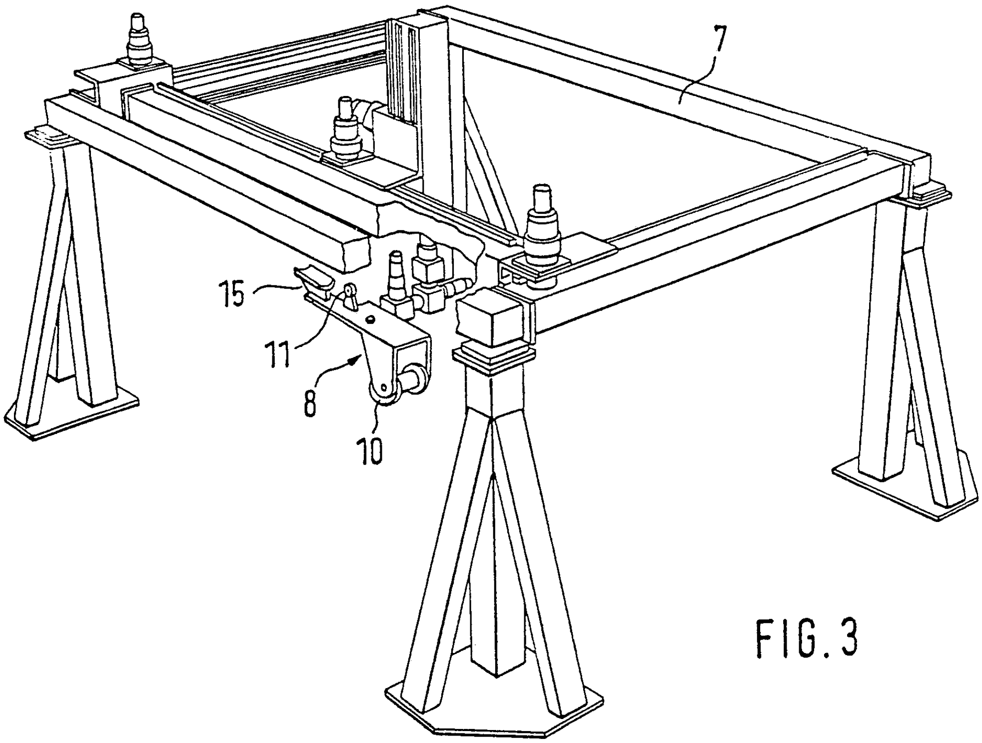

FIG. 3

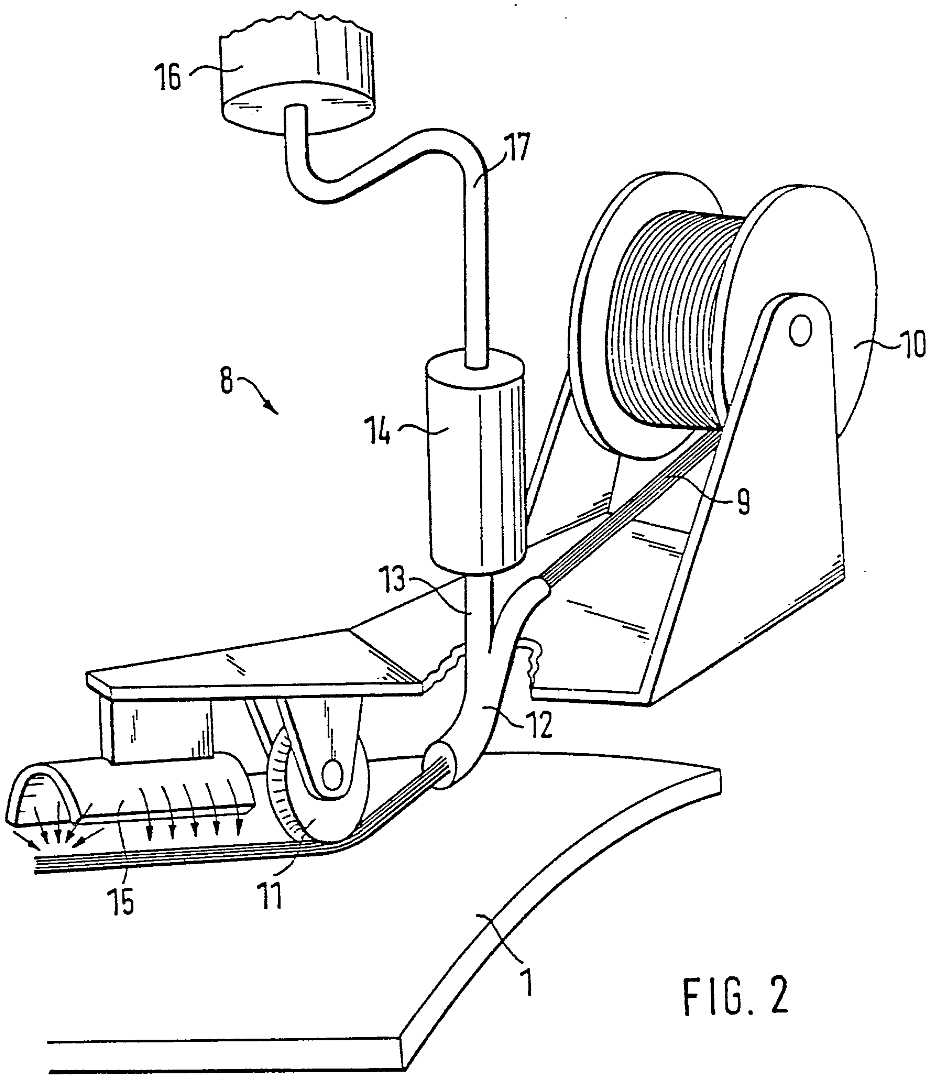

FIG. 2

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METHOD FOR MANUFACTURING A THREE-DIMENSIONALLY TWISTED ROTOR BLADE AIRFOIL

This invention relates to a method for the manufacture of a fibre reinforced component, particularly a three-dimensionally twisted rotor blade airfoil, by wrapping a core with a resin-impregnated fibre material.

Fibre components are rapidly gaining technical significance on account of their excellent properties. Their low density, high tensile strength and relative ease of shaping invites their use in areas that had formerly been the sole domain of metallic materials. Fibre-reinforced materials, e.g. are also finding use in aircraft applications, as for dynamically highly stressed rotor blades and propellors or for propfan airfoils.

Another outstanding property of fibre-reinforced materials is the option of influencing component properties by laying the fibres in preferred orientation to obtain different material data in different directions for, e.g. the modulus of elasticity or damping constants.

Technical problems are encountered, however, in the manufacture of fibre-reinforced components of complex shapes with three-dimensionally twisted surfaces, especially if these take a partially concave form and if the requirements are for different strength and vibration properties in different directions. This applies particularly to modern turbine engine fan or propan blades, where the attachment of the airfoil to the root or rotor poses another specific problem.

Conventional manufacture of these components is associated with considerable effort involving high manufacturing costs. It employs so-called prepegs, which are fibre panels impregnated with a matrix material and inserted in a hollow mould to be cured under pressure and heat. One disadvantage of this method is the extremely high cost involved when trying to deliberately influence component properties with it, which basically is a feasible proposition.

One object of this invention is to enable the manufacture of a fibre-reinforced component, particularly a three-dimensionally twisted rotor blade airfoil by a simple and rapid method that permits selective manipulation of component properties by selective routing of the fibres and more particularly so as to permit ready application of fibres also to concave surfaces.

According to this invention we propose a method for the manufacture of a fibre-reinforced component such as an airfoil, particularly a three-dimensionally twisted rotor blade airfoil by wrapping a core with a resin impregnated fibre material, wherein fibre strands wetted with a resin matrix are pressed against the core for example, by means of a nip roller, and the resin matrix precured immediately thereafter, preferably by a precuring facility such as an infrared radiator coupled to the nip roller.

Fibres can be applied in a simple manner, in each and every direction and on any shape of airfoil surface and

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