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(54) **FIBER PREFORM FOR A HOLLOW TURBINE ENGINE VANE**

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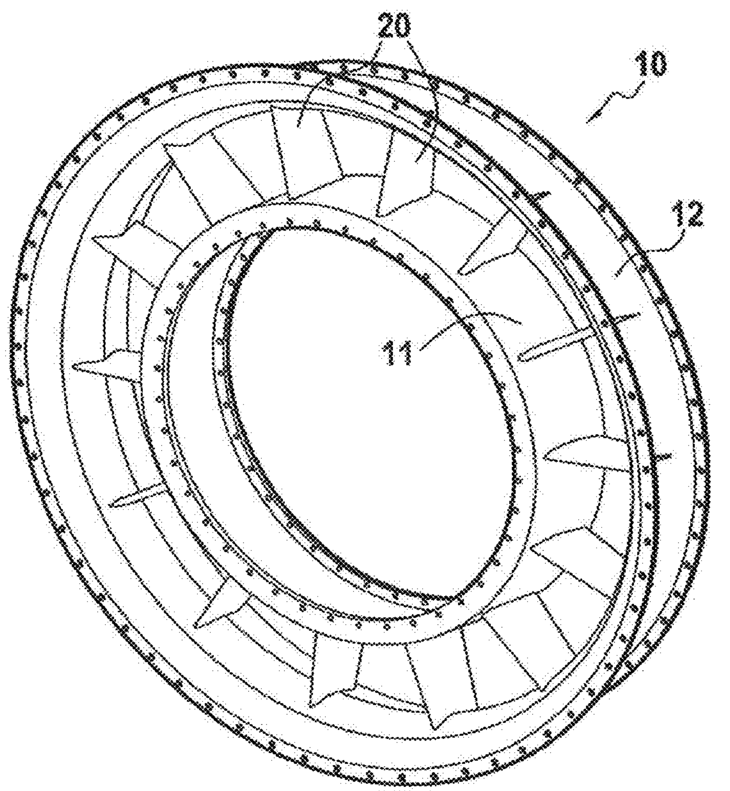
(57) **ABSTRACT**

A fiber preform for a hollow turbine engine vane, and a method of fabricating such a hollow vane are provided. The preform includes a first fiber structure including a main longitudinal portion for forming a pressure side wall of an airfoil; a second fiber structure including a main longitudinal portion for forming a suction side wall of the airfoil; each of the first and second fiber structures includes a first interlinking zone extending along the front edge of its main longitudinal portion, which first zones are integral with each other and form a first interlinking portion, and a second interlinking zone extending along the rear edge of its main longitudinal portion, the second zones being integral with each other and forming a second interlinking portion. The main longitudinal portions of the first and second fiber structures are dissociated so as to leave a gap between the main longitudinal portions forming an airfoil hollow.



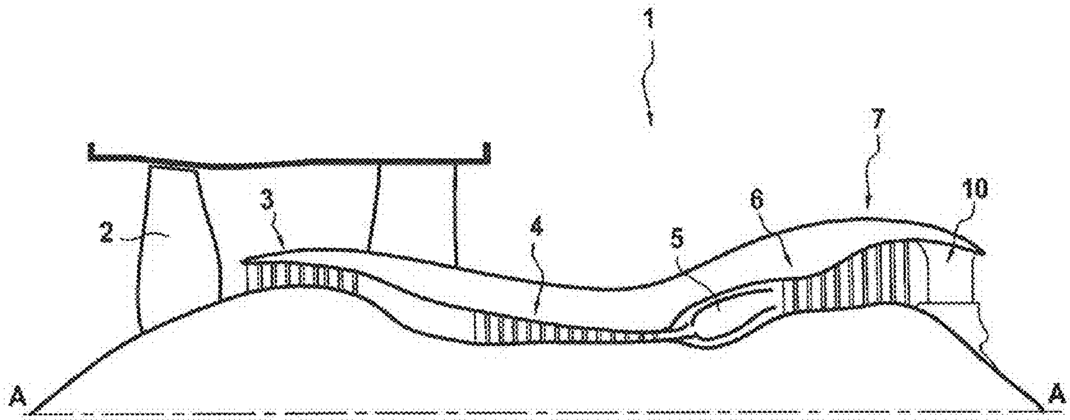


FIG.1

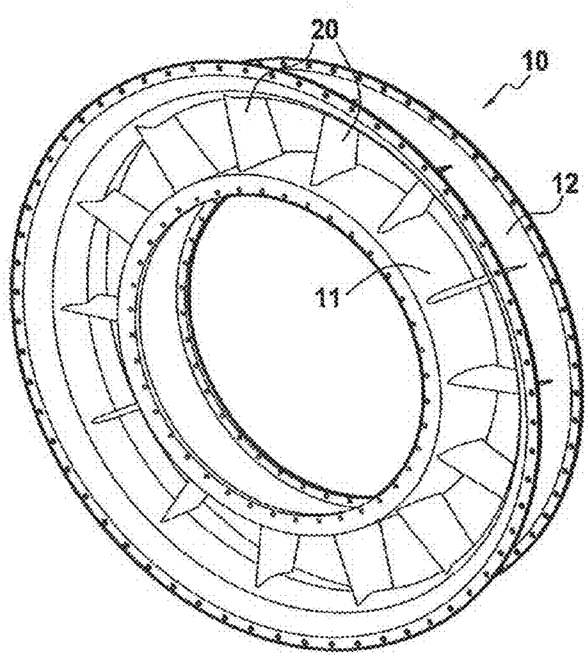


FIG.2

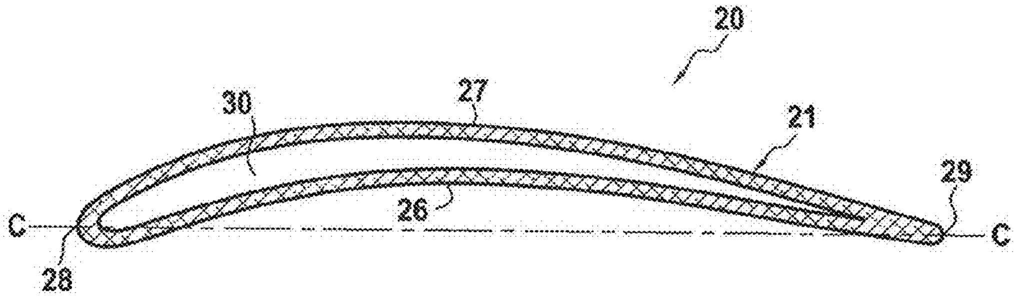


FIG.3

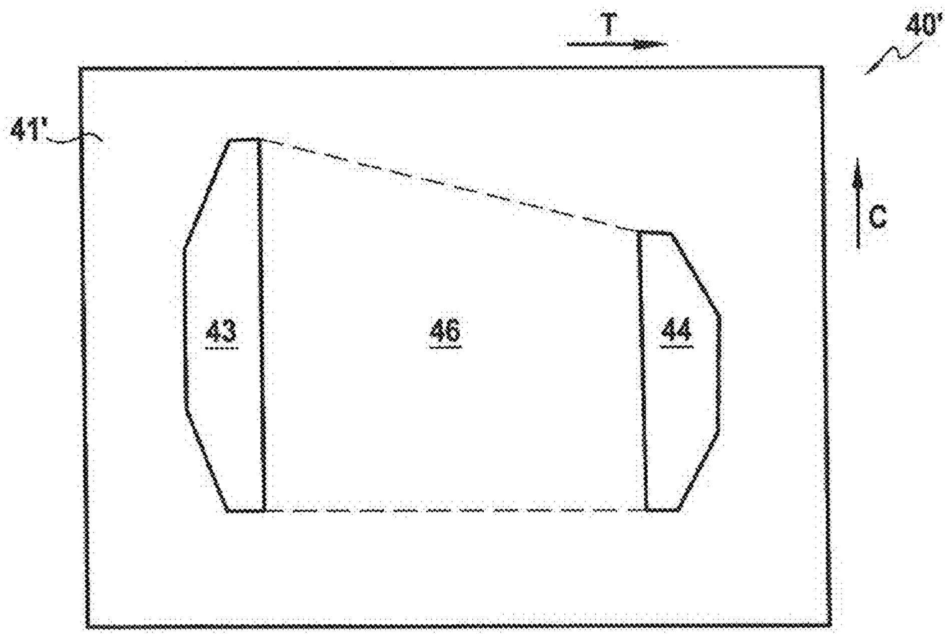


FIG.4A

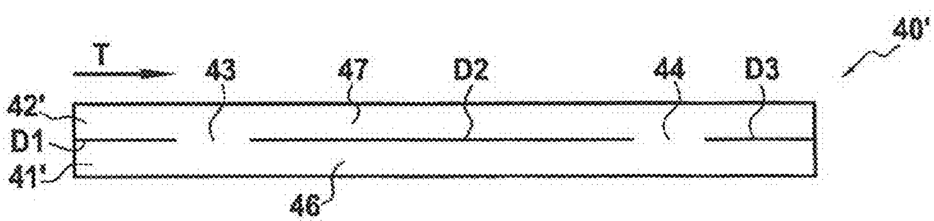


FIG.4B

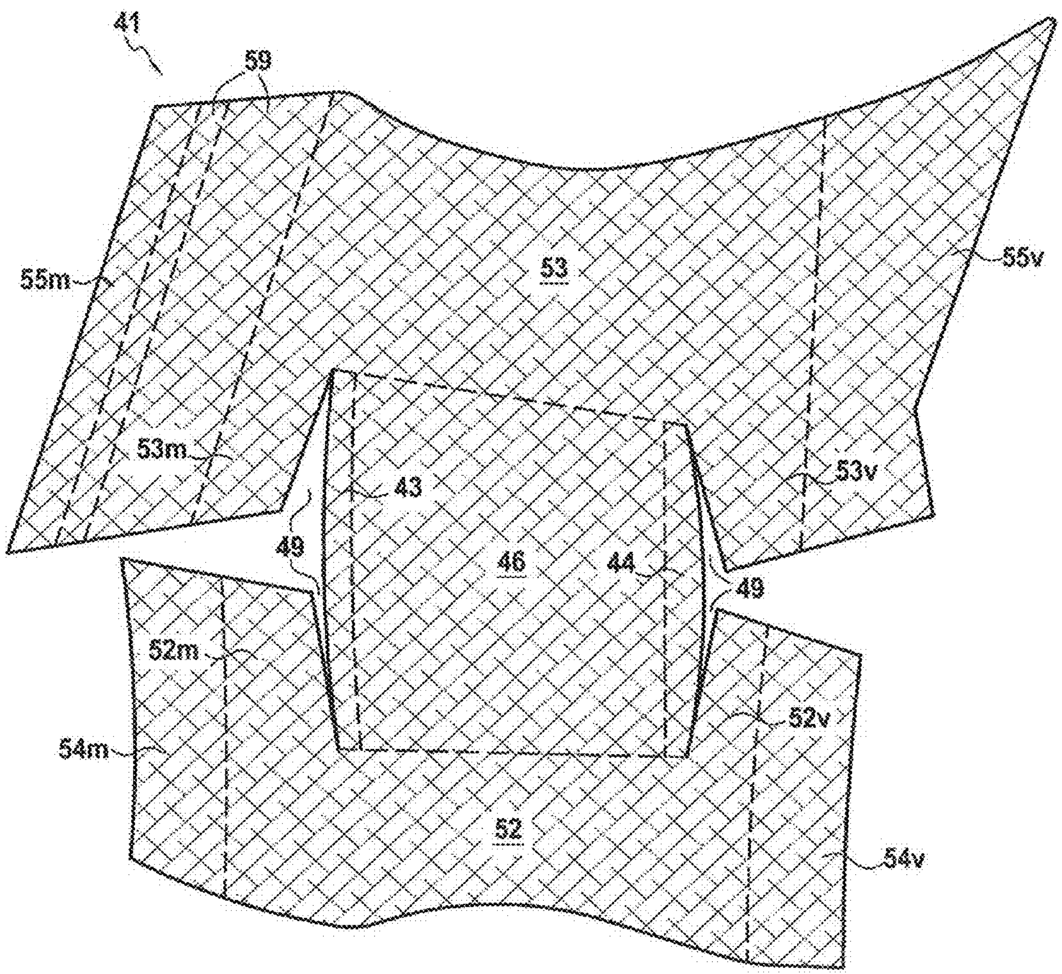


FIG.5A

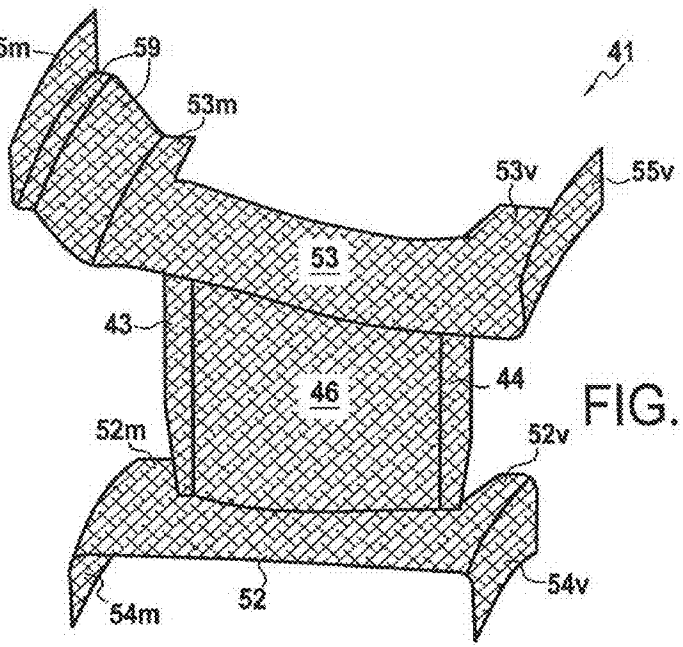


FIG.5B

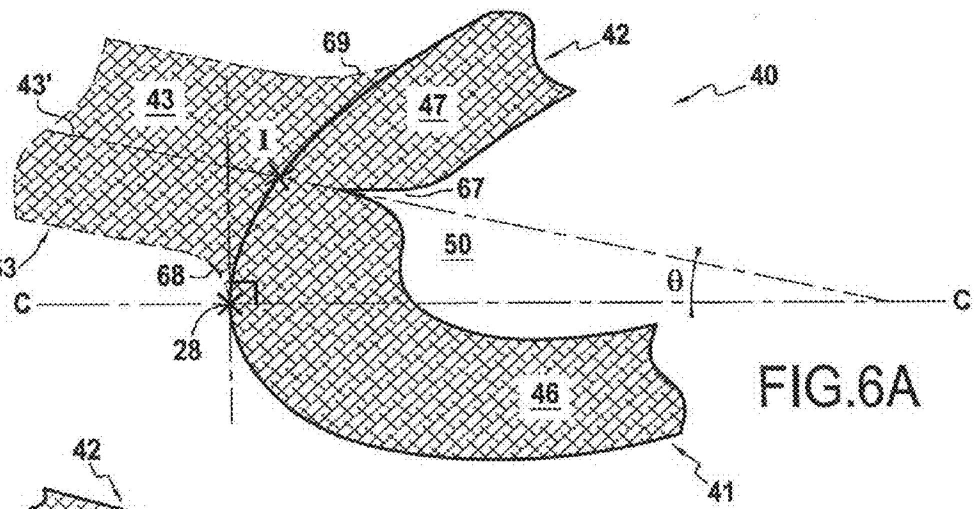


FIG.6A

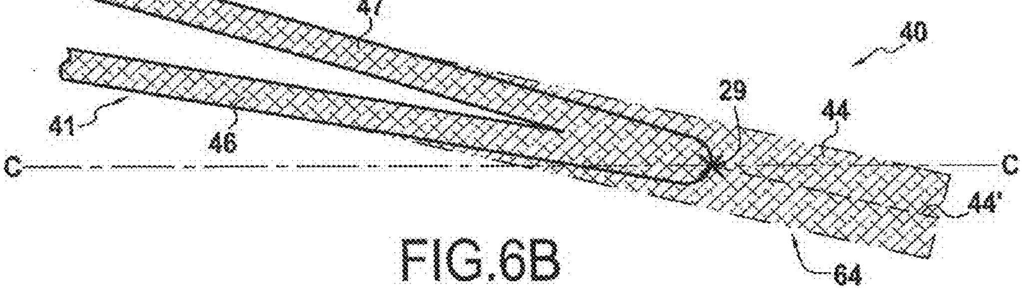


FIG.6B

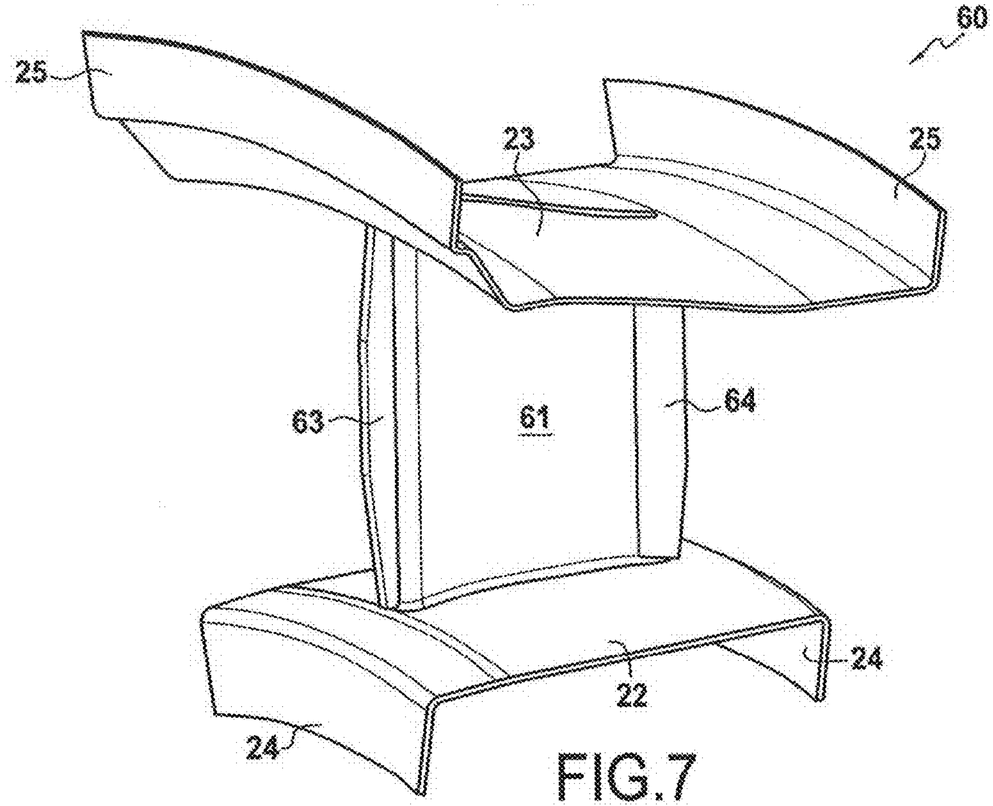


FIG.7

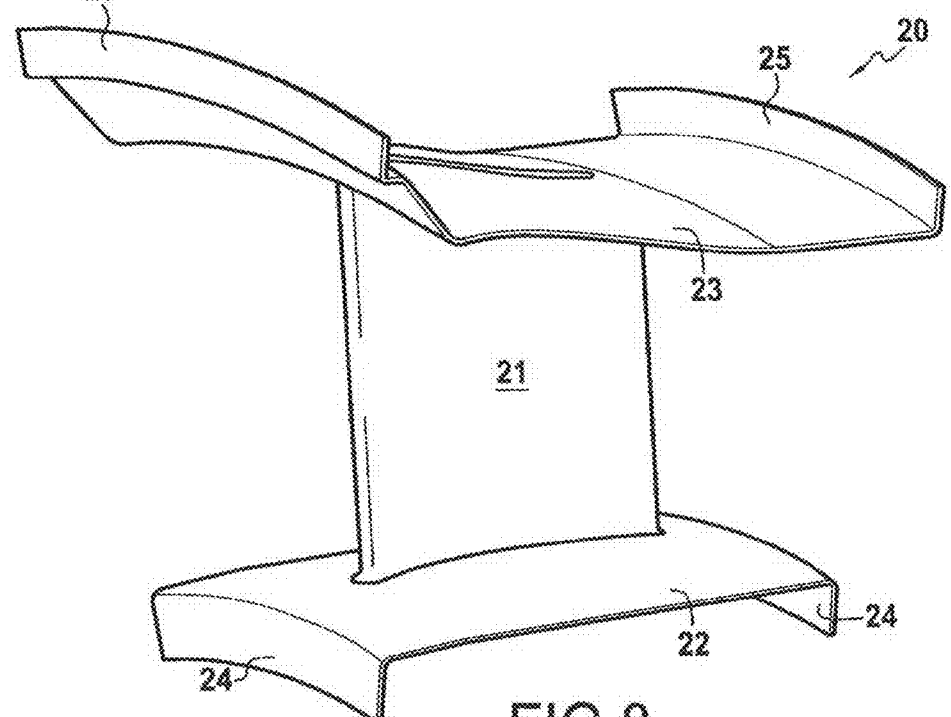


FIG.8

FIBER PREFORM FOR A HOLLOW TURBINE ENGINE VANE

FIELD OF THE INVENTION

[0001] The present description relates to a fiber preform for a hollow turbine engine vane, to such a hollow vane, and also to a method of fabricating such a hollow vane. The description also relates to a turbine engine and to an aircraft including such a hollow vane.

[0002] By way of example, such a preform may be used for fabricating a hollow vane of a rear turbine stator, or of some other module of a turbine engine.

STATE OF THE PRIOR ART

[0003] Because of the high price of fuel, considerable effort is being expended these days to reduce the fuel consumption of aircraft turbojets. A major factor having an influence on that consumption is the weight of the aircraft and its equipment, some of which comprises the turbojets themselves.

[0004] Thus, over the last few years, new materials have been appearing in aircraft turbojets and have enabled significant weight reductions to be obtained. This applies in particular to composite materials which provide simultaneously both good mechanical strength and low weight in comparison with the metal materials that have traditionally been used: new generations of turbojets thus include a large number of parts that are made out of such composite materials.

[0005] Another technique for reducing weight seeks to simplify the shapes of certain parts or to eliminate certain embodiments that are superfluous. In particular, it is possible to hollow out certain parts that have traditionally been solid. This applies in particular to certain vanes, particularly vanes of a rear turbine stator, which are hollow in recent generations of turbine engines.

[0006] Under such circumstances, it is theoretically possible to combine the advantages obtained by those two methods of weight reduction by making such hollow vanes out of composite material. Nevertheless, methods of fabricating hollow parts out of composites are rare, complex, and not very satisfactory.

[0007] In particular, a known method consists in weaving a plurality of two-dimensional fabrics, in shaping them by stacking them, and then in uniting them by co-sintering. Nevertheless, that method requires a large number of fabric sheets to be woven and raises difficulties while jointly shaping the sheets of the stack, and it gives rise to parts that suffer from structural weaknesses due to their layered structure.

[0008] There thus exists a real need for a fiber preform for a hollow turbine engine vane, for such a hollow vane, and for a method of fabricating such a hollow vane, that do not have the drawbacks inherent to the above-mentioned known methods, at least to some extent.

SUMMARY OF THE INVENTION

[0009] The present description relates to a fiber preform for a hollow turbine engine vane, the preform comprising: a first fiber structure obtained by three-dimensional weaving and comprising at least one main longitudinal portion suitable essentially for forming a pressure side wall of an airfoil; a second fiber structure obtained by three-dimensional weaving and comprising at least one main longitudinal portion suitable essentially for forming a suction side wall of the airfoil; wherein each of the first and second fiber structures further includes a first interlinking zone extending along the front edge of its main longitudinal portion, which first zones are integral with each other and form a first interlinking portion of the preform, and a second interlinking zone extending along the rear edge of its main longitudinal portion, the second zones being integral with each other and forming a second interlinking portion of the preform; and wherein the main longitudinal portions of the first and second fiber structures are dissociated so as to leave a gap between said main longitudinal portions suitable for forming an airfoil hollow.

[0010] By means of this preform, it is possible to obtain a hollow vane that is particularly light in weight because of its hollow and because composite materials are used.

[0011] In addition, because of the three-dimensional weaving, such a hollow vane possesses a single-piece structure that presents very good mechanical properties. The anisotropy of such a part is also diminished, thereby imparting great mechanical strength, regardless of the direction in which stress is exerted. In particular, its three-dimensional network of fibers enables it to withstand shear forces without any risk of delamination, unlike stacks of co-fired fabric sheets, for example.

[0012] By means of this preform, the method of fabricating such hollow vanes is also simplified. The preform need involve only a single weaving step that is performed using a three-dimensional loom as is nowadays well known in this field, thereby reducing the overall cost and the time needed for fabricating such a hollow vane. Where appropriate, it also makes it possible during the same single weaving step to incorporate other elements of its environment in the preform such as platforms or fastener flanges that are then formed integrally together with the hollow vane.

[0013] Preferably, the first interlinking zones extend all along the front edges of their respective main longitudinal portions, and the second interlinking zones extend all along the rear edges of their respective main longitudinal portions.

[0014] In the present description, the terms "longitudinal", "transverse", "bottom", "top", and their derivatives are defined relative to the main direction of the vane; furthermore, when applied to the preform, they are defined relative to the preform once shaped; the terms "axial", "radial", "tangential", "inner", "outer", and their derivatives are defined relative to the main axis of the turbine engine; finally, the terms "upstream" and "downstream" are defined relative to the flow of air through the turbine engine.

[0015] In certain embodiments, the first interlinking zones of the first and second fiber structures are woven jointly in interlinked manner and/or the second interlinking zones of the first and second fiber structures are woven jointly in interlinked manner; and the main longitudinal portions of the first and second fiber structures are woven jointly in non-interlinked manner. In this way, the preform, and thus the resulting hollow vane, benefit from a three-dimensional lattice of fibers that cohere, including in the interlinking zones: this serves to improve the mechanical strength of the interlinking zones and thus of the leading and trailing edges of the resulting vane.

[0016] In certain embodiments, layer crossing is used in the first interlinking zones of the first and second fiber structures and/or in the second interlinking zones of the first and second fiber structures. This further improves the cohesion of the first and second fiber structures.

[0017] In other embodiments, the first interlinking zones of the first and second fiber structures are woven in non-interlinked manner and they are sewn together and/or the second interlinking zones of the first and second fiber structures are woven in non-interlinked manner and they are sewn together.

[0018] In other embodiments, the first interlinking zones of the first and second fiber structures are woven in non-interlinked manner and they are adhesively bonded together and/or the second interlinking zones of the first and second fiber structures are woven in non-interlinked manner and they are adhesively bonded together.

[0019] In certain embodiments, at least one of the fiber structures further includes at least one radial portion extending from the bottom or top edge of its main longitudinal portion and suitable for forming a platform or a fastener flange. As mentioned above, this makes it possible to make a platform or a fastener flange integrally with the hollow vane during a single step. The overall mechanical strength is thus improved, in particular at the interface between the vane and the platform or the flange. In addition, this makes it possible to reduce the number of parts needed, in particular fastener parts, thereby reducing the overall weight and cost.

[0020] In certain embodiments, said radial portion extends all along said bottom or top edge of said main longitudinal portion.

[0021] In certain embodiments, at least said fiber structure further includes at least one secondary longitudinal portion extending from an edge of said radial portion and suitable for forming a fastener flange.

[0022] In certain embodiments, at least one of the fiber structures includes an overlap portion that, when the fiber structure is flat, lies in front of at least a portion of the first interlinking zone of said fiber structure or behind at least a portion of the second interlinking zone of said fiber structure, a gap being left between said overlap portion and the interlinking zone in question. This gap may be cut out from the fiber structures as they are obtained at the end of weaving. This makes it possible to make a platform portion or a flange portion that projects beyond the chord plane of the hollow vane. It is thus also possible to make overlap zones in which the two fiber structures overlap each other once they have been shaped, thereby enabling better cohesion and better strength to be obtained for the final complete platform or fastener flange.

[0023] In certain embodiments, the first and/or second interlinking portion possesses smaller width at its base and/or at its tip than in its middle. A narrower width at the base or at the tip serves to limit the amount of machining that is needed in this zone of the part; which zone is sensitive because of the junction between the leading or trailing edge and the platform. Nevertheless, a greater width is possible in the middles of the interlinking zones in order to obtain high strength, since this zone is subjected to fewer constraints.

[0024] In certain embodiments, the yarns used for weaving the preform are made of oxide type fibers, preferably fibers made of alumina, mullite, silica, or zirconia. Nevertheless, any other type of yarn could be used, e.g. made of carbon, glass, or kevlar fibers.

[0025] In certain embodiments, the weave used for the three-dimensional weaving of the preform may be of the 3D interlock type. Nevertheless, the weaving of the outside surfaces of the preform may be essentially two-dimensional, e.g. of satin type.

[0026] The present description also provides a hollow vane made as a single piece of composite material from a fiber preform of any of the above embodiments, said preform being shaped in a mold and embedded in a matrix.

[0027] In certain embodiments, the hollow vane is a vane of a rear turbine stator, i.e. a turbine rear vane (TRV). In other embodiments, the hollow vane is a nozzle vane.

[0028] In certain embodiments, the matrix is of oxide type. It is preferably a matrix of alumina, mullite, silica, or zirconia, and it is preferably porous. Nevertheless, it could equally well be a matrix that is ceramic or organic.

[0029] The present description also relates to a turbine engine including a hollow vane in accordance with any of the above embodiments.

[0030] The present description also relates to an aircraft including a turbine engine of the present description.

[0031] Finally, the present description also provides a method of fabricating a hollow vane, the method comprising the following steps: weaving and cutting out a fiber preform in accordance with any of the above embodiments; folding and shaping the fiber preform in a mold possessing the shape of the desired unfinished blank; placing an insert in the gap between the two main longitudinal portions; injecting and solidifying the matrix around the fiber preform in order to obtain the unfinished blank; removing the insert; and machining the interlinking parts of the unfinished flank corresponding to the interlinking portions of the fiber preform so as to obtain the leading and trailing edges of the final part.

[0032] This method makes it possible to obtain an unfinished blank that has essentially the shape of the desired final part, possibly including platform or flange portions, with the exception of the upstream and downstream protrusions formed by the ends of the interlinking portions of the preform: these protrusions are then machined in order to obtain the leading and trailing edges desired for the final part.

[0033] In certain implementations, the hollow vane is obtained from the preform by using a resin transfer molding (RTM) type method as is known in the art.

[0034] In other implementations, the hollow vane is obtained from the preform using a Polyflex type method.

[0035] In such a method, a fiber preform is placed on tooling having a surface with the profile desired for the final product. The preform is then covered by a flexible impermeable membrane and resin is injected between the membrane and the preform. From the other side of the membrane, isostatic pressure is exerted on the membrane by a fluid. This fluid forces the resin between the fibers and maintains a level of pressure during the stage of curing the resin.

[0036] In certain implementations, during the shaping step, the second fiber structure is curved so as to present, between its second and first interlinking zones, at least a first concave curve suitable for forming the downstream portion of the pressure side of the vane, followed by a convex curve suitable for forming the upstream portion of the pressure side of the vane, itself followed by a second concave curve serving to join with the first fiber structure in the first interlinking zone, a distal portion of the first interlinking zone then extending on the suction side of the chord plane defined by the leading and trailing edges of the desired final part. This configuration makes it possible to increase the length of the suction side and to reduce the length of the pressure side, thereby enabling the camber of the vane to be increased and thus enabling its efficiency to be increased.

[0037] In certain implementations, said distal portion of the first interlinking zone extends in a plane that forms an angle with the chord plane that lies in the range 5° to 30°.

[0038] In certain implementations, the second fiber structure is curved in such a manner that the point of inflection between the convex curve and the second concave curve is situated on the pressure side of the chord plane. This makes the unfinished blank easier to unmold on the pressure side by avoiding forming an undercut.

[0039] In certain implementations, the tangent at this point of inflection is perpendicular to the chord plane.

[0040] In certain implementations, the step of machining the first interlinking part of the unfinished blank, corresponding to the first interlinking portion of the fiber preform, includes cutting away from the distal portion of the first interlinking part and smoothing the leading edge and the suction side wall.

[0041] In certain implementations, the step of machining the second interlinking part of the unfinished blank, corresponding to the second interlinking portion of the fiber preform, essentially comprises thinning down said second interlinking part in order to obtain the trailing edge.

[0042] The above-mentioned characteristics and advantages, and others, appear on reading the following detailed description of embodiments of the proposed preform and method. The detailed description refers to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0043] The accompanying drawings are diagrammatic and seek above all to show the principles of the invention.

[0044] FIG. **1** is a section view of a turbine engine of the invention.

[0045] FIG. **2** is a perspective view of a rear stator of a turbine.

[0046] FIG. **3** is a section view of a hollow vane.

[0047] FIGS. **4**A and **4**B are a plan view and a section view of an example preform at the end of weaving.

[0048] FIGS. **5**A and **5**B are views of the first fiber structure of the preform when flat and once shaped.

[0049] FIG. **6**A is a detail view of the leading edge of the preform once shaped.

[0050] FIG. **6**B is a detail view of the trailing edge of the preform once shaped.

[0051] FIG. **7** is a perspective view of the unfinished blank obtained from the preform.

[0052] FIG. **8** is a perspective view of the final hollow vane obtained after machining the unfinished blank.

DETAILED DESCRIPTION OF AN EMBODIMENT

[0053] In order to make the invention more concrete, examples of a preform and of a method of fabrication are described in detail below, with reference to the accompanying drawing. It should be recalled that the invention is not limited to these examples.

[0054] FIG. **1** shows a bypass turbojet **1** of the invention in section on a vertical plane containing its main axis A. From upstream to downstream in the flow direction of the air stream, the turbojet comprises a fan **2**, a low pressure compressor **3**, a high pressure compressor **4**, a combustion chamber **5**, a high pressure turbine **6**, and a low pressure turbine **7**. At its downstream end, it also includes a rear turbine stator **10** that is placed in the primary air passage at the outlet from the low pressure turbine **7**.

[0055] FIG. **2** is a perspective view of such a rear turbine stator **10**. It comprises an inner hub **11** and an outer shroud **12** that are radially connected by turbine rear vanes (TRVs) **20**.

[0056] FIG. **8** is a perspective view of an example vane **20** of the present invention, specifically a TRV. Such a vane comprises an airfoil **21**, a bottom platform **22**, a top platform **23**, and bottom and top fastener flanges **24** and **25**. The airfoil portion **22** serves mainly to perform the aerodynamic function of the vane **20**; the platforms **22** and **23** serve to make up inner and outer passage walls that are smooth and streamlined; the fastener flanges **24** and **25** serve to fasten the vane **20** to the inner hub **11** and to the outer shroud **12**, respectively.

[0057] The airfoil **21** of such a TRV **20** is shown in section in FIG. **3**. It has a pressure side wall **26** and a suction side wall **27** that are joined together upstream at a leading edge **28** and downstream at a trailing edge **29**: these pressure side and suction side walls **26** and **27** define an internal empty space **30** forming an airfoil hollow. In this example, this airfoil hollow **30** is to be left empty in order to reduce the weight of the stator. Nevertheless, in other examples, and in particular for other types of part, such an airfoil hollow can be used for passing services. It should also be observed that the leading and trailing edges **28** and **29** serve to define a chord plane C.

[0058] FIGS. **4**A and **4**B show a fiber preform **40'** for obtaining such a vane **20**, in its form at the end of weaving. In these figures, the weft weaving direction is represented by arrow T, i.e. from left to right in the figures, and the warp direction is represented by arrow C. Nevertheless, weaving could naturally be performed starting from the other end and in the opposite direction, and it is also possible for weaving to be performed in a direction that is perpendicular to the arrow C, starting from or bottom edge of the preform **40'**.

[0059] In this embodiment, the preform **40'** is woven three-dimensionally using alumina fibers in a 3D interlock weave.

[0060] The preform **40'** essentially comprises two fiber structures **41'** and **42'** forming substantially two three-dimensionally woven rectangles possessing constant and identical numbers of layers of yarns. These two fiber structures **41'** and **42'** are woven jointly without interlinking over the major fraction of their surfaces; nevertheless, the first and second fiber structures **41'** and **42'** are woven jointly in interlinked manner in a first interlinking zone **43** forming an upstream interlinking portion, and in a second interlinking zone **44**, forming a downstream interlinking portion. Methods of weaving that enable such non-interlinking to be performed are now well known in the field of 3D weaving.

[0061] Thus, as can be seen in FIG. **4**B, a longitudinal section of the preform **40'** shows, in the weaving direction T, an upstream non-interlinking surface D**1**, the first interlinking zone **43**, an internal non-interlinking surface D**2**, the second interlinking zone **44**, and a downstream non-interlinking surface D**3**. Nevertheless, it can clearly be seen in FIG. **4**A that these non-interlinking surfaces D**1**, D**2**, and D**3**

are in fact interconnected, joining one another above and below the interlinking zones **43** and **44**.

[0062] As can be seen from the figures, each fiber structure **41'** and **42'** comprises a main longitudinal portion **46**, **47** extending between the interlinking zones **42** and **43** and separated transversely from its counterpart by the internal non-interlinking surface D2: it can thus be understood that the main longitudinal portions **46** and **47** can form the pressure side and suction side walls **26** and **27** of the airfoil **21** and that the internal non-interlinking surface D2 serves to form the airfoil hollow **30**.

[0063] FIG. **5**A shows the preform **40** spread out flat after it has been cut out. FIG. **5**B shows the same preform **40** after it has been shaped. In these figures, for reasons of legibility, only the first fiber structure **41** as cut out is shown: it should therefore be remembered that the second fiber structure **42** extends behind the first fiber structure **41** and possesses a shape that its substantially analogous.

[0064] In this first fiber structure **41**, there can be seen the main longitudinal portion **46** between the interlinking zones **43** and **44** that extend all along the upstream and downstream ends respectively of the main longitudinal portion **46**.

[0065] The first fiber structure **41** also includes a portion **52**, referred to as the bottom radial portion, that extends from the bottom edge of the main longitudinal portion to the bottom edge of the fiber structure **41**. This bottom radial portion **52** also includes an upstream overlap portion ***52m*** that goes round and extends in part in front of the first interlinking zone **43**, with a cut **49** separating this overlap portion ***52m*** from the first interlinking zone **43**. The bottom radial portion **52** also has a downstream overlap portion ***52v*** that goes round and extends in part behind the second interlinking zone **44**, with a cut **49** separating this overlap portion ***52v*** from the second interlinking zone **43**.

[0066] While the preform **40** is being shaped, this radial portion **52** is folded into a radial position so as to form the pressure side part of the bottom platform **22**.

[0067] This radial portion **52** is also extended forwards by an upstream secondary longitudinal portion ***54m*** and downstream by a downstream secondary longitudinal portion ***54v***. These portions are suitable for being folded longitudinally so as to form the bottom fastener flanges **24**.

[0068] In analogous manner, the first fiber structure **41** has a portion **53**, referred to as the top radial portion, that extends from the top edge of the main longitudinal portion **46** to the top edge of the fiber structure **41**. This top radial portion **53** has upstream and downstream overlap portions ***53m*** and ***53v*** that are separated by cuts **49** from the interlinking zones **43**, **44**. This top radial portion **53** is suitable for being folded into a radial position so as to form the pressure side part of the top platform **23**.

[0069] This top radial portion **53** is also extended forwards by a succession of junction portions **59** giving rise to an upstream secondary longitudinal portion ***55m***, and downstream by a downstream secondary longitudinal portion ***55v***. These secondary longitudinal portions are suitable for being folded longitudinally so as to form the top fastener flanges **25**.

[0070] The preform **40** may be moistened in order to soften it and make it easier to move the fibers out of register. It is then put into a shaper mold of inside space that matches the shape desired for the preform **40**.

[0071] The shaping of the leading edge and of the trailing edge of the preform **40** is described in greater detail with reference to FIGS. **6**A and **6**B. These figures show the shape of the preform **40** in dashed lines and the shape of the final part **20** in continuous lines. During shaping, the main longitudinal portions **46** and **47** are spaced apart from each other so as to leave a gap **50**. An insert is then inserted into the gap **50** so that the matrix does not fill it while being injected and solidified, thus making it possible to obtain the airfoil hollow **30**.

[0072] At the trailing edge **29**, the main longitudinal portions **46** and **47** converge regularly towards the second interlinking portion **44**. Shaping is performed in such a manner that the trailing edge **29** of the final part **20** lies on the midplane **44'** of the interlinking portion **44**.

[0073] Because of the camber of the airfoil **20**, the curvilinear distance between the trailing edge **29** and the leading edge **28** along the suction side wall **27** is longer than the curvilinear distance between the same trailing and leading edges **29** and **28** along the pressure side wall **26**, with the equal-length point I from the trailing edge **29** thus lying a little way from the leading edge **28** on the suction side wall. In contrast, and by construction, the main longitudinal portions **46** and **47** of the first and second fiber structures **41** and **42** possess the same length. Under such circumstances, although the midplane **44'** of the second interlinking portion **44** lies on the desired trailing edge **29**, the midplane **43'** of the first interlinking portion **43** lies at the equal-length point I and not at the leading edge **28**.

[0074] The first interlinking portion **43** thus extends on the suction side of the chord plane C, with its midplane **43'** also forming an angle θ of less than 45° and preferably of about 15° relative to the chord plane C.

[0075] At the leading edge **28**, the longitudinal portion **46** of the first fiber structure **41** on the pressure side is curved so as to form a substantially S-shaped bend, which is initially convex and then concave, so as to form the leading edge **28** and then join the second fiber structure **42** and the first interlinking portion **43**.

[0076] The longitudinal portion **47** of the second fiber structure **42** converges more regularly from the suction side towards the interlinking portion **43**.

[0077] When the profile of the preform **40** is compared with the profile desired for the vane, the distal end of the first interlinking portion, obtained from the interlinking portion **43**, thus forms a first protrusion **63** meeting the desired profile drawn in continuous lines via pressure side and suction side arcs **68** and **69**. In order to ensure correct unmolding, the pressure side arc **68** joins the desired profile at the leading edge **28**. As a result, the point of inflection between the convex and concave curves of the first fiber structure **41** coincides with the leading edge **28**; in addition, the tangent at this point of infliction is perpendicular to the chord plane C.

[0078] The junction between the two fiber structures **41** and **42** at the first interlinking portion **43** also forms a curved notch **67** in the inside surface of the vane that defines the gap **50**.

[0079] Once shaping has been performed with the shaper mold, the preform **40** is dried so as to stiffen, thereby blocking the shape imposed during shaping. The preform **40** is then placed in an injection mold having the dimensions of the desired vane blank **60** into which a matrix is injected, in this example a porous alumina matrix. By way of example, such injection may be performed by the liquid composite molding (LCM) method. At the end of this step, and after the insert has been removed, a vane blank **60** is obtained that is made of composite material comprising a preform **40** woven using alumina fibers and embedded in an alumina matrix.

[0080] It can be seen in FIG. **7** that the vane blank **60** already has the desired platforms **22** and **23** together with the fastener flanges **24** and **25**. In contrast, the airfoil **61** of the unfinished blank **60** possesses upstream and downstream protrusions **63** and **64** resulting from the respective distal ends of the interlinking part obtained from the upstream and downstream interlinking portions **43** and **44**. These protrusions, which can also be seen in FIGS. **6**A and **6**B need to be machined away in order to obtain the final airfoil **21**.

[0081] At the leading edge **28**, machining includes cutting away the upstream protrusion **63** and smoothing the leading edge **28** and the suction side wall **27** to have the desired profile.

[0082] At the trailing edge **29**, the machining includes cutting away from the downstream protrusion **64** and thinning down the trailing edge on either side of the midplane **44**' of the second interlinking portion **44**.

[0083] In order to make machining easier at the junctions between the airfoil **21** and the platforms **22** and **23**, and in order to avoid weakening the structure of the vane during machining, the interlinking portions **43** and **44** are of small width, equal to about 5 millimeters (mm), at their bottom and top ends; they are of greater width, equal to about 10 mm, in the middle of the airfoil **21**.

[0084] Other finishing steps, and in particular machining steps, may possibly be performed to finalize the vane **20**.

[0085] The embodiments or implementations described in the present description are given for illustrative and non-limiting purposes, it being easy in the light of this description for a person skilled in the art to modify the embodiments and implementations or to envisage others while remaining within the scope of the invention.

[0086] Furthermore, the various characteristics of these embodiments or implementations may be used singly or in combination with one another. When they are combined, these characteristics may be combined as described above or in other ways, the invention not being limited to the specific combinations described in the present description. In particular, unless specified to the contrary, a characteristic that is described with reference to any one embodiment or implementation may be applied in analogous manner to any other embodiment or implementation.

1. A fiber preform for a hollow turbine engine vane, the preform comprising:

a first fiber structure obtained by three-dimensional weaving and comprising at least one main longitudinal portion suitable essentially for forming a pressure side wall of an airfoil;

a second fiber structure obtained by three-dimensional weaving and comprising at least one main longitudinal portion suitable essentially for forming a suction side wall of the airfoil;

wherein each of the first and second fiber structures further includes a first interlinking zone extending along the front edge of its main longitudinal portion, which first zones are integral with each other and form a first interlinking portion of the preform, and a second interlinking zone extending along the rear edge of its main longitudinal portion, the second zones being integral with each other and forming a second interlinking portion of the preform; and

wherein the main longitudinal portions of the first and second fiber structures are dissociated so as to leave a gap between said main longitudinal portions suitable for forming an airfoil hollow;

wherein the first interlinking zones of the first and second fiber structures are woven jointly in interlinked manner and/or the second interlinking zones of the first and second fiber structures are woven jointly in interlinked manner;

wherein the main longitudinal portions of the first and second fiber structures are woven jointly in non-interlinked manner;

wherein at least one of the fiber structures further includes at least one radial portion extending from the bottom or top edge of its main longitudinal portion and suitable for forming a platform or a fastener flange; and

wherein at least one of the fiber structures includes an overlap portion that, when the fiber structure is flat, lies in front of at least a portion of the first interlinking zone of said fiber structure or behind at least a portion of the second interlinking zone of said fiber structure, a gap being left between said overlap portion and the interlinking zone in question.

2-**3**. (canceled)

4. A fiber preform according to claim **1**, wherein the first and/or second interlinking portion possesses smaller width at its base and/or at its tip than in its middle.

5. A hollow vane, in particular of the TRV type, wherein it is made as a single piece of composite material from a fiber preform according to claim **1**, said preform being shaped in a mold and embedded in a matrix.

6. A hollow vane according to claim **5**, wherein the fiber preform is made with fibers of ceramic oxide type, preferably of alumina, mullite, silica, or zirconia.

7. A hollow vane according to claim **5**, wherein the matrix is of ceramic oxide type, preferably of alumina, mullite, silica, or zirconia.

8. A turbine engine, comprising a hollow vane according to claim **5**.

9. A method of fabricating a hollow vane, comprising the following steps:

weaving and cutting out a fiber preform according to claim **1**;

folding and shaping the fiber preform in a mold possessing the shape of the desired unfinished blank;

placing an insert in the gap between the two main longitudinal portions;

injecting and solidifying the matrix around the fiber preform in order to obtain the unfinished blank;

removing the insert; and

machining the interlinking parts of the unfinished flank corresponding to the interlinking portions of the fiber preform so as to obtain the leading and trailing edges of the final part.

10. A method according to claim **9**, wherein, during the shaping step, the second fiber structure is curved so as to present, between its second and first interlinking zones, at least a first concave curve suitable for forming the downstream portion of the pressure side of the vane, followed by a convex curve suitable for forming the upstream portion of the pressure side of the vane, itself followed by a second concave curve serving to join with the first fiber structure in the first interlinking zone, a distal portion of the first interlinking zone then extending on the suction side of the chord plane defined by the leading and trailing edges of the desired final part.

11. A method according to claim **10**, wherein the step of machining the first interlinking part of the unfinished blank, corresponding to the first interlinking portion of the fiber preform, includes cutting away from the distal portion of the first interlinking part and smoothing the leading edge and the suction side wall.

12. A method according to claim **9**, wherein the step of machining the second interlinking part of the unfinished blank, corresponding to the second interlinking portion of the fiber preform, essentially comprises thinning down said second interlinking part in order to obtain the trailing edge.

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