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(54) **BLADE OR VANE FOR A COMPRESSOR AND COMPRESSOR COMPRISING SAID BLADE OR VANE**

LAUF- ODER LEITSCHAUFEL FÜR EINEN VERDICHTER UND VERDICHTER MIT EINER SOLCHEN
SCHAUFEL

AUBE ROTORIQUE OU STATORIQUE POUR COMPRESSEUR ET COMPRESSEUR AVEC UNE
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Description

[0001] The invention relates to a blade or vane for a compressor and to a compressor comprising said blade or vane. In particular, the invention relates to a blade or vane for a compressor of a gas turbine power plant.

[0002] Gas turbine power plants usually comprise a compressor, where an air flow flows, a combustion chamber, which is supplied with a fuel and with air coming from the compressor, a gas turbine, where the gases coming from the combustion chamber flow, and a generator, which is mechanically connected to a common shaft of the gas turbine and of the compressor and is connected to an electrical distribution network.

[0003] The compressor and the gas turbine extend along a longitudinal axis and respectively define a compression channel and an expansion channel, along which radial series of rotor blades, which rotate around the axis, alternate with radial series of stator vanes. Some examples of blades/vanes are disclosed in documents EP1112928, EP0615903, EP0833060, US2016348694 and EP2336492. EP 1112928 discloses a wing profile suitable for compressor blading, having a Gurney flap in a variety of shapes extending along the entire length of the trailing edge for improving wake flow and reducing noise. US 2016348694 discloses a gas turbine engine stator airfoil including a plurality of spanwise spaced winglets extending axially and outwardly from opposed sides of the airfoil to the trailing edge to aerodynamically manage boundary layers and micro-shocks. EP 2336492 discloses a guide vane for a compressor or turbine having a tip winglet to reduce leakage.

[0004] In the compressor, stall conditions can occur in the area of the aerofoil profile of the rotor blades or stator vanes. These conditions can cause instability phenomena, up to the surging of the entire compressor.

[0005] Since the surging of the compressor leads to a forced standstill of the plant and to the risk of serious structural damages for the compressor itself, the operation of the plant is usually limited so as to prevent this phenomenon from occurring. For example, the operation of the compressor can be restricted by limiting the value of the minimum air flow rate of the compressor to a safety value that exceeds the minimum values that can actually be borne by the compressor in order to ensure the operation thereof. This solution has evident negative impacts on the possibility of exploiting the potentialities of the plant.

[0006] Therefore, an object of the invention is to provide a blade or vane for a compressor, which is not affected by the drawbacks of the prior art; in particular, an object of the invention is to provide blade or vane for a compressor, which allows users to optimally and safely exploit the potentialities of the compressor in an easy and economic manner, both from the functional point of view and from the constructive point of view.

[0007] In accordance with these object, the invention relates to a blade or vane for a compressor according to

claim 1.

[0008] A further object of the invention is to provide a compressor, which is reliable and, at the same time, efficient.

[0009] In accordance with these object, the invention relates to a compressor for a gas turbine power plant as claimed in claim 6.

[0010] Further features and advantages of the invention will be best understood upon perusal of the following description of a non-limiting embodiment thereof, with reference to the accompanying drawing, wherein:

- figure 1 is a schematic sectional view, with parts removed for greater clarity, of a power plant comprising the compressor according to the invention;
- figure 2 is an enlarged view of a detail of the compressor of figure 1;
- figure 3 is a schematic perspective view, with parts removed for greater clarity, of a detail of a blade or vane not forming part of the invention;
- figure 4 is a schematic view from the top, with parts removed for greater clarity, of the blade or vane of figure 3;
- figure 5 is a sectional view along plane V-V indicated in figure 3;
- figure 6 is a schematic perspective view, with parts removed for greater clarity, of a detail of a blade or vane not forming part of the invention;
- figure 7 is a schematic perspective view, with parts removed for greater clarity, of a detail of the blade or vane according to the invention in accordance with an embodiment;
- figures 8A, 8B, 8C are schematic and simplified representations of the flow lines in the proximity of a compressor blade or vane, figure 8C representative for a blade or vane according to the invention.

[0011] In figure 1, number 1 indicates a gas turbine power plant.

[0012] The plant 1 extends along a longitudinal axis A and comprises a combustion chamber 2, a stator 3 and a rotor 4, which rotates around the axis A.

[0013] The stator 3 comprises a stator casing 5, which extends around the axis A over the entire length of the rotor 4 and is static, a plurality of stator rings 6, which are centred on the axis A, are supported by the stator casing 5 and are arranged in succession along the axis A, and a plurality of stator vanes 7, which substantially extend along respective radial directions and are fixed to the stator casing 5 and to the respective stator rings 6.

[0014] The rotor 4 comprises a shaft 8 extending along the axis A, a plurality of rotor discs 9, which are coupled to one another so as to define one single element rotating around the axis A, and a plurality of rotor blades 10, which are divided into series and are arranged radially with respect to the axis A.

[0015] The stator rings 6 extend around the rotor discs 9 and are spaced apart from one another so that, along

the axis A, radial series of rotor blades 10 alternate with radial series of stator vanes 7.

[0016] Said plurality of rotor discs 9, the stator rings 6 and the stator casing 5 define a compression channel 13a, where the air to be supplied in compression to the combustion chamber 2 flows, and an expansion channel 14a, where the hot gases coming from the combustion chamber 2 flow. The compression channel 13, the stator rings 6, the rotor discs 9 and the stator casing 5, which surround the compression channel 13, define the so-called compressor 13a.

[0017] The expansion channel 14, the stator rings 6, the rotor discs 9 and the stator casing 5, which surround the expansion channel 14, define the so-called turbine 14a.

[0018] The direction of the air flow is schematically shown by the arrow indicated with F.

[0019] Different stages follow one another along the compression channel 13. Each stage comprises a series of stator vanes 7 and a series of rotor blades 10.

[0020] Figure 2 schematically shows a portion of a stage of the compressor 13b, though without indicating in detail, for the sake of simplicity, all the aspects of the invention.

[0021] Each stator vane 7 of the compressor 13b comprises a main body 15, which is provided with a base face 16 coupled - in use - to the respective stator ring 6, with a top face 17 opposite the base face 16 and coupled - in use - to the stator casing 5, and with an outer face 18, which extends between the base face 16 and the top face 17 and defines the airfoil profile of the stator vane 7.

[0022] Basically, in use, the base face 16 is proximal to the axis A with respect to the top face 17 along the radial direction of extension of the stator vane 7.

[0023] Each rotor blade 10 of the compressor comprises a main body 25, which is provided with a base face 26 coupled - in use - to the respective rotor disc 9, with a top face 27, which is free and opposite the base face 26, and with an outer face 28, which extends between the base face 26 and the top face 27 and defines the airfoil profile of the rotor blade 10. The top face 27 is often defined "apex".

[0024] Basically, in use, the base face 26 is proximal to the axis A with respect to the top face 27 along the radial direction of extension of the rotor blade 10.

[0025] In figures 3, 4, 5, 6 we will refer, by mere way of example, to a stator vane 7 and to the respective main body 15.

[0026] Obviously, the features of the main body 15 and of the rotor vane 7 described here and hereinafter and shown in figures 3, 4 and 5 also apply to each rotor blade 10 of the compressor 13b and to the respective main body 25.

[0027] Figure 3 and figure 4 show a portion of a stator vane 7 not forming part of the invention.

[0028] The vane 7 comprises the main body 15 described above and at least one appendix 29.

[0029] The main body 15, for the sake of simplicity, is

represented like a solid body. However, the main body 15 can also be hollow.

[0030] More in detail, the main body 15 is shaped so as to define, along the outer face 18 a leading edge 30, a trailing edge 31, a pressure side 32 and a suction side 33.

[0031] The main body 15 has a radial height S (shown in figure 3), usually defined in the field as "span", an axial length C (shown in figure 4), usually defined in the field as "chord", and a median line M (shown with a broken line in figure 4), usually defined in the field as "camber line".

[0032] The appendix 29 is coupled to the main body 15 in the proximity of the trailing edge 31. In other words, the appendix 29 is arranged at a distance from the trailing edge 31 that is smaller than 20% of the axial length C.

[0033] In the non-limiting embodiment described and shown herein, the appendix 29 is arranged exactly in the area of the trailing edge 31 and, therefore, in this example the distance from the trailing edge 31 is substantially equal to zero.

[0034] Here and below, by appendix we mean a projection of the body, for example shaped like a wing, or a portion of the body itself, which is properly bent and/or shaped so as to obtain the specific aerodynamic effect described hereinafter.

[0035] In the example described and shown herein, the appendix 29 is arranged along the pressure side 32 in the proximity of the top face 17. In other words, the appendix 29 is arranged at a distance from the top face 17 that is smaller than 30% of the radial height S.

[0036] In the example described and shown herein, the appendix 29 is arranged exactly in the area of the top face 17 and, therefore, in this example the distance from the top face 17 is substantially equal to zero.

[0037] The appendix 29 extends along at least a portion of the trailing edge 31. Preferably, the appendix 29 has a radial height S1 that is equal to at least 2% of the radial height S of the main body 15.

[0038] In the example described and shown herein, the appendix 29 tapers towards the centre of the main body 15.

[0039] Figure 5 shows an axial section of the main body 15 in the area of plane V-V indicated in figure 3.

[0040] In the example described and shown herein, the appendix 29 has a substantially trapezoidal axial section.

[0041] In particular, the appendix 29 has a front face 40, a rear face 41 and an intermediate face 42 comprised between the rear face 41 and the front face 40. The position of the front face 40 and of the rear face 41 relates to the direction of the working fluid air flow in the compression channel 13. The front face 40, indeed, is the face that first meets the working fluid air flow in the compression channel 13.

[0042] In the example described and shown herein, the front face 40 is flat. According to a variant thereof, the front face is curved.

[0043] In the non-limiting example described and shown herein, the front face 40 projects from the pressure side 32 and is arranged so that the tangent in at least one point of the front face 40 intersects the median line M (camber line) forming an angle α that is greater than 10°, preferably greater than 30°.

[0044] In the example shown in figure 5, in which the front face 40 is flat, the tangent in at least one point of the front face 40 is the prolongation of the front face 40 itself.

[0045] In the non-limiting example described and shown herein, the rear face 41 is flat. According to a variant thereof, the rear face is curved.

[0046] In the non-limiting example described and shown herein, the rear face 41 projects from the trailing edge 31 and is arranged so that the tangent in at least one point of the rear face 41 intersects the median line M (camber line) forming an angle β that is greater than 30°, preferably greater than 50°.

[0047] In the example shown in figure 5, in which the rear face 41 is flat, the tangent in at least one point of the rear face 41 is the prolongation of the rear face 41 itself. The rear face has a width L, meaning the measure of the extension of the rear face 41 along a direction orthogonal to the median line M with respect to the pressure side 32, that is smaller than 10% of the axial length C (chord).

[0048] In the non-limiting example described and shown herein, the angle α is approximately 80° and the angle β is approximately 90°.

[0049] In the non-limiting example described and shown herein, the intermediate face 42 is flat. According to a variant thereof, the intermediate face is curved.

[0050] Preferably, the main body 15 and the appendix 29 are manufactured as one single piece. In other words, the main body 15 and the appendix 29 are a one-piece body.

[0051] With reference to figure 8A, where the flow lines are schematically represented like broken lines, the appendix 29 is shaped so as to obtain a specific aerodynamic effect in the compression channel 13a, namely redistributing the working fluid flow rate on the blade or vane, moving the excess flow rate present on the central section of the main body 15 towards the end section of the main body 15 close to the top face 17. By so doing, stall is avoided even in operating conditions that would be impossible for traditional blades or vanes.

[0052] Figure 6 shows a stator vane 70 not forming part of the invention. In figure 6 the same reference numbers used in the preceding figures 3-5 can be found to indicate parts that are substantially identical or similar.

[0053] The vane 70 basically differs from the vane 7 because it comprises an appendix 79 that is arranged in the proximity of the base face 16, instead of in the proximity of the top face 17. In other words, the appendix 79 is arranged at a distance from the base face 16 that is smaller than 30% of the radial height S.

[0054] In the example described and shown herein, the appendix 79 is arranged exactly in the area of the

base face 16 and, therefore, in this example the distance from the base face 16 is substantially equal to zero.

[0055] The appendix 79 has a radial height S2 that, again, is equal to at least 2% of the radial height S of the main body 15 and substantially has the same geometry as the appendix 29.

[0056] With reference to figure 8B, where the flow lines are schematically represented like broken lines, the appendix 79 is shaped so as to obtain a specific aerodynamic effect in the compression channel 13a, namely redistributing the working fluid flow rate on the blade or vane, moving the excess flow rate present on the central section of the main body 15 towards the end section of the main body 15 close to the base face 16. By so doing, stall can be avoided even in operating conditions that would be impossible for traditional blades or vanes.

[0057] Figure 7 shows a stator vane 700 according to an embodiment of the invention. In figure 7 the same reference numbers used in the preceding figures 3-5 can be found to indicate parts that are substantially identical or similar.

[0058] The vane 700 basically differs from the vane 7 because it comprises a further appendix 779 that is arranged in the proximity of the base face 16.

[0059] In other words, the appendix 29 is arranged at a distance from the top face 17 that is smaller than 30% of the radial height S, whereas the appendix 779 is arranged at a distance from the base face 16 that is smaller than 30% of the radial height S.

[0060] In the non-limiting example described and shown herein, the appendix 29 is arranged exactly in the area of the top face 17 and, therefore, in this example the distance from the top face 17 is substantially equal to zero, and the appendix 779 is arranged exactly in the area of the base face 16 and, therefore, in this example the distance of the appendix 779 from the base face 16 is substantially equal to zero.

[0061] The appendix 779 has a radial height S2 that, again, is equal to at least 2% of the radial height S of the main body 15 and substantially has the same geometry as the appendix 29.

[0062] According to a variant that is not shown herein, the appendix 29 and the appendix 779 have different geometries, so as to determine different and targeted flow deflecting effects.

[0063] With reference to figure 8C, where the flow lines are schematically represented like broken lines, the appendices 29 and 779 are shaped so as to obtain a specific aerodynamic effect in the compression channel 13a, namely redistributing the working fluid flow rate on the blade or vane, moving the excess flow rate present on the central section of the main body 15 towards the end sections of the main body 15 close to the top face 17 and to the base face 16. By so doing, stall can be avoided even in operating conditions that would be impossible for traditional blades or vanes.

[0064] As already mentioned above, the features of the vane 7, 70, 700 described with reference to figures

4 to 7 can also be applied to the rotor blades 10.

[0065] The blades or vanes 700 according to the invention are capable of significantly increasing the flow deflection capacity in the proximity of one end or both ends of the main body 15, 25. By so doing, stall can be avoided even in operating conditions that would be impossible for traditional blades or vanes. As already mentioned above with reference to figures 8A, 8B, 8C, the appendices 29, 79, 779 are capable of redistributing the working fluid flow rate on the blade or vane 7, 10, 70, 700, moving the excess flow rate present on the central section towards one or more end sections of the main body 15, 25.

[0066] As a matter of fact, the risk of stall increases in the area of the ends. The airfoil profiles of the blades or vanes of a compressor operate in different conditions in the central portion of the profile and at the two radial ends. In the aforesaid end areas, the blades or vanes cannot generate a deflection of the flow that is sufficient to make sure that the flow adheres to the profile, hence the function of the entire blade or vane is jeopardized.

[0067] The adherence of the flow to the profile of a blade or vane, or the lack thereof, depends on the shape of the blade or vane profile, on the speed of the flow and on the presence of viscous frictions, vortices and other disturbing aerodynamic phenomena.

[0068] In the end areas of a blade or vane viscous losses are high. When working fluid flow rates are low (for example, when the plant is operated with a minimum load), the end areas are the ones that are most subjected to flow separation and, therefore, to stall risk.

[0069] Thanks to this invention, therefore, the tendency to stall is reduced in the end sections of the blade or vane 7, 10, 70, 700 and, as a consequence, the useful operating range of the compressor 13b is increased, with evident advantages in terms of performances of the entire plant 1.

[0070] Advantageously, in the blades or vanes 700 according to the invention, the airfoil profile (i.e. the outer face 18, 28 of the main body 15, 25) is not changed in terms of curvature, axial or radial dimensions.

[0071] This avoids expensive and complicated interventions from the designing and constructive point of view.

[0072] The simple addition of one or more appendices determined an increase in the capacity of the blade or vane of redistributing the flow rate from the central section to the end one, given the same surface. This is determined by a significant increase in the lift of the end sections, though with a low resistance increase.

[0073] As a matter of fact, where there is an appendix, the blade or vane acts as if its axial length (chord) were longer. Estimations indicate that the appendix generates a blade or vane lift that is similar to the one of a blade or vane that has a surface increased by 20%.

[0074] In conclusion, thanks to the blade or vane according to the invention, the operating field of the compressor 13b is widened without important structural in-

terventions.

[0075] The reduced dimensions of the appendices 29, 779 make this invention easy and cheap to be manufactured.

[0076] Finally, it is clear that the blade or vane and the compressor described herein can be subjected to changes and variations, without for this reason going beyond the scope of protection set forth in the appended claims.

Claims

1. Blade or vane for a compressor comprising:

- a main body (15; 25) provided with a base face (16; 26), with a top face (17; 27), opposite with respect to the base face (16; 26), and with an outer face (18; 28), which extends between the base face (16; 26) and the top face (17; 27) and defines the airfoil profile of the blade or vane (7; 10; 70; 700); the main body (15; 25) being shaped so as to define along the outer face (18; 28) a leading edge (30), a trailing edge (31), a pressure side (32) and a suction side (33);
- one appendix (29) and one further appendix (779) arranged in the proximity of the trailing edge (31); wherein the blade is arranged, in use, along a radial direction with respect to the extension axis (A) of the compressor (13b); the main body (15; 25) having a span (S), which is the radial height, and a chord (C), which is the axial length; the appendix (29) and the further appendix (779) presenting a front face (40), which, in use, first meets the working fluid air flow, a rear face (41), which is arranged downstream the front face (40), and an intermediate face (42) comprised between the rear face (41) and the front face (40); wherein the front face (40) is arranged so that the tangent in at least one point of the front face (40) intersects a camber line (M) forming, on a plane orthogonal to the spanwise direction, a first downstream angle (α) greater than 10°, preferably greater than 30°, and wherein the rear face (41) is arranged so that the tangent in at least one point of the rear face (41) intersects the camber line (M) forming, on a plane orthogonal to the spanwise direction, a second downstream angle (β) greater than 30°, preferably greater than 50°;
- the appendix (29) and the further appendix (779) extending in spanwise direction along at least one respective portion of the trailing edge (31); the appendix (29) being arranged in the proximity of the top face (17; 27) and the further appendix (779) being arranged in the proximity of the base face (16; 26); the appendix (29) and the further appendix (779) tapering in spanwise direction towards the mid-span section of the

main body (15; 25) so as to define one central section along the span (S) of the trailing edge (31) which is not provided with appendixes.

2. Blade or vane according to any one of the foregoing claims, wherein the appendix (29; 779) is arranged along the pressure side (32). 5
3. Blade or vane according to any one of the foregoing claims, wherein the appendix (29; 779) has a radial height (S1; S2; S1, S2) equal to at least 2% of the radial height (S) of the main body. 10
4. Blade or vane according to any one of the foregoing claims, wherein the appendix (29; 79; 779) has a substantially trapezoidal axial section. 15
5. Blade or vane according to any one of the foregoing claims, wherein the rear face (41) has a width (L), intended as the measure of the extension of the rear face (41) along a direction orthogonal to the camber line (M) with respect to the pressure side (32), smaller than 10% of the axial length (C). 20
6. Compressor for a gas turbine power plant extending along a longitudinal axis (A) and provided with a plurality of rotor blades (10) and with a plurality of stator vanes (7); at least one of the plurality of rotor blades (10) and of the plurality of stator vanes (7) being of the type claimed in anyone of the foregoing claims. 25 30

Patentansprüche

1. Schaufel oder Leitschaufel für einen Verdichter, umfassend: 35
 - einen Hauptkörper (15; 25) mit einer Unterseite (16; 26), einer in Bezug auf die Unterseite (16; 26) gegenüberliegenden Oberseite (17; 27) und einer Außenseite (18; 28), die sich zwischen der Unterseite (16; 26) und der Oberseite (17; 27) erstreckt und das Schaufelblattprofil der Schaufel oder Leitschaufel (7; 10; 70; 700) begrenzt; wobei der Hauptkörper (15; 25) so geformt ist, dass er entlang der Außenseite (18; 28) eine Vorderkante (30), eine Hinterkante (31), eine Druckseite (32) und eine Saugseite (33) begrenzt; 40
 - einen Ansatz (29) und einen weiteren Ansatz (779), die in der Nähe der Hinterkante (31) angeordnet sind; 45
 - wobei die Schaufel im Betrieb in Bezug auf die Erstreckungsachse (A) des Verdichters (13b) entlang einer Radialrichtung angeordnet ist; der Hauptkörper (15; 25) eine Spannweite (S) aufweist, die der Radialhöhe entspricht, und eine Sehne (C), die der Axiallänge entspricht; wobei 50 55

der Ansatz (29) und der weitere Ansatz (779) eine Vorderfläche (40) aufweisen, die im Betrieb zuerst auf die Luftströmung der Arbeitsflüssigkeit trifft, eine Rückfläche (41), die abströmseitig der Vorderfläche (40) angeordnet ist, und eine Zwischenfläche (42), die zwischen der Rückfläche (41) und der Vorderfläche (40) angeordnet ist; wobei die Vorderfläche (40) so angeordnet ist, dass die Tangente in mindestens einem Punkt der Vorderfläche (40) eine Wölbungslinie (M) schneidet, so dass auf einer Ebene orthogonal zu der Spannweitenrichtung ein erster Abströmwinkel (α) größer als 10° , bevorzugt größer als 30° , gebildet wird, wobei die Rückfläche (41) so angeordnet ist, dass die Tangente in mindestens einem Punkt der Rückfläche (41) die Wölbungslinie (M) schneidet, so dass auf einer Ebene orthogonal zu der Spannweitenrichtung ein zweiter Abströmwinkel (β) größer als 30° , bevorzugt größer als 50° , gebildet wird; wobei sich der Ansatz (29) und der weitere Ansatz (779) in der Spannweitenrichtung entlang mindestens einem entsprechenden Abschnitt der Hinterkante (31) erstrecken; wobei der Ansatz (29) in der Nähe der Oberseite (17; 27) angeordnet ist und der weitere Ansatz (779) in der Nähe der Unterseite (16; 26) angeordnet ist; wobei sich der Ansatz (29) und der weitere Ansatz (779) in der Spannweitenrichtung in Richtung des mittleren Spannweitenabschnitts des Hauptkörpers (15; 25) verjüngen, so dass sie entlang der Spannweite (S) der Hinterkante (31) einen Mittelabschnitt begrenzen, der nicht mit Ansätzen versehen ist.

2. Schaufel oder Leitschaufel nach einem der vorstehenden Ansprüche, wobei der Ansatz (29; 779) entlang der Druckseite (32) angeordnet ist.
3. Schaufel oder Leitschaufel nach einem der vorstehenden Ansprüche, wobei der Ansatz (29; 779) eine Radialhöhe (S1; S2; S1, S2) aufweist, die mindestens 2% der Radialhöhe (S) des Hauptkörpers entspricht.
4. Schaufel oder Leitschaufel nach einem der vorstehenden Ansprüche, wobei der Ansatz (29; 79; 779) einen im Wesentlichen trapezförmigen Axialabschnitt aufweist.
5. Schaufel oder Leitschaufel nach einem der vorstehenden Ansprüche, wobei die Rückfläche (41) eine Breite (L) aufweist, die, in Bezug auf die Druckseite (32) als Maß der Erstreckung der Rückfläche (41) entlang einer Richtung orthogonal zu der Wölbungslinie (M) gedacht, kleiner als 10% der Axiallänge (C) ist.

6. Verdichter für ein Gasturbinenkraftwerk, wobei sich der Verdichter entlang einer Längsachse (A) erstreckt und mit einer Vielzahl von Laufschaufeln (10) und einer Vielzahl von Leitschaufeln (7) versehen ist; wobei mindestens eine der Vielzahl von Laufschaufeln (10) und der Vielzahl von Leitschaufeln (7) dem Typ entspricht, der in einem der vorstehenden Ansprüche beansprucht wird.

Revendications

1. Pale ou aube de compresseur comprenant :

- un corps principal (15 ; 25) doté d'une face de base (16 ; 26), d'une face supérieure (17 ; 27), opposée à la face de base (16 ; 26), et d'une face extérieure (18 ; 28), qui s'étend entre la face de base (16 ; 26) et la face supérieure (17 ; 27), et qui définit le profil aérodynamique de la pale ou de l'aube (7 ; 10 ; 70 ; 700) ; le corps principal (15 ; 25) présentant une forme permettant de définir le long de la face extérieure (18 ; 28), un bord d'attaque (30), un bord de fuite (31), un côté pression (32) et un côté aspiration (33) ;
 - un appendice (29) et un autre appendice (779) agencés à proximité du bord de fuite (31) ;
 où la pale est agencée, en service, le long d'une direction radiale par rapport à l'axe d'extension (A) du compresseur (13b) ; le corps principal (15 ; 25) présentant une longueur (S), qui est la hauteur radiale, et une corde (C), qui est la longueur axiale ; l'appendice (29) et l'autre appendice (779) présentant une face avant (40), qui, en service, rencontre d'abord le flux d'air du fluide de travail, une face arrière (41), qui est agencée en aval de la face avant (40), et une face intermédiaire (42) comprise entre la face arrière (41) et la face avant (40) ; où la face avant (40) est agencée de telle sorte que la tangente en un point au moins de la face avant (40) coupe une ligne de cambrure (M) en formant, sur un plan orthogonal à la direction de la longueur, un premier angle aval (α) supérieur à 10° , de préférence supérieur à 30° , et où la face arrière (41) est agencée de telle sorte que la tangente en un point au moins de la face arrière (41) coupe la ligne de cambrure (M) en formant, sur un plan orthogonal à la direction de la longueur, un second angle aval (β) supérieur à 30° , de préférence supérieur à 50° ;
 l'appendice (29) et l'autre appendice (779) s'étendant dans la direction de la longueur le long au moins d'une partie respective du bord de fuite (31) ; l'appendice (29) étant agencé à proximité de la face supérieure (17 ; 27), et l'autre appendice (779) étant agencé à proximité de la face de base (16 ; 26) ; l'appendice (29)

et l'autre appendice (779) s'amincissant dans la direction de la longueur vers la section à mi-longueur du corps principal (15 ; 25) afin de définir une section centrale le long de la longueur (S) du bord de fuite (31) qui n'est pas dotée d'appendices.

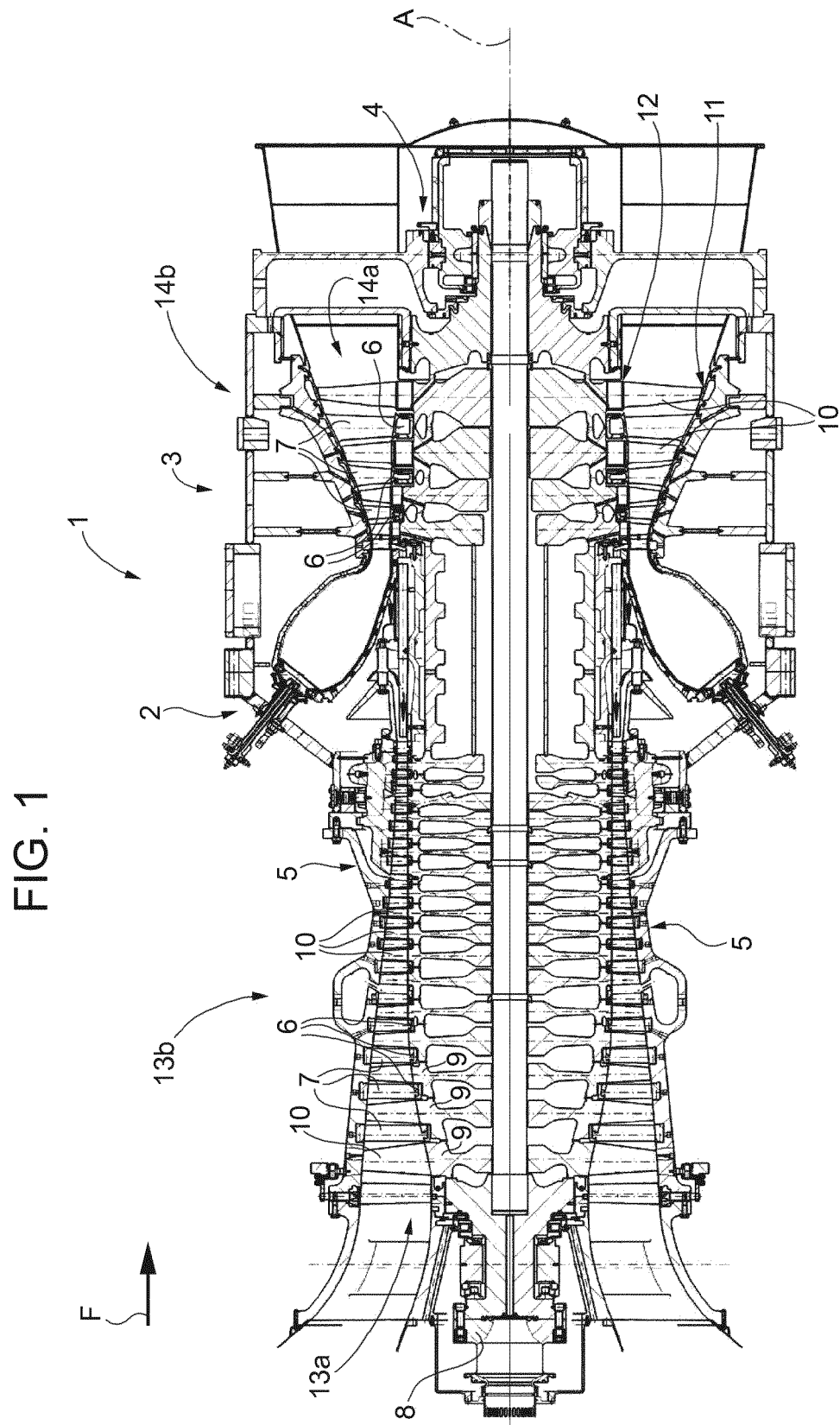
2. Pale ou aube selon la revendication précédente, où l'appendice (29 ; 779) est agencé le long du côté pression (32).

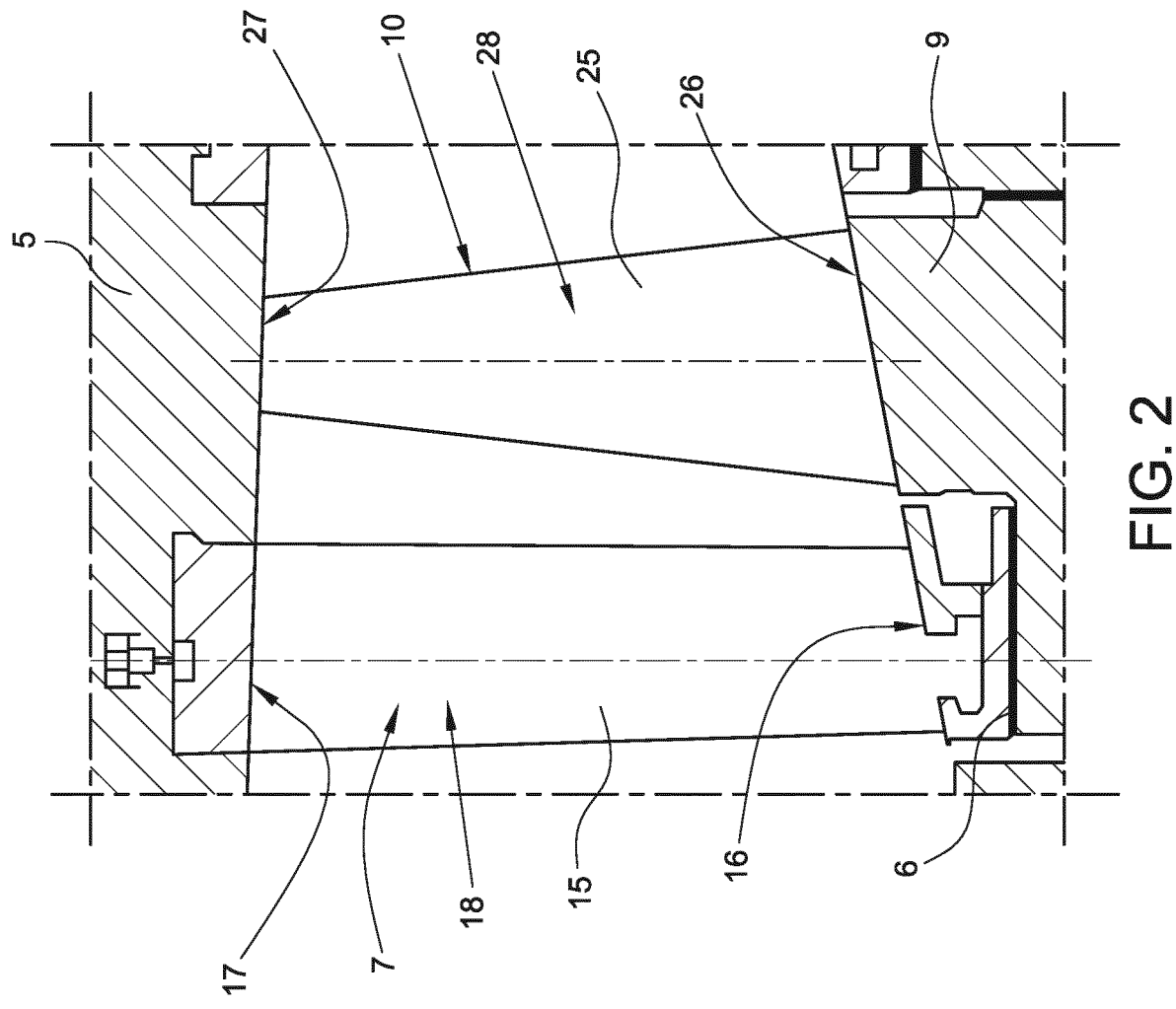
3. Pale ou aube selon l'une quelconque des revendications précédentes, où l'appendice (29 ; 779) présente une hauteur radiale (S1 ; S2 ; S1, S2) égale au moins à 2 % de la hauteur radiale (S) du corps principal.

4. Pale ou aube selon l'une quelconque des revendications précédentes, où l'appendice (29 ; 79 ; 779) présente une section axiale sensiblement trapézoïdale.

5. Pale ou aube selon l'une quelconque des revendications précédentes, où la face arrière (41) présente une largeur (L), prévue comme mesure de l'extension de la face arrière (41) le long d'une direction orthogonale à la ligne de cambrure (M) par rapport au côté pression (32), inférieure à 10 % de la longueur axiale (C).

6. Compresseur d'une centrale à turbine à gaz, s'étendant le long d'un axe longitudinal (A), et doté d'une pluralité de pales de rotor (10), et d'une pluralité d'aubes de stator (7) ; l'une au moins de la pluralité de pales de rotor (10) et de la pluralité d'aubes de stator (7), étant du type revendiqué selon l'une quelconque des revendications précédentes.





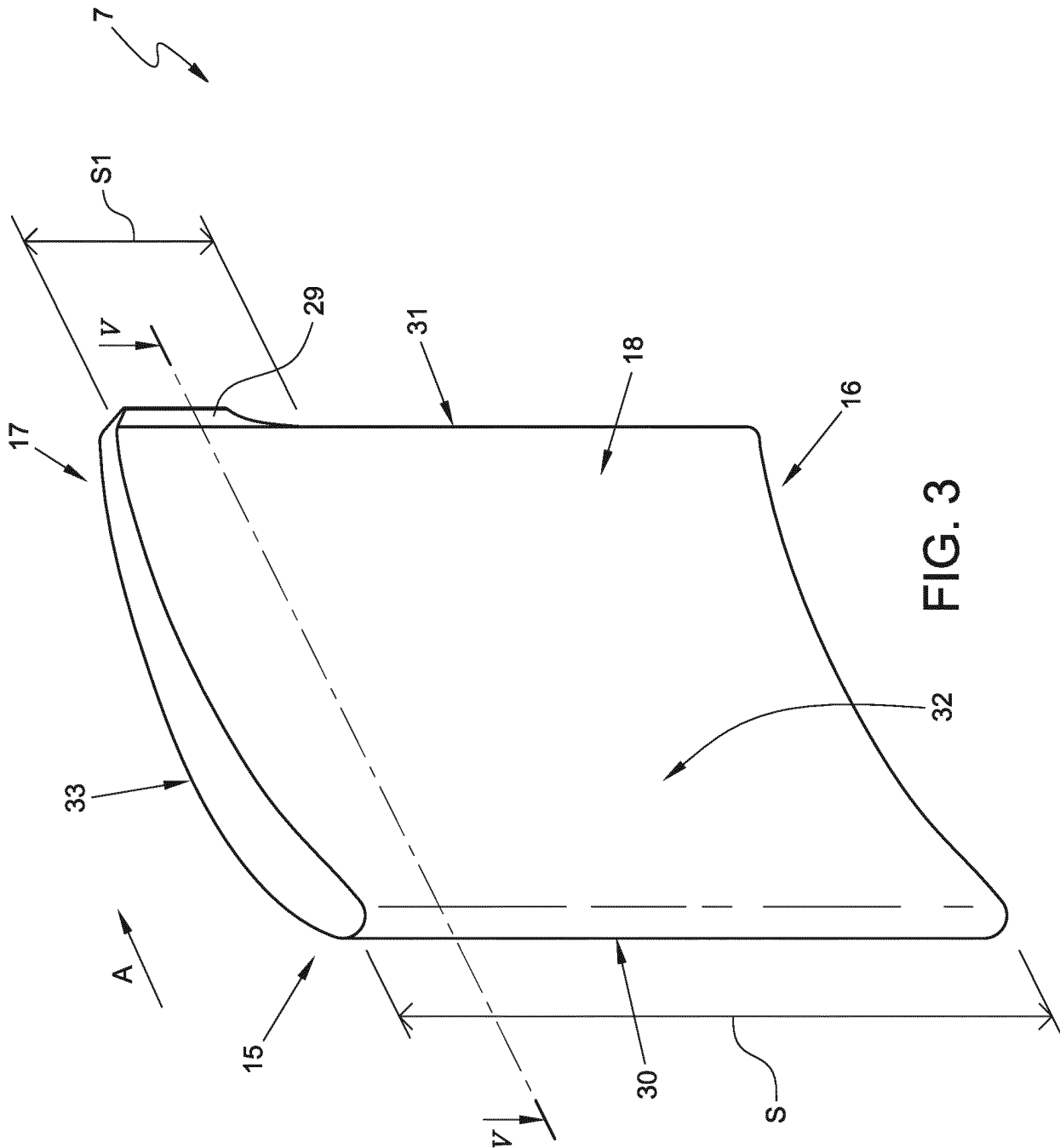
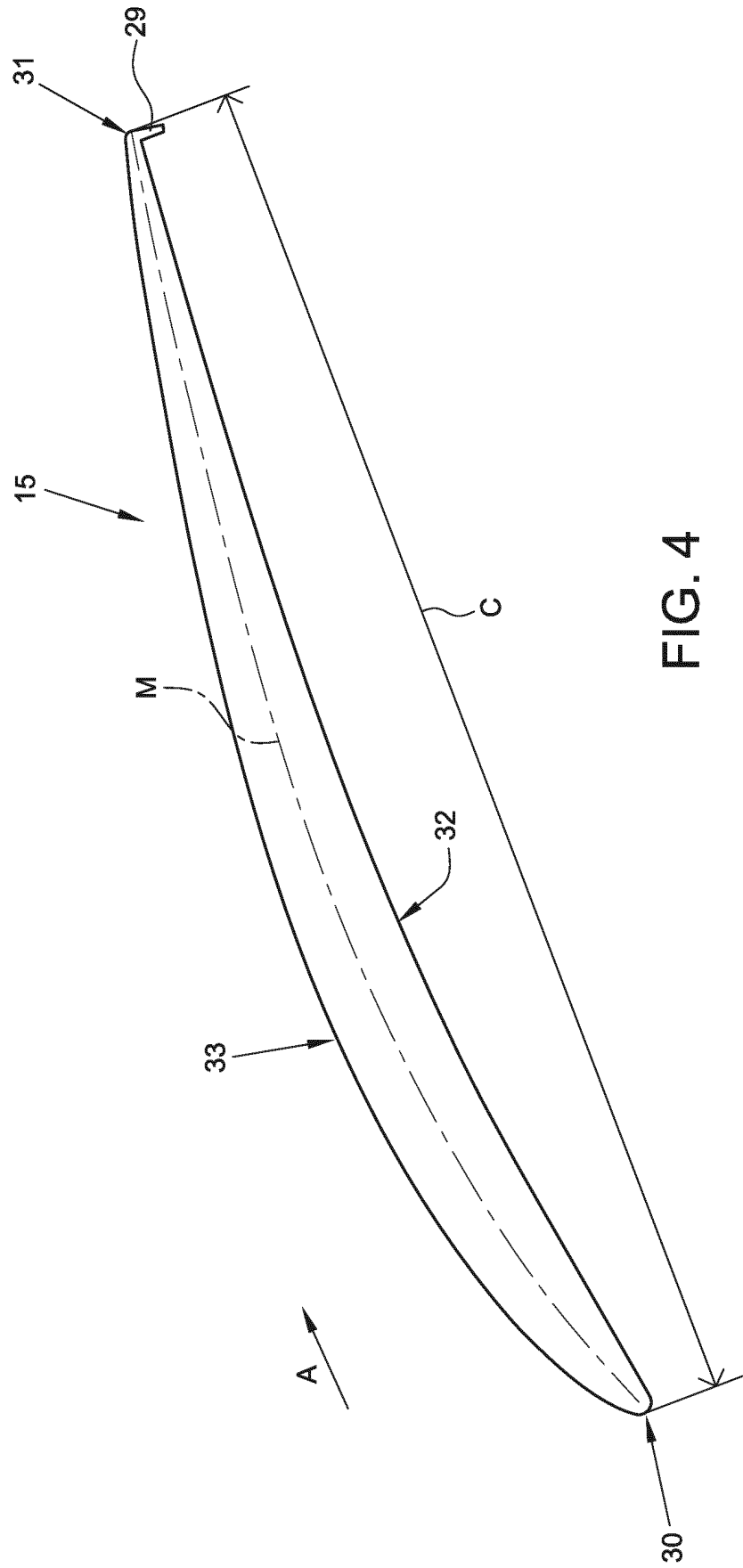


FIG. 3



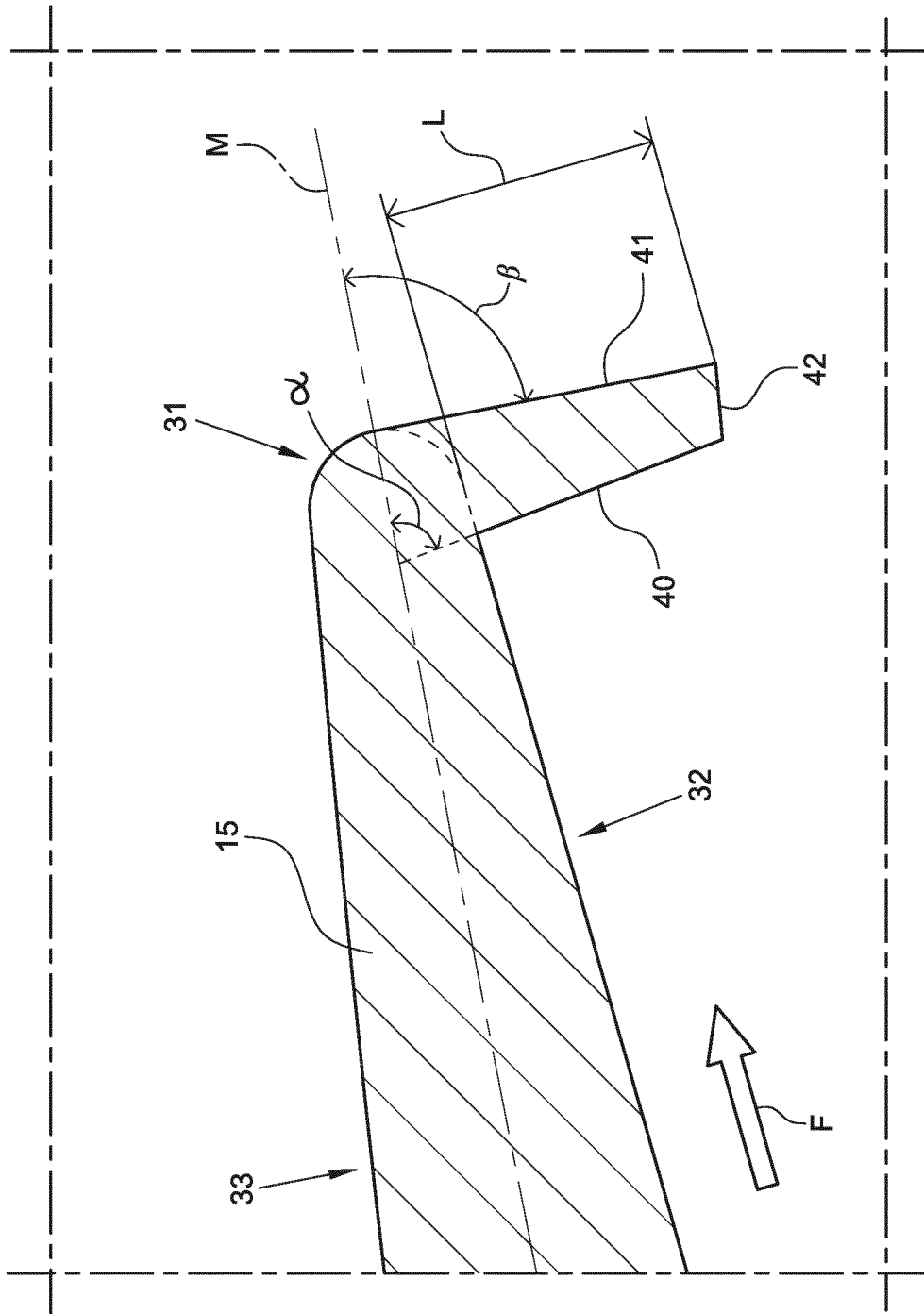


FIG. 5

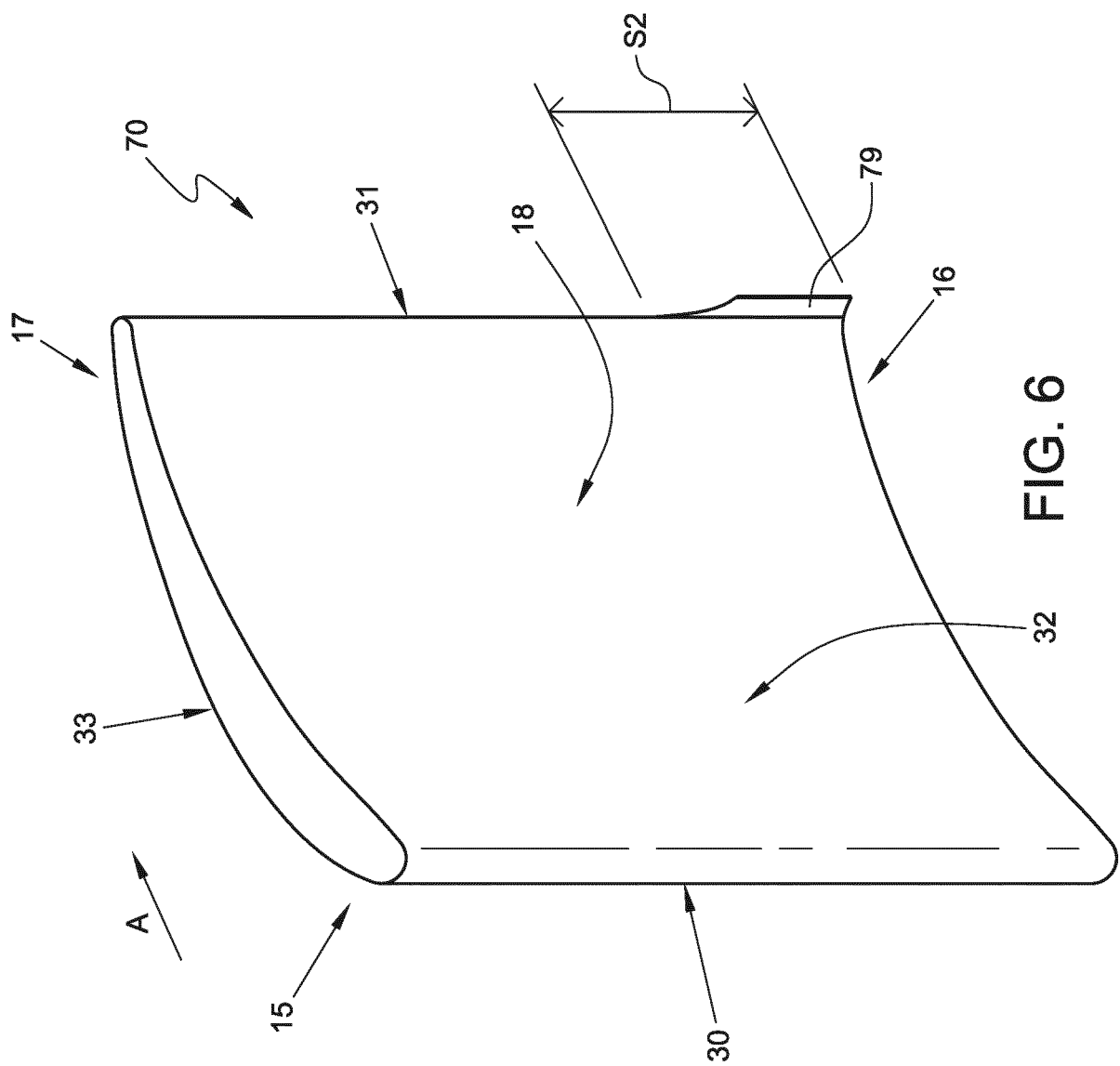


FIG. 6

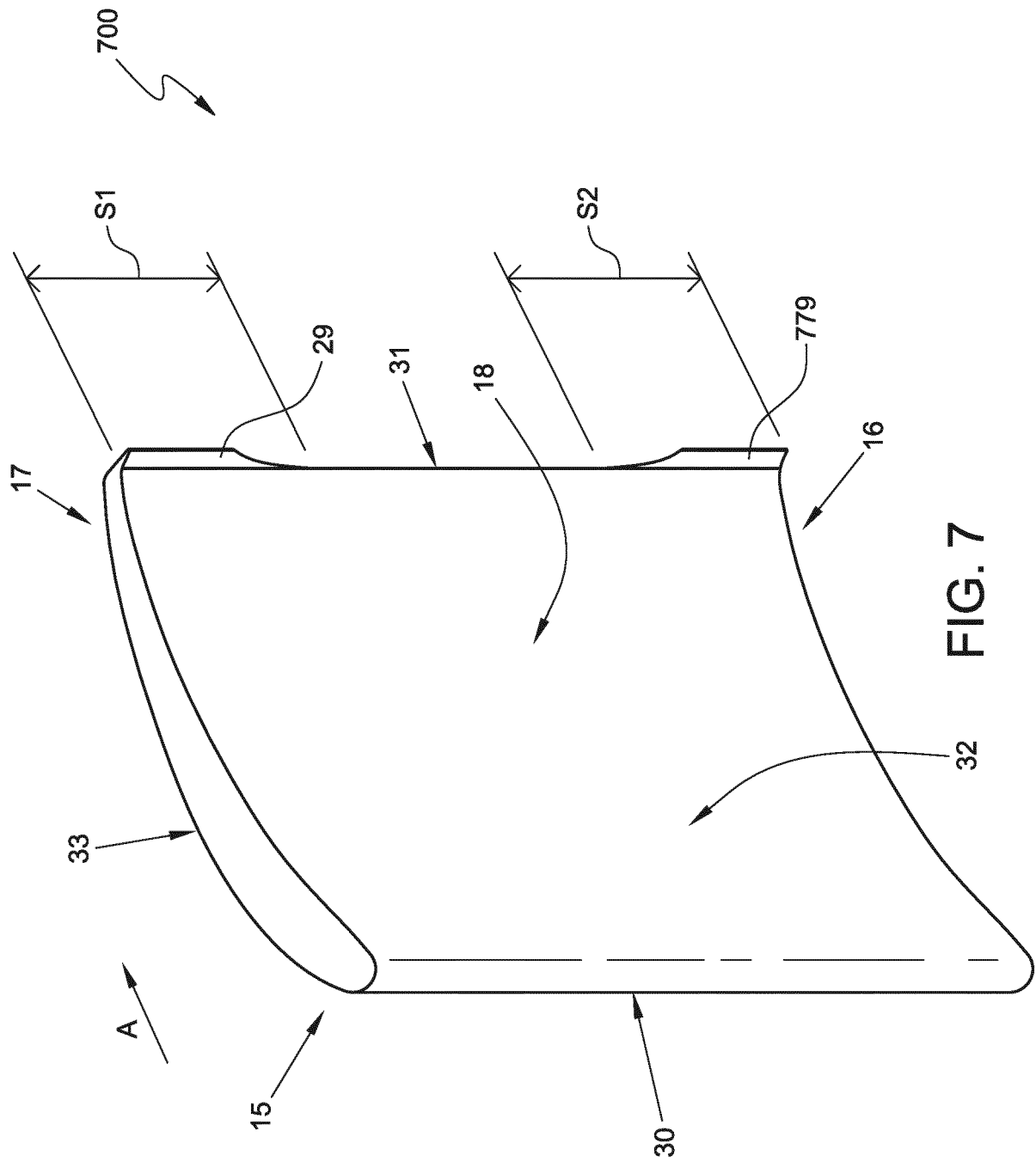


FIG. 7

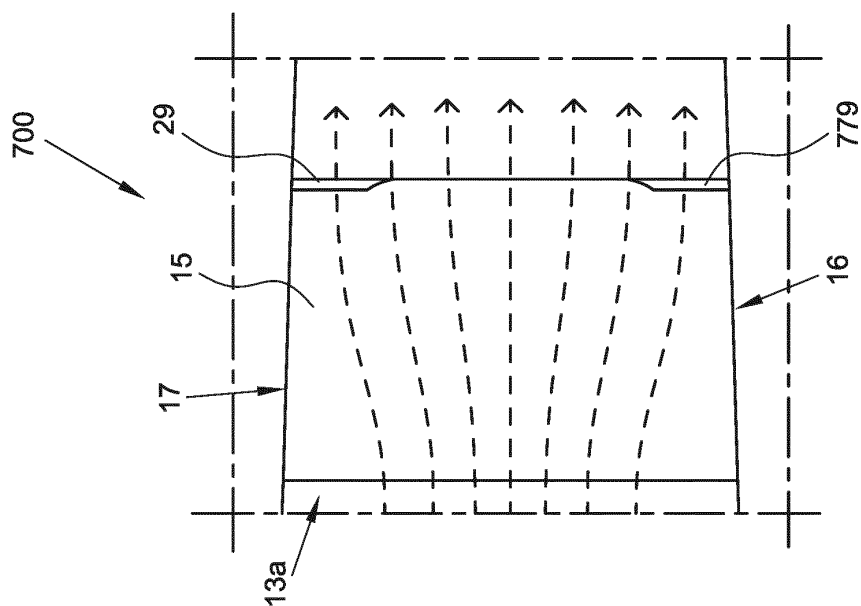


FIG. 8C

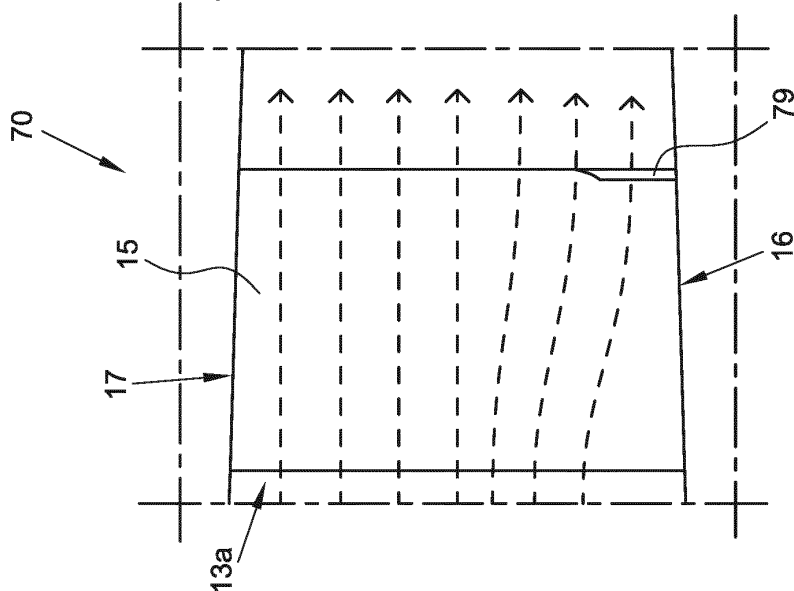


FIG. 8B

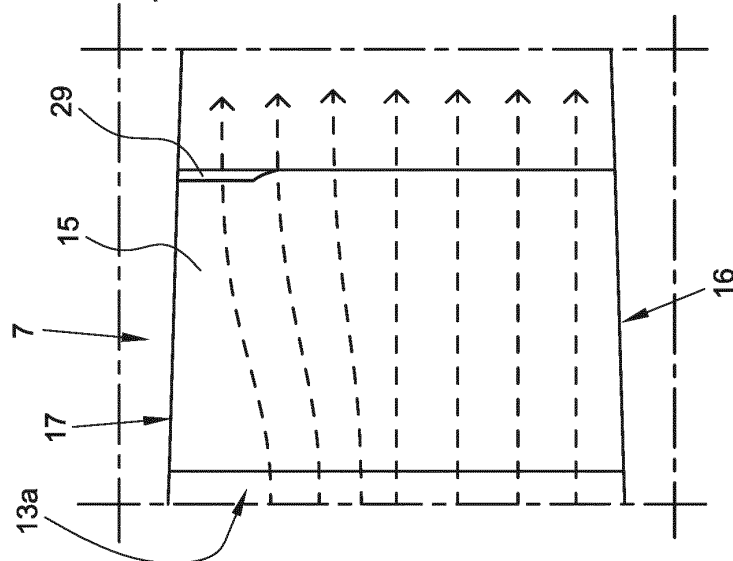


FIG. 8A

REFERENCES CITED IN THE DESCRIPTION

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