

(19)



(11)

EP 2 886 800 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
24.06.2015 Bulletin 2015/26

(51) Int Cl.:
F01D 11/00 (2006.01)

(21) Application number: **13198156.5**

(22) Date of filing: **18.12.2013**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA ME

(71) Applicant: **Rolls-Royce Deutschland Ltd & Co KG
15827 Blankenfelde-Mahlow (DE)**

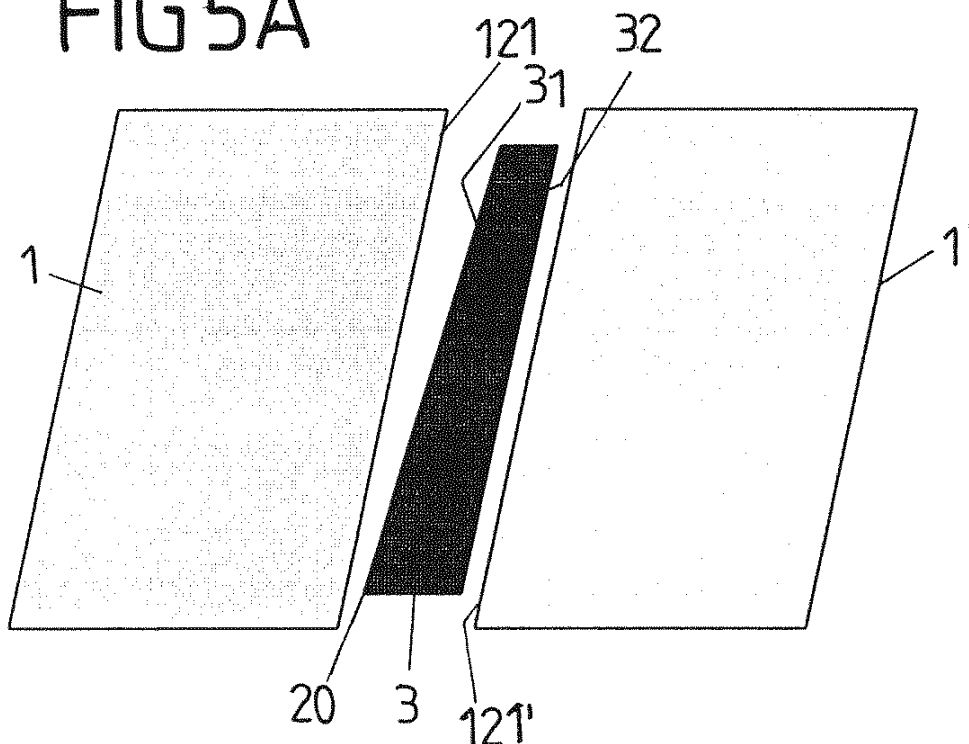
(72) Inventor: **Oyarbide, Asier
10247 Berlin (DE)**

(74) Representative: **Müller, Wolfram Hubertus et al
Patentanwälte
Maikowski & Ninnemann
Postfach 15 09 20
10671 Berlin (DE)**

(54) **Guide vane assembly for a gas turbine and corresponding strip seal**

(57) The invention provides an guide vane assembly with a strip seal (3-12) which comprises at least one first elongated edge (31-91) which is arranged in a groove (2) of a first wedge face (121) of a first guide vane (1) and at least one second elongated edge (32-92) which is arranged in a groove (2') of a second wedge face (121') of a second guide vane (2') that neighbours the first guide vane, wherein the strip seal (3-12) is designed such that in the assembled state of the guide vane assembly at least one of the first and second edges runs at least partly angular with respect to the wedge face in which it is arranged.

FIG 5A



EP 2 886 800 A1

FIG 5B

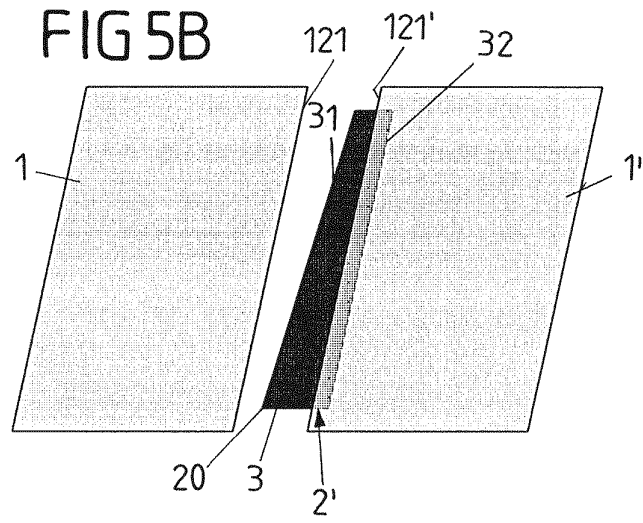


FIG 5C

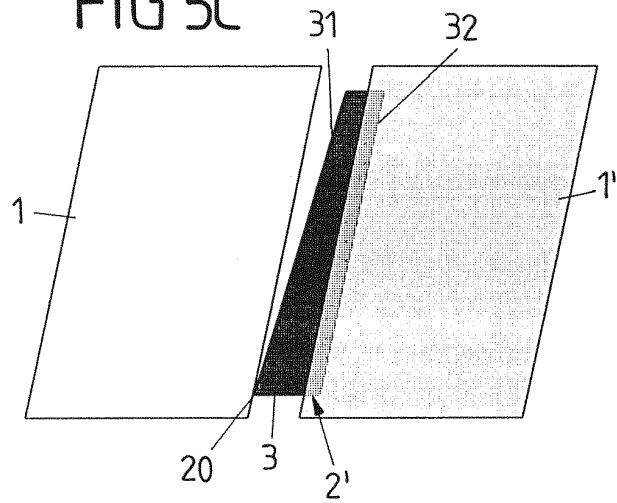
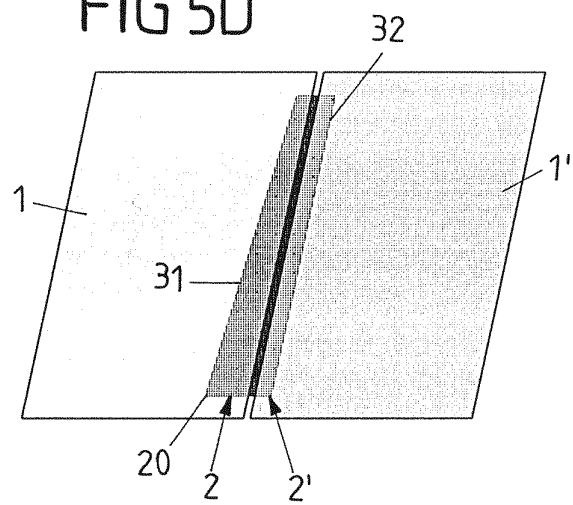


FIG 5D



Description

[0001] The invention regards a guide vane assembly for a gas turbine.

[0002] A guide vane assembly is known to consist of a plurality of guide vanes, which are arranged next to each other in a circumferential direction in a gas turbine. Each guide vane comprises an airfoil section which is arranged in an annular gas flow path of the gas turbine, a vane root and a vane tip. The vane root serves to attach the guide vane at an inner shroud or casing, wherein the vane tip serves to assemble the guide vane in an outer casing.

[0003] It is further known to provide strip seals for sealing gaps between adjacent guide vanes. Such strip seals serve to seal gaps between adjacent guide vanes that would allow gas to leave the annular gas flow path of the gas turbine and as well to seal adjacent cavities to fulfil the secondary air system requirements. Typically, such strip seals are arranged in grooves which are located in wedge faces in the vane root and/or the vane tip.

[0004] It is an object to the present invention to provide for an improved guide vane assembly for a gas turbine in which strip seals are provided which allow an improved assembly of the strip seals in grooves of neighbouring guide vanes. It is a further object of the invention to provide an improved strip seal for such improved guide vane assembly.

[0005] The present invention provides a guide vane assembly which the features of claim 1 and a strip seal with the features of claim 13. Embodiments of the invention are identified in the dependent claims.

[0006] Accordingly, the invention provides an guide vane assembly with a strip seal which comprises at least one first elongated edge which is arranged in a groove of a first wedge face of a first guide vane and at least one second elongated edge which is arranged in a groove of a second wedge face of a second guide vane that neighbours the first guide vane. According to the invention, the strip seal is designed such that in the assembled state of the guide vane assembly at least one of the first and second edges runs at least partly angular with respect to the wedge face in which it is arranged.

[0007] Accordingly, at least one of the elongated edges of the strip seal does not run parallel to the wedge face into which it is inserted. This has the effect that such elongated edge of a strip seal does not need to be placed in a groove over its complete length at once. Instead, there is provided a leading geometry which points towards the wedge face. Insertion of such elongated edge of the strip seal into a respective groove is simplified as the leading geometry leads the strip seal into the groove, wherein the strip seal by its own geometry is driven into the right position.

[0008] The invention thus provides for an improvement in placing an elongated edge of a strip seal into the groove of a wedge face by abandoning a parallel orientation of the elongated edge with respect to the wedge face and

by using instead a design of the strip seal in which at least one of the elongated first and second edges run at least partly angular with respect to the wedge face, thereby forming a leading geometry which is inserted first in the respective groove, thereby leading the strip seal along its elongated edge gradually into the groove. This way, the situation is avoided that the complete edge of the strip seal needs to be assembled into the groove at the same time. By means of the invention, the assembly of a strip seal is simplified and the risk of a wrong assembly is reduced.

[0009] In an embodiment of the present invention, the strip seal forms at least one leading corner at the elongated edge which runs angular with respect to the wedge face. Such leading corner points towards the guide vane in which the groove is located in which the elongated edge is arranged. Such leading corner in one embodiment is located at one of the two ends of the edge. In another embodiment, the leading corner is located between the two ends of the edge. In the first case, in an embodiment, the elongated edge is formed by a straight line. In the second case, in an embodiment, the elongated edge comprises two or more sections, each of which are formed by a straight line, and which run at an angle to each other such that the leading corner is formed where the two sections meet.

[0010] However, it is pointed out that in other embodiments the elongated edge may not be formed by a straight line or sections of straight lines, but may instead have, e.g., a curved or wavy configuration. Further, it is pointed out that the leading corner may be formed by a sharp corner or alternatively may be formed by a rounded corner.

[0011] In a further embodiment of the invention, there are provided a plurality of strip seals which cross each other in a crossing area. In such crossing area, the strip seals may include structures that allows to attach the strip seals to each other in an angled configuration. Such structure may be formed, e.g., by respective slots in the strip seals in the crossing area.

[0012] According to a further aspect of the invention, when a strip seal crosses with a further strip seal, the leading corner may be provided in the crossing area. Similarly, if the strip seal comprises a bended region, the leading corner may be provided in the bended region. The placement of the leading corner in a crossing area or in a bended area is associated with the advantage that the leading corner can guide and lead the strip seal into the respective grooves of both strip seals that cross each other or of both parts of the strip seal that are before and behind the bended region.

[0013] In a further embodiment of the invention, both the first elongated edge and the second elongated edge comprise a leading corner. In such case, preferably, the leading corners at both the first and the second elongated edges are arranged in a symmetrical configuration. This provides for a fool-proof design which allows to assemble a strip seal without having to consider if a particular

of the elongated edges of the strip seal needs to be arranged in a particular groove. Due to the symmetrical configuration, the strip seal can be turned 180 degrees without harm to the assembly process.

[0014] In an embodiment of the invention the strip seal has a flat planar configuration or a flat corrugated configuration. A flat configuration means that the strip seal essentially extends in two dimensions, with its extension in the third dimension being much smaller than its extension in the two other dimensions. For example, the strip seal may be stamped out of a metal sheet or other flat structure. A feature that the strip seal may have a flat planar configuration means that the strip seal extends in a plane. Such strip seals are used in connection with grooves which extend along a straight line. Alternatively, the strip seal may have a corrugated, wavy or curved configuration. Such strip seal is used if the respective groove is not formed by a straight line but also has a corrugated, wavy or curved configuration.

[0015] According to a further embodiment of the invention, the first wedge face and/or the second wedge face are planar. However, the invention is not limited to any specific form of the wedge face which may take any complex geometry. The first wedge face and/or the second wedge face, accordingly, may also be non-planar.

[0016] According to an embodiment of the invention, the strip seal is defined such that in the assembled state of the guide vane assembly one of the first and second edges runs angled with respect to the wedge face in which it is arranged and the other one of the first and second edges runs parallel with respect to the wedge face in which it is arranged. This represents a simple embodiment of the invention, in which only one of the elongated edges of the strip seal provides for a leading geometry.

[0017] The guide vanes of the guide vane assembly of the present invention may be formed by nozzle guide vanes. However, the principles of the invention can be applied in a similar manner to any other guide vane which is assembled with other guide vanes to form a guide vane assembly such as a stator wheel. Accordingly, the guide vanes could, e.g., also be guide vanes in a compressor of a gas engine such as compressor inlet guide vanes or compressor outlet guide vanes.

[0018] The invention further provides for a strip seal for use in a guide vane assembly. According to the invention the strip seal is designed such that at least one of its edges forms a leading geometry such that, when the strip seal is inserted into a groove of a wedge face, the leading geometry leads insertion of the strip seal into the groove. Such leading geometry may be a leading corner.

[0019] In invention will be further discussed with respect to the drawings, which show exemplar embodiments of the invention, and in which

Fig. 1 illustrates a sectional view of a turbine section of a jet engine that includes a

guide vane;

- Fig. 2 is a perspective view of an embodiment of a guide vane which includes grooves in a wedge face of a guide vane root;
- Fig. 3A, B illustrate schematically the placement of a strip seal in grooves of two adjacent guide vanes in accordance with the state of the art;
- Fig. 4A - E illustrate different embodiments of a strip seal that are in accordance with the invention;
- Fig. 5A - D illustrate the placement and arrangement of a strip seal according to a first embodiment of the invention in two adjacent guide vanes;
- Fig. 6A - D illustrate the placement and arrangement of a strip seal according to a second embodiment of the invention in two adjacent guide vanes;
- Fig. 7A - D illustrate the placement and arrangement of a strip seal according to a third embodiment of the invention in two adjacent guide vanes;
- Fig. 8A - D illustrate the placement and arrangement of a strip seal according to a fourth embodiment of the invention in two adjacent guide vanes;
- Fig. 9A, B illustrate two strip seals connected to each other in a crossing area in accordance with the prior art and in accordance with the invention; and
- Fig. 10A, B illustrate an embodiment of a bent strip seal in accordance with the prior art and in accordance with the invention.

[0020] Fig. 1 shows a cross-sectional view of a turbine section of a jet engine, in which the present invention may be embodied. The turbine section comprises rotor blades 15 and nozzle guide vanes 1, wherein Fig. 1 depicts two rotor blades 15 and one nozzle guide vane 1. The rotor blades 15 and nozzle guide vanes 1 are located in an annular gas flow path 16 of the turbine section, in which gas flows in a direction 17.

[0021] In the context of the present invention, the construction of the nozzle guide vanes 1 is of particular interest. Each nozzle guide vane 1 comprises an airfoil section 110 arranged in the annular gas flow path 16, a vane root or vane inner platform 120 and a vane tip or vane outer platform 130. The vane root 120 is fastened

to a structure 19 of an inner casing and the vane tip 130 is fastened to an outer casing 18.

[0022] As can be seen from Fig. 1, each guide vane 1 comprises in a wedge face 121 of its vane root 120 and in a wedge face 131 of its vane tip 130 a groove 2 which serves to receive and hold a seal strip, as will be explained below. The groove 2 may be formed of different sections 2a, 2b, 2c, 2d, 2e. Strip seals inserted into the grooves 2a, 2b, 2c, 2d, 2e serve to seal a gap that exist between neighbouring nozzle guide vanes 1, when a plurality of nozzle guide vanes 1 are arranged next to each other in a circumferential direction to form a stator wheel.

[0023] Fig. 2 shows an exemplary embodiment of a guide vane 1 which comprises an airfoil section 110 and vane root or vane inner platform 120. The vane root 120 comprises a wedge face 121 which faces a corresponding wedge face of a neighbouring guide vane when in the assembled state. In the wedge face 121, there are provided grooves 2 which form different groove sections 2a, 2b, 2c. The grooves may have a straight or curved or wavy form. In each of the grooves 2a, 2b, 2c a respective strip seal is to be inserted.

[0024] Fig. 3A, 3B illustrate the insertion of a strip seal 30 in grooves of two wedge faces of neighbouring guide vanes 1, 1' according to the state of the art to indicate the problems associated with state of the art strip seals. As shown in Fig. 3A, a strip seal 30 has a generally flat, elongated configuration and comprises two elongated edges, a first elongated edge 310 and a second elongated edge 320. The two elongated edges 310, 320 are formed by straight lines which run parallel to each other. The strip seal 30 further includes two narrow sides which, however, are not of relevance in the present context. Each of the guide vanes 1, 1' comprise, e.g., in the vane root and/or in the vane tip, a wedge face 121, 121' with one or several grooves as discussed with respect to Figs. 1 and 2.

[0025] To assemble the seal strip 30 in the grooves of the neighbouring guide vanes 1, 1', the strip seal is first inserted along its elongated edge 320 into the respective groove of wedge face 121'. Afterwards, the subassembly consisting of guide vane 1' and strip seal 30 is to be assembled into the groove of the opposite guide vane 1. Because of the parallel orientation of the two edges 310, 320, to achieve this, edge 310 needs to be assembled and inserted into the respective groove of wedge face 121 along the complete length of the edge 310 at the same time. Therefore, such assembly is difficult and involves a considerable assembly time. Also, there is the risk of errors and of damaging the strip seal along its elongated edge 310. After the assembly has been completed, as is shown in Fig. 3B, the gap between the two neighbouring guide vanes 1, 1' has been sealed by means of the seal strip 30.

[0026] Fig. 4A to 4E show five embodiments of a strip seal which are in accordance with the present invention. Generally the strip seal of each embodiments is formed such that at least one of its edges forms a leading geom-

etry in the form of a leading edge such that, when the strip seal is inserted into a groove of a wedge face, the leading geometry leads the insertion of the strip seal into the groove and, this way, improves the assembly time and reduces the risk of errors.

[0027] In the embodiment of Fig. 4A, a strip seal 3 is provided which has two elongated edges 31, 32, which are each formed by a straight line, without the two edges 31, 32 being parallel. More particular, while the edge 32 runs parallel to a wedge face into which it is to be inserted, the edge 31 runs angular with respect to such wedge face, thereby forming a leading geometry in form of a leading edge 20 at one of its ends. Assembly of such strip seal in grooves of two neighbouring guide vanes will be explained with respect to Figs. 5A to 5D below.

[0028] Fig. 4B shows an embodiment of a strip seal 4 which has two elongated edges 41, 42, wherein one of the elongated edges 41 is comprised of two straight sections 411, 412, which are arranged at an angle to each other and thus form a leading corner 20 which points towards the wedge face into which the strip seal 4 is to be inserted. Accordingly, in this embodiment, a leading corner is provided that is located between the upper and lower ends, i.e., the narrow faces of the strip seal 4.

[0029] Fig. 4C to 4E show embodiments of a strip seal in which a leading corner is provided on both elongated edges of the strip seal, wherein the leading corners are arranged in a symmetrical configuration. In Fig. 4C, a strip seal 5 has two elongated edges 51, 52 which each form a leading corner 20 at one of its ends and on opposite ends. Fig. 4D shows a strip seal 6 which comprises two elongated edges 61, 62, which each consist of two straight sections 611, 612 und 621, 622 which form two leading corners 20 at a location between the two ends of the strip seal 6. The lengths of the sections 611, 612, 621, 622 is essentially the same, such that the leading corners 20 are arranged opposite to each other.

[0030] Fig. 4E shows an embodiment of a strip seal 7 which is similar to the embodiment of Fig. 4D, except that the length of the straight sections 711, 712 forming elongated edge 71 and of the straight sections 721, 722 forming elongated edge 72 are different, such that the leading corners 20 formed at the two elongated edges 71, 72 are offset, but in a symmetrical configuration.

[0031] Fig. 5A shows the assembly of a strip seal 3 according to Fig. 4A into adjacent guide vanes 1, 1'. According to Fig. 5A the wedge faces 121, 121' of two adjacent guide vanes 1, 1' are directed towards each other. Each wedge face 121, 121' comprises a groove (not shown in Fig. 5A). In between the two wedge faces 121, 121' is arranged strip seal 3. In a first step, according to Fig. 5B, an operator assembles the strip seal 3 along its elongated edge 32 - that runs parallel to wedge face 121' - into groove 2'. Such subassembly is then assembled into the opposite guide vane 1, wherein strip seal 3 needs to be inserted along elongated edge 31 into the respective groove of wedge face 121. To this end, the operator positions the leading corner 20 (see Fig. 5C) in the groove

2' of the adjacent guide vane 1, and then pushes the two guide vanes 1, 1' together, as seen in Fig. 5D.

[0032] By means of the leading corner 20, the strip seal 3 is led automatically into the groove 2 of guide vane 1, within automatic correct positioning of the edge 31 of strip seal 3 in groove 2 of guide vane 1. This way, assembly time is reduced, the risk of errors is reduced and the risk of damaging parts is also reduced.

[0033] Naturally, the groove 2 in guide vane 1 in which the edge 31 of strip seal 3 is inserted needs to be formed differently than groove 2' of guide vane 1' in that it needs to be provided with more depth towards the leading corner 20. Generally, the groove in the guide vane needs to be formed such that its depth corresponds to the form and width of the strip seal which is inserted into the groove.

[0034] In order to provide the groove 2 with more depth, the machining time for producing the groove will be slightly increased. Also as the strip seal 3 is provided with a leading corner 20, the weight of the strip seal is increased compared to a state of the art strip seal as shown in Fig. 3. However, both of these effects are negligible.

[0035] Figs. 6A to 6D show the assembly of a strip seal 4 in accordance with the embodiment of Fig. 4B. The sequence of steps is similar as in Figs. 5A to 5D. In the first step, the strip seal is arranged with its elongated edge 42 which runs parallel to the wedge face 121' of guide vane 1' into the respective groove. Afterwards, the such formed subassembly is assembled to the opposite guide vane 1. To this end, the sharp corner 20 of the strip seal 4 is positioned in the groove of the opposite guide vane 1 and the two guide vanes 1, 1' are then pushed together, wherein the sharp, leading corner 20 of strip seal 4 leads the strip seal 4 along the edge 41 into the groove of guide vane 1, see Figs. 5C and 5D.

[0036] When assembling a strip seal as shown in the embodiments of Figs. 4C to 4E, a similar sequence of steps is provided. When using symmetrical strip seals as those in Figs. 4C to 4E, there is a fool-proof assembly as the strip seals can be rotated by 180° and need not be in a specific position for assembly. Naturally the grooves in the guide vanes need to be machined accordingly to correspond in depth to the structure of the strip seals.

[0037] In the previously described embodiments the wedge faces 121, 121' of guide vanes 1, 1' were formed as a planar surface. However, the wedge faces 121, 121' can alternatively have a non-planar form and implement complex geometries that require wavy shapes of strip seals. Figs. 7A to 7D and Figs. 8A to 8D show two corresponding embodiments in which the wedge faces 121, 121' of two adjacent guide vanes 1, 1' are non-planar, but correspond to each other to only have a minimal gap in between two adjacent guide vanes 1, 1' when assembled.

[0038] According to the embodiment of Figs. 7A to 7D, there is provided a strip seal 8 which comprises two elongated edges 81, 82, which each comprise two straight

sections 811, 812, 821, 822. The edge 82 with section 821, 822 runs parallel to the respective surface 121 of guide vane 1'. However, edge 81 runs at least partly, namely, in the area of section 812 angular with respect to the wedge face 121 which comprises the groove into which the strip seal 8 is to be inserted.

[0039] For assembly, the operator assembles the strip seal 8 along edge 82 into the respective groove in wedge face 121' of guide vane 1'. Afterwards, the operator positions the leading corner 20 of edge 81 in the groove of the adjacent guide vane 1 in wedge face 121 and then pushes the guide vanes 1, 1' together. The assembly does follow the same principles as discussed before.

[0040] In Figs. 8A to 8D there is provided a strip seal 9 with elongated edges 91, 92 which are each comprised of two straight sections 911, 912, 921, 922. The sections 921, 922 run parallel to areas of the wedge face 121' of guide vane 1' with include a groove into which the strip seal 9 is to be inserted. On the other hand, the elongated edge 91 arranged next to wedge face 121 of guide vane 1 is formed such that it does not run parallel to the corresponding wedge face 121, but instead forms a leading corner 20. The assembly resembles the assembly in Figs. 7A to 7D, wherein after assembly of the strip seal 9 in guide vane 1' the leading corner 20, which is arranged not at an end but in the center of strip seal 9, is positioned in the groove of the adjacent guide vane 1 and afterwards the two guide vanes 1, 1' are pushed together. Again, by having a leading corner 20, the assembly is improved in time and reduced in risk of error.

[0041] Fig. 9B shows an embodiment in which a first strip seal 10 is crossed by a second strip seal 11, wherein, e.g., strip seal 10 is arranged in groove 2a of Fig. 2 and strip seal 11 is arranged in groove 2c of Fig. 2. The two strip seals 10, 11 are joined to each other in a crossing area 20. To this end, the strip seals may have specific structure such as slots (not shown) which allow assembly of the two strip seals 10, 11 together. As shown in Fig. 9B, the leading corner 20 is provided in the crossing area 40. Both the strip seal 10 and the strip seal 11 form the leading corner 20. This way, the strip seal structure consisting of strip seal 10 and strip seal 11 can be inserted into two grooves (such as grooves 2a, 2c of Fig. 2) at the same time, again with the advantage that the leading corner 20 leads the strip seals 10, 11 into the respective grooves and provides for an improved assembly. In further embodiments, additional strip seals are connected to strip seal 10 in other crossing areas forming further leading corners.

[0042] Fig. 9A shows a state of the art strip seal combination of strip seals 30, 31 without the inventive features.

[0043] Fig. 10B shows a further embodiment of a strip seal 12, wherein the strip seal 12 includes a first region 12a which is essentially planar, a second region 12b which is bent, and a third region 12c which is essentially planar again. In the bended region 12b, there is provided a leading corner 20 at each edge of the strip seal 12. As

the leading corner 20 is provided in the bended region 12d, the leading corner 20 improves insertion of the strip seal 12 into a respective groove both along the area 12a and along the area as 12b.

[0044] For comparison, Fig. 10A shows a strip seal 32 with a bended region 32b and two planar regions 32a, 32c without the inventive features.

[0045] A number of implementations of the present invention have been described. Nevertheless, it will be understood that various modifications may be made without departing from the principles underlying these implementations. For example, the form of the strip seal may differ from the forms shown in the described embodiments. Also, e.g., the leading geometry does not have to be in the form of a sharp corner but may have a curved form instead. Also, the wedge faces of the guide vanes may have other and more complex geometries than those shown schematically in the Figures. Accordingly, other implementations are within the scope of the following claims.

Claims

1. Guide vane assembly for a gas turbine, the assembly comprising:

- a plurality of guide vanes (1, 1'), each guide vane (1, 1') comprising a vane root (120), a vane tip (130) and an airfoil section (110),
- at least one strip seal (3-12) for sealing gaps between at least two of the guide vanes (1, 1'),
- wherein at least some of the guide vanes (1, 1') comprise in the vane root (120) and/or in the vane tip (130) a wedge face (121, 121') which faces a wedge face (121, 121') of a neighbouring guide vane (1, 1'),
- wherein such wedge face (121, 121') comprises at least one groove (2, 2'),
- and
- wherein the strip seal (3-12) comprises at least one first elongated edge (31-91) which is arranged in a groove (2) of a first wedge face (321) of a first guide vane (1) and at least one second elongated edge (32-92) which is arranged in a groove (2') of a second wedge face (121') of a second guide vane (1') that neighbours the first guide vane (1),

characterized in that

the strip seal (3-12) is designed such that in the assembled state of the guide vane assembly at least one of the first and second edges (31-91; 32-92) runs at least partly angular with respect to the wedge face (321, 321') in which it is arranged.

2. Guide vane assembly according to claim 1, **characterized in that** the strip seal (3-12) forms at least

one leading corner (20) at an edge which runs angular with respect to a wedge face, wherein said leading corner (20) points towards the guide vane (1, 1') in the groove of which it is arranged.

3. Guide vane assembly according to claim 2, **characterized in that** said edge (31, 51, 52, 81) comprises two ends, wherein the leading corner (20) is located at one of said ends.
4. Guide vane assembly according to claim 2, **characterized in that** said edge (41, 61, 62, 71, 72, 91) comprises two ends, wherein the leading corner (20) is located between said ends.
5. Guide vane assembly according to any of claims 2 to 4, **characterized in that** the strip seal (10) crosses with a further strip seal (11), wherein the leading corner (20) is provided in the crossing area (40).
6. Guide vane assembly according to any of claims 2 to 4, **characterized in that** the strip seal (12) comprises a bended region (12b), wherein the leading corner (20) is provided in the bended region (12b).
7. Guide vane assembly according to any of claims 2 to 6, **characterized in that** both the first elongated edge (51, 61, 71) and the second elongated edge (52, 62, 72) comprise a leading corner (20).
8. Guide vane assembly according to claim 7, **characterized in that** said leading corners (20) are arranged in a symmetrical configuration.
9. Guide vane assembly according to any preceding claim, **characterized in that** the strip seal (1, 1') has a flat planar configuration or a flat corrugated or curved configuration.
10. Guide vane assembly according to any preceding claim, **characterized in that** the first wedge face (121) and/or the second wedge face (121') are planar.
11. Guide vane assembly according to any of claims 1 to 9, **characterized in that** the first wedge face (121) and/or the second wedge face (121') are non-planar.
12. Guide vane assembly according to any preceding claim, **characterized in that** the strip seal (4) is designed such that in the assembled state of the guide vane assembly one (31) of the first and second edges runs angled with respect to the wedge face (121) in which it is arranged and the other one (32) of the first and second edges runs parallel with respect to the wedge face (121') in which it is arranged.
13. Strip seal for use in a guide vane assembly that in-

cludes a plurality of guide vanes (1, 1'), wherein the strip seal (3-12) comprises a first elongated edge (31-91) which is arrangable in a groove (2) of a first wedge face (121) of a first guide vane (1) and a second elongated edge (32-92) which is arrangable in a groove (2') of a second wedge face (121') of a second guide vane (1') that neighbours the first guide vane (1),

characterized in that

the strip seal (3-12) is designed such that at least one of its edges (31-91; 32-92) forms a leading geometry (20) such that, when the strip seal (3-12) is inserted into a groove (2, 2') of a wedge face (121, 121'), the leading geometry (20) leads insertion of the strip seal (3-12) into the groove (2, 2').

14. Strip seal according to claim 13, characterized in that the leading geometry (20) is a leading corner.

15. Strip seal according to claim 14, characterized in that both the first elongated edge (51, 61, 71) and the second elongated edge (52, 62, 72) comprise a leading corner (20), wherein said leading corners (20) are arranged in a symmetrical configuration.

5

10

15

20

25

30

35

40

45

50

55

FIG 1

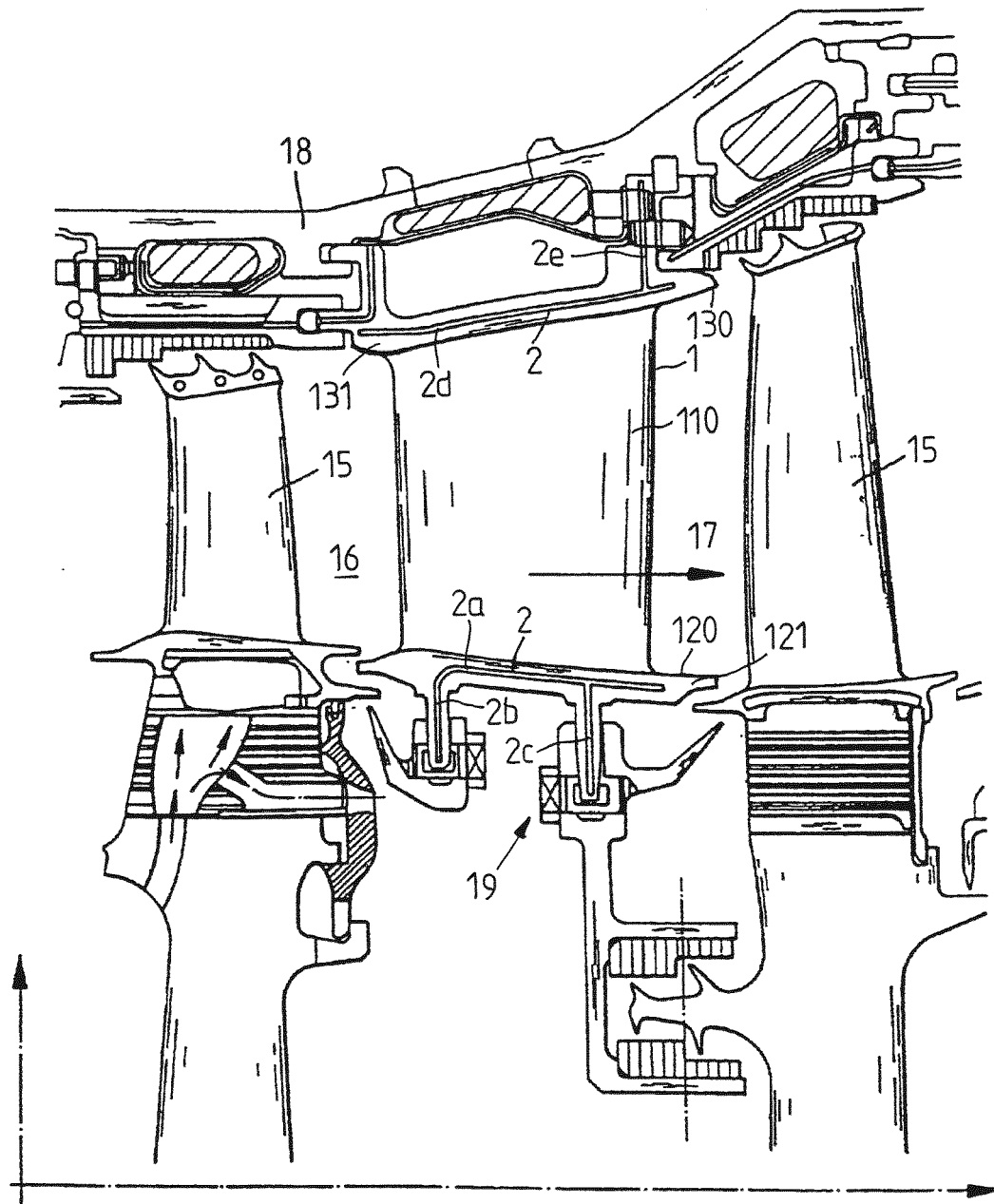


FIG 2

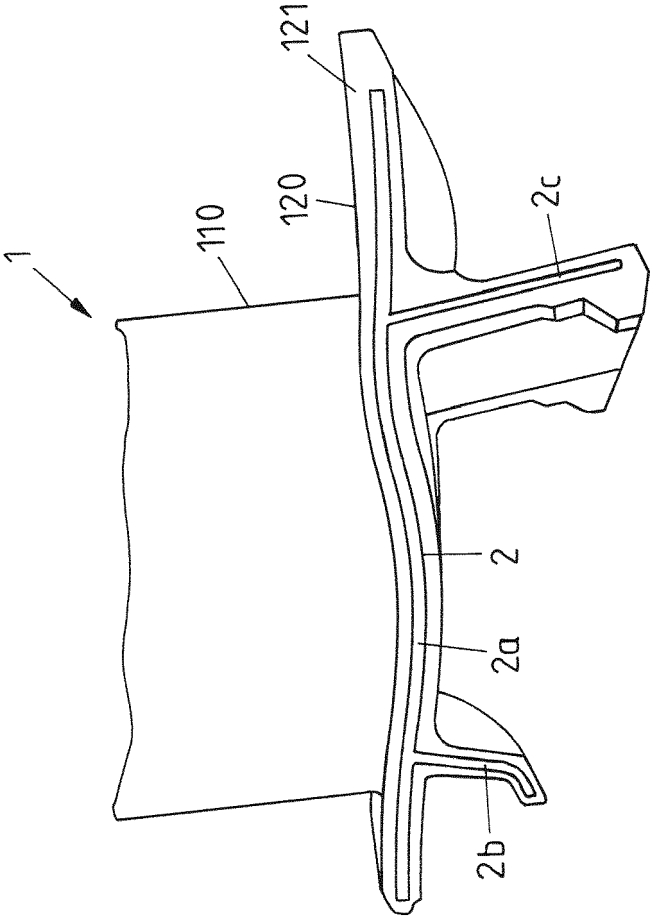


FIG 3B

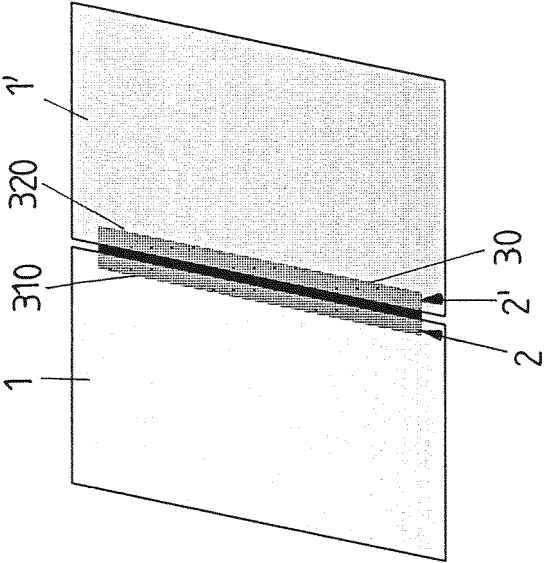


FIG 3A

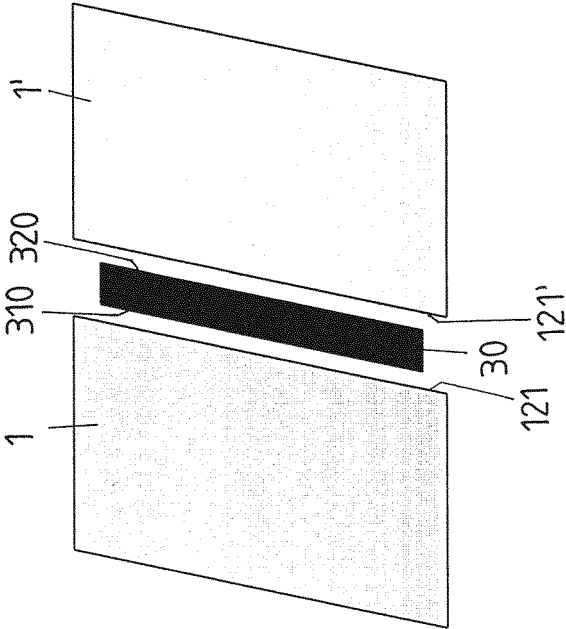


FIG 4A

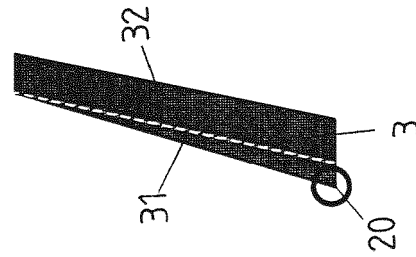


FIG 4B

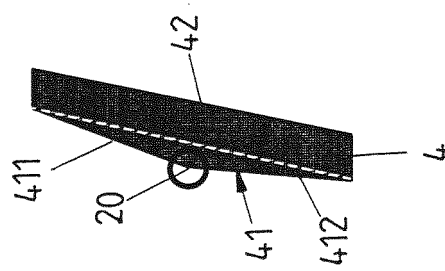


FIG 4C

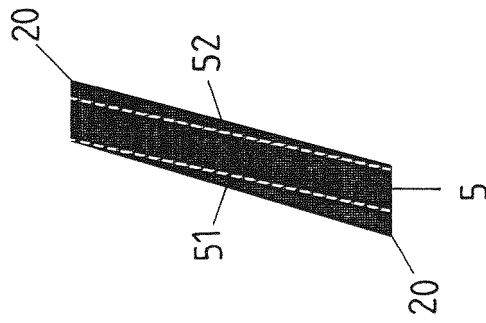


FIG 4D

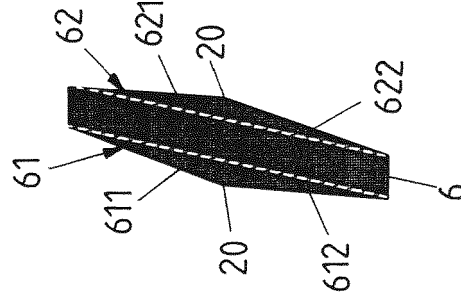
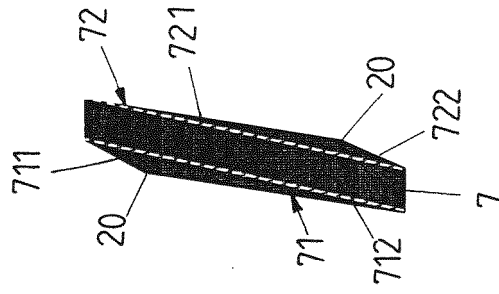
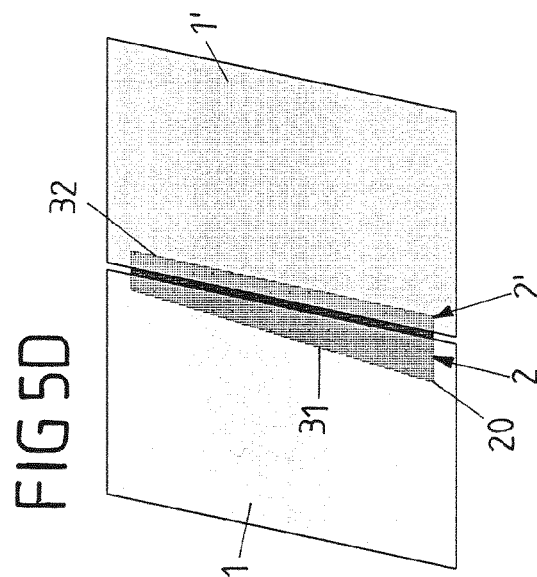
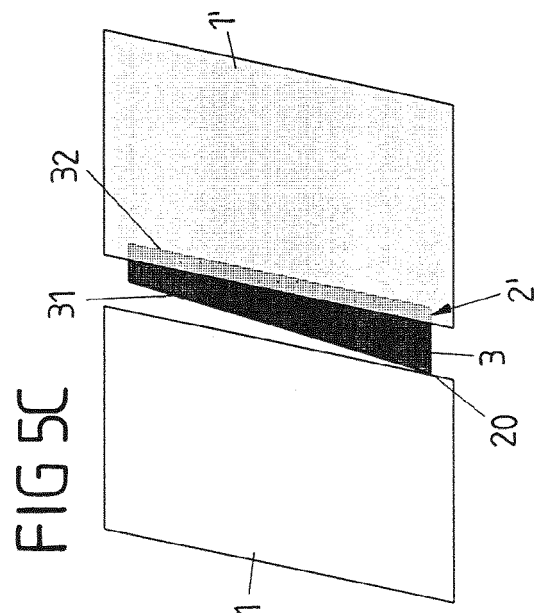
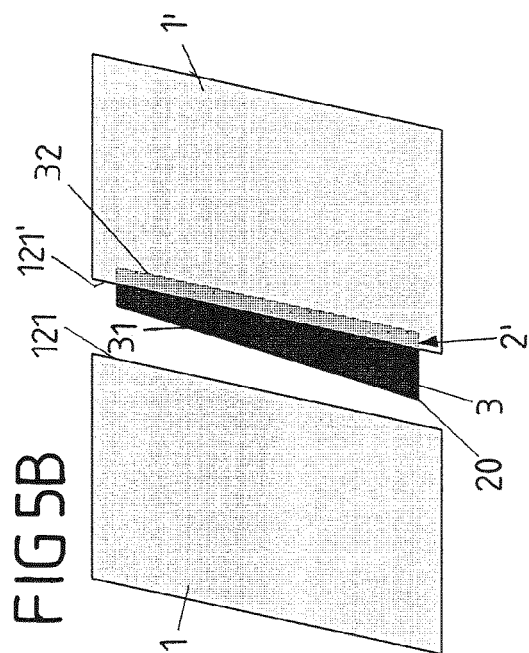
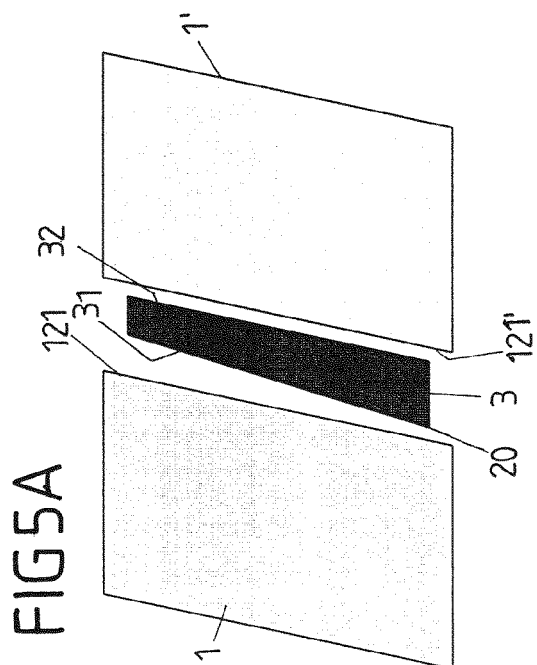


FIG 4E





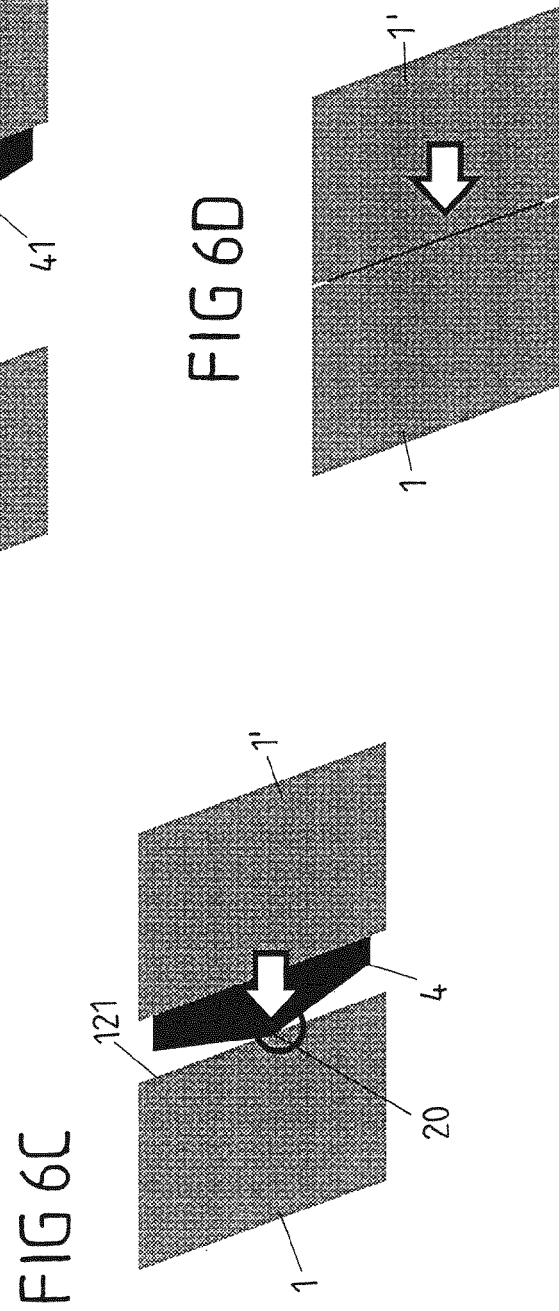
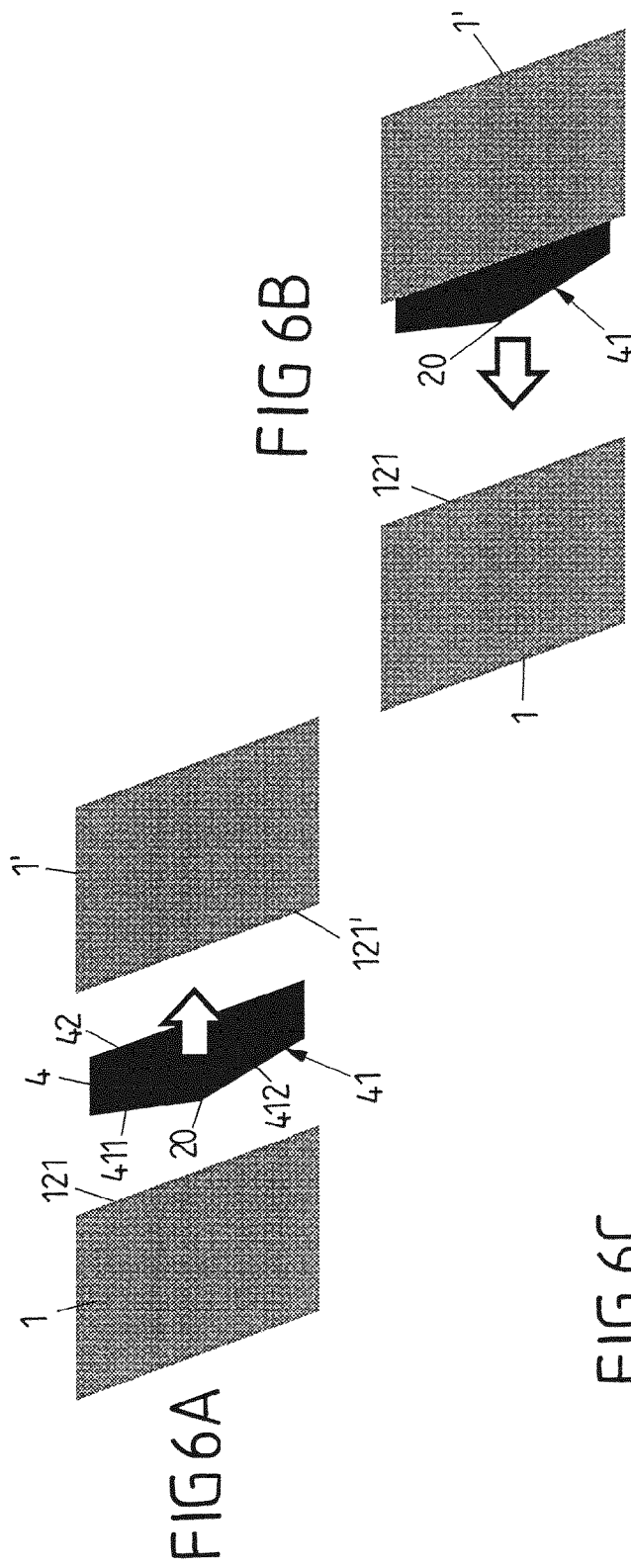


FIG 7A

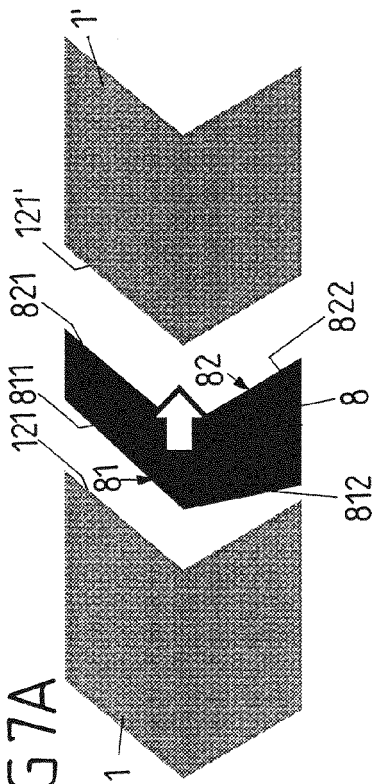


FIG 7B

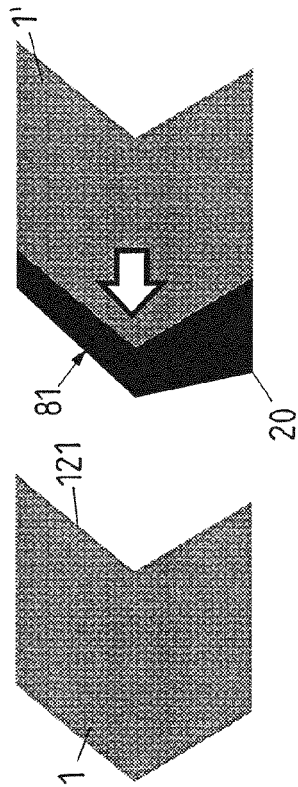


FIG 7C

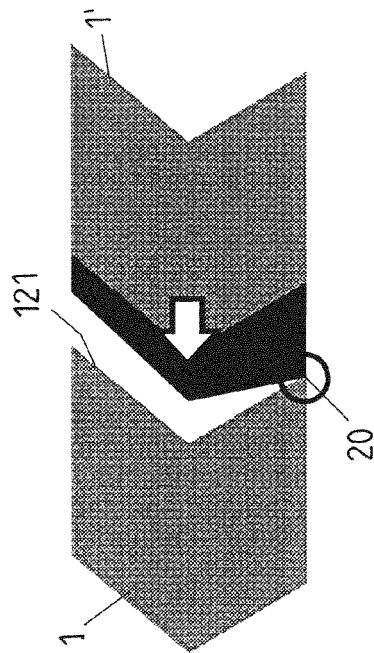


FIG 7D

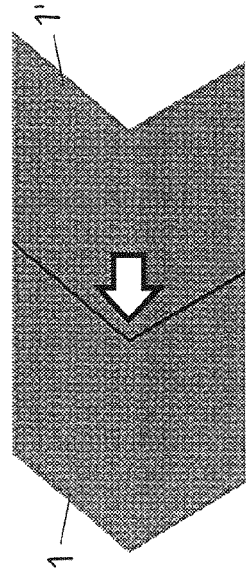


FIG 8A

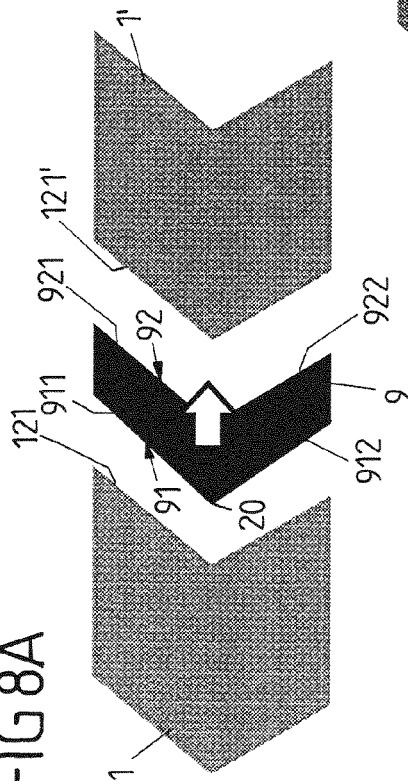


FIG 8B

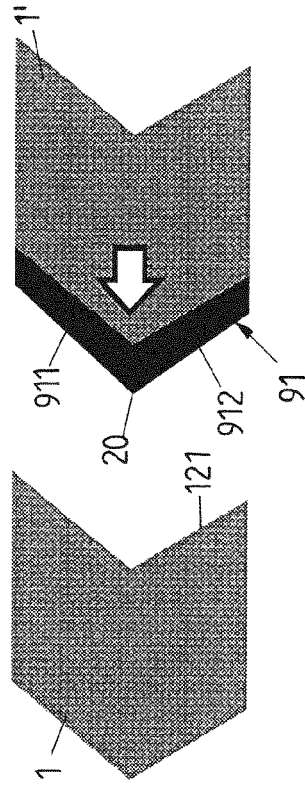


FIG 8C

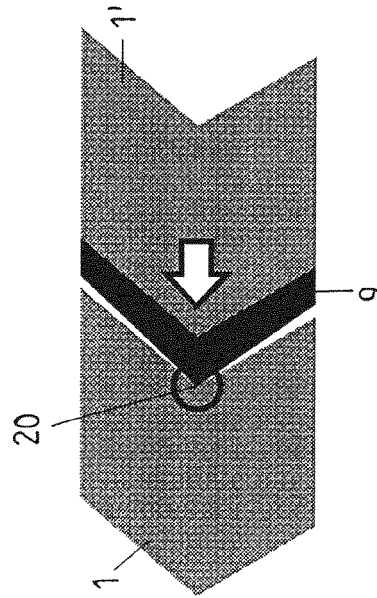
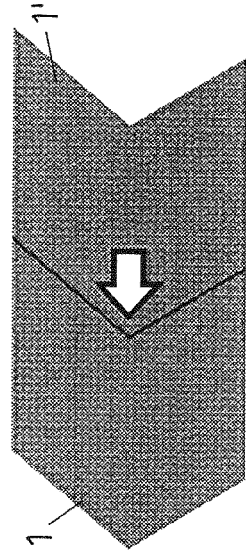


FIG 8D



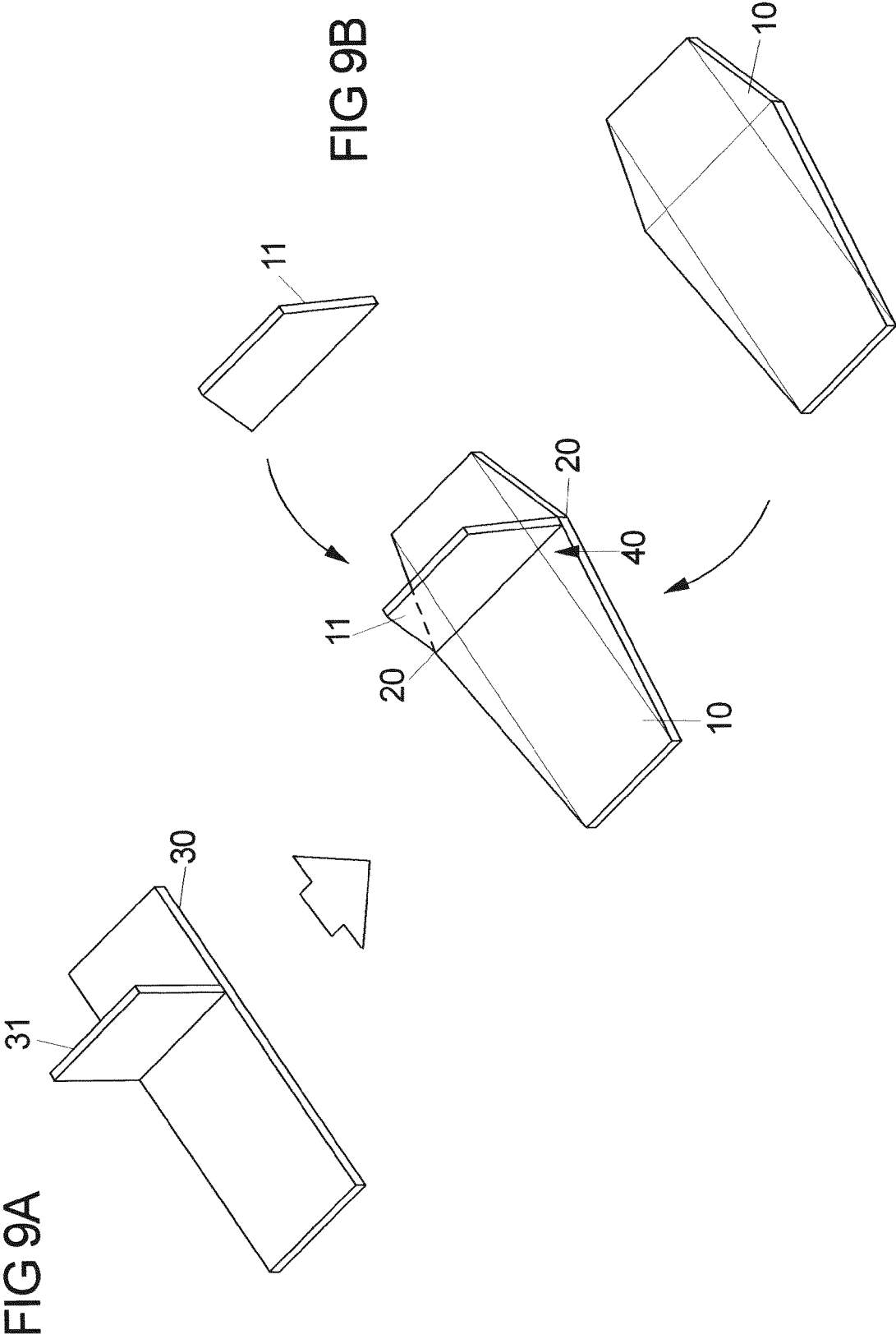


FIG 10A

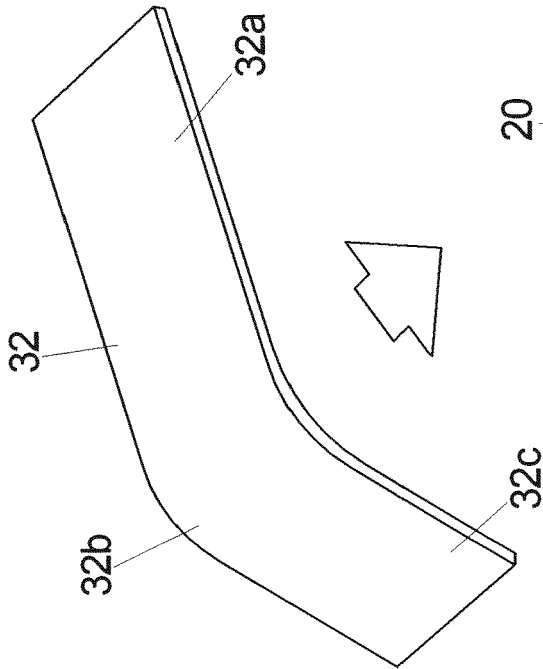
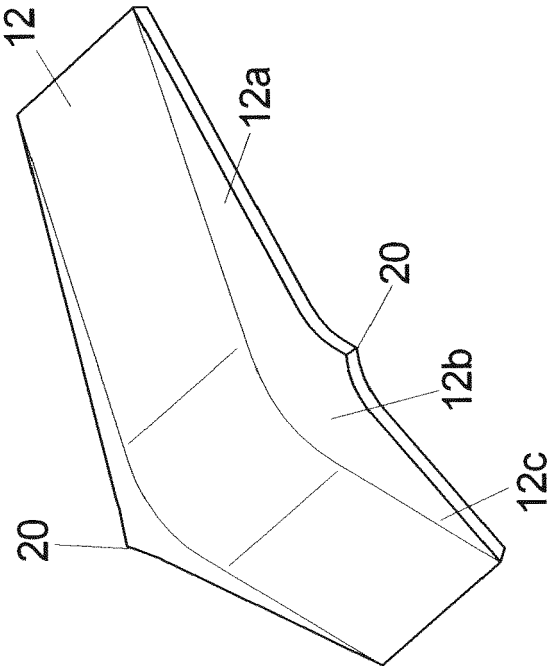


FIG 10B





EUROPEAN SEARCH REPORT

Application Number
EP 13 19 8156

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2004/074640 A1 (ALSTOM TECHNOLOGY LTD [CH]; LONDON RICHARD [CH]; MARX PETER [CH]) 2 September 2004 (2004-09-02) * figures 1,3b *	1-4,6-15	INV. F01D11/00
X	US 5 868 398 A (MAIER M STEFAN [US] ET AL) 9 February 1999 (1999-02-09) * figures 5,6 *	1,2,4,5,7-15	
X	EP 1 798 380 A2 (GEN ELECTRIC [US]) 20 June 2007 (2007-06-20) * figures 2-6 *	1-4,7-10,13-15	
X	US 2009/269188 A1 (MARTIN YVES [CA]) 29 October 2009 (2009-10-29) * paragraph [0028]; figures 2,4 *	13-15	
X	US 6 162 014 A (BAGEPALLI BHARAT SAMPATHKUMAR [US] ET AL) 19 December 2000 (2000-12-19) * figures 1-6 *	13-15	
E	EP 2 679 770 A1 (SIEMENS AG [DE]) 1 January 2014 (2014-01-01) * figure 4 *	13-15	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 14 March 2014	Examiner Rolé, Florian
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

EPO FORM 1503 03.92 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 13 19 8156

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

14-03-2014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2004074640 A1	02-09-2004	AT 366864 T	15-08-2007
		AT 369228 T	15-08-2007
		AU 2003203130 A1	09-09-2004
		EP 1595058 A1	16-11-2005
		ES 2289256 T3	01-02-2008
		KR 20050105476 A	04-11-2005
		MX PA05008823 A	18-10-2005
		US 2006182624 A1	17-08-2006
		US 2006263204 A1	23-11-2006
		WO 2004074640 A1	02-09-2004

US 5868398 A	09-02-1999	NONE	

EP 1798380 A2	20-06-2007	CA 2571175 A1	16-06-2007
		EP 1798380 A2	20-06-2007
		JP 5154788 B2	27-02-2013
		JP 2007162699 A	28-06-2007
		US 2007140843 A1	21-06-2007

US 2009269188 A1	29-10-2009	CA 2649515 A1	29-10-2009
		US 2009269188 A1	29-10-2009

US 6162014 A	19-12-2000	EP 0989287 A2	29-03-2000
		JP 2000136731 A	16-05-2000
		KR 20000023246 A	25-04-2000
		TW 399120 B	21-07-2000
		US 6162014 A	19-12-2000

EP 2679770 A1	01-01-2014	EP 2679770 A1	01-01-2014
		WO 2014001084 A1	03-01-2014

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82