US 20110189015A1

(19) United States
(12) Patent Application Publication
(10) Pub. No.: US 2011/0189015 A1
(43) Pub. Date: Aug. 4, 2011

Shepherd

(54) **TURBINE ENGINE COMPONENT FOR ADAPTIVE COOLING**

(76) Inventor: **Andrew Shepherd**, Branston (GB)

(21) Appl. No.: **13/017,350**

(22) Filed: **Jan. 31, 2011**

(30) **Foreign Application Priority Data**

Feb. 2, 2010 (EP) 10152428.8

Publication Classification

(51) **Int. Cl.**
F01D 5/18 (2006.01)

(52) **U.S. Cl.** **416/95**

(57) **ABSTRACT**

A turbine engine component, particularly an aerofoil, including a body is provided. The turbine engine component includes a first surface exposed to a working fluid of high temperatures during operation, a second surface including a depression, the depression is exposed to a cooling fluid during operation and oriented such that, starting from the second surface, the depression deepens in the direction of a back face of the first surface. Furthermore the body includes a body portion between the back face and the first surface. The depression is defined such that a diameter of the depression decreases from the second surface in direction of the back face.

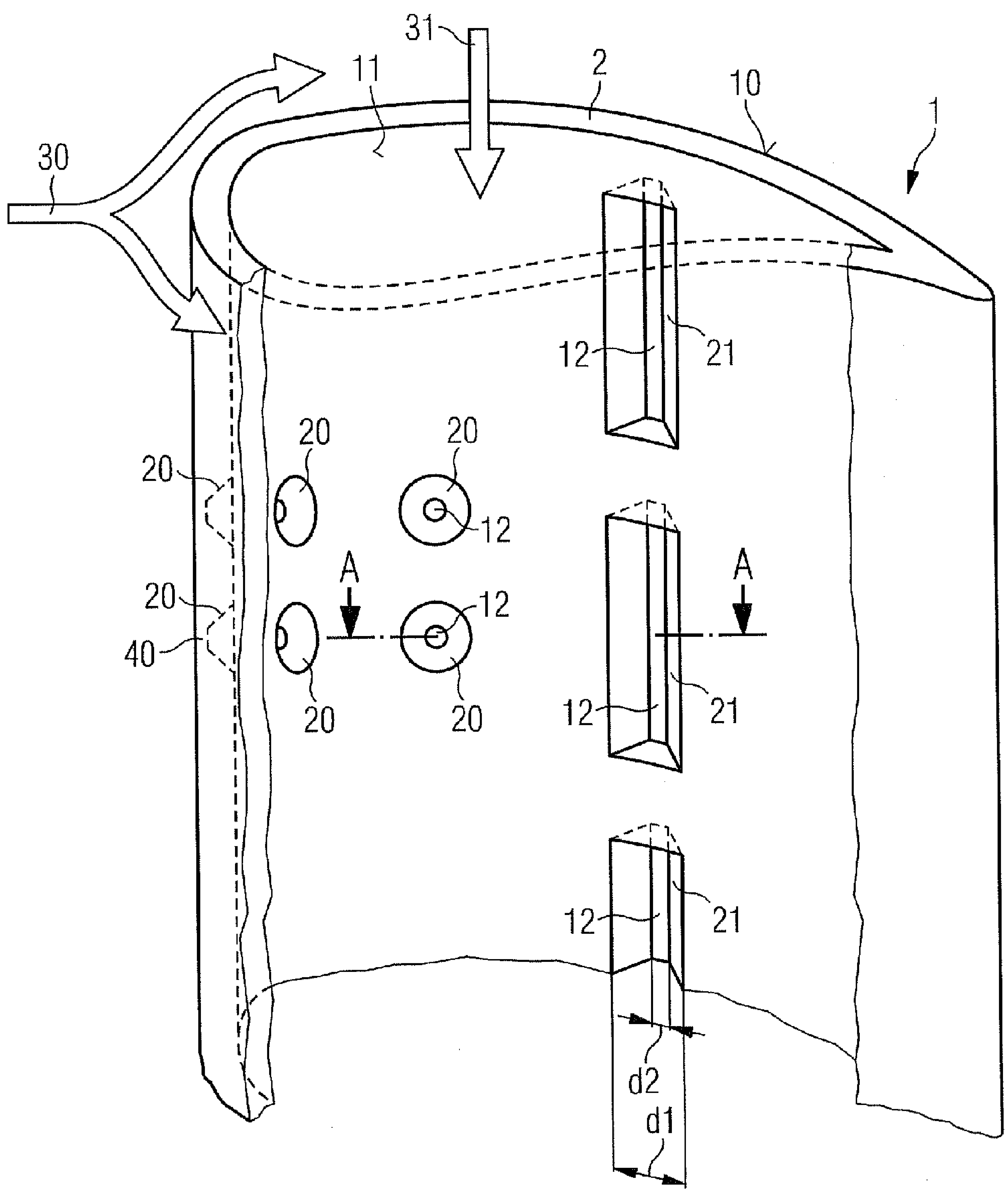


FIG 1

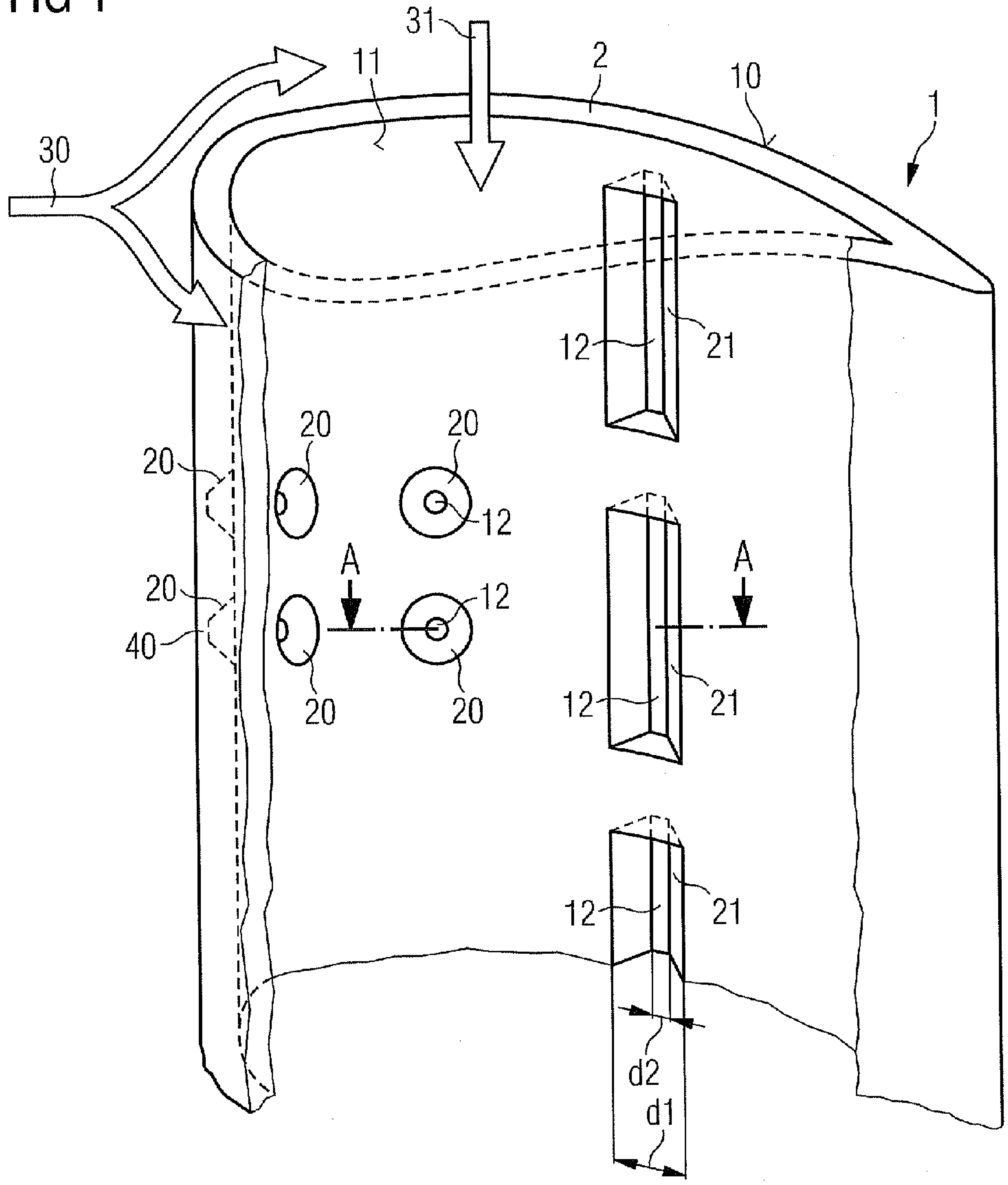


FIG 2A

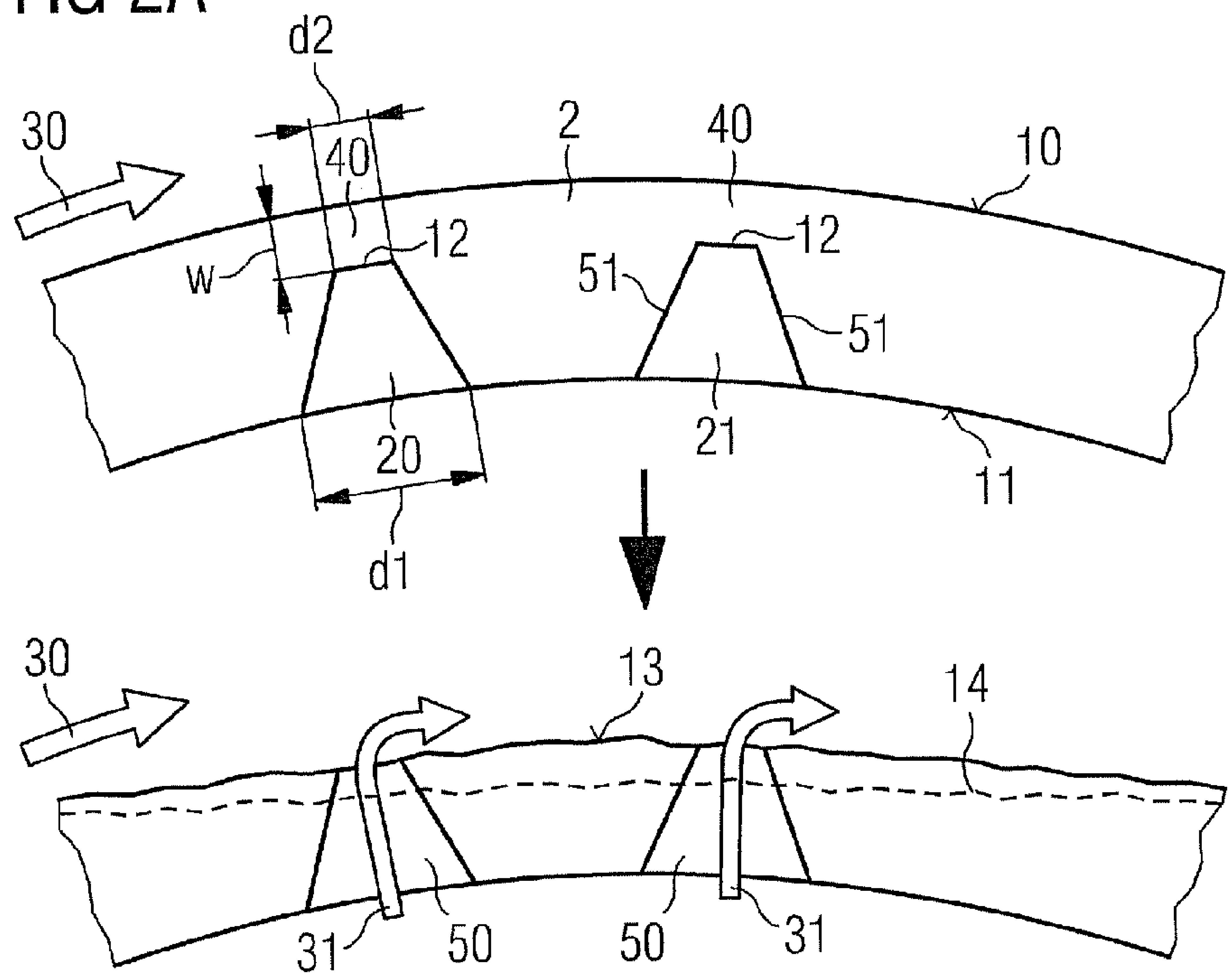

d2
30
2
40
10
40
12
12
w
51
51
20
21
11
20
d1
30
13
14
31
50
50
31

FIG 2B

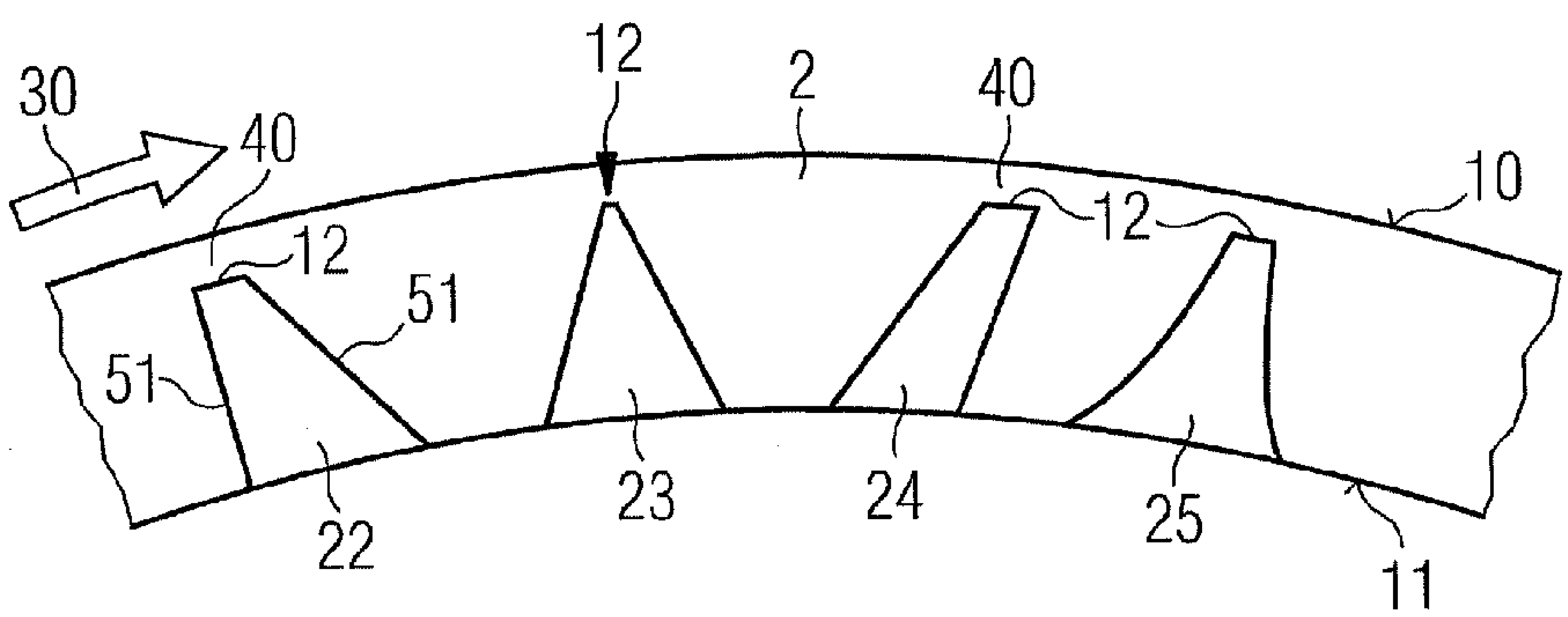

12
2
40
30
40
10
12
12
51
51
22
23
24
25
11

FIG 2C

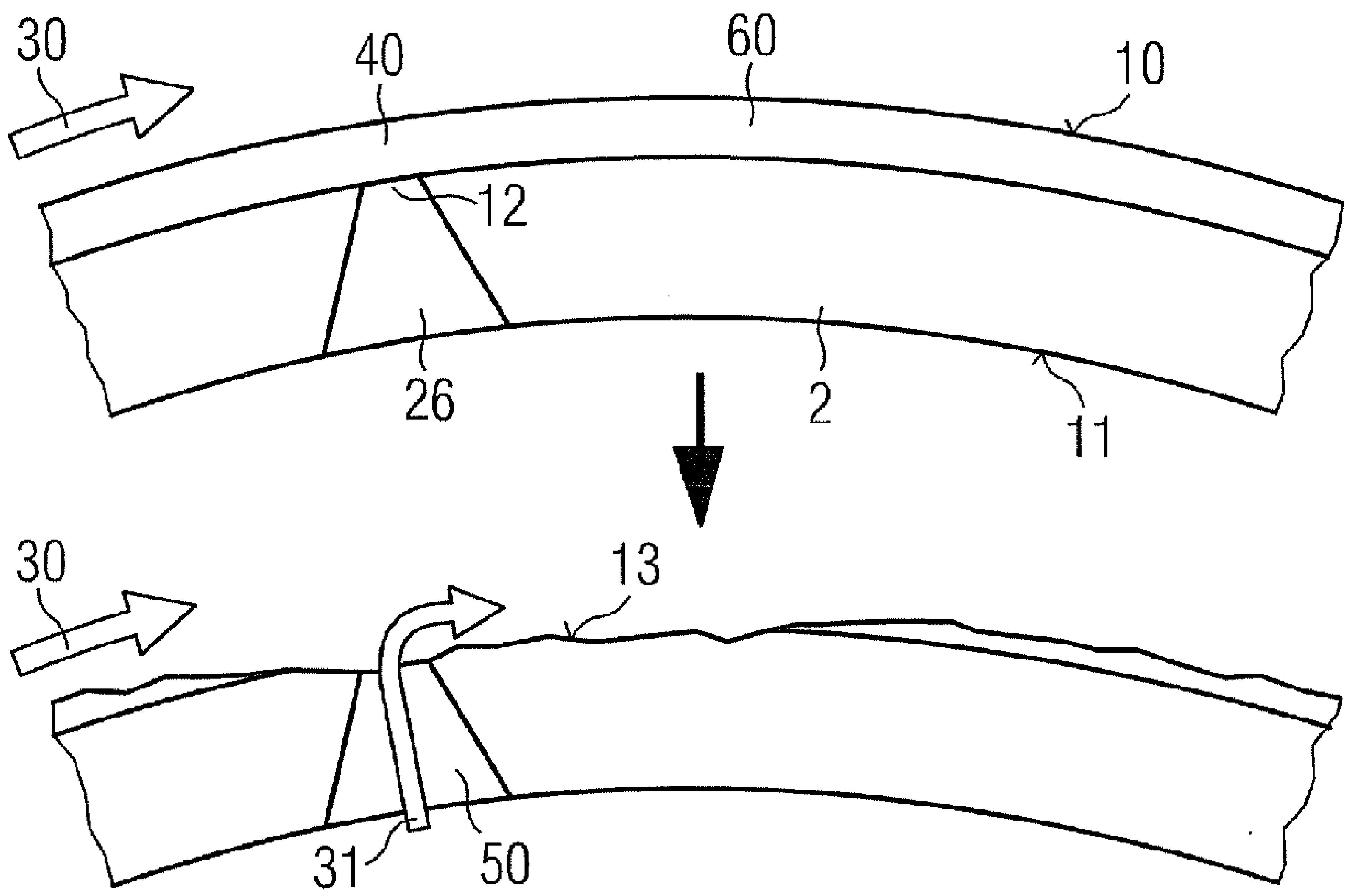
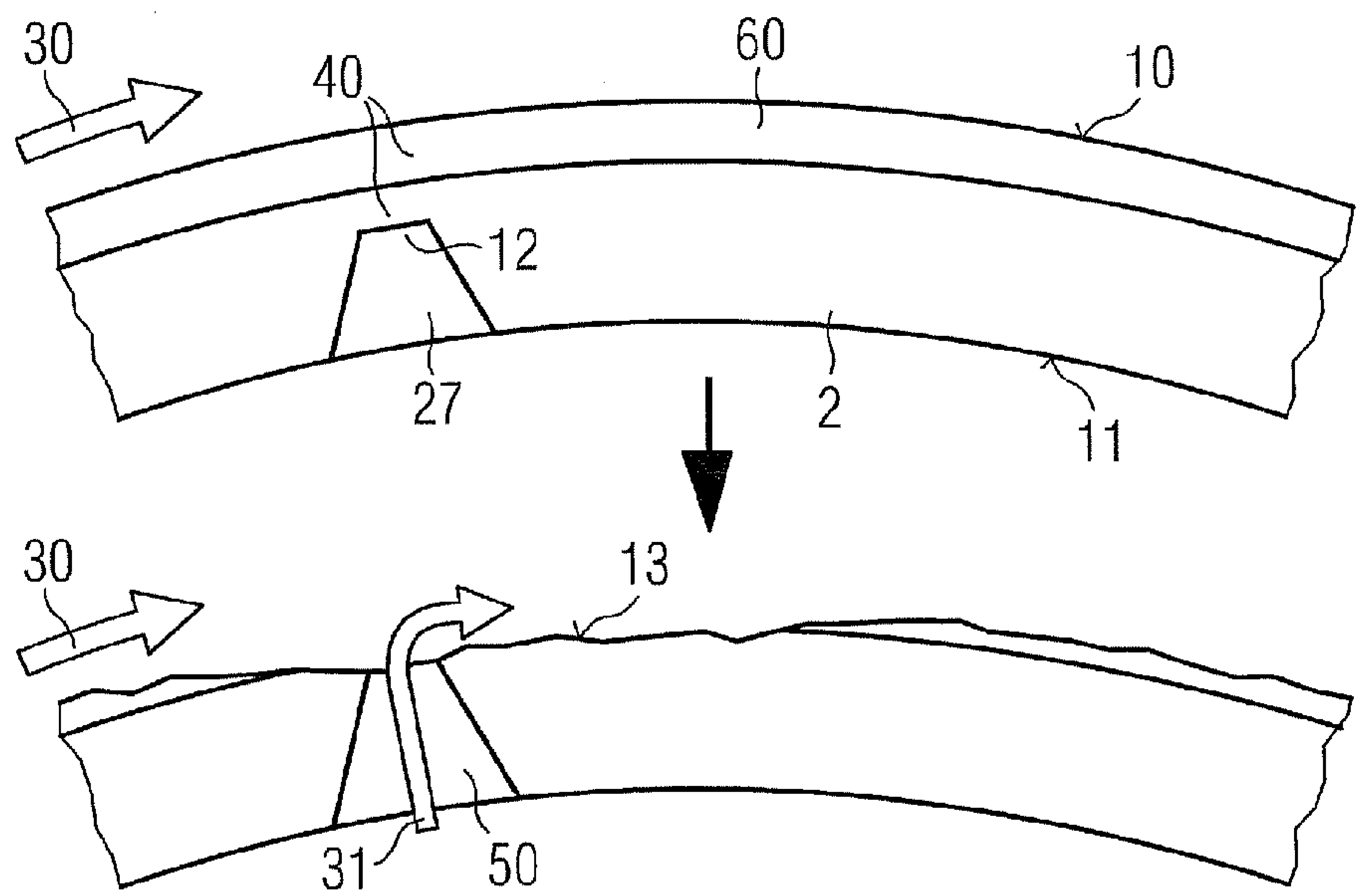


FIG 2D



TURBINE ENGINE COMPONENT FOR ADAPTIVE COOLING

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority of European Patent Office application No. 1015248.8 EP filed Feb. 2, 2010, which is incorporated by reference herein in its entirety.

FIELD OF THE INVENTION

[0002] The invention relates to adaptive cooling of a hot turbine engine component, particularly a turbine aerofoil within a turbine section of a gas turbine engine.

BACKGROUND OF THE INVENTION

[0003] Components such as gas turbine blades, vanes and others in a turbine or a combustion section of a gas turbine may be affected by hot fluids resulting in oxidation of the components. This problem is addressed in several ways, e.g. by using heat resistant materials or by applying a coating, like a thermal barrier coating (TBC). Alternatively or additionally the components may be cooled. For this additional cooling, cooling air may be supplied and cooling features and cooling holes may be designed in regions to be cooled.

[0004] Even though cooling may be necessary, the existence of cooling holes and the supply of cooling air to the region to be cooled—the cooling air may typically be taken from a compressor section of the gas turbine—may have negative side effects on the overall performance of the compressor and/or of the turbine section.

[0005] Thus, a gas turbine may be designed such that only that amount of cooling air is provided and distributed that is considered necessary. In installed gas turbines, even if thoroughly designed, material may still oxidise during operation, e.g. due to high temperature peaks.

[0006] According to patent application US 2007/0036942 A1 an apparatus for adaptive cooling is disclosed comprising a first component having at least one aperture extending therethrough with a sacrificial component positioned within the at least one aperture. The first component is operable at a maximum duty temperature and the sacrificial component has a melting or sublimation point below the maximum duty temperature of the first component. The sacrificial component defines an effective aperture, the size of which may be increased if, in use, the sacrificial component is subjected to a temperature between the melting or sublimation point of the sacrificial component and the maximum duty temperature of the first component. The sacrificial component is a separate component than the first component.

[0007] A similar solution is shown in patent U.S. Pat. No. 4,136,516, in which plugs are provided to initially close secondary air outlets. The plugs are fabricated of a material having a lower melting point temperature than that of the remainder of the blade airfoil portion such that, in the event of failure in the primary cooling system, the plugs will melt, thereby permitting the secondary coolant to rush through the blade and provide internal cooling thereof. A fairly similar technology is disclosed in patent application EP 1416225 A1 and patent U.S. Pat. No. 3,990,837.

[0008] U.S. Pat. No. 7,241,107 B2 shows that cooling air passages may be coated. The coating is being made of a material that has an oxidizing property such that the material oxidizes away and opens the passage to more flow when exposed to a temperature above a critical temperature of an airfoil. When the airfoil surface is not properly cooled by a flow passing through the passage, the material oxidizes away until the size of the passage increases to allow for the proper amount of cooling air to flow to cool the airfoil. The passages are through holes and each have a fixed diameter. To coat these passages may be difficult.

[0009] According to patent application GB 2259118 A a leading edge of an airfoil, particularly a coating and airfoil material, may erode or corrode such that a passage for cooling air—the passage being built inside of the airfoil—may become exposed to allow a cooling fluid to effect film cooling of a selected portion of the airfoil.

SUMMARY OF THE INVENTION

[0010] The present invention seeks to find a solution in which the time of operation can be stretched further and downtime may be avoided even when oxidation of parts has already occurred, so that repair or replacement of parts can be performed at the next maintenance schedule and still providing a mode of operation with only marginal performance losses.

[0011] This objective is achieved by the independent claims. The dependent claims describe advantageous developments and modifications of the invention.

[0012] In accordance with the invention there is provided a turbine engine component, particularly an aerofoil, having a body comprising a first surface exposed to a working fluid of high temperatures during operation, so that erosion and/or corrosion, e.g. particularly oxidation, may take place on the first surface. The body is further comprising a second surface comprising at least one depression, the depression being exposed to a cooling fluid during operation, the depression being oriented such that, starting from the second surface, it deepens in direction of a back face of the first surface. A depression may be in form of a blind hole or a trench. The body also comprises a body portion between the back face and the first surface, wherein a diameter of the depression decreases from the second surface in direction of the back face. Thus, the depression can be seen as to have a particularly V-shaped cross section.

[0013] The turbine engine component may be, besides the already mentioned aerofoils like blades or vanes in a turbine section of a gas turbine engine, a component inside a hot fluid path or a component defining and guiding the hot fluid path. This component may be located in the turbine section, in a combustor section of a gas turbine engine or any intermediate component—like a transition duct between combustor and turbine section—or downstream component—like an exhaust or a diffuser of the gas turbine engine that is downstream of the turbine section.

[0014] More precisely, the turbine engine component may be any component within a gas turbine engine or a similar type of engine having surfaces over which hot gases are swept. Furthermore these surfaces may be part of a vane aerofoil and/or a vane platform within a turbine section, and/or a blade aerofoil and/or a blade platform and/or a blade shroud within the turbine section. The surface may also be part of a combustor. Additionally the surface may be part of a static shroud and/or a heat shield. Besides, the invention is also applicable to other hot gas swept surfaces downstream of the turbine section in a diffuser and/or in an exhaust, including heat recovery system.

[0015] The depression may be casted or machined. If instead of a blind hole a through hole is produced during manufacturing, the through hole may be filled again partly, covered and/or plugged so that the first surface may be closed again.

[0016] The through hole may be filled by a heat resistant material, possibly by the same material as the body, or of a material with a melting point that will permanently exceed the temperature during operation. Thus, this heat resistant material is not designed to melt during operation. But the surface directed to the hot fluid path of the heat resistant material may encounter oxidation.

[0017] In contrast to prior art disclosure, no special coating material is needed that is merely applied to be oxidised away faster than the remainder of the first surface. Additionally, the invention is not directed to oxidise surfaces of cooling passages. It is directed to scenarios in which a hot surface that is designed to guide the hot fluid—the first surface according to the invention—may oxidise.

[0018] The invention is advantageous, if the first surface oxidises until the body portion between the back face and the first surface gets oxidised away, so that the depression becomes a passage to the hot fluid path. Due to the fact that the depression is being exposed to the cooling fluid, this newly built passage performs the function of a cooling hole via which the cooling fluid will be guided in direction of the first surface. This results in cooling of the first surface and its surroundings in a proximity of the passage. As a consequence the oxidation may stop in that area.

[0019] According to the invention the depression has a specific shape, so that the diameter of the depression decreases from the second surface in direction of the back face of the first surface. Once a passage has been built, this passage has an exit with a first diameter, as defined by the width of the depression, providing a first amount of cooling fluid. This will stop or slow down further oxidation in the future. Assuming, oxidation will not be prevented completely because the first amount of cooling fluid may not be sufficient to do so, the first surface including the rim of the newly built passage may oxidise further. This results in a further gradual reduction of surface material and also in enlarging the diameter of the cooling passage, due to the specific shape of the depression with its tilted walls. With the new and larger dimensions of the exit of the passage—having a second diameter—, a second amount of cooling fluid will be provided to the surroundings of the exit. The second diameter will be greater than the first diameter, the second amount of cooling fluid will exceed the first amount of cooling fluid. This principle will continue until enough cooling fluid will pass the passage so that no oxidation will occur anymore in the surroundings of the passage.

[0020] To summarise, the inner walls of the passage itself will not oxidise but the first surface will continue to oxidise which then directly has an effect on the diameter of the exit of the passage.

[0021] Thus, the invention advantageously provides a self adapting principle to adapt to the conditions within the hot fluid path.

[0022] In contrast to provide a large number of cooling holes during manufacturing to accommodate the needs of worst case scenarios in regards of hot spots, the invention is advantageous because, if the heat will never reach an oxidising temperature, the depression will never become a cooling passage and therefore no performance losses will occur.

[0023] As a consequence, uniform components may be built and installed, even though they will be impacted differently by heat due to their different locations of installation. Some of the components will operate without oxidisation and others may be affected by oxidisation.

[0024] In an advantageous embodiment of the invention a part of the body adjacent to the body portion is of a further material that is less susceptible to erosion and/or corrosion, particularly oxidation, than the body portion. The compositions of the material may be seamlessly change so that this effect may take place. Alternatively the part of the body adjacent to the body portion may be coated.

[0025] The last paragraph is based on the fact that one might anticipate at which positions hot spots will occur. This may not always be the case. The invention is also advantageous if the positions of hot spots will not be known beforehand or on which components the hot spots will occur. This may be the case if the locations of the hot spots depend on how the parts are assembled. In this case a plurality of depressions may be arranged in many places on several components and only these depressions will become holes eventually that are actually located at or near a hot spot.

[0026] The body portion may also incorporate a protective coating over the first surface. Cooling holes would then be exposed after the coating and part of the component material have been lost.

[0027] It has to be noted that embodiments of the invention have been described with reference to different subject matters. In particular, some embodiments have been described with reference to apparatus type claims whereas other embodiments have been described with reference to method type claims. However, a person skilled in the art will gather from the above and the following description that, unless other notified, in addition to any combination of features belonging to one type of subject matter also any combination between features relating to different subject matters, in particular between features of the apparatus type claims and features of the method type claims is considered as to be disclosed with this application.

[0028] The aspects defined above and further aspects of the present invention are apparent from the examples of embodiment to be described hereinafter and are explained with reference to the examples of embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, of which:

[0030] FIG. **1**: shows schematically an aerofoil with different depressions according to an embodiment of the invention;

[0031] FIG. **2**A: illustrates a cross section along a plane indicated by a line A-A in FIG. **1** showing two depressions;

[0032] FIG. **2**B, **2**C, **2**D: illustrate in a cross sectional view further alternative forms of depressions.

[0033] The illustration in the drawing is schematical. It is noted that for similar or identical elements in different figures, the same reference signs will be used.

DETAILED DESCRIPTION OF THE INVENTION

[0034] Referring now to FIG. **1**, one half of an aerofoil **1** of a turbine is shown in a perspective view as seen from the inside of the aerofoil **1**. The second half of the aerofoil **1** that would disallow the view to the inside of the aerofoil **1** is not shown is only indicated by broken and dashed lines.

[0035] The aerofoil **1**, for example a guide vane or a blade within a turbine section of a gas turbine engine, represents the turbine engine component as defined in the invention and will be present in a working fluid flow **30** during operation. This working fluid flow **30** is indicated as a double arrow and may be a hot gas provided by a combustion chamber located upstream. The aerofoil **1** has a circumferential wall **2** as a body of turbine engine component and a cavity to allow cooling fluid—a cooling fluid flow **31** is indicated via a further arrow—to cool the wall **2** from the inside and to supply cooling holes (not shown in the figure).

[0036] The wall **2** has a first surface **10** which is exposed, in use, to the working fluid flow **30**—a hot gas path—of high temperatures. The first surface **10** is directed to the outside of the aerofoil **1**.

[0037] The wall **2** may be coated from the outside (not shown in FIG. **1**; indicated in FIG. **2**C), for example by a thermal barrier coating or oxidation resistant coating, such as MCrAlY. In this case the first surface **10** may also comprise the coating.

[0038] The wall **2** has a second surface **11** which is facing away from the hot gas path and is being exposed to the cooling fluid flow **31**. For the aerofoil **1**, the second surface **11** is the inner wall of the aerofoil **1**, surrounding the cavity.

[0039] The second surface **11** comprises a plurality of depressions **20**, **21** in different forms, e.g. a first depression **20** in form of a truncated cone, having a circular rim with the second surface **11**. As a second depression **21** a trench is indicated having two side planes and a third bottom plane. Further types of depressions will be shown in FIG. **2**.

[0040] The depressions **20**, **21** are being exposed to the cooling fluid during operation. At the time of installation, the depressions **20**, **21** are blind holes and may not supply any cooling fluid to the first surface **10**.

[0041] As already indicated, each of the depressions **20**, **21** is oriented such that, starting from the second surface **11**, the depression **20**, **21** deepens in direction of a back face **12** of the first surface **10**, and at the same time, a diameter of the depression **20**, **21** decreases from the second surface in direction of the back face, thus resulting in a depression in form of a truncated cone (like the first depression **20**), a truncated pyramid, a truncated triangular prism (like the second depression **21**), or any kind of frustum, for example.

[0042] The back face **12** will be the result of the truncation. The back face **12** may be substantially flat.

[0043] A diameter may be defined as the distance between two opposing points on a wall of the depression **20**, **21**. The diameter of the depression **20**, **21** decreases from the second surface **11** in direction of the back face **12**, with a first diameter d**1** at the second surface **11** and a second diameter d**2** at the back face **12**, with d**1** greater than d**2**.

[0044] As it should become clear by also consulting the figures, walls of the depression **20**, **21** are tilted, narrowing the diameter until the back face **12** is reached, which defines the narrowest plane with the depression **20**, **21**.

[0045] Furthermore a body portion **40** can be defined between the back face **12** of the first surface **10** and the first surface **10**, which is part of the wall **2**. The body portion **40** may comprise less material than other areas of the wall **2** and may define a narrow section of the wall **2**. This is intentional, so that in case of oxidation of the first surface **11** of the wall **2**, the wall **2** may be breached at this location and will result in a passage (see FIG. **2**A and FIG. **2**C, reference sign **50**) for cooling air.

[0046] In FIG. **1** the aerofoil **1** is shown as manufactured. All depression **20**, **21** may be blind holes which have not become passages yet.

[0047] In FIG. **2**A the same is shown for a short section of the wall **2** as a cross section from a direction indicated by the line A-A in FIG. **1**. Furthermore FIG. **2**A also shows the appearance of the wall section once oxidation of the first surface **10** has taken place.

[0048] According to FIG. **2**A, a section of the wall **2** is shown, with its first surface **10** that is directed to the hot gas path. Hot streaming gas is indicated again via an arrow for the working fluid flow **30**. In the second surface **11**, as before, the first depression **20** in form of a truncated cone and a second depression **21** in form of a truncated triangular prism is shown, which both appear in a cross section as truncated trapezoid or trapezium.

[0049] The first depression **20** has an opening of the first diameter d**1** then narrows until the back face **12** is reached with a diameter of the second diameter d**2**. The width of the material of the body portion **40** is indicated by the width w and may be a fraction of a width of a medium distance between the first surface **10** and the second surface **11**.

[0050] The first drawing of FIG. **2**A shows the aerofoil **1** without being oxidised, for example when manufactured or if installed in an area in which no extreme temperatures occur.

[0051] The second drawing of FIG. **2**A show the aerofoil **1** after oxidisation has occurred for a longer time span. The first surface **10** is affected by oxidisation resulting in material loss and in an oxidised first surface **13**. If the temperature remains extremely hot, the oxidisation of the oxidised first surface **11** continues, until all the material of the body portion **40** has vanished. In this case the blind holes of the depressions **20**, **21** will become through holes, i.e. passages **50** which allow cooling air to pass, as indicated via arrows for cooling fluid flow **31**. As a further consequence the cooling air will cool the oxidised first surface **13** in a proximity of the passage **50**.

[0052] This will diminish the oxidisation of the already oxidised first surface **13** and slowing down the material degradation at the first surface **10**.

[0053] If still temperature peaks occur, the material degradation of the first surface **10** may continue at a slower pace. This result in further oxidisation, as indicated by a dashed line for a further oxidised first surface **14**. As it can be seen, the height of the passages **50** will also decrease, which has a direct impact on the width of the passage **50**, due to the tilted walls of the passage **50**. The throughput of cooling air will increase through the passage **50**, because the second diameter d**2** indicating the diameter of the passage exit will also increase. This has the consequence that the oxidisation of the first surface **10** will decrease further until a stable point of operation is reached, at which enough cooling air is provided via the passage **50**.

[0054] Thus, the invention provides a self adjusting principle, in which cooling passages will be created "automatically" for hot spots and the turbine engine component will adapt the diameters of the exits of the cooling passages "itself" such that the minimum needed cooling air is provided, so that no oxidisation takes place any further.

[0055] Even though this principle is explained for an aerofoil, the invention can be applied to other turbine engine components being affected by hot fluids. Dependent on the location of the turbine engine component, different types of depressions with different orientations may be advantageous. As examples, several types of depressions are shown in FIG. 2B and 2C.

[0056] In FIG. 2B a number of depressions **22**, **23**, **24**, **25** are shown, that are slight modifications of the first depression **20** and the second depression **21**.

[0057] The drawing of FIG. 2A showed depressions **20**, **21** that show a plane symmetry in regards of a plane through the centre of the back face **12**, the plane being perpendicular to the first surface **10** extending perpendicular to the plane of projection. Due to the symmetry tilted walls **51** of the depression **20**, **21** have the same length in the projection of FIG. 2A. Depressions with different walls **51** are shown for the depressions **22** and **24** in FIG. 2B. This allows to direct the depression in a wanted direction, so that the cooling fluid, once the passage **50** has been occurred, will be guided in a the wanted direction, for example to provide film cooling or alternatively to create turbulences.

[0058] Depression **23** shows a specific form, in which the depression is a cone or a trapezoid without truncation. Thus, the back face **12** may only be a point or a line. This will result in a very small passage **50** at the beginning.

[0059] Even though up to now only flat walls of the depressions **20**, **21**, **22**, **23**, **24** were shown, depression **25** shows a different form, in which the walls **51** are convex.

[0060] Other forms may be also advantageous.

[0061] Not discussed so far, the wall **2** of the aerofoil **1** may be designed such that the oxidation mainly takes place or will be affecting the material faster on the first surface in the area of the body portion **40**. This may be possible if a part of the wall **2** adjacent to the body portion **40** is of a further material that is less susceptible to erosion and/or corrosion, e.g. oxidation, than the body portion **40**. This allows creating a passage **50** for cooling air even before the remainder of the first surface **10** of the wall **2** is totally oxidised.

[0062] This may also be possible, if only parts of the first surface **10** of the aerofoil **1** will be coated by an oxidation resistant coating, leaving coating free gaps in the area of the body portion **40**.

[0063] FIG. 2C shows an embodiment in which the complete first surface **10** is coated. The body portion **40** is sealing the passage **50** to become a depression in form of a blind hole merely by a coating **60**. The principle of operation does not differ from the previously said, thus resulting in a passage **50** as shown in the second drawing of FIG. 2C. The solution of FIG. 2C may be advantageous in respect of manufacturing the aerofoil with its depressions, because the depression can be manufactured initially as through hole and then be closed by the coating **60**.

[0064] Besides this approach the aerofoil with depressions may be manufactured by casting the aerofoil including its depressions or by casting a solid aerofoil without depressions and later drilling the depressions.

[0065] FIG. 2D shows a slightly different embodiment, in which a depression **27** is a blind hole as in FIG. 2A, with an additional coating **60** as known from FIG. 2C. Thus, the cooling passage **50** will then be exposed after the coating **60** and part of the wall **2** material have been lost. The body portion **40**, which may oxidise away, comprises a portion of the coating **60** and a portion of the wall **2** between the back face **12** and the first surface **10**, as indicated in FIG. 2D. As before, in FIG. 2D the part of the aerofoil **1** is shown once at the beginning of operation and in a second drawing after oxidisation has taken place and the passage **50** has been formed.

[0066] This invention is particularly advantageous, because the operation time of turbine engine components that may be affected by oxidisation may be extended. Furthermore the invention is directed to protect installed components in a way that a slight oxidation of surfaces will be accepted. Besides, an adaption to the needed amount of cooling fluid is possible, and due to the fact that the walls of the depression are tilted, this adaption may take less time than in other implementations.

[0067] Not mentioned so far, the invention may have further advantages in respect of internal convection cooling. One of the benefits of a tapered depression is that it increases the internal surface area of the wall to which it is applied. This means that the depression provides some cooling benefit even before the outside part—the body portion **40**—of the depression is removed and a passage is built. If there is active impingement cooling on the inside surface, as there often is in an aerofoil, this cooling benefit could be significant. In this case, to distinguish from prior art convective cooling solutions, it may be the target to design the depression such that in a perfect installation the convective cooling may be sufficient and no erosion and/or corrosion takes place. In a real life installation, in which hot spots may arise due to assembly and/or manufacturing inaccuracies, the body portion **40** may be sized such that there is a chance that a passage **50** may arise during typical time of operation of the component. Thus, the body portion **40** may have a lesser width than known depressions that are solely intended for convection cooling.

[0068] Besides, the convective heat transfer coefficient will also be enhanced due to turbulences of the cooling air resulting of the tapered depression.

[0069] In other words, the depression may be arranged such that the body portion may be eroded and/or corroded completely and generating the passage **50** before a next scheduled inspection of the gas turbine in cases of continuously occurring hot spots.

[0070] Besides, it has to be mentioned that the invention allows easy manufacturing. Particularly due to the tapered form of the depressions, the turbine engine component may be easier to cast. A ceramic forming the depression during the casting process is stronger with a tapered shape than with a parallel sided shape.

[0071] Even though the invention was explained for depressions with a continuous reduction in the diameter of the depression, also non-continuous forms are possible. For example a depression could start from the second surface with a cylindrical shape, later followed by a tapered portion in direction of the back face.

1.-**10**. (canceled)

11. A turbine engine component including a body, comprising:

a first surface exposed to a working fluid having a high temperature during operation;

a second surface including a depression, the depression being exposed to a cooling fluid during operation and oriented such that, starting from the second surface, the depression deepens in a direction of a back face of the first surface; and

a body portion disposed between the back face and the first surface, wherein a diameter of the depression decreases from the second surface in the direction of the back face.

12. The turbine engine component according to claim **11**, wherein the body portion is comprised of a material and/or of a width between the first surface and the back face of the first surface, and

wherein when the body portion is exposed to a specific temperature, erosion and/or corrosion on the first surface side of the body portion a passage through the depression will open.

13. The turbine engine component according to claim **12**, wherein a part of the body adjacent to the body portion includes a further material that is less susceptible to erosion and/or corrosion than the body portion.

14. The turbine engine component according to claim **13**, wherein the further material is an oxidation resistant coating.

15. The turbine engine component according to claim **12**, wherein the open passage provides a cooling fluid producing a cooling to a proximity of the first surface.

16. The turbine engine component according to claim **15**, wherein the cooling is film cooling.

17. The turbine engine component according to claim **15**, wherein the diameter of the depression decreases from the second surface in the direction of the back face such that, when in use, continuing erosion and/or corrosion on the first surface side of the body portion results in widening the passage to let pass a larger amount of cooling fluid.

18. The turbine engine component according to claim **17**, wherein the diameter of the depression decreases from the second surface in direction of the back face such that, when in use, continuing widening of the passage due to erosion and/or corrosion provides an increasing amount of passed cooling fluid such that a temperature of a proximity of the first surface is reduced to a value at which erosion and/or corrosion on the first surface side of the body portion terminates.

19. The turbine engine component according to claim **11**, wherein the turbine engine component is an aerofoil.

20. A gas turbine engine, comprising:

a turbine engine component, comprising:

a first surface exposed to a working fluid having a high temperature during operation,

a second surface including a depression, the depression being exposed to a cooling fluid during operation and oriented such that, starting from the second surface, the depression deepens in a direction of a back face of the first surface, and

a body portion disposed between the back face and the first surface,

wherein a diameter of the depression decreases from the second surface in the direction of the back face.

21. The gas turbine engine according to claim **20**, wherein the turbine engine component is disposed in a vane aerofoil, and/or a vane platform, and/or a blade aerofoil, and/or a blade platform, and/or a blade shroud, and/or a transition duct between a combustor and a turbine section, and/or a combustor, and/or a static shroud, and/or a heat shield, and/or a diffuser, and/or an exhaust.

22. The gas turbine engine according to claim **20**,

wherein the body portion is comprised of a material and/or of a width between the first surface and the back face of the first surface, and

wherein when the body portion is exposed to a specific temperature, erosion and/or corrosion on the first surface side of the body portion a passage through the depression will open.

23. The gas turbine engine according to claim **22**, wherein a part of the body adjacent to the body portion includes a further material that is less susceptible to erosion and/or corrosion than the body portion.

24. The gas turbine engine according to claim **23**, wherein the further material is an oxidation resistant coating.

25. The gas turbine engine according to claim **22**, wherein the open passage provides a cooling fluid producing a cooling to a proximity of the first surface.

26. The gas turbine engine according to claim **25**, wherein the cooling is film cooling.

27. The gas turbine engine according to claim **25**, wherein the diameter of the depression decreases from the second surface in the direction of the back face such that, when in use, continuing erosion and/or corrosion on the first surface side of the body portion results in widening the passage to let pass a larger amount of cooling fluid.

28. A method for adaptive cooling a turbine engine component, the method comprising:

providing a cooling fluid to the turbine engine component including a body, the gas turbine component comprising:

a first surface exposed to a working fluid of a high temperature during operation,

a second surface comprising a depression, the depression being exposed to the cooling fluid during operation and oriented such that, starting from the second surface, the depression deepens in a direction of a back face of the first surface, and

a body portion disposed between the back face and the first surface; and

applying heat to the first surface such that a material of the first surface is eroded and/or corroded on the first surface side of the body portion so that a passage to the depression will open allowing the cooling fluid to pass,

wherein a diameter of the depression decreases from the second surface in direction of the back face.

29. The method according to claim **20**, wherein the depression is cast or machined.

* * * * *