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(54) VANE INCLUDING INTERNAL RADIANT HEAT SHIELD

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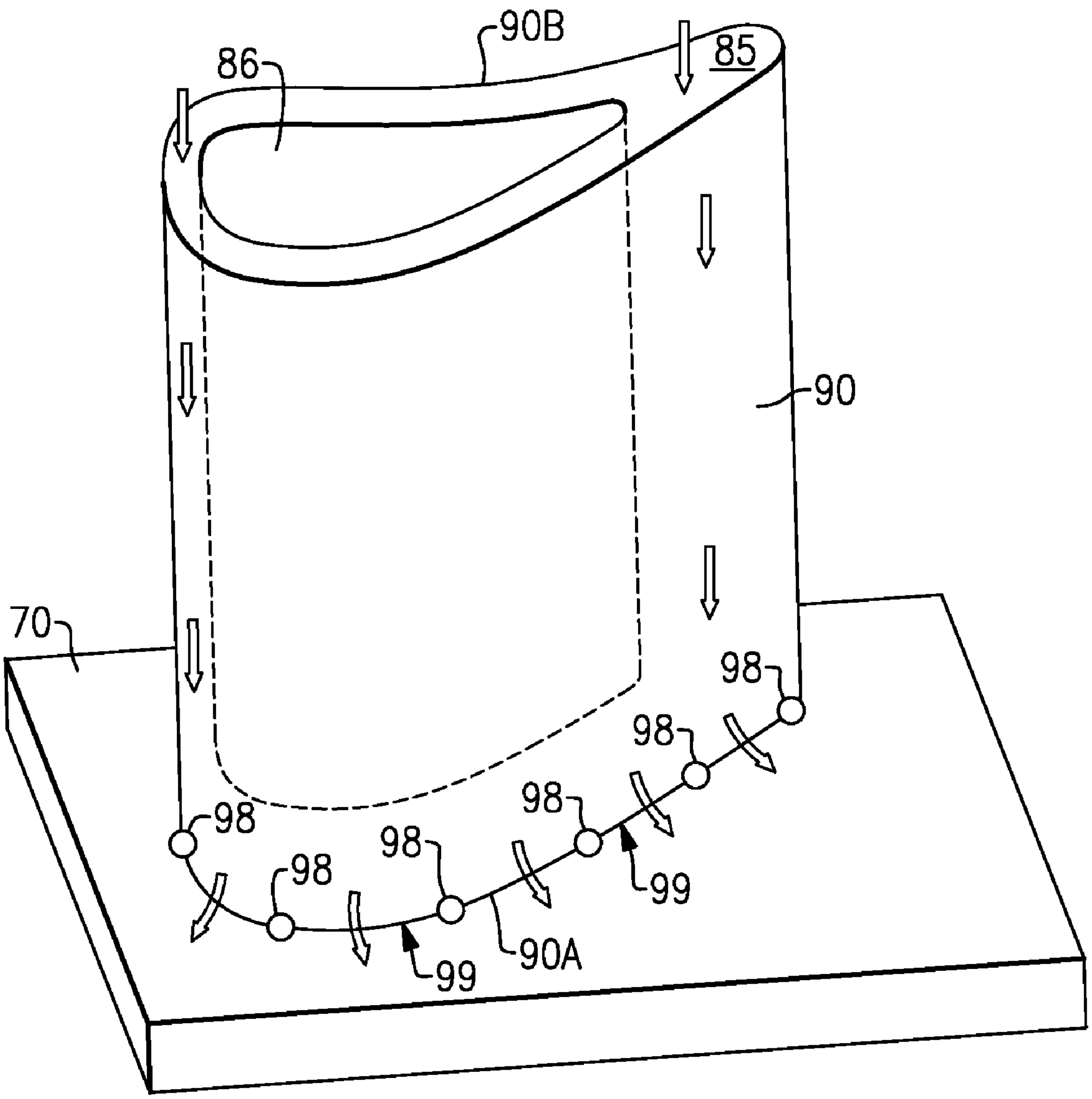
(57) **ABSTRACT**

A component for a gas turbine engine includes an airfoil shell having an internal cavity and extending between a radially inner platform and a radially outer platform. The component also includes a spar disposed within the internal cavity. The airfoil shell has a greater resistance to heat than the spar, and the spar has a greater strength than the airfoil shell. A radiant heat shield circumscribes the spar within the internal cavity. The radiant heat shield is enclosed within the airfoil shell and has a reflectance to radiant heat that is greater than or equal to that of the spar.



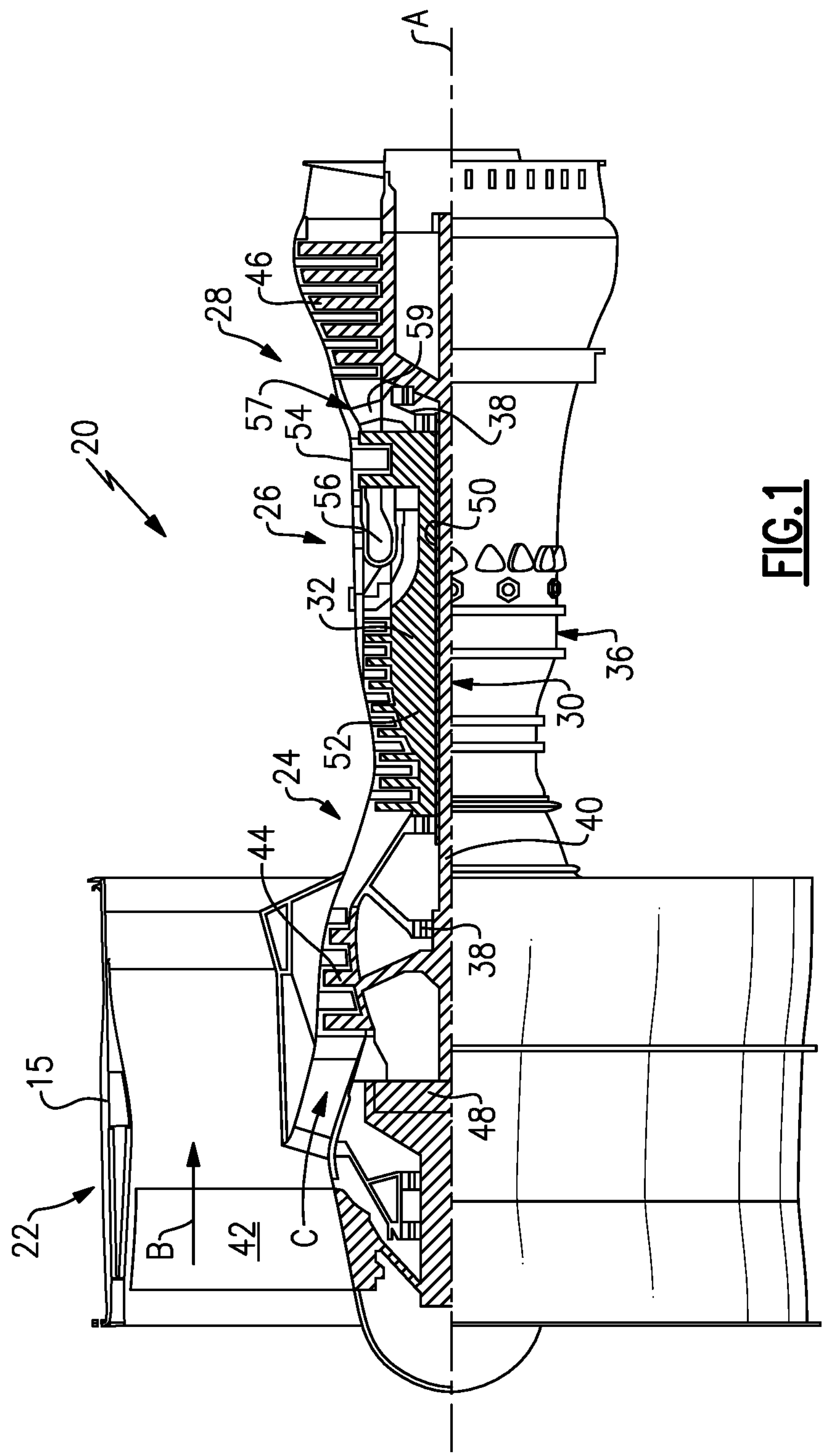
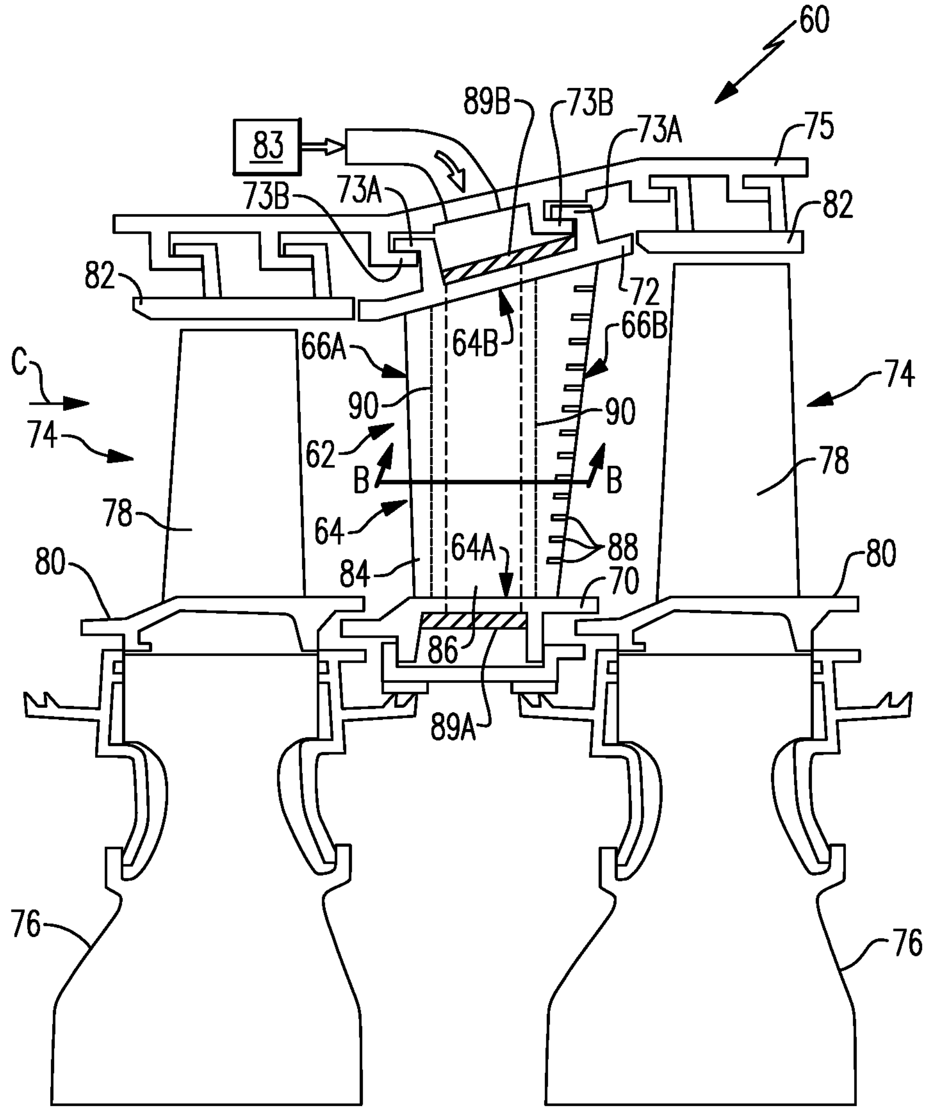



FIG.1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89B
73B
73A
75
83
73B
73A
82
82
72
64B
66B
66A
C
74
74
90
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89A
76
76

FIG.2

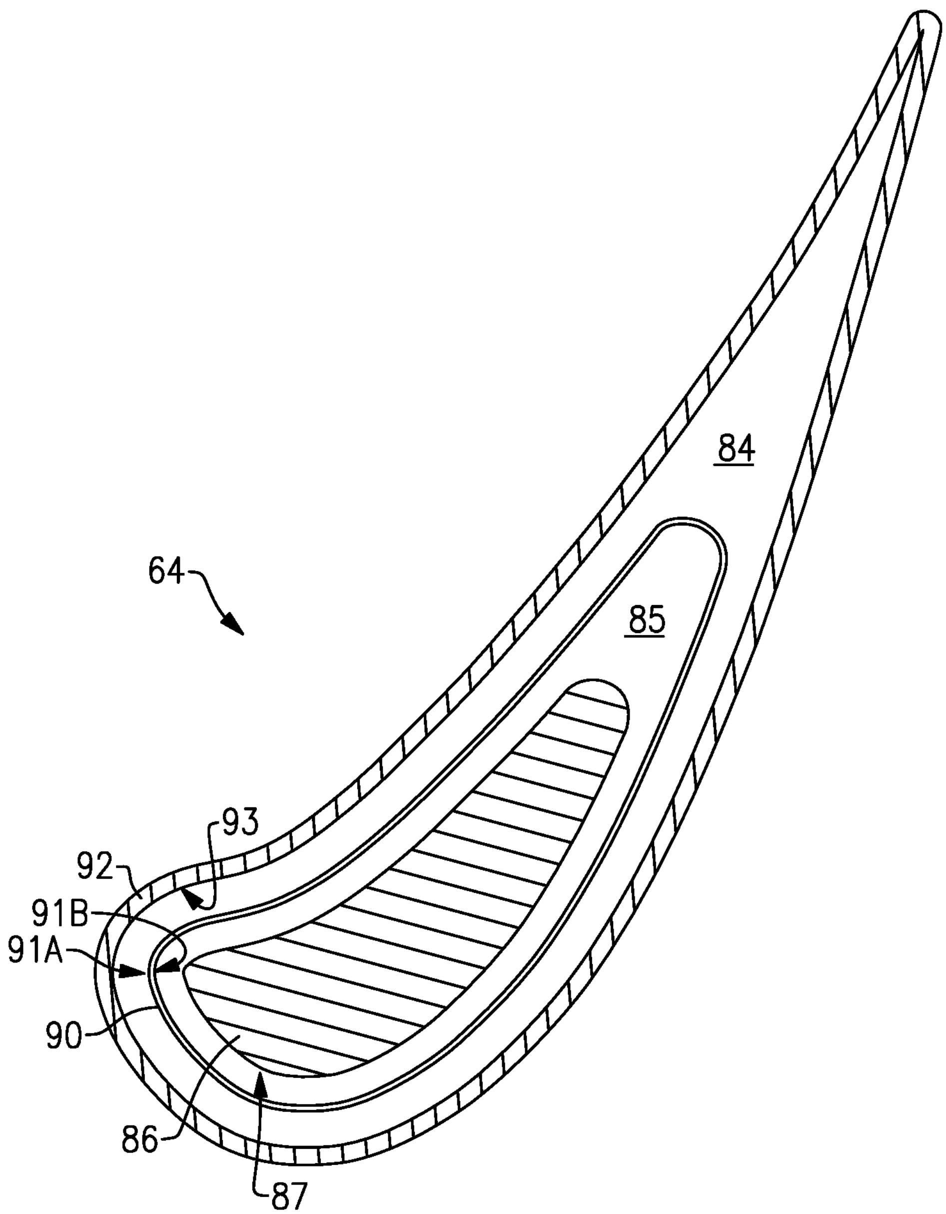


FIG.3A

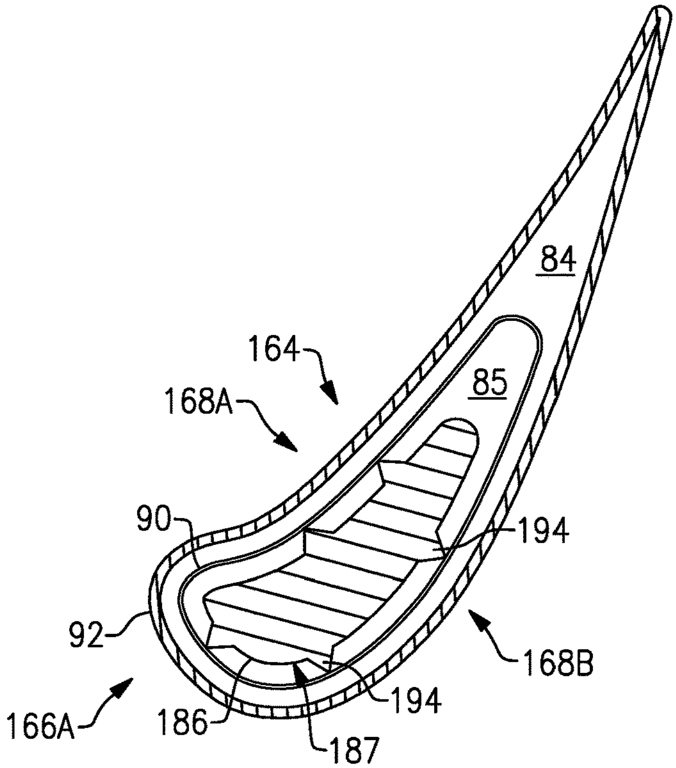


FIG.3B

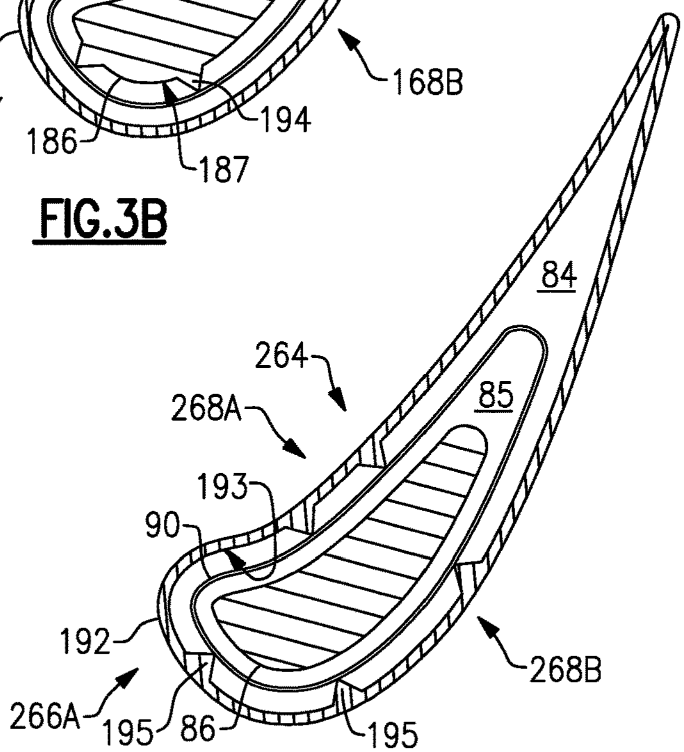


FIG.3C

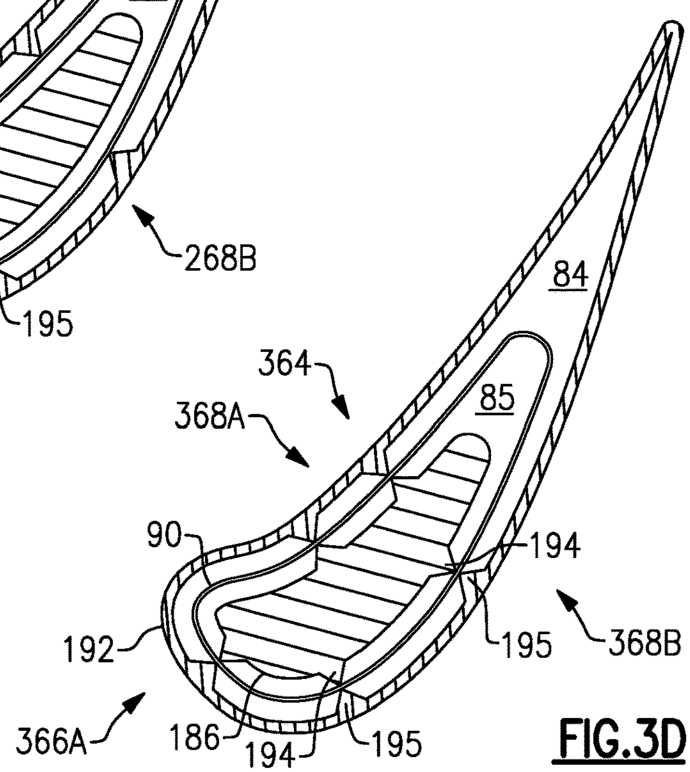


FIG.3D

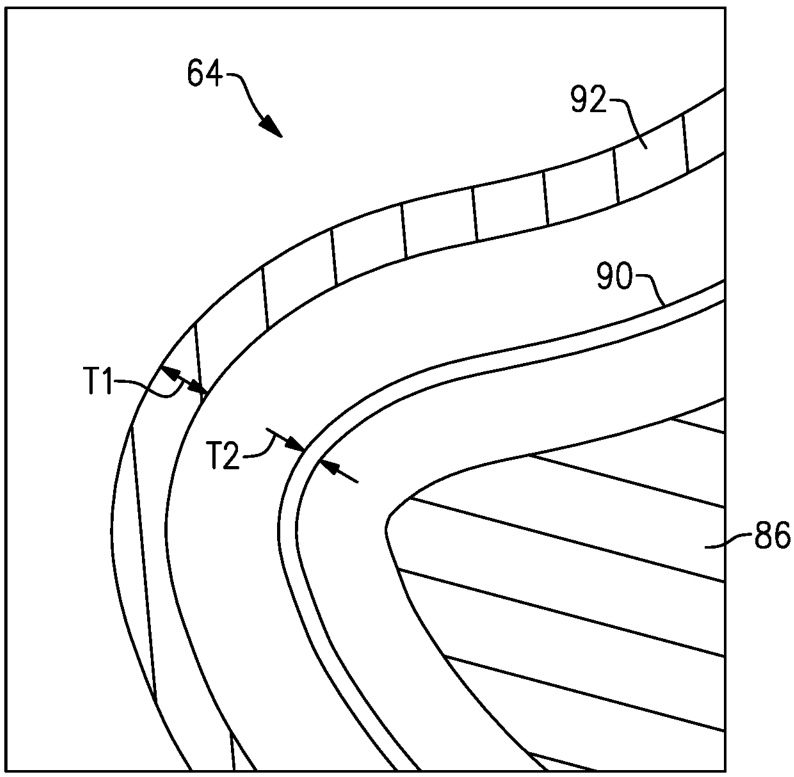


FIG.3E

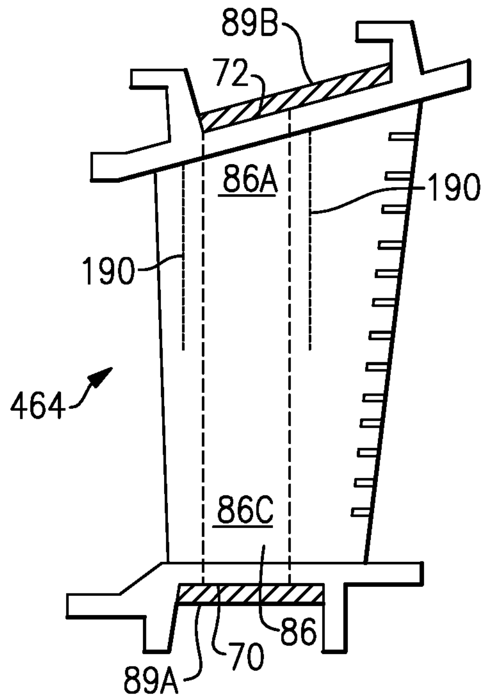


FIG.4A

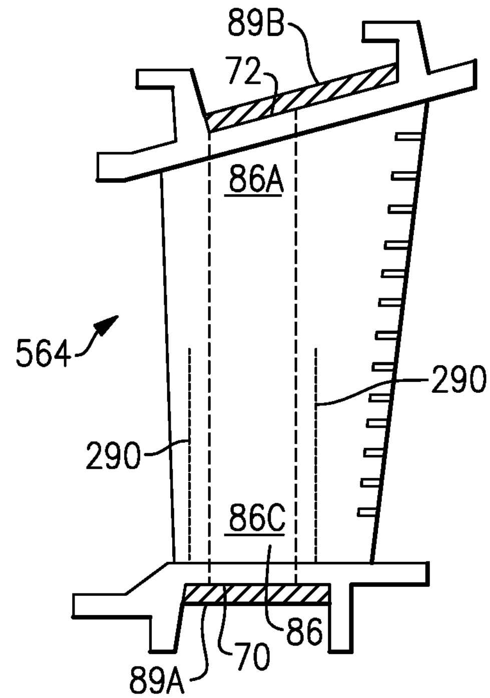


FIG.4B

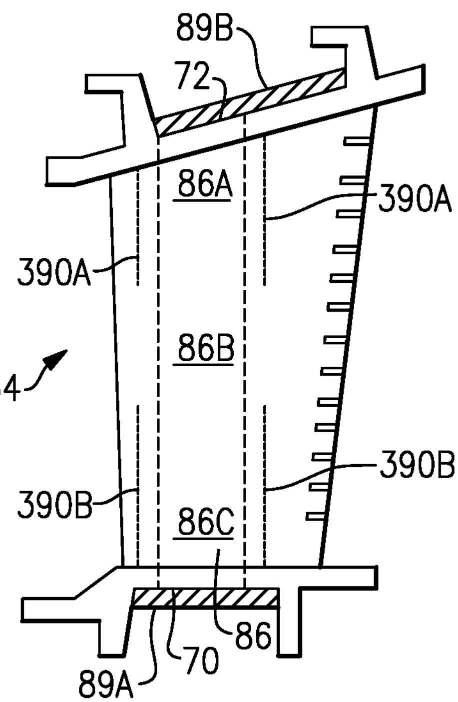


FIG.4C

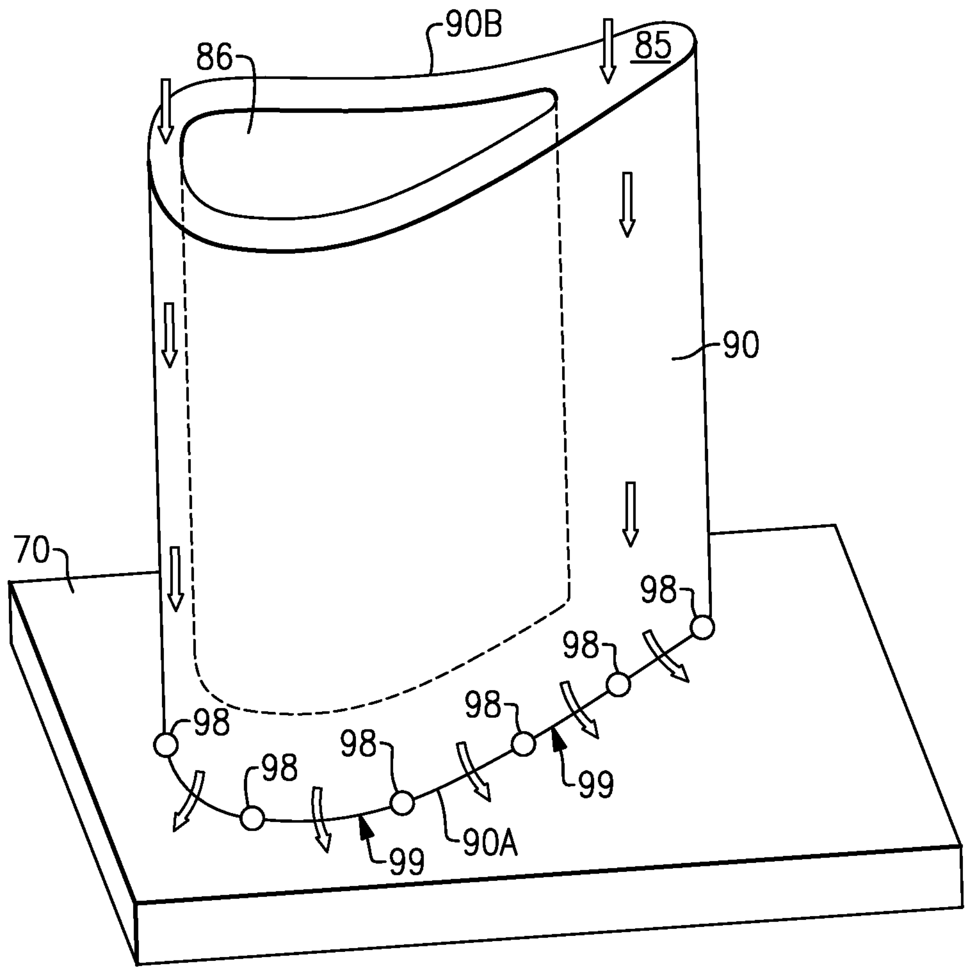


FIG.5

# VANE INCLUDING INTERNAL RADIANT HEAT SHIELD

## BACKGROUND

[0001] This application relates to vanes, and more particularly to a vane having a radiant heat shield.

[0002] A gas turbine engine typically includes a fan section, a compressor section, a combustor section, and a turbine section. Air entering the compressor section is compressed and delivered into the combustion section where it is mixed with fuel and ignited to generate a high-speed exhaust gas flow. The high-speed exhaust gas flow expands through the turbine section to drive the compressor and the fan section.

[0003] The turbine section includes components such as turbine vanes that are subjected to high temperatures during engine operation. Conventional turbine vanes have been made of a single crystal nickel superalloy that forms an aerodynamic surface of the vane as well as carrying any structural loads. More recently, it has been proposed to form vanes of a non-metallic material, such as a ceramic matrix composite (CMC). CMC vanes can withstand higher operating temperatures than a single crystal nickel superalloy, but cannot support structural loads as well as the single crystal nickel superalloy vanes.

## SUMMARY

[0004] A component for a gas turbine engine according to an example of the present disclosure includes an airfoil shell having an internal cavity and extending between a radially inner platform and a radially outer platform. The component also includes a spar disposed within the internal cavity. The airfoil shell has a greater resistance to heat than the spar, and the spar has a greater strength than the airfoil shell. A radiant heat shield circumscribes the spar within the internal cavity. The radiant heat shield is enclosed within the airfoil shell and has a reflectance to radiant heat that is greater than or equal to that of the spar.

[0005] In a further embodiment of any of the foregoing embodiments, the radiant heat shield is at least partially spaced apart from an outer surface of the spar and an inner surface of the airfoil shell.

[0006] In a further embodiment of any of the foregoing embodiments, the airfoil shell includes a plurality of lateral extensions that extend away from the inner surface of the airfoil shell and space the radiant heat shield away from the inner surface of the airfoil shell.

[0007] In a further embodiment of any of the foregoing embodiments, the outer surface of the spar includes a plurality of lateral extensions that extend away from the outer surface of the spar and space the radiant heat shield away from the outer surface of the spar.

[0008] In a further embodiment of any of the foregoing embodiments, the radiant heat shield continuously circumscribes the spar between the radially inner platform and the radially outer platform.

[0009] In a further embodiment of any of the foregoing embodiments, the radiant heat shield discontinuously circumscribes the spar between the radially inner platform and the radially outer platform.

[0010] In a further embodiment of any of the foregoing embodiments, the radiant heat shield continuously circumscribes a portion of the spar that extends from one of the radially inner platform and the radially outer platform.

[0011] In a further embodiment of any of the foregoing embodiments the radiant heat shield includes a first portion that continuously circumscribes a portion of the spar that extends from the radially inner platform, and also includes a second portion that is separate from the first portion and circumscribes a portion of the spar that extends from the radially outer platform.

[0012] In a further embodiment of any of the foregoing embodiments, the spar includes a nickel alloy.

[0013] In a further embodiment of any of the foregoing embodiments, the airfoil shell includes a ceramic matrix composite (CMC) or an alloy comprising one or more of niobium, tantalum, tungsten, rhenium, and molybdenum.

[0014] In a further embodiment of any of the foregoing embodiments, the radiant heat shield includes an alloy comprising one or more of nickel, cobalt, and gold.

[0015] In a further embodiment of any of the foregoing embodiments, the spar includes a nickel alloy; the airfoil shell includes a ceramic matrix composite (CMC) or an alloy comprising one or more of niobium, tantalum, tungsten, rhenium, and molybdenum; and the radiant heat shield includes an alloy comprising one or more of nickel, cobalt, and gold.

[0016] In a further embodiment of any of the foregoing embodiments, the radiant heat shield has an emissivity that is 1-50%.

[0017] In a further embodiment of any of the foregoing embodiments, the radiant heat shield has a reflectance that is 50-99%.

[0018] In a further embodiment of any of the foregoing embodiments, the radiant heat shield has an absorptivity that is 1-80%.

[0019] In a further embodiment of any of the foregoing embodiments, the airfoil shell defines a first wall having a first thickness measured perpendicular to an outer surface of the spar, and the radiant heat shield defines a second wall having a second thickness measured perpendicular to the outer surface of the spar, and the first thickness is at least twice the second thickness.

[0020] In a further embodiment of any of the foregoing embodiments, a portion of an internal cavity between the spar and the radiant heat shield is in fluid communication with a source of cooling air.

[0021] In a further embodiment of any of the foregoing embodiments, the airfoil shell is part of a turbine vane.

[0022] A component for a gas turbine engine, according to an example of the present disclosure includes an airfoil shell having an internal cavity and extending between a radially inner platform and a radially outer platform. The airfoil shell includes a ceramic matrix composite (CMC) or an alloy including one or more of niobium, tantalum, tungsten, rhenium, and molybdenum. A spar is disposed within the internal cavity. The airfoil shell has a greater resistance to heat than the spar, and the spar has a greater strength than the airfoil shell. The spar includes a nickel alloy. A radiant heat shield circumscribes the spar within the internal cavity. The radiant heat shield is enclosed within the airfoil shell and has a reflectance to radiant heat that is greater than or equal to that of the spar. The radiant heat shield includes an alloy comprising one or more of nickel, cobalt, and gold. The radiant heat shield is at least partially spaced apart from an outer surface of the spar and an inner surface of the airfoil shell. The radiant heat shield has an emissivity that is 1-50%, a reflectance that is 50-99%, and an absorptivity that is 1-80%.

**[0023]** A gas turbine engine according to an example of the present disclosure includes a compressor section, a combustor section in fluid communication with the compressor section, and a turbine section in fluid communication with the combustor section. The turbine section includes a turbine vane. The turbine vane includes an airfoil shell having an internal cavity and extending between a radially inner platform and a radially outer platform. A spar is disposed within the internal cavity. The airfoil shell has a greater resistance to heat than the spar, and the spar has a greater strength than the airfoil shell. A radiant heat shield circumscribes the spar within the internal cavity. The radiant heat shield is enclosed within the airfoil shell and has a reflectance to radiant heat that is greater than or equal to that of the spar.

**[0024]** The embodiments, examples, and alternatives of the preceding paragraphs, the claims, or the following description and drawings, including any of their various aspects or respective individual features, may be taken independently or in any combination. Features described in connection with one embodiment are applicable to all embodiments, unless such features are incompatible.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0025]** FIG. **1** is a schematic view of an example gas turbine engine.

**[0026]** FIG. **2** is a schematic view of a portion of a gas turbine engine.

**[0027]** FIG. **3**A is a cross-sectional view of a turbine vane of FIG. **2** taken along line B-B of FIG. **2**.

**[0028]** FIG. **3**B is a schematic view of an example radiant heat shield spacing configuration for a turbine vane.

**[0029]** FIG. **3**C is a schematic view of another example radiant heat shield spacing configuration for a turbine vane.

**[0030]** FIG. **3**D is a schematic view of another example radiant heat shield spacing configuration for a turbine vane.

**[0031]** FIG. **3**E is an enlarged view of a portion of FIG. **3**A.

**[0032]** FIG. **4**A is a schematic view of an example turbine vane.

**[0033]** FIG. **4**B is a schematic view of another example turbine vane.

**[0034]** FIG. **4**C is a schematic view of another example turbine vane.

**[0035]** FIG. **5** is a schematic view of an example arrangement for securing a radiant heat shield to a radially inner platform.

## DETAILED DESCRIPTION

**[0036]** FIG. **1** schematically illustrates a gas turbine engine **20**. The gas turbine engine **20** is disclosed herein as a two-spool turbofan that generally incorporates a fan section **22**, a compressor section **24**, a combustor section **26** and a turbine section **28**. The fan section **22** drives air along a bypass flow path B in a bypass duct defined within a nacelle **15**, and also drives air along a core flow path C for compression and communication into the combustor section **26** then expansion through the turbine section **28**. Although depicted as a two-spool turbofan gas turbine engine in the disclosed non-limiting embodiment, it should be understood that the concepts described herein are not limited to use with two-spool turbofans as the teachings may be applied to other types of turbine engines including three-spool architectures.

**[0037]** The exemplary engine **20** generally includes a low speed spool **30** and a high speed spool **32** mounted for rotation about an engine central longitudinal axis A relative to an engine static structure **36** via several bearing systems **38**. It should be understood that various bearing systems **38** at various locations may alternatively or additionally be provided, and the location of bearing systems **38** may be varied as appropriate to the application.

**[0038]** The low speed spool **30** generally includes an inner shaft **40** that interconnects a fan **42**, a first (or low) pressure compressor **44** and a first (or low) pressure turbine **46**. The inner shaft **40** is connected to the fan **42** through a speed change mechanism, which in exemplary gas turbine engine **20** is illustrated as a geared architecture **48** to drive the fan **42** at a lower speed than the low speed spool **30**. The high speed spool **32** includes an outer shaft **50** that interconnects a second (or high) pressure compressor **52** and a second (or high) pressure turbine **54**. A combustor **56** is arranged in exemplary gas turbine **20** between the high pressure compressor **52** and the high pressure turbine **54**. A mid-turbine frame **57** of the engine static structure **36** is arranged generally between the high pressure turbine **54** and the low pressure turbine **46**. The mid-turbine frame **57** further supports bearing systems **38** in the turbine section **28**. The inner shaft **40** and the outer shaft **50** are concentric and rotate via bearing systems **38** about the engine central longitudinal axis A which is collinear with their longitudinal axes.

**[0039]** The core airflow is compressed by the low pressure compressor **44** then the high pressure compressor **52**, mixed and burned with fuel in the combustor **56**, then expanded over the high pressure turbine **54** and low pressure turbine **46**. The mid-turbine frame **57** includes airfoils **59** which are in the core airflow path C. The turbines **46**, **54** rotationally drive the respective low speed spool **30** and high speed spool **32** in response to the expansion. It will be appreciated that each of the positions of the fan section **22**, compressor section **24**, combustor section **26**, turbine section **28**, and fan drive gear system **48** may be varied. For example, gear system **48** may be located aft of combustor section **26** or even aft of turbine section **28**, and fan section **22** may be positioned forward or aft of the location of gear system **48**.

**[0040]** The engine **20** in one example is a high-bypass geared aircraft engine. In a further example, the engine **20** bypass ratio is greater than about six (6), with an example embodiment being greater than about ten (10), the geared architecture **48** is an epicyclic gear train, such as a planetary gear system or other gear system, with a gear reduction ratio of greater than about 2.3 and the low pressure turbine **46** has a pressure ratio that is greater than about five. In one disclosed embodiment, the engine **20** bypass ratio is greater than about ten (10:1), the fan diameter is significantly larger than that of the low pressure compressor **44**, and the low pressure turbine **46** has a pressure ratio that is greater than about five 5:1. Low pressure turbine **46** pressure ratio is pressure measured prior to inlet of low pressure turbine **46** as related to the pressure at the outlet of the low pressure turbine **46** prior to an exhaust nozzle. The geared architecture **48** may be an epicycle gear train, such as a planetary gear system or other gear system, with a gear reduction ratio of greater than about 2.3:1. It should be understood, however, that the above parameters are only exemplary of one embodiment of a geared architecture engine and that the present invention is applicable to other gas turbine engines including direct drive turbofans.

**[0041]** A significant amount of thrust is provided by the bypass flow B due to the high bypass ratio. The fan section **22** of the engine **20** is designed for a particular flight condition—typically cruise at about 0.8 Mach and about 35,000 feet (10,668 meters). The flight condition of 0.8 Mach and 35,000 ft (10,668 meters), with the engine at its best fuel consumption—also known as "bucket cruise Thrust Specific Fuel Consumption ('TSFC')"—is the industry standard parameter of lbm of fuel being burned divided by lbf of thrust the engine produces at that minimum point. "Low fan pressure ratio" is the pressure ratio across the fan blade alone, without a Fan Exit Guide Vane ("FEGV") system. The low fan pressure ratio as disclosed herein according to one non-limiting embodiment is less than about 1.45. "Low corrected fan tip speed" is the actual fan tip speed in ft/sec divided by an industry standard temperature correction of $[(\text{Tram } ° \text{ R})/(518.7° \text{ R})]^{0.5}$. The "Low corrected fan tip speed" as disclosed herein according to one non-limiting embodiment is less than about 1150 ft/second (350.5 meters/second).

**[0042]** FIG. **2** shows a schematic view of selected portions of a section **60** of a gas turbine engine, such as a portion of the turbine section **28** of the gas turbine engine **20** of FIG. **1**. In this example, the section **60** includes a vane section **62** having a stator vane **64** that has an airfoil shape and has a leading edge **66**A and a trailing edge **66**B. The vane **64** extends between a radially inner platform **70** and a radially outer platform **72**. In this disclosure, "radially inner" and "radially outer" refer to the engine central longitudinal axis A. In the example of FIG. **2**, the radially outer platform **72** includes hooks **73**A that engage hooks **73**B of engine case **75**.

**[0043]** The vane section **62** is spaced axially away from rotor sections **74** with respect to the engine central longitudinal axis A. The rotor sections **74** each include a rotor disk **76** carrying one or more blades **78** extending from a platform **80** for rotation about the engine central longitudinal axis A. In the example of FIG. **2**, the rotor sections **74** also include a blade outer air seal **82** ("BOAS") situated radially outward of the blades **78**.

**[0044]** The vane **64** includes an internal cavity **84** that extends radially outward from the radially inner platform **70** to the radially outer platform **72**. The internal cavity **84** is in fluid communication with a source **83** of cooling air. The vane **64** includes a plurality of trailing edge openings **88** that allow the cooling air to exit through the trailing edge **66**B.

**[0045]** A first end **64**A of the vane **64** extends to the radially inner platform **70**, and the opposite second end **64**B of the vane **64** extends to the radially outer platform **72**. In one example, the vane **64** is connected as a single component with the radially inner platform **70** and radially outer platform **72**.

**[0046]** A spar **86** is disposed within the internal cavity **84**. The spar **86** extends between the radially inner platform **70** and the radially outer platform **72**, and defines a primary load path between the platforms **70**, **72**. In the non-limiting example of FIG. **2**, the spar **86** is held in place by plate **89**A that abuts the radially inner platform **70** and plate **89**B that abuts the radially outer platform **72**. However, other attachment arrangements could be used, such as one in which the spar **86** engaged hooks **73**B of engine case **75** (e.g., by being integral with the hooks **73**A of the radially outer platform **72**).

**[0047]** A radiant heat shield **90** is also disposed within the internal cavity and circumscribes the spar **86**. The radiant heat shield **90** protects the spar **86** from radiant heat from an interior of an airfoil shell **92** of the vane **64** (see FIG. **3**), and has a reflectance to radiant heat that is greater than or equal to that of the spar **86**. In some examples (e.g., where the spar **86** and radiant heat shield **90** are composed of different materials), a reflectance of the radiant heat shield **90** is greater than that of the spar **86**. In the example of FIG. **2**, the radiant heat shield **90** continuously circumscribes the spar **86** between the radially inner platform **70** and the radially outer platform **72**. In one example, the radiant heat shield **90** is substantially non-load bearing.

**[0048]** FIG. **3**A is a cross-sectional view of the turbine vane **64** of FIG. **2** taken along line B-B of FIG. **2**. Referring now to FIG. **3**A with continued reference to FIG. **2**, the vane **64** includes an airfoil shell **92** that defines the internal cavity **84**. The airfoil shell **92** has a greater resistance to heat than the spar **86**, and the spar **86** has a greater strength than the airfoil shell **92**.

**[0049]** The radiant heat shield **90** is enclosed within the airfoil shell **92**. As used herein, the radiant heat shield **90** being "enclosed within" the airfoil shell **92** means that no portion of the radiant heat shield **90** extends outside of the airfoil shell **92**.

**[0050]** A portion **85** of the internal cavity **84** is provided between the spar **86** and the radiant heat shield **90**. The portion **85** is in fluid communication with the source **83** of cooling air. The radiant heat shield **90** segments portion **85** of the internal cavity **84**, and thereby concentrates a flow of cooling air within the portion **85**. By segmenting the portion **85** from the larger internal cavity **84**, the radiant heat shield **90** enhances convective cooling of the cooling air from source **83** within the portion **85**, because the cooling area is concentrated in a smaller area. Also, because the cooling air within the portion **85** is segmented from the hotter temperature air in the internal cavity outside of the portion **85**, the exit temperature of the cooling air is reduced, making it more useful for cooling downstream components (e.g., downstream blades).

**[0051]** The radiant heat shield **90** protects the spar **86** from a radiant heat load applied to the airfoil shell **92**. The radiant heat shield **90** has a reflectance, an emissivity, and an absorptivity, each of which are measurable on a scale of 0%-100%. The reflectance refers to a degree to which the radiant heat shield **90** reflects radiant heat away from itself. The absorptivity refers to a degree to which the radiant heat shield **90** absorbs incident radiant heat. The emissivity refers to a degree to which the radiant heat shield re-emits radiant heat from its interior surface **91**B that the radiant heat shield **90** absorbs from its exterior surface **91**A. In one example, the radiant heat shield **90** includes one or any combination of the following attributes: a reflectance that is 50-99%, an emissivity that is 1-50%, and an absorptivity that is 1-80%. In one example, the radiant heat shield **90** includes a coating, such as magnesium fluoride ($MgF_2$) or calcium fluoride ($CaF_2$) to improve its reflectance. The radiant heat shield **90** could be polished to improve its reflectivity after coating, or without a coating.

**[0052]** As shown in FIG. **3**A, the radiant heat shield **90** is spaced apart from an inner surface **93** of the airfoil shell **92**, and is also spaced away from an outer surface **87** of the spar **86**. In one example, the radiant heat shield **90** does not contact the airfoil shell **92** and also does not contact the spar **86**. Optionally, spacers can be utilized to maintain that spacing.

**[0053]** In this disclosure, like reference numerals designate like elements where appropriate and reference numerals with the addition of one-hundred or multiples thereof designate modified elements that are understood to incorporate the same features and benefits of the corresponding elements.

**[0054]** FIG. **3**B is a schematic view of a turbine vane **164** using a first example spacing configuration for the radiant heat shield **90**. The turbine vane **164** includes a pressure side **168**A and a suction side **168**B. In the example of FIG. **3**B, the spar **186** includes a plurality of lateral extensions **194** that extend way from the outer surface **187** of the spar **186** and space the radiant heat shield **90** away from the outer surface **187** of the spar **186**. In particular, the extensions **194** are disposed along a pressure side **168**A, suction side **168**B, and leading edge **166**A of the vane **164**.

**[0055]** FIG. **3**C is a schematic view of a turbine vane **264** using a second example spacing configuration for the radiant heat shield **90**. In the example of FIG. **3**C, the airfoil shell **192** includes a plurality of lateral extensions **195** that extend way from the inner surface **193** of the spar airfoil shell **192** and space the radiant heat shield **90** away from the inner surface **193** of the airfoil shell **192**. In particular, the lateral extensions **195** are disposed along a pressure side **268**A, suction side **268**B, and leading edge **266**A of the vane **264**.

**[0056]** FIG. **3**D is a schematic view of a turbine vane **364** using a third example spacing configuration for the radiant heat shield **90** that utilizes the spar **186** of FIG. **3**B and the airfoil shell **192** of FIG. **3**C such that each of the spar **186** and airfoil shell **192** include respective lateral extensions **194**, **195**. In the example of FIG. **3**D, the lateral extensions **194**, **195** are disposed along a pressure side **368**A, suction side **368**B, and leading edge **366**A of the vane **364**.

**[0057]** FIG. **3**E is an enlarged view of a portion of FIG. **3**A. As shown in the example of FIG. **3**E, the airfoil shell **92** defines a first wall having a thickness T**1** measured perpendicular to the outer surface **87** of the spar. The radiant heat shield **90** defines a second wall having a thickness T**2** measured perpendicular to the outer surface **87** of the spar. In the non-limiting example of FIG. **3**E, the thickness T**1** is at least twice the thickness T**2**. It is understood, however, that other thicknesses could be used.

**[0058]** FIG. **4**A is a schematic view of an example turbine vane **464** in which the radiant heat shield **190** discontinuously circumscribes the spar **86** between the radially inner platform **70** and the radially outer platform **72**. In particular, the radiant heat shield **190** circumscribes a portion **86**A of the spar **86** that extends from the radially outer platform **72**, but does not circumscribe a portion **86**C of the spar **86** that extends from the radially inner platform **70**.

**[0059]** FIG. **4**B is a schematic view of another example turbine vane **564** in which radiant heat shield **290** discontinuously circumscribes the spar **86** between the radially inner platform **70** and the radially outer platform **72**. In particular, the radiant heat shield **290** circumscribes a portion **86**C of the spar **86** that extends from the radially inner platform **70**, but does not circumscribe portion **86**A of the spar **86** that extends from the radially outer platform **72**.

**[0060]** FIG. **4**C is a schematic view of another example turbine vane **564** in which radiant heat shield **390** discontinuously circumscribes the spar **86** between the radially inner platform **70** and the radially outer platform **72**. In particular, the radiant heat shield **390** includes a first portion **390**A that continuously circumscribes the portion **86**A of the spar **86** that extends from the radially outer platform **72**, and includes a second portion **390**B that is separate from the first portion **390**A and circumscribes the portion **86**C of the spar **86** that extends from the radially inner platform **70**. In the example of FIG. **4**C, the radiant heat shield **390** does not circumscribe an intermediate portion **86**B that is between the portions **86**A, **86**C of the spar **86**. In one example, the radiant heat shields **190**, **290**, **390** of FIGS. **4**A-C provide a weight savings over the radiant heat shield **90** of FIG. **2** by using less material.

**[0061]** The spacing configurations shown in any of FIGS. 3B-3D could be used in the embodiments of any of FIGS. **2** and **4**A-C to maintain a desired offset between the radiant heat shield **90** and one or both of the spar **86** and airfoil shell **92**.

**[0062]** The airfoil shell **92** is formed of a high-temperature material that is capable of withstanding extended continuous operation at high temperatures (e.g., on the order of 2200° F. and above). Some example high temperature materials include a ceramic matrix composite (CMC) and alloys that contain one or more of niobium, tantalum, tungsten, rhenium, molybdenum.

**[0063]** In one example, the spar is at least partially composed of a nickel alloy. In one example, the spar **86** is composed of a different material than the radiant heat shield **90** and the airfoil shell **92**.

**[0064]** In one example, the radiant heat shield **90** includes an alloy of one or more of nickel, cobalt, and gold. In one example, the radiant heat shield **90** is made from the same material as either the airfoil shell **92** or the spar **86**. In one example, the radiant heat shield **90** is made of sheet metal.

**[0065]** FIG. **5** schematically illustrates an example of how a first end **90**A of the radiant heat shield **90** can be secured to the radially inner platform **70** using a plurality of tack welds **98**. In this example, the entirety of first end **90**A of the radiant heat shield is not sealed to the radially inner platform **70**, which provides passages **99** between end **90**A of the radiant heat shield **90** and the radially inner platform **70**, and between the tack welds **98**. The passages **99** permit a flow of cooling air from the portion **85** of the cavity between the spar **86** and radiant heat shield **90** to flow radially inward from the source **83** of cooling air, and then to exit the portion **85** through between the tack welds **98**, and then exit the trailing edge openings **88** shown in FIG. **2**. Although not shown in FIG. **5**, the opposite second end **90**B of the radiant heat shield could be secured to the radially outer platform **72** in a similar manner using a plurality of tack welds and passages between the second end **90**B and the radially outer platform **72**.

**[0066]** The spar **86** provides a primary load path between the radially inner platform **70** and radially outer platform **72**, and bears a load that in the prior art would have been borne primarily by the exterior of the vane **64**. The spar **86** can support a greater structural load than the airfoil shell **92**, but may be unable to withstand the same temperatures as the airfoil shell **92**. The radiant heat shield **90** mitigates application of radiant heat from the airfoil shell **92** to the spar **86**, and thereby facilitates the use of an airfoil shell **92** that is well-suited for operation in high temperatures (and that needs less structural load bearing capability), and use of a spar **86** that is well-suited for load bearing (and that needs less high temperature operation capability).

**[0067]** Although turbine vanes, are discussed in the examples above, it is understood that the vane features discussed above could be applied to other vanes of a gas turbine engine, such as vanes in the compressor section **24**.

**[0068]** Although example embodiments have been disclosed, a worker of ordinary skill in this art would recognize that certain modifications would come within the scope of this disclosure. For that reason, the following claims should be studied to determine the scope and content of this disclosure.

What is claimed is:

**1**. A component for a gas turbine engine, comprising:

an airfoil shell having an internal cavity and extending between a radially inner platform and a radially outer platform;

a spar disposed within the internal cavity, the airfoil shell having a greater resistance to heat than the spar, and the spar having a greater strength than the airfoil shell; and

a radiant heat shield that circumscribes the spar within the internal cavity, the radiant heat shield enclosed within the airfoil shell and having a reflectance to radiant heat that is greater than or equal to that of the spar.

**2**. The component of claim **1**, wherein the radiant heat shield is at least partially spaced apart from an outer surface of the spar and an inner surface of the airfoil shell.

**3**. The component of claim **2**, wherein the airfoil shell comprises a plurality of lateral extensions that extend away from the inner surface of the airfoil shell and space the radiant heat shield away from the inner surface of the airfoil shell.

**4**. The component of claim **2**, wherein the outer surface of the spar comprises a plurality of lateral extensions that extend away from the outer surface of the spar and space said radiant heat shield away from the outer surface of the spar.

**5**. The component of claim **1**, wherein the radiant heat shield continuously circumscribes the spar between the radially inner platform and the radially outer platform.

**6**. The component of claim **1**, wherein the radiant heat shield discontinuously circumscribes the spar between the radially inner platform and the radially outer platform.

**7**. The component of claim **6**, wherein the radiant heat shield continuously circumscribes a portion of the spar that extends from one of the radially inner platform and the radially outer platform.

**8**. The component of claim **6**, wherein the radiant heat shield comprises:

a first portion that continuously circumscribes a portion of the spar that extends from the radially inner platform; and

a second portion that is separate from the first portion and circumscribes a portion of the spar that extends from the radially outer platform.

**9**. The component of claim **1**, wherein the spar comprises a nickel alloy.

**10**. The component of claim **1**, wherein the airfoil shell comprises a ceramic matrix composite (CMC) or an alloy comprising one or more of niobium, tantalum, tungsten, rhenium, and molybdenum.

**11**. The component of claim **1**, wherein the radiant heat shield comprises an alloy comprising one or more of nickel, cobalt, and gold.

**12**. The component of claim **1**, wherein:

the spar comprises a nickel alloy;

the airfoil shell comprises a ceramic matrix composite (CMC) or an alloy comprising one or more of niobium, tantalum, tungsten, rhenium, and molybdenum; and

the radiant heat shield comprises an alloy comprising one or more of nickel, cobalt, and gold.

**13**. The component of claim **1**, wherein the radiant heat shield has an emissivity that is 1-50%.

**14**. The component of claim **1**, wherein the radiant heat shield has a reflectance that is 50-99%.

**15**. The component of claim **1**, wherein the radiant heat shield has an absorptivity that is 1-80%.

**16**. The component of claim **1**, wherein the airfoil shell defines a first wall having a first thickness measured perpendicular to an outer surface of the spar, and the radiant heat shield defines a second wall having a second thickness measured perpendicular to the outer surface of the spar, and the first thickness is at least twice the second thickness.

**17**. The component of claim **1**, wherein a portion of an internal cavity between the spar and the radiant heat shield is in fluid communication with a source of cooling air.

**18**. The component of claim **1**, wherein the airfoil shell is part of a turbine vane.

**19**. A component for a gas turbine engine, comprising:

an airfoil shell having an internal cavity and extending between a radially inner platform and a radially outer platform, the airfoil shell comprising a ceramic matrix composite (CMC) or an alloy comprising one or more of niobium, tantalum, tungsten, rhenium, and molybdenum;

a spar disposed within the internal cavity, the airfoil shell having a greater resistance to heat than the spar, and the spar having a greater strength than the airfoil shell, the spar comprising a nickel alloy; and

a radiant heat shield that circumscribes the spar within the internal cavity, the radiant heat shield enclosed within the airfoil shell and having a reflectance to radiant heat that is greater than or equal to that of the spar, the radiant heat shield comprising an alloy comprising one or more of nickel, cobalt, and gold;

wherein the radiant heat shield is at least partially spaced apart from an outer surface of the spar and an inner surface of the airfoil shell; and

wherein the radiant heat shield has an emissivity that is 1-50%, a reflectance that is 50-99%, and an absorptivity that is 1-80%.

**20**. A gas turbine engine comprising:

a compressor section;

a combustor section in fluid communication with the compressor section; and

a turbine section in fluid communication with the combustor section, the turbine section including a turbine vane, the turbine vane comprising:

an airfoil shell having an internal cavity and extending between a radially inner platform and a radially outer platform;

a spar disposed within the internal cavity, the airfoil shell having a greater resistance to heat than the spar, and the spar having a greater strength than the airfoil shell; and a radiant heat shield that circumscribes the spar within the internal cavity, the radiant heat shield enclosed within the airfoil shell and having a reflectance to radiant heat that is greater than or equal to that of the spar.

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