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(54) **Spoked spacer for a gas turbine engine**

Speichenabstandhalter für einen Gasturbinenmotor

Espaceur de disque échelé pour un moteur à turbine à gaz

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Description

BACKGROUND

[0001] The present disclosure relates to a gas turbine engine, and more particularly to a rotor system therefor.

[0002] Gas turbine rotor systems include successive rows of blades, which extend from respective rotor disks that are arranged in an axially stacked configuration. The rotor stack may be assembled through a multitude of systems such as fasteners, fusion, tie-shafts and combinations thereof.

[0003] Gas turbine rotor systems operate in an environment in which significant pressure and temperature differentials exist across component boundaries which primarily separate a core gas flow path and a secondary cooling flow path. For highpressure, high-temperature applications, the components experience thermo-mechanical fatigue (TMF) across these boundaries. Although resistant to the effects of TMF, the components may be of a heavier-than-optimal weight for desired performance requirements.

[0004] US 2,656,147, which shows the technical features of the preamble of independent claim 1, discloses a rotor for a multi-stage gas turbine engine.

[0005] EP 2,186,997 A2 discloses a rotor having a longitudinal stack of a plurality of discs surrounding the shaft.

[0006] US 2011/0164982 A1 discloses a rotor including a first rotor segment having a first outer surface and a second rotor segment having a second outer surface.

[0007] US 2,619,317 discloses a rotor built up of several pieces arranged side by side in the axial direction.

[0008] US 2,492,833 discloses an improved rotor construction comprising a plurality of discs.

SUMMARY

[0009] From a first aspect, the present invention provides a spacer for a gas turbine engine as claimed in claim 1.

[0010] A spool for a gas turbine engine according to an exemplary aspect of the present invention includes a first rotor disk defined along an axis of rotation, a plurality of first blades which extend from the first rotor disk, and a spacer as claimed in any of claims 1 to 8. The plurality of core gas path seals are adjacent the plurality of first blades. A spool for a gas turbine engine according to an exemplary aspect of the present invention includes a spacer as claimed in any of claims 1 to 8 and a first rotor disk defined along an axis of rotation and a plurality of first blades which extend from said first rotor disk. Each of said plurality of blades extend from said first rotor disk at an interface. A second rotor disk is defined along said axis of rotation and a plurality of second blades which extend from said second rotor disk. Each of said plurality of second blades extend from said second rotor disk at an interface. A rotor ring is defined along said axis of rotation, said rotor ring is in contact with said first rotor disk and said second rotor disk. A plurality of core gas path seals extend from said rotor ring between said plurality of first blades and said plurality of second blades.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] Various features will become apparent to those skilled in the art from the following detailed description of the disclosed non-limiting embodiment. The drawings that accompany the detailed description can be briefly described as follows:

- Figure 1 is a schematic cross-sectional view of a gas turbine engine;
- Figure 2 is an exploded view of the gas turbine engine separated into primary build modules;
- Figure 3 is an enlarged schematic cross-sectional view of a high pressure compressor section of the gas turbine engine;
- Figure 4 is a perspective view of a rotor of the high pressure compressor section;
- Figure 5 is an expanded partial sectional perspective view of the rotor of Figure 4;
- Figure 6 is an expanded partial sectional perspective view of a portion of the high pressure compressor section;
- Figure 7 is a top partial sectional perspective view of a portion of the high pressure compressor section with an outer directed inlet;
- Figure 8 is a top partial sectional perspective view of a portion of the high pressure compressor section with an inner directed inlet;
- Figure 9 is an expanded partial sectional view of a portion of the high pressure compressor section;
- Figure 10 is an expanded partial sectional perspective view of a portion of the high pressure compressor section illustrating a rotor stack load path;
- Figure 11 is a RELATED ART expanded partial sectional perspective view of a portion of the high pressure compressor section illustrating a more tortuous rotor stack load path;
- Figure 12 is an expanded partial sectional perspective view of a portion of the high pressure compressor section illustrating a wire seal structure;
- Figure 13 is an expanded schematic view of the wire seal structure;
- Figure 14 is an expanded partial sectional perspective view of a high pressure turbine section;
- Figure 15 is an expanded exploded view of the high pressure turbine section; and
- Figure 16 is an expanded partial sectional perspective view of the rotor of Figure 15.

DETAILED DESCRIPTION

[0012] Figure 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. Alternative engines might include an augmentor section (not shown) among other systems or features. The fan section 22 drives air along a bypass flowpath while the compressor section 24 drives air along a core flowpath for compression and communication into the combustor section 26 then expansion through the turbine section 28. Although depicted as a 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 turbofans as the teachings may be applied to other types of turbine engines, such as three-spool architectures.

[0013] The 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.

[0014] The low speed spool 30 generally includes an inner shaft 40 that interconnects a fan 42, a low pressure compressor 44 and a low pressure turbine 46. The inner shaft 40 may be connected to the fan 42 directly or through a geared architecture 48 to drive the fan 42 at a lower speed than the low speed spool 30 which in one disclosed non-limiting embodiment includes a gear reduction ratio reduction ratio of, for example, at least 2.4:1. The high speed spool 32 includes an outer shaft 50 that interconnects a high pressure compressor (HPC) 52 and high pressure turbine (HPT) 54. A combustor 56 is arranged between the high pressure compressor 52 and the high pressure turbine 54. The inner shaft 40 and the outer shaft 50 are concentric and rotate about the engine central longitudinal axis A which is collinear with their longitudinal axes.

[0015] 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 turbines 54, 46 rotationally drive the respective low speed spool 30 and high speed spool 32 in response to the expansion.

[0016] The gas turbine engine 20 is typically assembled in build groups or modules (Figure 2). In the illustrated embodiment, the high pressure compressor 52 includes eight stages and the high pressure turbine 54 includes two stages in a stacked arrangement. It should be appreciated, however, that any number of stages will benefit hereform as well as other engine sections such as the low pressure compressor 44 and the low pressure turbine 46. Further, other gas turbine architectures such as a three-spool architecture with an intermediate spool will also benefit herefrom as well.

[0017] With reference to Figure 3, the high pressure compressor (HPC) 52 is assembled from a plurality of successive HPC rotors 60C which alternate with HPC spacers 62C arranged in a stacked configuration. The rotor stack may be assembled in a compressed tie-shaft configuration, in which a central shaft (not shown) is assembled concentrically within the rotor stack and secured with a nut (not shown), to generate a preload that compresses and retains the HPC rotors 60C with the HPC spacers 62C together as a spool. Friction at the interfaces between the HPC rotor 60C and the HPC spacers 62C is solely responsible to prevent rotation between adjacent rotor hardware.

[0018] With reference to Figure 4, each HPC rotor 60C generally includes a plurality of blades 64 circumferentially disposed around a rotor disk 66. The rotor disk 66 generally includes a hub 68, a rim 70, and a web 72 which extends therebetween. Each blade 64 generally includes an attachment section 74, a platform section 76 and an airfoil section 78 (Figure 5).

[0019] The HPC rotor 60C may be a hybrid dual alloy integrally bladed rotor (IBR) in which the blades 64 are manufactured of one type of material and the rotor disk 66 is manufactured of different material. Bi-metal construction provides material capability to separately address different temperature requirements. For example, the blades 64 are manufactured of a single crystal nickel alloy that are transient liquid phase bonded with the rotor disk 66 which is manufactured of a different material such as an extruded billet nickel alloy. Alternatively, or in addition to the different materials, the blades 64 may be subject to a first type of heat treat and the rotor disk 66 to a different heat treat. That is, the Bi-metal construction as defined herein includes different chemical compositions as well as different treatments of the same chemical compositions such as that provided by differential heat treatment.

[0020] With reference to Figure 5, a spoke 80 is defined between the rim 70 and the attachment section 74. The spoke 80 is a circumferentially reduced section defined by interruptions which produce axial or semi-axial slots which flank each spoke 80. The spokes 80 may be machined, cut with a wire EDM or other processes to provide the desired shape. An interface 801 that defines the transient liquid phase bond and or heat treat transition between the blades 64 and the rotor disk 66 are defined within the spoke 80. That is, the spoke 80 contains the interface 801. Heat treat transition as defined herein is the transition between differential heat treatments.

[0021] The spoke 80 provides a reduced area subject to the thermo-mechanical fatigue (TMF) across the relatively high temperature gradient between the blades 64 which are within the relatively hot core gas path and the rotor disk 66 which is separated therefrom and is typically cooled with a secondary cooling airflow.

[0022] With reference to Figure 6, the HPC spacers 62C provide a similar architecture to the HPC rotor 60C in which a plurality of core gas path seals 82 are bonded or otherwise separated from a rotor ring 84 at an interface 861 defined along a spoke 86. In one example, the seals 82 may be manufactured of the same material as the blades 64 and the rotor ring 84 may be manufactured of the same material as the rotor disk 66. That is, the HPC spacers 62C may be manufactured of a hybrid dual alloy which are transient liquid phase bonded at the spoke 86. Alternatively, the HPC spacers 62C may be manufactured of a single material but subjected to the differential heat treat which transitions within the spoke 86. In another disclosed non-limiting embodiment, a relatively low-temperature configuration will benefit from usage of a single material such that the spokes 86 facilitate a weight reduction. In another disclosed non-limiting embodiment, low-temperature bi-metal designs may further benefit from dissimilar materials for weight reduction where, for example, low density materials may be utilized where load carrying capability is less critical.

[0023] The rotor geometry provided by the spokes 80, 86 reduces the transmission of core gas path temperature via conduction to the rotor disk 66 and the seal ring 84. The spokes 80, 86 enable an IBR rotor to withstand increased T3 levels with currently available materials. Rim cooling may also be reduced from conventional allocations. In addition, the overall configuration provides weight reduction at similar stress levels to current configurations.

[0024] The spokes 80, 86 in the disclosed non-limiting embodiment are oriented at a slash angle with respect to the engine axis A to minimize windage and the associated thermal effects. That is, the spokes are non-parallel to the engine axis A.

[0025] With reference to Figure 7, the passages which flank the spokes 80, 86 is also utilized to define airflow paths to receive an airflow from an inlet HPC spacer 62CA. The inlet HPC spacer 62CA includes a plurality of inlets 88 which may include a ramped flow duct 90 to communicate an airflow into the passages defined between the spokes 80, 86. The airflow is core gas path flow which is communicated from an upstream, higher pressure stage for use in a later section within the engine such as the turbine section 28.

[0026] It should be appreciated that various flow paths may be defined through combinations of the inlet HPC spacers 62CA to include but not limited to, core gas path flow communication, secondary cooling flow, or combinations thereof. The airflow may be communicated not only forward to aft toward the turbine section, but also aft to forward within the engine 20. Further, the airflow may be drawn from adjacent static structure such as vanes to effect boundary flow turbulence as well as other flow conditions. That is, the HPC spacers 62C and the inlet HPC spacer 62CA facilitate through-flow for use in rim cooling, purge air for use downstream in the compressor, turbine, or bearing compartment operation.

[0027] In another disclosed non-limiting embodiment, the inlets 88' may be located through the inner diameter of an inlet HPC spacer 62CA' (Figure 8). The inlet HPC spacer 62CA' may be utilized to, for example, communicate a secondary cooling flow along the spokes 80, 86 to cool the spokes 80, 86 as well as communicate secondary cooling flow to other sections of the engine 20.

[0028] In another disclosed non-limiting embodiment, the inlets 88, 88' may be arranged with respect to rotation to essentially "scoop" and further pressurize the flow. That is, the inlets 88, 88' include a circumferential directional component.

[0029] With reference to Figure 9, each rotor ring 84 defines a forward circumferential flange 92 and an aft circumferential flange 94 which is captured radially inboard of the associated adjacent rotor rim 70. That is, each rotor ring 84 is captured therebetween in the stacked configuration. In the disclosed tie-shaft configuration with multi-metal rotors, the stacked configuration is arranged to accommodate the relatively lower-load capability alloys on the core gas path side of the rotor hardware, yet maintain the load-carrying capability between the seal rings 84' and the rims 70 to transmit rotor torque.

[0030] That is, the alternating rotor rim 70 to seal ring 84 configuration carries the rotor stack preload - which may be upward of 150,000 lbs (66.7 kN) - through the high load capability material of the rotor rim 70 to seal ring 84 interface, yet permits the usage of a high temperature resistant, yet lower load capability materials in the blades 64 and the seal surface 82 which are within the high temperature core gas path. Divorce of the sealing area from the axial rotor stack load path facilitates the use of a disk-specific alloy to carry the stack load and allows for the high-temp material to only seal the rotor from the flow path. That is, the inner diameter loading and outer diameter sealing permits a segmented airfoil and seal platform design which facilitates relatively inexpensive manufacture and highly contoured airfoils. The disclosed rotor arrangement facilitates a compressor inner diameter bore architectures in which the reduced blade/platform pull may be taken advantage of in ways that produce a larger bore inner diameter to thereby increase shaft clearance.

[0031] The HPC spacers 62C and HPC rotors 60C of the IBR may also be axially asymmetric to facilitate a relatively smooth axial rotor stack load path (Figure 10). The asymmetry may be located within particular rotor rims 70A and/or seal rings 84A. For example, the seal ring 84A includes a thinner forward circumferential flange 92 compared to a thicker aft circumferential flange 94 with a ramped interface 84Ai. The ramped interface 84Ai provides a smooth rotor stack load path. Without tangentially slot assembled airfoils in an IBR, the load path along the spool may be designed in a more efficient manner as compared to the heretofore rather torturous conventional rotor stack load path (Figure 11; RELATED ART).

[0032] With reference to Figure 12, the blades 64 and seal surface 82 may be formed as segments that include tangential wire seals 96 between each pair of the multiple of seal surfaces 82 and each pair of the multiple of blades 64 as well as axial wire seals 98 between the adjacent HPC spacers 62C and HPC rotors 60C. The tangential wire seals 96 and the axial wire seals 98 are located within teardrop shaped cavities 100 (Figure 13) such that centrifugal forces increase the seal interface forces.

[0033] Although the high pressure compressor (HPC) 52 is discussed in detail above, it should be appreciated that the high pressure turbine (HPT) 54 (Figure 14) is similarly assembled from a plurality of successive respective HPT rotor disks 60T which alternate with HPT spacers 62T (Figure 15) arranged in a stacked configuration and the disclosure with respect to the high pressure compressor (HPC) 52 is similarly applicable to the high pressure turbine (HPT) 54 as well as other spools of the gas turbine engine 20 such as a low spool and an intermediate spool of a three-spool engine architecture. That is, it should be appreciated that other sections of a gas turbine engine may alternatively or additionally benefit herefrom.

[0034] With reference to Figure 14, each HPT rotor 60T generally includes a plurality of blades 102 circumferentially disposed around a rotor disk 124. The rotor disk 124 generally includes a hub 126, a rim 128, and a web 130 which extends therebetween. Each blade 102 generally includes an attachment section 132, a platform section 134, and an airfoil section 136 (Figure 16).

[0035] The blades 102 may be bonded to the rim 128 along a spoke 136 at an interface 1361 as with the high pressure compressor (HPC) 52. Each spoke 136 also includes a cooling passage 138 generally aligned with each turbine blade 102. The cooling passage 138 communicates a cooling airflow into internal passages (not shown) of each turbine blade 102.

[0036] It should be understood that like reference numerals identify corresponding or similar elements throughout the several drawings. It should also be understood that although a particular component arrangement is disclosed in the illustrated embodiment, other arrangements will benefit herefrom.

[0037] Although particular step sequences are shown, described, and claimed, it should be understood that steps may be performed in any order, separated or combined unless otherwise indicated and will still benefit from the present disclosure.

[0038] The foregoing description is exemplary rather than defined by the limitations within. Various non-limiting embodiments are disclosed herein, however, one of ordinary skill in the art would recognize that various modifications and variations in light of the above teachings will fall within the scope of the appended claims. It is therefore to be understood that within the scope of the appended claims, the disclosure may be practiced other than as specifically described. For that reason the appended claims should be studied to determine true scope and content.

Claims

1. A spacer (62C) for a gas turbine engine comprising:

a rotor ring (84) defined along an axis of rotation and configured to be positioned between a first rotor (60C) and a second rotor (60C) in use,
characterised in that the spacer comprises a plurality of core gas path seals (82) which extend radially outwardly from said rotor ring (84) between the first rotor (60C) and the second rotor (60C) in use, each of said plurality of core gas path seals (82) being separated from said rotor ring (84) at an interface (861), each interface being defined along a spoke (86), the spoke (86) extending radially between the rotor ring (84) and the core gas path seal (82) and comprising a reduced section defined by interruptions which produce axial or semi-axial slots which flank each spoke,

wherein a plurality of passages which flank the spokes (86) are formed between the rotor ring (84) and the core gas path seal (82) to define airflow paths.

2. The spacer (62C) as recited in claim 1, wherein said interface (861) includes a heat treat transition.

3. The spacer (62C) as recited in claim 1, wherein said interface (861) includes a bond.

4. The spacer (62C) as recited in any preceding claim, wherein said rotor ring (84) is manufactured of a first material and said plurality of core gas path seals (82) are manufactured of a second material, said first material different than said second material.

5. The spacer (62C) as recited in any preceding claim, wherein each spoke (86) is parallel to said axis of rotation.

6. The spacer (62C) as recited in any of claims 1 to 4, wherein each spoke (86) is angled with respect to said axis of rotation, and wherein said axial or semi-axial slots flank each side of said spoke.

7. The spacer (62C) as recited in any preceding claim, wherein at least one of said plurality of core gas path seals (82) includes an inlet (88), wherein, optionally, said inlet (88) is to one of the plurality of passages adjacent to said spoke (86).

8. The spacer (62C) as recited in any preceding claim, wherein said rotor ring (84) defines a first circumferential flange (92) and a second circumferential flange (94), said second circumferential flange (92) thicker than said first circumferential flange (94), and further optionally comprising a ramped interface (84Ai) between said second circumferential flange (94) and said first circumferential flange (92).

9. A spool for a gas turbine engine comprising:

a rotor disk (66) for the first rotor (60C) defined

along an axis of rotation and a second rotor disk (6) for the second rotor (60C) downstream of the first rotor (60C);
a plurality of first blades (64) which extend from said first rotor disk (66) and a plurality of second blades (64) which extend from said second rotor disk (66);
a spacer (62C) as recited in any preceding claim, said rotor ring (84) of said spacer (62C) in contact with said first rotor disk (66) and said second rotor disk (66); and
said plurality of core gas path seals (82) between said plurality of first blades (64) and said plurality of second blades (64).

10. The spool as recited in claim 9, further comprising a seal (96) extending in an axial direction between each pair of said plurality of core gas path seals (82), and/or a wire seal (98) extending in a circumferential direction between said plurality of core gas path seals (82) and said plurality of blades (64).

11. The spool as recited in claim 9 or 10, wherein said plurality of core gas path seals (82) interface with a platform (76) of said plurality of first blades (64) and a platform (76) of said plurality of second blades (64).

12. A spool for a gas turbine engine comprising:

a first rotor disk (66) for the first rotor (60C) defined along an axis of rotation;
a plurality of first blades (64) which extend from said first rotor disk (66), each of said plurality of first blades (64) extending from said first rotor disk (66) at a first interface (801), said first interface (801) defined along a first spoke (80);
a second rotor disk (66) for the second rotor (60C) defined along said axis of rotation;
a plurality of second blades (64) which extend from said second rotor disk, each of said plurality of second blades (64) extending from said second rotor disk (66) at a second interface (801), said second interface (801) defined along a second spoke (80);
a spacer (62C) as recited in any claims 1 to 8, said rotor ring (84) in contact with said first rotor disk (66) and said second rotor disk (66); and
said plurality of core gas path seals (82) extending radially outward from said rotor ring (84) in an axial direction between said plurality of first blades (64) and said plurality of second blades (64).

13. The spool as recited in claim 12, further comprising a first wire seal (98) extending in a circumferential direction between said plurality of core gas path seals (82) and said plurality of first blades (64) and a second wire seal (98) extending in a circumferential direction between said plurality of core gas path seals (98) and said plurality of second blades (64).

14. The spool as recited in claim 12 or 13, wherein at least one of said plurality of core gas path seals (82) includes an inlet (88) in communication with a passage in communication said second spoke (80) and said first spoke (80).

15. The spool as recited in claim 12, 13 or 14, wherein said first spoke (80), said second spoke (80) and said spoke (86) of said spacer (62C) are axially aligned.

Patentansprüche

1. Abstandhalter (62C) für ein Gasturbinentriebwerk, umfassend:

einen Rotorring (84), der entlang einer Drehachse definiert ist und konfiguriert ist, um zwischen einem ersten Rotor (60C) und einem zweiten Rotor (60C) im Betrieb angeordnet zu werden, **dadurch gekennzeichnet, dass** der Abstandhalter eine Vielzahl von Kerngaswegdichtungen (82) umfasst, die radial nach außen von dem Rotorring (84) zwischen dem ersten Rotor (60C) und dem zweiten Rotor (60C) im Betrieb verlaufen, wobei jede aus der Vielzahl von Kerngaswegdichtungen (82) von dem Rotorring (84) an einer Trennfläche (86I) beabstandet ist, wobei jede Trennfläche entlang einer Speiche (86) definiert ist, wobei die Speiche (86) radial zwischen dem Rotorring (84) und der Kerngaswegdichtung (82) verläuft und einen verringerten Querschnitt umfasst, der durch Unterbrechungen definiert ist, die axiale oder halbaxiale Schlitze erzeugen, die jede Speiche flankieren,
wobei eine Vielzahl von Kanälen, die die Speichen (86) flankieren, zwischen dem Rotorring (84) und der Kerngaswegdichtung (82) ausgebildet sind, um Luftströmungswege zu definieren.

2. Abstandhalter (62C) nach Anspruch 1, wobei die Trennfläche (86I) einen wärmebehandelten Übergang umfasst.

3. Abstandhalter (62C) nach Anspruch 1, wobei die Trennfläche (86I) eine Klebverbindung umfasst.

4. Abstandhalter (62C) nach einem der vorstehenden Ansprüche, wobei der Rotorring (84) aus einem ersten Material hergestellt ist und die Vielzahl von Kerngaswegdichtungen (82) aus einem zweiten Material hergestellt sind, wobei sich das erste Material vom zweiten Material unterscheidet.

5. Abstandhalter (62C) nach einem der vorstehenden Ansprüche, wobei jede Speiche (86) zur Drehachse parallel ist.

6. Abstandhalter (62C) nach einem der Ansprüche 1 bis 4, wobei jede Speiche (86) in Bezug auf die Drehachse abgewinkelt ist und wobei die axialen oder halbaxialen Schlitze jede Seite der Speiche flankieren.

7. Abstandhalter (62C) nach einem der vorstehenden Ansprüche, wobei mindestens eine aus der Vielzahl von Kerngaswegdichtungen (82) einen Einlass (88) umfasst, wobei optional der Einlass (88) zu einem aus der Vielzahl von Kanälen, die an die Speiche (86) angrenzen, führt.

8. Abstandhalter (62C) nach einem der vorstehenden Ansprüche, wobei der Rotorring (84) einen ersten Umfangsflansch (92) und einen zweiten Umfangsflansch (94) umfasst, wobei der zweite Umfangsflansch (92) dicker als der erste Umfangsflansch (94) ist, und ferner optional umfassend eine abgeschrägte Trennfläche (84Ai) zwischen dem zweiten Umfangsflansch (94) und dem ersten Umfangsflansch (92).

9. Welle für ein Gasturbinentriebwerk, umfassend:

eine Rotorscheibe (66) für den ersten Rotor (60C), der entlang einer Drehachse definiert ist; und
eine zweite Rotorscheibe (6) für den zweiten Rotor (60C), der dem ersten Rotor (60C) nachgeschaltet ist;
eine Vielzahl erster Laufschaufeln (64), die von der ersten Rotorscheibe (66) aus verlaufen, und eine Vielzahl zweiter Laufschaufeln (64), die von der zweiten Rotorscheibe (66) aus verlaufen;
einen Abstandhalter (62C) nach einem der vorstehenden Ansprüche, wobei der Rotorring (84) des Abstandhalters (62C) in Kontakt mit der ersten Rotorscheibe (66) und der zweiten Rotorscheibe (66) steht;
und
die Vielzahl von Kerngaswegdichtungen (82) zwischen der Vielzahl erster Laufschaufeln (64) und der Vielzahl zweiter Laufschaufeln (64).

10. Welle nach Anspruch 9, ferner umfassend eine Dichtung (96), die in axialer Richtung zwischen jedem Paar aus der Vielzahl von Kerngaswegdichtungen (82) verläuft, und/oder eine Drahtdichtung (98), die in einer Umfangsrichtung zwischen der Vielzahl von Kerngaswegdichtungen (82) und der Vielzahl von Laufschaufeln (64) verläuft.

11. Welle nach Anspruch 9 oder 10, wobei sich die Vielzahl von Kerngaswegdichtungen (82) an eine Plattform (76) der Vielzahl erster Laufschaufeln (64) und eine Plattform (76) der Vielzahl zweiter Laufschaufeln (64) anschließt.

12. Welle für ein Gasturbinentriebwerk, umfassend:

eine erste Rotorscheibe (66) für den ersten Rotor (60C), der entlang einer Drehachse definiert ist;
eine Vielzahl erster Laufschaufeln (64), die von der ersten Rotorscheibe (66) aus verlaufen, wobei sich jede aus der Vielzahl erster Laufschaufeln (64) von der ersten Rotorscheibe (66) an einer ersten Trennfläche (80I) erstreckt, wobei die erste Trennfläche (80I) entlang einer ersten Speiche (80) definiert ist;
eine zweite Rotorscheibe (66) für den zweiten Rotor (60C), der entlang der Drehachse definiert ist;
eine Vielzahl zweiter Laufschaufeln (64), die von der zweiten Rotorscheibe aus verlaufen, wobei sich jede aus der Vielzahl zweiter Laufschaufeln (64) von der zweiten Rotorscheibe (66) an einer zweiten Trennfläche (80I) erstreckt, wobei die zweite Trennfläche (80I) entlang einer zweiten Speiche (80) definiert ist
einen Abstandhalter (62C) nach einem der Ansprüche 1 bis 8, wobei der Rotorring (84) in Kontakt mit der ersten Rotorscheibe (66) und der zweiten Rotorscheibe (66) steht;
und
die Vielzahl von Kerngaswegdichtungen (82) radial nach außen vom Rotorring (84) in einer axialen Richtung zwischen der Vielzahl erster Laufschaufeln (64) und der Vielzahl zweiter Laufschaufeln (64) verläuft.

13. Welle nach Anspruch 12, ferner umfassend eine erste Drahtdichtung (98), die in einer Umfangsrichtung zwischen der Vielzahl von Kerngaswegdichtungen (82) und der Vielzahl erster Laufschaufeln (64) verläuft, und eine zweite Drahtdichtung (98), die in einer Umfangsrichtung zwischen der Vielzahl von Kerngaswegdichtungen (98) und der Vielzahl zweiter Laufschaufeln (64) verläuft.

14. Welle nach Anspruch 12 oder 13, wobei mindestens eine aus der Vielzahl von Kerngaswegdichtungen (82) einen Einlass (88) in Kommunikation mit einem Kanal in Kommunikation mit der zweiten Speiche (80) und der ersten Speiche (80) umfasst.

15. Welle nach Anspruch 12, 13 oder 14, wobei die erste Speiche (80), die zweite Speiche (80) und die Speiche (86) des Abstandhalters (62C) axial ausgerichtet sind.

Revendications

1. Espaceur (62C) pour un moteur à turbine à gaz comprenant :

   une bague de rotor (84) définie selon un axe de rotation et configurée pour être positionnée entre un premier rotor (60C) et un second rotor (60C) en utilisation,
   caractérisé en ce que l'espaceur comprend une pluralité de joints d'étanchéité de trajet de gaz de noyau (82) qui s'étendent radialement vers l'extérieur depuis ladite bague de rotor (84) entre le premier rotor (60C) et le second rotor (60C) en utilisation, chacun de ladite pluralité de joints d'étanchéité de trajet de gaz de noyau (82) étant séparé de ladite bague de rotor (84) au niveau d'une interface (86I), chaque interface étant définie le long d'un rayon (86), le rayon (86) s'étendant radialement entre la bague de rotor (84) et le joint d'étanchéité de trajet de gaz de noyau (82) et comprenant une section réduite définie par des interruptions qui produisent des fentes axiales ou semi-axiales qui encadrent chaque rayon,
   dans lequel une pluralité de passages qui encadrent les rayons (86) est formée entre la bague de rotor (84) et le joint d'étanchéité de trajet de gaz de noyau (82) pour définir des trajets d'écoulement d'air.

2. Espaceur (62C) selon la revendication 1, dans lequel ladite interface (86I) comporte une transition de traitement thermique.

3. Espaceur (62C) selon la revendication 1, dans lequel ladite interface (86I) comporte une liaison.

4. Espaceur (62C) selon une quelconque revendication précédente, dans lequel ladite bague de rotor (84) est fabriquée en un premier matériau et ladite pluralité de joints d'étanchéité de trajet de gaz de noyau (82) est fabriquée en un second matériau, ledit premier matériau étant différent dudit second matériau.

5. Espaceur (62C) selon une quelconque revendication précédente, dans lequel chaque rayon (86) est parallèle audit axe de rotation.

6. Espaceur (62C) selon l'une quelconque des revendications 1 à 4, dans lequel chaque rayon (86) est oblique par rapport audit axe de rotation, et dans lequel lesdites fentes axiales ou semi-axiales encadrent chaque côté dudit rayon.

7. Espaceur (62C) selon une quelconque revendication précédente, dans lequel au moins l'un de ladite pluralité de joints d'étanchéité de trajet de gaz de noyau (82) comporte un orifice d'entrée (88), dans lequel, facultativement, ledit orifice d'entrée (88) mène à l'un de la pluralité de passages adjacents audit rayon (86).

8. Espaceur (62C) selon une quelconque revendication précédente, dans lequel ladite bague de rotor (84) définit une première bride circonférentielle (92) et une seconde bride circonférentielle (94), ladite seconde bride circonférentielle (92) étant plus épaisse que ladite première bride circonférentielle (94), et comprenant en outre facultativement une interface à gradins (84Ai) entre ladite seconde bride circonférentielle (94) et ladite première bride circonférentielle (92).

9. Tiroir cylindrique pour un moteur à turbine à gaz comprenant :

   un disque de rotor (66) pour le premier rotor (60C) défini selon un axe de rotation et un second disque de rotor (6) pour le second rotor (60C) en aval du premier rotor (60C) ;
   une pluralité de premières aubes (64) qui s'étendent depuis ledit premier disque de rotor (66) et une pluralité de secondes aubes (64) qui s'étendent depuis ledit second disque de rotor (66) ;
   un espaceur (62C) selon une quelconque revendication précédente, ladite bague de rotor (84) dudit espaceur (62C) étant en contact avec ledit premier disque de rotor (66) et ledit second disque de rotor (66) ; et
   ladite pluralité de joints d'étanchéité de trajet de gaz de noyau (82) entre ladite pluralité de premières aubes (64) et ladite pluralité de secondes aubes (64).

10. Tiroir cylindrique selon la revendication 9, comprenant en outre un joint d'étanchéité (96) s'étendant dans une direction axiale entre chaque paire de ladite pluralité de joints d'étanchéité de trajet de gaz de noyau (82), et/ou un joint d'étanchéité de fil (98) s'étendant dans une direction circonférentielle entre ladite pluralité de joints d'étanchéité de trajet de gaz de noyau (82) et ladite pluralité d'aubes (64).

11. Tiroir cylindrique selon la revendication 9 ou 10, dans lequel ladite pluralité de joints d'étanchéité de trajet de gaz de noyau (82) sert d'interface avec une plateforme (76) de ladite pluralité de premières aubes (64) et une plateforme (76) de ladite pluralité de secondes aubes (64).

12. Tiroir cylindrique pour un moteur à turbine à gaz comprenant :

   un premier disque de rotor (66) pour le premier

rotor (60C) défini selon un axe de rotation ;
une pluralité de premières aubes (64) qui s'étendent depuis ledit premier disque de rotor (66), chacune de ladite pluralité de premières aubes (64) s'étendant depuis ledit premier disque de rotor (66) au niveau d'une première interface (80I), ladite première interface (80I) étant définie le long d'un premier rayon (80) ;
un second disque de rotor (66) pour le second rotor (60C) défini selon ledit axe de rotation ;
une pluralité de secondes aubes (64) qui s'étendent depuis ledit second disque de rotor, chacune de ladite pluralité de secondes aubes (64) s'étendant depuis ledit second disque de rotor (66) au niveau d'une seconde interface (80I), ladite seconde interface (80I) étant définie le long d'un second rayon (80) ;
un espaceur (62C) selon l'une quelconque des revendications 1 à 8, ladite bague de rotor (84) étant en contact avec ledit premier disque de rotor (66) et ledit second disque de rotor (66) ; et ladite pluralité de joints d'étanchéité de trajet de gaz de noyau (82) s'étendant radialement vers l'extérieur depuis ladite bague de rotor (84) dans une direction axiale entre ladite pluralité de premières aubes (64) et ladite pluralité de secondes aubes (64).

13. Tiroir cylindrique selon la revendication 12, comprenant en outre un premier joint d'étanchéité de fil (98) s'étendant dans une direction circonférentielle entre ladite pluralité de joints d'étanchéité de trajet de gaz de noyau (82) et ladite pluralité de premières aubes (64) et un second joint d'étanchéité de fil (98) s'étendant dans une direction circonférentielle entre ladite pluralité de joints d'étanchéité de trajet de gaz de noyau (98) et ladite pluralité de secondes aubes (64).

14. Tiroir cylindrique selon la revendication 12 ou 13, dans lequel au moins l'un de ladite pluralité de joints d'étanchéité de trajet de gaz de noyau (82) comporte un orifice d'entrée (88) en communication avec un passage en communication avec ledit second rayon (80) et ledit premier rayon (80).

15. Tiroir cylindrique selon la revendication 12, 13 ou 14, dans lequel ledit premier rayon (80), ledit second rayon (80) et ledit rayon (86) dudit espaceur (62C) sont alignés axialement.

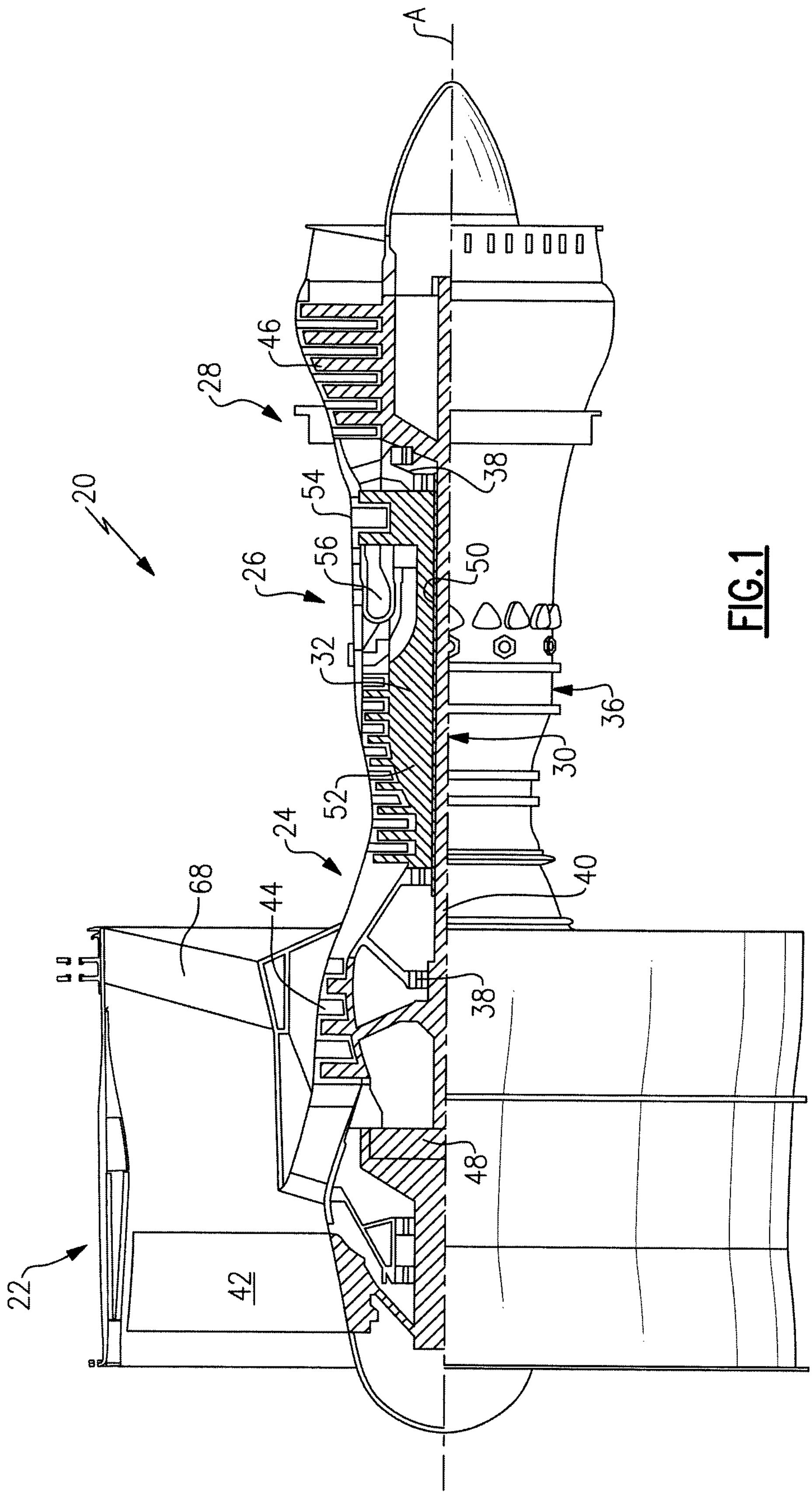


FIG.1

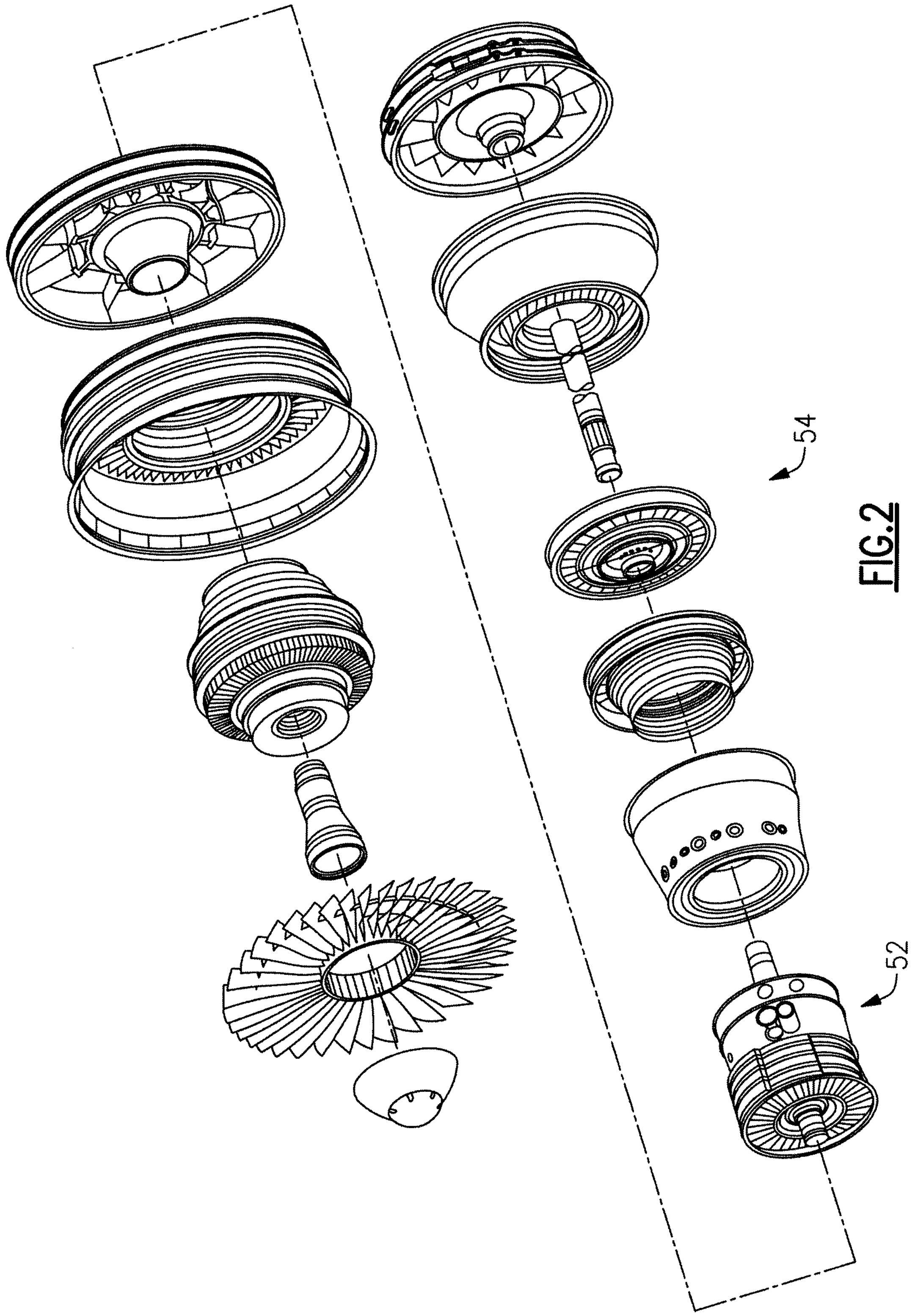


FIG.2

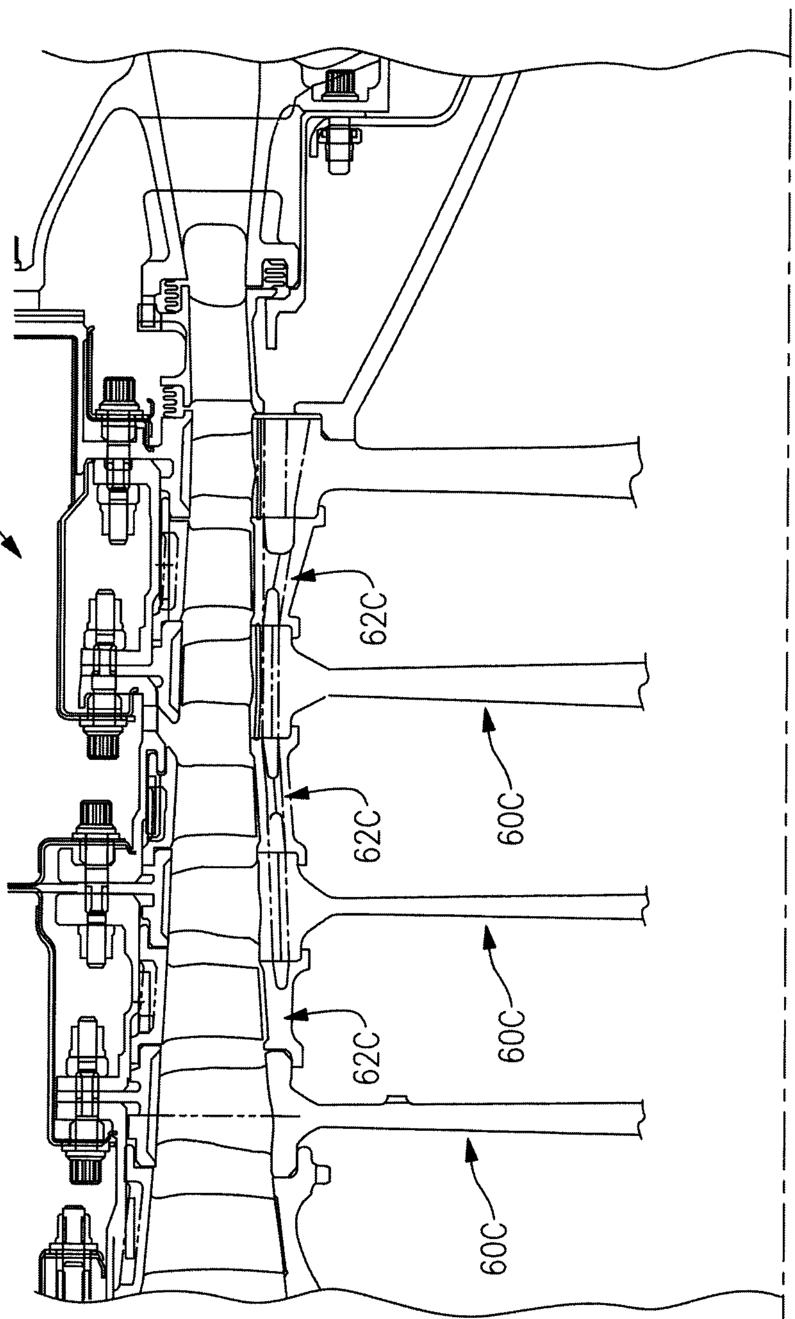


FIG.3

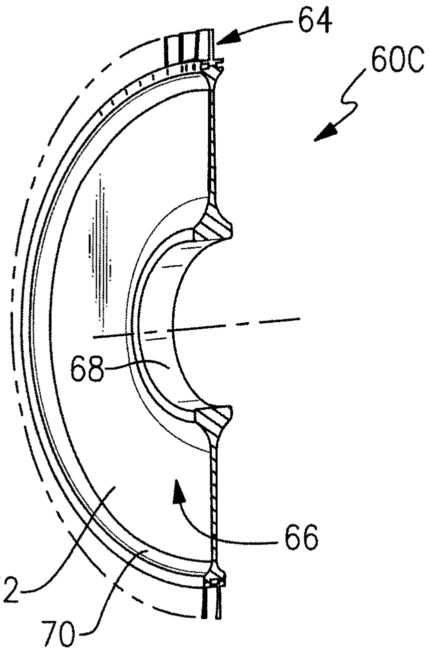


FIG.4

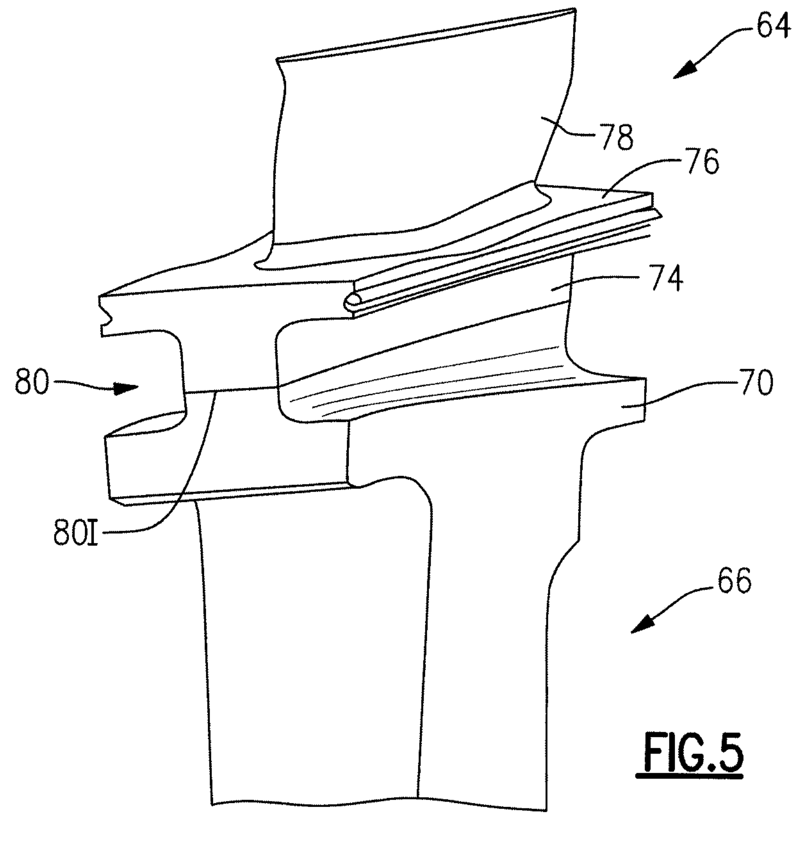


FIG.5

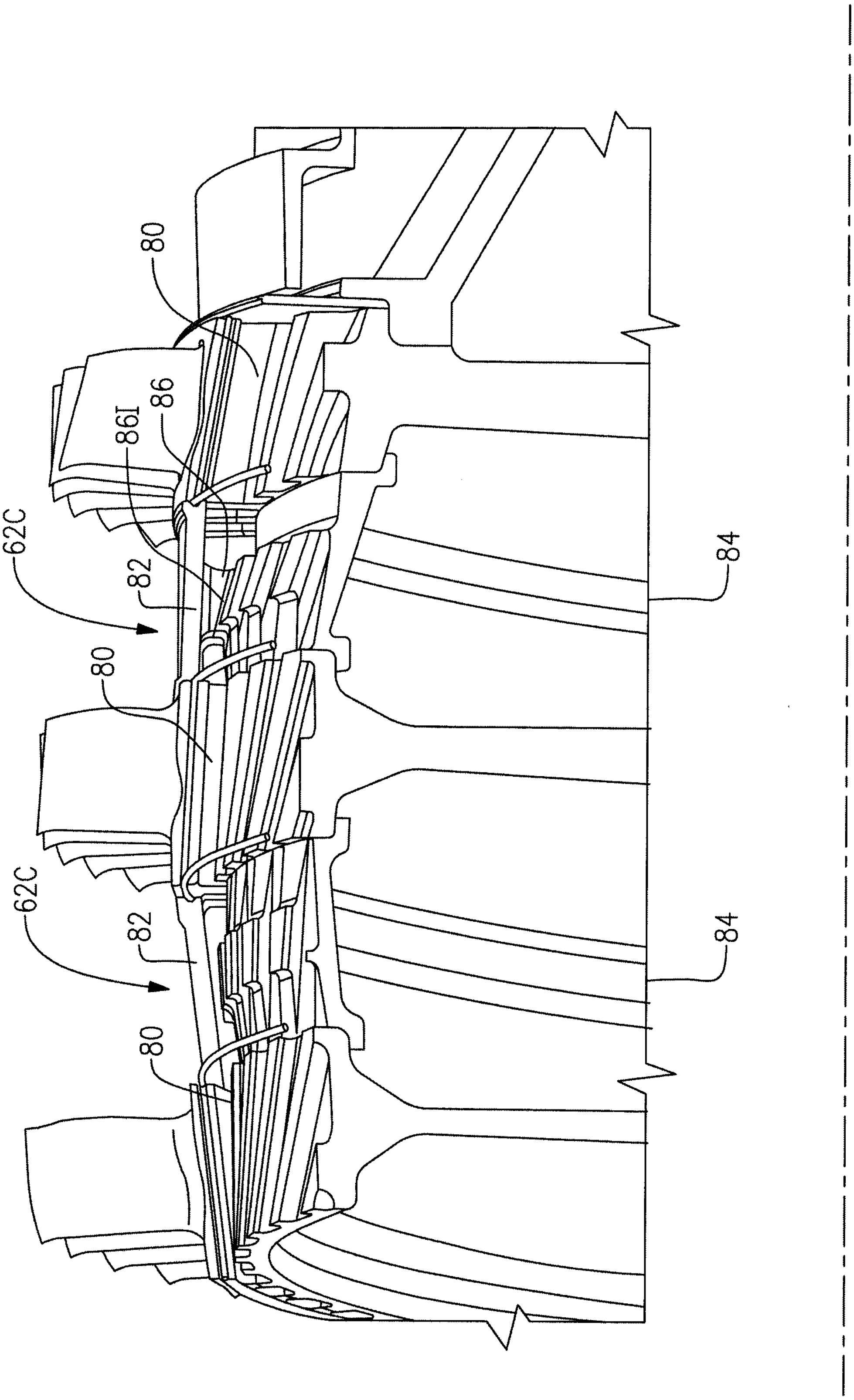


FIG.6

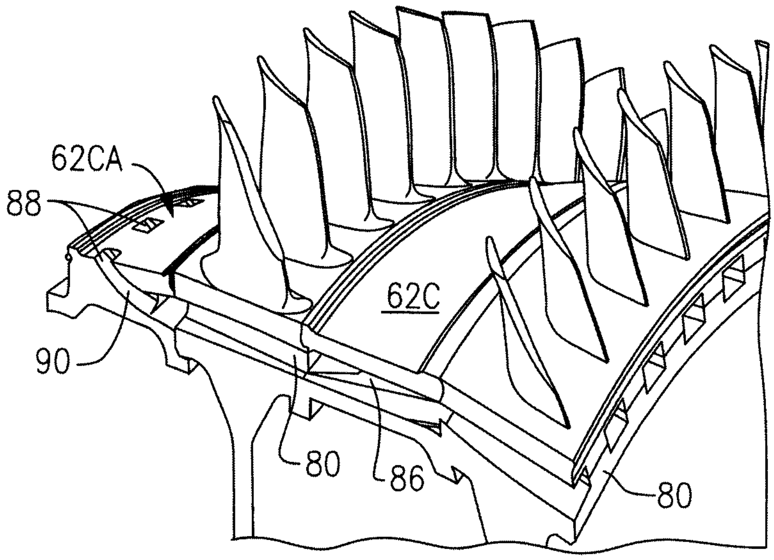


FIG.7

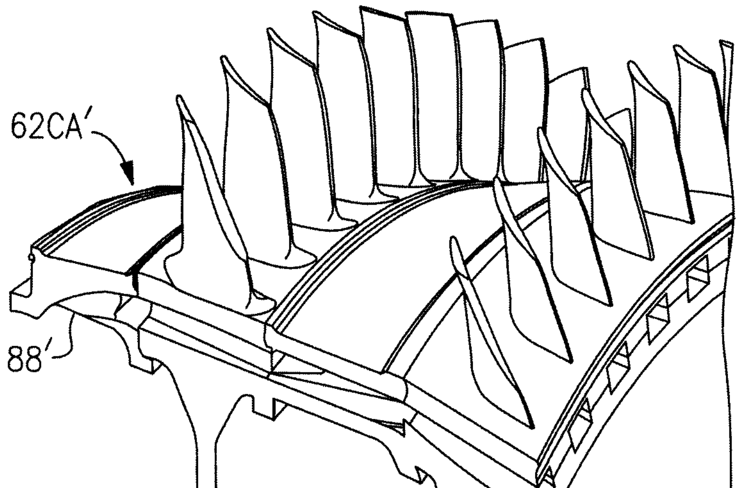


FIG.8

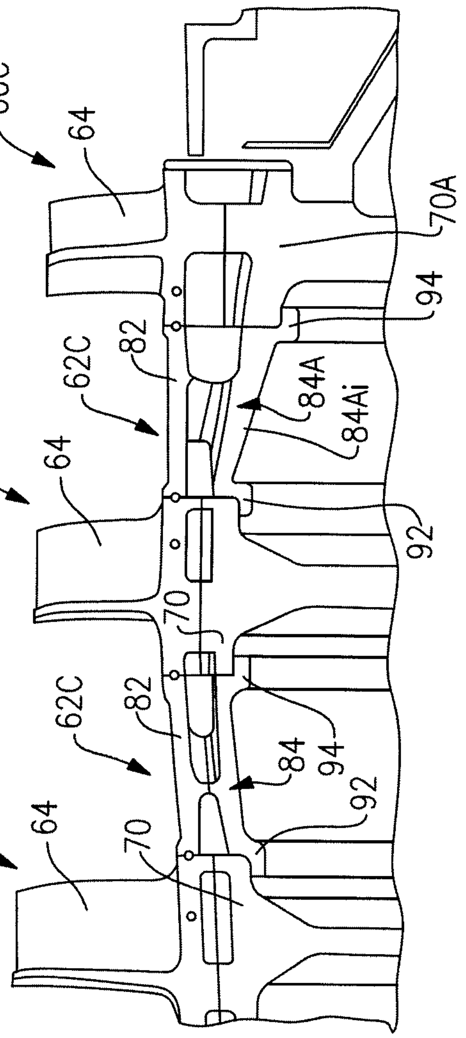


FIG.9

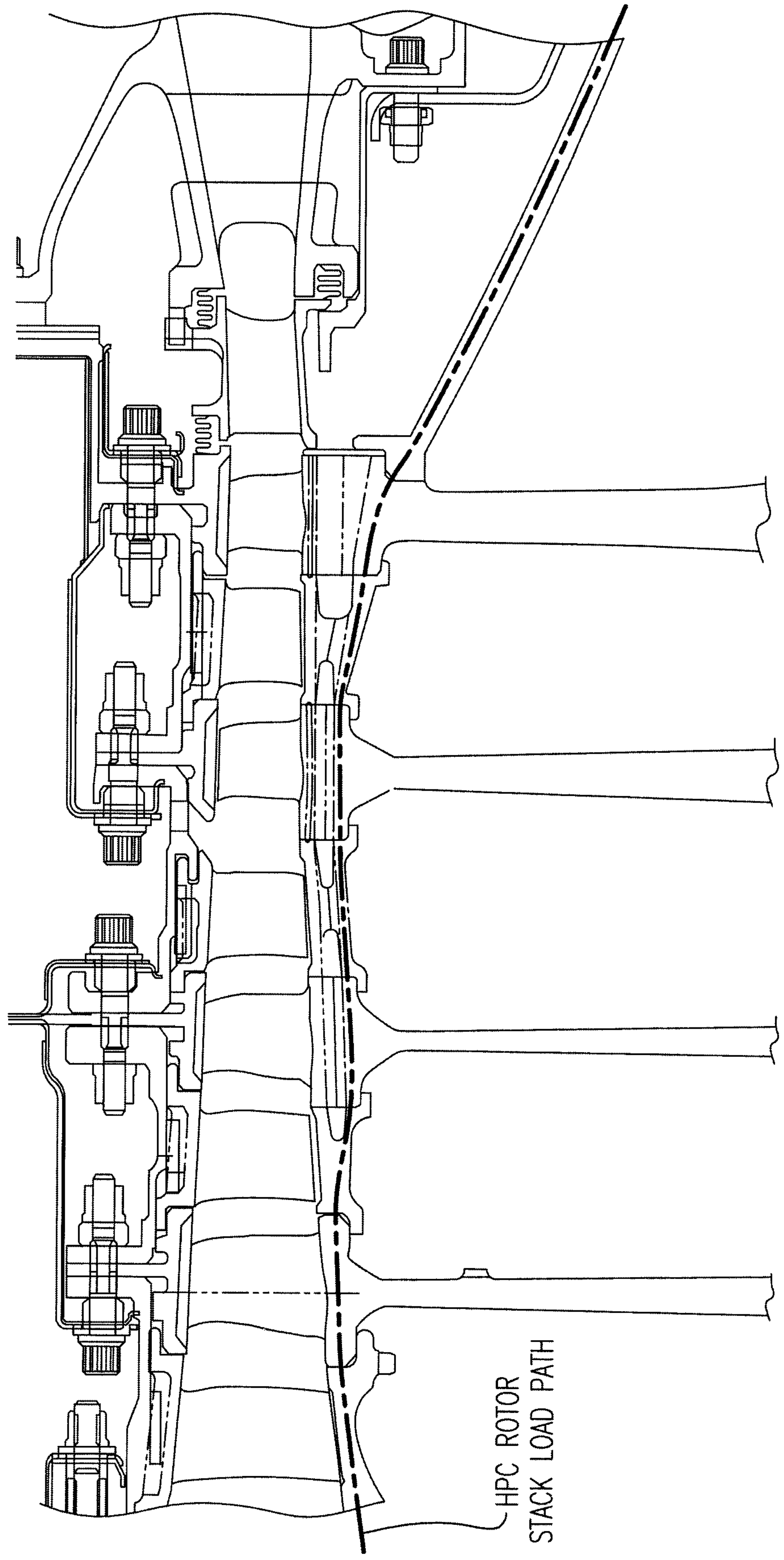


FIG.10

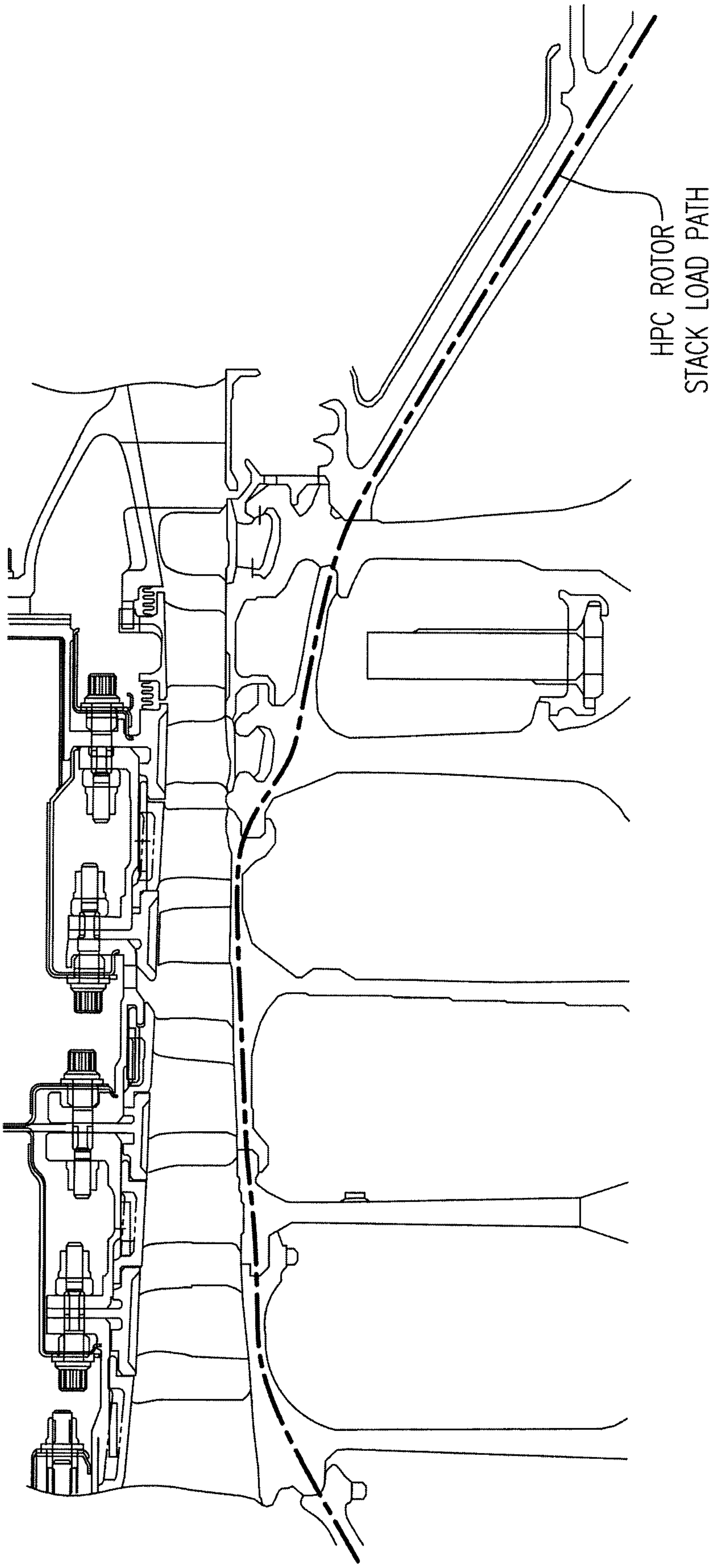


FIG.11
Related Art

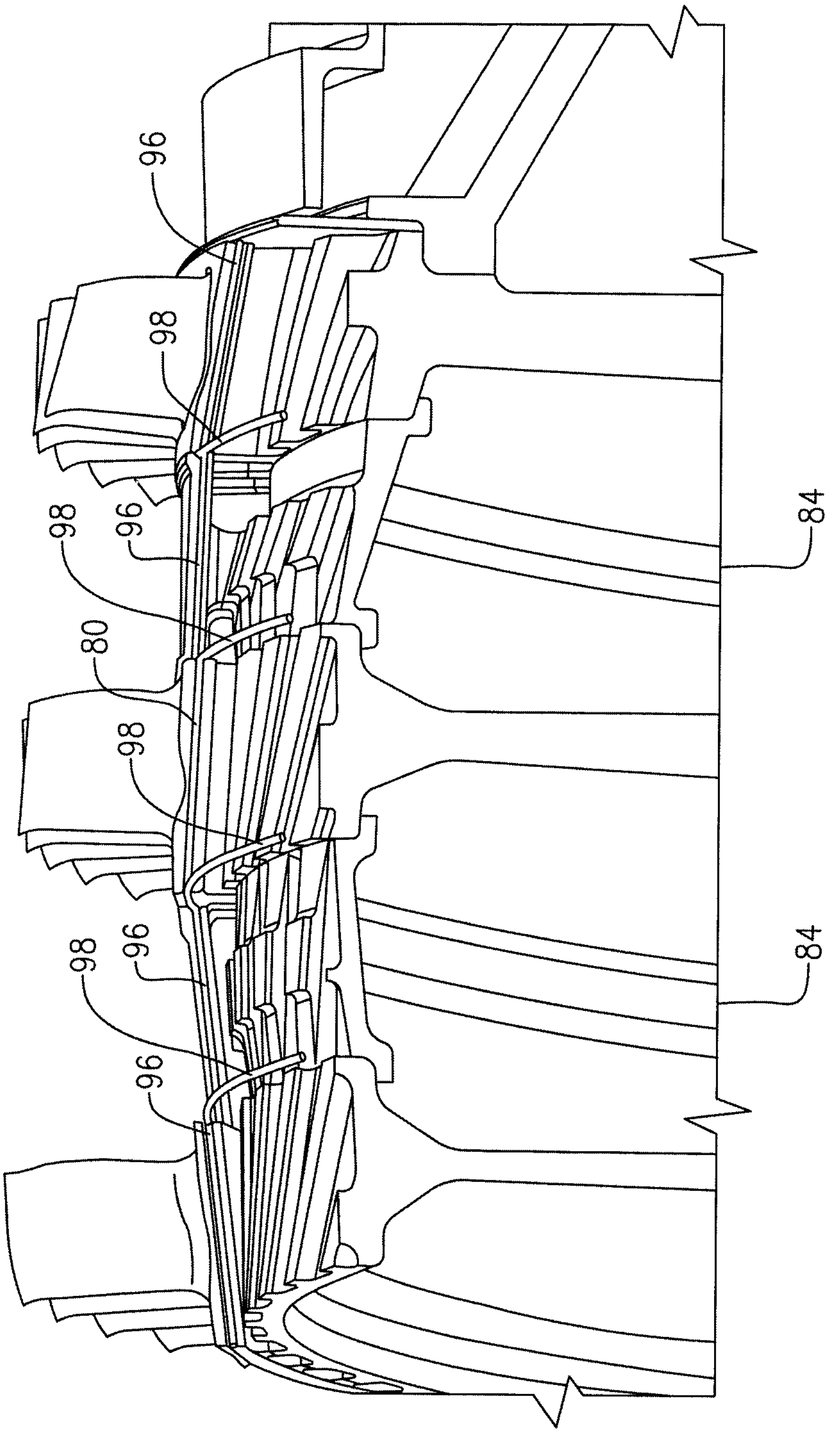


FIG.12

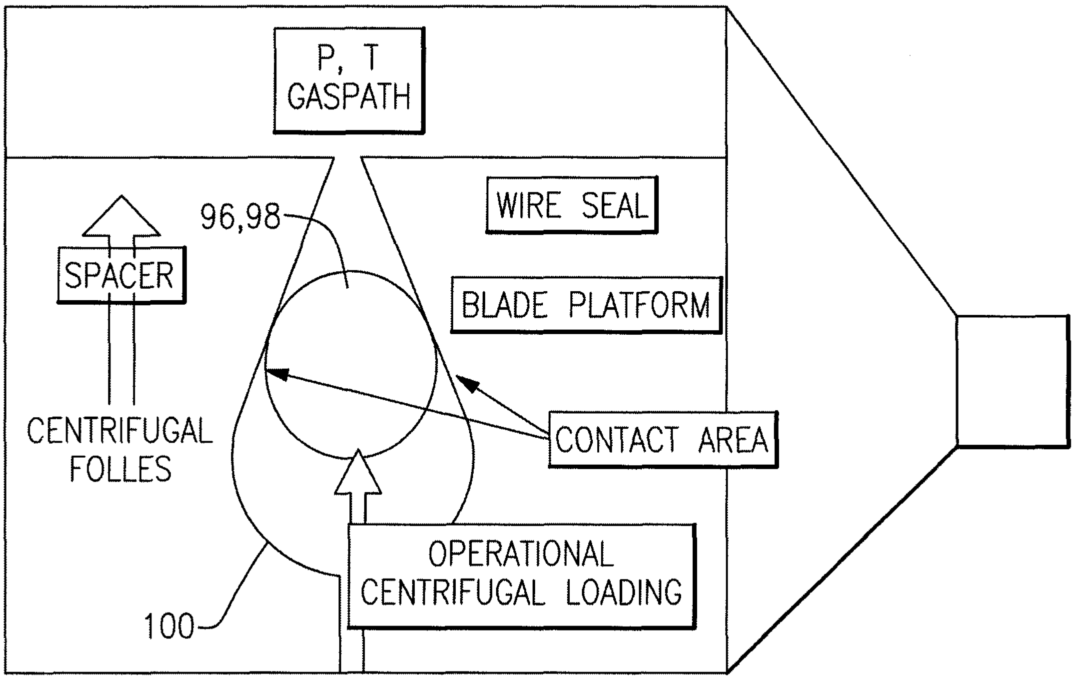

P, T
GASPATH
WIRE SEAL
96,98
SPACER
BLADE PLATFORM
CENTRIFUGAL
FOLLES
CONTACT AREA
OPERATIONAL
CENTRIFUGAL LOADING
100

FIG.13

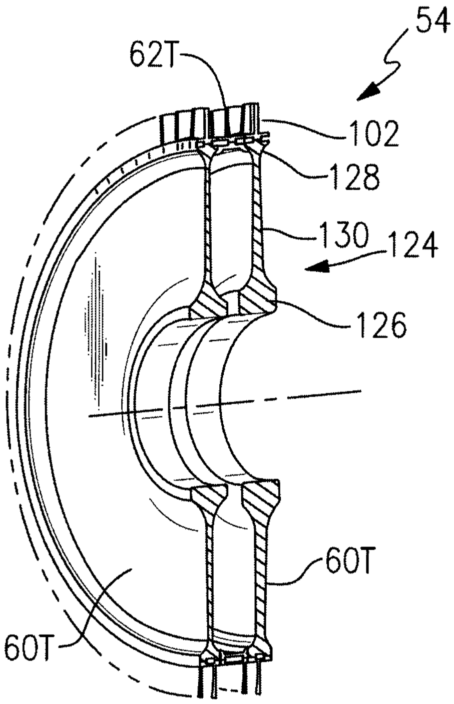
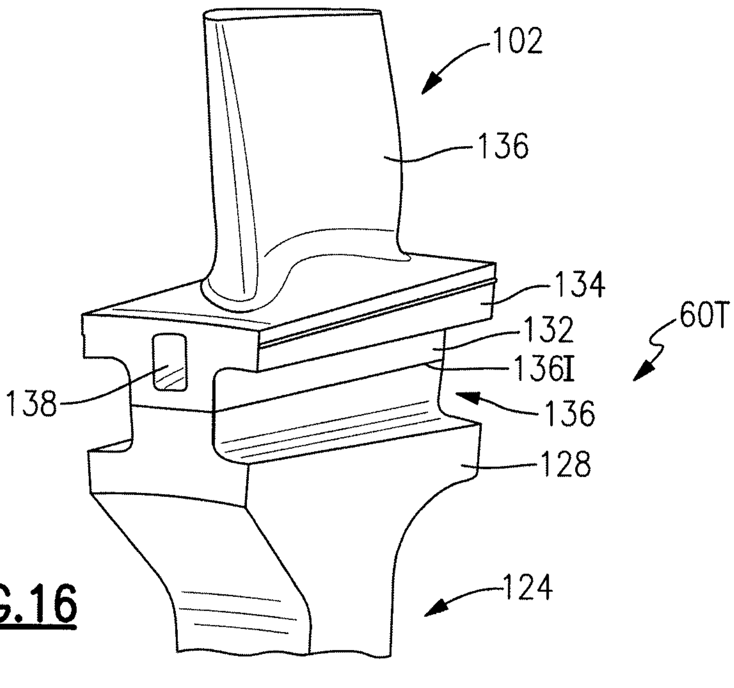

54
62T
102
128
130
124
126
60T
60T

FIG.14


102
136
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124

FIG.16

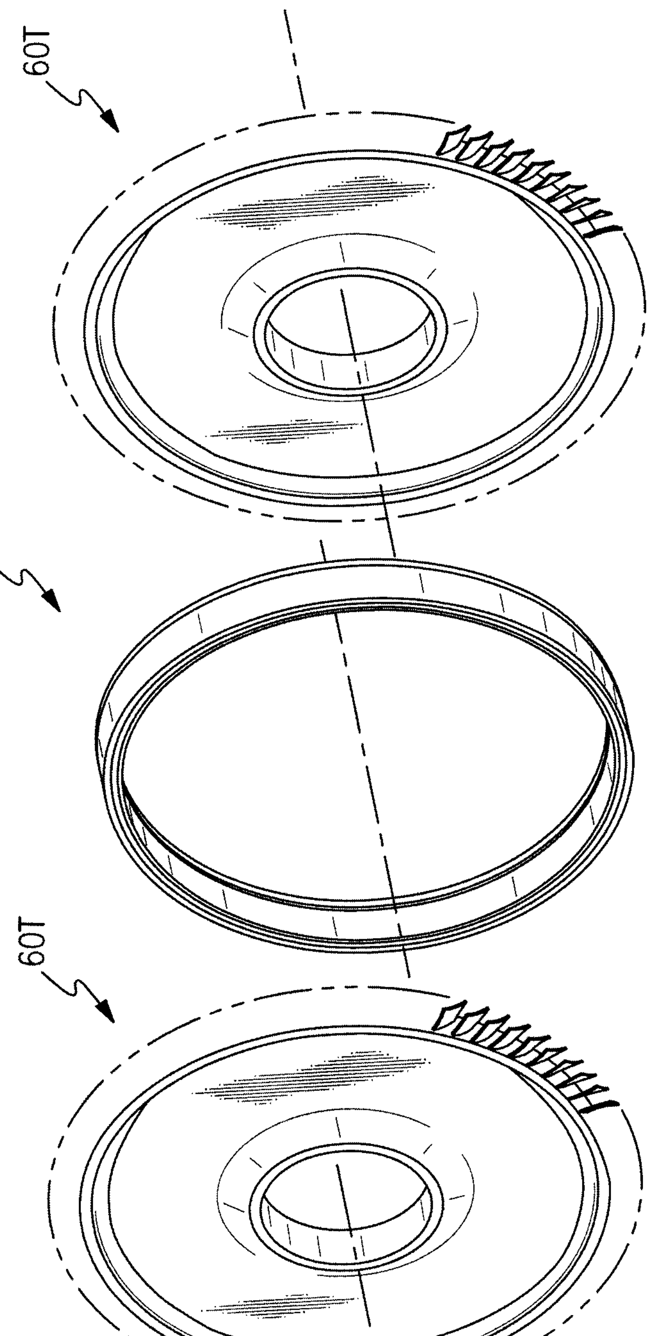

FIG.15

REFERENCES CITED IN THE DESCRIPTION

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- US 2492833 A **[0008]**