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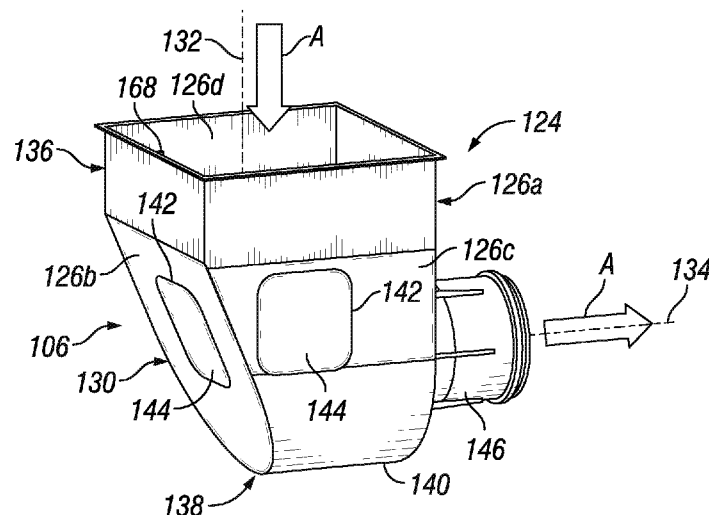


FIG. 2A

(57) Abstract: An inlet duct (106) for a gas turbine wherein the inlet duct (106) may include a gas turbine inlet interface assembly (124) and a plurality of walls (126a-d) defining a first portion (128a) of an inlet flow channel (128a, 128b). The gas turbine inlet interface assembly (124) may include a mounting plate (148) pivotably connected to a first wall of the plurality of walls (126a-d) and defining a plate opening (156). The gas turbine inlet interface assembly (124) may also include an annular duct having a first end (152) coupled to or integral with the mounting plate (148), and a first end (152) configured to sealingly connect with an inlet component (116) of the gas turbine. The annular duct may define a second portion of the inlet flow channel (128b) extending from the plate opening (156). The first portion (128a) and the second portion (128b) of the inlet flow channel (128a, 128b) may be configured to fluidly couple a motive gas source with the gas turbine.

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GAS TURBINE INLET INTERFACE ASSEMBLY

PRIORITY CLAIM

[0001] This application claims the benefit under 35 U.S.C. § 119(e) of copending U.S. Provisional Application No. 62/504,573 filed on May 11, 2017 and entitled GAS TURBINE INLET INTERFACE ASSEMBLY, Attorney Docket No. 2017P08735US, which is incorporated herein by reference in its entirety and to which this application claims the benefit of priority.

BACKGROUND

1. Technical Field

[0002] Aspects of the present invention relate to a gas turbine inlet interface assembly and, more particularly, to an inlet duct for a gas turbine wherein the inlet duct includes a plurality of walls defining a first portion of an inlet flow channel and wherein the inlet duct further includes a gas turbine inlet interface assembly having an annular duct that defines a second portion of the inlet flow channel wherein the first portion and the second portion of the inlet flow channel are configured to fluidly couple a motive gas source with the gas turbine.

2. Description of Related Art

[0003] Gas turbines are commonly used to drive generators for power generation and/or to drive process equipment such as compressors or pumps. To drive the process equipment and/or the generators, gas turbines may receive and compress motive air in a compressor, combust the compressed motive air with fuel in a combustor to produce a combusted motive gas, and expand the combusted motive gas through a power turbine. Operational efficiencies of the gas turbine may often be determined, at least in part, by one or more properties of the motive air delivered thereto. Accordingly, gas turbines, particularly, aeroderivative gas turbines including gas generators, may have a motive air conditioning system (MACS) disposed upstream of the inlet to the gas generator and configured to control the one or more

properties (e.g., temperature, humidity, acoustics, cleanliness, etc.) of the motive air. The MACS may be typically coupled to the gas generator via ducting.

[0004] Typically, there is a great emphasis on limiting the spatial footprint of gas turbines, especially when installed in an offshore environment, such as on an offshore rig or marine vessel, due to the limited available space in such an environment. In addition, there is a great emphasis on safety and noise attenuation, and thus, the gas turbines are often mounted in isolation enclosures. Accordingly, maintenance of the gas turbine may require the removal of the gas generator from the isolation enclosure.

As available space surrounding the gas turbine is typically limited in offshore environments, disengaging the ducting coupling the gas generator and MACS and allowing for the axial repositioning of the ducting may be difficult and time-consuming, and often requires the removal and temporary relocation of many large and cumbersome inlet interfacing components.

[0005] What is needed, therefore, is a gas turbine inlet interface assembly that provides for a more facile decoupling of the ducting and the gas generator, thereby allowing for the removal of the gas generator, while still maintaining a compact inlet ducting topology that does not compromise the gas turbine performance or increase the size, weight, or cost of the gas turbine.

SUMMARY

[0006] Embodiments of this disclosure may provide an inlet duct for a gas turbine. The inlet duct may include a gas turbine inlet interface assembly and a plurality of walls defining a first portion of an inlet flow channel. The gas turbine inlet interface assembly may include a mounting plate pivotably connected to a first wall of the plurality of walls and defining a plate opening. The gas turbine inlet interface assembly may also include an annular duct having a first end coupled to or integral with the mounting plate, and a second end configured to sealingly connect with an inlet component of the gas turbine. The annular duct may define a second portion of the inlet flow channel extending from the plate opening. The first portion and the second portion of the inlet flow channel may be configured to fluidly couple a motive gas source with the gas turbine.

[0007] Embodiments of this disclosure may further provide a gas turbine assembly. The gas turbine assembly may include a gas turbine and an inlet duct. The gas turbine may include a gas generator having a longitudinal axis, a gas generator inlet configured to receive a motive gas, a compressor fluidly coupled to the gas generator inlet and configured to compress the motive gas, and a combustor fluidly coupled to the compressor and configured to receive a fuel from a fuel source. The combustor may be further configured to combust a compressed motive gas with the fuel received from the fuel source. The gas turbine may also include a power turbine configured to expand a combusted motive gas and generate mechanical power. The inlet duct may be configured to fluidly couple the gas generator and a motive gas source providing the motive gas. The inlet duct may include a plurality of walls defining a first portion of an inlet flow channel, and a gas turbine inlet interface assembly. The gas turbine inlet interface assembly may include a mounting plate pivotably connected to a first wall of the plurality of walls and defining a plate opening. The gas turbine inlet interface assembly may also include an annular duct having a first end coupled to or integral with the mounting plate, and a second end configured to sealingly connect with the gas generator inlet. The annular duct may define a second portion of the inlet flow channel extending from the plate opening. The first portion and the second portion of the inlet flow channel may be configured to fluidly couple the motive gas source with the gas turbine.

[0008] Embodiments of this disclosure may further provide a method for accessing a gas generator coupled to a motive air conditioning system via an inlet duct in order to perform maintenance on the gas generator. The method may include decoupling a mounting plate of a gas turbine inlet interface assembly from a first wall of a plurality of walls forming the inlet duct, the plurality of walls further defining a first portion of the inlet flow channel. The method may also include decoupling an annular duct of the gas turbine inlet interface assembly from the gas generator, the annular duct coupled to the mounting plate and forming a second portion of an inlet flow channel fluidly coupling the motive air conditioning system and the gas generator. The method may further include pivoting the mounting plate at a first end portion thereof coupled to the first wall such that the annular duct and a second end portion of the mounting plate opposing the first end portion of the mounting plate are positioned in the first portion of

the inlet flow channel, thereby providing access to the gas generator to perform maintenance.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Aspects of the present disclosure are best understood from the following detailed description when read with the accompanying Figures. It is emphasized that, in accordance with the standard practice in the industry, various features are not drawn to scale. In fact, the dimensions of the various features may be arbitrarily increased or reduced for clarity of discussion.

[0010] Figure 1A illustrates a side view of a motive air conditioning system (MACS) operatively coupled with a gas turbine assembly, according to one or more embodiments of the disclosure.

[0011] Figure 1B illustrates a cross-sectional view of the MACS operatively coupled with the gas turbine assembly in Figure 1A, according to one or more embodiments of the disclosure.

[0012] Figure 2A illustrates an isometric view of an inlet duct including an exemplary gas turbine inlet interface assembly in operation orientation, according to one or more embodiments of the disclosure.

[0013] Figure 2B illustrates a cross-sectional view of the inlet duct including the gas turbine inlet interface in operation orientation in Figure 2A, according to one or more embodiments of the disclosure.

[0014] Figure 3 illustrates a cross-sectional view of the inlet duct of Figures 2A and 2B where the gas turbine inlet interface is in maintenance orientation, according to one or more embodiments of the disclosure.

[0015] Figure 4 depicts an alternate embodiment for the inlet duct.

[0016] Figure 5 illustrates a flowchart depicting a method for accessing a gas generator coupled to a motive air conditioning system via an inlet duct in order to perform maintenance on the gas generator, according to one or more embodiments disclosed.

DETAILED DESCRIPTION

[0017] It is to be understood that the following disclosure describes several exemplary embodiments for implementing different features, structures, or functions of the invention. Exemplary embodiments of components, arrangements, and configurations are described below to simplify aspects of the present disclosure; however, these exemplary embodiments are provided merely as examples and are not intended to limit the scope of the invention. Additionally, aspects of the present disclosure may repeat reference numerals and/or letters in the various exemplary embodiments and across the Figures provided herein. This repetition is for the purpose of simplicity and clarity and does not in itself dictate a relationship between the various exemplary embodiments and/or configurations discussed in the various Figures. Moreover, the formation of a first feature over or on a second feature in the description that follows may include embodiments in which the first and second features are formed in direct contact, and may also include embodiments in which additional features may be formed interposing the first and second features, such that the first and second features may not be in direct contact. Finally, the exemplary embodiments presented below may be combined in any combination of ways, *i.e.*, any element from one exemplary embodiment may be used in any other exemplary embodiment, without departing from the scope of the disclosure.

[0018] Additionally, certain terms are used throughout the following description and claims to refer to particular components. As one skilled in the art will appreciate, various entities may refer to the same component by different names, and as such, the naming convention for the elements described herein is not intended to limit the scope of the invention, unless otherwise specifically defined herein. Further, the naming convention used herein is not intended to distinguish between components that differ in name but not function. Additionally, in the following discussion and in the claims, the terms "including" and "comprising" are used in an open-ended fashion, and thus should be interpreted to mean "including, but not limited to." All numerical values in this disclosure may be exact or approximate values unless otherwise specifically stated. Accordingly, various embodiments of the disclosure may deviate from the numbers, values, and ranges disclosed herein without departing from the intended scope. Furthermore, as it is used in the claims or specification, the term "or" is

intended to encompass both exclusive and inclusive cases, *i.e.*, "A or B" is intended to be synonymous with "at least one of A and B," unless otherwise expressly specified herein.

[0019] Figures 1A and 1B illustrate a side view and a cross-sectional view, respectively, of a motive air conditioning system (MACS) 100 operatively coupled with a gas turbine assembly 102, according to one or more embodiments. The gas turbine assembly 102 may include a gas turbine 104 and an inlet duct 106 fluidly coupling the MACS 100 and the gas turbine 104. The MACS 100 may be configured to condition or regulate one or more properties of motive air utilized in the gas turbine 104. For example, the MACS 100 may be configured to regulate or control the temperature, humidity, acoustics, purity, composition, flow, or the like, of the motive air utilized in the gas turbine 104. As illustrated in Figure 1A and further illustrated in detail in Figure 1B, the MACS 100 may include a filtration assembly 108 fluidly coupled with the inlet duct 106. The filtration assembly 108 may include one or more filter housings or modules (three shown 110) configured to filter motive air (see Figure 2A, arrow A) directed to the gas turbine assembly 102 from a motive air source (not shown). In one or more embodiments, the motive air source may be the atmosphere surrounding the MACS 100. In another embodiment, the motive air source may be a storage vessel including compressed or non-compressed air.

[0020] The gas turbine 104 may be configured for marine or offshore operations including, for example, drilling rigs, drilling vessels, FPSO units, and production platforms; however, the gas turbine 104 is not limited thereto and may be configured for land-based operations, such as a refinery or liquefied natural gas (LNG) plant. In one or more embodiments, the gas turbine 104 may be an aeroderivative gas turbine. Accordingly, the gas turbine 104 may include a gas generator 112 and a power turbine (not shown) in one or more embodiments. As configured, an inlet 116 of the gas generator 112 may fluidly couple the inlet duct 106 with a compressor 118 of the gas generator 112. A combustor (not shown) of the gas generator 112 may be disposed about a longitudinal axis 122 thereof and may be fluidly coupled to the compressor 118 and the power turbine.

[0021] The gas turbine 104 may be configured to drive a generator (not shown) for power generation and/or to drive other process equipment (not shown), such as

compressors or pumps. To drive the process equipment and/or the generators, the gas turbine 104 may receive and compress the motive air in the compressor 118, combust the compressed motive air with fuel in the combustor to provide a combusted motive gas, and expand the combusted motive gas through the power turbine. The expansion of the combusted motive gas in the power turbine may generate mechanical power, which may be translated via a drive shaft (not shown), or common shaft in some embodiments, to drive the process equipment and/or the generators.

[0022] Referring now to Figures 2A, 2B, and 3 with continued reference to Figures 1A and 1B, the inlet duct 106 may include a gas turbine inlet interface assembly 124 operatively coupled to a plurality of walls 126a-d to collectively define an inlet flow channel 128a, 128b fluidly coupled with the filtration assembly 108 and configured to direct the motive air (arrow A) from the filter modules 110 of the filtration assembly 108 to the gas turbine assembly 102. The inlet flow channel 128a, 128b may include a vertical or substantially vertical portion 128a defined by the plurality of walls 126a-d and fluidly coupled with the filter modules 110 of the filtration assembly 108, and a horizontal or substantially horizontal portion 128b fluidly coupled with the vertical portion 128a via a turn or elbow 130 and defined at least in part by the gas turbine inlet interface assembly 124 coupled to the gas turbine 104. The vertical portion 128a may be configured to direct the motive air from the filter modules 110 of the filtration assembly 108 to the elbow 130. The elbow 130 may be configured to turn or direct the motive air from the vertical portion 128a to the horizontal portion 128b. The horizontal portion 128b may be configured to direct the motive air from the elbow 130 through the gas turbine inlet interface assembly 124 and into the gas turbine 104.

[0023] Based on the foregoing, the vertical portion 128a may extend along a vertical axis 132, and the horizontal portion 128b may extend along a horizontal axis 134 as shown most clearly in Figures 1B and 2A. The plurality of walls 126a-d forming the vertical portion 128b of the inlet flow channel 128a, 128b may extend along the vertical axis 132 and may include a rear wall 126a, a front wall 126b, and two side walls 126c, 126d opposing one another and connecting respective longitudinally extending end portions of the rear wall 126a and the front wall 126b. As arranged, a top end portion 136 of the plurality of walls 126a-d proximal the MACS 100 may form a square or rectangular cross section. Generally, the top end portion 136 of the plurality of walls

126a-d may be configured to mate or interface with the MACS 100 to provide a sealed connection. Accordingly, the top end portion 136 of the plurality of walls 126a-d may vary in shape based on the shape or contour of the MACS 100 to which the top end portion 136 may be coupled. In addition, the top end portion 136 of the plurality of walls 126a-d may vary in shape based on the number of walls 126a-d forming the vertical portion 128a, and thus, the top end portion 136 of the plurality of walls 126a-d may form a multitude of polygonal shapes in cross section.

[0024] In one or more embodiments, one or more of the plurality of walls 126a-d may bend or otherwise alter the orientation thereof as the wall or walls 126a-d extend along the vertical section. In another embodiment, one or more of the plurality of walls 126a-d may be formed from a plurality of wall segments such that at least one wall segment may extend in a different direction from the other wall segment(s). As shown most clearly in Figure 2A, the front wall 126b may extend from the top portion 136 of the plurality of walls 126a-d in both a horizontal and vertical direction toward a bottom end portion 138 of the plurality of walls 126a-d to form the elbow 130 to thereby assist in turning or directing the motive air to the gas turbine inlet interface assembly 124. In an embodiment, the front wall 126b may extend about 15 degrees from the vertical axis 132. In another embodiment, the front wall 126b may extend about 20 degrees from the vertical axis 132. In another embodiment, the front wall 126b may extend about 25 degrees from the vertical axis 132. In another embodiment, the front wall 126b may extend about 30 degrees from the vertical axis 132.

[0025] Further, as shown most clearly in Figures 2A, 2B, and 3, the side walls 126c, 126d may each be curved at the bottom end portion 138 of the plurality of walls 126a-d, thereby coupling with one another to form an arcuate bottom surface 140 at the bottom end portion 138 of the plurality of walls 126a-d. In one or more embodiments, each of the walls 126a-d may be individual components coupled with one another via welding, brazing, or the like. In another embodiment, two or more of the walls 126a-d may be formed from a single piece. For example, in an embodiment, the side walls 126c, 126d may be a single piece shaped to form opposing walls extending from the arcuate bottom surface 140. In yet another embodiment, the plurality of walls 126a-d may be formed from a single piece of material.

[0026] One or more of the walls 126a-d may define an access opening 142 removably covered by an access plate 144 and configured to provide access to the inlet flow channel 128a, 128b from the exterior of the plurality of walls 126a-d. In one embodiment, the front wall 126b may define an access opening 142 between the top end portion 136 and the bottom end portion 138 of the plurality of walls 126a-d. In another embodiment, at least one of the side walls 126c, 126d may define an access opening 142 between the top end portion 136 and the bottom end portion 138 of the plurality of walls 126a-d.

[0027] A plurality of vanes (not shown) may extend from one or more of the walls 126a-d and into the inlet flow channel 128a, 128b. The plurality of vanes may be configured to condition the motive air flowing therethrough. In at least one embodiment, the plurality of vanes may be disposed in the inlet flow channel 128a, 128b and configured to attenuate the generation and/or proliferation of sound or sound waves produced by the motive air flowing therethrough. For example, each of the vanes may include a perforated, rigid outer shell (not shown) encapsulating a sound insulating or attenuating material. The sound attenuating material may include, but is not limited to, fiberglass, mineral wool, one or more polymers, steel wool, or any acoustically treated media. In another embodiment, the plurality of vanes may be disposed in the inlet flow channel 128a, 128b to condition the motive air to achieve predetermined or desired fluid properties and/or fluid flow attributes. For example, the plurality of vanes may be configured to control or regulate the velocity, flow rate, pressure, and/or any other suitable fluid properties and/or fluid flow attributes of the motive air flowing through the inlet flow channel 128a, 128b. In another example, the plurality of vanes may be configured to minimize or reduce pressure losses and/or maintain uniform or substantially uniform flow distribution of the motive air through the inlet flow channel 128a, 128b. In another example, the plurality of vanes may be disposed in the elbow 130 and configured to at least partially turn the motive air from the vertical portion 128a toward the gas generator inlet 116 of the gas turbine 104.

[0028] The gas turbine inlet interface assembly 124 may include a first duct 146 and a mounting plate 148. The first duct 146 may have a longitudinal axis 150 extending between a first end 152 and a second end 154 of the first duct 146. The first end 152 of the first duct 146 may be integral or coupled with the mounting plate 148, and the

second end 154 of the first duct 146 may be configured to sealingly connect with an inlet component of the gas generator 112. In one or more embodiments, the inlet component may be the gas generator inlet 116. The first duct 146 may define the horizontal portion 128b of the inlet flow channel 128a, 128b fluidly coupled with the gas turbine 104. In one or more embodiments, the first duct 146 may have a substantially annular or polygonal shape. For example, the first duct 146 may have a bell mouth shape. For purposes of illustration, the first duct 146 will be referred to herein as an annular duct 146.

[0029] The mounting plate 148 may be pivotably connected to the rear wall 126a of the plurality of walls 126a-d and may define a mounting plate opening 156. As coupled or integral with the mounting plate 148, the horizontal portion 128b defined by the annular duct 146 may extend from the mounting plate opening 156 such that the mounting plate opening 156 fluidly couples the vertical portion 128a and the horizontal portion 128b of the inlet flow channel 128a, 128b. An outer perimeter of the mounting plate 148 may be sized and configured to align with a rear wall opening 158 defined by the rear wall 126a, such that in an operation orientation, the mounting plate 148 may cover and seal the rear wall opening 158.

[0030] As shown most clearly in Figures 2A, 2B, and 3, a top end portion 160 of the mounting plate 148 may be pivotably connected to the rear wall 126a via one or more hinges 162. The one or more hinges 162 may be a single continuous hinge, or the one or more hinges may be a plurality of hinges 162. The one or more hinges 162 are configured to permit the mounting plate 148 and the annular duct 146 to pivot between the operation orientation or position (Figures 1A, 1B, 2A, and 2B), and a maintenance position or orientation (Figure 3). As shown most clearly in Figures 2A and 2B, the mounting plate 148 and annular duct 146 are in the operation orientation, such that a bottom end portion 164 of the mounting plate 148 opposing the top end portion 160 of the mounting plate 148 is flush or substantially flush with a remainder of the rear wall 126a. In the operation position, the longitudinal axis 150 of the annular duct 146 is coaxial or at least substantially parallel with the longitudinal axis 122 of the gas generator 112 and the horizontal axis 134 of the horizontal portion 128b of the inlet flow channel 128a, 128b. The mounting plate 148 may be fixed in the operation position via one or more fasteners (not shown) coupling the mounting plate 148 to the

rear wall 126a. The one or more fasteners may detachably couple the mounting plate 148 to the rear wall 126a, such that the fasteners may be removed and the mounting plate 148 decoupled from the rear wall 126a (except for the pivotally connected top end portion 160) to change the position of the mounting plate 148 as desired.

[0031] As shown in Figure 3, the mounting plate 148 and annular duct 146 are in the maintenance position, such that bottom end portion 164 of the mounting plate 148 and the annular duct 146 are disposed within the vertical portion 128a of the inlet flow channel 128a, 128b. In the maintenance position, the longitudinal axis 150 of the annular duct 146 is not coaxial or substantially parallel with the longitudinal axis 122 of the gas generator 112, and instead, the longitudinal axis 150 of the annular duct 146 and the longitudinal axis 122 of the gas generator 112 form an obtuse angle (not shown).

[0032] The gas turbine inlet interface assembly 124 may further include a lifting system coupled to the mounting plate 148 and the front wall 126b of the plurality of walls 126a-d and configured to move the mounting plate 148 and the annular duct 146 from the operation position to the maintenance position. In one or more embodiments, the lifting system may include a mounting plate lifting lug 166 coupled to or integral with the mounting plate 148 and a front wall lifting lug 168 coupled to or integral with the front wall 126b. The lifting system may further include an actuator 170 and one or more cables (one shown 172) coupled to the actuator 170, the mounting plate lifting lug 166, and the front wall lifting lug 168. The actuator 170 may be configured to move the mounting plate 148 and the annular duct 146 from the operation position to the maintenance position via the one or more cables 172. In one embodiment, the actuator 170 may be a winch. In another embodiment, the actuator 170 may be a come-along. The lifting system may further include one or more pulleys (not shown). Alternatively, the actuator 170 may be a hydraulic or pneumatic cylinder.

[0033] In the operation position, as illustrated in Figure 1A and Figure 1B, the annular duct 146 of the gas turbine inlet interface assembly 124 may be coupled with the gas generator inlet 116 of the gas turbine 104, thereby fluidly coupling the MACS 100 and the inlet duct 106 with the gas turbine 104. As further illustrated in Figures 1A and 1B, the annular duct 146 of the gas turbine inlet interface assembly 124 may be at least partially disposed in an enclosure or housing 174 of the gas turbine assembly 102.

The annular duct 146 may be configured to secure, mount, or otherwise couple the gas turbine 104 with the inlet flow channel 128a, 128b via one or more mechanical fasteners (not shown). A seal or membrane (not shown) may be utilized at an interface between the annular duct 146 and the gas generator inlet 116 of the gas turbine 104 to provide an air-tight seal therebetween. For example, an annular flexible membrane may be disposed at the interface between the annular duct 146 and the gas generator inlet 116 to prevent leakage of the motive air from the inlet flow channel 128a, 128b. In the event access to the gas generator 112 is desired, the annular duct 146 may be configured to be urged or translated away from the gas generator inlet 116 to uncouple or dismount the inlet duct 106 from the gas generator 112 to facilitate removal, reinstallation, service, and/or maintenance of the gas generator 112. For example, as illustrated in Figure 3, the mounting plate 148 and annular duct 146 may be pivoted about the hinged axis provided by the one or more hinges 162 and translated axially and radially away from the gas generator 112 and into the vertical portion 128a of the inlet flow channel 128a, 128b via the lifting system to facilitate access to and maintenance of the gas generator 112.

[0034] Referring to Figure 4, an alternate embodiment for the inlet duct 106 is shown. In this embodiment, the top end portion 136 includes a straight back wall 200 and curved front 202 and side 204 portions to form a substantially semicircular cross-section. In addition, the bottom end portion 138 is spherically shaped. Further, the back wall 200 is sized to accommodate the mounting plate or access panel 148.

[0035] Turning now to Figure 5, Figure 5 illustrates a flowchart depicting a method 400 for accessing a gas generator coupled to a motive air conditioning system via an inlet duct in order to perform maintenance on the gas generator, or gas turbine, according to one or more embodiments disclosed. The method 400 may include decoupling a mounting plate of a gas turbine inlet interface assembly from a first wall of a plurality of walls forming the inlet duct, the plurality of walls further defining a first portion of the inlet flow channel, as at 402. The method 400 may also include decoupling an annular duct of the gas turbine inlet interface assembly from the gas generator, the annular duct coupled to the mounting plate and forming a second portion of an inlet flow channel fluidly coupling the motive air conditioning system and the gas generator, as at 404. The method 400 may further include pivoting the

mounting plate at a first end portion thereof coupled to the first wall such that the annular duct and a second end portion of the mounting plate opposing the first end portion of the mounting plate are positioned in the first portion of the inlet flow channel, thereby providing access to the gas generator to perform maintenance, as at 406.

[0036] The method 400 may also include lifting the mounting plate and the annular duct at the second end portion of the mounting plate. Lifting the mounting plate and the annular duct may include attaching a cable to a first lug coupled to the second end portion of the mounting plate, attaching the cable to a second lug coupled to a second wall of the plurality of walls opposing the first wall, and applying a force to the cable via an actuator to direct the second end portion of the mounting plate and the annular duct toward the second wall such that the annular duct and the second end portion of the mounting plate are positioned in the first portion of the inlet flow channel.

[0037] The method 400 may further include maintaining the annular duct and the second end portion of the mounting plate in a fixed position within the first portion of the inlet flow channel during access to the gas generator. The method 400 may also include removing an access panel covering an access opening defined by the second wall of the plurality of walls, and accessing the first portion of the inlet flow channel via the access opening defined by the second wall. As provided in the method 400, the first end portion of the mounting plate may be pivotably connected to the first wall via one or more hinges.

[0038] As disclosed herein, the gas turbine inlet interface assembly 124 may be securely fixed in either an operation position or a maintenance position. This is especially valuable in offshore applications where wave induced platform motion can force large inertia objects to rapidly move in unpredictable and harmful ways. Additionally, the ability of the mounting plate 148 and annular duct to retract into the vertical portion 128a of the inlet flow channel 128a, 128b allows for the deployment of the gas turbine assembly 102 in compact areas. Further, the facile repositioning of the gas turbine assembly components significantly reduces the time and cost of the maintenance of the gas generator 112.

[0039] It should be appreciated that all numerical values and ranges disclosed herein are approximate values and ranges, whether "about" is used in conjunction therewith. It should also be appreciated that the term "about," as used herein, in conjunction with

a numeral refers to a value that is $\pm 5\%$ (inclusive) of that numeral, $\pm 10\%$ (inclusive) of that numeral, or $\pm 15\%$ (inclusive) of that numeral. It should further be appreciated that when a numerical range is disclosed herein, any numerical value falling within the range is also specifically disclosed.

[0040] The foregoing has outlined features of several embodiments so that those skilled in the art may better understand aspects of the present disclosure. Those skilled in the art should appreciate that they may readily use aspects of the present disclosure as a basis for designing or modifying other processes and structures for carrying out the same purposes and/or achieving the same advantages of the embodiments introduced herein. Those skilled in the art should also realize that such equivalent constructions do not depart from the spirit and scope of aspects of the present disclosure, and that they may make various changes, substitutions and alterations herein without departing from the spirit and scope of aspects of the present disclosure.

CLAIMS

We claim:

1. An inlet duct (106) for a gas turbine, comprising:
 - a plurality of walls (126a-d) defining a first portion (128a) of an inlet flow channel (128a, 128b); and
 - a gas turbine inlet interface assembly (124) comprising
 - a mounting plate (148) pivotably connected to a first wall (126a) of the plurality of walls (126a-d) and defining a plate opening (156);
 - a first duct (146) having a first end (152) coupled to or integral with the mounting plate (148), and a second end (154) configured to sealingly connect with an inlet component (116) of the gas turbine, the first duct (146) defining a second portion (128b) of the inlet flow channel extending from the plate opening (156),
 - wherein the first portion (128a) and the second portion (128b) of the inlet flow channel (128a, 128b) are configured to fluidly couple a motive gas source with the gas turbine.
2. The inlet duct (106) of claim 1, wherein:
 - the mounting plate (148) has a first end portion (160) and a second end portion (164) opposing the first end portion (160), the first end portion (160) of the mounting plate (148) being pivotably connected to the first wall (126a) via one or more hinges (162); and
 - the one or more hinges (162) are configured to permit the mounting plate (148) and the first duct (146) to pivot between a first position and a second position.
3. The inlet duct (106) of claim 2, wherein:
 - the second end portion (164) of the mounting plate (148) is flush with a remainder of the first wall (126a) in the first position; and
 - the second end portion (164) of the mounting plate (148) and the first duct (146) are disposed within the first portion (128a) of the inlet flow channel (128a, 128b) in the second position.

4. The inlet duct (106) of claim 2, wherein the gas turbine inlet interface assembly (124) further comprises a lifting system coupled to the mounting plate (148) and a second wall (126b) of the plurality of walls (126a-d) opposing the first wall (126a), the lifting system configured to move the mounting plate (148) and the first duct (146) from the first position to the second position.
5. The inlet duct (106) of claim 4, wherein the lifting system comprises:
 - an actuator (170);
 - a first lifting lug (166) coupled to the mounting plate (148);
 - a second lifting lug (168) coupled to the second wall (126b);
 - a cable (172) coupled to the actuator (170), the first lifting lug (166), and the second lifting lug (168),wherein the actuator (170) is configured to move the mounting plate (148) and the first duct (146) from the first position to the second position, the first position allowing for operation of the gas turbine and the second position allowing for maintenance of the gas turbine.
6. The inlet duct (106) of claim 5, wherein the lifting system further comprises one or more pulleys.
7. The inlet duct (106) of claim 5, wherein the actuator (170) comprises a winch or a come-along.
8. The inlet duct (106) of claim 2, wherein one or more walls of the plurality of walls (126a-d) defines an access opening (142) removably covered by an access panel (148).
9. The inlet duct (106) of claim 2, wherein:
 - the first duct (146) is a bell mouth duct; and
 - the mounting plate (148) has an outer perimeter configured to align with a first wall (126a) opening defined in the first wall (126a).

10. The inlet duct (106) of claim 2, wherein the first duct (146) has a substantially annular shape.
11. The inlet duct (106) of claim 2, wherein the first duct (146) has a substantially polygonal shape.
12. The inlet duct (106) of claim 2, wherein the plurality of walls (126a-d) further comprises:
- a second wall (126b) opposing the first wall (126a);
 - a third wall (126c) coupling respective first longitudinal end portions of the first wall (126a) and the second wall (126b); and
 - a fourth wall (126d) opposing the third wall (126c) and coupling respective second longitudinal end portions of the first wall (126a) and the second wall (126b),
- wherein
- top end portions (126) of the first wall (126a), the second wall (126b), the third wall (126c), and the fourth wall (126d) form a square cross section, and
 - bottom end portions (138) of the third wall (126c) and the fourth wall (126d) are arcuate.
13. The inlet duct (106) of claim 12, wherein:
- the first inlet flow channel (128a) extends along a first axis (132);
 - the second inlet flow channel (128a, 128b) extends along a second axis (134) substantially perpendicular to the first axis (132); and
 - the second wall (126b) extends at an angle of at least about 20 degrees from the first axis (132) from the top end portion (126) thereof to the bottom end (138) portion thereof.
14. A gas turbine assembly comprising:
- a gas turbine comprising
 - a gas generator (112) comprising
 - a longitudinal axis (122);
 - a gas generator inlet (116) configured to receive a motive gas;

a compressor (118) fluidly coupled to the gas generator inlet (116) and configured to compress the motive gas; and

a combustor fluidly coupled to the compressor (118) and configured to receive a fuel from a fuel source, the combustor configured to combust a compressed motive gas with the fuel received from the fuel source;

a power turbine configured to expand a combusted motive gas and generate mechanical power; and

an inlet duct (106) configured to fluidly couple the gas generator (112) and a motive gas source providing the motive gas, the inlet duct (106) comprising

a plurality of walls (126a-d) defining a first portion (128a) of an inlet flow channel (128a, 128b); and

a gas turbine inlet interface assembly (124) comprising

a mounting plate (148) pivotably connected to a first wall (126a) of the plurality of walls (126a-d) and defining a plate opening (156);

a first duct (146) having a first end (152) coupled to or integral with the mounting plate (148), and a first end (152) configured to sealingly connect with the gas generator inlet (116), the first duct (146) defining a second portion (128b) of the inlet flow channel (128a, 128b) extending from the plate opening (156),

wherein the first portion (128a) and the second portion (128b) of the inlet flow channel (128a, 128b) are configured to fluidly couple the motive gas source with the gas turbine.

15. The gas turbine assembly of claim 14, wherein:

the mounting plate (148) has a first end portion (160) and a second end portion (164) opposing the first end portion (160), the first end portion (160) of the mounting plate (148) being pivotably connected to the first wall (126a) via one or more hinges (162); and

the one or more hinges (162) are configured to permit the mounting plate (148) and the first duct (146) to pivot between a first position and a second position.

16. The gas turbine assembly of claim 15, wherein:
the first duct (146) has a longitudinal axis (134);
the first duct (146) is sealingly connected with the gas generator inlet (116) in the first position, such that the longitudinal axis (134) of the first duct (146) is coaxial with the longitudinal axis (122) of the gas generator (112); and
the first duct (146) is decoupled from the gas generator inlet (116), and the second end portion (164) of the mounting plate (148) and the first duct (146) are disposed within the first portion (128a) of the inlet flow channel (128a, 128b) in the second position.
17. The gas turbine assembly of claim 15, wherein the gas turbine inlet interface assembly (124) further comprises a lifting system coupled to the mounting plate (148) and a second wall (126b) of the plurality of walls (126a-d) opposing the first wall (126a), the lifting system configured to move the mounting plate (148) and the first duct (146) from the first position to the second position.
18. The gas turbine assembly of claim 14, wherein the first duct (146) has a substantially annular shape.
19. The gas turbine assembly of claim 14, wherein the first duct (146) has a substantially polygonal shape.
20. The gas turbine assembly of claim 17, wherein the lifting system comprises:
an actuator (170);
a first lifting lug (166) coupled to the mounting plate (148);
a second lifting lug (168) coupled to the second wall (126b);
a cable (172) coupled to the actuator (170), the first lifting lug (166), and the second lifting lug (168),
wherein the actuator (170) is configured to move the mounting plate (148) and the first duct (146) from the first position to the second position, the first position allowing for operation of the gas generator (112) and the second position allowing for maintenance of the gas generator (112).

21. A method for accessing a gas generator (112) coupled to a motive air conditioning system via an inlet duct (106) in order to perform maintenance on the gas generator (112), comprising:

decoupling a mounting plate (148) of a gas turbine inlet interface assembly (124) from a first wall (126a) of a plurality of walls (126a-d) forming the inlet duct (106), the plurality of walls (126a-d) further defining a first portion (128a) of the inlet flow channel (128a, 128b);

decoupling an annular duct (146) of the gas turbine inlet interface assembly (124) from the gas generator (112), the annular duct (146) coupled to the mounting plate (148) and forming a second portion (128b) of an inlet flow channel (128a, 128b) fluidly coupling the motive air conditioning system and the gas generator (112); and

pivoting the mounting plate (148) at a first end portion (160) thereof coupled to the first wall (126a) such that the annular duct (146) and a second end portion (164) of the mounting plate (148) opposing the first end portion (160) of the mounting plate (148) are positioned in the first portion (128a) of the inlet flow channel (128a, 128b), thereby providing access to the gas generator (112) to perform maintenance.

22. The method of claim 21, further comprising:

lifting the mounting plate (148) and the annular duct (146) at the second end portion (164) of the mounting plate (148), wherein lifting the mounting plate (148) and the annular duct (146) further comprises

attaching a cable (172) to a first lug (166) coupled to the second end portion (164) of the mounting plate (148),

attaching the cable (172) to a second lug (168) coupled to a second wall (126b) of the plurality of walls (126a-d) opposing the first wall (126a), and

applying a force to the cable (172) via an actuator (170) to direct the second end portion (164) of the mounting plate (148) and the annular duct (146) toward the second wall (126b) such that the annular duct (146) and the second end portion (164) of the mounting plate (148) are positioned in the first portion (128a) of the inlet flow channel (128a, 128b); and

maintaining the annular duct (146) and the second end portion (164) of the mounting plate (148) in a fixed position within the first portion (128a) of the inlet flow channel (128a, 128b) during access to the gas generator (112).

23. The method of claim 22, further comprising:
removing an access panel (148) covering an access opening (142) defined by the second wall (126b) of the plurality of walls (126a-d); and
accessing the first portion (128a) of the inlet flow channel (128a, 128b) via the access opening (142) defined by the second wall (126b).
24. The method of claim 21, wherein the first end portion (160) of the mounting plate (148) is pivotably connected to the first wall (126a) via one or more hinges (162).

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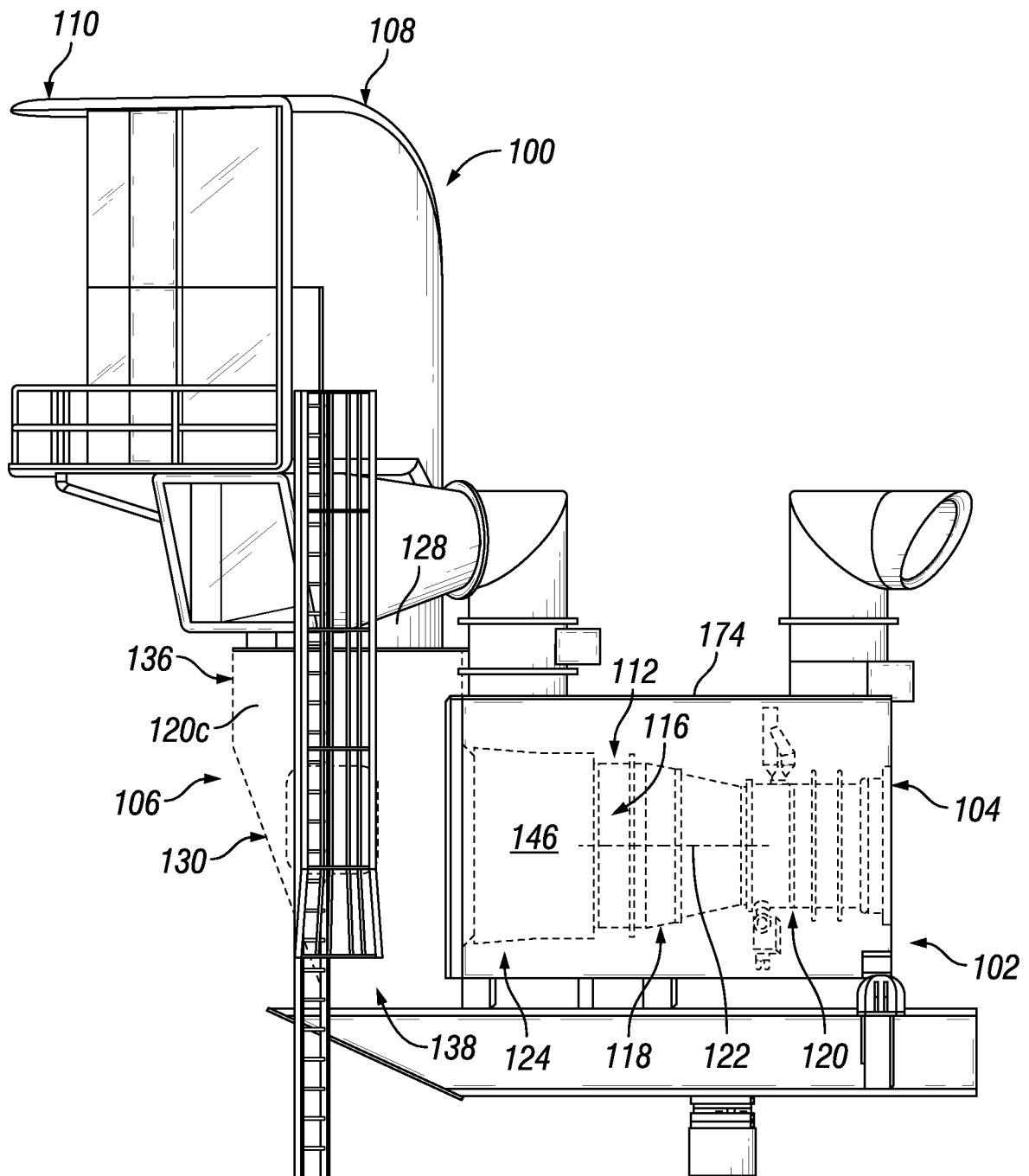


FIG. 1A

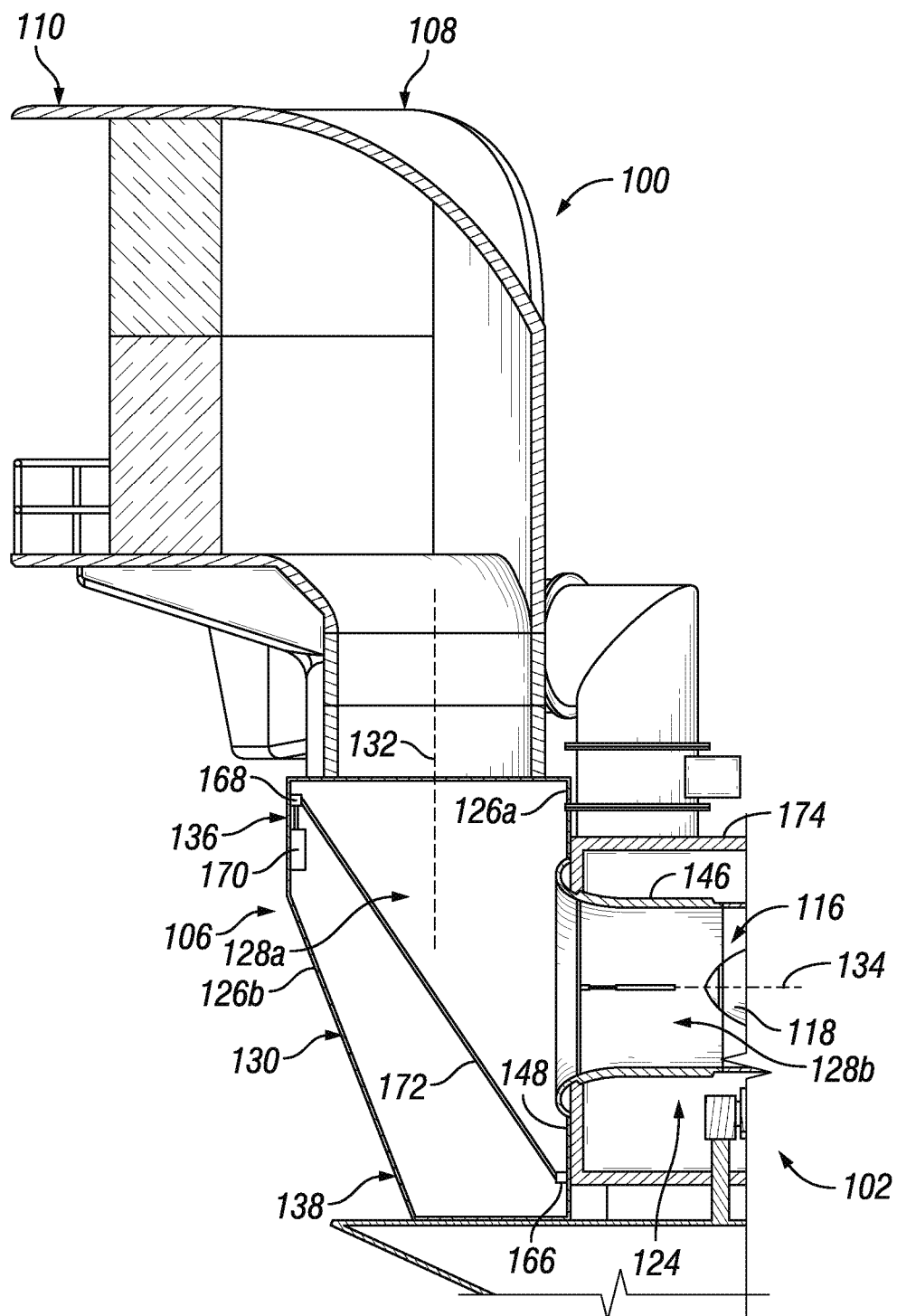


FIG. 1B

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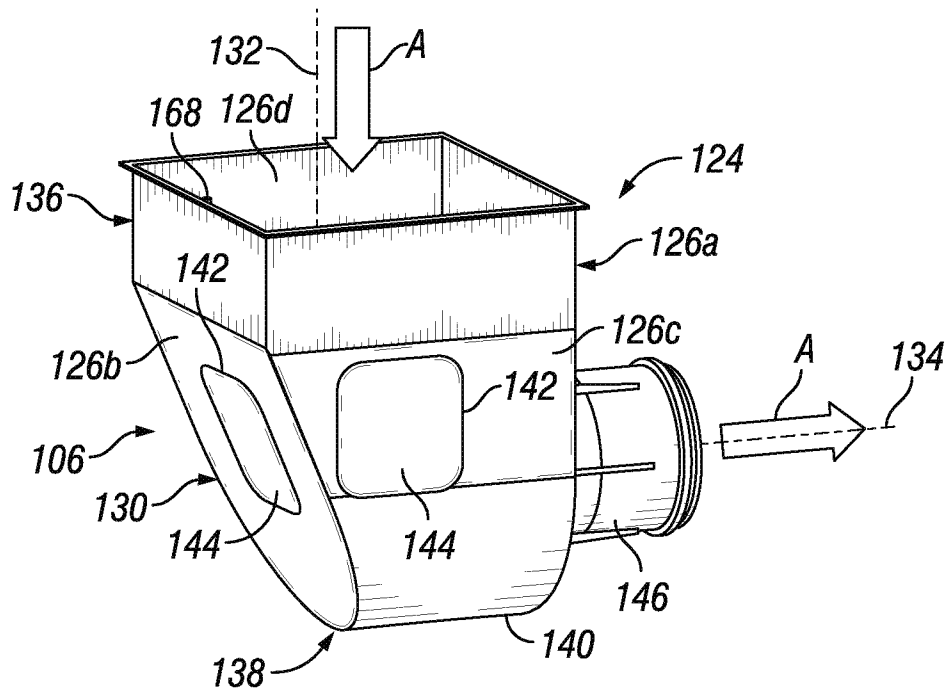


FIG. 2A

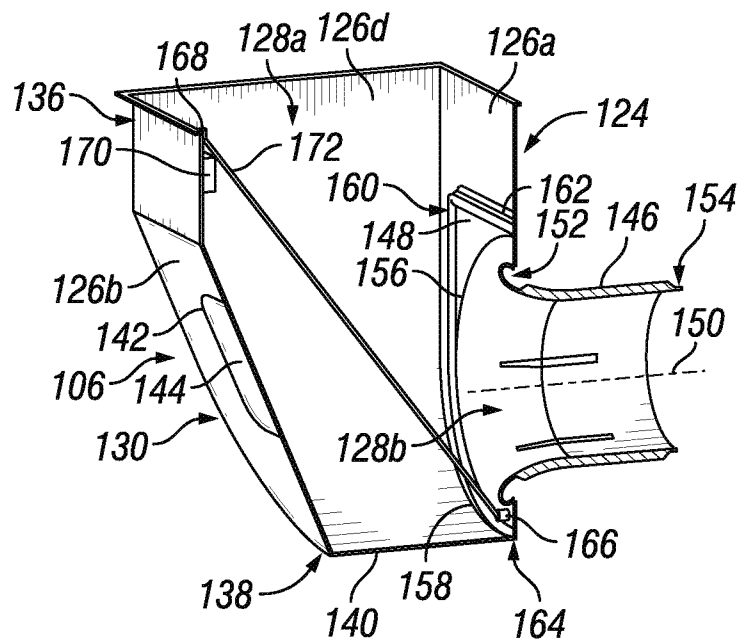


FIG. 2B

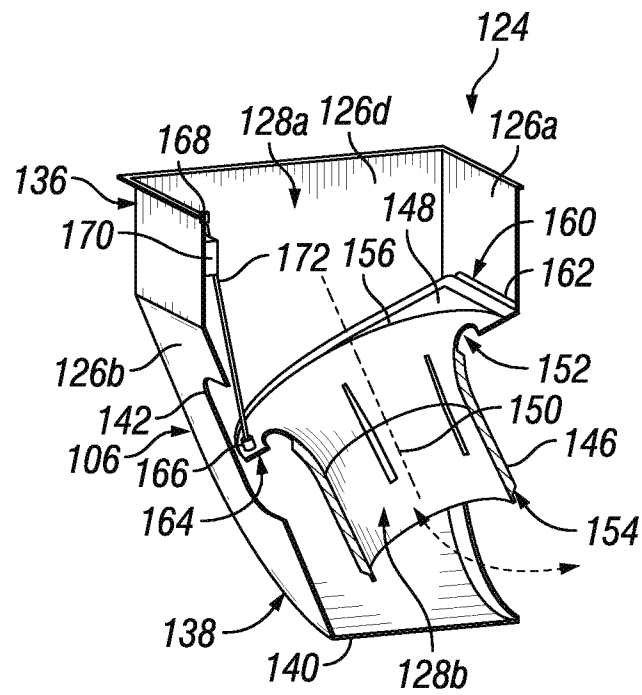


FIG. 3

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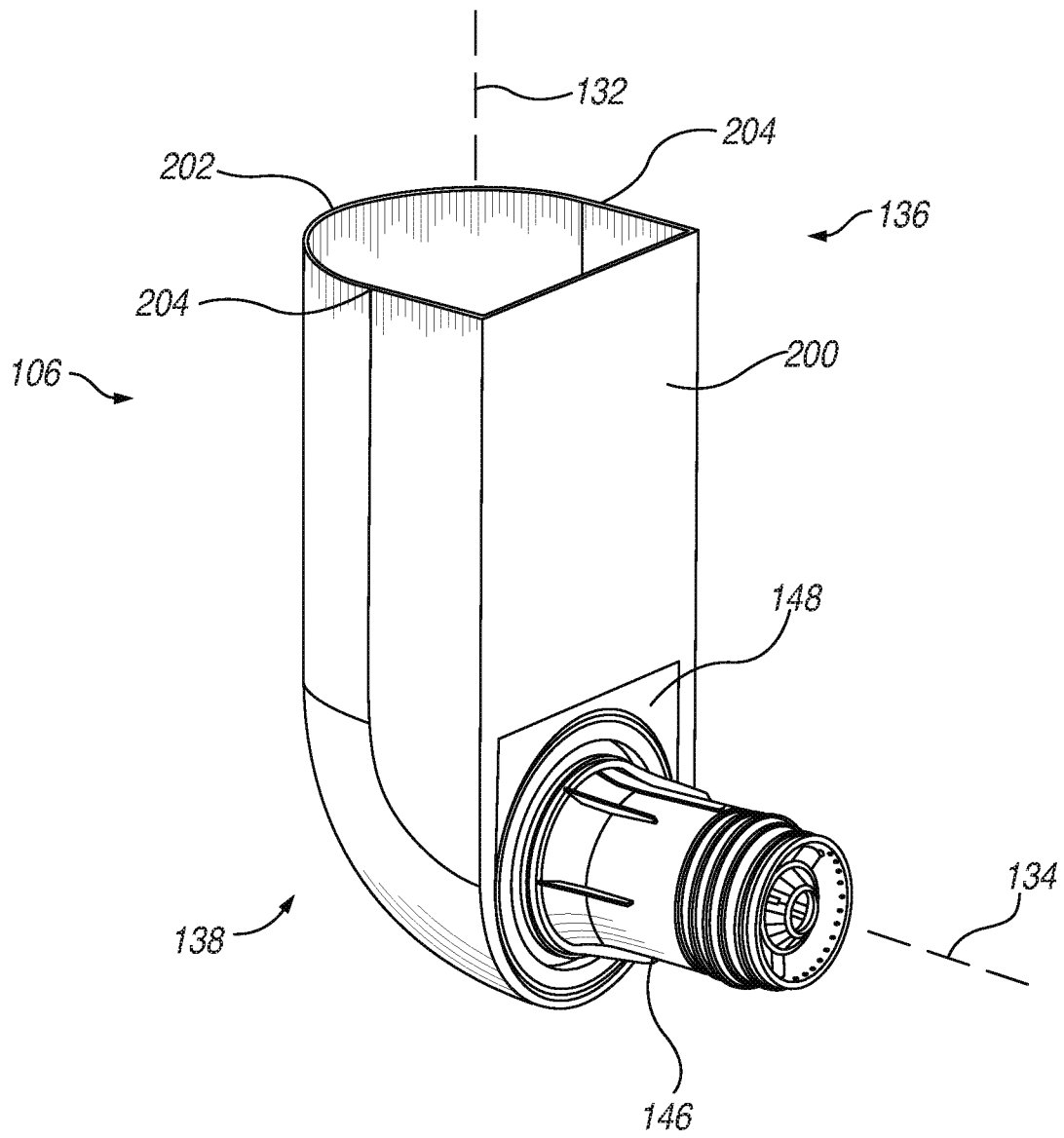


FIG. 4

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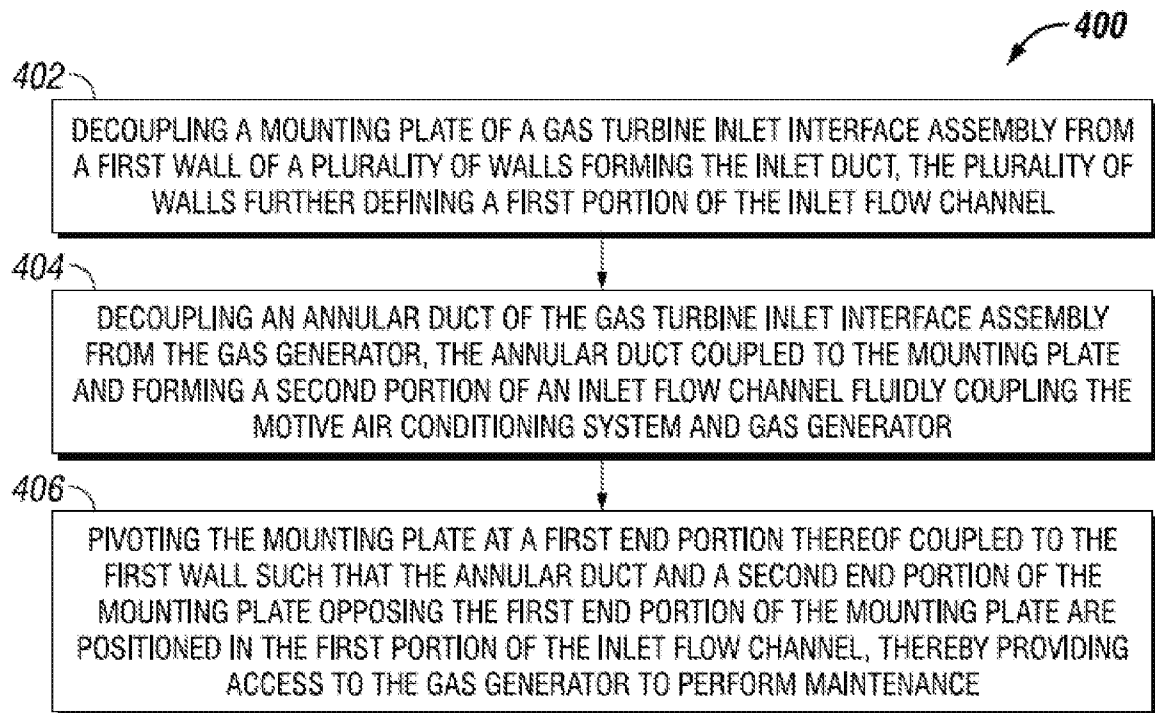


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2018/029821

A. CLASSIFICATION OF SUBJECT MATTER
INV. F02C7/04
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F02C F01D B01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2017/009654 A1 (MAIER WILLIAM C [US]) 12 January 2017 (2017-01-12) paragraph [0028]; figures 1A,1C,1G,1H -----	1-24
A	US 2016/076447 A1 (MERLO ROBERTO [IT] ET AL) 17 March 2016 (2016-03-17) paragraphs [0043], [0044], [0048]; figures 1,3,7 -----	1-24
A	US 2016/108930 A1 (HASHIMOTO SHINYA [JP] ET AL) 21 April 2016 (2016-04-21) paragraphs [0038] - [0040]; figures 2,3 -----	1-24
A	US 4 691 561 A (GANZ ULRICH W [US] ET AL) 8 September 1987 (1987-09-08) column 2, lines 56-65; figure 1 -----	1-24



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

27 June 2018

Date of mailing of the international search report

04/07/2018

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Steinhauser, Udo

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2018/029821

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