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(54) **Annular Flow Conditioning Member for Gas Turbomachine Combustor Assembly**

(57) A turbomachine combustor assembly (20) includes a combustor body (34), a combustor liner (43) arranged within the combustor body (34) and defining a combustion chamber (48), a fluid passage (46) defined

between the combustor body (34) and the combustor liner (43), and an annular flow conditioning member (60) arranged in the fluid passage (46) and extending about the combustor liner (43).

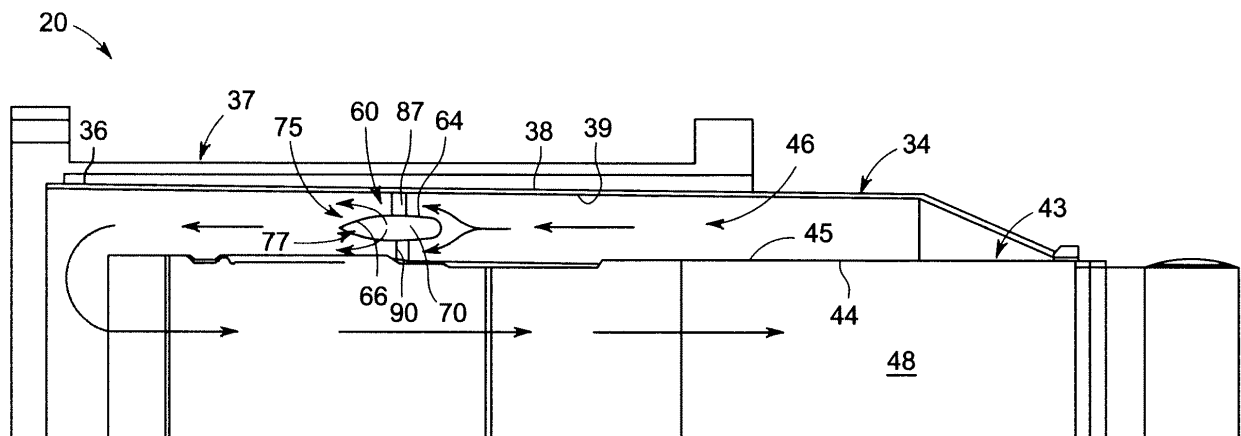


FIG. 2

Description

BACKGROUND OF THE INVENTION

[0001] The subject matter disclosed herein relates to the art of turbomachines and, more particularly, to an annular flow conditioning member for a gas turbomachine combustor assembly.

[0002] In general, gas turbine engines combust a fuel/air mixture that releases heat energy to form a high temperature gas stream. The high temperature gas stream is channeled to a turbine via a hot gas path. The turbine converts thermal energy from the high temperature gas stream to mechanical energy that rotates a turbine shaft. The turbine may be used in a variety of applications, such as for providing power to a pump or an electrical generator.

[0003] Many gas turbines include an annular combustor within which are formed the combustion gases that create the high temperature gas stream. Other turbomachines employ a plurality of combustors arranged in a can-annular array. In such a turbomachine, the combustion gases are formed in each of the plurality of combustors, combusted in a combustion chamber defined by a combustor body, and delivered to the turbine through a transition piece. Often times, compressor discharge air is passed into the combustor to cool various surfaces and aid in forming the fuel/air mixture. In certain arrangements, compressor discharge air is often channeled along a combustor liner toward a venturi.

[0004] A portion of the compressor discharge air is directed onto internal surfaces of the venturi for cooling. The compressor discharge air passes from the venturi into a passage formed between the combustor body and the combustor liner. In certain arrangements, a plurality of turbulator members is arranged in the passage. The turbulator members create flow vortices that enhance heat transfer in the combustor body. The compressor discharge air exits the passage into the combustion chamber to mix with the combustion gases.

BRIEF DESCRIPTION OF THE INVENTION

[0005] According to one aspect of the invention, a turbomachine combustor assembly includes a combustor body, a combustor liner arranged within the combustor body and defining a combustion chamber, a fluid passage defined between the combustor body and the combustor liner, and an annular flow conditioning member arranged in the fluid passage and extending about the combustor liner.

[0006] According to another aspect of the invention, a gas turbomachine system including a compressor portion, a turbine portion operatively coupled to the compressor portion, and a combustor assembly as described above fluidly connecting the compressor portion and the turbine portion.

[0007] These and other advantages and features will

become more apparent from the following description taken in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWING

[0008] Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawing in which:

FIG. 1 is a schematic diagram of a gas turbomachine system including a combustor assembly having a flow conditioning member in accordance with an exemplary embodiment;

FIG. 2 is a partial cross-sectional view of the combustor assembly of FIG. 1 illustrating a flow conditioning member in accordance with an exemplary embodiment;

FIG. 3 is a perspective view of a flow conditioning member in accordance with an exemplary embodiment;

FIG. 4 is a partial cross-sectional view of the combustor assembly of FIG. 2 illustrating the flow conditioning member in accordance with an exemplary embodiment;

FIG. 5 is a partial cross-sectional view of the combustor assembly of FIG. 1 illustrating first and second flow conditioning members in accordance with an exemplary embodiment;

FIG. 6 is a partial cross-sectional view of the combustor assembly of FIG. 1 illustrating first and second flow conditioning members in accordance with another aspect of the exemplary embodiment;

FIG. 7 is a partial cross-sectional view of the combustor assembly of FIG. 1 illustrating first and second flow conditioning members in accordance with yet another exemplary embodiment; and

FIG. 8 is a partial cross-sectional view of the combustor assembly of FIG. 1 illustrating first and second flow conditioning members in accordance with still yet another exemplary embodiment.

[0009] The detailed description explains embodiments of the invention, together with advantages and features, by way of example with reference to the drawings.

DETAILED DESCRIPTION OF THE INVENTION

[0010] With reference to FIG. 1, a turbomachine constructed in accordance with an exemplary embodiment is indicated generally at 2. Turbomachine 2 includes a compressor portion 4 and a turbine portion 6. Compres-

sor portion 4 includes a compressor housing 8 and turbine portion 6 includes a turbine housing 10. Compressor portion 4 is linked to turbine portion 6 through a common compressor/turbine shaft or rotor 16. Compressor portion 4 is also linked to turbine portion 6 through a plurality of circumferentially spaced combustor assemblies, one of which is indicated at 20.

[0011] As best shown in FIG. 2, combustor assembly 20 includes a combustor body 34 having a forward end 36 to which is mounted an injector nozzle housing 37. Combustor body 34 includes an outer surface 38 and an inner surface 39. In the exemplary embodiment shown, combustor assembly 20 includes a combustor liner 43 arranged within combustor body 34. Combustor liner 43 includes an inner surface 44 and an outer surface 45. Outer surface 45 is spaced from an inner surface 39 of combustor body 34 thereby forming a fluid flow passage 46 that transmits compressor discharge air from compressor portion 4 toward injector nozzle housing 37. Inner surface 44 of combustor liner 43 defines a combustion chamber 48. In further accordance with the exemplary embodiment shown, combustor assembly 20 includes an annular flow conditioning member 60. As will become more fully evident below, flow conditioning member 60 is arranged within fluid flow passage 46 and extends about combustor liner 43.

[0012] Annular flow conditioning member 60 includes an external surface 64 and an internal surface 66 that defines an annular fuel plenum 70. External surface 64 of flow conditioning member 60 includes an aerodynamic profile 75 that defines an airfoil 77. As best shown in FIG. 3, annular flow conditioning member 60 includes a first airfoil surface 79 and a second airfoil surface 80. First airfoil surface 79 includes a plurality of openings 82 and second airfoil surface 80 includes a second plurality of openings 84. Openings 82 and 84 extend into annular fuel plenum 70. With this arrangement, fuel flowing into annular fuel plenum 70 exits through first and second plurality of openings 82 and 84 to mix with air flowing through fluid flow passage 46 prior to entering an injection nozzle (not shown) and being combusted in combustion chamber 48. The particular profile of annular flow conditioning member 60 enhances air/fuel mixing. In addition, the positioning of annular flow conditioning member 60 within fluid flow passage 46 leads to more consistent flow velocities particularly in axial and tangential directions. Furthermore, by supporting annular flow conditioning member 60 within fluid flow passage 46 flow separations are reduced.

[0013] In further accordance with the exemplary embodiment, annular flow conditioning member 60 is supported within fluid flow passage 46 by first and second support members 87 and 90. First support member 87 extends between inner surface 39 of combustor body 34 and first airfoil surface 79. Second support member 90 extends between second airfoil surface 80 and combustor liner 43. The number and location of support members 87 and 89 can vary. That is, while shown with two support

members 87 and 90, annular flow conditioning member 60 could be supported within flow passage 46 through a single support member that extends from combustor body 34 or combustor liner 43. In addition to first and second support members 87 and 89, annular flow conditioning member 60 is coupled to a fuel delivery passage 93 (FIG. 4). In accordance with one aspect of the exemplary embodiment first and second support members 87 and 89 are designed with an airfoil shape so as to reduce downstream flow separation. Fuel delivery passage 93 fluidly couples annular fuel plenum 70 and a source of fuel (not shown). Fuel delivery passage 93 may take on a variety of forms that include rigid and flexible connections.

[0014] Reference will now be made to FIG. 5, wherein like reference numbers represent corresponding parts in the respective views, in describing a combustor assembly 106 in accordance with another aspect of the exemplary embodiment. Combustor assembly 106 includes a first annular flow conditioning member 110 having a first annular fuel plenum 111 and a second annular flow conditioning member 113 having a second annular fuel plenum 114. First annular flow conditioning member 110 includes a first aerodynamic profile 117 that defines a first airfoil 118. Similarly, second annular flow conditioning member 113 includes a second aerodynamic profile 121 that defines a second airfoil 122. In the exemplary aspect shown, first annular flow conditioning member 110 extends about second annular flow conditioning member 113 within fluid flow passage 46. The number and radial location of annular flow conditioning members 110 and 113 can vary. The particular orientation of flow conditioning members 110 and 113 allows for enhanced fuel/air mixing while also leading to more consistent flow velocities and reduced air/fuel separation within fluid flow passage 46.

[0015] Reference will now be made to FIG. 6, wherein like reference numbers represent corresponding parts in the respective views, in describing a combustor assembly 126 in accordance with another aspect of the exemplary embodiment. Combustor assembly 126 includes a first annular flow conditioning member 130 having a first annular fuel plenum 131 and a second annular flow conditioning member 133 having a second annular fuel plenum 134. First annular flow conditioning member 130 includes a first aerodynamic profile 137 that defines a first airfoil 138. Similarly, second annular flow conditioning member 133 includes a second aerodynamic profile 141 that defines a second airfoil 142. In the exemplary aspect shown, second annular flow conditioning member 133 is positioned downstream from first annular flow conditioning member 130 within fluid flow passage 46. The number and axial location of annular flow conditioning members 130 and 133 can vary. In a manner similar to that described above, the particular orientation of flow conditioning members 133 and 130 allows for enhanced fuel/air mixing while also leading to more consistent flow velocities and reduced air/fuel separation within fluid flow

passage 46.

[0016] Reference will now be made to FIG. 7, wherein like reference numbers represent corresponding parts in the respective views, in describing a combustor assembly 144 in accordance with another aspect of the exemplary embodiment. Combustor assembly 144 includes a first annular flow conditioning member 146 having a first annular fuel plenum 147 and a second annular flow conditioning member 149 having a second annular fuel plenum 150. First annular flow conditioning member 146 includes a first aerodynamic profile 154 that defines a first airfoil 155. Similarly, second annular flow conditioning member 149 includes a second aerodynamic profile 157 that defines a second airfoil 158. In the exemplary aspect shown, second annular flow conditioning member 149 is positioned downstream from, and is axially off-set relative to first annular flow conditioning member 146 within fluid flow passage 46. The number and location of annular flow conditioning members 146 and 149 can vary. In a manner also similar to that described above, the particular orientation of flow conditioning members 146 and 149 allows for enhanced fuel/air mixing while also leading to more consistent flow velocities and reduced air/fuel separation within fluid flow passage 46.

[0017] Reference will now be made to FIG. 8, wherein like reference numbers represent corresponding parts in the respective views, in describing a combustor assembly 200 in accordance with another aspect of the exemplary embodiment. Combustor assembly 200 includes a first annular flow conditioning member 206 having a first annular fuel plenum 207 and a second annular flow conditioning member 209 having a second annular fuel plenum 210. First annular flow conditioning member 206 includes a first aerodynamic profile 214 that defines a first airfoil 215. Similarly, second annular flow conditioning member 209 includes a second aerodynamic profile 217 that defines a second airfoil 218. In the exemplary aspect shown, first and second annular flow conditioning members 206 and 209 are curved so as to form respective pressure and suction sides (not separately labeled). In this manner, first and second flow conditioning members 206 and 209 assist in turning fluid flow from fluid flow passage 46 into the respective combustor (not separately labeled) without developing flow separations in the fluid flow.

[0018] At this point it should be appreciated that the exemplary embodiments describe an annular flow conditioning member(s) that is suspended within a flow passage of a turbomachine combustor assembly. The aerodynamic profile and the positioning of the annular flow conditioning member enhances air/fuel mixing and also leads to more consistent flow velocities particularly in axial and tangential directions. Furthermore, by supporting annular flow conditioning member 60 within fluid flow passage 46 separation of fluid flow is reduced. It should also be understood that fuel may be passed to the fuel plenum defined by the annular flow conditioning member either through the support member instead of or as a

supplement to the fuel passage.

[0019] While the invention has been described in detail in connection with only a limited number of embodiments, it should be readily understood that the invention is not limited to such disclosed embodiments. Rather, the invention can be modified to incorporate any number of variations, alterations, substitutions or equivalent arrangements not heretofore described, but which are commensurate with the spirit and scope of the invention. Additionally, while various embodiments of the invention have been described, it is to be understood that aspects of the invention may include only some of the described embodiments. Accordingly, the invention is not to be seen as limited by the foregoing description, but is only limited by the scope of the appended claims.

Claims

1. A turbomachine combustor assembly (20) comprising:
 - a combustor body (34);
 - a combustor liner (43) arranged within the combustor body (34) and defining a combustion chamber (48);
 - a fluid passage (46) defined between the combustor body (34) and the combustor liner (43); and
 - an annular flow conditioning member (60) arranged in the fluid passage (46) and extending about the combustor liner (43).
2. The turbomachine combustor assembly according to claim 1, wherein the annular flow conditioning member (60) includes an external surface (64) and an internal surface (66) that defines an annular fuel plenum (70).
3. The turbomachine combustor assembly according to claim 2, wherein the external surface (64) of the annular flow conditioning member (60) includes an aerodynamic profile (75).
4. The turbomachine combustor assembly according to claim 3, wherein the aerodynamic (75) profile defines an airfoil (77).
5. The turbomachine combustor assembly according to any of claims 2 to 5, wherein the annular flow conditioning member (60) includes a plurality of openings (82) extending through the external (64) and internal surfaces (66), the plurality of openings (82) fluidly connecting the annular fuel plenum (70) and the fluid passage (46).
6. The turbomachine combustor assembly according to any of claims 2 to 5, further comprising: a fuel

delivery passage fluidly (93) connected to the annular fuel plenum (70).

7. The turbomachine combustor assembly according to any preceding claim, further comprising: a support member (87,89) extending between the combustor body (34) and the annular flow conditioning member (60). 5
8. The turbomachine combustor assembly according to claim 7, further comprising: another annular flow conditioning member (113) between the combustor liner (43) and the annular flow conditioning member (110). 10
9. The turbomachine combustor assembly according to any preceding claim, further comprising: another annular flow conditioning member (130) arranged in the fluid passage (46) and extending about the combustor liner (43). 15 20
10. The turbomachine combustor assembly according to claim 9, wherein the another annular flow conditioning member (113) extends about the annular flow conditioning member (110). 25
11. The turbomachine combustor assembly according to claim 9, wherein the another annular flow conditioning member (133) is arranged downstream relative to the annular flow conditioning member (130). 30
12. The turbomachine combustor assembly according to claim 11, wherein the another annular flow conditioning member (133) is arranged substantially coplanar relative to the annular flow conditioning member (130). 35
13. The turbomachine combustor assembly according to claim 11, wherein the another annular flow conditioning member (149) is axially off-set relative to the annular flow conditioning member (146). 40
14. A gas turbomachine system comprising:
 - a compressor portion; 45
 - a turbine portion operatively coupled to the compressor portion; and
 - a combustor assembly fluidly connecting the compressor portion and the turbine portion, the combustor assembly as recited in any of claims 1 to 13. 50

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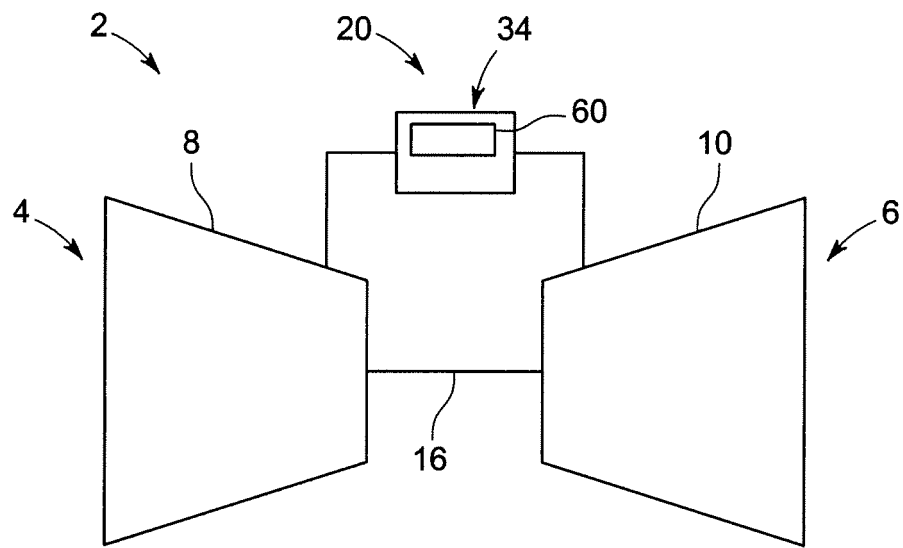


FIG. 1

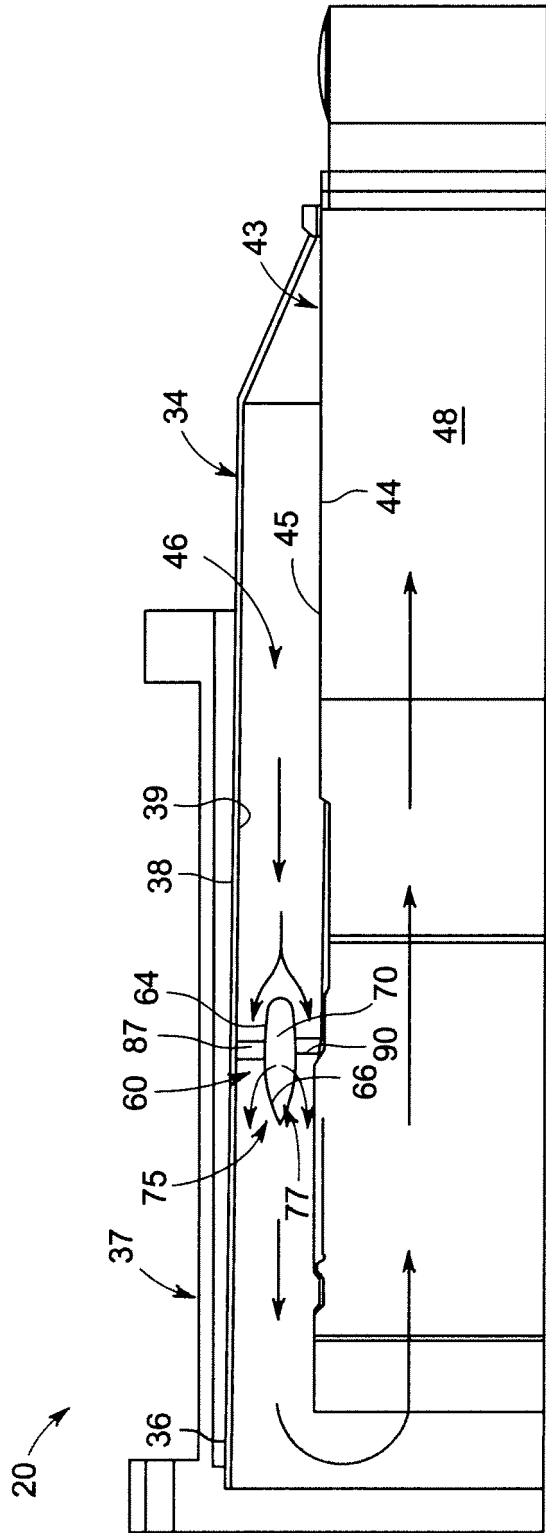


FIG. 2

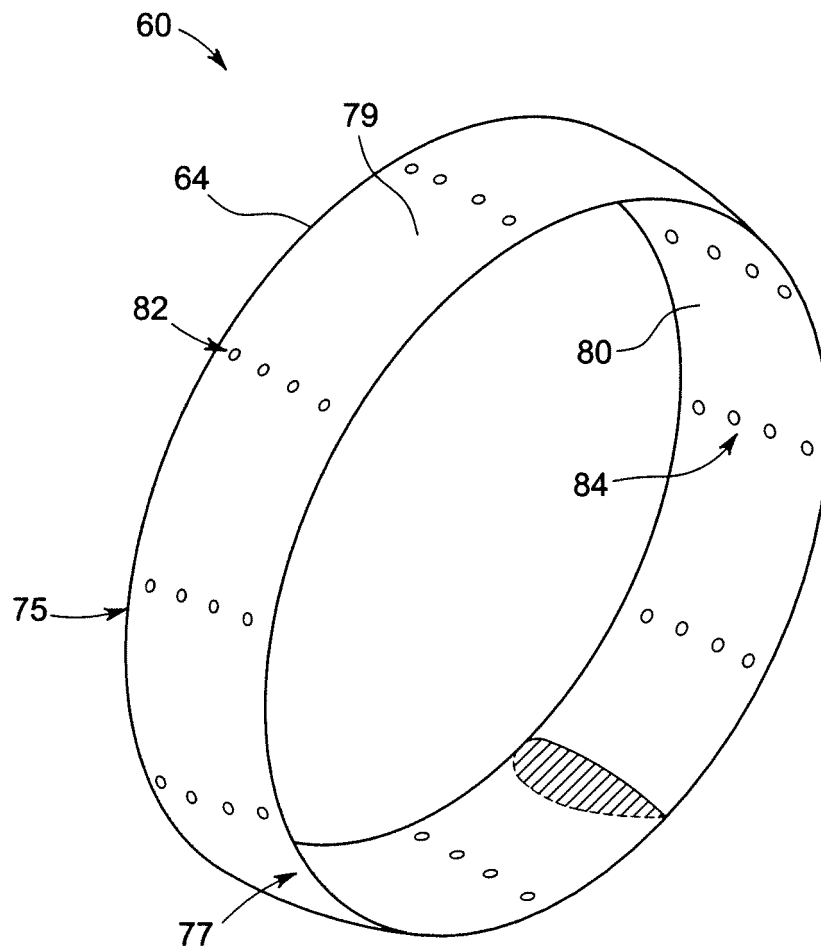


FIG. 3

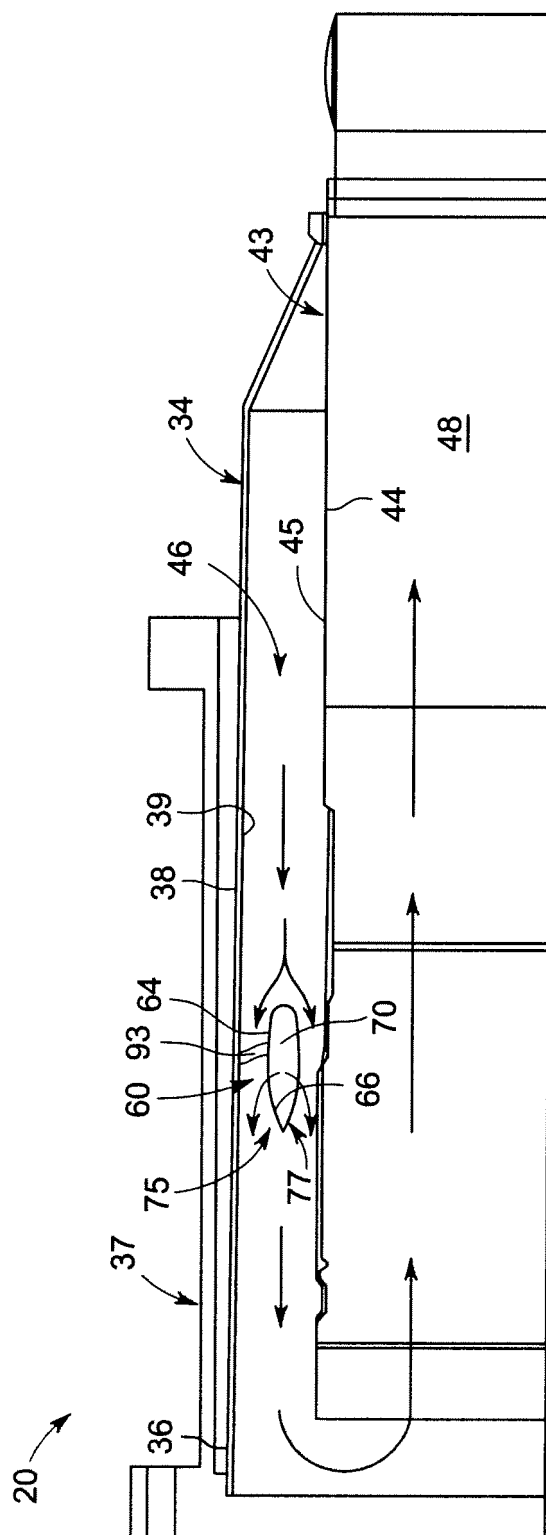


FIG. 4

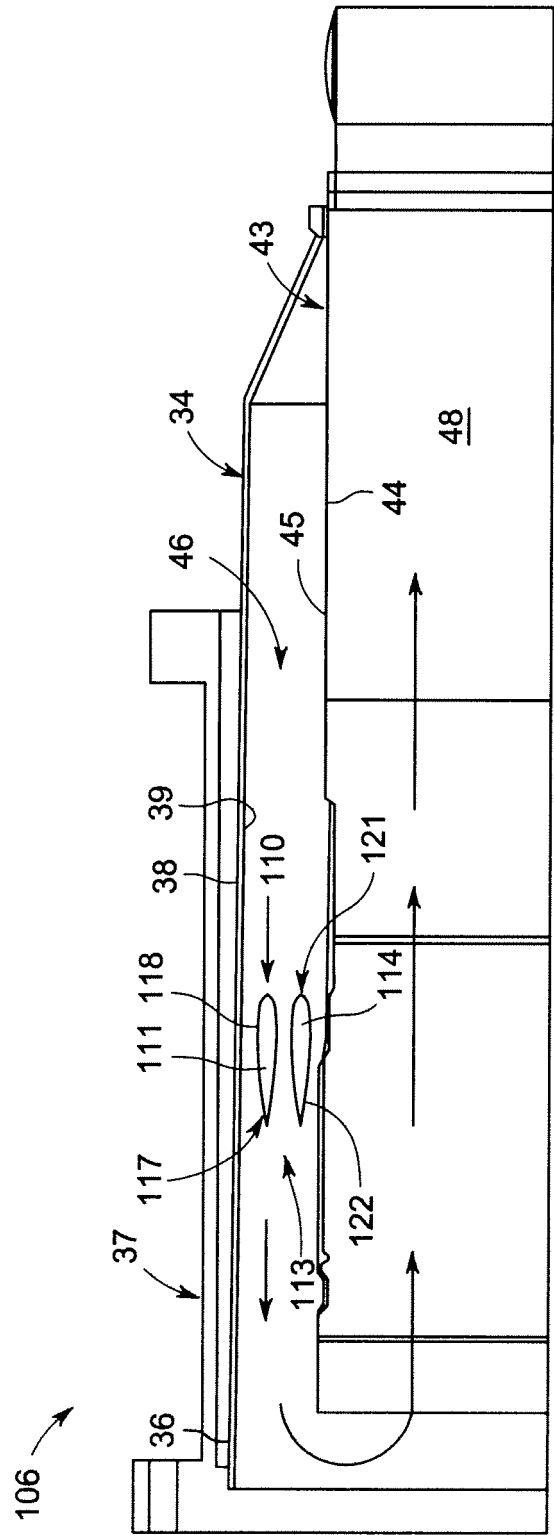


FIG. 5

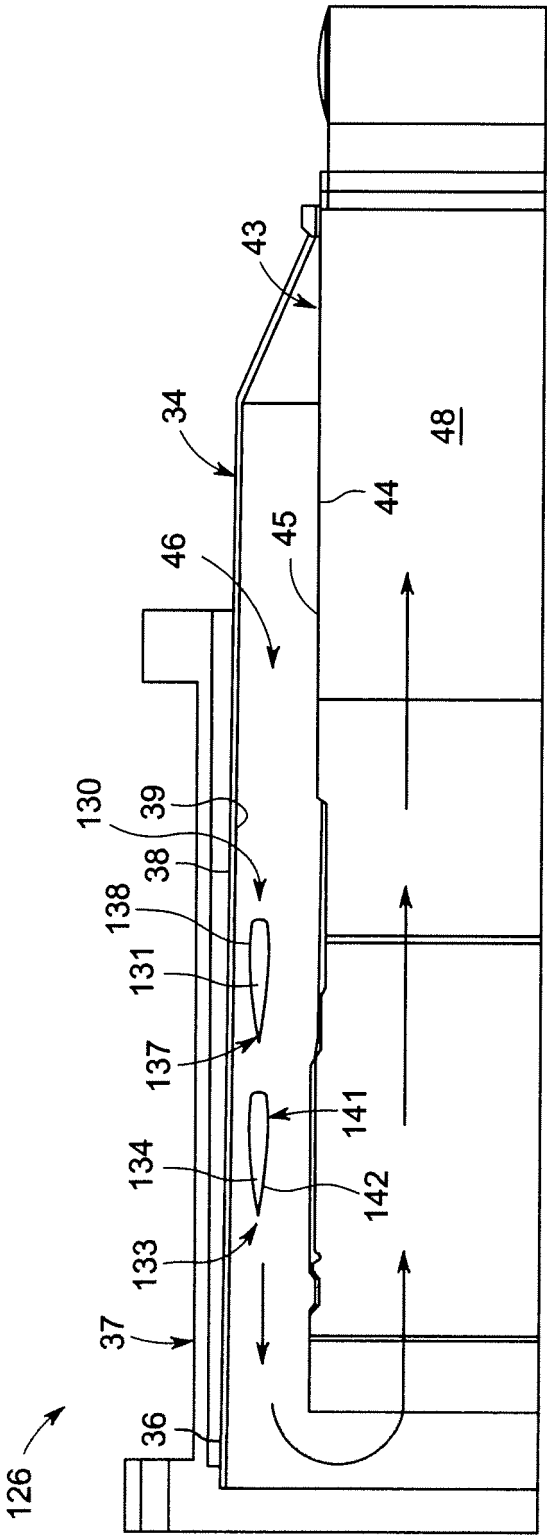


FIG. 6

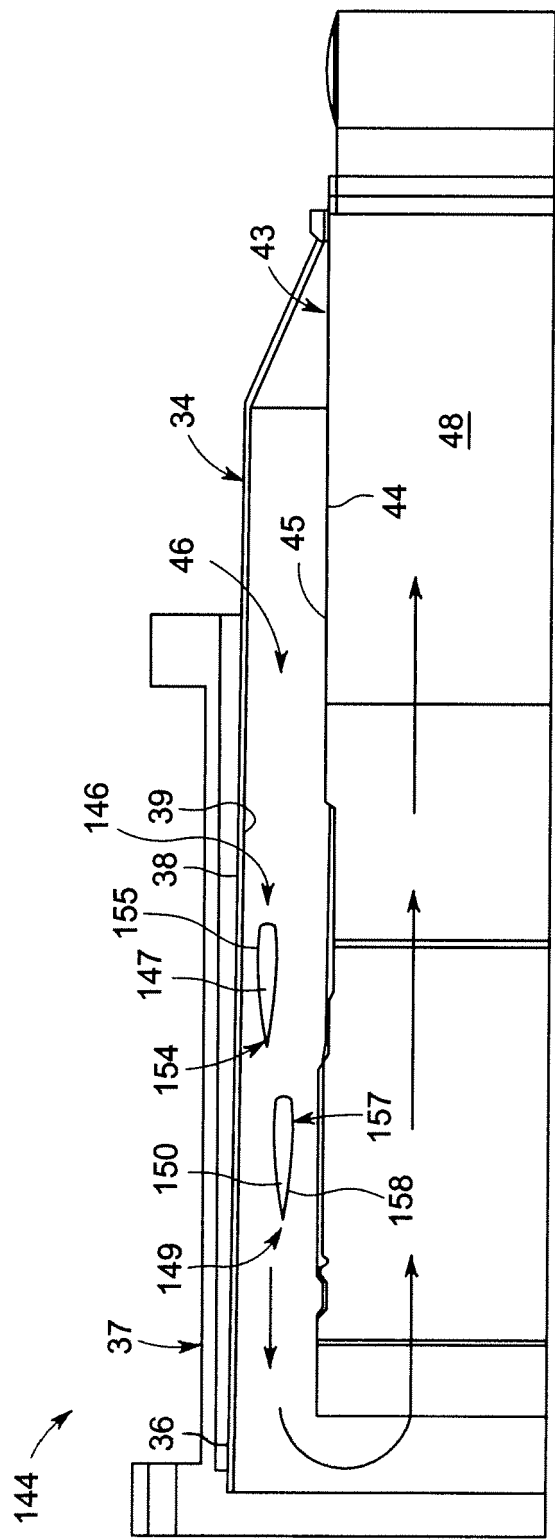


FIG. 7

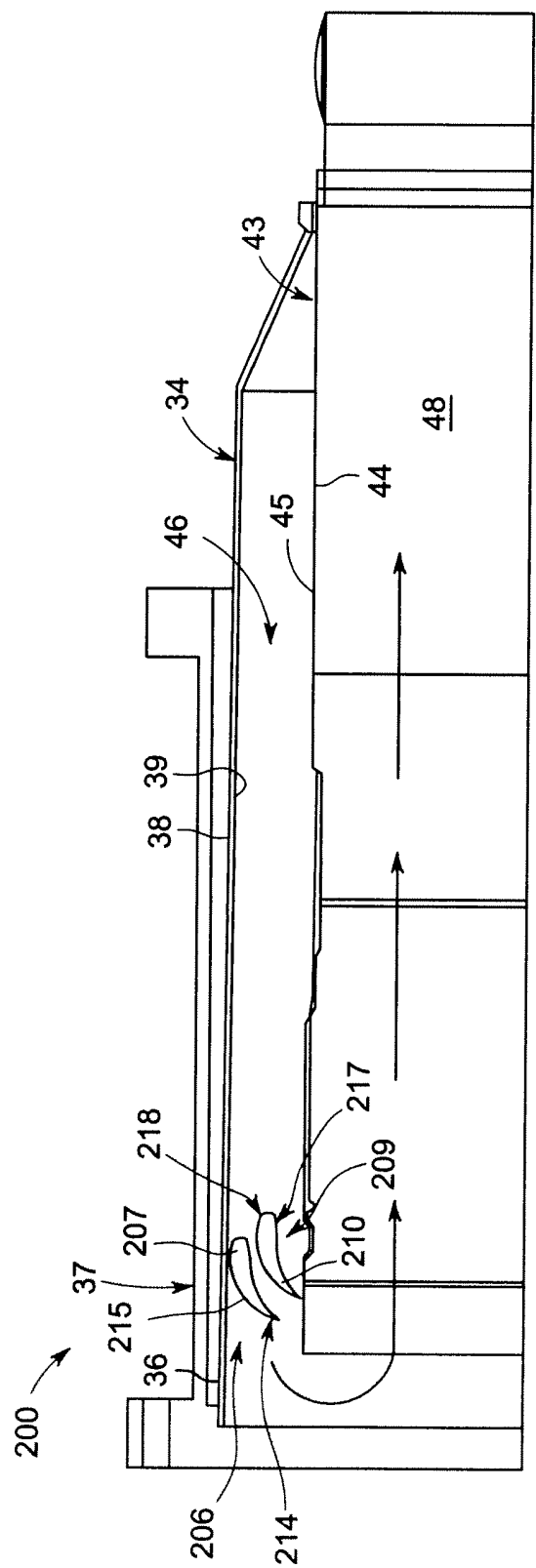


FIG. 8



EUROPEAN SEARCH REPORT

Application Number
EP 12 18 8187

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Place of search Munich		Date of completion of the search 24 January 2013	Examiner Gavriliu, Costin
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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