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(54) MIXER RETENTION

(57) Aspects of the disclosure are directed to methods and systems associated with a gas turbine engine of an aircraft. In some embodiments, a surface of a liner 208 of the gas turbine engine is coupled to a fuel/air mixer 202, and a surface of a panel 204 of the engine is coupled to the mixer 202 such that a portion of the mixer 202 is disposed between the liner surface and the panel surface.

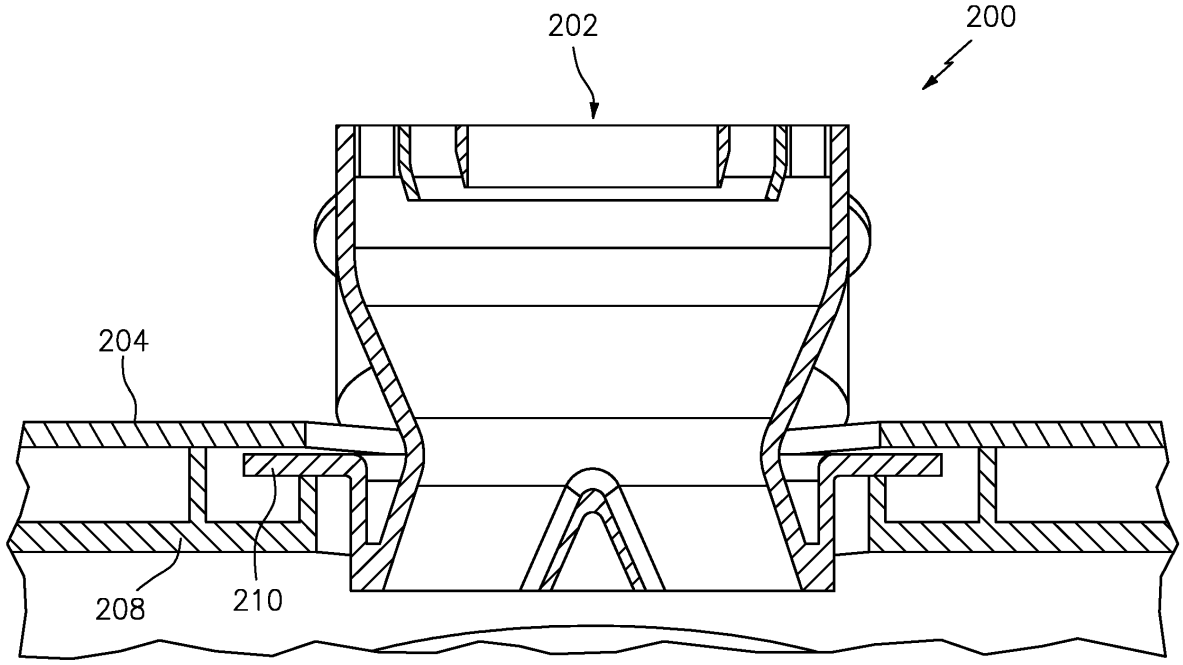

FIG. 2B

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Description

BACKGROUND

[0001] Mixers (e.g., swirlers) are used to mix reactants with one another. For example, mixers may assist in a mixing of air and fuel to facilitate combustion in an aerospace environment.

[0002] Typically, mixers are mounted to a bulkhead via brazing. Alternatively, a mechanical attachment technique can be used. Such mechanical attachment techniques include the use of straps to clamp down the mixer and a bolting to the bulkhead's heat shield studs. "Ears" can be added to the mixer such that the ears are retained by the heat shield studs.

[0003] Design requirements or constraints can influence the type of mounting that is used. For example, packaging constraints and a count of mixers used on a given platform may render conventional mounting techniques impractical.

BRIEF SUMMARY

[0004] The following presents a simplified summary in order to provide a basic understanding of some aspects of the disclosure. The summary is not an extensive overview of the disclosure. It is neither intended to identify key or critical elements of the disclosure nor to delineate the scope of the disclosure. The following summary merely presents some concepts of the disclosure in a simplified form as a prelude to the description below.

[0005] Aspects of the disclosure are directed to a method comprising: coupling a surface of a liner of a gas turbine engine of an aircraft to a fuel/air mixer, and coupling a surface of a panel of the engine to the mixer such that a portion of the mixer is disposed between the liner surface and the panel surface. In some embodiments, the method comprises coupling the panel to the liner. In some embodiments, the method comprises bolting the panel to at least one of the liner, the mixer, and a body of the aircraft. In some embodiments, the method comprises decoupling the panel from the mixer. In some embodiments, the method comprises servicing at least one of the liner and the mixer. In some embodiments, the servicing of the at least one of the liner and the mixer comprises repairing the at least one of the liner and the mixer. In some embodiments, the servicing of the at least one of the liner and the mixer comprises replacing the at least one of the liner and the mixer. In some embodiments, the method comprises recoupling the panel subsequent to the servicing. In some embodiments, the portion of the mixer that is disposed between the liner and the panel corresponds to a flange of the mixer.

[0006] Aspects of the disclosure are directed to a system comprising: a liner of a gas turbine engine of an aircraft, a panel of the engine, and a fuel/air mixer associated with a combustion chamber of the aircraft, wherein a portion of the mixer is disposed between a surface of the liner and a surface of the panel. In some embodiments, the liner comprises sheet metal. In some embodiments, the panel is at least one of cast and molded. In some embodiments, the portion of the mixer that is disposed between the liner and the panel comprises a flange of the mixer. In some embodiments, the mixer is configured to have a conical shape to match a conical shape of the panel. In some embodiments, the liner is configured to have a flat surface, and wherein the panel and the mixer are configured to have flat, circular shapes. In some embodiments, the mixer is a swirler.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The present disclosure is illustrated by way of example and not limited in the accompanying figures in which like reference numerals indicate similar elements.

FIGS. 1A-1B illustrate a retention system for a mixer in accordance with the prior art.

FIGS. 2A-2B illustrate a retention system for a mixer in accordance with aspects of the disclosure.

FIG. 3 illustrates a flow chart of an exemplary method in accordance with aspects of the disclosure.

FIG. 4 illustrates a gas turbine engine.

DETAILED DESCRIPTION

[0008] It is noted that various connections are set forth between elements in the following description and in the drawings (the contents of which are included in this disclosure by way of reference). It is noted that these connections are general and, unless specified otherwise, may be direct or indirect and that this specification is not intended to be limiting in this respect. A coupling between two or more entities may refer to a direct connection or an indirect connection. An indirect connection may incorporate one or more intervening entities.

[0009] In accordance with various aspects of the disclosure, apparatuses, systems and methods are described for retaining a mixer. A panel of, e.g., a bulkhead may be used as part of the mixer retention/sealing, allowing for a reduced packaging envelope. Accordingly, greater flexibility may be obtained in terms of mixer sizing and location. Mixers may be easily replaced in accordance with aspects of the disclosure, thereby reducing costs associated with maintenance.

[0010] Referring to FIG. 1A, a mixer system 100 is shown. The system 100 includes mixers 102. Due to spacing, or lack thereof, forming a sealing surface for the mixers 102 in a sheet metal liner 104 is not possible.

[0011] One or more retaining rings 106 are shown as being associated with the mixers 102. A retaining ring 106 requires brazing or welding, which represents a manufacturing cost. The brazing or welding also makes the

mixer 102 inseparable from the liner 104, which makes maintenance and replacement costly. For example, degradation or breakage experienced in the liner 104 and/or one or more of the mixers 102 results in the entirety of the liner 104 and mixers 102 having to be disposed of.

[0012] FIG. 1B represents another view of the system 100. As shown in FIG. 1B, the system 100 includes a panel 108. The panel 108 couples to the liner 104 and protects/shields the liner 104 from high temperatures experienced in a combustion chamber (not shown). As shown in FIG. 1B, a mixer 102 is coupled to the retaining ring 106 and the liner 104 via one or more lips/flanges 110, such that the flanges 110 are sandwiched/disposed in between the retaining ring 106 and the liner 104. Traversing the stack-up of entities in FIG. 1B in a bottom-to-top direction, the stack-up includes the panel 108, the liner 104, the mixer 102/flanges 110, and the retaining ring 106. In FIGS. 1A-1B the panel 108 does not play a role in the retention or sealing of the mixer 102.

[0013] Referring now to FIGS. 2A-2B, a mixer system 200 in accordance with aspects of the disclosure is shown. The system 200 may include one or more mixers 202. The mixers 202 may be substantially similar to a mixers 102 of FIGS. 1A-1B. For example, the mixers 202 may include one or more lips/flanges 210.

[0014] As seen in FIG. 2B, the flanges 210 are sandwiched/disposed in between a liner 204 and a panel 208. The panel 208, which may be cast or molded, can be used to incorporate the sealing surface at no added cost. Accordingly, the system 200 may have a reduced liner cost relative to the system 100 via the elimination of: (1) welding/machining and forming operations, and/or (2) retaining rings (e.g., retaining rings 106). The system 200 may also have a smaller or reduced profile relative to the system 100, thereby providing savings in terms of space. Traversing the stack-up of entities in FIG. 2B in a bottom-to-top direction, the stack-up includes the panel 208, the mixer 202/flanges 210, and the liner 204.

[0015] Replacement or re-working of the mixers 202 is easy relative to replacement of the mixers 102, as the panel 208 is bolted on. The mixers 202 may be removed at one or more inspection intervals and do not require a re-working or scrapping of the entirety of the liner 204 and the mixers 202 in the event of failure or degradation. In order to replace or service a mixer 202, the panel 208 can be removed, the mixer 202 may be accessed or replaced, and then the panel 208 can be reattached or bolted back on. Similarly, if the liner 204 needs to be scrapped or serviced the mixers 202 can be easily decoupled from the liner 204 to enable such operations.

[0016] In terms of a coupling between the panel 208 and the mixer 202, the panel 208 (which may correspond to the panel 108) may include a conical surface to accommodate or seat the mixer 202. In order to provide for a robust sealing between the panel 208 and the mixer 202, the mixer 202 may also be configured (e.g., machined/manufactured) to have a conical shape or geometry to match the panel 208. Additionally or alternatively, the liner 204 may be configured (e.g., coined/stamped) to have a flat, or planar, surface, allowing the panel 208 and the mixer 202 to be configured with flat, or planar, surfaces as well. In this version the sealing surfaces would be identical such that any orientation (rotated around a vertical axis at the center of the mixer in the orientation of FIG. 2B) of the mixer 202 to the panel 208 would provide face to face sealing. This planar sealing surface could be advantageous in ensuring a better seal since sealing would no longer be orientation dependent, and would be at the expense of adding more complexity into the liner forming process. The optimal shape may therefore be a trade of cost, packaging space and required sealing and may be optimized on a case by cases basis.

[0017] Referring to FIG. 3, a flow chart of a method 300 is shown. The method 300 may be executed for purposes of making a mixer system, such as the system 200 described above.

[0018] In block 302, one or more entities may be constructed. For example, a panel, a liner, and/or a mixer may be manufactured, machined, or assembled as part of block 302. The construction 302 may adhere to one or more requirements or specifications associated with the system. For example, device tolerances may be taken into consideration as part of block 302.

[0019] In block 304, the mixer and the liner may be coupled to one another. The coupling of block 304 may result in a lip/flange of the mixer abutting with the liner.

[0020] In block 306, the panel may be coupled (e.g., bolted) to one or more of the mixer, the liner, or a body (e.g., a body of an aircraft). The coupling of block 306 may result in a portion of the mixer (e.g., the lip/flange) being sandwiched/disposed between the liner and the panel.

[0021] In block 308, the panel may be decoupled from, e.g., the liner, the mixer or the body of the aircraft. Block 308 may be executed to facilitate maintenance/service activities with respect to, e.g., the liner or the mixer. Such maintenance/service activities may include a repair or replacement of one or more of the liner and the mixer.

[0022] In block 310, the panel may be recoupled to the mixer, the liner or the body subsequent to the maintenance/service activity of block 308.

[0023] Aspects of the disclosure may be applied in connection with a gas turbine engine. For example, FIG. 4 is a side-sectional illustration of a gas turbine engine 10. The engine 10 includes a compressor section 12, a turbine section 14 and one or more engine hot sections. The engine hot sections may include, for example, a first engine hot section 16 configured as a combustor section and a second engine hot section 18 configured as an augmentor section. The compressor section 12, the first engine hot section 16, the turbine section 14 and the second engine hot section 18 may be sequentially aligned along an axial centerline 20 between a forward engine airflow inlet 22 and an aft engine airflow exhaust 24.

[0024] Aspects of the disclosure have been described in terms of illustrative embodiments thereof. Numerous other embodiments, modifications, and variations within the scope and spirit of the appended claims will occur to persons of ordinary skill in the art from a review of this disclosure. For example, one of ordinary skill in the art will appreciate that the steps described in conjunction with the illustrative figures may be performed in other than the recited order, and that one or more steps illustrated may be optional in accordance with aspects of the disclosure.

Claims

1. A method comprising:

coupling a surface of a liner (204) of a gas turbine engine of an aircraft to a fuel/air mixer (202); and
coupling a surface of a panel (208) of the engine to the mixer (202) such that a portion of the mixer (202) is disposed between the liner surface and the panel surface.

2. The method of claim 1, further comprising:

coupling the panel (208) to the liner (204).

3. The method of claim 1 or 2, further comprising:

bolting the panel (208) to at least one of the liner (204), the mixer (202), and a body of the aircraft.

4. The method of claim 1, 2 or 3, further comprising:

decoupling the panel (208) from the mixer (202).

5. The method of claim 4, further comprising:

servicing at least one of the liner (204) and the mixer (202).

6. The method of claim 5, wherein servicing the at least one of the liner (204) and the mixer (202) comprises repairing or replacing the at least one of the liner (204) and the mixer (202).

7. The method of claim 5 or 6, further comprising:

recoupling the panel (208) subsequent to the servicing.

8. The method of any preceding claim, wherein the portion of the mixer (202) that is disposed between the liner (204) and the panel (208) corresponds to a flange (210) of the mixer (202).

9. A system comprising:

a liner (204) of a gas turbine engine of an aircraft;
a panel (208) of the engine; and
a fuel/air mixer (202) associated with a combustion chamber of the aircraft,
wherein a portion of the mixer (202) is disposed between a surface of the liner (204) and a surface of the panel (208).

10. The system of claim 9, wherein the liner (204) comprises sheet metal.

11. The system of claim 9 or 10, wherein the panel (208) is at least one of cast and molded.

12. The system of claim 9, 10 or 11, wherein the portion of the mixer (202) that is disposed between the liner (204) and the panel (208) comprises a flange (210) of the mixer (202).

13. The system of any of claims 9 to 12, wherein the mixer (202) is configured to have a conical shape to match a conical shape of the panel (208).

14. The system of any of claims 9 to 13, wherein the liner (204) is configured to have a flat surface, and wherein the panel (208) and the mixer (202) are configured to have flat, circular shapes.

15. The system of any of claims 9 to 14, wherein the mixer (202) is a swirler.

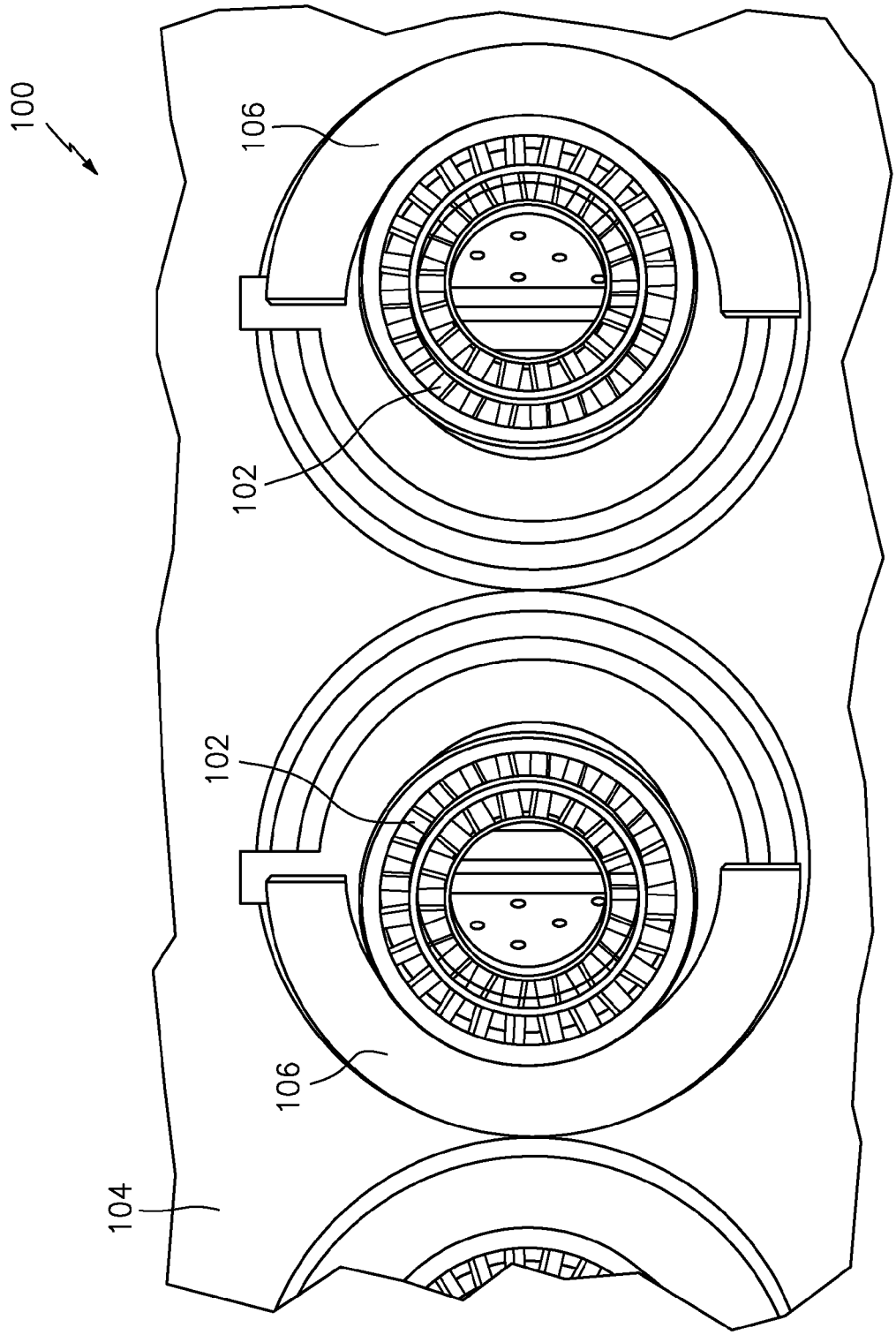

FIG. 1A
(PRIOR ART)

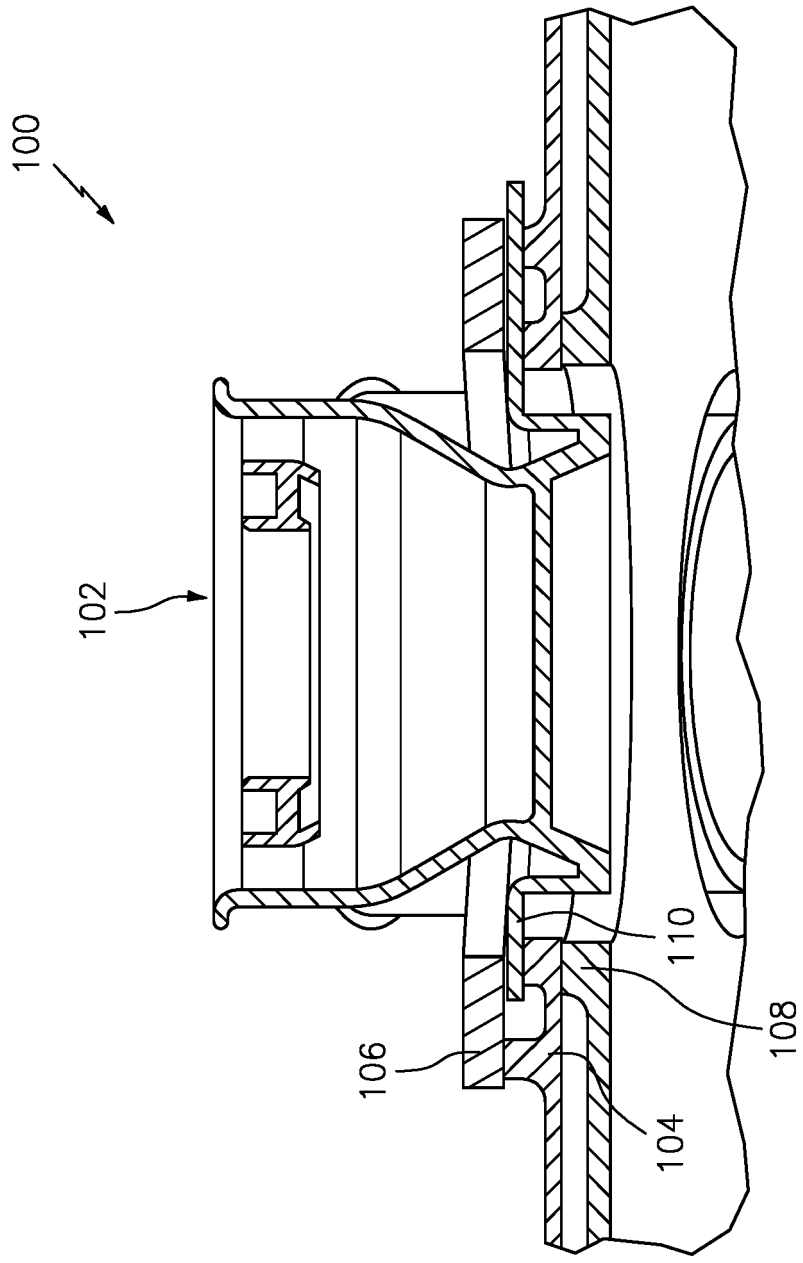

FIG. 1B
(PRIOR ART)

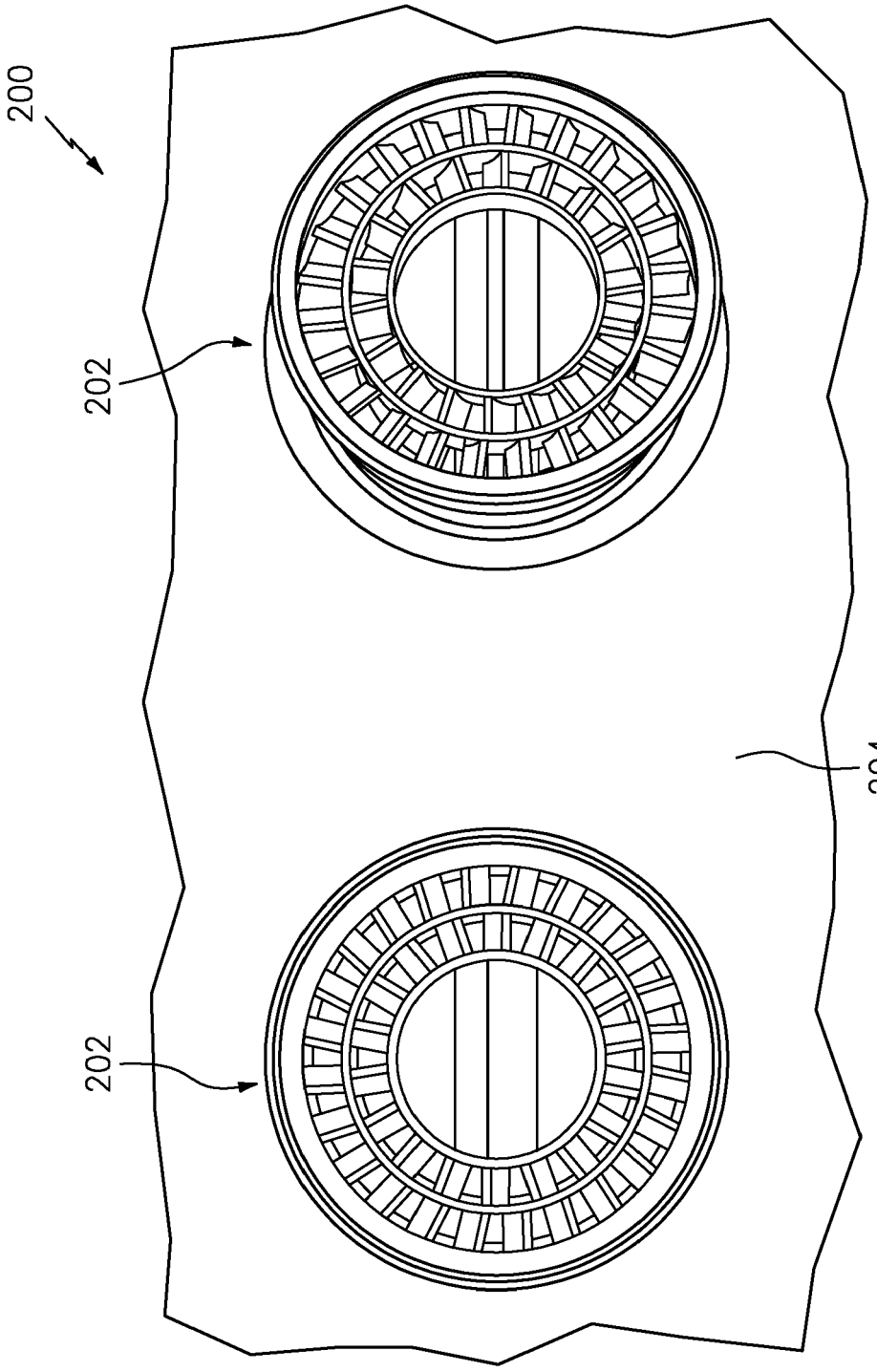

FIG. 2A

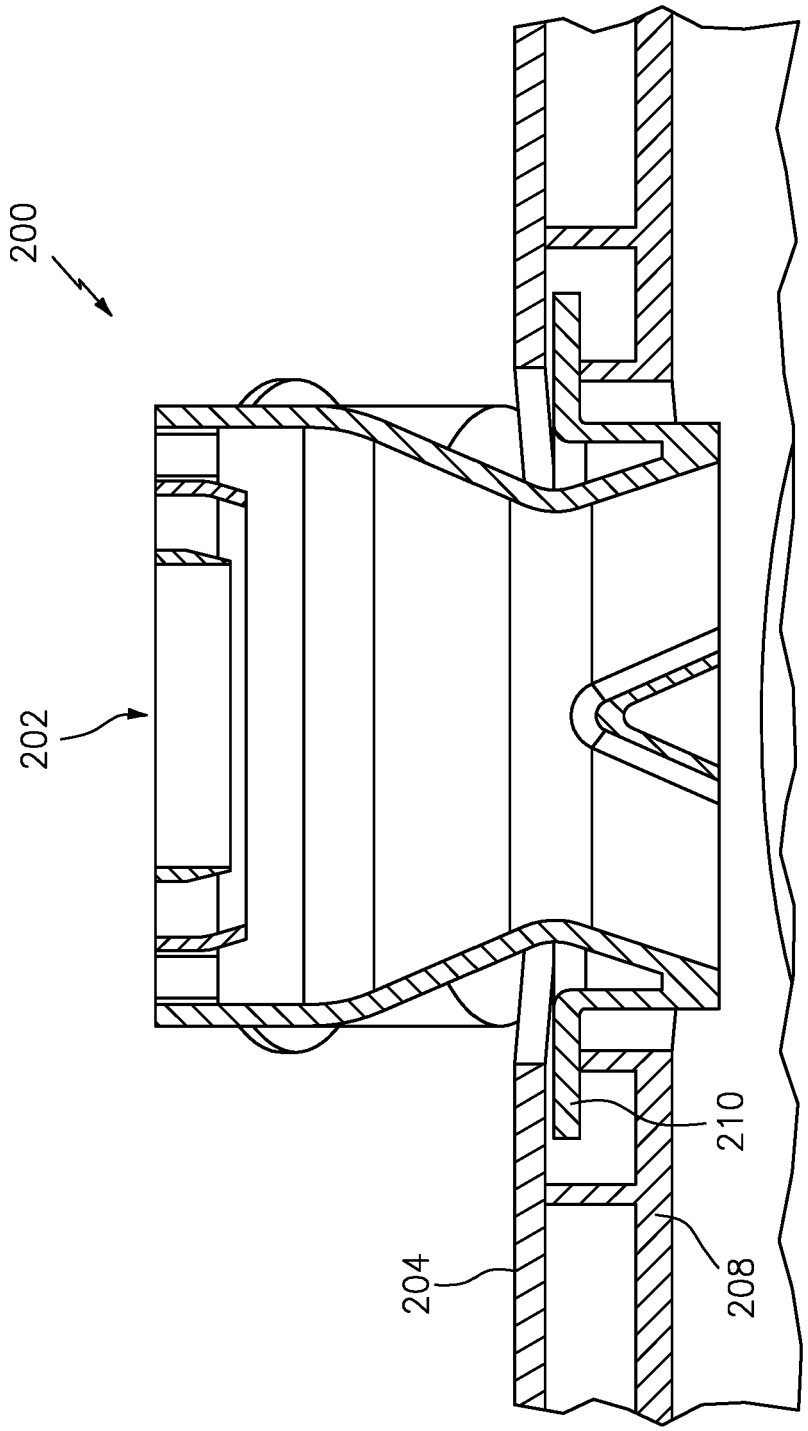

FIG. 2B

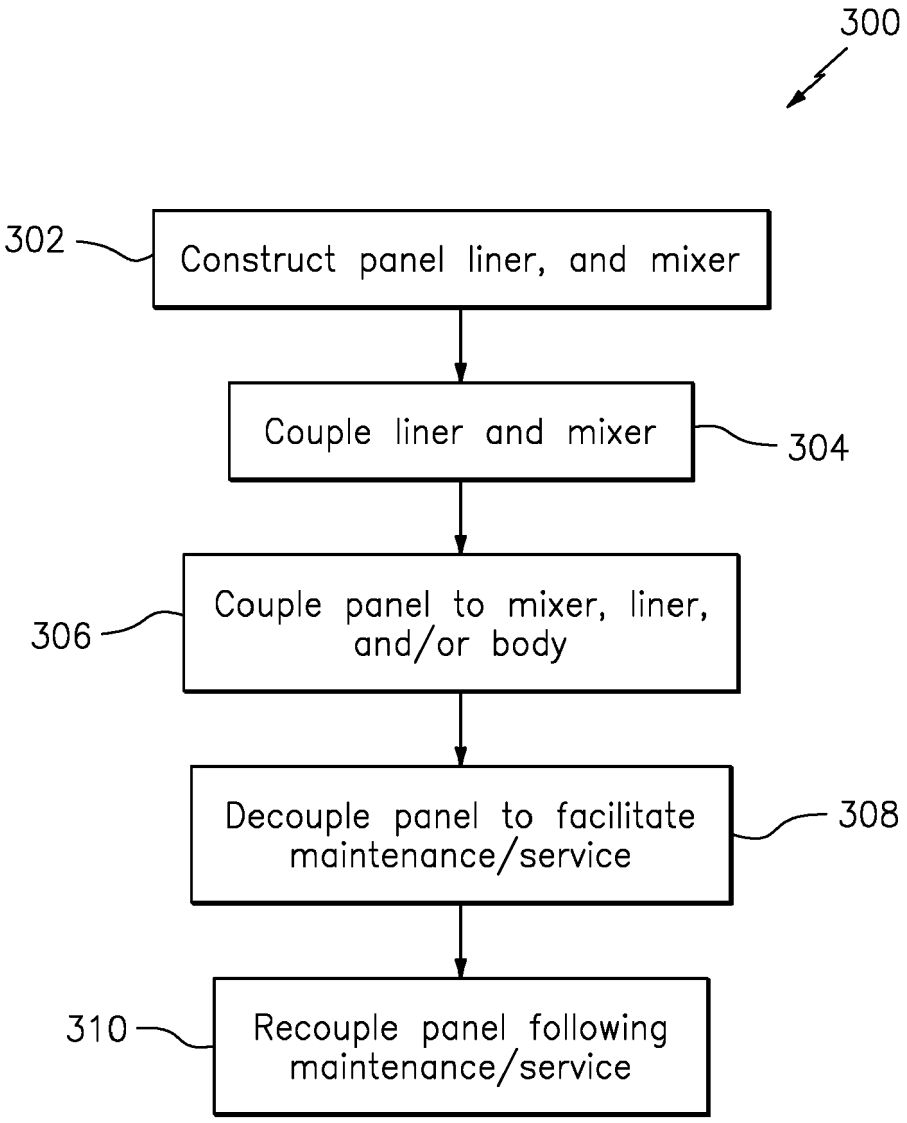
300
302
Construct panel liner, and mixer
Couple liner and mixer
304
306
Couple panel to mixer, liner, and/or body
Decouple panel to facilitate maintenance/service
308
310
Recouple panel following maintenance/service

FIG. 3

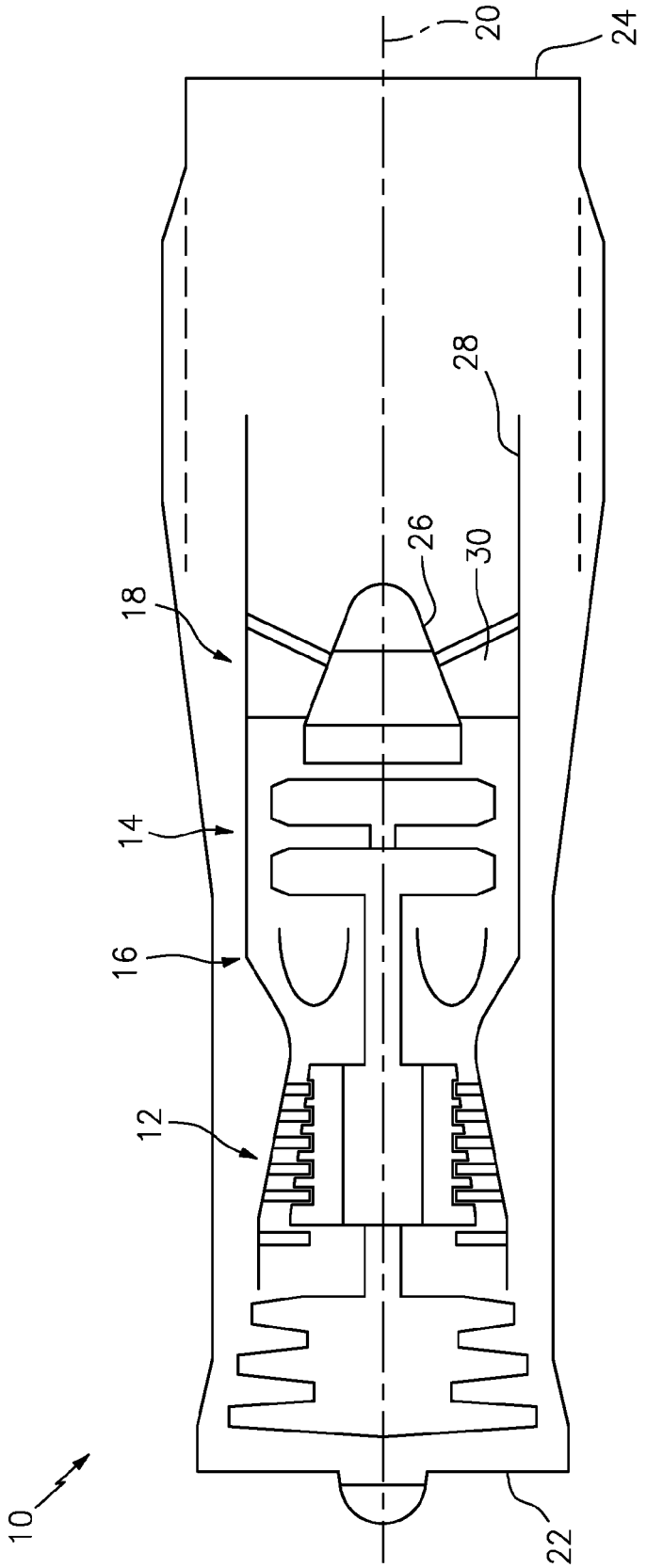

FIG. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 15 18 7480

DOCUMENTS CONSIDERED TO BE RELEVANT

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X Y	EP 2 518 408 A2 (ROLLS ROYCE PLC [GB]) 31 October 2012 (2012-10-31) * paragraphs [0022], [0023], [0025], [0030], [0034]; figures 2a,2b * -----	1-9,12, 14,15 13	INV. F23R3/14 F23R3/28 B23P6/00
Y	US 6 412 272 B1 (TITTERTON III GEORGE F [US] ET AL) 2 July 2002 (2002-07-02) * figure 1 * * column 2, line 16 - line 19 * * column 3, line 61 - line 67 * * column 4, line 61 - column 5, line 17 * -----	13	
X	US 2008/115499 A1 (PATEL BHAWAN B [CA] ET AL) 22 May 2008 (2008-05-22) * paragraphs [0019] - [0021]; figures 2,2b * -----	1-3, 8-12,14, 15	
X	GB 2 287 310 A (ROLLS ROYCE PLC [GB]) 13 September 1995 (1995-09-13) * figures 1,3a, 3b * * page 1, paragraph 2 * * page 4, paragraph 1 - page 5, paragraph 1 * -----	1-3,8,9, 12,14	TECHNICAL FIELDS SEARCHED (IPC) F23R B23P
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	27 January 2016	Mougey, Maurice

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 15 18 7480

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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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82