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(71) Applicant: **Ansaldo Energia Switzerland AG**
5401 Baden (CH)

(72) Inventors:
- **GAUPP, Christoph**
  8050 Zurich (CH)
- **BENZ, Urs**
  5073 Gipf-Oberfrick (CH)
- **MAURER, Michael**
  79713 Bad Säckingen (DE)

(74) Representative: **Andreotti, Erika et al**
Studio Torta S.p.A.
Via Viotti, 9
10121 Torino (IT)

(54) BURNER ASSEMBLY FOR A COMBUSTOR OF A GAS TURBINE POWER PLANT AND COMBUSTOR COMPRISING SAID BURNER ASSEMBLY

(57) A burner assembly for a combustor is provided with a pilot burner (2) extending along a longitudinal axis (A) and a premix burner (3) surrounding the pilot burner; the pilot burner (2) being integral with the premix burner (3).

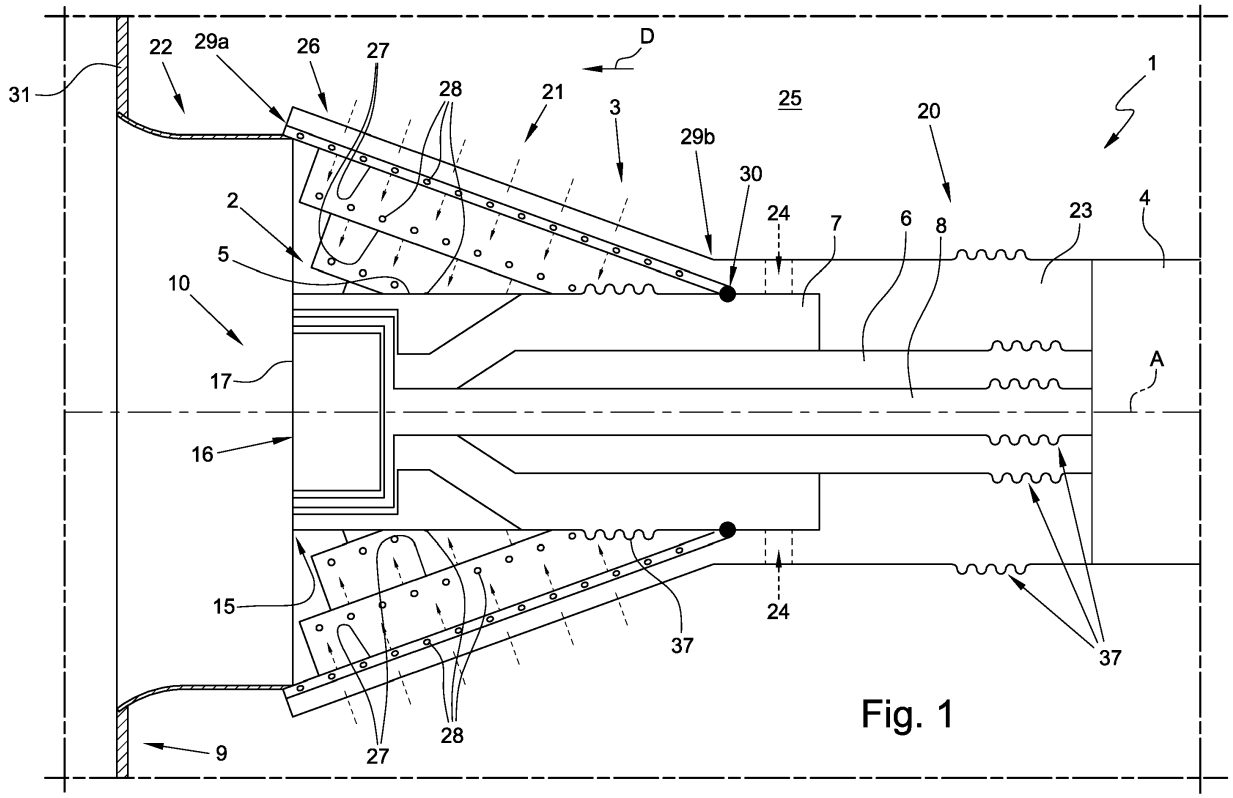

Fig. 1

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Description

Field of the Invention

[0001] The present invention relates to a burner assembly for a combustor of a gas turbine power plant.

[0002] Moreover, the present application refers to a combustor comprising said burner assembly.

Description of prior art

[0003] As known, a gas turbine power plant (in the following only gas turbine plant) comprises a rotor provided with an air compressor, with at least one combustor, which is arranged downstream of the compressor and fed with the air coming from the compressor, and with at least one gas turbine, which is arranged downstream of the combustor and fed with the gas coming from the combustor that has undergone combustion.

[0004] More in detail, the compressor comprises an inlet supplied with air and a plurality of blades and vanes configured for compressing the air entering the compressor. The compressed air leaving the compressor flows into a plenum and from there into at least one burner assembly of the combustor. Inside the burner assembly, the compressed air is mixed with at least one fuel. The mixture of such fuel and the compressed air is then combusted. The resulting hot gas leaves the combustor chamber and expands in the turbine performing work on the rotor.

[0005] The burner assembly used in gas turbine plants of the last generation are preferably of the premix type, as they are characterized by low emissions. This kind of burner assembly is known, for example from document US 2007/0231762. Said burner assembly comprises a premix burner and a pilot burner. The premix burner is configured so as to swirl incoming combustion air and mix it with the fuel into a premix region.

[0006] The pilot burner comprises a pilot lance centrally arranged in the burner assembly. At low operating loads, the pilot lance is configured to inject fuel into the combustion air axially in order to create fuel-rich zones ensuring that flame being not extinguished. At higher operating loads, the injection of fuel via the pilot lance is lowered in order to reduce pollutants, and the injection of fuel via the premix burner is increased.

[0007] The burner assemblies of this known type have a structure made of a plurality of component parts that need to be assembled together. Therefore the assembling of each burner assembly require several steps and is, consequently, highly burdensome.

[0008] An object of the present invention is therefore to provide a burner assembly for a combustor that enables avoiding, or at least mitigating, the described drawbacks.

[0009] In particular, it is an object of the present invention to provide a burner assembly which has a simplified structure in order to reduce the assembling costs and, at the same time, is sufficiently reliable.

[0010] According to the present invention, there is provided a burner assembly for a combustor comprising a pilot burner extending along a longitudinal axis; a premix burner surrounding the pilot burner; the pilot burner being integral with the premix burner.

[0011] In this way the structure of the burner assembly is noticeably simplified. The number of the component parts of the burner assembly is in fact reduced and the pilot burner has a reduced axial length with respect to the prior art solutions as the burner assembly can be fixed only to the combustor wall and the pilot burner and the premix burner do not need any more to be coupled to other fixed structures of the combustor (i.e. pressure vessel) or of the gas turbine plant as normally made in prior art solution. Thanks to the reduced axial length of the pilot burner, the thermal expansion displacement of the pilot burner are advantageously reduced. Moreover, the fact that the burner assembly can be fixed only to the combustor wall greatly simplifies the assembly operation with evident advantages in terms of saving costs and time.

[0012] According to a preferred embodiment of the present invention, the premix burner and the pilot burner are a monolithic body.

[0013] In this way also the assembling time and costs are noticeably reduced.

[0014] According to a preferred embodiment of the present invention, the premix burner and the pilot burner are two separated pieces fixed together.

[0015] According to a preferred embodiment of the present invention, the pilot burner is fixed to an inner surface of the premix burner.

[0016] According to a preferred embodiment of the present invention, the premix burner comprises an inlet portion coupled to a fuel supply assembly and an injection portion extending, in use, about the longitudinal axis and coupled to the inlet portion.

[0017] According to a preferred embodiment of the present invention, the injection portion is provided with a first end and a second end; the second end having a second section diameter lower than a first section diameter of the first end; the inlet portion being coupled to the second end.

[0018] According to a preferred embodiment of the present invention, the pilot burner is fixed to the inlet portion of the premix burner.

[0019] According to a preferred embodiment of the present invention, the pilot burner is fixed to the inlet portion of the premix burner along at least two contact zones axially displaced. In this way the fixing between the pilot burner and the premix burner is furthermore stable and reliable.

[0020] According to a preferred embodiment of the present invention, the pilot burner and the premix burner are fixed together so as to define a sliding interface between the pilot burner and the premix burner. In this way relative axial displacements due to thermal expansions

between the pilot burner and the premix burner are allowed.

[0021] According to a preferred embodiment of the present invention, the sliding interface is defined by an air gap between the pilot burner and the inlet portion of the premix burner.

[0022] According to a preferred embodiment of the present invention, the pilot burner comprises at least two concentric conduits; at least one of the conduits being provided with an extendible portion.

[0023] In this way relative axial displacements in the pilot burner due to thermal expansions are compensated.

[0024] According to a preferred embodiment of the present invention, the premix burner comprises at least one fuel supply conduit provided with a further extendible portion. In this way relative axial displacements in the premix burner due to thermal expansions are compensated.

[0025] A further object of the present invention is to provide a combustor for a gas turbine power plant having a simplified structure.

[0026] According to the present invention, there is provided a combustor for a gas turbine according to claim 12.

[0027] The present invention will now be described with reference to the accompanying drawings, which illustrate some non-limitative embodiment, in which:

- Figure 1 is a schematic section view, with parts removed for sake of clarity, of the burner assembly according to the present invention;
- Figure 2 is a schematic section view, with parts removed for sake of clarity, of the burner assembly according to a second embodiment of the present invention.

[0028] Reference number 1 in figure 1 indicate a burner assembly for a combustor 9 of a gas turbine power plant (here only partially illustrated).

[0029] Burner assembly 1 comprises a pilot burner 2 extending along a longitudinal axis A and a premix burner 3 extending about the pilot burner 2.

[0030] Pilot burner 2 and premix burner 3 are coupled to a fuel supply assembly 4 (schematically represented in the attached figures) which is connected to a respective fuel supply circuit (not illustrated). In the non-limiting here disclosed and illustrated, the fuel supply assembly 4 is arranged along the longitudinal axis A. However, variants of the fuel supply assembly 4 can be provided in order to supply the fuel from other sides of the burner assembly 1. For example, fuel supply assembly 4 can comprise metal rigid hoses or/and flexible hoses connected to the pilot burner 2 and to the premix burner 3.

[0031] The pilot burner 2 comprises a lance 5 which is provided with a first conduit 6 supplied, in use, with a first fuel, with a second conduit 7 supplied, in use, with air and with a third conduit 8 supplied, in use, with a second fuel.

[0032] Preferably the first fuel is gas and the second fuel is fuel oil.

[0033] Preferably the first conduit 6, the second conduit 7 and the third conduit 8 are concentric and extends about the longitudinal axis A.

[0034] In the non-limiting example here disclosed, the third conduit 8 extends along the longitudinal axis A, the first conduit 6 extends about the third conduit 8 and the second conduit 7 extends about the first conduit 6.

[0035] The first conduit 6 and the third conduit 8 are supplied with the respective first fuel and second fuel by the fuel supply assembly 4. In particular the fuel is supplied along a flow direction D (indicated by an arrow in figures 1 and 2) towards the inside of the combustor 9.

[0036] The second conduit 7 has an axial length lower than the axial length of the first conduit 6 and the third conduit 8.

[0037] The lance 5 has an end tip 10 which faces inside the combustor 9.

[0038] The lance 5 is schematically represented in the attached drawings. Preferably the lance 5 is provided with a plurality of first nozzles (not illustrated) connected to the first conduit 6, with a plurality of second nozzles (not illustrated) connected to the second conduit 7 and with a plurality of third nozzles (not illustrated) connected to the third conduit 8.

[0039] The lance end tip 10 has preferably a circular section and is provided with a circular edge 15. The end tip 10 comprises an end surface 16 which is defined by a respective end wall 17 and is preferably planar.

[0040] The premix burner 3 extends about the pilot burner 2 and substantially comprises an inlet portion 20 coupled to the supply assembly 4, an injection portion 21 coupled to the inlet portion 20 and an outlet portion 22 coupled to the injection portion 21 and to the combustor 9.

[0041] The inlet portion 20 comprises a fuel supply conduit 23 which is preferably annular and extends about a respective inlet portion of the pilot burner 2.

[0042] The dimensions of the fuel supply conduit 23 are designed so as to allow an easy insertion of the pilot burner 2 into the substantially cylindrical seat defined by the fuel supply conduit 23.

[0043] The fuel supply conduit 23 is supplied with fuel by the fuel supply assembly 4 along a flow direction D (indicated by an arrow in figures 1 and 2) towards the inside of the combustor 9. The fuel supplied to the fuel supply conduit 23 is gas.

[0044] In the fuel supply conduit 23 are arranged a plurality of air inlet channels 24 (represented in dotted lines) which are configured to supply air to the second conduit 7 of the pilot burner 2. The air supplied through the air inlet channels 24 is air collected in a plenum 25 (only partially visible in the drawings) in communication with the outlet of the compressor of the plant.

[0045] The injection portion 21 is preferably defined by a truncated-cone shaped swirler 26 provided with air slots 27 (the air slots are not well visible in the attached drawings - dotted arrows indicate the air flowing through said air slots) and fuel nozzles 28.

[0046] The air slots 27 are supplied with the air collected in the plenum 25 in communication with the outlet of the compressor of the plant.

[0047] Fuel nozzles 28 are supplied with fuel by the fuel supply conduit 23.

[0048] The injection portion 21 is provided with a first end 29a and a second end 29b; the second end 29b having a section diameter lower than the section diameter of the first end 29a.

[0049] The inlet portion 20 is coupled to the second end 29b, while the outlet portion 22 is coupled to the first end 29a.

[0050] Preferably, the injection portion 21 is made by two shells assembled together.

[0051] The outlet portion 22 has preferably a cylindrical shape and is generally defined as CBO (cylindrical burner outlet). The outlet portion 22 is coupled to a wall 31 of the combustor 9.

[0052] The pilot burner 2 and the premix burner 3 are integral.

[0053] In other words, the pilot burner 2 and the premix burner 3 are rigidly fixed together.

[0054] Preferably, the pilot burner 2 is fixed to at least a portion of an inner surface of the premix burner 3. The inner surface of the premix burner 3 is the surface of the premix burner 3 facing, in use, the pilot burner 2.

[0055] In the non-limiting example here disclosed and illustrated, the premix burner 3 and the pilot burner 2 are two separated pieces fixed together. Preferably, the premix burner 3 and the pilot burner 2 are directly fixed together.

[0056] According to an embodiment not illustrated, the premix burner 3 and the pilot burner 2 can be made as a monolithic body. For example, the monolithic body can be obtained by additive manufacturing or by casting processes.

[0057] In detail, the pilot burner 2 is fixed to the inlet portion 20 of the premix burner 3. In particular, the outer surface of the pilot burner 2 is fixed to the inner surface of the inlet portion 20 of the premix burner 3.

[0058] In the non-limiting example illustrated in figure 1, the outer surface of the second conduit 7 is fixed to the inner surface of the inlet portion 20.

[0059] Preferably, the outer surface of the second conduit 7 is fixed to the inner surface of the inlet portion 20 at the boundary with the injection portion 21.

[0060] Preferably, the fixing of the pilot burner 2 is made along at least one contact zone 30 (schematically represented in the attached figure by a black dot) of the inner surface of the inlet portion 20.

[0061] The fixing of the pilot burner 2 to the inner surface of the inlet portion 20 can be made, for example, by welding, by bolts or by clamping means, by casting of by additive manufacturing.

[0062] According to a variant illustrated in figure 2, the pilot burner 2 and the premix burner 3 are fixed together so as to define a sliding interface 35 between the pilot burner 2 and the inlet portion 20 of the premix burner 3.

[0063] Said sliding interface 35 allows relative axial movements between the pilot burner 2 and the premix burner 3 due to thermal expansions.

[0064] In the non-limiting example here disclosed and illustrated, the sliding interface 35 is defined by an air gap 36 between the pilot burner 2 and the inlet portion 20 of the premix burner 3.

[0065] Preferably, the sliding interface 35 is defined by an air gap 36 between the outer surface of the second conduit 7 and the inner surface of the inlet portion 20 of the premix burner 3.

[0066] The air gap 36 is preferably arranged along the inlet portion 20 near the injection portion 21.

[0067] The outer surface of the pilot burner 2 is fixed to the inner surface of the inlet portion 20 of the premix burner 3.

[0068] In the non-limiting example illustrated in figure 2, the outer surface of the first conduit 6 is fixed to the inner surface of the inlet portion 20.

[0069] Preferably, the inner surface of the inlet portion 20 is fixed to the outer surface of the first conduit 6 near the beginning of the second conduit 7.

[0070] Analogously to the embodiment of figure 1, the fixing of the pilot burner 2 is made along at least one contact zone 30 (schematically represented in the attached figure by a black dot) of the inner surface of the inlet portion 20.

[0071] The fixing of the pilot burner 2 to the inner surface of the inlet portion 20 can be made, for example, by welding, by bolts or by clamping means, by casting of by additive manufacturing.

[0072] According to one variant not illustrated, the fixing of the pilot burner 2 to the premix burner 3 can be made along at least two contact zones axially displaced in order to ensure a more stable coupling. For example, the pilot burner 2 and the premix burner 3 can be coupled according to a combination of the coupling illustrated in figure 1 and figure 2.

[0073] With reference to both the embodiments of figure 1 and figure 2 the first conduit 6, the second conduit 7 and the third conduit 8 of the pilot burner 2 and the fuel supply conduit 23 of the premix burner 3 are provided with at least one extendible portion 37.

[0074] These extendible portions 37 can be provided in order to compensate the axial displacement due to thermal expansions of the first conduit 6, the second conduit 7 and the third conduit 8 of the pilot burner 2 and of the fuel supply conduit 23 of the premix burner 3.

[0075] In the embodiment shown in figure 2, wherein a sliding interface 35 is provided between the pilot burner 2 and the inlet portion 20 of the premix burner 3, the second conduit 7 does not require the extendible portion as the thermal expansions are compensated by the sliding between the pilot burner 2 and the inlet portion 20 of the premix burner 3.

[0076] In the non-limiting example here disclosed and illustrated, the extendible portions 37 are defined by a corrugated portions of the conduit.

[0077] According to a variant not illustrated, the extendible portions can be defined by a helical wrapped portion of the conduit.

[0078] Finally, it is clear that modifications and variants can be made to the burner assembly and to the combustor described herein without departing from the scope of the present invention, as defined in the appended claims.

Claims

1. Burner assembly for a combustor (9) comprising:

   a pilot burner (2) extending along a longitudinal axis (A);
   a premix burner (3) surrounding the pilot burner (2);
   the pilot burner (2) being integral with the premix burner (3).

2. Burner assembly according to claim 1, wherein the premix burner (3) and the pilot burner (2) are a monolithic body.

3. Burner assembly according to claim 1, wherein the premix burner (3) and the pilot burner (2) are two separated pieces fixed together.

4. Burner assembly according to anyone of the foregoing claims, wherein the pilot burner (2) is fixed to an inner surface of the premix burner (3).

5. Burner assembly according to claim 3 or 4, wherein the premix burner (3) comprises an inlet portion (20) coupled to a fuel supply assembly (4) and an injection portion (21) extending, in use, about the longitudinal axis (A) and coupled to the inlet portion (20).

6. Burner assembly according to claim 5, wherein the injection portion (21) is provided with a first end (29a) and a second end (29b); the second end (29b) having a second section diameter lower than a first section diameter of the first end (29a); the inlet portion (20) being coupled to the second end (29b).

7. Burner assembly according to claim 5 or 6, wherein the pilot burner (2) is fixed to the inlet portion (20) of the premix burner (3).

8. Burner assembly according to claim 7, wherein the pilot burner (2) is fixed to the inlet portion (20) of the premix burner (3) along at least two contact zones axially displaced.

9. Burner assembly according to anyone of the claims from 4 to 8, wherein the pilot burner (2) and the premix burner (3) are fixed together so as to define a sliding interface (35) between the pilot burner (2) and the premix burner (3).

10. Burner assembly according to claim 9, wherein the sliding interface (35) is defined by an air gap (36) between the pilot burner (2) and the inlet portion (20) of the premix burner (3).

11. Burner assembly according to anyone of the foregoing claims, wherein the pilot burner (2) comprises at least two concentric conduits (7; 8; 9); at least one of the conduits (7; 8; 9) being provided with an extendible portion (37).

12. Burner assembly according to anyone of the foregoing claims, wherein the premix burner (3) comprises at least one fuel supply conduit (23) provided with a further extendible portion (37).

13. Combustor for a gas turbine power plant comprising the burner assembly (1) claimed in anyone of the foregoing claims.

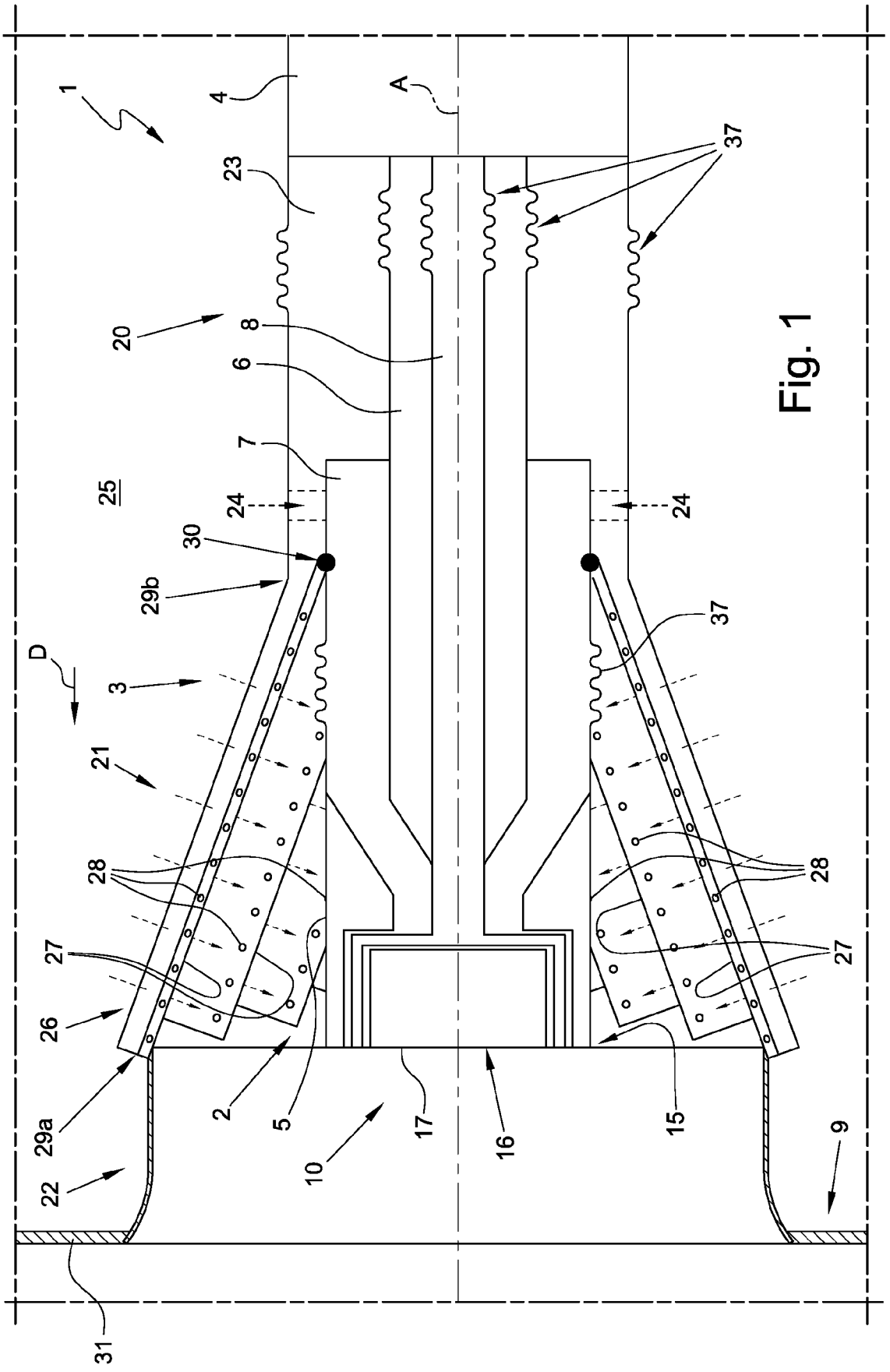
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Fig. 1

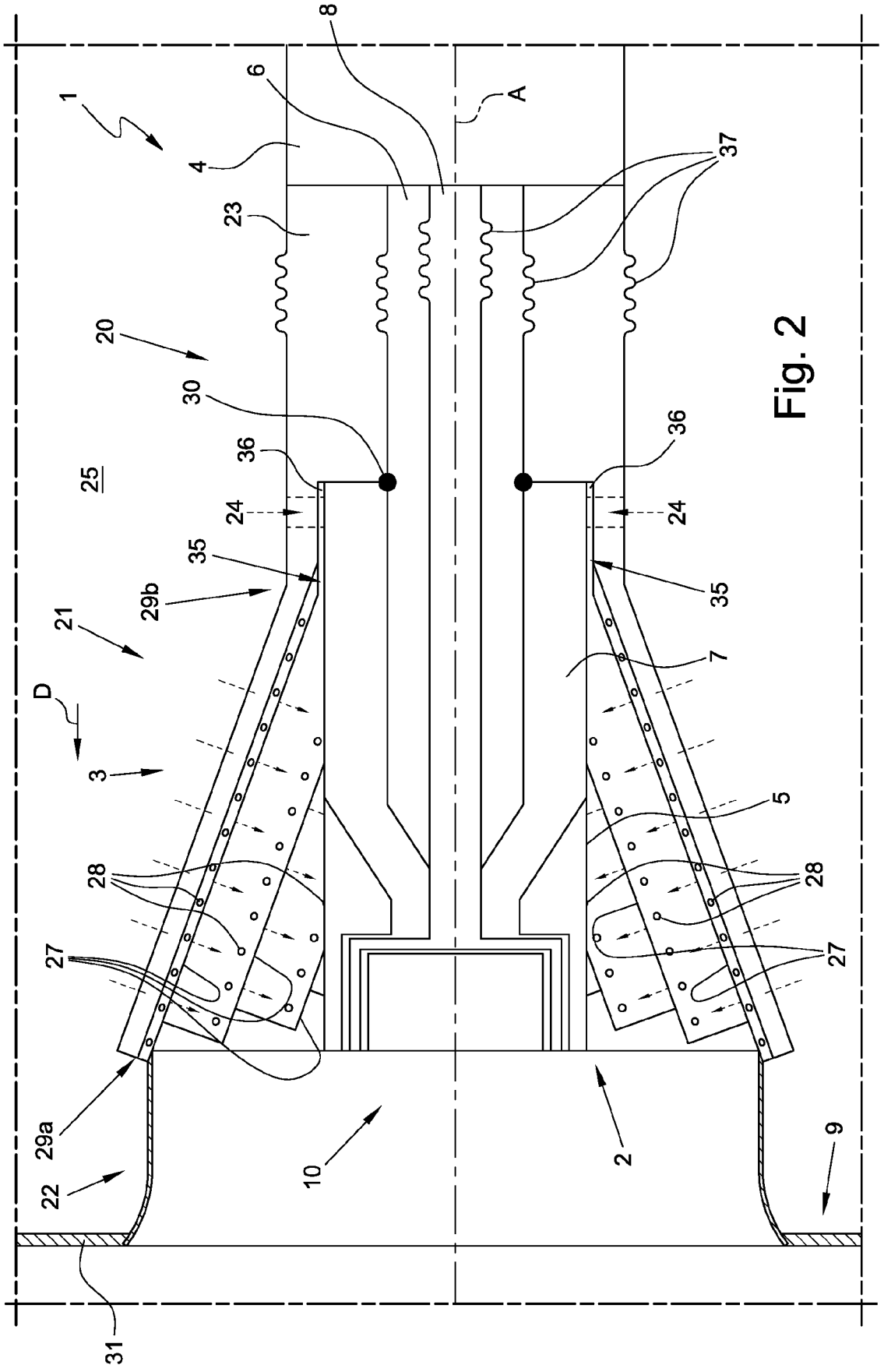
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Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 17 15 5917

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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
Munich	7 July 2017	Gavriliu, Costin

CATEGORY OF CITED DOCUMENTS

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