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(54) **LANCE FOR A BURNER AND METHOD FOR RETROFITTING A LANCE**

(57) The lance (6) comprises a duct (10) having at least a nozzle (12), a sleeve (13) around the duct (10), the sleeve (13) having at least a nozzle (14), the nozzle (12) of the duct (10) and the nozzle (14) of the sleeve (13) are aligned. The sleeve (13) has a terminal portion (20) closed by a cap (21) having a pin (22), the duct (10) has a hole (23), the pin (22) is form fittingly inserted into the hole (23). The method for retrofitting the lance comprises removing the closed terminal portion of the sleeve, providing a cap (21) having a pin (22), providing a hole (23) in the duct (10), form fittingly inserting the pin (22) into the hole (23), connecting the cap (21) to the sleeve (13).

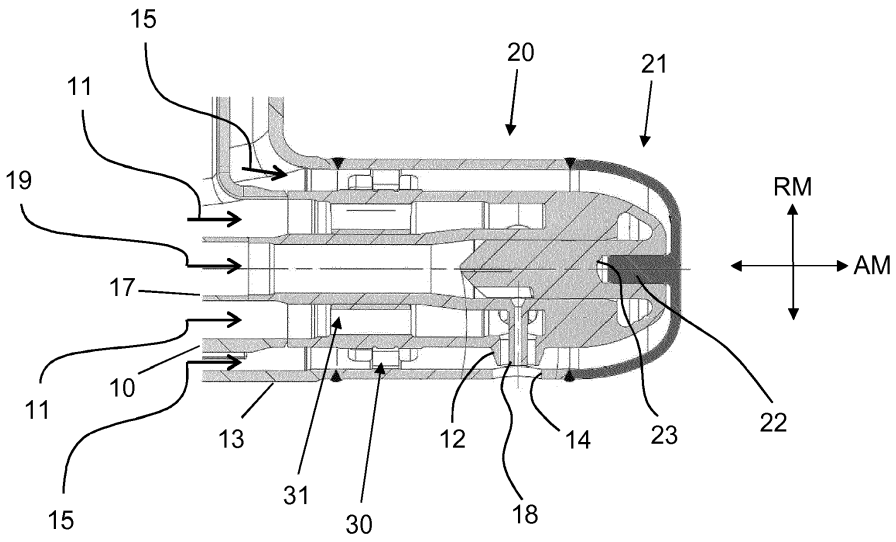

Fig. 2

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Description

TECHNICAL FIELD

[0001] The present invention relates to lance for a burner and a method for retrofitting a lance.

BACKGROUND

[0002] Burners, in particular those of the reheat type, can comprise a body, through which a hot gas flow can flow through, and a lance protruding into the body for injecting fuel into the hot gas flow.

[0003] The lance can have a duct for a first fuel and nozzles for injecting it. The lance can further comprise a sleeve encircling the duct and provided with nozzles as well; the nozzles of the sleeve are aligned with the nozzles of the duct.

[0004] The lance can further comprise an inner duct, provided inside of the duct for injecting a second fuel, typically different from the fuel passing through the duct, via nozzles. The nozzles of the inner duct are also aligned with the nozzles of the duct and nozzles of the sleeve.

[0005] During operation, fuel is supplied via the inner duct or via the duct and at the same time air is supplied via the sleeve, such that fuel (from the inner duct or from the duct) is injected together with shielding air (via the sleeve).

[0006] During operation in order to guarantee correct operation of the burner, it is important that the nozzles of the inner duct, nozzles of the duct and nozzles of the sleeve are aligned.

[0007] Nevertheless, because of the construction the alignment of the nozzles can be lost during operation.

SUMMARY

[0008] An aspect of the invention includes providing a lance and a method by which the alignment of the nozzles through which fuel and shielding air is injected is improved compared to existing lances.

[0009] These and further aspects are attained by providing a lance and a method in accordance with the accompanying claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Further characteristics and advantages will be more apparent from the description of a preferred but non-exclusive embodiment of the lance and method, illustrated by way of non-limiting example in the accompanying drawings, in which:

Figure 1 shows a burner having the lance;
Figure 2 shows a portion of the lance;
Figure 3 shows a portion of another embodiment of the lance;
Figure 4 shows a cap;
Figures 5 through 8 show the steps of a first embodiment of the method;
Figures 9 through 12 show the steps of the method in another embodiment.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0011] With reference to the figures, these show a burner, preferably of a gas turbine.

[0012] The gas turbine can comprise, in sequence, a compressor, a first combustion chamber, a second combustion chamber and a turbine. Between the first and the second combustion chambers a high pressure turbine and/or a mixer for supplying diluting air can be provided.

[0013] During operation, air is compressed at the compressor and is supplied into the first combustion chamber, where fuel is supplied and combusted with the compressed air, generating hot gas. The hot gas can be partially expanded in a high pressure turbine and/or can be diluted with air in a mixer (according to the scheme of the gas turbine) and is then supplied into the second combustion chamber. At the second combustion chamber further fuel is injected and combusted with the residual oxygen contained in the hot gas after the combustion in the first combustion chamber; the hot gas emerging from the second combustion chamber is expanded in the turbine.

[0014] The second combustion chamber is schematically shown in figure 1 and it is identified with reference 1.

[0015] The second combustion chamber 1 comprises a burner 2 and a combustion area 3. The burner 2 has a tubular body 4 with vortex generators 5 at its entrance to increase vorticity of the hot gas, and a lance 6 for injecting fuel. Reference 7 in figure 1 identifies the flame.

[0016] The lance 6 has a duct 10 for carrying a fuel 11, typically gas, and one or preferably more than one nozzles

12, for injecting the fuel 11.

[0017] The lance 6 also has a sleeve 13, provided around the duct 10, preferably concentrically; the sleeve 13 defines a channel between the duct 10 and the sleeve 13 and has one or preferably more than one nozzles 14. The sleeve 13 carries air 15, that is injected through the nozzles 14 as shielding air.

[0018] The nozzles 12 of the duct 10 and the nozzle 14 of the sleeve 13 are aligned, e.g. their axes substantially overlap.

[0019] The lance 6 can also have an inner duct 17 inside the duct 10; preferably the inner duct 17 is concentrically provided in the duct 10. In addition, the inner duct 17 is provided with one or more than one nozzles 18, which are aligned with the nozzles 12 of the duct 10 and nozzles 14 of the sleeve 13, e.g. the axes of the nozzles 12, 14, 18 substantially overlap.

[0020] Preferably the terminal parts of the duct 10 and inner duct 17 are connected together.

[0021] A first channel for carrying a fuel 19, which can be same as or different from the fuel 11, is defined by the inner duct 17.

[0022] Advantageously, the sleeve 13 has a terminal portion 20 closed by a cap 21 having a pin 22; correspondingly, the duct 10 has an end with a hole 23. The pin 22 is form fittingly inserted into the hole 23. Therefore the pin 22 prevents radial movements of the sleeve 13 with respect to the duct 10 as indicated by the arrow RM, but it allows axial sliding of the pin 22 into the hole 23, in the direction of arrow AM, caused for example by differential temperatures among the different parts of the lance 6 during operation.

[0023] Advantageously, since the pin 22 is provided in a cap that is connected to the terminal part of the sleeve, it can be manufactured with very small tolerances; likewise the hole 23 can be realised with very small tolerances, such that the coupling of the pin 22 into the hole 23 defines a form fitting coupling.

[0024] The cap 21 has a hub part 25 and a concave part 26 extending from the hub part 25; the pin 22 extends from the hub part 25 and is housed in the concave part 26.

[0025] In addition, the concave part 26 has a cap border 27 defining a terminal section for the cap 21; the pin end 28 is closer to the cap border 27 than to the hub part 25.

[0026] In an advantageous embodiment, the pin 22 has a length L that is at least as large as its diameter D.

[0027] Figure 3 shows a lance similar to the one of figure 2. In particular, the lance of figure 3 has a bush 29 between the pin 22 and the hole 23.

[0028] For example a lance according to this embodiment can be the result of a repair operation, in which damaged material around the hole 23 is removed and the bush 29 is provided to match the new bigger diameter of the hole 23 with the diameter of the pin 22.

[0029] The lance also has a centering arrangement, which is provided between the duct 10 and the sleeve 13, for fixing the radial position of the sleeve 13 with respect to the duct 10.

[0030] The centering arrangement is provided at a side of the lance 6 opposite the one with the cap 21 with respect to the aligned nozzles 12, 14, 18.

[0031] The lance 6 further has a stop arrangement for fixing the axial position of the sleeve 13 with respect to the duct 10; this stop arrangement is also provided between the duct 10 and the sleeve 13.

[0032] Preferably, the centering arrangement and the stop arrangement are defined by a same system 30, such as a bayonet system.

[0033] A further centering arrangement 31 is also provided between the duct 10 and the inner duct 17.

[0034] The operation of the lance is apparent from that described and illustrated and is substantially the following.

[0035] Fuel 11 (gas fuel) is injected via the nozzles 12 and/or fuel 19 (liquid fuel) is injected via the nozzles 18. At the same time shielding air 15 is injected via the nozzles 14.

[0036] Thermal and mechanical stresses tend to move the inner duct 17, duct 10 and sleeve 13 away from their correct positions and so misalign the axes of the nozzles 12, 14, 18. The pin 22 together with the hole 23 precisely defines the centering of the inner duct 17, duct 10 and sleeve 13. This guarantees that centering is not lost and consequently the axes of the nozzles 12, 14, 18 maintain their alignment.

[0037] On the contrary without a form fitting connection of the pin into a hole, correct centering is difficult to maintain, with consequent misalignment of the axes of the nozzles 12, 14, 18.

[0038] The present invention also refers to a method for retrofitting a lance.

[0039] The lance, before retrofitting (figure 5), comprises

a. a duct having at least a nozzle,
b. a sleeve around and preferably concentric to the duct, the sleeve having at least a nozzle,
c. wherein the nozzle of the duct and the nozzle of the sleeve are aligned,
d. the sleeve having a closed terminal portion.

[0040] The method comprises

- removing the closed terminal portion of the sleeve; for example this can be done by cutting (figure 6),
- providing a cap 21 having a pin 22 (figure 6),
- providing a hole 23 in the duct (figure 7),
- form fittingly inserting the pin 22 into the hole 23 (figure 8),
- connecting the cap 21 to the sleeve (figure 8).

[0041] The method can also comprises providing a bush 29 between the hole 23 and the pin 22 (figure 11); in this case the provision of the hole can also encompass the provision of an enlargement of an already existing hole, e.g. a hole is already provided but it is made bigger, e.g. to remove damaged material. This particular embodiment of the method is particularly relevant for repair of damaged lances.

[0042] In this respect, figures 5 through 8 show the steps of a method for retrofitting a lance that originally is not provided with pin 22 and hole 23, and figures 9 through 12 show the steps of a method for retrofitting a lance that is originally already provided with pin 22 and hole 23.

[0043] The bush 29 is preferably fixed only to the hole 23 and the pin 22 is form fittingly inserted into the bush 29.

[0044] Naturally the features described may be independently provided from one another.

[0045] In practice the materials used and the dimensions can be chosen at will according to requirements and to the state of the art.

REFERENCE NUMBERS

1	combustion chamber		sleeve
2	burner	21	cap
3	combustion area	22	pin
4	body	23	hole
5	vortex generator	25	hub
6	lance	26	concave part
7	flame	27	cap border
10	duct	28	pin end
11	first fuel (gas fuel)	29	bush
12	nozzle	30	bayonett system
13	sleeve	31	further centering system
14	nozzle	RM	radial movement
15	air	AM	axial movement
17	inner duct	L	length of the pin
18	nozzle	D	diameter of the pin
19	second fuel (liquid fuel)		
20	terminal portion of the		

Claims

1. A lance (6) for a burner (2) comprising

a. a duct (10) having at least a nozzle (12),
b. a sleeve (13) around the duct (10), the sleeve (13) having at least a nozzle (14),
c. the nozzle (12) of the duct (10) and the nozzle (14) of the sleeve (13) are aligned,

characterized in that
the sleeve (13) has a terminal portion (20) closed by a cap (21) having a pin (22),
the duct (10) has a hole (23),
the pin (22) is form fittingly inserted into the hole (23).

2. The lance (6) of claim 1, **characterised in that** the cap (21) has a hub part (25) and a concave part (26) extending from the hub part (25), wherein the pin (22) extends from the hub part (25) and is housed in the concave part (26).

3. The lance (6) of any of the previous claims, **characterised in that** the concave part (26) has a cap border (27) defining a terminal section for the cap (21), wherein a pin end (28) is closer to the cap border (27) than to the hub

part (25).

4. The lance (6) of any of the previous claims, **characterised in that** the pin (22) has a length (L) that is at least as large as its diameter (D).

5. The lance (6) of any of the previous claims, **characterized in that** a bush (29) is provided between the pin (22) and the hole (23).

6. The lance (6) of any of the previous claims, **characterised in that** a centering arrangement is provided between the duct (10) and the sleeve (13).

7. The lance (6) of claim 6, **characterised in that** the centering arrangement is provided at a side of the lance (6) opposite the one with the cap (21) with respect to the aligned at least a nozzle (12) of the duct (10) and nozzle (14) of the sleeve (13).

8. The lance (6) of any of the previous claims, **characterised in that** a stop arrangement for fixing the position of the sleeve (13) with respect to the duct (10) is provided between the duct (10) and the sleeve (13).

9. The lance of claims 6 and 8 or 7 and 8, **characterised in that** the centering arrangement and the stop arrangement are defined by a same system (30).

10. The lance (6) of any of the previous claims, **characterized by** comprising an inner duct (17) inside the duct (10), wherein the inner duct (17) has at least a nozzle (18) aligned with the at least a nozzle (12) of the duct (10) and the at least a nozzle (14) of the sleeve (13).

11. The lance of claim 10, **characterised in that** the terminal parts of the duct (10) and inner duct (17) are connected together.

12. Method for retrofitting a lance comprising

    a. a duct having at least a nozzle,
    b. a sleeve around the duct and having at least a nozzle,
    c. wherein the at least a nozzle of the duct and the at least a nozzle of the sleeve are aligned,
    d. the sleeve having a closed terminal portion,

    the method comprising
    removing the closed terminal portion of the sleeve, providing a cap (21) having a pin (22),
    providing a hole (23) in the duct (10),
    form fittingly inserting the pin (22) into the hole (23),
    connecting the cap (21) to the sleeve (13).

13. The method of claim 12, **characterised by** providing a bush (29) between the hole (23) and the pin (22).

14. The method of claim 13, **characterised in that** the bush (29) is fixed only to the hole (23) and the pin (22) is form fittingly inserted into the bush (29).

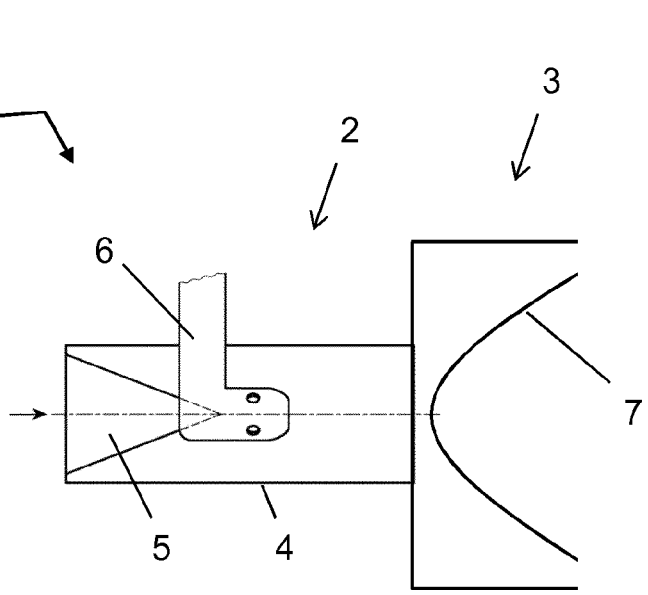

Fig. 1

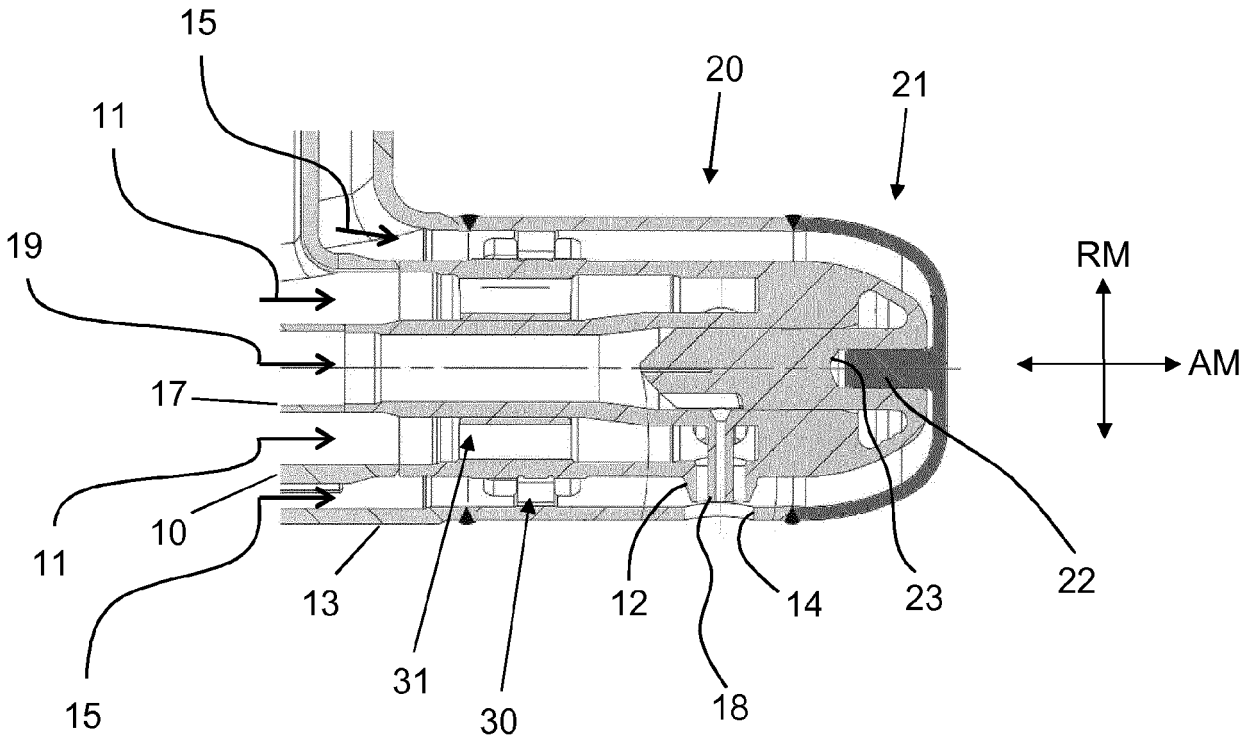

Fig. 2

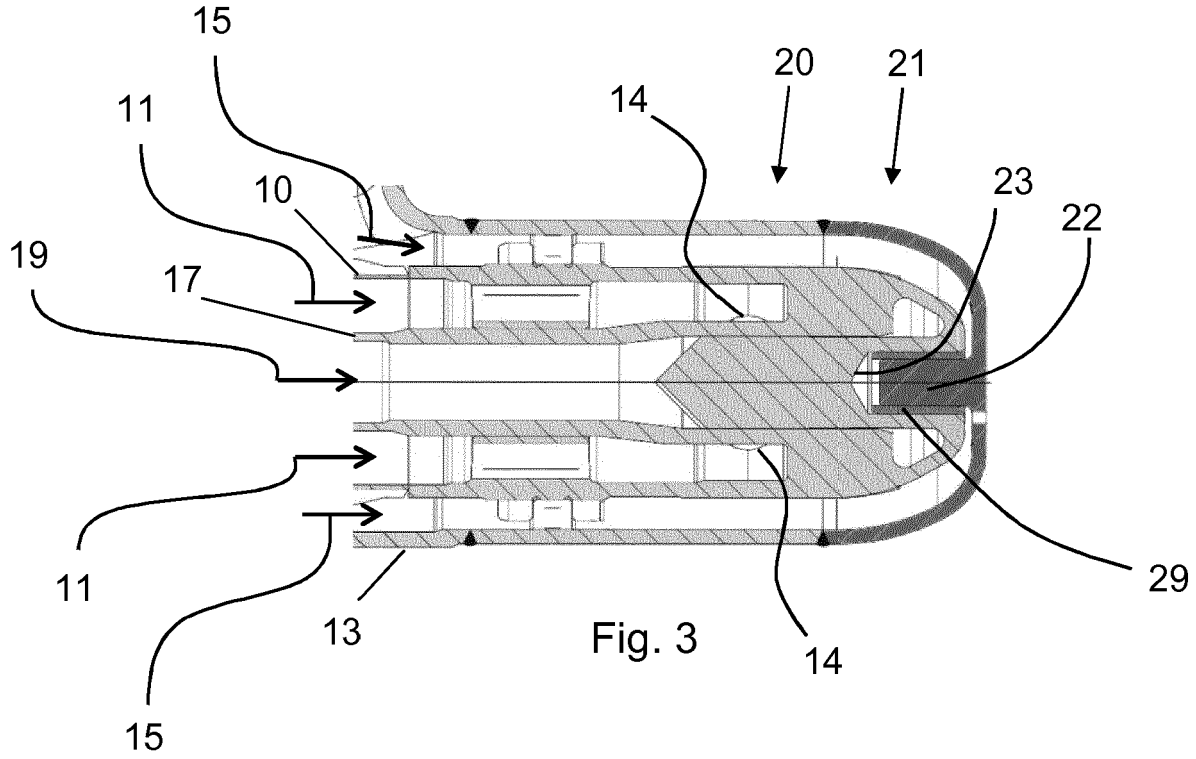

Fig. 3

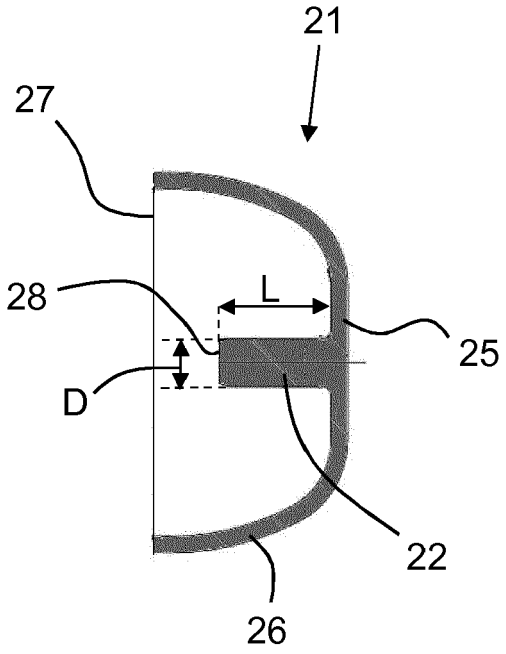

Fig. 4

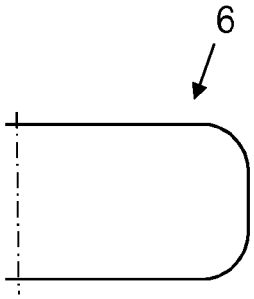

Fig. 5

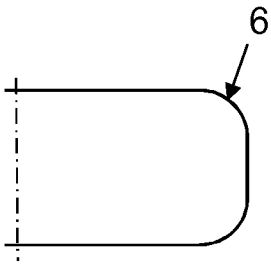

Fig. 9

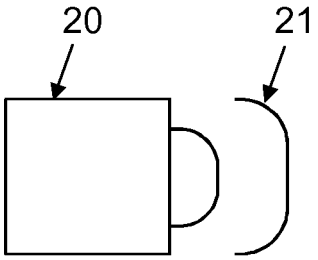

Fig. 6

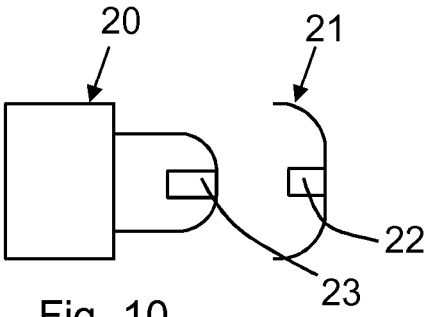

Fig. 10

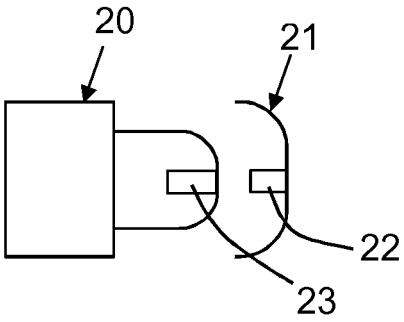

Fig. 7

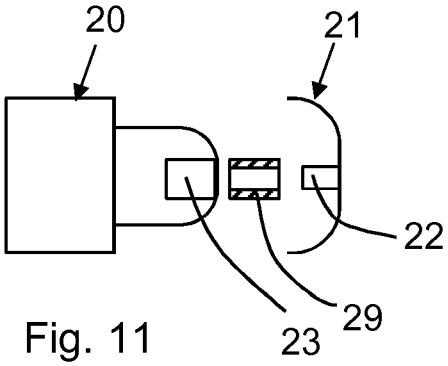

Fig. 11

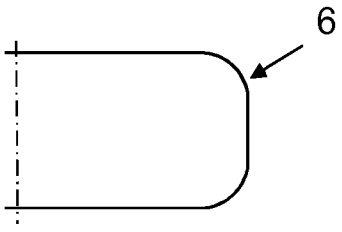

Fig. 8

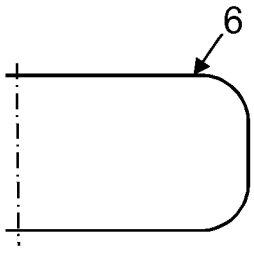

Fig. 12

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EUROPEAN SEARCH REPORT

Application Number
EP 18 20 8164

DOCUMENTS CONSIDERED TO BE RELEVANT

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A	EP 2 199 674 A1 (ALSTOM TECHNOLOGY LTD [CH]) 23 June 2010 (2010-06-23) * the whole document * -----	1-14	

TECHNICAL FIELDS SEARCHED (IPC)

F23R
F23D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	2 April 2019	Hauck, Gunther

CATEGORY OF CITED DOCUMENTS

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