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(54) Igniter lance and method for operating a burner having said igniter lance

(57) The igniter lance (1) comprises a lance fuel duct (2) for pulverised fuel and an electric igniter (3) for ignition of the pulverized fuel passing through the lance fuel duct (2).

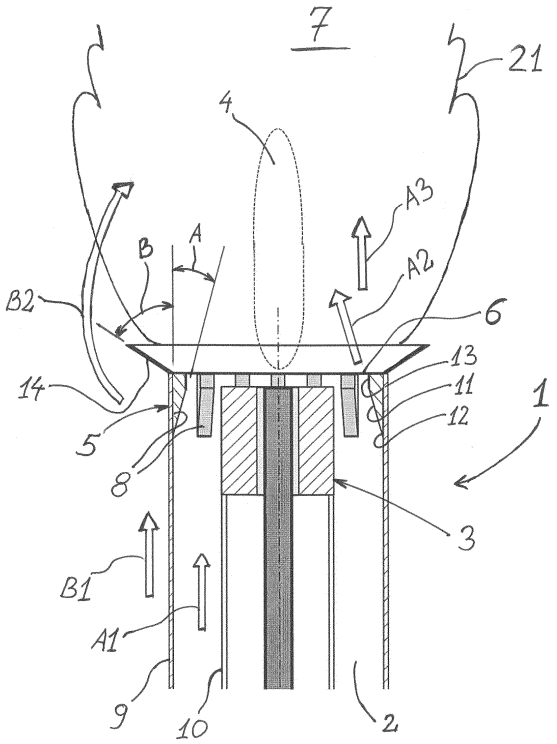


Fig. 1

EP 2 908 051 A1

Description

TECHNICAL FIELD

[0001] The present disclosure relates to an igniter lance and a method for operating a burner having said igniter lance.

BACKGROUND

[0002] Beside rectangular jet burners, round burners (i.e. burners with concentric flows) are the most frequently used burners (e.g. as main and/or start-up burner) in furnaces of, for example, large power plants for burning pulverized fossil fuels and/or biomass.

[0003] Round burners are supplied with pulverized fuel as the main fuel (e.g. pulverized coal). The ignition of the main fuel requires the use of oil or gas that usually is ignited by means of electric sparks. During the start-up oil or gas are used to generate a flame that in turn ignites the main fuel (pulverized fossil fuel and/or biomass). After ignition of the main fuel, the oil or gas is usually switched off.

[0004] This concept has the disadvantage that significant amounts of expensive oil or gas are consumed before the combustion with main fuel can stand alone without support of a flame generated by oil or gas as secondary fuels. Furthermore, a complex infrastructure for storage, preparation, transport and supply of oil or gas has to be installed and maintained in addition to the infrastructure for the pulverized main fuel.

[0005] To overcome the necessity of operating an ancillary firing system using oil or gas for igniting the main fuel, DE 10 2011 056 655 describes a round or rectangular shaped main burner, operating with pulverized fuel as the main fuel (e.g. dry lignite), and having at least one plasma lance used for direct ignition of the main fuel.

[0006] The plasma lance is able to generate small flames, therefore often a number of plasma lances are needed to ignite the pulverized fuel and in addition the positioning of the plasma lance is relevant for a correct ignition of the pulverized fuel.

BRIEF DESCRIPTION OF THE INVENTION

[0007] An aspect of the disclosure comprises providing an apparatus and method for start-up of an industrial scale burner operating with pulverized fuel (e.g. fossil fuels, biomass, and others) without the prior need of oil and/or gas for ignition of the pulverized main fuel. This apparatus is hereafter referred to as the igniter lance.

[0008] This and further aspects are attained by providing the igniter lance and a method for in accordance with the accompanying claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Characteristics and advantages become apparent from the description of a preferred but non-exclusive embodiment of the igniter lance and method for operating a burner having said lance, illustrated by the non-limiting example in the accompanying drawings, in which:

Figures 1 and 2 show examples of the terminal part of an igniter lance;
Figure 3 shows an example of a burner with the igniter lance.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0010] Figure 1 shows an igniter lance 1 having a lance fuel duct 2 for pulverized fossil fuel and/or biomass fuel (e.g. coal, lignite, dry lignite, biomass, bituminous coal, and other), and an electric igniter 3 for the ignition of the pulverized fuel passing through the lance fuel duct 2.

[0011] The electric igniter 3 can be of different types and can include for example:

- a microwave system generating a plasma flame,
- a systems implementing electrodes connected to an electric circuit for generating one or more electric arcs,
- a systems implementing electrodes connected to an electric circuit for generating electric sparks,
- other systems creating ionizing and / or electrical fields or discharges.

[0012] The electric igniter 3 is flowed around or flowed through (allowed by suitable openings applied) by any oxidizing or inert gas (preferably air), and provides the necessary energy to form a plasma 4 that is sufficient to ignite the pulverised fuel supplied through the lance fuel duct 2.

[0013] The igniter lance 1 does not need oil or gas for operation, but it is only supplied with electric power and pulverized fuel transported by air and/or another oxidizing medium.

[0014] Preferably, within the terminal part of the lance fuel duct 2 there is provided a deflector 5 facing a mouth 6. The purpose of the deflector 5 is to deflect a part of the pulverized fuel passing through the lance fuel duct 2 towards a plasma 4 formed by the electric igniter 3 in an area 7 facing the igniter lance 1.

[0015] The deflector 5 comprises protrusions 8 extending from a wall 9 and/or a wall 10; in the example presented in Figure 1, the deflector 5 comprises protrusions 8 which extend from the wall 9 and which define a teethring.

[0016] The protrusions 8 in the presented example in Figure 1 extend over the periphery of the wall 9, preferably over the whole circumference of the lance fuel duct 2 and are equidistant from one another. The protrusions 8 can also not be equidistant from one another.

[0017] The protrusions 8 have a sloped surface 11 with their thinner part 12 farther from the mouth 6 and a thicker

part 13 closer to the mouth 6. The sloped surface 11 defines an angle A with the wall 9 from which they extend, with the angle A being between 5 (five) and 90 (ninety) degree and with preferably between 10 (ten) and 45 (fourty-five) degree. For example, in certain embodiments approximately 90 degree could be applied in order to reduce the velocity of the pulverised fuel in the lance fuel duct 2 and in order to increase the pulverised fuel particles' residence time in the plasma 4.

[0018] Advantageously the deflector 5 is able to deflect up to about 50% by volume, preferably between 10 (ten) and 30% (thirty) by volume and more preferably about 20% (twenty) by volume of the flow A1 passing through the lance fuel duct 2.

[0019] Additional examples of deflector 5 are continuous rings (that is to say without the teeth-ring structure) with a flat or conical shape. The deflector 5 can also not be present within the lance fuel duct 2.

[0020] The wall 9 (that is to say the lance fuel duct's 2 outer wall) has a flared terminal part 14 to deflect a part of the flow B1 passing around the outer side of the wall 9, therefore around the igniter lance 1. The flow B1 could be air and/or another oxidizing medium; in certain embodiments could be air and/or another oxidizing medium mixed with pulverized fossil fuels and/or pulverized biomass.

[0021] In different examples, the electric igniter 3 does not extend in the flared terminal part 14 (Figure 1), or does extend into the flared terminal part 14 (Figure 2), or it can also be movable, such that it is positioned in the flared terminal part 14 or protruded further into the area 7 (that is to say into the furnace) according to the needs.

[0022] In the example shown in Figure 3 the flared terminal part 14 deflects a part of the flow B1 passing through the core air duct 16 of the burner 15; for example up to 80 % (eighty) by volume, preferably between 30 (thirty) and 70 (seventy) % by volume of the flow pass through the core air duct 16. The flared terminal part 14 defines a cone having an opening angle B between 0 (zero) and 90 (ninety) degree, preferably between 30 (thirty) and 75 (seventy-five) degree. This design supports flame attachment and stabilisation. The flared terminal part 14 can also not be present within the terminal part of the wall 9.

[0023] Preferably, as shown in Figure 3, the burner 15 houses the igniter lance 1 within - as in the present example - the core air duct 16 and that in turn is surrounded externally by the burner fuel duct 17. This generates a symmetrical main burner flame by igniting with the plasma formed by the electric igniter 3 the pulverized fuel coming through the lance fuel duct 2 that in turn ignites the pulverized fuel coming through the burner fuel duct 17. By this method a compact and reliable ignition reaction can be obtained.

[0024] Furthermore the burner could anyhow be different. For example

- without core air duct, or
- with pulverized main fuel supply through the burner centre, or
- with pulverised fuel supply through the nozzles, and/or
- rectangular burner without concentric flows.

[0025] In certain embodiments the one or more igniter lance(s) 1 could be housed within the one or more burner main fuel ducts, or within the one or more combustion air ducts. In this way a compact and reliable ignition reaction can be obtained for different kinds burner types (e.g. round burner, rectangular burner, and other industrial scale burners).

[0026] Preferably, the pulverized main fuel supplied through the burner fuel duct 17 of the burner 15 and through the lance fuel duct 2 of the igniter lance 1, are of identical fuel type and quality (e.g. bituminous coal, dry lignite, biomass, or other fossil fuels); they could anyhow be different (e.g. bituminous coal and dry lignite, bituminous coal and biomass, or other fossil fuels and/or biomass combination) or combinations of or with any other pulverized fuels).

[0027] The lance fuel duct 2 supplies sufficient energy for safe and secure ignition of an industrial scale burner as required by safety codes and standards as for example EN 12952, NFPA and GB code.

[0028] The burner 15 can also be provided with one or more additional air ducts for supplying air or another oxidizer such as oxygen; Figure 3 shows for example the burner 15 with the igniter lance 1 housed within the core air duct 16 and this in turn is housed within the burner fuel duct 17. Furthermore, two additional air ducts 18 and 19 are provided and which include swirl generators 20.

[0029] In the following some examples for burner are described.

(1) The burner 15 has the igniter lance 1 housed within the core air duct 16 and this is in turn housed within the burner fuel duct 17; furthermore the burner fuel duct 17 is surrounded externally by one or more air duct 18, 19.

(2) The burner 15 has the igniter lance 1 housed within the burner fuel duct 17; furthermore the burner fuel duct 17 is surrounded externally by one or more air duct 18, 19.

(3) The burner 15 has the igniter lance 1 housed within one of the at least one air duct 18, 19.

(4) The burner 15 has the igniter lance 1 housed within each air duct 18, 19.

[0030] The operation is described in the following for the burner 15 combined with the igniter lance 1; it can be easily translated for other burner systems combined with the igniter lance 1.

[0031] At start-up, firstly, pulverized fuel is supplied through the lance fuel duct 2 by transport air and/or another oxidizing medium forming flow A1. The maximum amount of fuel that can be transported by flow A1 is limited

in accordance with valid boiler safety codes and standards; in the present example it can be limited to max 10% by weight of the total amount of pulverized fuel supplied through the burner 15 at full load. The part flow A2, which is a part of the flow A1, is deflected by the deflector 5 towards the previously formed plasma 4 in the area 7 and thereby improves the ignition of the pulverised fuel. Another part of flow A1, part flow A3, passes through the protrusions 8 (defining the deflector 5) without being deflected and flows towards the area 7.

[0032] While passing through the plasma 4 the pulverized fuel is ignited and generates an ignition flame 21 in the area 7 within the furnace. The ignition flame 21 is generated by a sufficient amount of the pulverized fuel to provide sufficient energy for safe and secure ignition of the burner 15.

[0033] The part flow B2 (in this example core air), that is diverted by the flared terminal part 14 towards the area 7, supports the combustion process and generates a recirculation zone that holds the ignition flame 21 in its position in area 7.

[0034] Once the ignition flame 21 is stable and has sufficient energy for ignition of the burner 15, the fuel supply of burner 15 is activated and pulverized fuel is sent through the burner fuel duct 17 and ignited by the ignition flame 21.

[0035] After ignition of the main fuel (i.e. pulverised fuel supplied through the burner fuel duct 17) and the establishment of a stable combustion, the fuel flow through the lance fuel duct 2 can either be stopped or continued as required. Furthermore, operation of the electric ignitor 3 can be also stopped or continued as required.

[0036] The present disclosure also refers to a method for operating a burner (such as an industrial scale burner for example for a power plant) having the igniter lance 1.

[0037] The method comprises:

providing a plasma 4 by the electric igniter 3,
supplying pulverized fuel through the lance fuel duct 2,
igniting the pulverized fuel supplied through the lance fuel duct 2 through the plasma 4 provided by the electric ignitor 3,
generating an ignition flame 21,
supplying pulverized fuel through the burner fuel duct 17,
igniting the pulverized fuel supplied through the burner fuel duct 17, through the ignition flame 21.

[0038] This method allows stable combustion and sufficient energy for safe and secure ignition of the industrial scale burner 15.

[0039] Preferably, the deflector 5 faces a mouth 6 and deflects at least a part of up to 25 (twenty-five) % by volume of the pulverized fuel flowing through the lance fuel duct 2 towards the plasma 4.

[0040] Naturally the features described may be independently provided from one another.

[0041] 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

[0042]

1	ignitor lance
2	lance fuel duct
3	electric ignitor
4	plasma
5	deflector
6	mouth
7	area
8	protrusion
9	wall
10	wall
11	sloped surface
12	thinner part
13	thicker part
14	flared terminal part
15	burner
16	core air duct
17	burner fuel duct
18	air duct
19	air duct
20	swirl generator
21	ignition flame
A	angle
B	angle
A1	flow
A2	part flow

A3 part flow

B1 flow

B2 part flow

Claims

1. An igniter lance (1) comprising a lance fuel duct (2) for pulverised fuel and an electric igniter (3) for ignition of the pulverized fuel passing through the lance fuel duct (2).

2. The igniter lance (1) of claim 1, **characterised in that** the electric igniter (3) is arranged for providing a plasma (4) in an area (7) in front of the igniter lance (1).

3. The igniter lance (1) of claim 1, **characterised in that** the electric igniter (3) is housed in the lance fuel duct (2) at a terminal part thereof.

4. The igniter lance (1) according to claim 1 to 3, **characterised by** comprising at least one deflector (5) for deflecting at least one part of the pulverized fuel flowing through the lance fuel duct (2) towards the formed plasma (4).

5. The igniter lance (1) according to claim 4, **characterised in that** the at least one deflector (5) comprises at least one protrusion (8) extending from a wall (9, 10) of lance fuel duct (2).

6. The igniter lance (1) according to claim 5, **characterised in that** the at least one protrusion (8) extends over the periphery of the first wall (9) and/or the second wall (10).

7. The igniter lance (1) according to claim 5 or 6, **characterised in that** the at least one protrusion (8) has a sloped surface (11) with a thinner part (12) farther from a mouth (6) and a thicker part (13) closer to the mouth (6), the sloped surface (11) defining an angle (A) with the wall from which they extend, the angle (A) being between 5 and 90 degree and preferably between 10 and 45 degree.

8. The igniter lance (1) according to claim 1, **characterised in that** the lance fuel duct (2) has a flared terminal part (14).

9. The igniter lance (1) according to claim 8, **characterised in that** the flared terminal part (14) defines a cone having an opening angle (B) of between 0 and 90 degree, preferably between 30 and 75 degree.

10. The igniter lance (1) according to claim 4 and 8, **characterised in that** the deflector (5) does not extend in the flared terminal part (14).

11. The igniter lance (1) according to claim 4 and 8, **characterised in that** the deflector (5) extends in the flared terminal part (14).

12. The igniter lacze (1) according to claim 8, **characterised in that** the electric igniter (3) does not extend in the flared terminal part (14).

13. The igniter lance (1) according to claim 8, **characterised in that** the electric igniter (3) extends in the flared terminal part (14) or protrudes further into an area (7) facing the flared terminal part (14).

14. A method for operating a burner (15) having a igniter lance (1),
the burner (15) comprising at least one or more burner fuel duct (17) for pulverised fuel, at least one or more air duct (18, 19), and at least an igniter lance (1) according to any of claims 1 to 13, the method being **characterised by**:

providing a plasma (4) by the electric igniter (3),
supplying pulverized fuel through the lance fuel duct (2),
igniting the pulverized fuel supplied through the lance fuel duct (2) through the plasma (4) provided by the electric igniter 3,
generating an ignition flame (21),
supplying pulverized fuel through the burner fuel duct (17),
igniting the pulverized fuel supplied through the burner fuel duct (17) through the ignition flame (21).

15. A burner (15) comprising at least a burner fuel duct (17) for pulverised fuel, at least an air duct (18, 19), and at least an igniter lance (1) according to any of claims 1 to 13, **characterised in that**:

the burner (15) has a igniter lance (1) housed within a core air duct (16) and this is in turn housed within the burner fuel duct (17), furthermore the burner fuel duct (17) is surrounded externally by one or more air duct (18,19), or
the burner (15) has the igniter lance (1) housed within the burner fuel duct (17), furthermore the burner fuel duct (17) is surrounded externally by one or more air duct (18, 19), or
the burner (15) has the igniter lance (1) housed within one of the at least one air duct (18, 19), or
the burner (15) has the igniter lance (1) housed within each air duct (18,19).

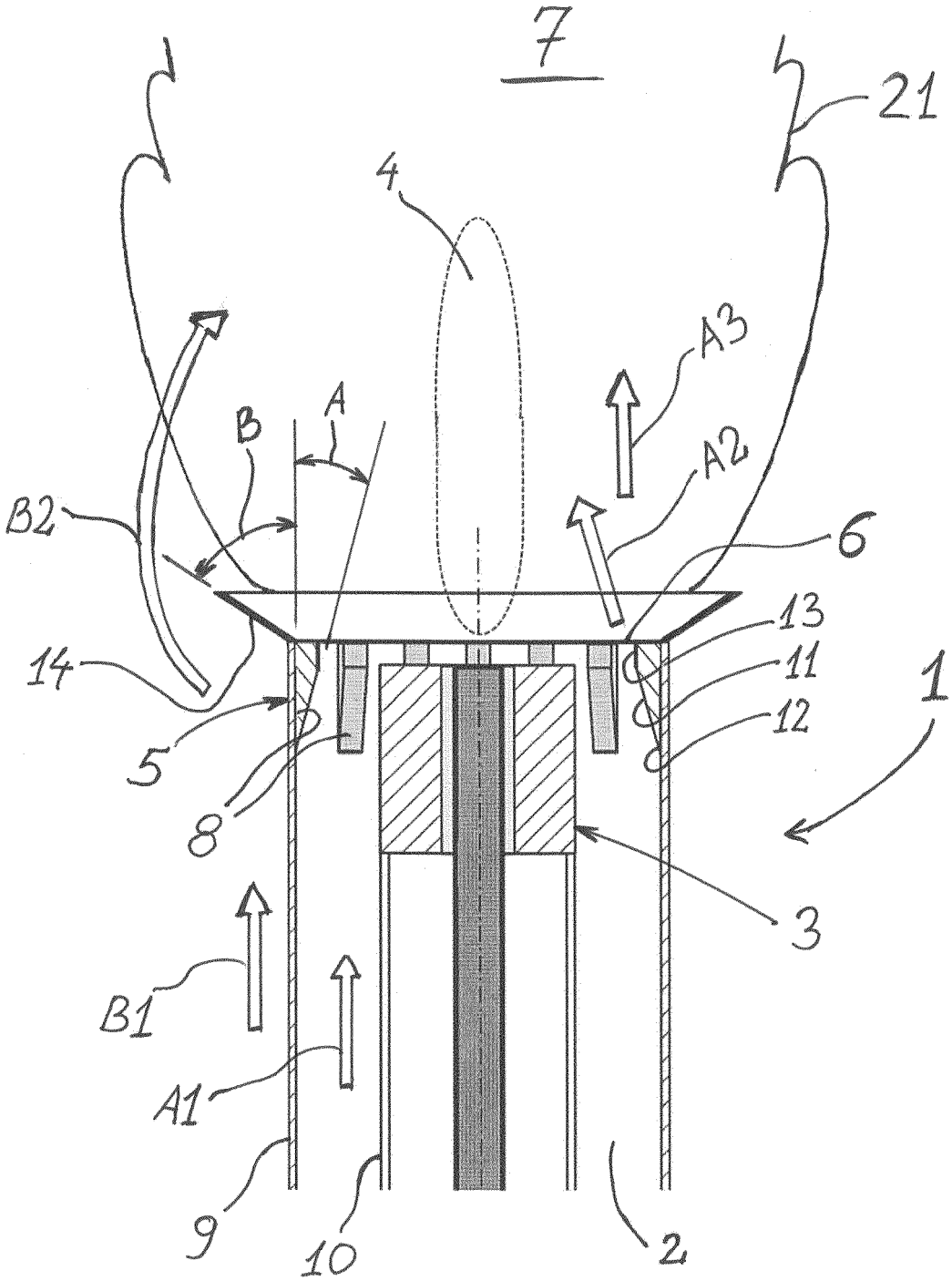


Fig. 1

Fig.2

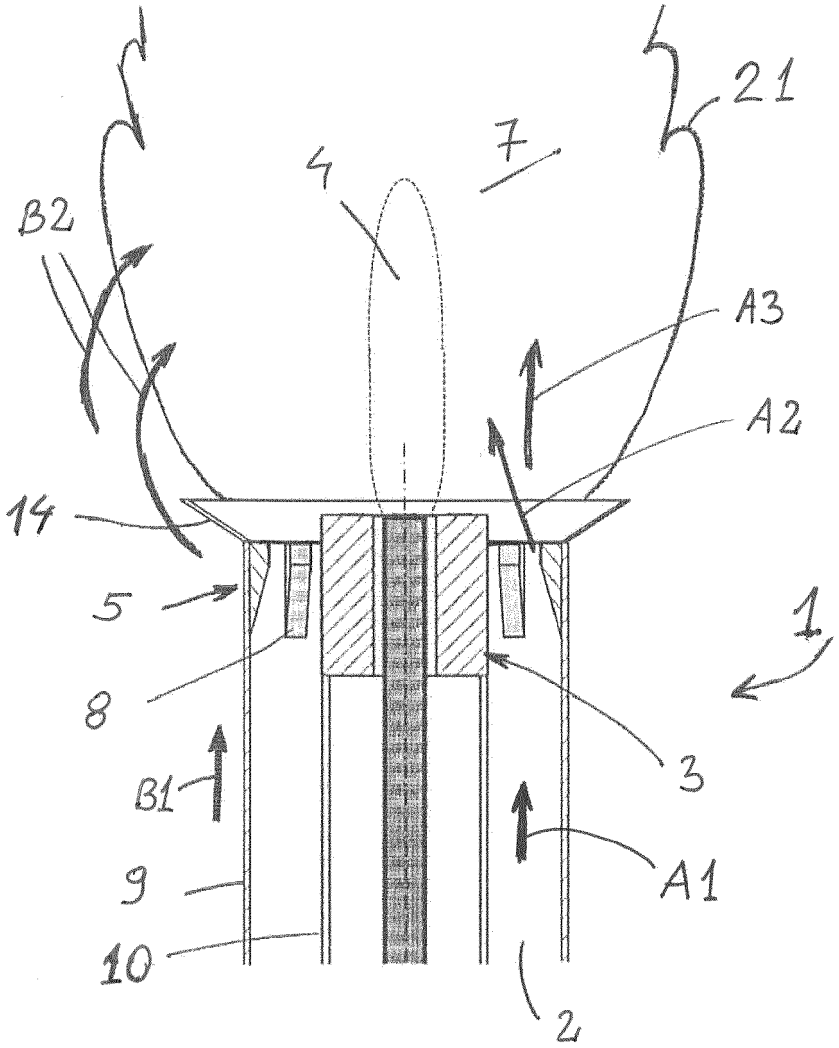
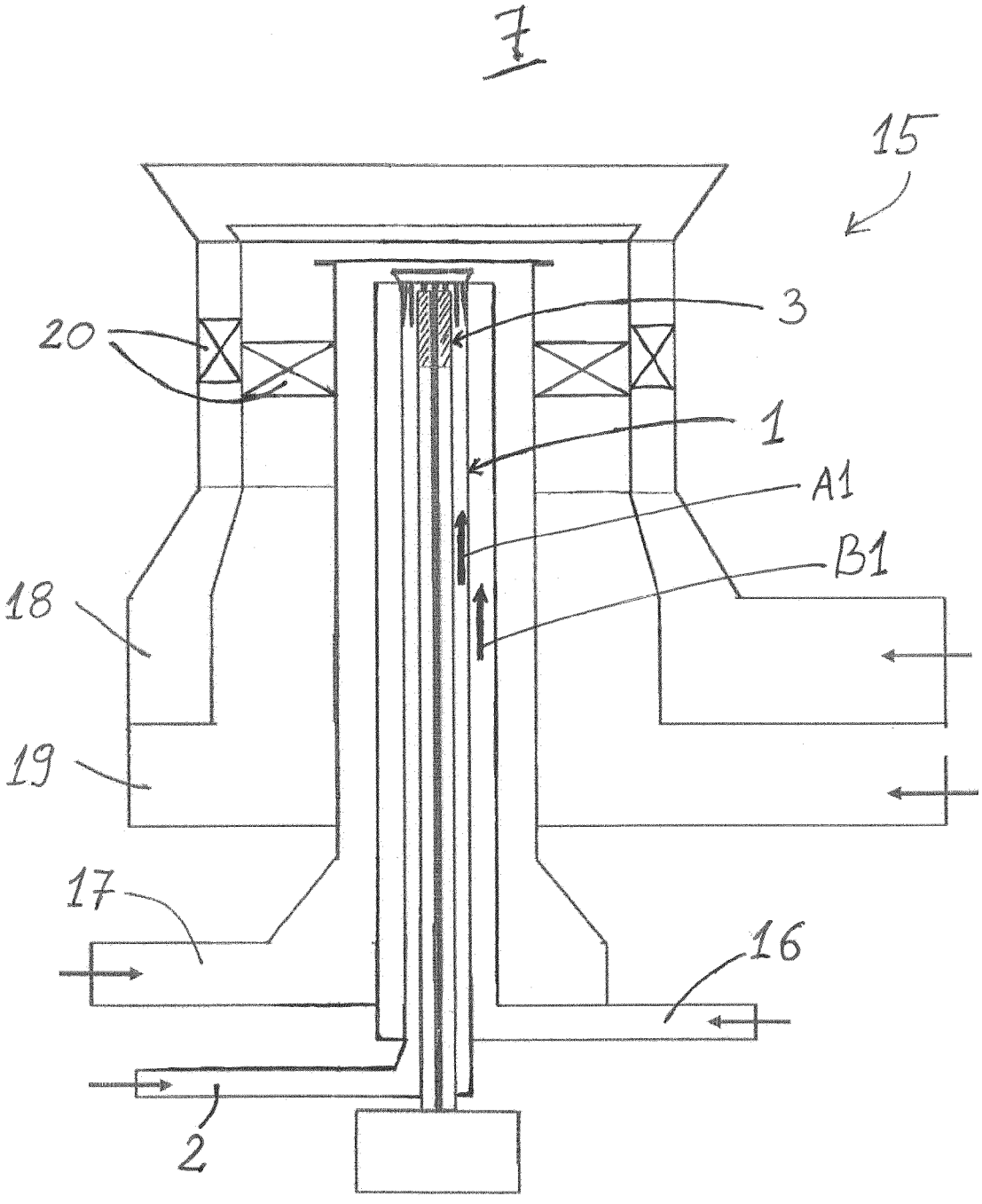


Fig.3



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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	19 March 2014	Gavriliu, Costin

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