(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 908 051 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
13.01.2021 Bulletin 2021/02

(51) Int Cl.:
F23D 1/04 *(2006.01)* ***F23Q 3/00*** *(2006.01)*
F23Q 9/00 *(2006.01)*

(21) Application number: **14154855.2**

(22) Date of filing: **12.02.2014**

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

Zünderlanze und Verfahren zum Betrieb eines Brenners mit besagter Zünderlanze

Lance d'allumage et procédé pour faire fonctionner un brûleur présentant ladite lance d'allumage

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(43) Date of publication of application:
19.08.2015 Bulletin 2015/34

(73) Proprietor: **General Electric Technology GmbH**
5400 Baden (CH)

(72) Inventors:
- **Ristic, Dragisa**
  73240 Wendlingen (DE)
- **Hilber, Thomas**
  71394 Kernen-Stetten (DE)
- **Moenckert, Patrick**
  71726 Benningen (DE)
- **Kluger, Frank Michael**
  73527 Schwaebisch Gmuend (DE)

(74) Representative: **BRP Renaud & Partner mbB**
Rechtsanwälte Patentanwälte
Steuerberater
Königstraße 28
70173 Stuttgart (DE)

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EP 2 908 051 B1

Printed by Jouve, 75001 PARIS (FR)

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] US 4 466 363 A shows a burner with a ignition dust tube with a constant inner diameter according to the preamble of claim 1.

[0003] JP S60-194211 A discloses a burner with a pulverized coal / air flow nozzle with a flame stabilizer provided at the front end of the nozzle. An igniter lance is provided creating a plasma in front of the igniter lance.

[0004] 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.

[0005] 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.

[0006] 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.

[0007] 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.

[0008] 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.

[0009] 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

[0010] The invention provides 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.

[0011] 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

[0012] 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

[0013] 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.

[0014] 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.

[0015] 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.

[0016] 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.

[0017] 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.

[0018] 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 teeth-

ring.

[0019] 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.

[0020] 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.

[0021] 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.

[0022] 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.

[0023] 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.

[0024] 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.

[0025] 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.

[0026] 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.

[0027] 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.

[0028] 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).

[0029] 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).

[0030] 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.

[0031] 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.

[0032] 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.

[0033] 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.

[0034] 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.

[0035] 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.

[0036] 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.

[0037] 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.

[0038] 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.

[0039] 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.

[0040] 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.

[0041] This method allows stable combustion and sufficient energy for safe and secure ignition of the industrial scale burner 15.

[0042] 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.

[0043] Naturally the features described may be independently provided from one another.

[0044] 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

[0045]

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) wherein the electric igniter (3) is arranged for providing a plasma (4) in an area (7) in front of the igniter lance (1) comprising at least one deflector (5) facing a mouth (6) and provided within a terminal part of the lance fuel duct (2), **characterised in that** the deflector (5) is arranged for deflecting at least one part of the pulverized fuel flowing

through the lance fuel duct (2) towards the formed plasma (4).

2. 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.

3. The igniter lance (1) according to any one of claim 1 to 2, **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).

4. The igniter lance (1) according to claim 3, **characterised in that** the at least one protrusion (8) extends over the periphery of the first wall (9) and/or the second wall (10).

5. The igniter lance (1) according to claim 3 or 4, **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.

6. 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 5, wherein:

the burner (15) has an 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).

7. A method for operating a burner (15) having an 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 5, the method comprising:

providing a plasma (4) by the electric igniter (3),
supplying pulverized fuel through the lance fuel duct (2),
deflecting at least one part of the pulverized fuel flowing through the lance fuel duct (2) towards the formed plasma (4) using at least one one deflector (5) within a terminal part of 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) .

Patentansprüche

1. Zünderlanze (1), umfassend einen Lanzenbrennstoffkanal (2) für pulverisierten Brennstoff und einen elektrischen Zünder (3) zum Zünden des pulverisierten Brennstoffs, der durch den Lanzenbrennstoffkanal (2) gelangt, wobei der elektrische Zünder (3) zum Bereitstellen eines Plasmas (4) in einem Bereich (7) vor der Zünderlanze (1) eingerichtet ist, umfassend mindestens ein Ablenkelement (5), welches einer Mündung (6) zugewandt ist und innerhalb eines Endteils des Lanzenbrennstoffkanals (2) vorgesehen ist, **dadurch gekennzeichnet, dass** das Ablenkelement (5) zum Ablenken zumindest eines Teils des durch den Lanzenbrennstoffkanal (2) strömenden pulverisierten Brennstoffs in Richtung des gebildeten Plasmas (4) eingerichtet ist.

2. Zünderlanze (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** der elektrische Zünder (3) in dem Lanzenbrennstoffkanal (2) an einem Endteil davon untergebracht ist.

3. Zünderlanze (1) nach einem der Ansprüche 1 bis 2, **dadurch gekennzeichnet, dass** das mindestens eine Ablenkelement (5) mindestens einen Vorsprung (8) umfasst, der sich von einer Wand (9, 10) des Lanzenbrennstoffkanals (2) aus erstreckt.

4. Zünderlanze (1) nach Anspruch 3, **dadurch gekennzeichnet, dass** sich der mindestens eine Vorsprung (8) über den Rand der ersten Wand (9) und/oder der zweiten Wand (10) erstreckt.

5. Zünderlanze (1) nach Anspruch 3 oder 4, **dadurch gekennzeichnet, dass** der mindestens eine Vorsprung (8) eine abgeschrägte Fläche (11) mit einem dünneren Teil (12) weiter von einer Mündung (6) entfernt und einem dickeren Teil (13) näher an der Mündung (6) aufweist, wobei die abgeschrägte Fläche (11) einen Winkel (A) mit der Wand definiert, von der sie sich erstrecken, wobei der Winkel (A) 5 bis 90 Grad und vorzugsweise 10 bis 45 Grad beträgt.

6. Brenner (15), umfassend mindestens einen Brennerbrennstoffkanal (17) für pulverisierten Brennstoff, mindestens einen Luftkanal (18, 19) und mindestens eine Zünderlanze (1) nach einem der Ansprüche 1 bis 5, wobei:

der Brenner (15) eine Zünderlanze (1) aufweist, die innerhalb eines Kernluftkanals (16) untergebracht ist, und dieser wiederum innerhalb des Brennerbrennstoffkanals (17) untergebracht ist, ferner der Brennerbrennstoffkanal (17) außen von einem oder mehreren Luftkanälen (18, 19) umgeben ist, oder
die Zünderlanze (1) des Brenners (15) innerhalb des Brennerbrennstoffkanals (17) untergebracht ist, ferner der Brennerbrennstoffkanal (17) außen von einem oder mehreren Luftkanälen (18, 19) umgeben ist, oder
die Zünderlanze (1) des Brenners (15) innerhalb eines des mindestens einen Luftkanals (18, 19) untergebracht ist, oder
die Zünderlanze (1) des Brenners (15) innerhalb jedes Luftkanals (18, 19) untergebracht ist.

7. Verfahren zum Betreiben eines Brenners (15) mit einer Zünderlanze (1),
wobei der Brenner (15) mindestens einen oder mehrere Brennerbrennstoffkanäle (17) für pulverisierten Brennstoff, mindestens einen oder mehrere Luftkanäle (18, 19) und mindestens eine Zünderlanze (1) nach einem der Ansprüche 1 bis 5 umfasst, wobei das Verfahren umfasst:

Bereitstellen eines Plasmas (4) durch den elektrischen Zünder (3), Zuführen von pulverisiertem Brennstoff durch den Lanzenbrennstoffkanal (2),
Ablenken zumindest eines Teils des pulverisierten Brennstoffs, der durch den Lanzenbrennstoffkanal (2) strömt, in Richtung des gebildeten Plasmas (4) unter Verwendung mindestens eines Ablenkelements (5) innerhalb eines Endteils des Lanzenbrennstoffkanals (2),
Zünden des durch den Lanzenbrennstoffkanal (2) zugeführten pulverisierten Brennstoffs durch das Plasma (4), das durch den elektrischen Zünder (3) bereitgestellt wird,
Erzeugen einer Zündflamme (21),
Zuführen von pulverisiertem Brennstoff durch den Brennerbrennstoffkanal (17),
Zünden des durch den Brennerbrennstoffkanal (17) zugeführten pulverisierten Brennstoffs durch die Zündflamme (21).

Revendications

1. Lance d'allumage (1) comprenant un conduit de combustible de lance (2) pour combustible pulvérisé et un allumeur électrique (3) pour l'allumage du combustible pulvérisé passant à travers le conduit de combustible de lance (2) dans laquelle l'allumeur électrique (3) est agencé pour fournir un plasma (4) dans une zone (7) à l'avant de la lance d'allumage (1) comprenant au moins un déflecteur (5) faisant face vers une embouchure (6) et situé dans une partie terminale du conduit de combustible de lance (2), **caractérisée en ce que** le déflecteur (5) est disposé pour dévier au moins une partie du combustible pulvérisé s'écoulant à travers le conduit de combustible de lance (2) en direction du plasma formé (4).

2. Lance d'allumage (1) selon la revendication 1, **caractérisée en ce que** l'allumeur électrique (3) est logé dans le conduit de combustible de lance (2) au niveau d'une partie terminale de celui-ci.

3. Lance d'allumage (1) selon l'une quelconque des revendications 1 à 2, **caractérisée en ce que** l'au moins un déflecteur (5) comprend au moins une saillie (8) s'étendant à partir d'une paroi (9, 10) du conduit de combustible de lance (2).

4. Lance d'allumage (1) selon la revendication 3, **caractérisée en ce que** l'au moins une saillie (8) s'étend vers la périphérie de la première paroi (9) et/ou de la seconde paroi (10).

5. Lance d'allumage (1) selon la revendication 3 ou 4, **caractérisée en ce que** l'au moins une saillie (8) a une surface inclinée (11) avec une partie plus mince (12) plus éloignée d'une embouchure (6) et une partie plus épaisse (13) plus proche de l'embouchure (6), la surface inclinée (11) définissant un angle (A) avec la paroi à partir de laquelle elles s'étendent, l'angle (A) faisant entre 5 et 90 degrés et de préférence entre 10 et 45 degrés.

6. Brûleur (15) comprenant au moins un conduit de combustible de brûleur (17) pour combustible pulvérisé, au moins un conduit d'air (18, 19), et au moins une lance d'allumage (1) selon l'une quelconque des revendications 1 à 5, dans lequel :

le brûleur (15) a une lance d'allumage (1) logée dans un conduit d'air central (16) et celui-ci est à son tour logé à l'intérieur du conduit de combustible de brûleur (17), de plus le conduit de combustible de brûleur (17) est entouré de manière externe par un ou plusieurs conduits d'air (18, 19), ou
le brûleur (15) a la lance d'allumage (1) logée à l'intérieur du conduit de combustible de brûleur (17), en plus le conduit de combustible de brûleur (17) est entouré de manière externe par un ou plusieurs conduits d'air (18, 19), ou

le brûleur (15) a la lance d'allumage (1) logée à l'intérieur de l'au moins un conduit d'air (18, 19), ou
le brûleur (15) a la lance d'allumage (1) logée à l'intérieur de chaque conduit d'air (18, 19).

7. Procédé d'actionnement d'un brûleur (15) ayant une lance d'allumage (1),
le brûleur (15) comprenant au moins un ou plusieurs conduits de combustible de brûleur (17) pour combustible pulvérisé, au moins un ou plusieurs conduits d'air (18, 19), et au moins une lance d'allumage (1) selon l'une quelconque des revendications 1 à 5, le procédé comprenant :

la fourniture d'un plasma (4) par l'allumeur électrique (3), fournissant du combustible pulvérisé à travers le conduit de combustible de lance (2),
la déviation d'au moins une partie du combustible pulvérisé s'écoulant à travers le conduit de combustible de lance (2) vers le plasma formé (4) en utilisant au moins un un déflecteur (5) à l'intérieur d'une partie terminale du conduit de combustible de lance (2),
l'allumage du carburant pulvérisé fourni à travers le conduit de combustible de lance (2) à travers le plasma (4) fourni par l'allumeur électrique (3),
la génération d'une flamme d'allumage (21),
l'alimentation en combustible pulvérisé à travers le conduit de combustible de brûleur (17),
l'allumage du combustible pulvérisé fourni à travers le conduit de combustible de brûleur (17) grâce à la flamme d'allumage (21).

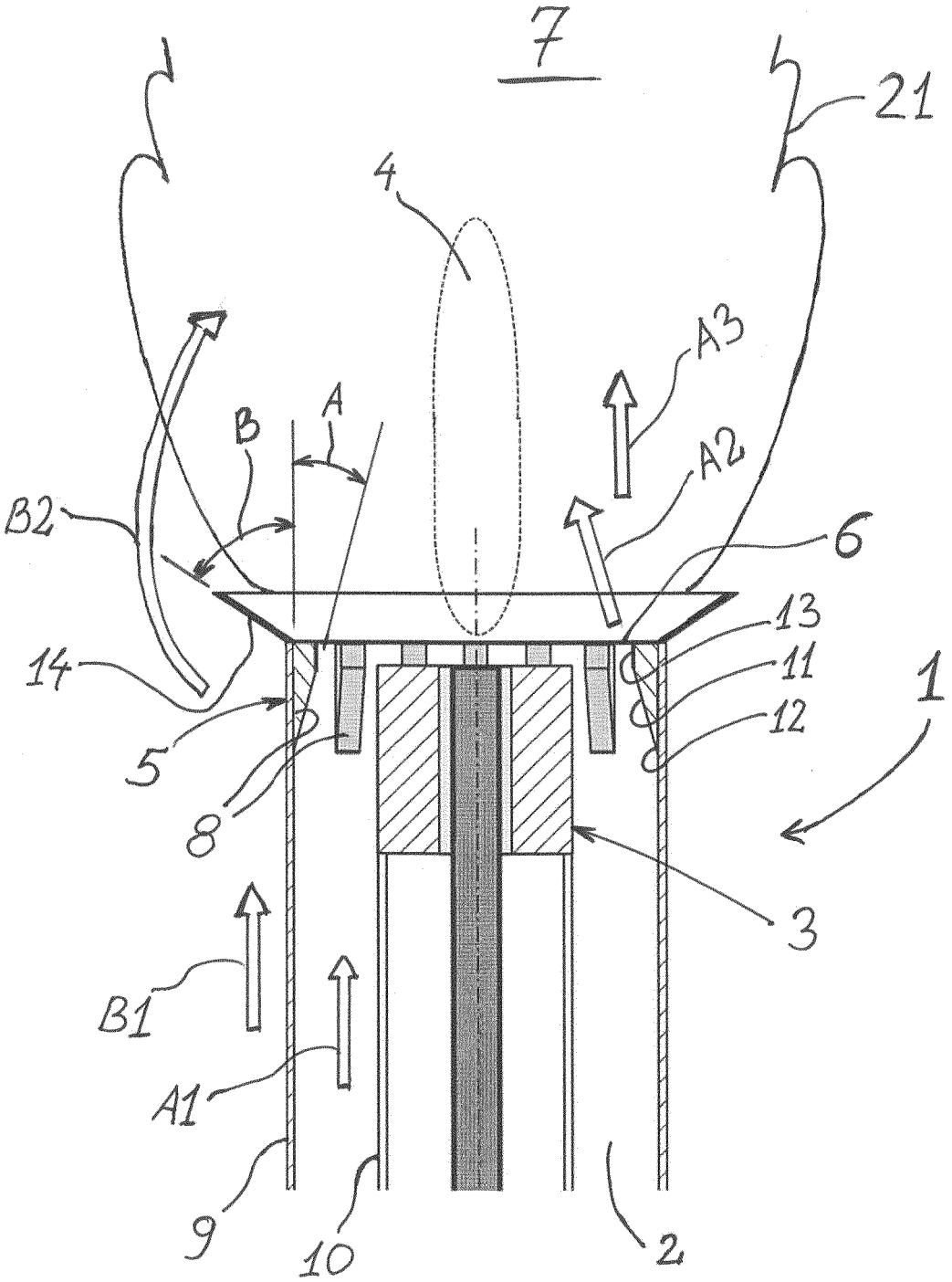


Fig. 1

Fig.2

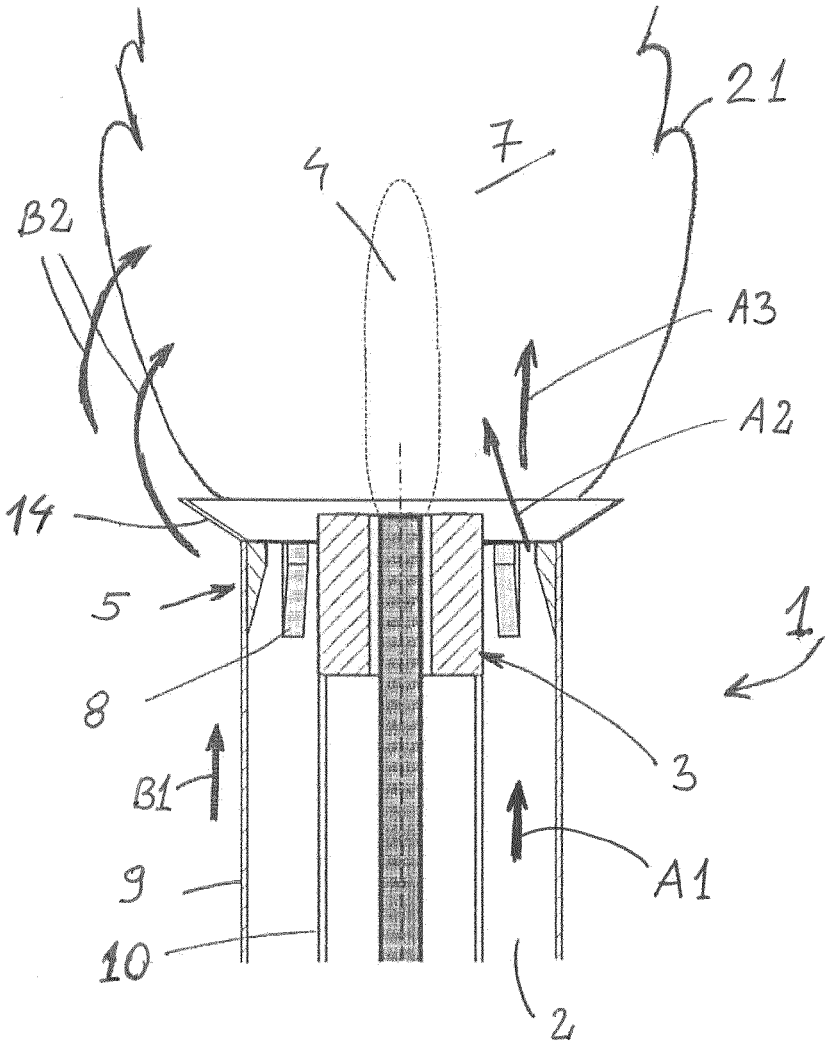
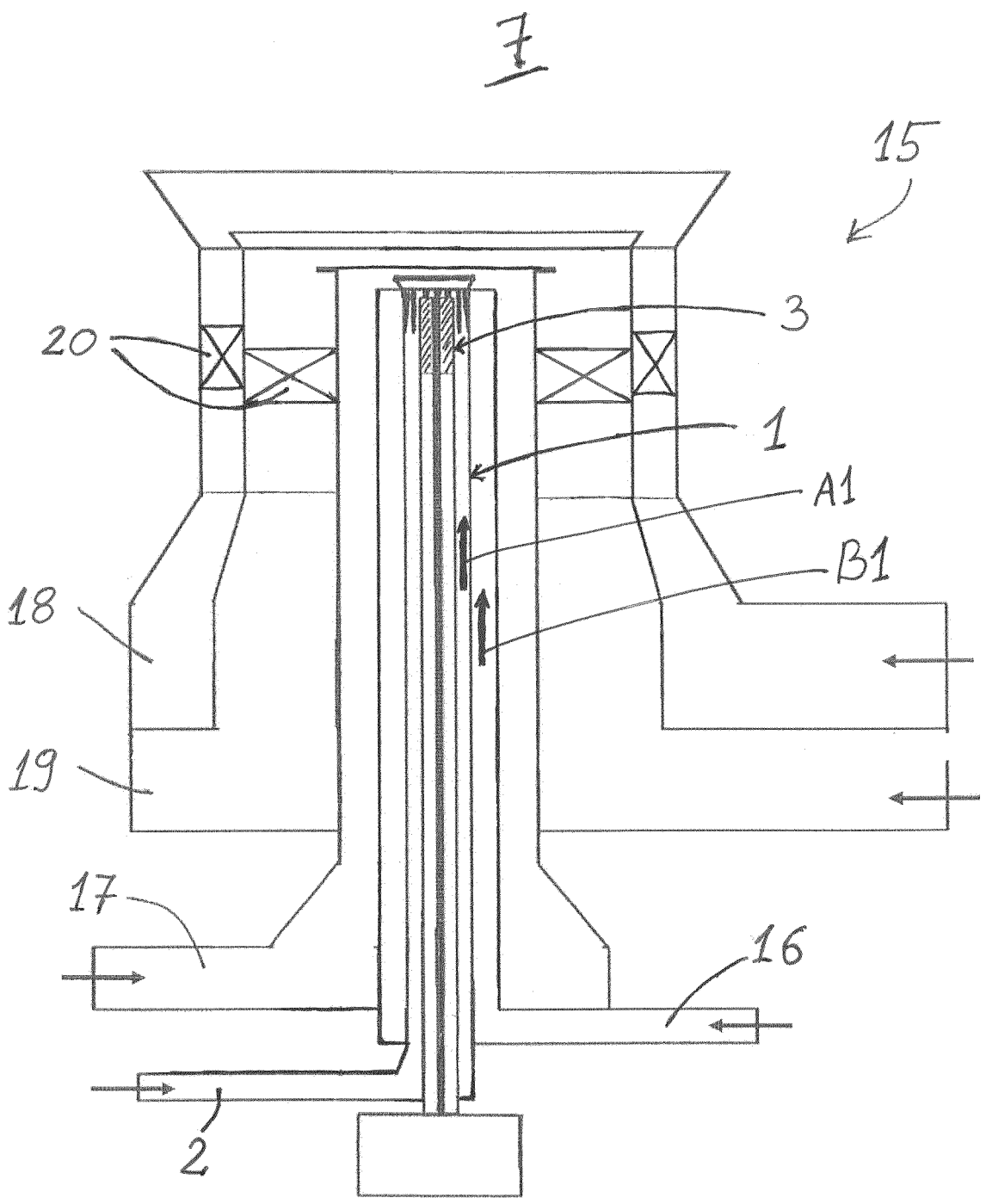


Fig.3



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 4466363 A **[0002]**
- JP S60194211 A **[0003]**
- DE 102011056655 **[0008]**