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(54) **INCINERATION PLANT FOR SOLID MATERIAL AND METHOD FOR REPLACING ITS NOZZLE INSERT**

ABFALL-VERBRENNUNGSANLAGE FÜR FESTSTOFF UND VERFAHREN ZUM AUSTAUSCH IHRES DÜSENEINSATZES

INSTALLATION D'INCINÉRATION DE MATIÈRES SOLIDES ET PROCÉDÉ DE REMPLACEMENT DE SON INSERT DE BUSE

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(56) References cited:
EP-A1- 0 498 014
GB-A- 795 252
GB-A- 2 077 892
US-A- 4 911 744

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Description

[0001] The present invention relates to an incineration plant for solid material such as waste or biomass, the incineration plant having a combustion material inlet through which the solid material is to be introduced, a combustion chamber into which the solid material is introduced and in which the solid material is combusted, whereby flue gases are produced, a combustion grate with which the solid material and combusted solid material can be conveyed through the combustion chamber, a primary air supply below the top of the combustion grate, at least one nozzle arranged above the combustion grate with which a gaseous medium such as secondary air, tertiary air and/or an oxygen poor carrier gas can be provided, the nozzle having a gas inlet and a gas outlet.

[0002] The incineration plant usually comprises a combustion grate arranged within a lower section of the combustion chamber with which the solid material and combusted solid material can be conveyed through the combustion chamber from the combustion material inlet to a slag container. Primary air is usually supplied from below the combustion grate to the solid material arranged on the combustion grate, so that the solid material arranged on the combustion grate is combusted with the primary air.

[0003] Additionally, nozzles are provided above the combustion grate with which secondary air, tertiary air for afterburning or an oxygen poor carrier gas can be provided to the flue gases.

[0004] At least one empty pass may be arranged downstream of the combustion chamber extending vertically or horizontally, wherein the flue gases flow from the combustion chamber through the at least one empty pass to a heat recovery steam generator. In particular, two, three or more parallel empty passes may be embodied.

[0005] The heat recovery steam generator downstream of the empty pass may be arranged (in sections) vertically and/or horizontally, wherein also an oblique orientation is possible.

[0006] The walls of the combustion chamber, the empty pass(es) and the heat generator are usually equipped with heat exchangers (i.e. tubes), wherein the heat exchange medium of the heat exchangers is in particular provided to one common boiler drum.

[0007] The flue gas purification device downstream of the heat recovery steam generator may comprise elements for dedusting, scrubbing and/or desulfurization (such as SCR or SNCR) of the flue gas. A chimney may by arranged downstream of the flue gas purification device.

[0008] Usually there are multiple nozzles arranged above the combustion grate for providing secondary air, tertiary air and/or an oxygen poor carrier gas, wherein the nozzles of specific gaseous medium are connected with its inlets to a common supply. The nozzles are also secured to a wall of the combustion chamber. If the nozzles are to be replaced due to wear or in order to provide a different flow behavior to the provided gaseous medium, the whole nozzle needs to be disconnected from the central supply and from the wall. Accordingly, there is a great effort to replace a respective nozzle.

[0009] An incineration plant for solid material with the features of the preamble of claim 1 is known from EP 0 498 014 A1. GB 795 252 A discloses a furnace chamber having firing means for the combustion of an ash-containing fuel, wherein the furnace chamber has a nozzle for supplying secondary air. The nozzle comprises a secondary air discharge duct with a circular air discharge passage terminating at the inner surface of a wall of the furnace chamber. A nozzle insert is mounted at the outlet end of the air discharge passage. The nozzle insert is connected to the air discharge passage with welds arranged at the inner wall surface of the air discharge passage.

[0010] In view of this, it is an object of the present invention to provide an incineration plant, in which the effort for maintaining or exchanging a nozzle is reduced.

[0011] This object is achieved by an incineration plant with the features of the independent claim and by a method for maintaining the incineration plant. Preferred embodiments of the invention are described in the sub claims and in the whole description, wherein single features of the preferred embodiments can be combined with each other in a technically meaningful manner.

[0012] The object is achieved in particular in that the gas inlet is embodied by a nozzle pipe, preferably being connected to a common supply line for the gaseous medium and being connected to a wall of the combustion chamber, and in that the gas outlet is embodied by an (separate) outlet insert, the outlet insert being at least partly inserted into the nozzle pipe, wherein the outlet insert is connected to the nozzle pipe by a welded joint. In order that the welded joint is easily accessible, it is arranged on the outside of the nozzle pipe.

[0013] The invention also suggests a method for replacing an outlet insert of a nozzle in an incineration plant in particular in an incineration plant according to the invention, comprising the following steps:

- destroying a welded joint between the used outlet insert of the nozzle and a nozzle pipe, the welded joint being arranged on the outside of the nozzle pipe,
- removing the used outlet insert out of the nozzle pipe,
- inserting a new outlet insert into the nozzle pipe,
- welding the new outlet insert to the nozzle pipe.

[0014] With other words, the present invention suggests to provide a nozzle in an incineration plant which is made of multiple parts, wherein a nozzle pipe, in particular having a constant (inner and/or outer) diameter, connects the nozzle to a common supply for gaseous medium and to a wall of the combustion chamber, and wherein the outlet insert, comprising elements for providing the desired flow properties to the gaseous medium, is at least partially and interchangeably arranged in

the nozzle pipe. Furthermore, a welded connection is provided between the nozzle pipe and the outlet insert, which welded connection is in particular provided at such a location, that the welded connection can be destroyed, at least when the incineration plant is shout down. This way, the outlet insert can be easily exchanged, wherein the new outlet insert can be connected by welding to the nozzle pipe. Accordingly, it is not only possible to provide an outlet insert that provides the same flow property to the gaseous medium but it may also be possible to provide an outlet insert that provides a different flow property than the used outlet insert.

[0015] The outer diameter of the section of the outlet insert inserted into the nozzle pipe is of the same dimension/size as the inner diameter of the nozzle pipe.

[0016] While it is principally sufficient that the outlet insert has a constant inner diameter which is smaller than the inner diameter of the nozzle pipe, it is preferred that the outlet insert comprises at least one element which provides a desired flow property to the gaseous medium.

[0017] For example, the inner diameter of the outlet insert may decrease along its extension from the inlet side to the outlet side and may optionally increase after a minimum diameter is reached.

[0018] The outlet insert may also comprise a swirling part, such as a helically extending guiding part in its inner flow cross section, with which a swirl can be provided to the gaseous medium.

[0019] The outlet insert may also comprise a deflecting part, with which the flow of the gaseous medium is at least partially deflected, so that the main direction of the gaseous medium stream leaving the outlet insert is inclined to the axial direction of the nozzle pipe.

[0020] It is also possible that the outlet insert comprises a diverting element, with which the flow of the gaseous medium is diverted in two, three or more sub flows, wherein the main directions of the sub flows are inclined to each other.

[0021] Preferably, the welded joint is accessible from the combustion chamber, so that it can be manually destroyed during maintenance of the incineration plant, when the incineration plant is shout down.

[0022] In one embodiment, it can be provided that the outlet insert has a flange which abuts against an end face of the nozzle pipe, wherein the welded joint is provided between the flange and an outer circumference of the end face of the nozzle pipe. This way the welded joint is easily accessible but it does not affect the flow properties which are provided from the outlet insert to the gaseous medium.

[0023] In order that the nozzle pipe is fixed to a wall of the incineration plant it is suggested that the nozzle pipe is arranged partly in an inner wall delimiting the combustion chamber, wherein the nozzle pipe protrudes into the combustion chamber and wherein the welded joint is arranged on a section of the nozzle pipe that extends into the combustion chamber.

[0024] The invention and the technical background will now be explained with regard to the figures, which show an exemplary embodiment of the invention. The figures show schematically

Figure 1: a side view of a part of an incineration plant and

Figure 2: a nozzle of the incineration plant having a nozzle pipe and an outlet insert.

[0025] The incineration plant comprises a combustion chamber 2 with a combustion material inlet 1, through which solid combustion material such as waste can be introduced in the combustion chamber 2. At the bottom of the combustion chamber 2 a combustion grate 3 is embodied, with which the solid material and combusted material (i.e. ashes) can be transported towards a slag outlet 4.

[0026] Primary air for the combustion of the solid material is provided from below the combustion grate 3. The flue gases produced in the combustion chamber 2 are supplied into vertically extending empty passes 5. Downstream of the empty passes 5 a horizontally extending heat recovery steam generator 6 is arranged.

[0027] In the heat recovery steam generator 6 a superheater heat exchanger 7, an evaporator heat exchanger 8 and an economizer heat exchanger 9 are arranged, which are all connected to one common boiler drum 10.

[0028] In figure 2 a nozzle for providing a gaseous medium, such as secondary air, tertiary air and/or an oxygen poor carrier gas into the combustion chamber 2 is depicted.

[0029] The combustion chamber 2 is delimited by a wall 15. The nozzle comprises a nozzle pipe 11 and an outlet insert 12. The nozzle pipe 11 is connected on the left side to a common supply of gaseous medium (not shown). The nozzle pipe 11 extends through the wall 15 into the combustion chamber 2.

[0030] The outlet insert 12 is inserted into the nozzle pipe 11, wherein the outlet insert 12 comprises a flange 13, which abuts against an end face of the nozzle pipe 11.

[0031] The outlet insert 12 is connected to the nozzle pipe 11 by a welded joint 13, which is arranged at an outer circumference of the nozzle pipe 11 and behind the flange 14.

[0032] The outlet insert 12 can be easily exchanged by destroying the welded joint 13, so that afterwards the outlet insert 12 can be removed from the nozzle pipe 11. After inserting a new outlet insert 12, the new outlet insert 12 can be connected to the nozzle pipe 11 by welding.

[0033] While the depicted embodiment of the outlet insert 12 only has a slightly smaller inner diameter than the inner diameter of the nozzle pipe 11, the outlet insert 12 may also have different elements (such as diverters, swirlers or similar) in order to affect the flow properties of the provided gaseous medium.

Reference sings

[0034]

1	combustion material inlet
2	combustion chamber
3	combustion grate
4	slag outlet
5	empty pass
6	heat recovery steam generator
7	superheater heat exchanger
8	evaporator heat exchanger
9	economizer heat exchanger
10	boiler drum
11	nozzle pipe
12	outlet insert
13	welded joint
14	flange
15	wall

Claims

1. Incineration plant for solid material having

- a combustion material inlet (1) through which solid material can be introduced,
- a combustion chamber (2) in which the solid material is introduced and in which the solid material is combusted,
- a combustion grate (3) with which the solid material and combusted solid material can be conveyed through the combustion chamber (2),
- a primary air supply below the top of the combustion grate (3),
- at least one nozzle arranged above the combustion grate (3) with which a gaseous medium can be provided, the nozzle having a gas inlet and a gas outlet,

characterized in that
the gas inlet is embodied by a nozzle pipe (11) and the gas outlet is embodied by an outlet insert (12), the outlet insert (12) being at least partly inserted in the nozzle pipe (11), wherein the outlet insert (12) is connected to the nozzle pipe (11) by a welded joint (13), the welded joint (13) being arranged on the outside of the nozzle pipe (11).

2. Incineration plant according to claim 1, wherein the welded joint (13) is accessible from the combustion chamber (2).

3. Incineration plant according to one of the preceding claims, wherein the outlet insert (12) has a flange (14) which abuts against an end face of the nozzle pipe (11), wherein the welded joint (13) is provided between the flange (14) and an outer circumference of the end face of the nozzle pipe (11).

4. Incineration plant according to one of the preceding claims, wherein the nozzle pipe (11) is arranged in a wall (15) delimiting the combustion chamber (2), wherein the nozzle pipe (11) protrudes into the combustion chamber (2) and the welded joint (13) is arranged on a section of the nozzle pipe (11) that extends into the combustion chamber (2).

5. Incineration plant according to one of the preceding claims, wherein the welded joint (13) being embodied by at least one of the following:

- a continuous welding seam,
- multiple welding beads,
- multiple welding points.

6. Incineration plant according to one of the preceding claims, wherein the outlet insert (12) comprises at least one of the following:

- a multiple outlet part,
- a deflecting part,
- a swirling part.

7. Incineration plant according to one of the preceding claims, further having

- an empty pass (5) downstream of the combustion chamber (2),
- a heat recovery steam generator (6) downstream of the empty pass (5),
- a flue gas purification device downstream of the heat recovery steam generator (6).

8. Method for replacing an outlet insert (12) of a nozzle in an incineration plant, comprising the following steps:

- Destroying a welded joint (13) between the used outlet insert (12) of the nozzle and a nozzle pipe (11), the welded joint (13) being arranged on the outside of the nozzle pipe (11),
- Removing the used outlet insert (12) out of the nozzle pipe (11),
- Inserting a new outlet insert (12) into the nozzle pipe (11),
- Welding the new outlet insert (12) to the nozzle pipe (11).

Patentansprüche

1. Verbrennungsanlage für Feststoff, aufweisend

- einen Verbrennungsmaterialeinlass (1), durch den Feststoff eingeführt werden kann,

- eine Brennkammer (2), in die der Feststoff eingeführt wird und in der der Feststoff verbrannt wird,
- einen Verbrennungsrost (3), mit dem der Feststoff und der verbrannte Feststoff durch die Brennkammer (2) befördert werden können,
- eine Primärluftzufuhr unterhalb der Oberseite des Verbrennungsrostes (3),
- mindestens eine Düse, die oberhalb des Verbrennungsrostes (3) angeordnet ist, mit der ein gasförmiges Medium bereitgestellt werden kann, wobei die Düse einen Gaseinlass und einen Gasauslass aufweist,

dadurch gekennzeichnet, dass
der Gaseinlass durch ein Düsenrohr (11) und der Gasauslass durch einen Auslasseinsatz (12) ausgebildet ist, wobei der Auslasseinsatz (12) mindestens teilweise in das Düsenrohr (11) eingesetzt ist, wobei der Auslasseinsatz (12) mit dem Düsenrohr (11) durch eine Schweißverbindung (13) verbunden ist, wobei die Schweißverbindung (13) an der Außenseite des Düsenrohrs (11) angeordnet ist.

2. Verbrennungsanlage nach Anspruch 1, wobei die Schweißverbindung (13) von der Brennkammer (2) aus zugänglich ist.

3. Verbrennungsanlage nach einem der vorhergehenden Ansprüche, wobei der Auslasseinsatz (12) einen Flansch (14) aufweist, der an einer Endfläche des Düsenrohrs (11) anliegt, wobei die Schweißverbindung (13) zwischen dem Flansch (14) und einem Außenumfang der Endfläche des Düsenrohrs (11) bereitgestellt ist.

4. Verbrennungsanlage nach einem der vorhergehenden Ansprüche, wobei das Düsenrohr (11) in einer Wand (15) angeordnet ist, die die Brennkammer (2) begrenzt, wobei das Düsenrohr (11) in die Brennkammer (2) hineinragt und die Schweißverbindung (13) an einem Abschnitt des Düsenrohrs (11) angeordnet ist, der in die Brennkammer (2) hineinreicht.

5. Verbrennungsanlage nach einem der vorhergehenden Ansprüche, wobei die Schweißverbindung (13) durch mindestens eine der folgenden Ausführungsformen ausgeführt wird:

- eine durchgehende Schweißnaht,
- mehrere Schweißraupen,
- mehrere Schweißpunkte.

6. Verbrennungsanlage nach einem der vorhergehenden Ansprüche, wobei der Auslasseinsatz (12) mindestens eines der folgenden Elemente umfasst:

- ein Teil mit mehreren Ausgängen,
- ein Ablenkteil,
- ein Wirbelteil.

7. Verbrennungsanlage nach einem der vorhergehenden Ansprüche, ferner aufweisend

- einen Leerzug (5) stromabwärts der Brennkammer (2),
- einen Abhitzedampferzeuger (6) stromabwärts des Leerzuges (5),
- eine Rauchgasreinigungseinrichtung stromabwärts des Abhitzedampferzeugers (6).

8. Verfahren zum Auswechseln eines Auslasseinsatzes (12) einer Düse in einer Verbrennungsanlage, das die folgenden Schritte umfasst:

- Zerstören einer Schweißverbindung (13) zwischen dem benutzten Auslasseinsatz (12) der Düse und einem Düsenrohr (11), wobei die Schweißverbindung (13) an der Außenseite des Düsenrohrs (11) angeordnet ist,
- Herausnehmen des benutzten Auslasseinsatzes (12) aus dem Düsenrohr (11),
- Einsetzen eines neuen Auslasseinsatzes (12) in das Düsenrohr (11),
- Anschweißen des neuen Auslasseinsatzes (12) an das Düsenrohr (11).

Revendications

1. Usine d'incinération pour matériau solide ayant

- une entrée de matériau de combustion (1) à travers laquelle le matériau solide peut être introduit,
- une chambre de combustion (2) dans laquelle le matériau solide est introduit et dans laquelle le matériau solide est brûlé,
- une grille de combustion (3) avec laquelle le matériau solide et le matériau solide brûlé peuvent être acheminés à travers la chambre de combustion (2),
- une alimentation d'air primaire au-dessous de la partie supérieure de la grille de combustion (3),
- au moins une buse agencée au-dessus de la grille de combustion (3) avec laquelle un milieu gazeux peut être fourni, la buse ayant une entrée de gaz et une sortie de gaz,

caractérisé en ce que
l'entrée de gaz est mise en application par un conduit de buse (11) et la sortie de gaz et mise en application par un insert de sortie (12), l'insert de sortie (12) étant au moins partiellement inséré dans le conduit de buse (11), dans laquelle l'insert de sortie (12) est

raccordé au conduit de buse (11) par un raccord soudé (13), le raccord soudé (13) étant agencé sur l'extérieur du conduit de buse (11).

2. Usine d'incinération selon la revendication 1, dans laquelle le raccord soudé (13) est accessible depuis la chambre de combustion (2).

3. Usine d'incinération selon l'une quelconque des revendications précédentes, dans laquelle l'insert de sortie (12) a un rebord (14) qui bute contre une face frontale du conduit de buse (11), dans laquelle le raccord soudé (13) est fourni entre le rebord (14) et une circonférence extérieure de la face frontale de la conduite de buse (11).

4. Usine d'incinération selon l'une quelconque des revendications précédentes, dans laquelle la conduite de buse (11) est agencée dans une paroi (15) délimitant la chambre de combustion (2), dans laquelle la conduite de buse (11) fait saillie dans la chambre de combustion (2) et le raccord soudé (13) est agencé sur une section de la conduite de buse (11) qui s'étend dans la chambre de combustion (2).

5. Usine d'incinération selon l'une quelconque des revendications précédentes, dans laquelle le raccord soudé (13) est mis en application par au moins l'un de :

- une ligne de soudure continue,
- des perles de soudure multiples,
- des points de soudure multiples.

6. Usine d'incinération selon l'une quelconque des revendications précédentes, dans laquelle l'insert de sortie (12) comprend au moins l'un de :

- une partie sortie multiple,
- une partie de déflection,
- une partie de tourbillonnement.

7. Usine d'incinération selon l'une quelconque des revendications précédentes, ayant en outre

- un passage vide (5) en aval de la chambre de combustion (2),
- un générateur de vapeur à récupération de chaleur (6) en aval du passage vide (5),
- un dispositif de purification de gaz de combustion en aval du générateur de vapeur à récupération de chaleur (6).

8. Procédé de remplacement d'un insert de sortie (12) d'une buse dans une usine d'incinération, comprenant les étapes suivantes :

- destruction d'un raccord soudé (13) entre l'insert de sortie (12) utilisé de la buse et une conduite de buse (11), le raccord soudé (13) étant agencé sur l'extérieur de la conduite de buse (11),
- retrait de l'insert de sortie (12) utilisé de la conduite de buse (11),
- insertion d'un nouvel insert de sortie (12) dans la conduite de buse (11),
- soudure du nouvel insert de sortie (12) à la conduite de buse (11).

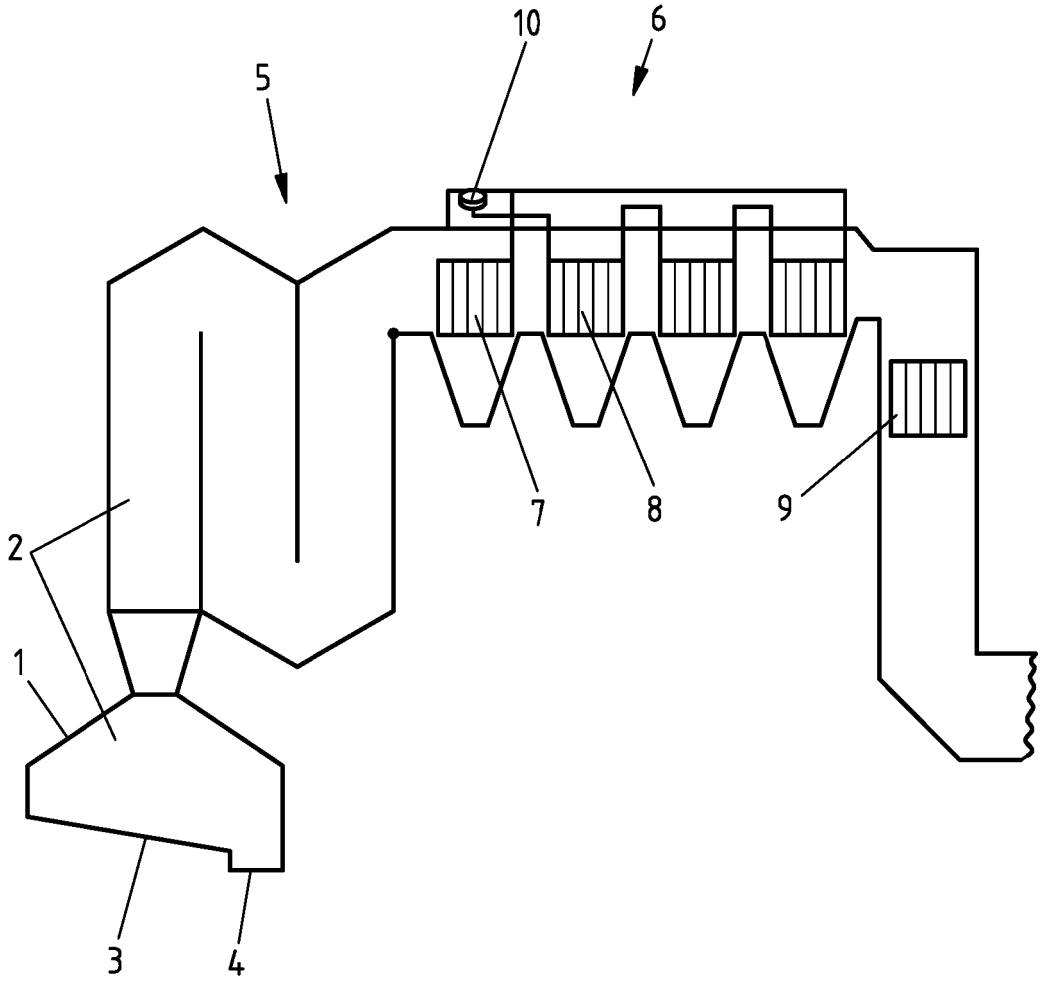

FIG.1

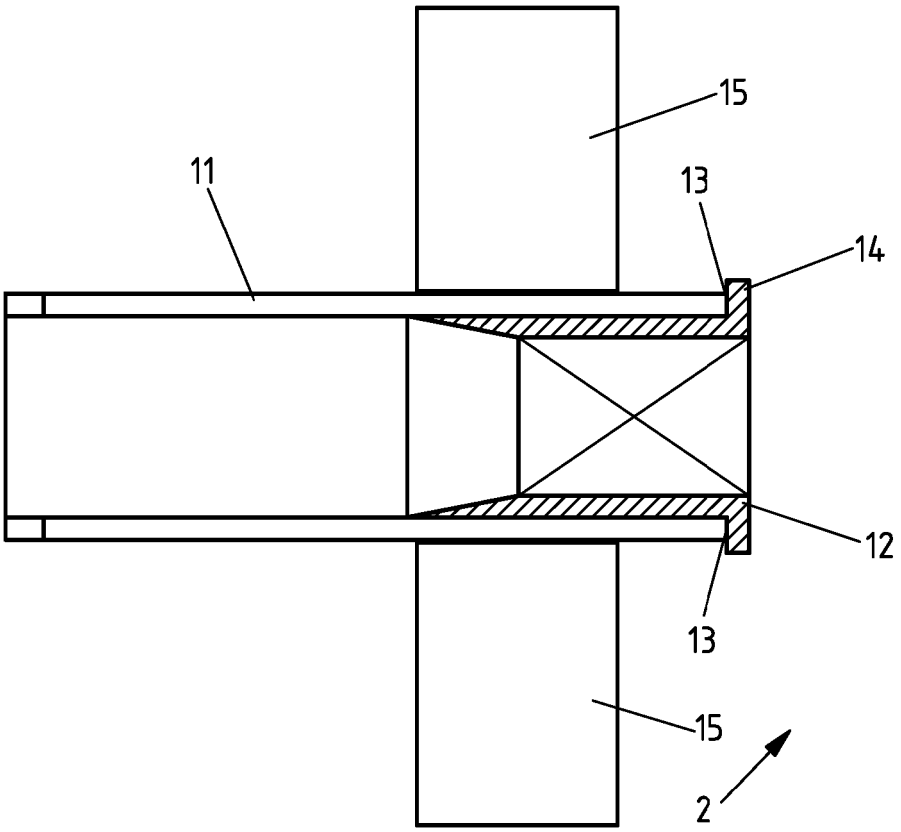

FIG.2

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 0498014 A1 **[0009]**
- GB 795252 A **[0009]**