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(54) **INCINERATION PLANT WITH A NOZZLE, REACTOR FOR CLEANING FLUE GASES WITH A NOZZLE**

VERBRENNUNGSANLAGE MIT EINER DÜSE, REAKTOR ZUR REINIGUNG VON ABGASEN MIT EINER DÜSE

USINE D'INCINÉRATION DOTÉE D'UNE BUSE, RÉACTEUR DE NETTOYAGE DE GAZ DE CARNEAU DOTÉ D'UNE BUSE

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US-A- 2 613 481 **US-A- 5 011 400**
US-A- 5 503 089 **US-A1- 2016 258 685**

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Description

[0001] The present invention relates to an incineration plant comprising a nozzle having a gas inlet and a gas outlet as well as to a reactor for cleaning flue gases by a dry or quasi-dry sorption process comprising a nozzle having a gas inlet and a gas outlet.

[0002] The incineration plant for combusting solid material (i.e. waste) comprises a combustion chamber, a combustion material inlet through which solid material can be introduced into the combustion chamber, 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 and at least one nozzle arranged above the combustion grate, with which secondary air and/or an oxygen poor carrier gas can be provided, wherein the nozzle has a gas inlet and a gas outlet. In such an incineration plant the solid material to be combusted is introduced via the inlet into the combustion chamber and is conveyed by the combustion grate towards an outlet on the opposite side of the combustion chamber. Primary air is provided from below the solid material arranged on the combustion grate and the solid material is combusted with the primary air under release of primary combustion gases. The combusted solid particles are also conveyed by the combustion grate to the outlet. Secondary air and eventually an oxygen poor carrier gas (such as flue gases withdrawn from the incinerator downstream of the combustion chamber) are provided to the primary combustion gases above the solid material via a nozzle, to which the present invention relates. Accordingly, the inventive nozzle may be used in an incineration plant in which flue gases (German: Rezigas) may be recirculated. Such an incineration plant and method is known from DE 10 2004 037 442 B4, according to which the recirculated flue gas is provided by a two substance nozzle with a central nozzle section and an outer nozzle section.

[0003] The invention also relates to a nozzle used in a reactor for cleaning (in particular desulfurizing) flue gases by a dry or quasi-dry sorption process, the reactor comprising a flue gas inlet at the bottom of the reactor, an outlet at the top of the reactor, a dry sorbent injection system with at least one dry sorbent nozzle for injecting dry sorbent into the reactor, the at least one nozzle being arranged between the flue gas inlet and the outlet. The combustion gases produced in a combustion chamber are usually introduced as flue gas through the flue gas inlet into the reactor. A dry sorbent is injected into the flue gas, for example calcium oxide or calcium hydroxide powder is injected into the flue gas. The dry sorbent powder can be injected as particles together with a carrier gas through a nozzle according to the present invention. The carrier gas and the dry sorbent powder is mixed with the flue gas, wherein the dry sorbent containing flue gas may be forced through a venturi system, so that a so called fluidized bed is formed downstream of the venturi system in order to enhance the sorption process. The dry sorbent is usually injected by a nozzle arranged at the wall of the reactor, so that the highest dry sorbent concentration is at the outer circumference of the reactor at the injection side. After the sorbent comprising flue gas leaves the reactor through the outlet it is advanced to a separator/filter, in which solid particles are separated from the stream. A reactor with the above described features is for example known from CN 101 402 019 B.

[0004] US 2,613,481 discloses a pressure regulating valve, US 2016/0258685 A1 discloses a dispersion apparatus for use with a solid fuel burner. EP 0 543 705 A1 discloses an injection head for dispersion of a powder in a desulfurization chamber of a heat generator and therefore a reactor according to the preamble of claim 2. US 5,503,089 discloses an incineration plant with the features of the preamble of claim 1.

[0005] It is desirable that the secondary air and/or oxygen poor gas (i.e. recirculated flue gas) is more efficiently mixed with the primary combustion gases in an incineration plant. It is also desirable that the dry sorbent powder provided with a carrier gas stream to the reactor for cleaning (desulfurization) of flue gases is more efficiently mixed with the flue gases. Additionally, it is desirable that flow properties of the gases (i.e. pure gases, gas mixture, carrier gases with particles) provided through the nozzle can be easily altered, eventually even during operation, in order to influence the mixing behavior with the medium (i.e. primary combustion gases in the incineration plant or flue gases in the reactor), in which the gases are introduced.

[0006] These objects are achieved by an incineration plant and a reactor having the features of the respective independent claims. Preferred embodiments are disclosed in the dependent claims and in the description, wherein single features of the preferred embodiments can be combined with each other in a technically meaningful manner. In particular, the features disclosed with regard to any nozzle can be applied to a nozzle of an inventive incineration plant and/or to a nozzle of an inventive reactor and vice versa.

[0007] The object is in particular achieved in that the nozzle has a helically shaped guiding element, which helically shaped guiding element is arranged between the gas inlet and the gas outlet of the nozzle for impinging a swirl to the gas, wherein the helically shaped guiding element has a front edge and a back edge, the front edge and the back edge being displaced with a distance to each other in a longitudinal direction of the nozzle.

[0008] By embodying such a helically shaped guiding element in the nozzle, the gas stream provided to the gas (nozzle) inlet is forced into a helically shaped movement (trajectory), so that the gas stream, which leaves the gas (nozzle) outlet comprises a swirl (angular momentum). By this swirl the gas provided through the nozzle is more efficiently mixed with the medium, in which the gas is introduced. The degree of the swirl is characterized by the so called swirl number.

[0009] The front edge of a helically shaped guiding element is that edge, which is assigned to the gas (nozzle) inlet and the back edge is that edge of the helically shaped guiding element, which is assigned to the gas (nozzle) outlet. Preferably, the helically shaped guiding element extends continuously from the front edge to the back edged. But, it may also be possible, that a helically shaped guiding element comprises multiple sections, which are arranged behind each other. Preferably, the front edge is arranged in the plane of the gas (nozzle) inlet or downstream of the gas inlet (inside the nozzle), while the back edge of the helically shaped guiding element is arranged upstream or in the plane of the gas (nozzle) outlet. But, it may also be possible that at least the back edge is arranged downstream of the nozzle, in particular outside of an outer tube of the nozzle, so that the helically shaped guiding element extends over the nozzle body.

[0010] The helically shaped guiding element might extend only over a part of a flow cross section (flow channel) of the nozzle, in which case the helically shaped guiding element may extend from an outer wall or from an inner wall into the flow channel of the nozzle. But, preferably the helically shaped guiding element extends over the whole flow cross section of the respective flow channel of the nozzle, thereby forcing the complete gas stream on a helically shaped trajectory through the nozzle.

[0011] Preferably, the helically shaped guiding element extends at least 360° around a central (imaginary) axis, so that one helically shaped guiding element covers the whole cross section of the respective flow channel of the nozzle.

[0012] Each nozzle or each flow channel of the nozzle may have exactly one or more than one helically shaped guiding element, for example two, three or four helically shaped guiding elements, which are arranged parallel to each other. The front edge and the back edge of each of this multiple helically shaped guiding elements may be arranged in a respective plane so that all of the helically shaped guiding elements extend over the same length of the nozzle. But, it may also be possible, that some of the multiple helically shaped guiding elements are shorter than other helically shaped guiding elements.

[0013] In a simple embodiment the nozzle body is provided by a tube like structure, wherein the helically shaped guiding element is arranged in the tube like structure.

[0014] In order to alter the properties with which the gas provided though the nozzle is introduced into the medium, it is desirable to be able to alter the swirl number of the provided gas. Accordingly, it is suggested that the helically shaped guiding element is flexible and that the nozzle has a setting element embodied to alter the distance between the front edge and the back edge of the helically shaped guiding element. By altering the distance between the front edge and the back edge of the helically shaped guiding element the helically shaped guiding element is compressed or uncompressed in the longitudinal direction of the nozzle, so that the pitch (slope) of the helically shaped guiding element is altered, whereby the trajectory of the gas and thereby the swirl number can be altered.

[0015] In particular, the helically shaped guiding element is flexible and the nozzle has a setting element embodied to alter the distance between the front edge and the back edge of the helically shaped guiding element. For example, the helically shaped guiding element can be made of an elastic material or can be formed by a (rubber or metal) sheet, which can be deformed elastically.

[0016] The setting element can be embodied by a rod or tube, to which the helically shaped guiding element is directly or indirectly attached at its front or back, wherein the setting element can be displaced in the longitudinal direction of the nozzle. For example, the rod may be arranged centrally within the nozzle, so that the helically shaped guiding element extends around the rod. Alternatively, a tubelike setting element may surround at least a part of the helically shaped guiding element.

[0017] In particular, the front or back of the helically shaped guiding element is stationary fixed to a stationary part of the nozzle (such as the nozzle body), while the back or the front is fixed to the setting element, which can be displaced in the longitudinal direction of the nozzle, in particular relative to the nozzle body.

[0018] The setting element might be actuated manually, for example by a manually displaceable setting wheel, or by an electronically controllable actuator. The actuator may be an electrical, pneumatically or hydraulically driven motor. While a manually actuatable setting element is preferable to alter the guiding element between two operation periods, the helically shaped guiding element might be altered by the electronically controllable actuator even during operation.

[0019] The invention is in particular suitable for a nozzle having only one flow channel for one gas (pure gas, gas mixture, carrier gas with solid particles), wherein the helically shaped guiding element is arranged in the one flow channel. But, the invention can also be applied to a multiple substance nozzle, wherein more than one flow channel for different gases (mixtures) are embodied, each flow channel being connectable to different gas sources. A helically shaped guiding element might be arranged in only one, multiple or all flow channels of the multiple substance nozzle. In particular, the invention is applicable to a two-substance nozzle, in which the nozzle has a central flow channel and an outer flow channel surrounding the central flow channel, wherein a helically shaped guiding element is arranged in the central flow channel and/or in the outer flow channel. The helically shaped guiding elements assigned to the different flow channels may be altered independently of each other. With such a multiple substance nozzle there is a higher degree of flexibility for altering the parameters with which the gas or gases can be supplied to the medium.

[0020] In particular, with regard to the incineration plant recirculated flue gas or other oxygen poor carrier gas may be provided through one flow channel, while secondary air may be provided through the other flow channel.

[0021] The incineration plant has preferable more than four, in particular at least six or even at least twelve nozzles according to the invention, which are preferable arranged in a horizontal plane within the combustion chamber.

[0022] The reactor according to the present invention is preferable arranged in a vertical manner, wherein the flue gas inlet is arranged at the very bottom of the reactor, meaning that there is preferable no mean for collecting residuals below the flue gas inlet. Usually, the flue gas is provided through a duct from a combustion chamber, which duct leads in horizontal manner to the flue gas inlet of the reactor. In such a vertical reactor, the flue gas outlet is arranged vertically above the flue gas inlet, so that the reactor can be considered that part, in which the flue gas advances vertically from the bottom to the top. The reactor is delimited by a reactor wall.

[0023] A dry sorbent (i.e. CaO or $Ca(OH)_2$) powder is provided through the nozzle of the dry sorbent injection system into the reactor. It is preferred, that more than one dry sorbent nozzle is arranged at the reactor wall. For example, three, four or more nozzles are arranged in preferably one horizontal plane.

[0024] It is also possible that dry sorbent nozzles are arranged above each other.

[0025] In this regard, the outlet of the (dry sorbent) nozzles may be arranged with a distance from the wall, so that the dry sorbent does not contact the wall of the reactor immediately after injection. By impinging a swirl to the dry sorbent provided through the nozzle the mixture and therefore the sorption process with the flue gases is enhanced. This way, the need of a fluidized bed above the dry sorption injection system can eventually be avoided or reduced, so that the reactor can be built smaller.

[0026] The (dry sorbent) nozzles may be arranged below a venturi nozzle or below multiple venturi systems for the flue gases within the reactor. It is also possible that at least one dry sorbent nozzle is arranged within the venturi system.

[0027] The invention and the technical background are now explained with regard to the figures. The figures depict schematically

Figure 1: a nozzle according to the invention in a first state,

Figure 2: the nozzle in a second state,

Figure 3: the nozzle in a third state,

Figure 4: an incineration plant with a respective nozzle and

Figure 5 a reactor for desulfurization of flue gases with a respective nozzle.

[0028] Figures 1 to 3 depict a nozzle 1 in different states. The nozzle comprises a gas inlet 2 and a gas outlet 3. A helically shaped guiding element 4 is arranged between the gas inlet 2 and the gas outlet 3.

[0029] The helically shaped guiding element 4 comprises a front edge 5 and a back edge 6.

[0030] A gas (eventually comprising solid material to be transported) can be supplied through the gas inlet 2 into the nozzle 1, wherein the gas is forced by the helically shaped guiding element 4 onto a helical trajectory through the nozzle 1. Due to this helical trajectory the gas has a swirl at the gas outlet 3 when leaving the nozzle 1. The swirl of the gas is characterized by the swirl number.

[0031] In order to alter the swirl number, the front edge 5 is connected to a setting element, with which the front edge 5 can be moved towards the outlet 3 and back. By this movement the helically shaped guiding element 4 is compressed, so that the pitch of the helically shaped guiding element 4 is altered, thereby altering the swirl number.

[0032] As can be seen by a comparison of figures 1, 2 and 3 the compression of the helically shaped guiding element 4 can be set to different levels so that the swirl number can be altered continuously.

[0033] The nozzle depicted in figures 1 to 3 can be used in an incineration plant 7 as depicted in figure 4. The incineration plant 7 comprises a combustion chamber 8 with a combustion material inlet 9. The combustion material (i.e. waste) can be conveyed through the combustion chamber 8 by a combustion grate 10. Primary air for combusting the solid material on top of the combustion grate 10 is provided from below the combustion grate 10 (not depicted). Additionally, secondary air is supplied to the primary combustion gases through nozzles 1, which are arranged above the combustion grate 10. The nozzle 1 can also be used in a reactor 11 for desulfurization of flue gases by a dry or quasi-dry sorption process. A respective reactor 11 is depicted in figure 5. The reactor 11 comprises a flue gas inlet 12 and a flue gas outlet 13, which is arranged vertically above the flue gas inlet 12. The flue gas inlet 12 is connected to a vertically extending supply line, through which flue gases are supplied to the reactor 11. A venturi section is formed between the flue gas inlet 12 and the flue gas outlet 13. In the area of the venturi system a nozzle 1 is arranged as part of a dry sorbent injection system 14. Dry sorbent powder is provided with a carrier gas through the nozzle 1. The carrier gas and also the dry sorbent powder is provided into the reactor with a swirl, so that an enhanced mixture with the flue gas and therefore an enhanced sorption process occurs.

Reference signs

[0034]

1 nozzle
2 gas inlet
3 gas outlet
4 helically shaped guiding element
5 front edge
6 back edge
7 incineration plant
8 combustion chamber
9 combustion material inlet
10 combustion grate
11 reactor
12 flue gas inlet
13 flue gas outlet
14 dry sorbent injection system

Claims

1. Incineration plant (7) having

- a combustion chamber (8),
- a combustion material inlet (9) through which solid material can be introduced into the combustion chamber (8),
- a combustion grate (10) with which the solid material and combusted solid material can be conveyed through the combustion chamber (8),
- a primary air supply below the top of the combustion grate (10),
- at least one nozzle (1) arranged above the combustion grate (10) with which secondary air and/or an oxygen poor carrier gas can be provided, the nozzle (1) having a gas inlet (2) and a gas outlet (3),

characterized in that
a helically shaped guiding element (4) is arranged in the nozzle between the gas inlet (2) and the gas outlet (3) for impinging a swirl to the gas, the helically shaped guiding element (4) having a front edge (5) and a back edge (6), wherein the front edge (5) and the back edge (6) are displaced with a distance to each other in a longitudinal direction of the nozzle (1).

2. Reactor (11) for cleaning flue gases by a dry or quasi-dry sorption process, comprising

- a flue gas inlet (12) at the bottom of the reactor (11),
- an outlet (13) at the top of the reactor (11),
- a dry sorbent injection system (14) with at least one dry sorbent nozzle (1) for injecting dry sorbent with a carrier gas into the reactor (11), the at least one nozzle (1) being arranged between the flue gas inlet (12) and the outlet (13),
- the at least one nozzle (1) having a gas inlet (2) and a gas outlet (3),

characterized in that
a helically shaped guiding element (4) is arranged in the nozzle between the gas inlet (2) and the gas outlet (3) for impinging a swirl to the dry sorbent comprising carrying gas, the helically shaped guiding element (4) having a front edge (5) and a back edge (6), wherein the front edge (5) and the back edge (6) are displaced with a distance to each other in a longitudinal direction of the nozzle (1).

3. Incineration plant (7) according to claim 1 or reactor (11) according to claim 2, **characterized in that** the helically shaped guiding element (4) is flexible and **in that** the nozzle (1) has a setting element embodied to alter the distance between the front edge (5) and the back edge (6) of the helically shaped guiding element (4).

4. Incineration plant (7) or reactor (11) according to one of the respective preceding claims, wherein the helically shaped guiding element (4) is made of an elastic material or of an elastically deformable sheet.

5. Incineration plant (7) or reactor (11) according to claim 3 or 4,
wherein the front or back of the helically shaped guiding element (4) is stationary fixed and the back or the front is fixed to the setting element which can be displaced in the longitudinal direction.

6. Incineration plant (7) or reactor (11) according to claim 3 to 5,
wherein the setting element is to be actuated manually or by an electronically controllable actuator.

7. Incineration plant (7) or reactor (11) according to one of the preceding claims, wherein the nozzle (1) has a central flow channel and an outer flow channel surrounding the central flow channel, wherein the helically shaped guiding element (4) is arranged in the central flow or in the outer flow channel, wherein preferably a further helically shaped guiding element is arranged, such that helically shaped guiding elements are arranged in the central flow channel and in the outer flow channel.

Patentansprüche

1. Verbrennungsanlage (7) mit

- einer Brennkammer (8),
- einem Brennmaterialeinlass (9) durch den festes Material in die Brennkammer (8) eingeführt

werden kann,

- einem Verbrennungsrost (10), mit dem das feste Material und verbranntes festes Material durch die Brennkammer (8) befördert werden kann,
- einer Primärluftzufuhr unterhalb der Oberseite des Verbrennungsrostes (10),
- mindestens einer Düse (1), die oberhalb des Verbrennungsrostes (10) angeordnet ist, mit der Sekundärluft und/oder ein sauerstoffarmes Trägergas bereitgestellt werden kann, wobei die Düse (1) einen Gaseinlass (2) und einen Gasauslass (3) aufweist,

dadurch gekennzeichnet, dass
ein spiralförmiges Führungselement (4) in der Düse zwischen dem Gaseinlass (2) und dem Gasauslass (3) angeordnet ist, um das Gas mit einem Wirbel zu beaufschlagen, wobei das spiralförmige Führungselement (4) eine Vorderkante (5) und eine Hinterkante (6) aufweist, wobei die Vorderkante (5) und die Hinterkante (6) in Längsrichtung der Düse (1) in einem Abstand zueinander versetzt sind.

2. Reaktor (11) zum Reinigen von Abgasen durch ein trockenes oder quasi-trockenes Sorptionsverfahren, umfassend

- einen Abgaseinlass (12) am Boden des Reaktors (11),
- einen Auslass (13) am oberen Ende des Reaktors (11),
- ein Trockensorptionsmittel-Injektionssystem (14) mit mindestens einer Trockensorptionsmitteldüse (1) zum Injizieren von Trockensorptionsmittel mit einem Trägergas in den Reaktor (11), wobei die mindestens eine Düse (1) zwischen dem Abgaseinlass (12) und dem Auslass (13) angeordnet ist,
- wobei die mindestens eine Düse (1) einen Gaseinlass (2) und einen Gasauslass (3) aufweist,

dadurch gekennzeichnet, dass
ein spiralförmiges Führungselement (4) in der Düse zwischen dem Gaseinlass (2) und dem Gasauslass (3) angeordnet ist, um das Trockensorptionsmittel, das Trägergas umfasst, mit einem Wirbel zu beaufschlagen, wobei das spiralförmige Führungselement (4) eine Vorderkante (5) und eine Hinterkante (6) aufweist, wobei die Vorderkante (5) und die Hinterkante (6) in Längsrichtung der Düse (1) in einem Abstand zueinander versetzt sind.

3. Verbrennungsanlage (7) nach Anspruch 1 oder Reaktor (11) nach Anspruch 2, **dadurch gekennzeichnet, dass** das spiralförmige Führungselement (4) flexibel ist, und dadurch, dass die Düse (1) ein Einstellelement aufweist, das ausgebildet ist, um den Abstand zwischen der Vorderkante (5) und der Hinterkante (6) des spiralförmig geformten Führungselements (4) zu verändern.

4. Verbrennungsanlage (7) oder Reaktor (11) nach einem der jeweiligen vorhergehenden Ansprüche, wobei das spiralförmige Führungselement (4) aus einem elastischen Material oder aus einer elastisch verformbaren Platte hergestellt ist.

5. Verbrennungsanlage (7) oder Reaktor (11) nach Anspruch 3 oder 4, wobei die Vorderseite oder Rückseite des spiralförmigen Führungselementes (4) ortsfest und die Rückseite oder die Vorderseite an dem in Längsrichtung verschiebbaren Einstellelement befestigt ist.

6. Verbrennungsanlage (7) oder Reaktor (11) nach Anspruch 3 bis 5, wobei das Einstellelement manuell oder durch ein elektronisch steuerbares Stellglied zu betätigen ist.

7. Verbrennungsanlage (7) oder Reaktor (11) nach einem der vorhergehenden Ansprüche, wobei die Düse (1) einen zentralen Strömungskanal und einen den zentralen Strömungskanal umgebenden äußeren Strömungskanal aufweist, wobei in dem zentralen Strömungskanal und/oder in dem äußeren Strömungskanal ein spiralförmiges Führungselement (4) angeordnet ist.

Revendications

1. Usine d'incinération (7) ayant

- une chambre de combustion (8),
- une entrée de matériau de combustion (9) à travers laquelle de la matière solide peut être introduite dans la chambre de combustion (8),
- une grille de combustion (10) avec laquelle la matière solide et la matière solide brûlée peuvent être transportées à travers la chambre de combustion (8),
- une alimentation en air primaire située en dessous de la partie supérieure de la grille de combustion (10),
- au moins une buse (1) agencée au-dessus de la grille de combustion (10) avec laquelle l'air secondaire et/ou un gaz vecteur pauvre en oxygène peuvent être apportés, la buse (1) comportant une entrée de gaz (2) et une sortie de gaz (3),

caractérisée en ce que
un élément de guidage en forme d'hélice (4) est agencé dans la buse située entre l'entrée de gaz (2) et la sortie de gaz (3) pour mettre en contact un tour-

billon avec le gaz, l'élément de guidage en forme d'hélice (4) ayant un bord avant (5) et un bord arrière (6), dans laquelle le bord avant (5) et le bord arrière (6) sont déplacés à distance l'un par rapport à l'autre dans une direction longitudinale de la buse (1).

2. Réacteur (11) permettant de nettoyer les gaz d'échappement au moyen d'un procédé de sorption sec ou quasi-sec, comprenant

   - une entrée de gaz d'échappement (12) située au niveau de la partie inférieure du réacteur (11),
   - une sortie (13) située au niveau de la partie supérieure du réacteur (11),
   - un système d'injection de sorbant sec (1) permettant d'injecter un sorbant sec avec un gaz vecteur dans le réacteur (11), l'au moins une buse (1) étant agencée entre l'entrée de gaz d'échappement (12) et la sortie (13),
   - l'au moins une buse (1) comportant une entrée de gaz (2) et une sortie de gaz (3),

   caractérisée en ce que
   un élément de guidage en forme d'hélice (4) est agencé dans la buse située entre l'entrée de gaz (2) et la sortie de gaz (3) pour mettre en contact un tourbillon avec le sorbant sec comprenant le gaz de transport, l'élément de guidage en forme d'hélice (4) ayant un bord avant (5) et un bord arrière (6), dans laquelle le bord avant (5) et le bord arrière (6), dans lequel le bord avant (5) et le bord arrière (6) sont déplacés à distance l'un par rapport à l'autre dans une direction longitudinale de la buse (1).

3. Usine d'incinération (7) selon la revendication 1 ou réacteur (11) selon la revendication 2, **caractérisé en ce que** l'élément de guidage en forme d'hélice (4) est flexible et **en ce que** la buse (1) comporte un élément de réglage incorporé afin de modifier la distance entre le bord avant (5) et le bord arrière (6) de l'élément de guidage en forme d'hélice (4).

4. Usine d'incinération (7) ou réacteur (11) selon l'une quelconque des revendications précédentes, dans lequel l'élément de guidage en forme d'hélice (4) est constitué d'un matériau élastique ou d'un feuillet déformable de manière élastique.

5. Usine d'incinération (7) ou réacteur (11) selon la revendication 3 ou la revendication 4, dans lequel la partie avant ou la partie arrière de l'élément de guidage en forme d'hélice (4) est fixée de manière stationnaire, et la partie arrière et la partie avant sont fixées à l'élément de réglage qui peut être déplacé dans la direction longitudinale.

6. Usine d'incinération (7) ou réacteur (11) selon l'une quelconque des revendications 3 à 5, dans lequel l'élément de réglage doit être actionné manuellement ou au moyen d'un actionneur contrôlable de manière électronique.

7. Usine d'incinération (7) ou réacteur (11) selon l'une quelconque des revendications précédentes, dans lequel la buse (1) comporte un canal d'écoulement central et un canal d'écoulement externe entourant le canal d'écoulement central, dans lequel l'élément de guidage en forme d'hélice (4) est agencé dans le canal d'écoulement central dans le canal d'écoulement externe, dans lequel un autre élément de guidage en forme d'hélice est de préférence agencé, de sorte que les éléments de guidage en forme d'hélice sont agencés dans le canal d'écoulement central et dans le canal de externe.

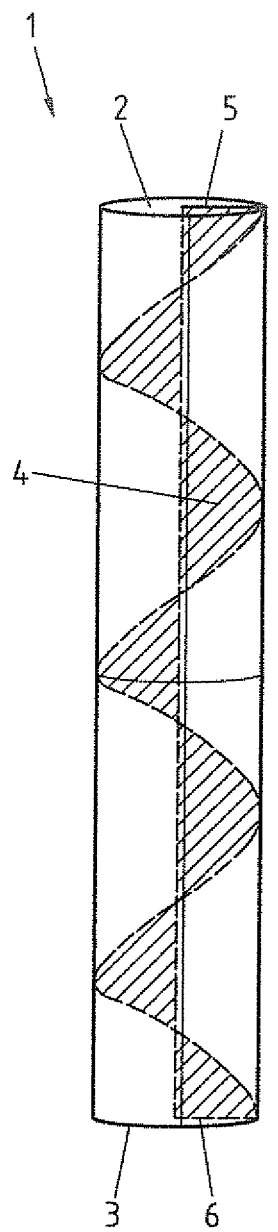

FIG.1

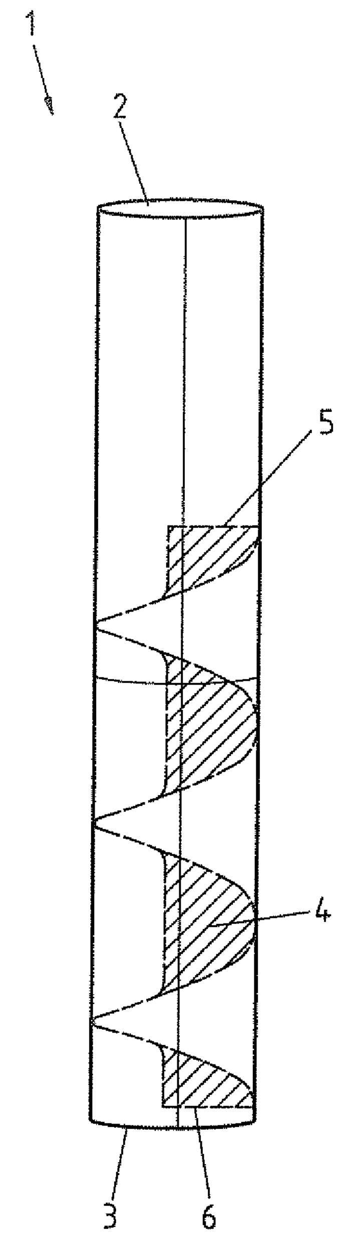

FIG.2

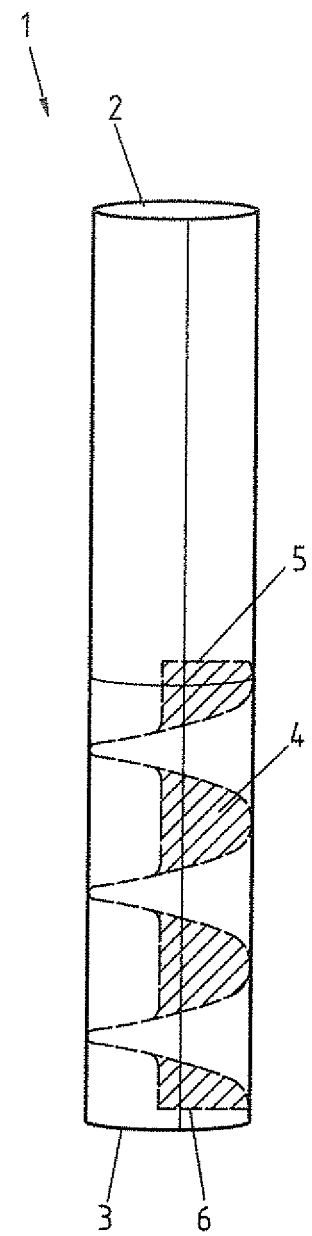

FIG.3

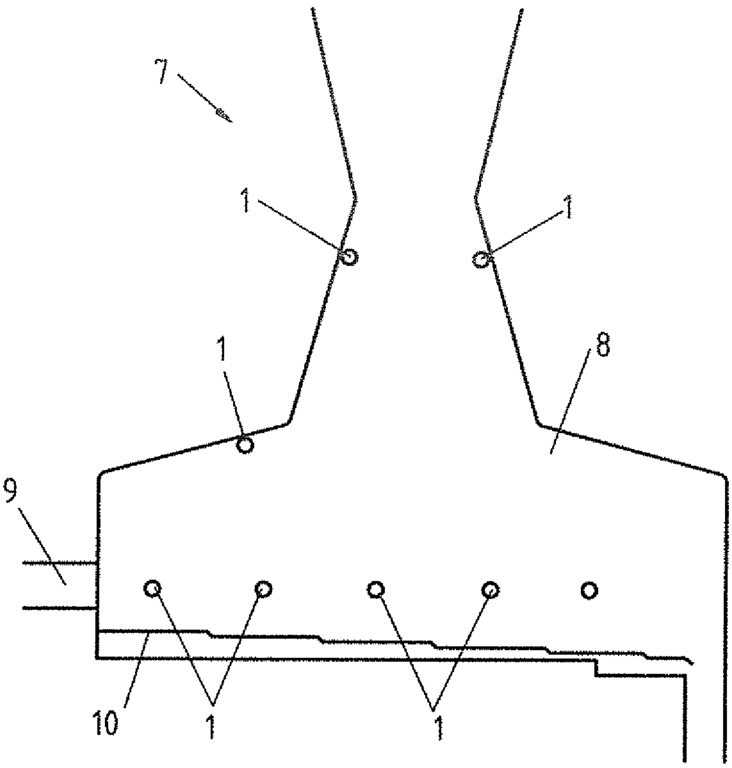

FIG.4

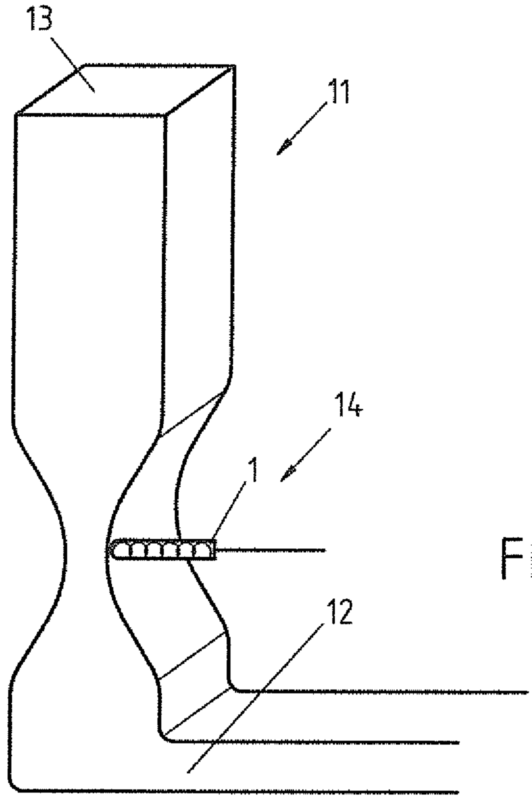

FIG.5

REFERENCES CITED IN THE DESCRIPTION

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