



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) **EP 1 489 354 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
22.12.2004 Bulletin 2004/52

(51) Int Cl.7: **F23G 5/027**, F23G 5/32,
F23C 7/02, F23G 5/16,
F23J 9/00

(21) Application number: **04022570.8**

(22) Date of filing: **19.04.2002**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE TR**

(30) Priority: **20.04.2001 JP 2001122859**
27.06.2001 JP 2001195269

(62) Document number(s) of the earlier application(s) in
accordance with Art. 76 EPC:
02720516.0 / 1 379 823

(71) Applicant: **EBARA CORPORATION**
Ohta-ku, Tokyo 144-8510 (JP)

(72) Inventors:
• **Endo, Hidekazu**
Tokyo 144-8510 (JP)

• **Ishikawa, Ryuichi**
Tokyo 144-8510 (JP)
• **Cho, Hiromitsu**
Tokyo 144-8510 (JP)

(74) Representative: **Emde, Eric**
Wagner & Geyer,
Gewürzmühlstrasse 5
80538 München (DE)

Remarks:

This application was filed on 22 - 09 - 2004 as a
divisional application to the application mentioned
under INID code 62.

(54) **Slagging combustion furnace**

(57) The present invention relates to a slagging
combustion furnace in a gasification and slagging com-
bustion system in which wastes are gasified to produce
combustible gas in a gasification furnace, and the pro-
duced combustible gas is combusted together with un-
burned carbon to generate molten slag in a slagging
combustion furnace. The slagging combustion furnace
(3) comprises a gas inlet port (20) formed in an upper
portion of the side wall for introducing combustible gas

(b) to produce a swirling flow of the combustible gas (b),
and a plurality of gas supply nozzles (24, 25), which are
open at an inner surface of the side wall and an inner
surface of the top wall, for supplying gas (f) for combus-
tion. The gas (f) for combustion is blown from the gas
supply nozzles (24, 25) into the swirling flow of the com-
bustible gas (b).

EP 1 489 354 A1

Description

Technical Field

[0001] The present invention relates to a waste treatment system for treating wastes including municipal wastes, industrial wastes, biomass wastes, medical wastes, automobile wastes such as waste tires or shredder dust, and the like, and more particularly to a slagging combustion furnace and a method of supplying gas for combustion in the slagging combustion furnace in a gasification and slagging combustion system in which the above wastes are gasified to produce combustible gas in a gasification furnace, and the produced combustible gas is combusted or gasified together with unburned carbon accompanied by the produced combustible gas to generate ash or molten slag in a swirling-type slagging combustion furnace.

Background Art

[0002] FIG. 1 of the accompanying drawings schematically shows essential elements of a conventional gasification and slagging combustion system having a waste heat boiler. As shown in FIG. 1, the conventional gasification and slagging combustion system comprises a waste supply device 1, a fluidized-bed gasification furnace 2, and a swirling-type slagging combustion furnace 3 having a primary combustion chamber 4, a secondary combustion chamber 5, and a tertiary combustion chamber 6. The gasification and slagging combustion system further comprises a waste heat boiler 7, an economizer 8, a bag filter 9, an exhaust gas reheater 10, a catalytic reaction tower 11, and a stack 12.

[0003] The conventional gasification and slagging combustion system shown in FIG. 1 operates as follows: Wastes *a* supplied from the waste supply device 1 into the fluidized-bed gasification furnace 2 are pyrolyzed and gasified to produce combustible gas *b* in a fluidized bed where a fluidized medium *c* (such as sand) is fluidized by fluidizing air *g* introduced from a bottom of the fluidized-bed gasification furnace 2. The gas *b* produced in the fluidized-bed gasification furnace 2 is introduced into the swirling-type slagging combustion furnace 3. In the swirling-type slagging combustion furnace 3, the produced gas *b* is mixed with gas *f* for combustion in the primary combustion chamber 4 and combusted at a high temperature of about 1350°C in the secondary combustion chamber 5 to combust char contained in the produced gas *b*, thus melting ash contained in the char. The produced gas *b* is further mixed with gas *f* for combustion in the tertiary combustion chamber 6 and combusted therein to generate exhaust gas *e*. The exhaust gas *e* having a high temperature of about 1350°C is then introduced into the waste heat boiler 7. Incombustibles *d* which are contained in the wastes *a* and are not gasified are discharged from the lower part of the fluidized bed in the fluidized-bed gasification furnace 2 to the out-

side. The ash melted in the swirling-type slagging combustion furnace 3 is discharged as molten slag *h* from the swirling-type slagging combustion furnace 3 to the outside.

[0004] The high-temperature exhaust gas *e* passes successively through the waste heat boiler 7 and the economizer 8, and thus is cooled to a temperature of about 160°C. The cooled exhaust gas *e* is introduced into the bag filter 9 where dust such as fly ash contained in the exhaust gas *e* is removed. Then, the exhaust gas *e* is preheated to a temperature (200°C to 210°C) enough to cause a catalytic reaction. NO_x and SO_x contained in the exhaust gas *e* are removed through a reaction with ammonia in the catalytic reaction tower 11, and then the exhaust gas *e* is discharged from the stack 12 into the atmosphere. On the other hand, steam produced in the waste heat boiler 7 is supplied to a steam turbine (not shown) coupled to a generator to generate electric power. The generated electric power is used for operating various equipment in the gasification and slagging combustion system to save energy and also to reduce the running cost.

[0005] As shown in FIGS. 2A and 2B of the accompanying drawings, the produced gas *b* from the fluidized-bed gasification furnace 2 is introduced into the primary combustion chamber 4 of the swirling-type slagging combustion furnace 3 in a direction tangential to an inner wall surface thereof from a high-temperature duct 21 connected to a gas inlet port 20 defined in an upper portion of the inner wall surface of the primary combustion chamber 4, thus generating a swirling flow of the gas in the primary combustion chamber 4. The gas *f* for combustion is supplied to the produced gas *b* in the primary combustion chamber 4 at a certain angle to the swirling flow of the produced gas *b* from a plurality of (eight in FIGS. 2A and 2B) gas supply nozzles 22 which are mounted on the side wall of the primary combustion chamber 4 and are open at the inner wall surface of the primary combustion chamber 4 downstream of the gas inlet port 20. Thus, the produced gas *b* is mixed with the gas *f* for combustion, and combusted at a high temperature in the secondary combustion chamber 5 and the tertiary combustion chamber 6. The primary combustion chamber 4 has a burner 23 mounted on its top wall for assisting the combustion of the produced gas *b* in the primary combustion chamber 4.

[0006] The structure shown in FIGS. 2A and 2B is disadvantageous in that, as shown in FIGS. 3A and 3B, a clinker *K*, which is made from the melted ash, is adhered (or attached) to and deposited on the inner wall surface of the primary combustion chamber 4 in the vicinity of the gas supply nozzles 22, where the gas is in the state within a transitional temperature range, which is uncertain range, between melting and solidifying of solid material constituting the ash in the gas.

[0007] More specifically, molten slag is produced at a temperature of 1300°C, preferably around 1350°C for the quality of slag.

[0008] If the combustible gas containing lots of solid material exists around this nozzle 22 in the space which is within the transitional temperature between melting and solidifying of solid material constituting the ash in the gas. In the transitional temperature, a part of the ash in the gas is in a melting state, and a part of the ash remains in a solid state. Because the ambient temperature of the solid material is lower than the start temperature of slag formation, for example, 1300°C and higher than the start temperature of slag fusion, for example, 1000°C, the melting state and the solid state of the material occur, and the material becomes highly viscous. Therefore, such material is liable to be adhered or attached to the inner wall surface. That is a reason of the making formation of the clinker-like material around the nozzle.

[0009] In order to prevent the clinker-like material from being formed, it is ideal that there is no gas at the transition temperature range. However, actually, the gas introduced from the gasification furnace and having a temperature of around 650°C up to 800°C should inevitably pass through the transitional temperature range because the gas reaches an available melting temperature of slag over 1300°C. Thus, the existence of the transitional temperature range has a great effect on clogging of the gas supply nozzles 22 or the primary combustion chamber 4. When the gas supply nozzles 22 or the primary combustion chamber 4 is clogged, the gasification and slagging combustion system fails to operate normally.

Disclosure of Invention

[0010] The present invention has been made in view of the above drawbacks. It is therefore an object of the present invention to provide a slagging combustion furnace for use in a gasification and slagging combustion system which can prevent a clinker from being adhered to an inner wall surface of the slagging combustion furnace for thereby preventing supply nozzles for supplying gas for combustion such as combustion air and a primary combustion chamber from being clogged, and allows the gasification and slagging combustion system to operate continuously stably.

[0011] Another object of the present invention is to provide a method of supplying gas for combustion into such slagging combustion furnace.

[0012] In order to achieve the above object of the present invention, according to an aspect of the present invention, there is provided a slagging combustion furnace comprising: a side wall and a top wall; a gas inlet port formed in an upper portion of the side wall for introducing combustible gas to produce a swirling flow of the combustible gas; and a plurality of gas supply nozzles, which are open at an inner surface of the side wall and an inner surface of the top wall, for supplying gas for combustion; wherein the gas for combustion is blown from the gas supply nozzles into the swirling flow of the

combustible gas.

[0013] According to the present invention, the gas for combustion is blown from the gas supply nozzles which are open at the inner surface of the side wall and the inner surface of the top wall, into the produced combustible gas to mix the gas for combustion well with the produced gas for thereby increasing the temperature of the gas quickly and minimizing the time of the gas which passes through the transitional temperature range, i.e., allowing the gas to pass through such transitional temperature range as quickly as possible, and minimizing the space, in the slagging combustion furnace, where the atmosphere is within the transitional temperature range, i.e., making such space as small as possible. With this specific arrangement of the present invention, the surface area of adhesion or attachment of clinker to the inner wall of the slagging combustion furnace is minimized, resulting in the prevention of adhesion or attachment to the inner wall surface of the slagging combustion furnace. As a result, a clinker is prevented from being adhered (or attached) to the inner wall surface of the slagging combustion furnace.

[0014] According to another aspect of the present invention, there is provided a slagging combustion furnace comprising: a side wall and a top wall; a gas inlet port formed in an upper portion of the side wall for introducing combustible gas to produce a swirling flow of the combustible gas; and a gas supply nozzle, which is open at an inner surface of the side wall near the gas inlet port, for supplying the combustible gas; wherein the gas for combustion is blown from the gas supply nozzle into the combustible gas introduced from the gas inlet port.

[0015] According to the present invention, the gas for combustion is blown from the gas supply nozzle which is open at the inner surface of the side wall near the gas inlet port for supplying the produced gas to mix the gas for combustion well with the produced gas for thereby increasing the temperature of the gas quickly and minimizing the time of the gas which passes through the transitional temperature range, i.e., allowing the gas to pass through such transitional temperature range as quickly as possible, and minimizing the space, in the slagging combustion furnace, where the atmosphere is within the transitional temperature range, i.e., making such space as small as possible. With this specific arrangement of the present invention, the surface area of adhesion or attachment of clinker to the inner wall of the slagging combustion furnace is minimized, resulting in the prevention of adhesion or attachment to the inner wall surface of the slagging combustion furnace. As a result, a clinker is prevented from being adhered or attached to the inner wall surface of the slagging combustion furnace.

[0016] According to a preferred aspect of the present invention, the gas supply nozzle forms a swirling flow of the gas for combustion.

[0017] Because the gas for combustion is introduced from the gas supply nozzle as a swirling flow into the

produced gas, the gas for combustion is mixed well with the produced gas for thereby increasing the temperature of the gas quickly and minimizing the time of the gas which passes through the transitional temperature range, i.e., allowing the gas to pass through such transitional temperature range as quickly as possible, and minimizing the space, in the slagging combustion furnace, where the atmosphere is within the transitional temperature range, i.e., making such space as small as possible. With this specific arrangement of the present invention, the surface area of adhesion or attachment of clinker to the inner wall of the slagging combustion furnace is minimized, resulting in the prevention of adhesion or attachment to the inner wall surface of the slagging combustion furnace. As a result, a clinker is further prevented from being adhered to the inner wall surface of the slagging combustion furnace.

[0018] According to another aspect of the present invention, there is provided a slagging combustion furnace comprising: a side wall and a top wall; a gas inlet port formed in the side wall for introducing combustible gas; and a gas supply nozzle, which is open at an inner surface of the side wall near the gas inlet, for supplying the combustible gas; wherein the gas for combustion is blown from the gas supply nozzle into the combustible gas introduced from the gas inlet port.

[0019] According to another aspect of the present invention, there is provided a method of supplying gas for combustion into a slagging combustion furnace, the method comprising: introducing combustible gas from a gas inlet port formed in an upper portion of a side wall of the slagging combustion furnace to produce a swirling flow of the combustible gas; and introducing gas for combustion from a plurality of gas supply nozzles which are open at an inner surface of the side wall and an inner surface of a top wall, into the swirling flow of the combustible gas.

[0020] According to the present invention, because the gas for combustion is introduced from the gas supply nozzles which are open at the inner surface of the side wall and the inner surface of the top wall of the slagging combustion furnace, into the swirling flow of the produced gas, a clinker is prevented from being adhered to the side and top walls of the slagging combustion furnace.

[0021] According to a preferred aspect of the present invention, a method of supplying gas for combustion into a slagging combustion furnace further comprises introducing gas for combustion from a gas supply nozzle which is open at an inner surface of the side wall near the gas inlet port, into the combustible gas.

[0022] According to the present invention, because the gas for combustion is introduced from the gas supply nozzle which is open at the inner surface of the side wall near the gas inlet port, into the produced gas, a clinker is further prevented from being adhered to the side and top walls of the primary combustion chamber of the slagging combustion furnace.

[0023] According to another aspect of the present invention, there is provided a method of supplying gas into a slagging combustion furnace comprising a primary combustion chamber, a secondary combustion chamber coupled to the primary combustion chamber, and a tertiary combustion chamber coupled to the secondary combustion chamber, the method comprising: introducing combustible gas produced at an air ratio ranging from 0.2 to 0.3 from a gas inlet port formed in an upper portion of a side wall of the primary combustion chamber; and adjusting the amount of gas for combustion introduced respectively into the primary combustion chamber, the secondary combustion chamber, and the tertiary combustion chamber such that the air ratio in an upper portion of the primary combustion chamber is approximately 1.0.

[0024] According to a preferred aspect of the present invention, the tertiary combustion chamber is adjusted such that the air ratios in the secondary and tertiary combustion chambers increase from 1.0 to 1.5.

[0025] According to the present invention, the air ratio in the upper portion of the primary combustion chamber is approximately 1.0, and hence the temperature in the primary combustion chamber near the gas inlet port for introducing the produced gas is maintained at a high value of about 1300°C, thus minimizing the time of the gas which passes through the transitional temperature range, i.e., allowing the gas to pass through such transitional temperature range as quickly as possible, and minimizing the space, in the slagging combustion furnace, where the atmosphere is within the transitional temperature range, i.e., making such space as small as possible. With this specific arrangement of the present invention, the surface area of adhesion or attachment of clinker to the inner wall of the slagging combustion furnace is minimized, resulting in the prevention of adhesion or attachment to the inner wall surface of the slagging combustion furnace. If the air ratio were greater than 1.0, the temperature in the primary combustion chamber is lowered, thus tending to approach to the temperature range in which a clinker is adhered to the inner wall surface of the primary combustion chamber. Further, the amount of gas for combustion is adjusted such that the air ratios in the secondary and tertiary combustion chambers increase progressively from 1.0 to 1.5, and hence the produced gas and unburned materials such as char contained therein are completely combusted, and the temperature in the slagging combustion furnace is kept at a high value for thereby increasing the percentage of slagging.

[0026] According to still another aspect of the present invention, there is provided a gasification and slagging combustion system comprising: a fluidized-bed gasification furnace for gasifying wastes to produce combustible gas; and a slagging combustion furnace for combusting the combustible gas and melting ash contained in the combustible gas to generate molten slag; the slagging combustion furnace comprising: a side wall and a

top wall; a gas inlet port formed in an upper portion of the side wall for introducing combustible gas to produce a swirling flow of the combustible gas; and a plurality of gas supply nozzles, which are open at an inner surface of the side wall and an inner surface of the top wall, for supplying gas for combustion; wherein the gas for combustion is blown from the gas supply nozzles into the swirling flow of the combustible gas.

[0027] According to still another aspect of the present invention, there is provided a gasification and slagging combustion system comprising: a fluidized-bed gasification furnace for gasifying wastes to produce combustible gas; and a slagging combustion furnace for combusting the combustible gas and melting ash contained in the combustible gas to generate molten slag; the slagging combustion furnace comprising: a side wall and a top wall; a gas inlet port formed in an upper portion of the side wall for introducing combustible gas to produce a swirling flow of the combustible gas; and a gas supply nozzle, which is open at an inner surface of the side wall near the gas inlet port, for supplying gas for combustion; wherein the gas for combustion is blown from the gas supply nozzle into the combustible gas introduced from the gas inlet port.

[0028] The above and other objects, features, and advantages of the present invention will become apparent from the following description when taken in conjunction with the accompanying drawings which illustrate preferred embodiments of the present invention by way of example.

Brief Description of Drawings

[0029]

FIG. 1 is a schematic diagram of essential elements of a conventional gasification and slagging combustion system having a waste heat boiler;

FIG. 2A is a side elevational view of a slagging combustion furnace in the conventional gasification and slagging combustion system;

FIG. 2B is a plan view of a primary combustion chamber of the slagging combustion furnace shown in FIG. 2A;

FIG. 3A is a cross-sectional view taken along line A-A of FIG. 3B;

FIG. 3B is a plan view showing how a clinker is adhered to and deposited on an inner wall surface of the primary combustion chamber of the slagging combustion furnace shown in FIG. 2A;

FIG. 4A is a side elevational view of a slagging combustion furnace in a gasification and slagging combustion system according to an embodiment of the present invention;

FIG. 4B is a plan view of a primary combustion chamber of the slagging combustion furnace shown in FIG. 4A;

FIG. 5A is a side elevational view of a slagging combustion furnace in a gasification and slagging combustion system according to another embodiment of the present invention;

FIG. 5B is a plan view of a primary combustion chamber of the slagging combustion furnace shown in FIG. 5A;

FIG. 6A is a side elevational view of a slagging combustion furnace in a gasification and slagging combustion system according to still another embodiment of the present invention;

FIG. 6B is a plan view of a primary combustion chamber of the slagging combustion furnace shown in FIG. 6A;

FIG. 7A is a side elevational view of a slagging combustion furnace in a gasification and slagging combustion system according to still another embodiment of the present invention;

FIG. 7B is a plan view of a primary combustion chamber of the slagging combustion furnace shown in FIG. 7A;

FIG. 8 is a view showing a gas supply nozzle for supplying gas for combustion used in the slagging combustion furnace according to the present invention;

FIG. 9A is a side elevational view, partly in cross section, of a swirler of the gas supply nozzle shown in FIG. 8;

FIG. 9B is a front elevational view of the swirler shown in FIG. 9A;

FIG. 10A is a side elevational view of a system for introducing gas for combustion into combustion chambers of the slagging combustion furnace according to the present invention; and

FIG. 10B is a cross-sectional view taken along line A-A of FIG. 10A.

Best Mode for Carrying Out the Invention

[0030] A slagging combustion furnace according to embodiments of the present invention will be described below with reference to the drawings. FIGS. 4A and 4B through 10A and 10B show slagging combustion furnaces in a gasification and slagging combustion system according to various embodiments of the present invention. Those parts of the slagging combustion furnaces shown in FIGS. 4A and 4B through 10A and 10B which are identical to those of the conventional slagging combustion furnace shown in FIGS. 2A and 2B are denoted by identical reference numerals, and will not be described in detail below.

[0031] FIGS. 4A and 4B show a slagging combustion furnace in a gasification and slagging combustion system according to an embodiment of the present invention. As shown in FIGS. 4A and 4B, the slagging combustion furnace comprises a swirling-type slagging combustion furnace 3 having a primary combustion chamber 4, a secondary combustion chamber 5, and a tertiary combustion chamber 6.

[0032] The swirling-type slagging combustion furnace 3 has a high-temperature duct 21 connected to a gas inlet port 20 defined in an upper portion of the inner wall surface of the primary combustion chamber 4. The high-temperature duct 21 serves to introduce the produced gas *b* supplied from the fluidized-bed gasification furnace 2 (see FIG. 1). Simultaneously, supplying a gas for combustion into the flow of the produced gas *b* is performed in a direction so as to be substantially along the flow of the produced gas *b* at the introductory part of the produced gas *b* in the slagging combustion furnace 3. That is, the gas for combustion is introduced into the flow of the produced gas *b* so as to flow in the identical direction or in substantially the same direction as the produced gas *b*. The swirling-type slagging combustion furnace 3 also has a plurality of (six in FIGS. 4A and 4B) gas supply nozzles 24 which are mounted on the top wall of the primary combustion chamber 4 and are open at the inner wall surface of the primary combustion chamber 4, and a plurality of (four in FIGS. 4A and 4B) gas supply nozzles 25 which are mounted on the side wall of the primary combustion chamber 4 and are open at the inner wall surface of the primary combustion chamber 4 near the gas inlet port 20.

[0033] The gas supply nozzles for supplying gas for combustion are disposed at the introduction part of the produced gas *b* supplied from the gasification furnace in the slagging combustion furnace. The amount of the gas for combustion supplied from the gas supply nozzles is such an amount that the supplied produced gas is substantially completely combusted (in case of air, the air ratio is 1.0), and hence combustion of the produced gas caused by supply of the gas for combustion raises rapidly the ambient temperature of the introduction part in the slagging combustion furnace to 1350°C. Therefore, the number of the gas supply nozzles is different depending on the size of the system and is not so important, and may be one or two or more.

[0034] In the swirling-type slagging combustion furnace 3 having the above structure, the produced gas *b* is introduced from the high-temperature duct 21 through the gas inlet port 20 into the primary combustion chamber 4 to generate a swirling flow of the produced gas *b* therein. At the same time, gas *f* for combustion comprising air, oxygen-enriched air, or oxygen is introduced from the gas supply nozzles 24 whose tip ends are open at the inner wall surface of the top wall, into the swirling flow in a direction perpendicular to the swirling flow of the produced gas *b*. Further, gas *f* for combustion is introduced from the gas supply nozzles 25 whose tip ends are open at the inner wall surface of the side wall, into the swirling flow of the produced gas *b* at a certain angle to the swirling flow. Since the gas *f* for combustion is introduced from the gas supply nozzles 24 and 25 on the top and side walls of the primary combustion chamber 4, it is well mixed with the produced gas *b*, thus allowing the produced gas *b* to be combusted quickly and achieving temperature rise quickly, and minimizing the

time of the gas which passes through the transitional temperature range, i.e., allowing the gas to pass through such transitional temperature range as quickly as possible, and minimizing the space, in the slagging combustion furnace, where the atmosphere is within the transitional temperature range, i.e., making such space as small as possible. With this specific arrangement of the present invention, the surface area of adhesion or attachment of clinker to the inner wall of the slagging combustion furnace is minimized, resulting in the prevention of adhesion or attachment to the inner wall surface of the primary combustion chamber 4 and furthermore the inner wall surface toward the outlet where the melted ash (i.e. slag) is discharged.

[0035] FIGS. 5A and 5B show a slagging combustion furnace in a gasification and slagging combustion system according to another embodiment of the present invention. The slagging combustion furnace shown in FIGS. 5A and 5B differs from the slagging combustion furnace shown in FIGS. 4A and 4B in that it additionally has a vertical array of (three in FIGS. 5A and 5B) gas supply nozzles 26 which are mounted on the side wall of the primary combustion chamber 4 and are open at the inner wall surface of the primary combustion chamber 4 on one side of the gas inlet port 20 in the vicinity of the gas inlet port 20. The gas supply nozzles 26 serve to introduce gas *f* for combustion comprising air, oxygen-enriched air, or oxygen so as to be across the gas inlet port 20. In the case where the produced gas *b* has a low calorific value, as the content of N₂ which is not related to the combustion is low, the gas *f* for combustion supplied from the gas supply nozzles 26 allows the produced gas *b* to be combusted efficiently for thereby achieving high temperature quickly. In addition to the advantages offered by the slagging combustion furnace shown in FIGS. 4A and 4B, the slagging combustion furnace shown in FIGS. 5A and 5B also offers the advantage that it is capable of preventing a clinker from being adhered to the vicinity of the gas inlet port 20.

[0036] FIGS. 6A and 6B show a slagging combustion furnace in a gasification and slagging combustion system according to still another embodiment of the present invention. The slagging combustion furnace shown in FIGS. 6A and 6B differs from the slagging combustion furnace shown in FIGS. 5A and 5B in that it additionally has two vertical arrays of (six in FIGS. 6A and 6B) gas supply nozzles 26 and 27 which are mounted on the side wall of the primary combustion chamber 4 and are open at the inner wall surface of the primary combustion chamber 4 on both sides of the gas inlet port 20 in the vicinity of the gas inlet port 20. The gas supply nozzles 26 serve to introduce the gas *f* for combustion comprising air, oxygen-enriched air, or oxygen so as to be across the gas inlet port 20, and the gas supply nozzles 27 serve to introduce the gas *f* for combustion at a certain angle to the swirling flow of the produced gas *b*. In addition to the advantages offered by the slagging combustion furnace shown in FIGS. 5A and 5B, the slagging

combustion furnace shown in FIGS. 6A and 6B also offers the advantage that it is capable of effectively preventing a clinker from being attached to the inner wall surface of the primary combustion chamber 4 in the vicinity of the gas inlet port 20.

[0037] FIGS. 7A and 7B show a slagging combustion furnace in a gasification and slagging combustion system according to still another embodiment of the present invention. The slagging combustion furnace shown in FIGS. 7A and 7B differs from the slagging combustion furnace shown in FIGS. 6A and 6B in that the gas supply nozzles 27 have tip ends 27a bent so as to cause the gas *f* for combustion introduced therefrom to flow in substantially the same direction as the produced gas *b* introduced from the gas inlet port 20. In addition to the advantages offered by the slagging combustion furnace shown in FIGS. 6A and 6B, the slagging combustion furnace shown in FIGS. 7A and 7B also offers the advantage that it is capable of more effectively preventing a clinker from being adhered to the inner wall surface of the primary combustion chamber 4 in the vicinity of the gas inlet port 20.

[0038] FIGS. 8, 9A and 9B show one of the gas supply nozzles 25 which supply gas for combustion and are identical to each other. As shown in FIG. 8, the gas supply nozzle 25 has an outer tube 25a, an inner tube 25c disposed in the outer tube 25a, and a swirler 25b attached to a distal end of the inner tube 25c. An outlet tube 25e is connected to the swirler 25d and disposed in the outer tube 25a which is open at the inner wall surface of the primary combustion chamber 4. A gas inlet tube 25g for introducing the gas *f* for combustion is connected to the outer tube 25a, and the outer tube 25a has a rear end closed by a lid 25b remotely from the primary combustion chamber 4.

[0039] As shown in FIGS. 9A and 9B, the swirler 25d comprises a boss 25d-3 fixed to the tip end of the inner tube 25c, a ring plate 25d-1 disposed around the boss 25d-3, and a plurality of swirling vanes 25d-2 disposed between and joined to the boss 25d-3 and the ring plate 25d-1 for producing a swirling flow of the gas for combustion.

[0040] The gas supply nozzle 25 operates as follows: The gas *f* for combustion introduced from the gas inlet tube 25g passes through the gap between the outer tube 25a and the inner tube 25c to the swirler 25d, and is turned by the swirling vanes 25d-2 into a helical swirling flow. Then, the gas *f* for combustion is introduced in the swirling flow through the outlet tube 25e into the primary combustion chamber 4.

[0041] Since the gas *f* for combustion is introduced as a swirling flow from the gas supply nozzle 25 into the primary combustion chamber 4, the gas *f* for combustion is well mixed with the produced gas *b*, thus allowing the produced gas *b* to be combusted quickly and achieving temperature rise quickly. Consequently, the temperature range in which a clinker is adhered to the inner wall surface of the primary combustion chamber 4 is mini-

mized. Each of the gas supply nozzles 24, 26 and 27 described above should preferably be of a structure identical or similar to the gas supply nozzle 25 shown in FIGS. 8, 9A and 9B.

[0042] In each of the above embodiments, the swirling-type slagging combustion furnace 3 is of a substantially U-shaped configuration in which the primary combustion chamber 4, the secondary combustion chamber 5, and the tertiary combustion chamber 6 are successively arranged. However, the swirling-type slagging combustion furnace according to the present invention is not limited to the illustrated structure, but may be of any structure capable of introducing produced combustible gas from a gas inlet port in a side wall thereof and generating a swirling flow of the produced combustible gas.

[0043] FIGS. 10A and 10B show a system for introducing gas for combustion into the combustion chamber of the slagging combustion furnace according to the present invention. FIG. 10A is a side cross-sectional view of the slagging combustion furnace, and FIG. 10B is a cross-sectional view taken along line A-A. As shown in FIG. 10A, the system includes a blower 30 for supplying gas *f* (mainly air) for combustion, a damper 31 connected to the blower 30, and flow control valves 32, 33, 34 and 35 connected to the damper 31 for supplying the gas *f* for combustion to the gas inlet port 20, the primary combustion chamber 4 coupled to the gas inlet port 20, the secondary combustion chamber 5 coupled to the primary combustion chamber 4, and the tertiary combustion chamber 6 coupled to the secondary combustion chamber 5.

[0044] As shown in FIG. 10B, the produced gas *b* flows through the high-temperature duct 21 and is introduced from the gas inlet port 20 at a speed of 15 m/s to 25 m/s, preferably 18 m/s to 20 m/s into the primary combustion chamber 4, and the gas *f* for combustion is introduced from the gas supply nozzles 26 and 27 into the gas inlet port 20, thereby forming flames 39 in the primary combustion chamber 4 of the swirling-type slagging combustion furnace 3. The gas *f* for combustion is blown such that the air ratio A·R in the upper portion of the primary combustion chamber 4 is in the range of 0.8 to 1.1, preferably 0.9 to 1.0. The air ratio is defined as the ratio of the amount of supplied air to the amount of air, which is set to 1.0, required to completely convert combustibles in the wastes into H₂O and CO₂ by way of combustion.

[0045] With the gas *f* for combustion thus introduced, the temperature in the primary combustion chamber 4 including the area near the gas inlet port 20 can be maintained at a high value of about 1300°C or higher, thus minimizing the time of the gas which passes through the transitional temperature range, i.e., allowing the gas to pass through such transitional temperature range as quickly as possible, and minimizing the space, in the slagging combustion furnace, where the atmosphere is within the transitional temperature range, i.e., making

such space as small as possible. With this specific arrangement of the present invention, the surface area of adhesion or attachment of clinker to the inner wall of the slagging combustion furnace is minimized, resulting in the prevention of adhesion or attachment to the inner wall surface of the slagging combustion furnace. If the air ratio were greater than 1.0, the amount of air which does not contribute to combustion would increase, and the cooling effect caused by air would also increase, thus lowering the temperature in the primary combustion chamber 4 and tending to expand the temperature range in which a clinker is adhered to the inner wall surface of the primary combustion chamber 4.

[0046] The air ratio A·R is increased successively in the secondary combustion chamber 5 and the tertiary combustion chamber 6. Specifically, the air ratio A·R in the secondary combustion chamber 5 is set to a value ranging from 0.9 to 1.3, preferably from 1.0 to 1.2, and the air ratio A·R in the tertiary combustion chamber 6 is set to a value ranging from 1.2 to 1.7, preferably from 1.3 to 1.5. When the air ratio A·R is set to a value ranging from 0.9 to 1.3, preferably from 1.0 to 1.2 until the molten slag *h* is discharged from a slag outlet port 40, the temperature in the secondary combustion chamber 5 up to the slag outlet port 40 is maintained at a maximum level, thus allowing the molten slag *h* to be discharged downwardly stably. In consideration of discharge of the exhaust gas to the outside of the stack, adding the gas for combustion in the high temperature is effective to combust a small amount of unburned CO (carbon monoxide) in almost all combusted gas in the slagging combustion furnace. Thus, the air ratio is set to a value ranging from 1.2 to 1.7, preferably from 1.3 to 1.5, while keeping the slagging combustion furnace at a high temperature. That is, the air ratio A·R in the tertiary combustion chamber 6 is set to a large value ranging from 1.3 to 1.5, whereby unburned CO is effectively combusted, and pyrolyzed gas and char are completely combusted without lack of air for combustion, even if the wastes are fluctuated in the supplied amount or quality.

[0047] By progressively increasing the air ratio A·R in the slagging combustion furnace 3 successively through the primary combustion chamber 4, the secondary combustion chamber 5, and the tertiary combustion chamber 6 from A·R=1.3 to A·R=1.5, the gas *f* for combustion is supplied in an excessive amount to absorb variations in the supplied amount of wastes and minimize any reduction in the temperature in the slagging combustion furnace 3. Therefore, the produced gas *b* and unburned materials such as char contained therein can be completely combusted, and the temperature in the slagging combustion furnace 3 can be kept at a high level for thereby increasing the percentage of slagging.

[0048] As shown in FIG. 10A, thermometers 36, 37 and 38 are mounted on the top wall of the primary combustion chamber 4, the wall of the secondary combustion chamber 5, and the wall of the tertiary combustion chamber 6, respectively, for measuring the tempera-

tures in these combustion chambers. Each of the thermometers 36, 37 and 38 may comprise a thermocouple or a radiation thermometer. The temperatures in the combustion chambers may alternatively be calculated from the temperature of the exhaust gas discharged from the slagging combustion furnace 3 using the amount of recovered heat and the amount of cooling air that is used. The above ranges of the air ratio can be controlled using the temperatures thus measured or calculated.

[0049] According to the present invention, the following excellent effects can be obtained.

1) The gas for combustion is blown from the gas supply nozzles which are open at the inner surface of the side wall and the inner surface of the top wall, into the produced combustible gas to mix the gas for combustion well with the produced gas for thereby increasing the temperature of the gas quickly and minimizing the temperature range in which a clinker is adhered (or attached) to the inner wall surface of primary combustion chamber of the slagging combustion furnace. As a result, a clinker is prevented from being adhered or attached to the inner wall surface of the slagging combustion furnace. Consequently, the gasification and slagging combustion system can be stably operated continuously.

2) The gas for combustion is blown from the gas supply nozzle which is open at the inner surface of the side wall near the gas inlet port for supplying the produced gas to mix the gas for combustion well with the produced gas for thereby increasing the temperature of the gas quickly and minimizing the temperature range in which a clinker is adhered or attached to the inner wall surface of the slagging combustion furnace. As a result, a clinker is prevented from being adhered or attached to the inner wall surface of the slagging combustion furnace. Consequently, the gasification and slagging combustion system can be stably operated continuously.

3) Because the gas for combustion is introduced from the gas supply nozzle as a swirling flow into the produced gas, the gas for combustion is mixed well with the produced gas for thereby increasing the temperature of the gas quickly and minimizing the temperature range in which a clinker is adhered to the inner wall surface of the slagging combustion furnace. As a result, a clinker is further prevented from being adhered to the inner wall surface of the slagging combustion furnace.

4) Because the gas for combustion is introduced from the gas supply nozzles which are open at the inner surface of the side wall and the inner surface of the top wall of the slagging combustion furnace, into the swirling flow of the produced gas, a clinker is prevented from being adhered to the side and top

walls of the slagging combustion furnace.

5) Because the gas for combustion is introduced from the gas supply nozzle which is open at the inner surface of the side wall near the gas inlet port, into the produced gas, a clinker is further prevented from being adhered to the side and top walls of the slagging combustion furnace.

6) The air ratio in the upper portion of the primary combustion chamber is approximately 1.0, and hence the temperature in the primary combustion chamber near the gas inlet port for introducing the produced gas is maintained at a high value of about 1300°C, thus minimizing the temperature range in which a clinker is adhered or attached to the inner wall surface of the primary combustion chamber. Further, the amount of gas for combustion is adjusted such that the air ratios in the secondary and tertiary combustion chambers increase progressively from 1.0 to 1.5, and hence the produced gas and unburned materials such as char contained therein are completely combusted, and the temperature in the slagging combustion furnace is kept at a high value for thereby increasing the percentage of slagging.

[0050] Although certain preferred embodiments of the present invention have been shown and described in detail, it should be understood that various changes and modifications may be made therein without departing from the scope of the appended claims.

Industrial Applicability

[0051] The present invention is applicable to a slagging combustion furnace in a gasification and slagging combustion system in which wastes including municipal wastes, industrial wastes, biomass wastes, medical wastes, automobile wastes such as waste tires or shredder dust, and the like are gasified to produce combustible gas in a gasification furnace, and the produced combustible gas is combusted or gasified together with unburned carbon accompanied by the combustible gas to generate ash or molten slag in a swirling-type slagging combustion furnace.

Claims

1. A slagging combustion furnace comprising:

a side wall and a top wall;
a gas inlet port formed in an upper portion of said side wall for introducing combustible gas to produce a swirling flow of said combustible gas; and
a plurality of gas supply nozzles, which are open at an inner surface of said side wall and an inner surface of said top wall, for supplying

gas for combustion;

wherein said gas for combustion is blown from said gas supply nozzles into said swirling flow of said combustible gas.

2. A slagging combustion furnace according to claim 1, wherein said combustible gas is produced by gasifying wastes in a gasification furnace, and then supplied to said gas inlet port.

3. A slagging combustion furnace according to claim 1, wherein said combustible gas is combusted by said gas for combustion and ash in said combustible gas is melted to produce molten slag.

4. A slagging combustion furnace according to claim 1, wherein said gas supply nozzle forms a swirling flow of said gas for combustion.

5. A slagging combustion furnace according to claim 4, wherein said gas supply nozzle comprises a swirler having vanes for producing said swirling flow of said gas for combustion.

6. A slagging combustion furnace according to claim 1, wherein said slagging combustion furnace comprises a primary combustion chamber, a secondary combustion chamber coupled to the primary combustion chamber, and a tertiary combustion chamber coupled to the secondary combustion chamber; and the amount of said gas for combustion introduced respectively into said primary combustion chamber, said secondary combustion chamber, and said tertiary combustion chamber is adjusted such that the air ratio in an upper portion of said primary combustion chamber is approximately 1.0 and the air ratios in the secondary and tertiary combustion chambers increase progressively from 1.0 to 1.5.

7. A slagging combustion furnace comprising:

a side wall and a top wall;
a gas inlet port formed in an upper portion of said side wall for introducing combustible gas to produce a swirling flow of said combustible gas; and
a gas supply nozzle, which is open at an inner surface of said side wall near said gas inlet port, for supplying said combustible gas;

wherein said gas for combustion is blown from said gas supply nozzle into said combustible gas introduced from said gas inlet port.

8. A slagging combustion furnace according to claim 7, wherein said combustible gas is produced by gasifying wastes in a gasification furnace, and then

supplied to said gas inlet port.

9. A slagging combustion furnace according to claim 7, wherein said combustible gas is combusted by said gas for combustion and ash in said 'combustible gas is melted to produce molten slag.

10. A slagging combustion furnace according to claim 7, wherein said gas supply nozzle forms a swirling flow of said gas for combustion.

11. A slagging combustion furnace according to claim 10, wherein said gas supply nozzle comprises a swirler having vanes for producing said swirling flow of said gas for combustion.

12. A slagging combustion furnace according to claim 7, wherein said slagging combustion furnace comprises a primary combustion chamber, a secondary combustion chamber coupled to the primary combustion chamber, and a tertiary combustion chamber coupled to the secondary combustion chamber; and the amount of said gas for combustion introduced respectively into said primary combustion chamber, said secondary combustion chamber, and said tertiary combustion chamber is adjusted such that the air ratio in an upper portion of said primary combustion chamber is approximately 1.0.

13. A slagging combustion furnace according to claim 12, wherein said tertiary combustion chamber is adjusted such that the air ratios in the secondary and tertiary combustion chambers increase from 1.0 to 1.5.

14. A slagging combustion furnace comprising:

a side wall and a top wall;
a gas inlet port formed in said side wall for introducing combustible gas; and
a gas supply nozzle, which is open at an inner surface of said side wall near said gas inlet, for supplying said combustible gas;

wherein said gas for combustion is blown from said gas supply nozzle into said combustible gas introduced from said gas inlet port.

15. A method of supplying gas for combustion into a slagging combustion furnace, the method comprising:

introducing combustible gas from a gas inlet port formed in an upper portion of a side wall of said slagging combustion furnace to produce a swirling flow of said combustible gas; and
introducing gas for combustion from a plurality of gas supply nozzles which are open at an in-

ner surface of said side wall and an inner surface of a top wall, into said swirling flow of said combustible gas.

16. A method according to claim 15, further comprising: introducing gas for combustion from a gas supply nozzle which is open at an inner surface of said side wall near said gas inlet port, into said combustible gas.

17. A method of supplying gas into a slagging combustion furnace comprising a primary combustion chamber, a secondary combustion chamber coupled to the primary combustion chamber, and a tertiary combustion chamber coupled to the secondary combustion chamber, the method comprising:

introducing combustible gas produced at an air ratio ranging from 0.2 to 0.3 from a gas inlet port formed in an upper portion of a side wall of said primary combustion chamber; and
adjusting the amount of gas for combustion introduced respectively into said primary combustion chamber, said secondary combustion chamber, and said tertiary combustion chamber such that the air ratio in an upper portion of said primary combustion chamber is approximately 1.0.

18. A method according to claim 17, wherein said tertiary combustion chamber is adjusted such that the air ratios in the secondary and tertiary combustion chambers increase from 1.0 to 1.5.

19. A gasification and slagging combustion system comprising:

a fluidized-bed gasification furnace for gasifying wastes to produce combustible gas; and
a slagging combustion furnace for combusting said combustible gas and melting ash contained in said combustible gas to generate molten slag;
said slagging combustion furnace comprising:

a side wall and a top wall;
a gas inlet port formed in an upper portion of said side wall for introducing combustible gas to produce a swirling flow of said combustible gas; and
a plurality of gas supply nozzles, which are open at an inner surface of said side wall and an inner surface of said top wall, for supplying gas for combustion;

wherein said gas for combustion is blown from said gas supply nozzles into said swirling flow of said combustible gas.

20. A gasification and slagging combustion system comprising:

a fluidized-bed gasification furnace for gasifying wastes to produce combustible gas; and 5
a slagging combustion furnace for combusting said combustible gas and melting ash contained in said combustible gas to generate molten slag;
said slagging combustion furnace comprising: 10

a side wall and a top wall;
a gas inlet port formed in an upper portion of said side wall for introducing combustible gas to produce a swirling flow of said 15
combustible gas; and
a gas supply nozzle, which is open at an inner surface of said side wall near said gas inlet port, for supplying gas for combustion; 20

wherein said gas for combustion is blown from said gas supply nozzle into said combustible gas introduced from said gas inlet port.

25

30

35

40

45

50

55

FIG. 1

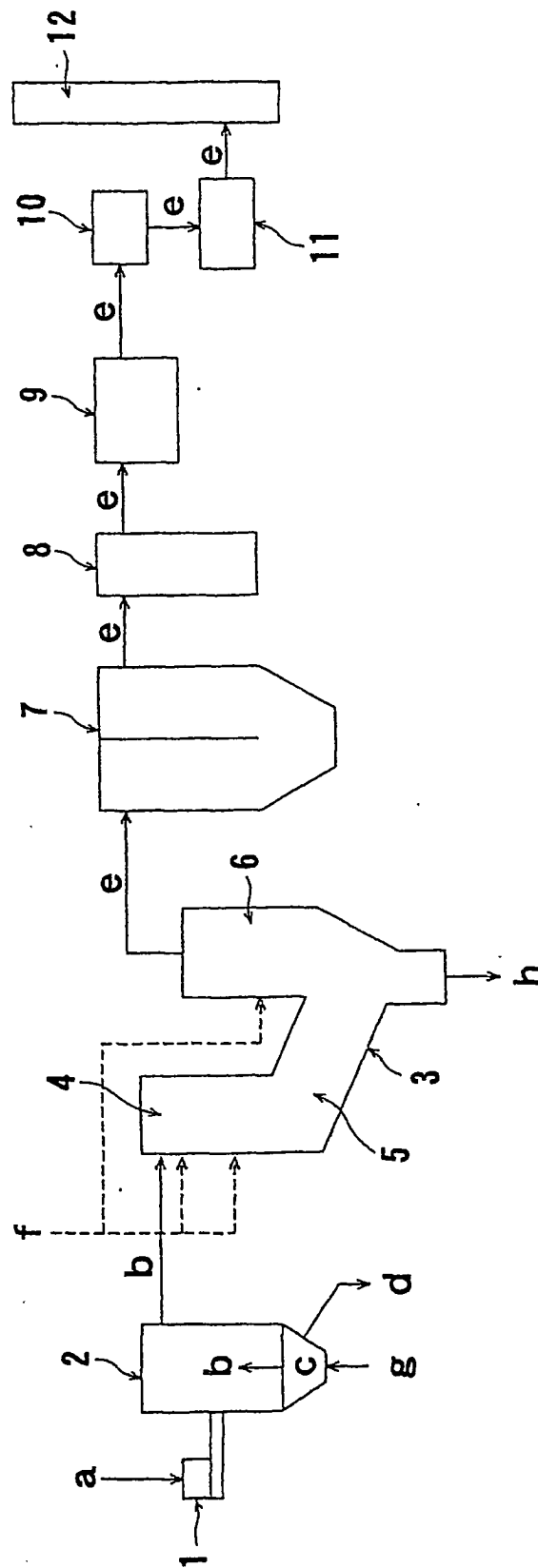


FIG. 2A

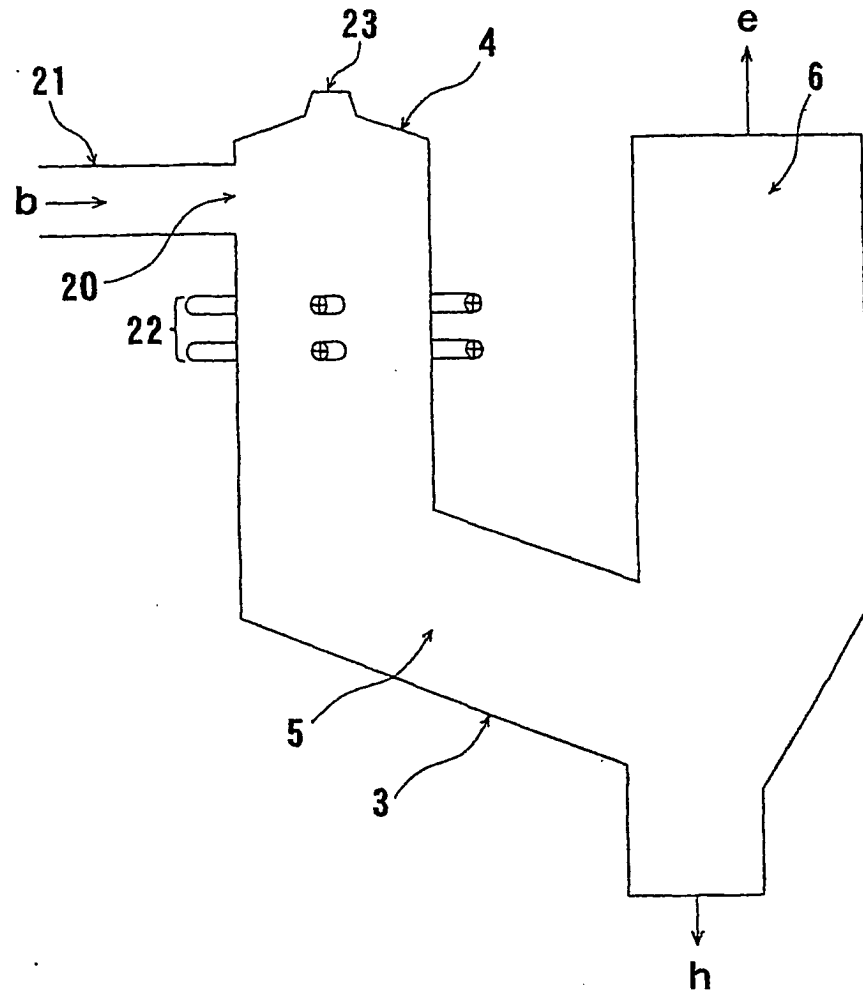


FIG. 2B

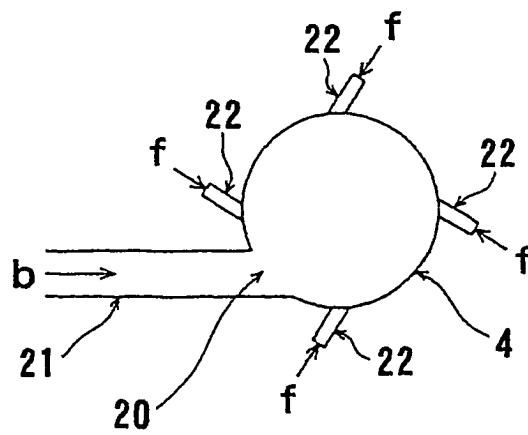


FIG. 3A

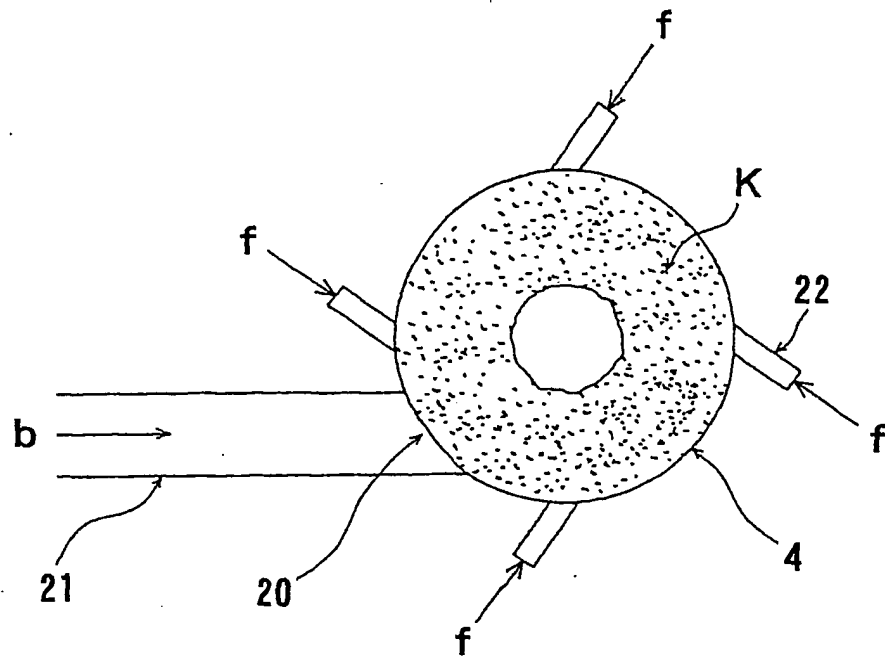


FIG. 3B

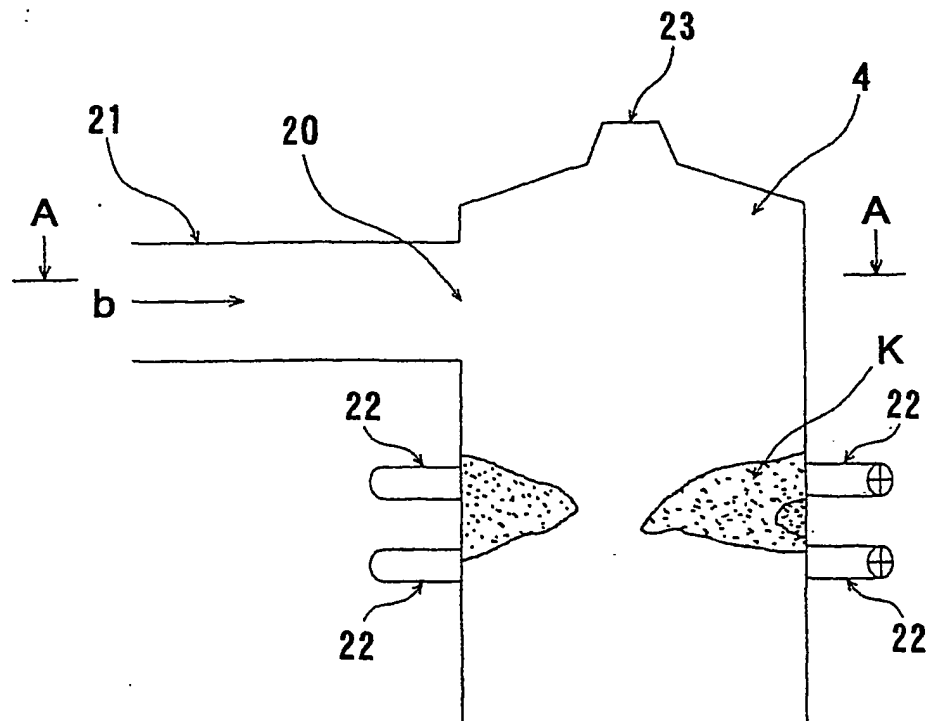


FIG. 4A

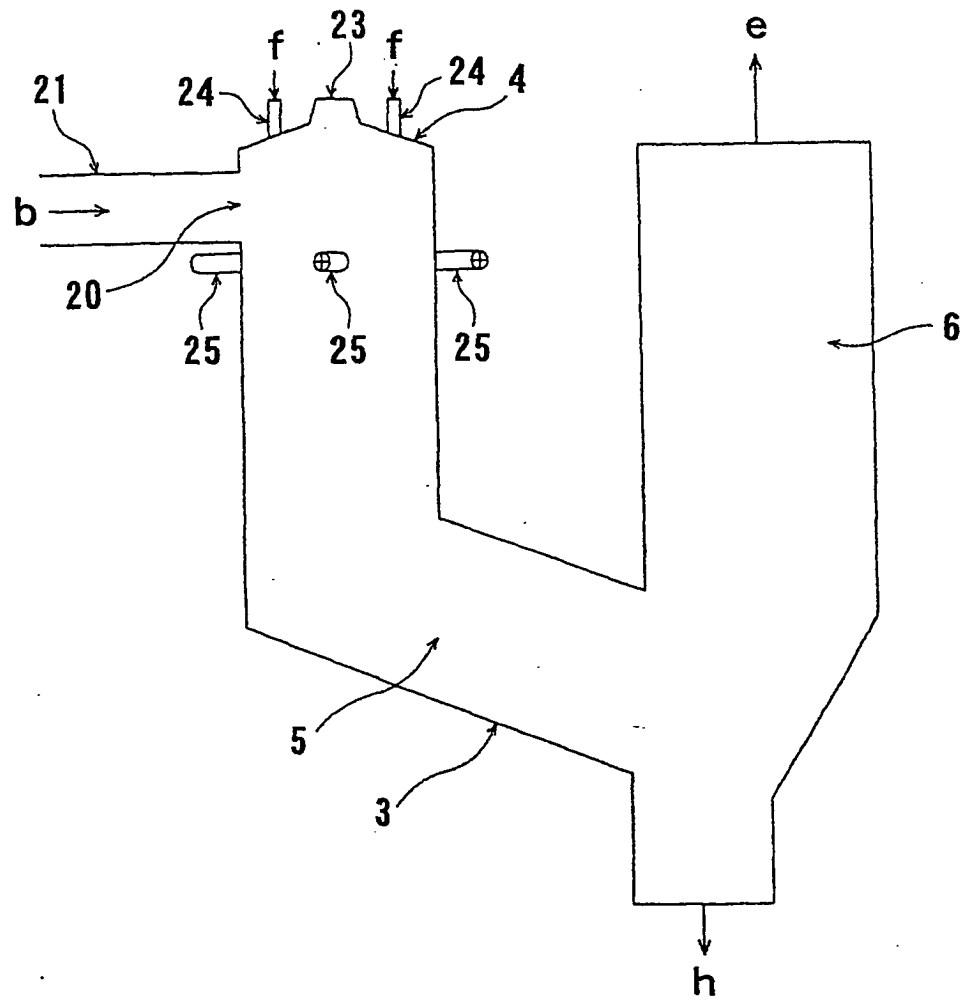


FIG. 4B

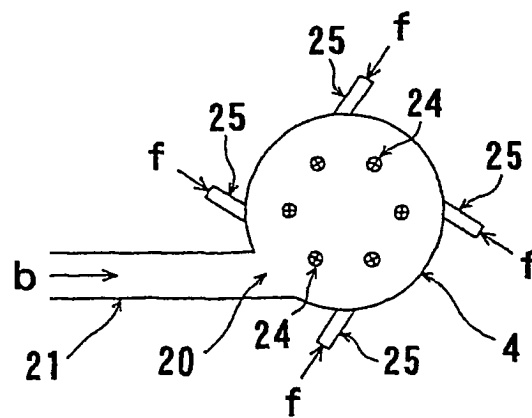


FIG. 5A

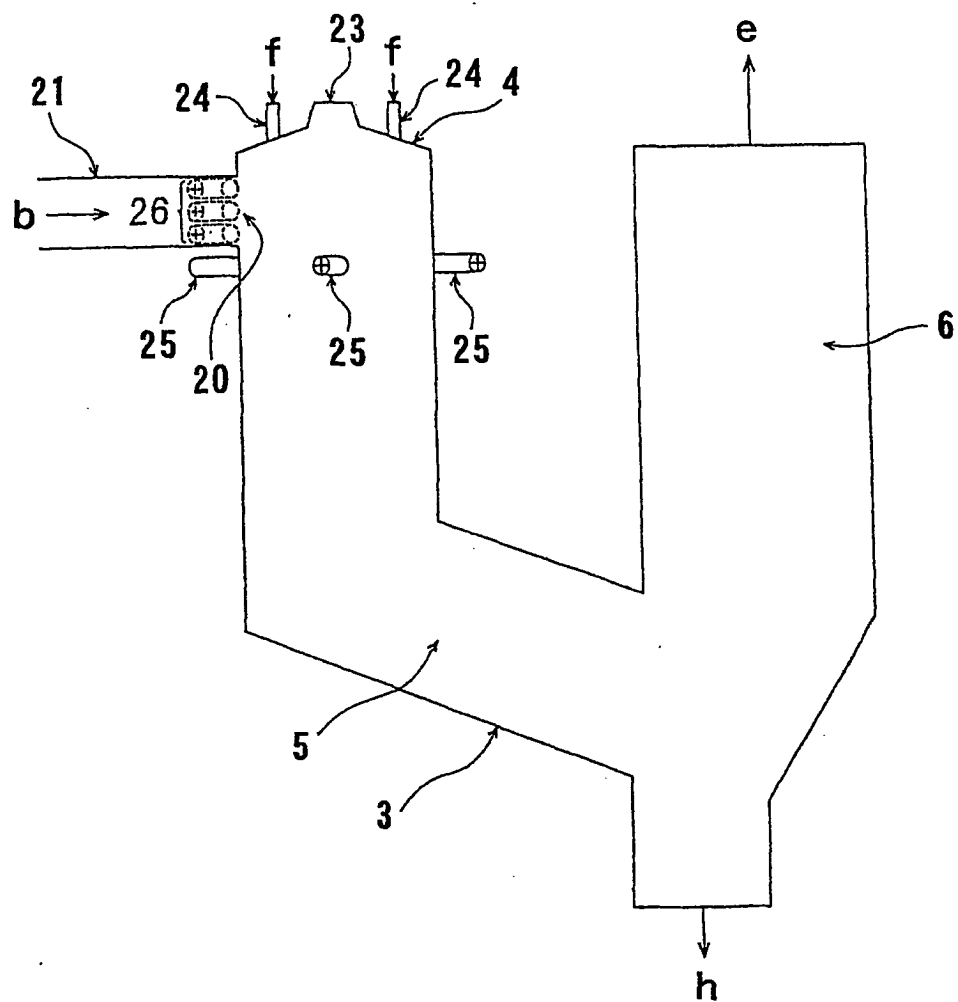


FIG. 5B

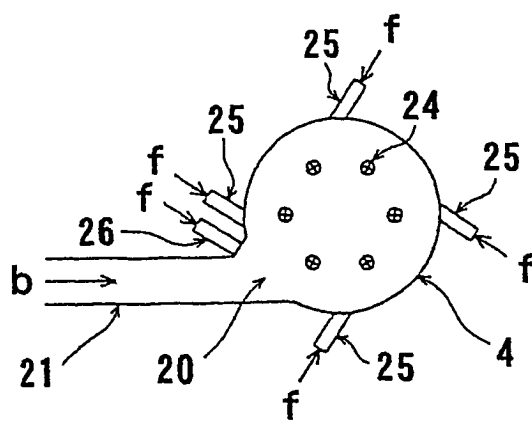


FIG. 6A

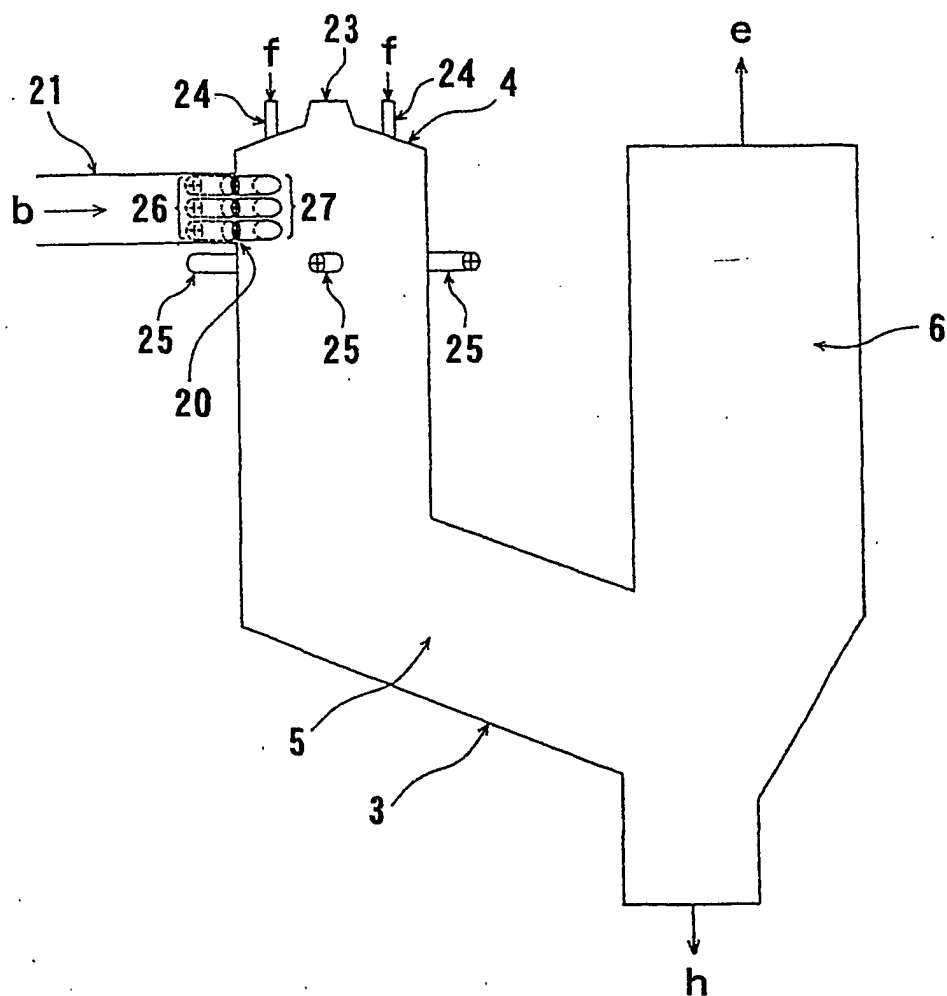


FIG. 6B

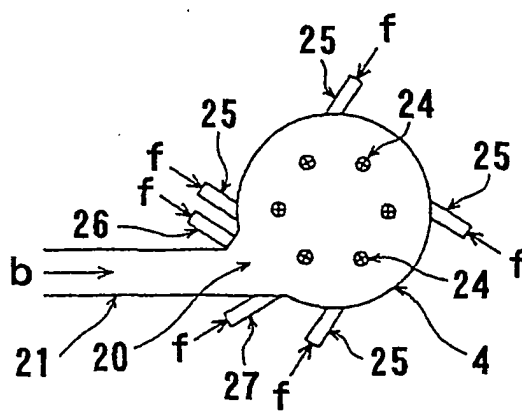


FIG. 7A

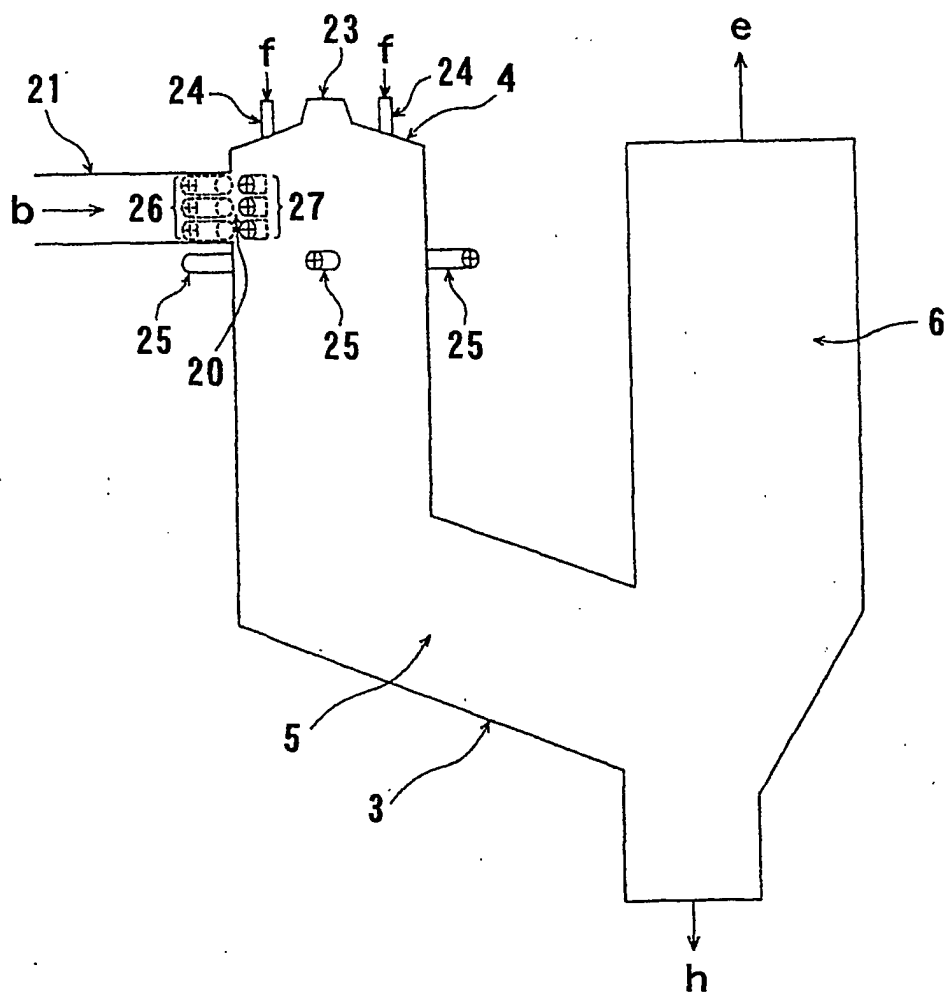


FIG. 7B

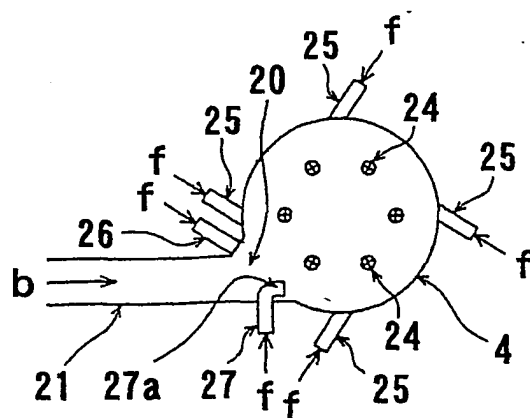


FIG. 8

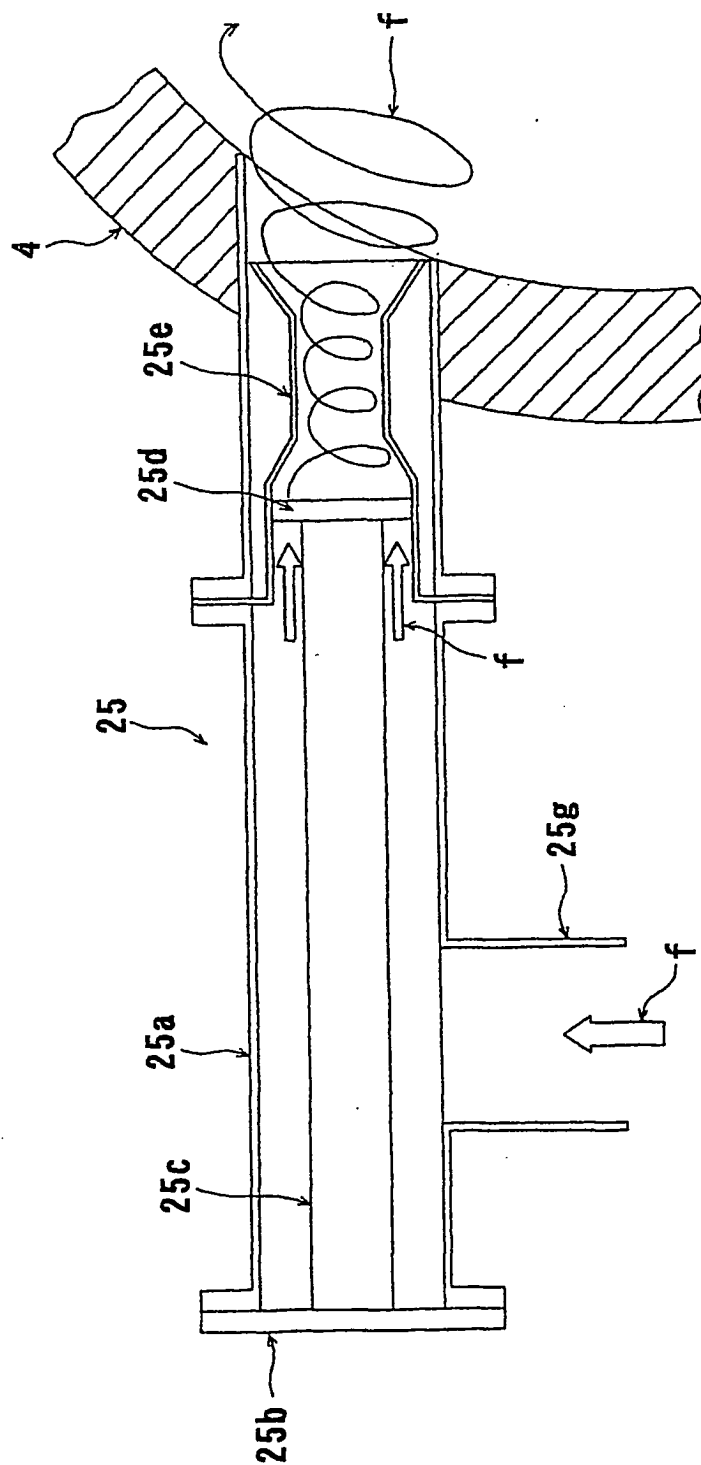


FIG. 9A

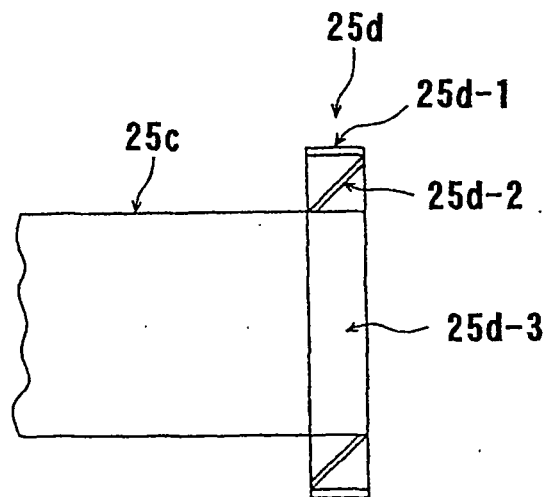


FIG. 9B

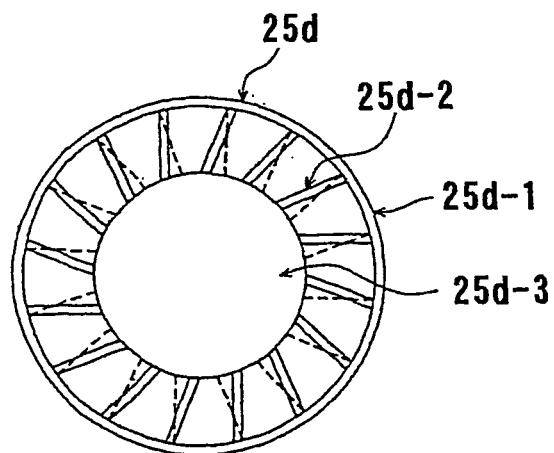


FIG. 10A

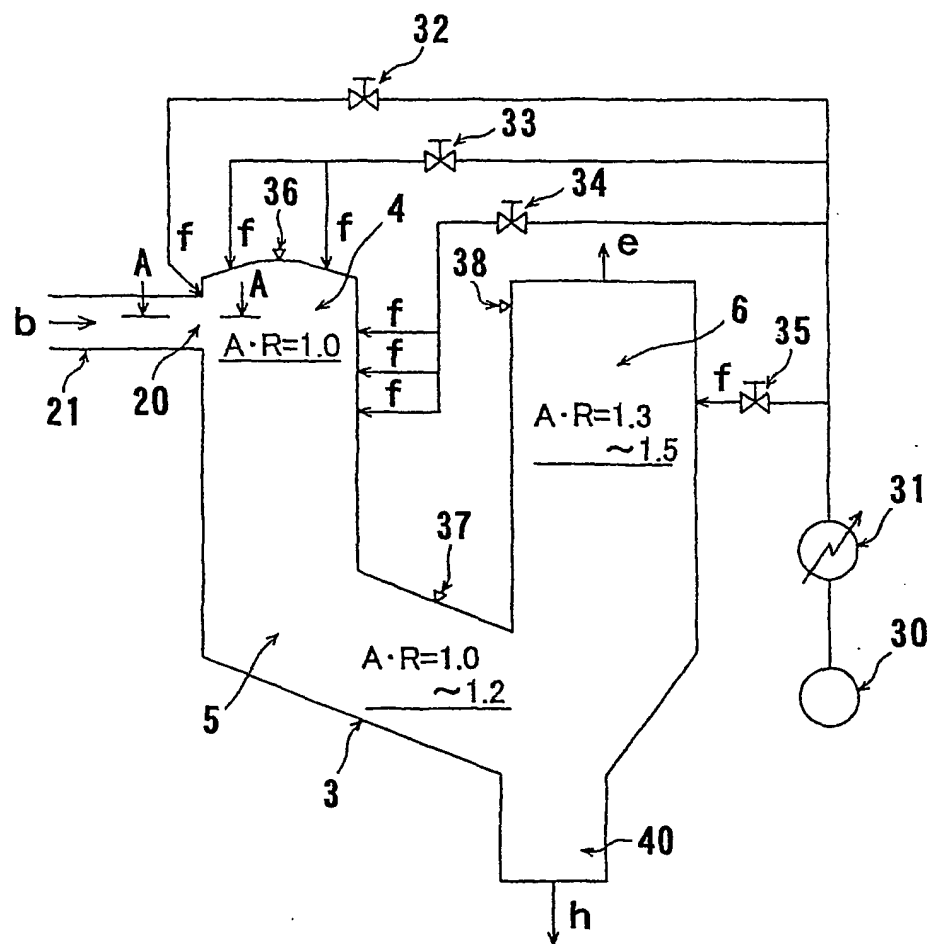
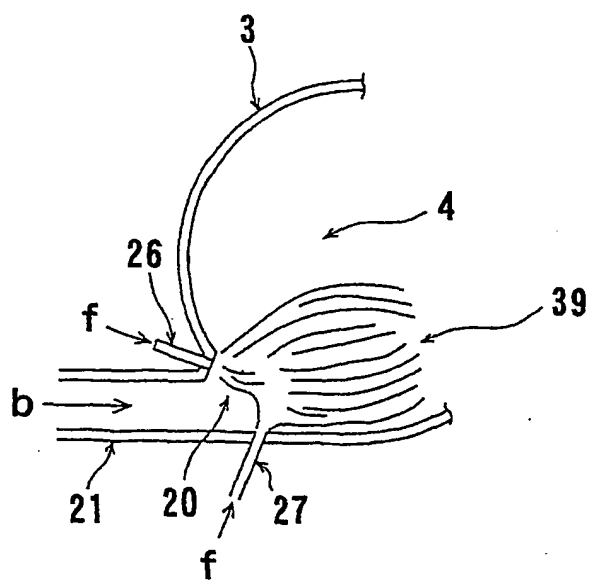


FIG. 10B





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 02 2570

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	EP 0 908 672 A (EBARA CORP) 14 April 1999 (1999-04-14) * column 3, line 54 - column 4, line 14 * * column 6, line 23 - column 7, line 5 * * column 8, line 35 - line 47 * * column 9, line 20 - line 51 *	17	F23G5/027 F23G5/32 F23C7/02 F23G5/16 F23J9/00
Y	* figure 1 *	1-3,6-9, 12-16, 19,20	
Y	----- EP 0 455 624 A (SGP VA ENERGIE UMWELT) 6 November 1991 (1991-11-06) * figure 4B * * column 1, line 1 - line 6 * * column 7, line 54 - column 8, line 7 *	1-3,6, 15,16, 19,20	
Y	----- US 3 817 712 A (WENTWORTH H) 18 June 1974 (1974-06-18) * column 2, line 42 - column 3, line 5 * * column 3, line 20 - line 25 *	7-9, 12-14	
A	----- FR 2 660 415 A (STEIN INDUSTRIE) 4 October 1991 (1991-10-04) * column 1, line 15 - line 27 * * column 4, line 5 - line 25 *	1,15	TECHNICAL FIELDS SEARCHED (Int.Cl.7) F23G F23C F23J
A	----- US 6 190 429 B1 (FUJIMURA HIROYUKI ET AL) 20 February 2001 (2001-02-20) * column 1, line 59 - column 2, line 4 * * column 3, line 32 - line 55 * * column 8, line 24 - column 9, line 6 *	1-3,7-9, 14-20	
		-/--	
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 5 October 2004	Examiner Mougey, M
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 02 2570

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	EP 0 853 215 A (ABFALLWIRTSCHAFTSGES) 15 July 1998 (1998-07-15) * column 3, line 14 - line 45 * * column 4, line 34 - line 50 * * column 7, line 6 - line 51 * * figures 1,3 * -----	4-6, 10-13, 17,18	
A	US 5 357 879 A (SHIONO SHUNICHI ET AL) 25 October 1994 (1994-10-25) * the whole document *	17,18	
A	EP 0 952 393 A (KOBE STEEL LTD) 27 October 1999 (1999-10-27) * column 2, line 10 - line 24 * * column 3, line 15 - line 25 * * column 4, line 11 - line 41 * -----	1-3,7-9, 14-20	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 5 October 2004	Examiner Mougey, M
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03 82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 04 02 2570

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

05-10-2004

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0908672	A	14-04-1999	DE 69724617 D1	09-10-2003
			DE 69724617 T2	12-08-2004
			EP 0908672 A1	14-04-1999
			US 6168425 B1	02-01-2001
			CN 1223715 A ,B	21-07-1999
			WO 9749953 A1	31-12-1997

EP 0455624	A	06-11-1991	AT 393970 B	10-01-1992
			AT 99490 A	15-07-1991
			EP 0455624 A2	06-11-1991

US 3817712	A	18-06-1974	NONE	

FR 2660415	A	04-10-1991	FR 2660415 A1	04-10-1991

US 6190429	B1	20-02-2001	JP 3153091 B2	03-04-2001
			JP 7332614 A	22-12-1995
			US 5922090 A	13-07-1999
			US 5725614 A	10-03-1998
			US 2001011438 A1	09-08-2001
			CN 1271074 A	25-10-2000
			CN 1487234 A	07-04-2004
			CN 1112662 A	29-11-1995
			DE 69523359 D1	29-11-2001
			DE 69523359 T2	11-07-2002
			DE 69531512 D1	18-09-2003
			DE 69531512 T2	17-06-2004
			EP 1111304 A2	27-06-2001
			EP 1286113 A2	26-02-2003
			EP 1367324 A1	03-12-2003
			EP 0676464 A2	11-10-1995
			ES 2204760 T3	01-05-2004
			ES 2167381 T3	16-05-2002
			HK 1037396 A1	12-12-2003
			JP 3270447 B2	02-04-2002
			JP 2001165416 A	22-06-2001
			JP 3270452 B2	02-04-2002
			JP 2002054808 A	20-02-2002
			JP 3270453 B1	02-04-2002
			JP 2002139206 A	17-05-2002
			JP 3270454 B1	02-04-2002
			JP 2002139207 A	17-05-2002
			JP 3270455 B2	02-04-2002
			JP 2002054813 A	20-02-2002
			JP 3270456 B2	02-04-2002
			JP 2002081621 A	22-03-2002

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 04 02 2570

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

05-10-2004

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 6190429	B1		JP 3270457 B1	02-04-2002
			JP 2002115829 A	19-04-2002
			JP 2002115830 A	19-04-2002
			JP 2002130630 A	09-05-2002
			JP 2002130633 A	09-05-2002
			JP 2002147724 A	22-05-2002
			JP 3544953 B2	21-07-2004
			JP 2002048318 A	15-02-2002
			JP 2003090520 A	28-03-2003
			RU 2138730 C1	27-09-1999
			RU 2154235 C1	10-08-2000
			US 6350288 B1	26-02-2002
			US 5620488 A	15-04-1997
			US 5858033 A	12-01-1999
			DE 69624073 D1	07-11-2002
			DE 69624073 T2	14-08-2003
			EP 0776962 A2	04-06-1997
			ES 2184825 T3	16-04-2003
			JP 2000140800 A	23-05-2000

EP 0853215	A	15-07-1998	DE 4409951 A1	28-09-1995
			AT 180558 T	15-06-1999
			DE 59505994 D1	01-07-1999
			EP 0674134 A1	27-09-1995
			EP 0853215 A2	15-07-1998
			ES 2081788 T1	16-03-1996
			ES 2120399 T1	01-11-1998

US 5357879	A	25-10-1994	JP 2654736 B2	17-09-1997
			JP 6031299 A	08-02-1994
			CA 2096571 A1	21-11-1993
			DE 69304248 D1	02-10-1996
			DE 69304248 T2	09-01-1997
			DE 69323906 D1	15-04-1999
			DE 69323906 T2	01-07-1999
			EP 0570949 A1	24-11-1993
			EP 0683359 A2	22-11-1995

EP 0952393	A	27-10-1999	JP 10103634 A	21-04-1998
			EP 0952393 A1	27-10-1999
			DE 69820986 D1	12-02-2004

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82