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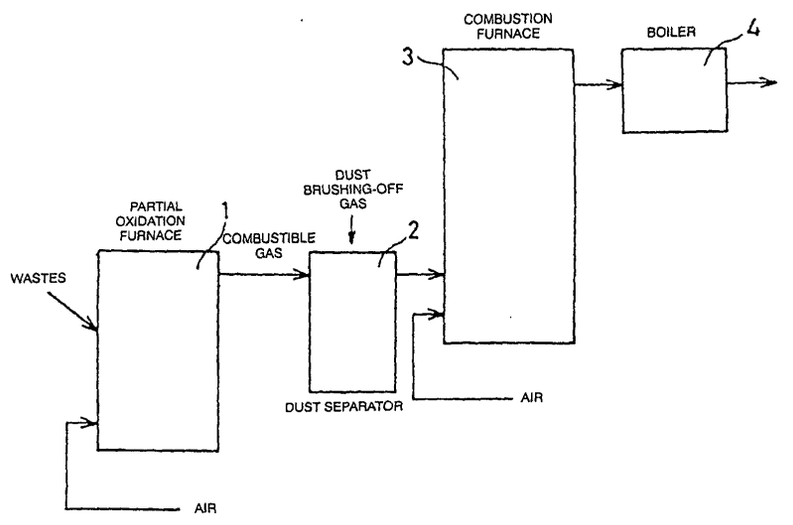
(54) WASTES TREATING METHOD AND DEVICE

(57) The present invention provides a method for waste treatment, in which wastes are incompletely burned or partially oxidized in a partial oxidation furnace in which combustion reaction takes place to yield combustible gas having a concentration converted to Oxygen of -30 to 1% at the outlet of the partial oxidation furnace; the combustible gas is introduced into a dust separator at a temperature of 250 to 800°C to reduce the dust concentration to 0.1 g/Nm^3 or lower; and after hydrogen chloride is removed from the combustible gas, from which dust is removed, by a wet gas treatment apparatus as necessary so that the concentration thereof is reduced to 20 ppm, the combustion gas is burned in a combustion furnace at a high temperature. With this method, wastes can be partially oxidized so that the concentration of dust that causes the corrosion of boiler tube etc. does not increase, and heat can be recovered from exhaust gas with high efficiency.

FIG.1



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Description

TECHNICAL FIELD

[0001] The present invention relates to a method and a system for waste treatment.

BACKGROUND ART

[0002] A method for waste treatment in which municipal wastes or industrial wastes (hereinafter referred simply to as wastes) are partially oxidized and gasified, and then are burned has been disclosed in Unexamined Japanese Patents JP-A-7-35322 and JP-A-9-159132.

[0003] FIG. 10 schematically shows an example of a typical method disclosed in JP-A-7-35322.

[0004] Wastes are gasified in a partial combustion fluidized bed furnace 1 in a reducing atmosphere with an air ratio of about 0.15 to 0.5 at a fluidized bed temperature of 450 to 650°C, and are introduced into a secondary combustion furnace 3 via a dust collector 2 such as a cyclone and an impact type dust collector. The yielded gas is mixed with secondary air in the secondary combustion furnace 3, and is burned completely at a high temperature of 800 to 1000°C. At this time, a desalting agent is supplied to restrain the generation of hydrogen chloride gas, and heat recovery is accomplished. A dust recovery line 6 is provided under the dust collector 2, so that some of the desalting agent and some or all of dust are returned again to the partial combustion fluidized bed furnace 1 after being cooled by a cooler 7.

[0005] FIG. 11 schematically shows an example of a typical method disclosed in JP-A-9-159132.

[0006] Exhaust gas generated by the combustion of refuse in a combustion furnace is cooled to a temperature of 450 to 650°C by heated water 20 introduced from a fuel economizer 8 into a waste heat boiler 4, and dust is removed by a filter 9. Some or all of the exhaust gas coming out of the filter 9 is supplied to a heating furnace 10, where the exhaust gas is heated to a high temperature by additional combustion using an auxiliary fuel 21, whereby it is used to overheat saturated steam 22, which comes from the waste heat boiler 4, to a temperature of about 500°C in a steam superheater 11. Also, some of the exhaust gas is discharged from a stack 14 through an induced draft fan 13 after waste heat is recovered by the fuel economizer 8 and an air preheater 12.

[0007] However, the above-described waste treatment methods have problems as described below. In these methods, the concentration of dust is high, so that the methods are disadvantageous in terms of dust removal. Also, in a boiler provided on the downstream side to recover heat, the boiler tube is corroded by salt etc. contained in dust, or the amount of unburned gas of the exhaust gas generated in the combustion furnace is small, so that waste heat cannot be recovered effectively in the heating furnace.

DISCLOSURE OF THE INVENTION

[0008] An object of the present invention is to provide a method and a system for waste treatment in which wastes can be partially oxidized so that the concentration of dust does not increase and heat can be recovered from exhaust gas with high efficiency.

[0009] The above object can be achieved by a method for waste treatment, comprising the steps of: incompletely burning or partially oxidizing wastes in a partial oxidation furnace in which combustion reaction takes place to yield combustible gas having a concentration converted to Oxygen of -30 to 1% at the outlet of the partial oxidation furnace; introducing the combustible gas into a dust separator at a temperature of 250 to 800°C to reduce the dust concentration to 0.1 g/Nm^3 or lower; and burning the combustion gas, from which dust has been removed, in a combustion furnace at a high temperature. Also, the above object can be achieved by a method for waste treatment, comprising the steps of: incompletely burning or partially oxidizing wastes in a partial oxidation furnace in which combustion reaction takes place to yield combustible gas having a concentration converted to Oxygen of -30 to 1% at the outlet of the partial oxidation furnace; introducing the combustible gas into a dust separator at a temperature of 250 to 800°C to reduce the dust concentration to 0.1 g/Nm^3 or lower; introducing the combustible gas, from which dust is removed, into a wet gas treatment apparatus to reduce the concentration of hydrogen chloride to 20 ppm or lower; and burning the combustible gas subjected to wet gas treatment in a combustion furnace at a high temperature.

[0010] These methods for waste treatment can be carried out by a system for waste treatment, comprising a partial oxidation furnace for incompletely burning or partially oxidizing wastes to yield combustible gas having a concentration converted to Oxygen of -30 to 1% at the outlet of the furnace; a dust separator for reducing the concentration of dust contained in the combustible gas at a temperature of 250 to 800°C to 0.1 g/Nm^3 or lower; and a combustion furnace for burning the combustion gas, from which dust has been removed, at a high temperature, or a system for waste treatment, comprising a partial oxidation furnace for incompletely burning or partially oxidizing wastes to yield combustible gas having a concentration converted to Oxygen of -30 to 1% at the outlet of the furnace; a dust separator for reducing the concentration of dust contained in the combustible gas at a temperature of 250 to 800°C to 0.1 g/Nm^3 or lower; a wet gas treatment apparatus for reducing the concentration of hydrogen chloride contained in the combustible gas, from which dust is removed, to 20 ppm or lower; and a combustion furnace for burning the combustion gas subjected to wet gas treatment at a high temperature.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

FIG. 1 is a block diagram schematically showing one embodiment of a waste treatment system in accordance with the present invention;
FIG. 2 is a graph showing the relationship between the dust concentration after dust removal and the useful life of boiler tube provided on the downstream side;
FIG. 3 is a view showing a shape of a ceramic filter;
FIG. 4 is a block diagram schematically showing another embodiment of a waste treatment system in accordance with the present invention;
FIG. 5 is a block diagram schematically showing still another embodiment of a waste treatment system in accordance with the present invention;
FIG. 6 is a block diagram schematically showing still another embodiment of a waste treatment system in accordance with the present invention;
FIGS. 7A and 7B are schematic views showing still another embodiment of a waste treatment system in accordance with the present invention;
FIG. 8 is a schematic view showing still another embodiment of a waste treatment system in accordance with the present invention;
FIGS. 9A and 9B are schematic views showing still another embodiment of a waste treatment system in accordance with the present invention;
FIG. 10 is a schematic view showing one example of a conventional waste treatment method; and
FIG. 11 is a schematic view showing another example of a conventional waste treatment method.

EMBODIMENTS FOR CARRYING OUT THE INVENTION

[0012] FIG. 1 schematically shows one embodiment of a waste treatment system in accordance with the present invention.

[0013] This system includes a partial oxidation furnace 1 for incompletely burning or partially oxidizing wastes, a dust separator 2 for decreasing the concentration of dust in combustible gas, a combustion furnace 3 for burning the combustible gas, from which dust has been removed, at a high temperature, and a boiler 4 for recovering heat.

[0014] Wastes charged in the partial oxidation furnace 1 is partially oxidized by the combustion of gas consisting mainly of air, whose oxygen concentration is controlled by steam or exhaust gas, by which combustible gas is yielded. At this time, if the concentration converted to Oxygen of the yielded combustible gas at the outlet of the furnace 1 is lower than -30%, a problem of tar adhesion etc. occurs as a strongly reduced gas. If the concentration exceeds 1%, combustion in which dioxin etc. can be decreased sufficiently cannot be produced. Therefore, the concentration must be made in the range of -30 to 1% by regulating the air ratio so as to be, for example, 0.15 to 0.9. Also, by controlling the concentration converted to Oxygen so as to be in this range, the danger of explosion caused by combustible components and oxygen is lessened, and also the fluctuations in potential of generated combustible gas is decreased, so that steady operation can be performed.

[0015] In this description, the concentration converted to Oxygen means a value defined by a difference between the oxygen concentration in an atmosphere and the concentration of oxygen supposed to be consumed by a gas to be possibly oxidized. For example, in the case where 2% of oxygen (O_2), 4% of carbon monoxide (CO), 2% of hydrogen (H_2), and 1% of methane (CH_4) are present, 4% of CO oxidizes into CO_2, so that 2% of O_2 is consumed, similarly 2% of H_2 consumes 1% of O_2, and 1% of methane CH_4 consumes 2% of O_2. Therefore, the concentration converted to Oxygen is 2-(2+1+2)= -3%. This value serves as an index indicating the degree of combustion of partially oxidized gas in the atmosphere and the degree of air ratio in the previous combustion. The smaller this value is, the higher the potential as combustible gas is.

[0016] The temperature in the furnace 1 is set at 400 to 800°C, at which temperature wastes is self-combustible and is partially oxidized.

[0017] The temperature of the yielded combustible gas is controlled so as to be 250 to 800°C according to the residence time in the partial oxidation furnace 1, and the combustible gas is sent to the dust separator 2, where dust is removed until the dust concentration becomes 0.1 g/Nm^3 or lower.

[0018] If the temperature of combustible gas sent to the dust separator 2 is 250°C or lower, tar etc. sticks in the system, and if the temperature thereof is 800°C or higher, salt melted in the dust sticks. Therefore, the temperature thereof must be controlled so as to be in the range of 250 to 800°C, preferably 250 to 650°C.

[0019] If the combustible gas whose temperature has been decreased to a relatively low temperature in this manner is sent to the dust separator 2, dust can be removed without excessive cooling effected by using an attemperator or other equipment.

[0020] FIG. 2 shows the relationship between the dust concentration after dust removal and the useful life of boiler tube provided on the downstream side. This figure reveals that if the dust concentration after dust removal is 0.1 g/Nm^3 or lower, the useful life of boiler tube increases remarkably. The reason for this is that the amount of salt in dust decreases, so that the corrosion of boiler tube etc. is restrained.

[0021] As the dust separator 2, a bag filter, ceramic filter, high-temperature electrical dust collector, inertial dust collector, high-performance cyclone, centrifugal dust collector, etc. are used according to the temperature of combustible gas. Also, it is desirable to use a filter type dust collector provided with a filter element of

a candle type ceramic filter or filter cloth as shown in FIG. 3, or a honeycomb type ceramic filter with an opening of 10 mm or smaller.

[0022] If dust sticking to the filter element is brushed off regularly, dust is removed efficiently, and the discharge of harmful gas is further restrained. In order to brush off the dust, it is desirable to use a gas with an oxygen concentration of 5% or lower or nitrogen gas for the purpose of restraining the oxidation of combustible gas and avoiding a danger of unnecessary explosion and combustion. The gas with an oxygen concentration of 5% or lower can be obtained by utilizing exhaust gas recirculation, or the pressure swing adsorption process or membrane separation process. Considering the peeling-off effect of sticking dust, it is desirable that the conditions of brushing-off method be such that the gas pressure is 1 kg/cm^2, the brushing-off time interval is several seconds to several hours, and the brushing-off period of time is 0.02 second to several tens of seconds.

[0023] Also it is desirable that the temperature of gas for brushing off dust be not lower than the temperature of the combustible gas to prevent the temperature of the combustible gas from decreasing.

[0024] Further, the coating layer on the surface of the dust collector may sometimes be peeled off by the blow of gas for brushing off dust. However, this phenomenon can be prevented completely if the gas is blown at the time when the pressure difference between the front and rear of the dust collector reaches a certain preset value.

[0025] After dust is removed in the dust separator 2, the combustible gas is burned in the combustion furnace 3 so as to have a high temperature of about 1000°C. In the combustion furnace 3, since combustion is provided by mixing an oxidizer, complete combustion is accomplished. Therefore, the discharge of unburned gas such as CO is restrained almost completely. Also, since dust has been removed from the combustion gas in advance, the concentration of aromatic organic compounds that is affected by soot is low. As a result, the concentration of dioxins and furan, which are incomplete combustion products, is also decreased.

[0026] If an ignition source is provided in the combustion furnace 3 to burn the combustible gas continuously, a danger that misfire occurs and thus the combustible gas and air are mixed with each other again to cause explosion can be avoided.

[0027] If the boiler 4 is disposed on the downstream side of the combustion furnace 3, heat can be recovered from the combustion gas with high efficiency, so that a high-temperature and high-pressure boiler with a temperature of 300°C or higher and a pressure of 20 ata or higher can be provided. Also, high-temperature air can be recovered as necessary. Although the boiler 4 is disposed on the downstream side of the combustion furnace 3 in the example shown in FIG. 1, the boiler 4 can be disposed within the combustion furnace 3.

[0028] Since dust has been removed in advance, the corrosion of boiler tube caused by dust can be restrained. In the case where heat is recovered from a high-temperature field with an exhaust gas temperature of 600°C or higher, in which the corrosion is accelerated by hydrogen chloride gas, a boiler tube using ceramics having corrosion resistance may be used to prolong the life of boiler tube. The exhaust gas from which heat has been recovered is discharged from a stack after passing through an exhaust gas treatment facility (not shown) provided on the downstream side of the boiler 4.

[0029] If, as shown in FIG. 4, a dust combustion furnace 15 is provided in the waste treatment system shown in FIG. 1 to burn the dust brushed off in the dust separator 2, and the brushed-off dust is burned at a temperature of 400 to 750°C with a gas containing oxygen, the concentration of unburned gas can be decreased to a certain value (for example, 6 wt%) or lower while the salt contained in the dust is fixed as it is. Also, since the gas generated at the time of combustion contains unburned gas, if the gas is introduced into the partial oxidation furnace 1 by means of a conduit pipe etc., the effective utilization of energy can be achieved.

[0030] FIG. 5 schematically shows another embodiment of a waste treatment system in accordance with the present invention.

[0031] In this system, a wet gas treatment apparatus 5 is provided between the dust separator 2 and the combustion furnace 3 in the system shown in FIG. 1.

[0032] After dust is removed, the combustible gas is introduced into this wet gas treatment apparatus 5, where the concentration of a neutralizer such as caustic soda is changed, and the concentration of hydrogen chloride is reduced to 20 ppm or lower. Thereby, even if the combustible gas is subsequently burned at a high temperature in the combustion furnace 3, the production of chlorine gas is decreased, so that the corrosion of boiler tube and other elements on the downstream side is restrained greatly. Therefore, the material with high corrosion resistance, such as ceramics, that has been used for a part etc. can be replaced with an inexpensive material.

[0033] Other conditions except that after dust is removed, the combustible gas is introduced into the wet gas treatment apparatus 5 and the concentration of hydrogen chloride is reduced to 20 ppm or lower are the same as the conditions in the case shown in FIG. 1 in which the wet gas treatment apparatus 5 is not provided.

Example 1

[0034] FIG. 6 schematically shows still another embodiment of a waste treatment system in accordance with the present invention.

[0035] The configuration of this system is the same as that of the system shown in FIG. 1, with the exception that a fluidized bed furnace 1 is used as the partial oxidization furnace.

[0036] Municipal refuse, which is waste, was supplied, at a rate of 1 t/h, to the fluidized bed furnace 1 with

a fluidized air temperature of 20 to 650°C and a sand layer temperature of 400 to 700°C, and was subjected to partial oxidation by controlling the air ratio in the range of 0.2 to 0.8, by which combustible gas was yielded.

[0037] The combustible gas was supplied to the dust separator 2 at a temperature of 250 to 800°C, and dust was removed by using a candle type ceramic filter. The candle type ceramic filter is formed of SiO_2, Al_2O_3, SiC, Cordurite, and a composite of these materials, or inorganic materials similar to these materials, and is of a ceramic fiber type or a porous type. To brush off dust in the dust separator 2, a gas that was obtained by recirculation of exhaust gas and has an oxygen concentration of 5% or lower and nitrogen gas were used. The brushing-off pressure was set at 3 to 7 kg/cm^2, the brushing-off time interval was set at 5 seconds to 50 minutes, and the brushing-off period of time was set at 0.1 to 20 seconds. Thereby, the dust concentration, which had been 5 to 20 g/Nm^3 before the combustible gas had flowed into the dust separator 2, was decreased to 0.1 g/Nm^3 or lower. The removed dust etc. were subjected to decharacterizing treatment in a melting furnace and an incinerator after being recovered.

[0038] After dust was removed, the combustible gas was burned in the combustion furnace 3 so as to have a temperature of 900 to 1000°C. At this time, heat could be recovered in the boiler 4 on the downstream side of the combustion furnace 3 by using steam with a temperature of 350 to 540°C and a pressure of 50 to 100 ata. As the boiler tube, stainless steel, Inconel, and other ally steels were used, with the result that remarkable corrosion etc. were not found, and the corrosion resistance such that the boiler tube could be used for a plurality of years was confirmed depending on the material. Also, high-temperature air was recovered. As a result, it was found that high-temperature air with a temperature of 350 to 700°C could be recovered.

Example 2

[0039] FIGS. 7A and 7B schematically show still another embodiment of a waste treatment system in accordance with the present invention.

[0040] The configuration of the system shown in FIG. 7A is the same as that of the system shown in FIG. 1, with the exception that a grate furnace 1 is used as the partial oxidation furnace. In the system shown in FIG. 7B, a boiler 3A is also provided within the combustion furnace 3 of the system shown in FIG. 7A.

[0041] Municipal refuse, which is waste, was supplied to the grate furnace 1 with an oxidizing air temperature of 20 to 250°C and an upper part temperature of 500 to 800°C, and was subjected to partial oxidation by controlling the air ratio in the range of 0.3 to 0.9, by which combustible gas was yielded.

[0042] The combustible gas was supplied to the dust separator 2 at a temperature of 250 to 800°C, and dust was removed by using a candle type ceramic filter and a honeycomb type ceramic filter. The ceramic filter is formed of SiO_2, Al_2O_3, SiC, Cordurite, and a composite of these materials, or inorganic materials similar to these materials, and is of a ceramic fiber type or a porous type. To brush off dust in the dust separator 2, nitrogen gas was used. The brushing-off pressure was set at 3 to 7 kg/cm^2, the brushing-off time interval was set at 10 seconds to 20 minutes, and the brushing-off period of time was set at 0.05 to 15 seconds. Thereby, the dust concentration, which had been 1 to 5 g/Nm^3 before the combustible gas had flowed into the dust separator 2, was decreased to 0.1 g/Nm^3 or lower. The removed dust etc. were subjected to decharacterizing treatment in a melting furnace and an incinerator after being recovered.

[0043] After dust was removed, the combustible gas was burned in the combustion furnace 3 so as to have a temperature of 900 to 1100°C. In the combustion furnace 3, the combustible gas was burned continuously by always placing an ignition source using a pilot burner (not shown) to avoid a danger of explosion etc. The output of the burner was several ten thousand to several hundred thousand kilo-calories per hour, and natural gas or kerosene was used as a fuel for the burner.

[0044] At this time, in all of the boiler 4 disposed on the downstream side in FIG. 7A, the boiler 3A disposed within the combustion furnace 3, and the boiler 4 shown in FIG. 7B, heat could be recovered by using steam with a temperature of 540°C and a pressure of 100 ata. As the boiler tube, stainless steel, Inconel, and other ally steels were used, with the result that remarkable corrosion etc. were not found, and steady operation could be performed for one year or longer.

Example 3

[0045] FIG. 8 schematically shows still another embodiment of a waste treatment system in accordance with the present invention.

[0046] The configuration of this system is the same as that of the system shown in FIG. 5, with the exception that a fluidized bed furnace 1 is used as the partial oxidation furnace.

[0047] Municipal refuse, which is waste, was supplied, at a rate of 1 t/h, to the fluidized bed furnace 1 with a fluidized air temperature of 20 to 650°C and a sand layer temperature of 400 to 700°C, and was subjected to partial oxidation by controlling the air ratio in the range of 0.2 to 0.8, by which combustible gas was yielded.

[0048] The combustible gas was supplied to the dust separator 2 at a temperature of 250 to 800°C, and dust was removed by using a candle type ceramic filter. The candle type ceramic filter is formed of SiO_2, Al_2O_3, SiC, Cordurite, and a composite of these materials, or inorganic materials similar to these materials, and is of a ceramic fiber type or a porous type. To brush off dust in the dust separator 2, a gas that was obtained by recirculation of exhaust gas and has an oxygen concentration of 5% or lower and nitrogen gas were used. The

brushing-off pressure was set at 3 to 7 kg/cm^2, the brushing-off time interval was set at 5 seconds to 50 minutes, and the brushing-off period of time was set at 0.1 to 20 seconds. Thereby, the dust concentration, which had been 5 to 20 g/Nm^3 before the combustible gas had flowed into the dust separator 2, was decreased to 0.1 g/Nm^3 or lower. The removed dust etc. were subjected to decharacterizing treatment in a melting furnace and an incinerator after being recovered.

[0049] After dust was removed, the combustible gas was introduced into the wet gas treatment apparatus 5, where the concentration of hydrogen chloride was reduced from 400 ppm, which had been the concentration before hydrogen chloride in the gas had been treated, to 20 ppm or lower.

[0050] The combustible gas in which the concentration of hydrogen chloride had been reduced was burned in the combustion furnace 3 so as to have a temperature of 900 to 1000°C. At this time, heat could be recovered in the boiler 4 on the downstream side of the combustion furnace 3 by using steam with a temperature of 350 to 540°C and a pressure of 50 to 100 ata. As the boiler tube, a stainless steel was used, with the result that remarkable corrosion etc. were not found, and the corrosion resistance such that the boiler tube could be used for a plurality of years was confirmed depending on the material. Also, high-temperature air was recovered. As a result, it was found that high-temperature air with a temperature of 350 to 700°C could be recovered.

Example 4

[0051] FIGS. 9A and 9B schematically show still another embodiment of a waste treatment system in accordance with the present invention.

[0052] The configuration of the system shown in FIG. 9A is the same as that of the system shown in FIG. 5, with the exception that a grate furnace 1 is used as the partial oxidation furnace. In the system shown in FIG. 9B, a boiler 3A is also provided within the combustion furnace 3 of the system shown in FIG. 9A.

[0053] Municipal refuse, which is waste, was supplied to the grate furnace 1 with an oxidizing air temperature of 20 to 250°C and an upper part temperature of 500 to 800°C, and was subjected to partial oxidation by controlling the air ratio in the range of 0.3 to 0.9, by which combustible gas was yielded.

[0054] The combustible gas was supplied to the dust separator 2 at a temperature of 250 to 800°C, and dust was removed by using a candle type ceramic filter and a honeycomb type ceramic filter. The ceramic filter is formed of SiO_2, Al_2O_3, SiC, Cordurite, and a composite of these materials, or inorganic materials similar to these materials, and is of a ceramic fiber type or a porous type. To brush off dust in the dust separator 2, nitrogen gas was used. The brushing-off pressure was set at 3 to 7 kg/cm^2, the brushing-off time interval was set at 10 seconds to 20 minutes, and the brushing-off period of time was set at 0.05 to 15 seconds. Thereby, the dust concentration, which had been 1 to 5 g/Nm^3 before the combustible gas had flowed into the dust separator 2, was decreased to 0.1 g/Nm^3 or lower. The removed dust etc. were subjected to decharacterizing treatment in a melting furnace and an incinerator after being recovered.

[0055] After dust was removed, the combustible gas was introduced into the wet gas treatment apparatus 5, where the concentration of hydrogen chloride was reduced from 250 ppm, which had been the concentration before hydrogen chloride in the gas had been treated, to 20 ppm or lower.

[0056] The combustible gas in which the concentration of hydrogen chloride had been reduced was burned in the combustion furnace 3 so as to have a temperature of 900 to 1100°C. In the combustion furnace 3, the combustible gas was burned continuously by always placing an ignition source using a pilot burner (not shown) to avoid a danger of explosion etc. The output of the burner was several ten thousand to several hundred thousand kilo-calories per hour, and natural gas or kerosene was used as a fuel for the burner.

[0057] At this time, in all of the boiler 4 disposed on the downstream side in FIG. 9A, the boiler 3A disposed within the combustion furnace 3 shown in FIG. 9B, and the boiler 4 on the downstream side, heat could be recovered by using steam with a temperature of 540°C and a pressure of 100 ata. As the boiler tube, stainless steel, Inconel, and other ally steels were used, with the result that remarkable corrosion etc. were not found, and steady operation could be performed for one year or longer.

Claims

1. A method for waste treatment, comprising the steps of:

   incompletely burning or partially oxidizing wastes in a partial oxidation furnace in which combustion reaction takes place to yield combustible gas having a concentration converted to Oxygen of -30 to 1% at the outlet of said partial oxidation furnace;
   introducing said combustible gas into a dust separator at a temperature of 250 to 800°C to reduce the dust concentration to 0.1 g/Nm^3 or lower; and
   burning said combustion gas, from which dust has been removed, in a combustion furnace at a high temperature.

2. The method according to claim 1, wherein said combustible gas is introduced into said dust separator at a temperature of 250 to 650°C to reduce the dust concentration to 0.1 g/Nm^3 or lower.

3. The method according to claim 1, wherein a filter type dust collector is used as said dust separator, and dust sticking to a filter element of said dust collector is brushed off regularly by a gas with an oxygen concentration of 5% or lower.

4. The method according to claim 1, wherein a filter type dust collector is used as said dust separator, and dust sticking to a filter element of said dust collector is brushed off regularly by nitrogen gas.

5. The method according to claim 3, wherein the temperature of said gas for brushing off dust is not lower than the temperature of said combustible gas.

6. The method according to claim 4, wherein the temperature of said gas for brushing off dust is not lower than the temperature of said combustible gas.

7. The method according to claim 5, wherein said gas for brushing off dust is blown at the time when the pressure difference between the front and rear of the dust collector reaches a preset value.

8. The method according to claim 6, wherein said gas for brushing off dust is blown at the time when the pressure difference between the front and rear of the dust collector reaches a preset value.

9. The method according to claim 7, wherein brushed-off dust is burned at a temperature of 400 to 750°C by a gas containing oxygen, and a gas generated by said combustion is introduced into said partial oxidation furnace.

10. The method according to claim 8, wherein brushed-off dust is burned at a temperature of 400 to 750°C by a gas containing oxygen, and a gas generated by said combustion is introduced into said partial oxidation furnace.

11. The method according to claim 1, wherein an ignition source is provided in said combustion furnace to burn said combustible gas continuously.

12. The method according to claim 1, wherein a boiler is provided within said combustion furnace or on the downstream side of said combustion furnace, and heat is recovered by said boiler.

13. A method for waste treatment, comprising the steps of:

incompletely burning or partially oxidizing wastes in a partial oxidation furnace in which combustion reaction takes place to yield combustible gas having a concentration converted to Oxygen of -30 to 1% at the outlet of said partial oxidation furnace ;
introducing said combustible gas into a dust separator at a temperature of 250 to 800°C to reduce the dust concentration to 0.1 g/Nm^3 or lower;
introducing said combustible gas, from which dust is removed, into a wet gas treatment apparatus to reduce the concentration of hydrogen chloride to 20 ppm or lower; and
burning said combustible gas subjected to wet gas treatment in a combustion furnace at a high temperature.

14. The method according to claim 13, wherein said combustible gas is introduced into said dust separator at a temperature of 250 to 650°C to reduce the dust concentration to 0.1 g/Nm^3 or lower.

15. The method according to claim 13, wherein a filter type dust collector is used as said dust separator, and dust sticking to a filter element of said dust collector is brushed off regularly by a gas with an oxygen concentration of 5% or lower.

16. The method according to claim 13, wherein a filter type dust collector is used as said dust separator, and dust sticking to a filter element of said dust collector is brushed off regularly by nitrogen gas.

17. The method according to claim 15, wherein the temperature of said gas for brushing off dust is not lower than the temperature of said combustible gas.

18. The method according to claim 16, wherein the temperature of said gas for brushing off dust is not lower than the temperature of said combustible gas.

19. The method according to claim 13, wherein an ignition source is provided in said combustion furnace to burn said combustible gas continuously.

20. The method according to claim 13, wherein a boiler is provided within said combustion furnace or on the downstream side of said combustion furnace, and heat is recovered by said boiler.

21. A system for waste treatment, comprising:

a partial oxidation furnace for incompletely burning or partially oxidizing wastes to yield combustible gas having a concentration converted to Oxygen of -30 to 1% at the outlet of said furnace;
a dust separator for reducing the concentration of dust contained in said combustible gas with a temperature of 250 to 800°C to 0.1 g/Nm^3 or lower; and
a combustion furnace for burning said combus-

tion gas, from which dust has been removed, in a combustion furnace at a high temperature.

22. The system according to claim 21, wherein said system further comprises a dust combustion furnace for burning dust brushed off by said dust separator and a conduit pipe for introducing a gas generated at the time of said combustion into said partial oxidization furnace.

23. The system according to claim 21, wherein an ignition source is provided in said combustion furnace.

24. A system for waste treatment, comprising:

a partial oxidation furnace for incompletely burning or partially oxidizing wastes to yield combustible gas having a concentration converted to Oxygen of -30 to 1% at the outlet of said furnace;
a dust separator for reducing the concentration of dust contained in said combustible gas with a temperature of 250 to 800°C to 0.1 g/Nm^3 or lower;
a wet gas treatment apparatus for reducing the concentration of hydrogen chloride contained in said combustible gas, from which dust is removed, to 20 ppm or lower; and
a combustion furnace for burning said combustion gas subjected to wet gas treatment at a high temperature.

25. The system according to claim 24, wherein an ignition source is provided in said combustion furnace.

FIG.1

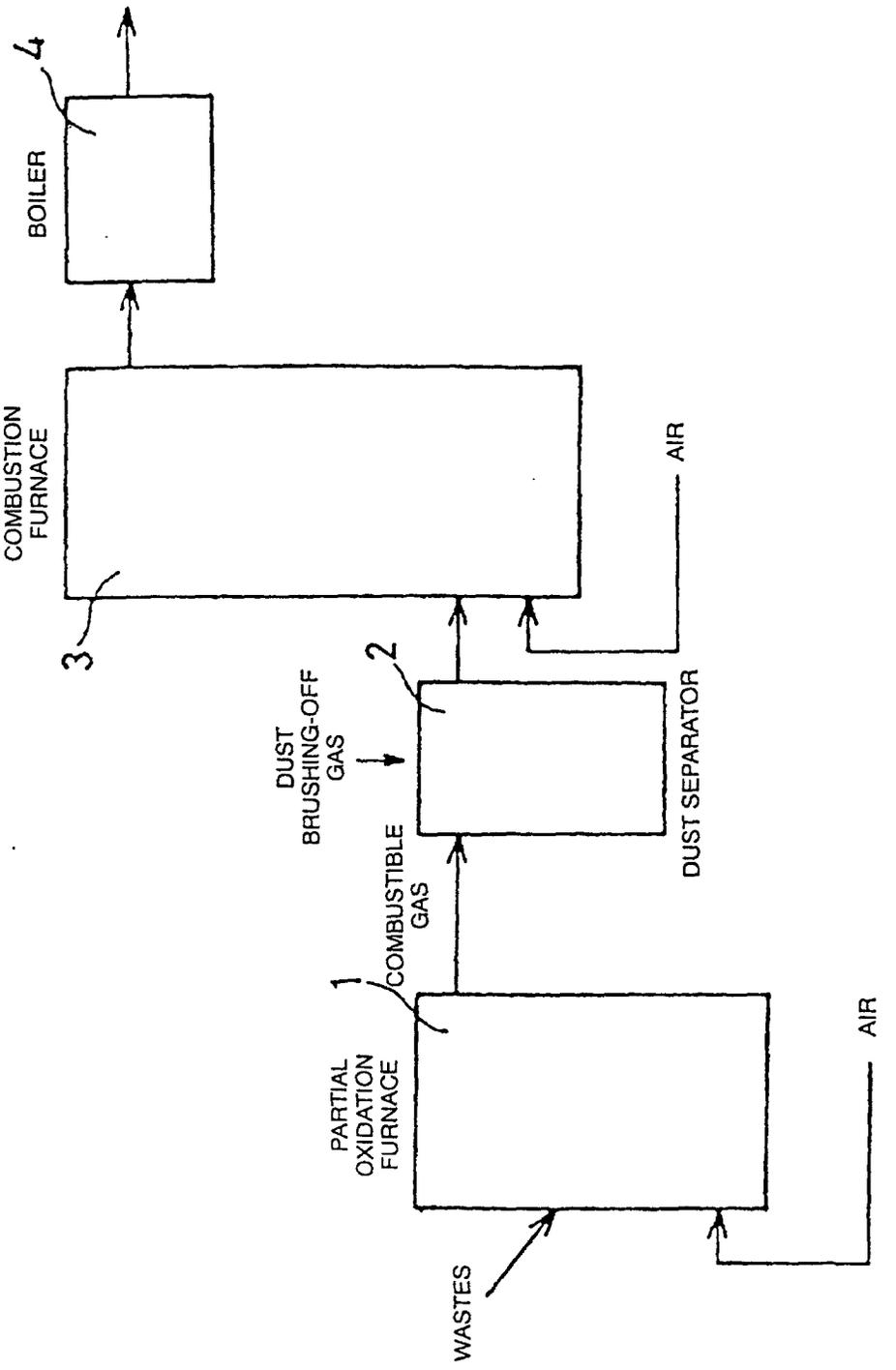

4
BOILER
COMBUSTION FURNACE
3
AIR
2
DUST BRUSHING-OFF GAS
DUST SEPARATOR
1
COMBUSTIBLE GAS
PARTIAL OXIDATION FURNACE
AIR
WASTES

FIG.2

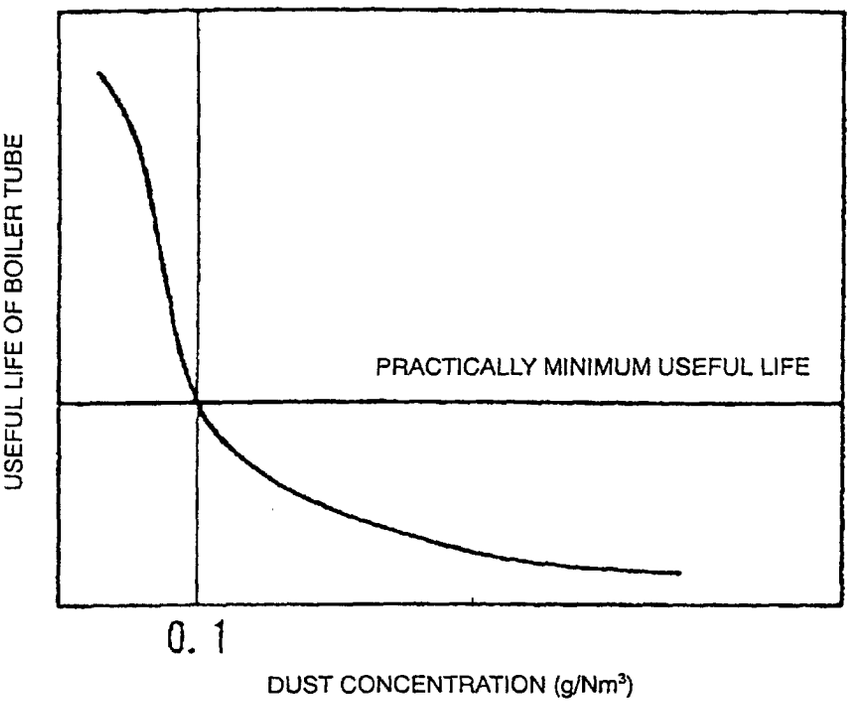

USEFUL LIFE OF BOILER TUBE
PRACTICALLY MINIMUM USEFUL LIFE
0.1
DUST CONCENTRATION (g/Nm³)

FIG.3

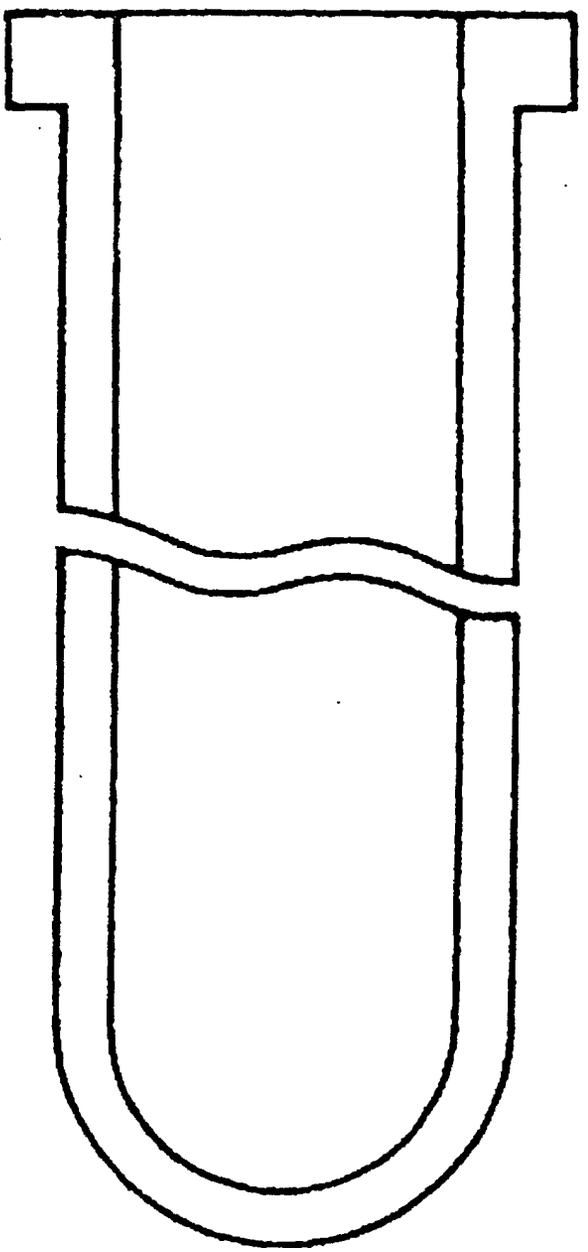


FIG.4

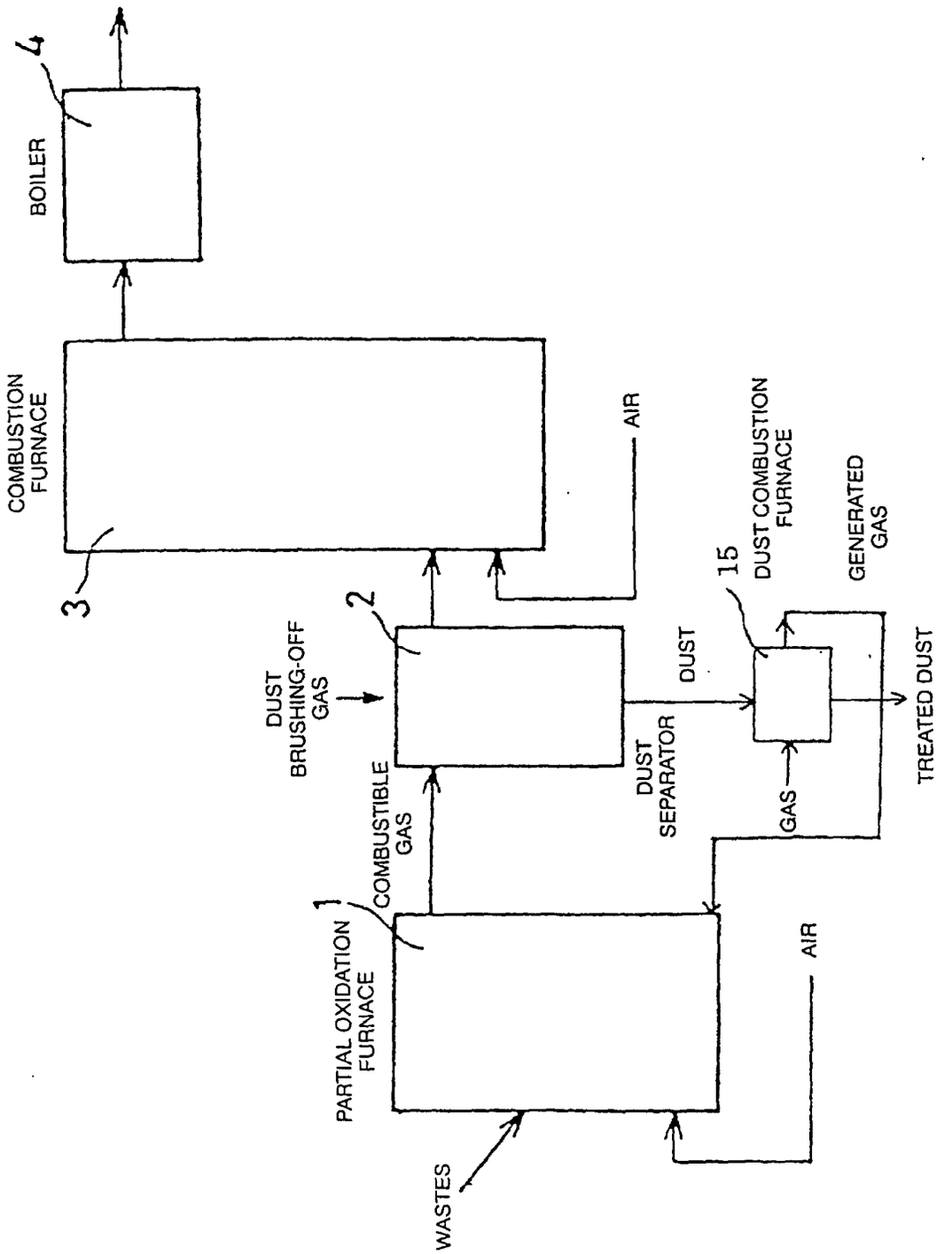

4
BOILER
COMBUSTION FURNACE
3
AIR
2
DUST BRUSHING-OFF GAS
DUST
15
DUST COMBUSTION FURNACE
GENERATED GAS
DUST SEPARATOR
GAS
TREATED DUST
1
COMBUSTIBLE GAS
PARTIAL OXIDATION FURNACE
AIR
WASTES

FIG.5

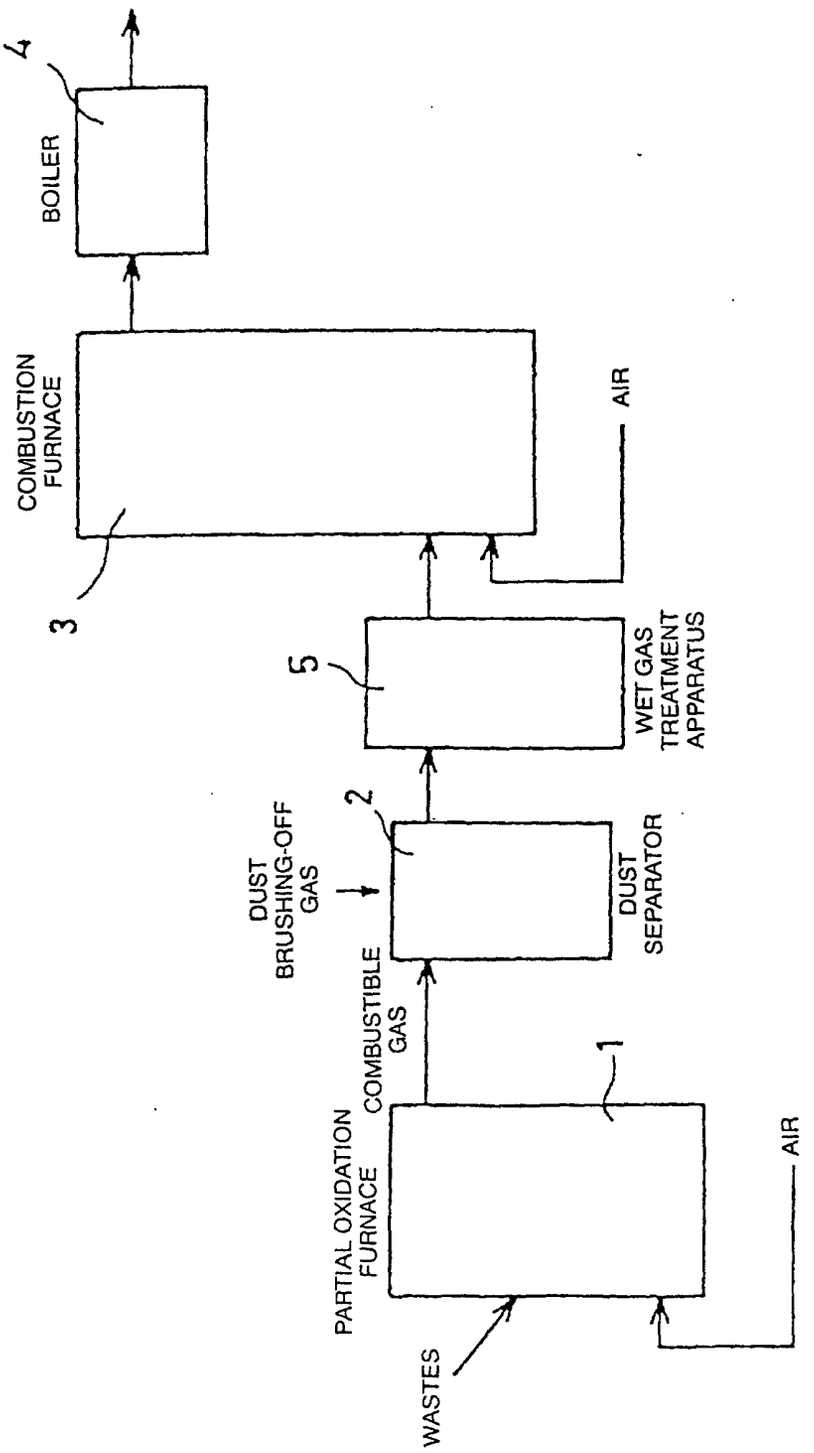

4
BOILER
COMBUSTION FURNACE
3
AIR
5
WET GAS TREATMENT APPARATUS
2
DUST BRUSHING-OFF GAS
DUST SEPARATOR
COMBUSTIBLE GAS
1
PARTIAL OXIDATION FURNACE
AIR
WASTES

FIG.6

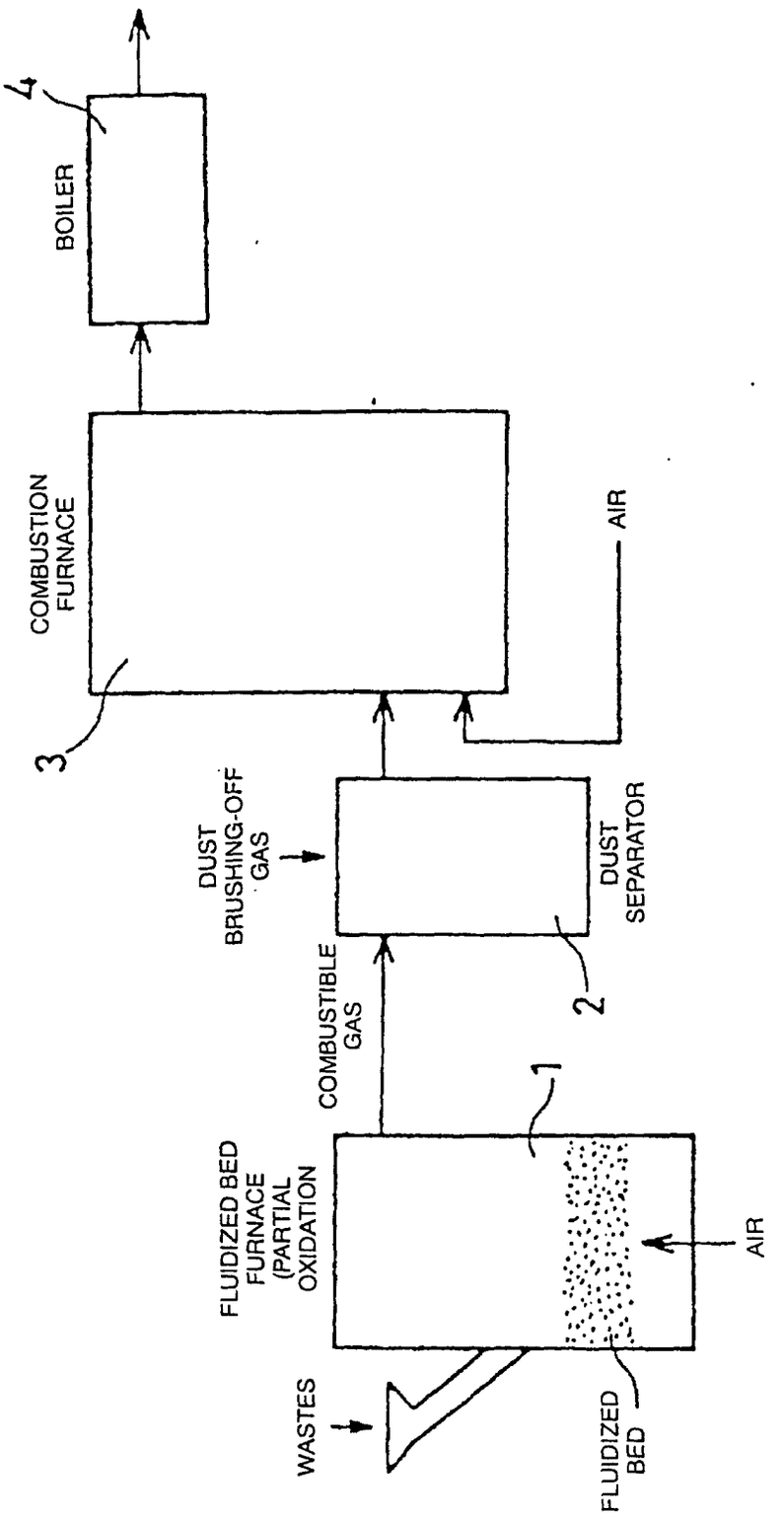

BOILER
4
COMBUSTION FURNACE
3
AIR
DUST BRUSHING-OFF GAS
DUST SEPARATOR
2
COMBUSTIBLE GAS
1
FLUIDIZED BED FURNACE (PARTIAL OXIDATION
AIR
WASTES
FLUIDIZED BED

FIG.7A

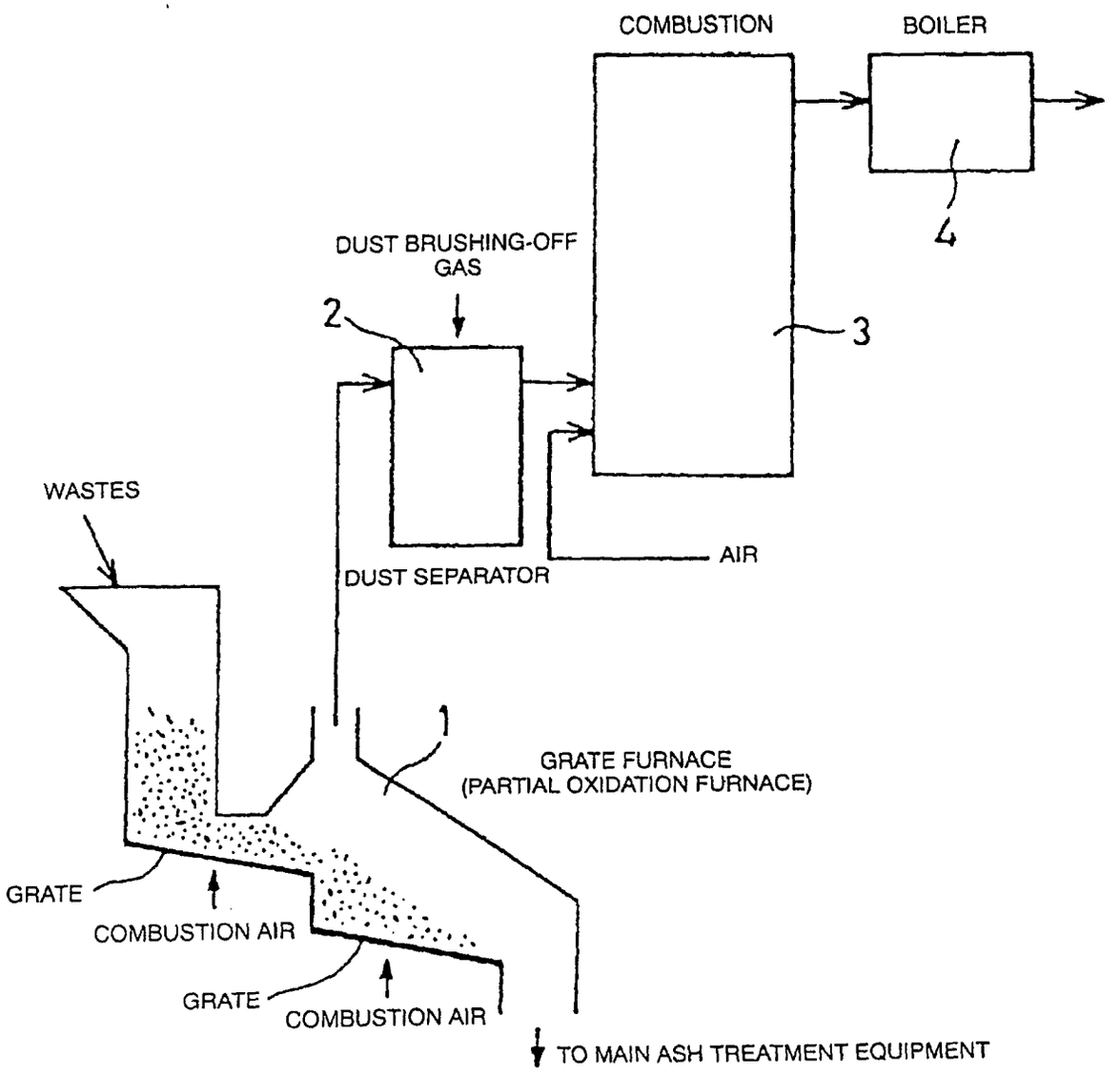

COMBUSTION
BOILER
4
DUST BRUSHING-OFF GAS
2
3
WASTES
AIR
DUST SEPARATOR
GRATE FURNACE
(PARTIAL OXIDATION FURNACE)
GRATE
COMBUSTION AIR
GRATE
COMBUSTION AIR
TO MAIN ASH TREATMENT EQUIPMENT

FIG.7B

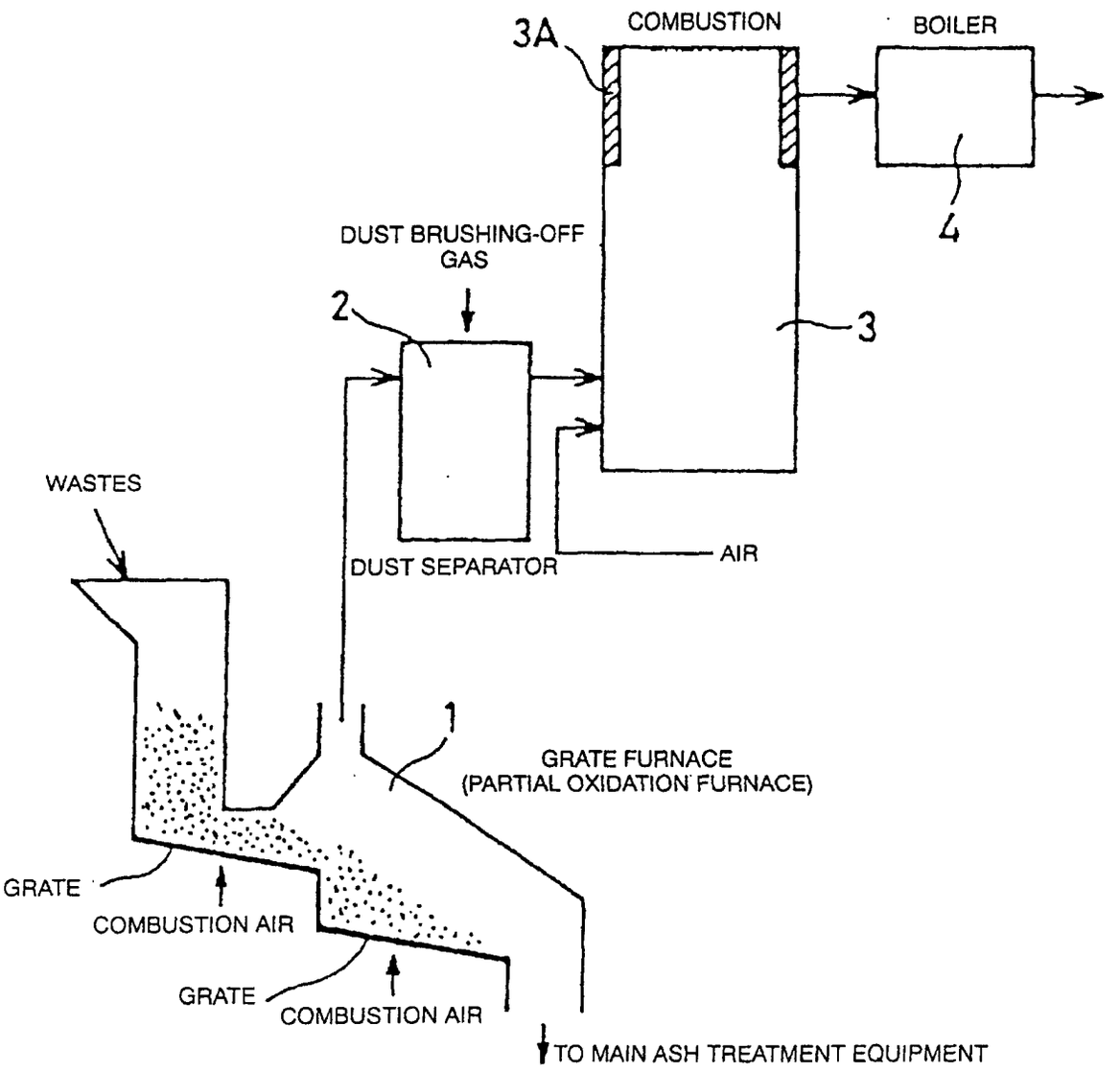

3A
COMBUSTION
BOILER
4
DUST BRUSHING-OFF GAS
2
3
WASTES
DUST SEPARATOR
AIR
1
GRATE FURNACE
(PARTIAL OXIDATION FURNACE)
GRATE
COMBUSTION AIR
GRATE
COMBUSTION AIR
TO MAIN ASH TREATMENT EQUIPMENT

FIG.8

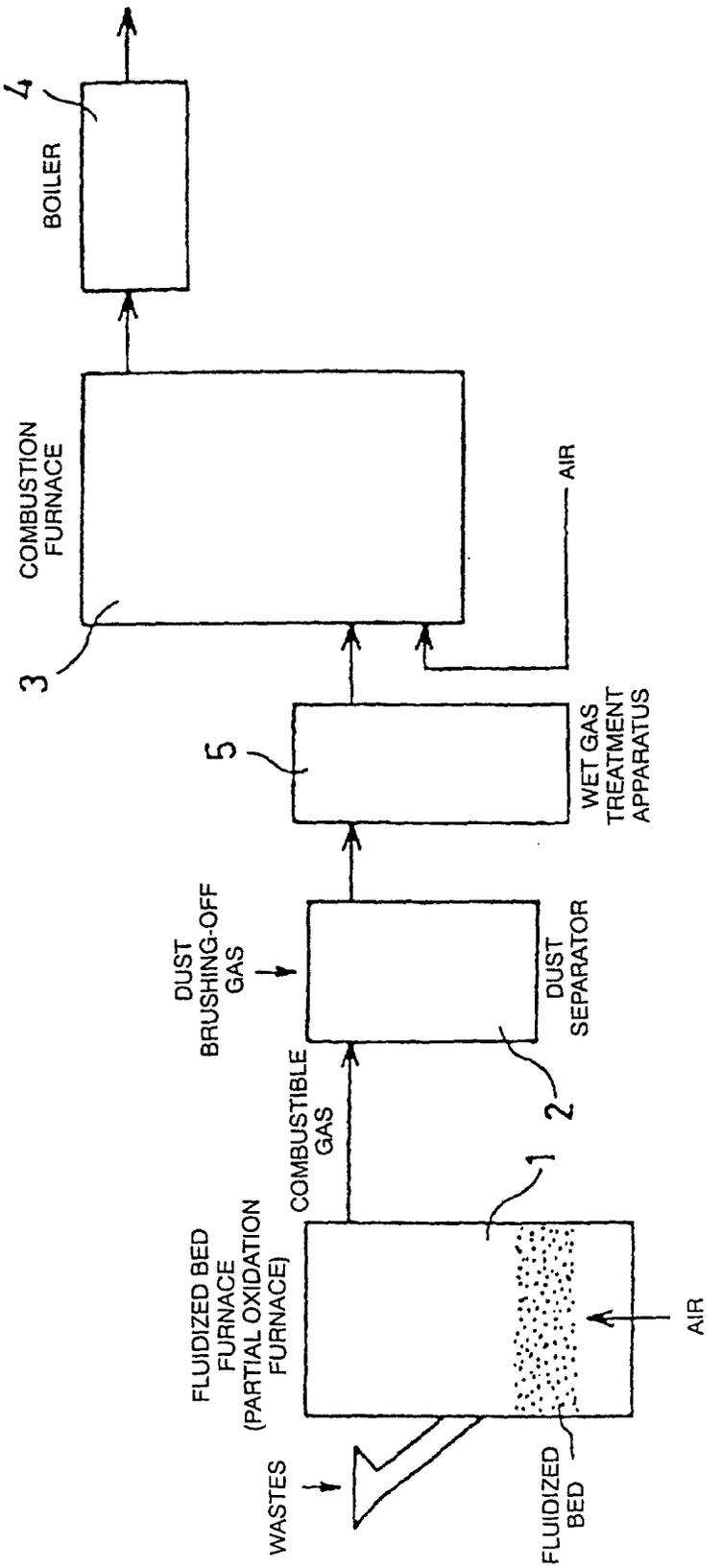

4
BOILER
COMBUSTION FURNACE
3
AIR
5
WET GAS TREATMENT APPARATUS
DUST BRUSHING-OFF GAS
DUST SEPARATOR
2
COMBUSTIBLE GAS
1
FLUIDIZED BED FURNACE (PARTIAL OXIDATION FURNACE)
AIR
WASTES
FLUIDIZED BED

FIG.9A

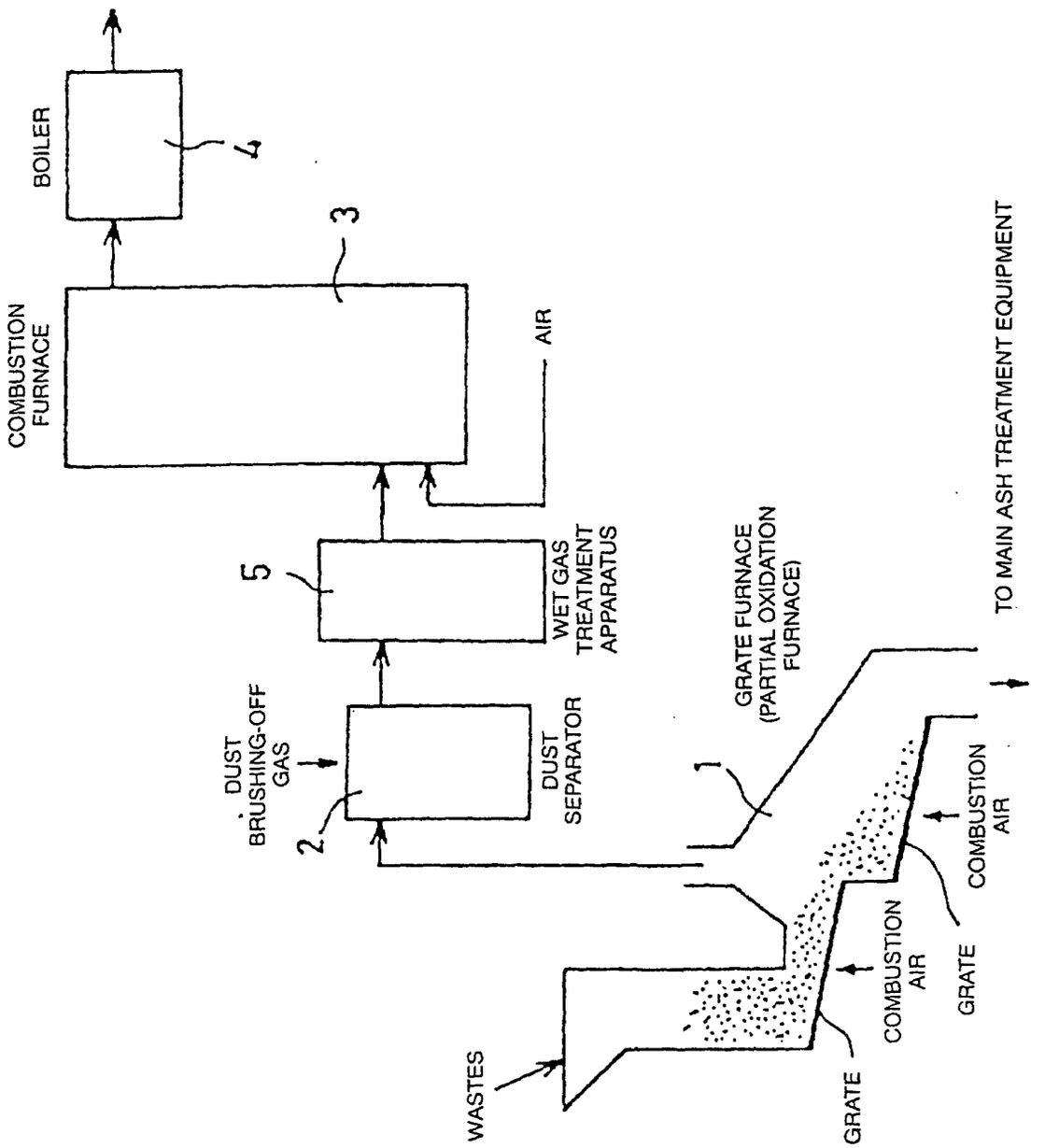

BOILER
4
3
COMBUSTION FURNACE
AIR
5
WET GAS TREATMENT APPARATUS
DUST BRUSHING-OFF GAS
2
DUST SEPARATOR
1
GRATE FURNACE (PARTIAL OXIDATION FURNACE)
TO MAIN ASH TREATMENT EQUIPMENT
COMBUSTION AIR
GRATE
COMBUSTION AIR
GRATE
WASTES

FIG.9B

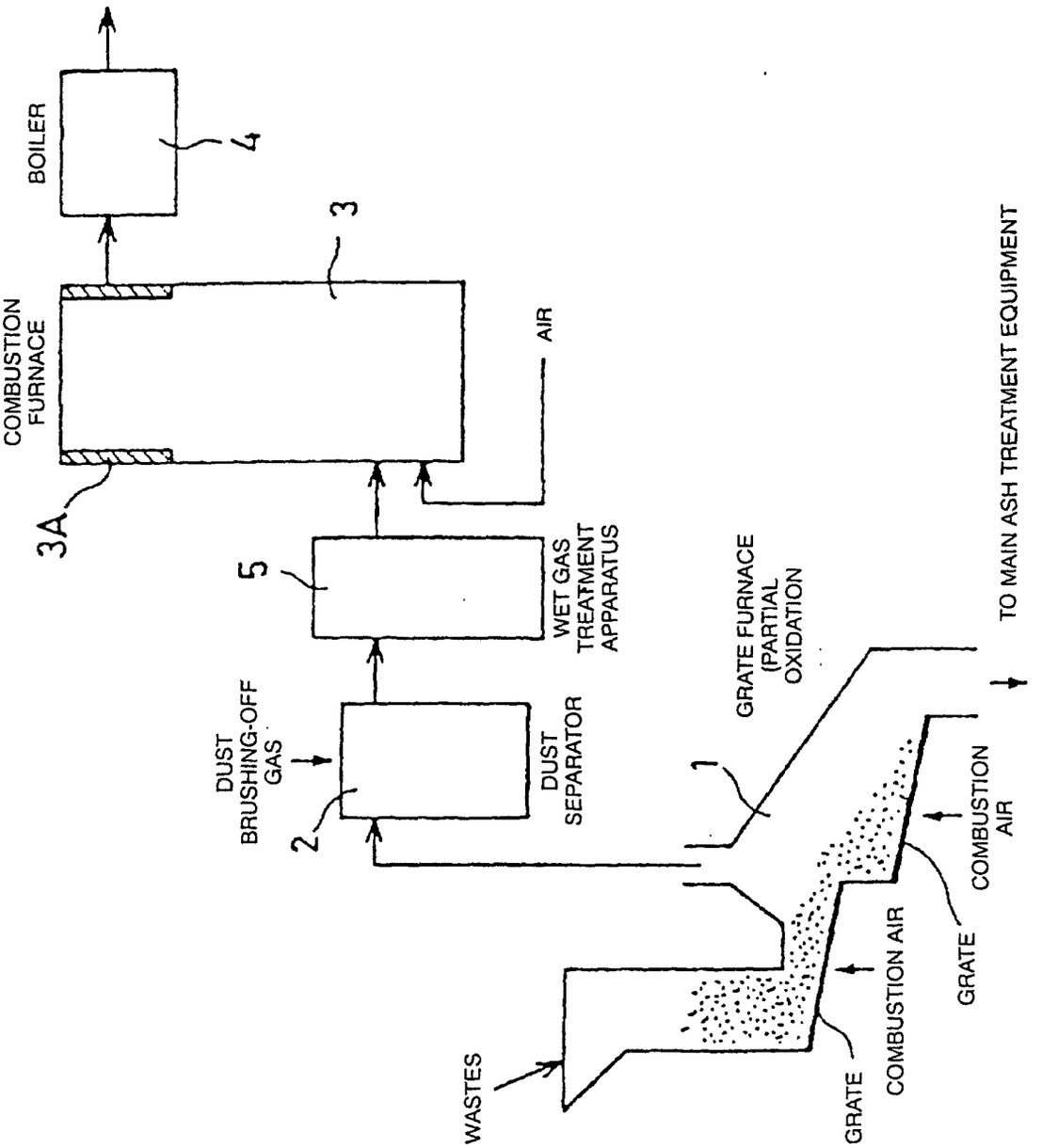

BOILER
4
3
COMBUSTION FURNACE
AIR
3A
5
WET GAS TREATMENT APPARATUS
DUST BRUSHING-OFF GAS
DUST SEPARATOR
2
1
GRATE FURNACE (PARTIAL OXIDATION
TO MAIN ASH TREATMENT EQUIPMENT
COMBUSTION AIR
GRATE
COMBUSTION AIR
GRATE
WASTES

FIG.10

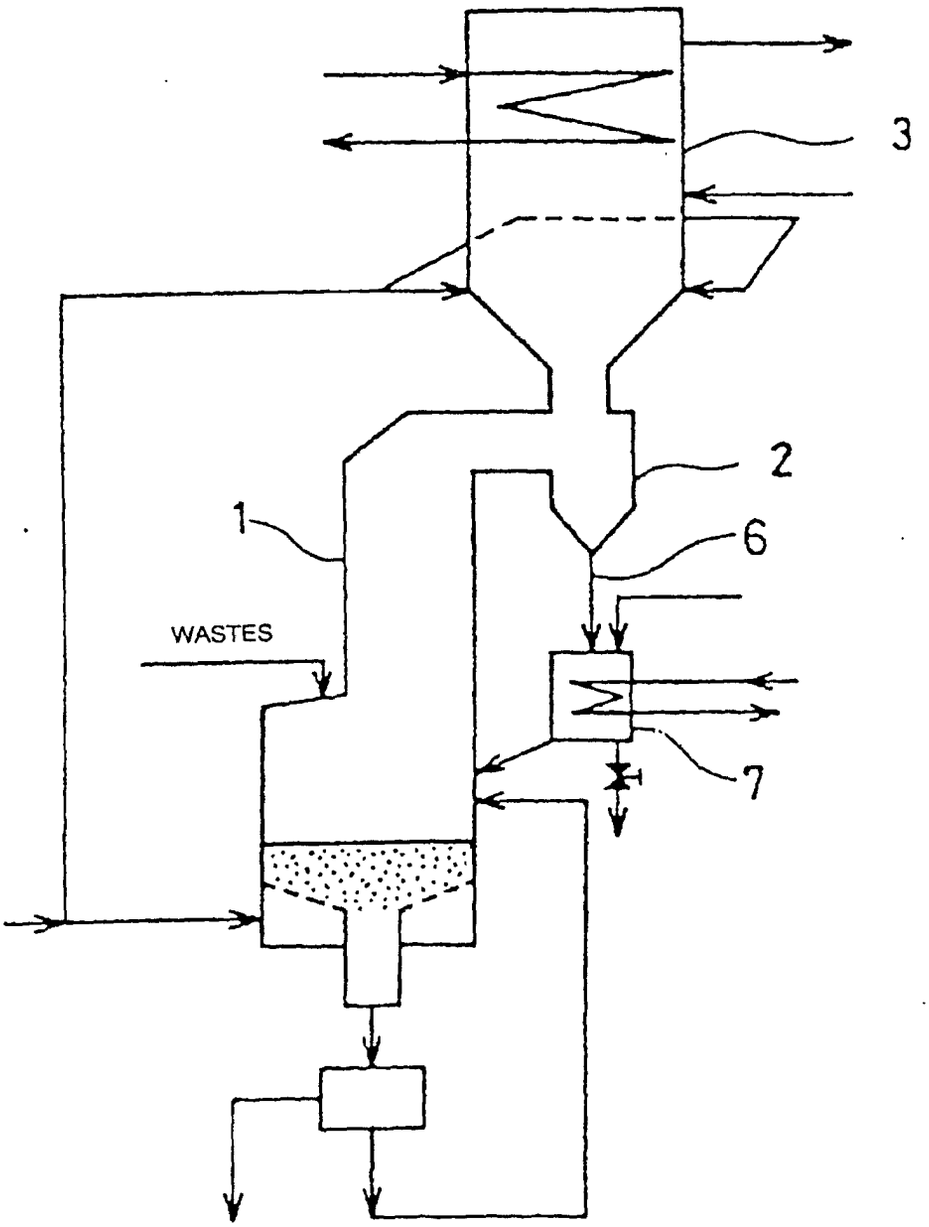
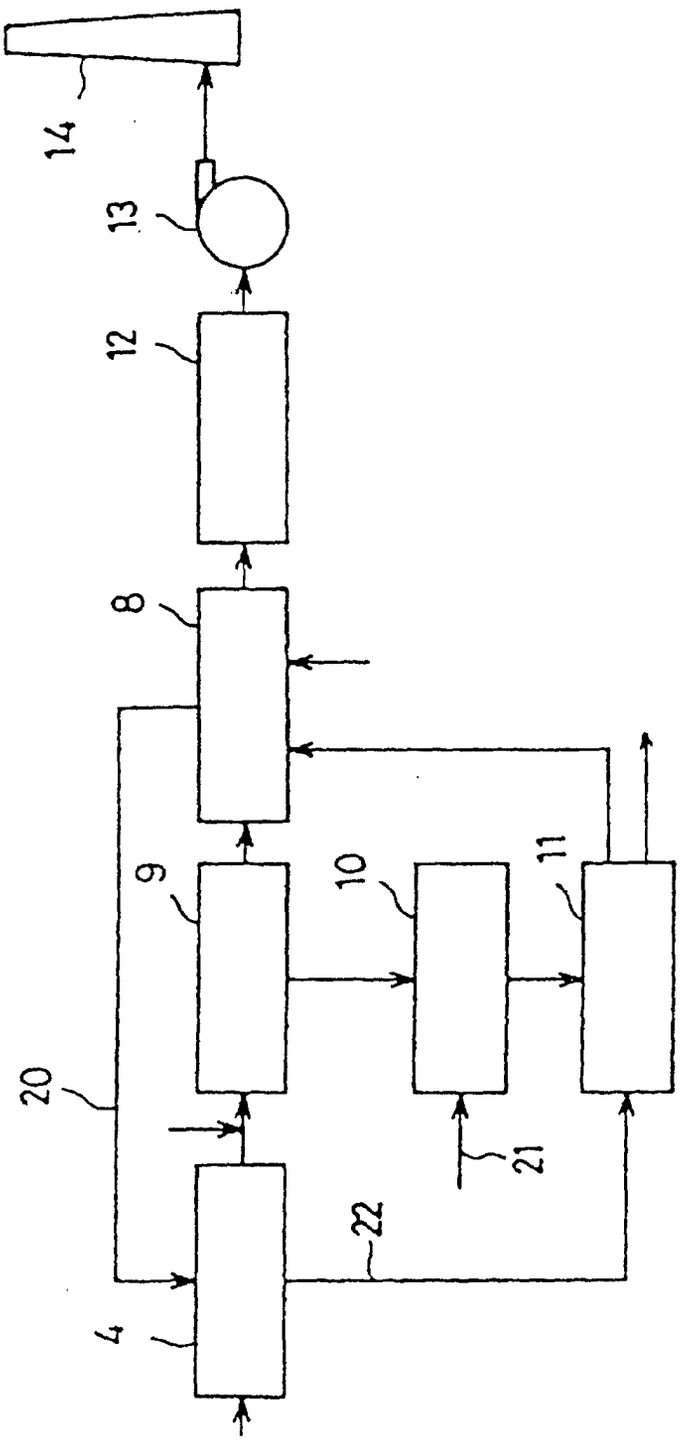


FIG.11



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP00/03306

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] F23G 5/027
F23G 5/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] F23G 5/027 B01D 46/42
F23G 5/14 - 5/18
F23J 15/00 -15/04

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1926-1996 Toroku Jitsuyo Shinan Koho 1994-2000
Kokai Jitsuyo Shinan Koho 1971-2000 Jitsuyo Shinan Toroku Koho 1996-2000

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
EX	JP 2000-161622 A (NKK Corporation), 16 June, 2000 (16.06.00), Full text; Fig. 1 (Family: none)	1-6,11,12, 21,23
EX	JP 2000-161623 A (NKK Corporation), 16 June, 2000 (16.06.00), Full text; Fig. 1 (Family: none)	13-20,24,25
A	JP 11-264525 A (KUBOTA Corporation), 28 September, 1999 (28.09.99) (Family: none)	1-25
A	JP 5-223238 A (Asahi Glass Co., Ltd.), 31 August, 1993 (31.08.93) (Family: none)	4,6-10,16,18
A	JP 9-60847 A (Kawasaki Heavy Industries, Ltd.), 04 March, 1997 (04.03.97) (Family: none)	9,10,22
A	JP 5-10514 A (Ishikawajima-Harima Heavy Industries Co., Ltd.), 19 January, 1993 (19.01.93) (Family: none)	11,19,23,25

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Date of the actual completion of the international search	Date of mailing of the international search report
16 August, 2000 (16.08.00)	29 August, 2000 (29.08.00)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP00/03306

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 11-351528 A (Babcock-Hitachi K.K.), 24 December, 1999 (24.12.99) (Family: none)	12-20,24,25

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