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(54) **COMBUSTION APPARATUS IN WHICH EMISSION OF N2O IS CONTROLLED, AND METHOD FOR CONTROLLING EMISSION OF N2O**

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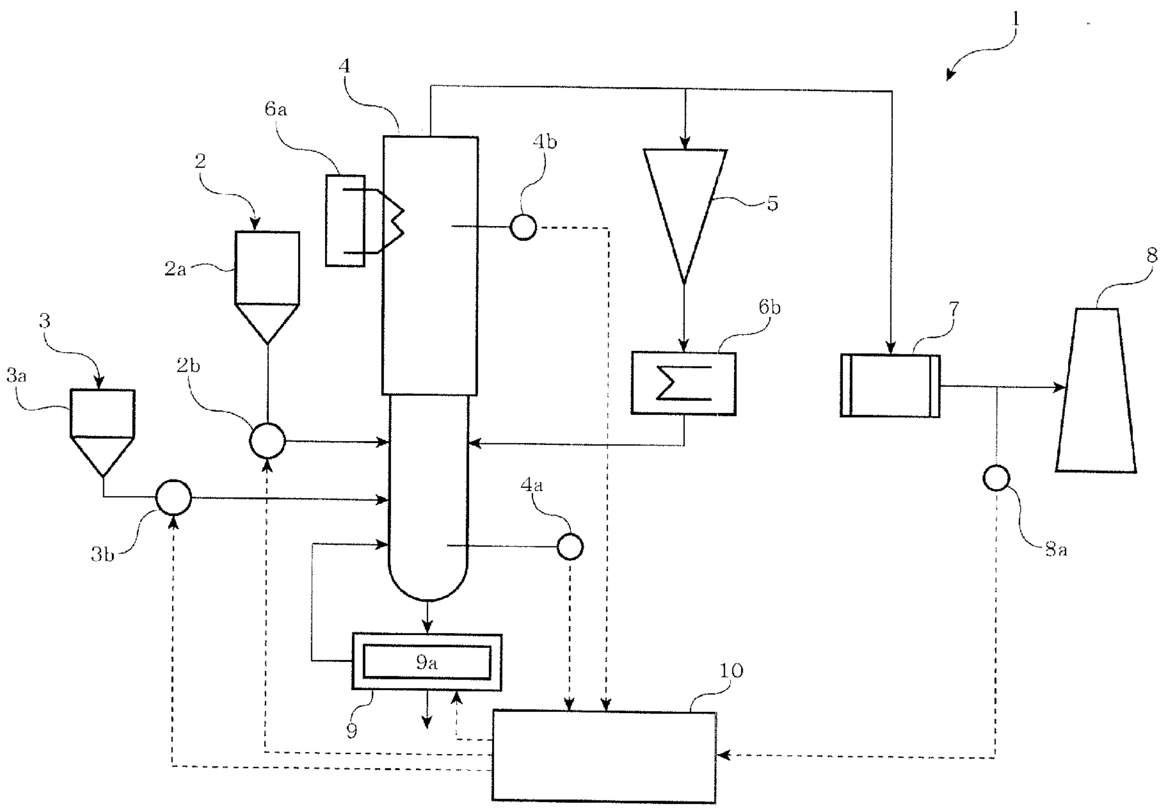
(57) **ABSTRACT**

Emission of N_2O is efficiently suppressed by supplying an appropriate amount of the N_2O-decomposing particles.

Disclosed is a combustor which controls emission of N_2O generated upon combustion of a predetermined nitrogen-containing fuel, including the N_2O-decomposing particles supply part **3** which supplies the particles being capable of decomposing N_2O in the apparatus; a N_2O concentration measurement meter **8*a*** which measures the concentration of N_2O contained in an exhaust gas; and a control part **10** which compares the measured N_2O concentration value with a predetermined control value and controls the supply amount of the N_2O-decomposing particles based on these comparison results.



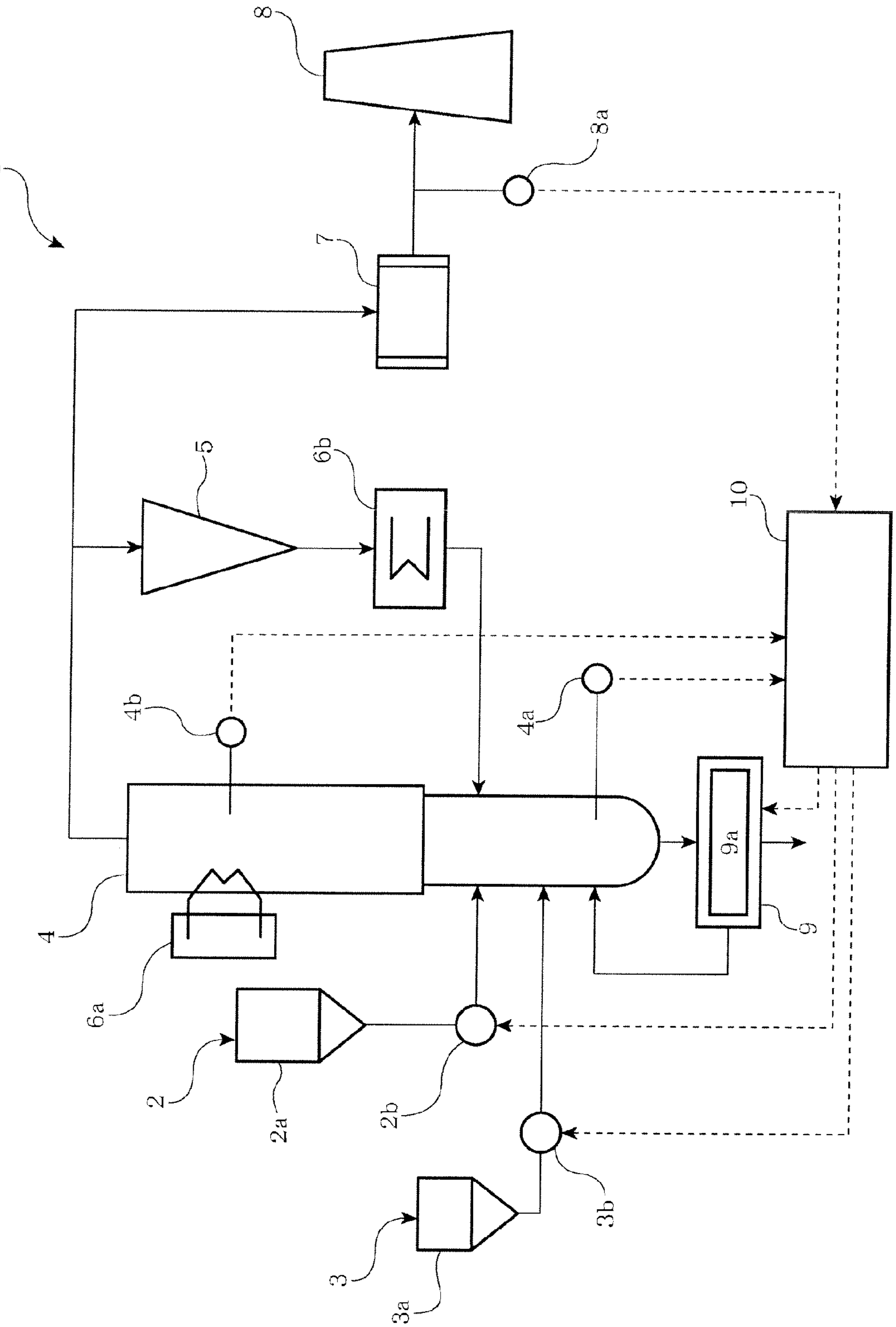
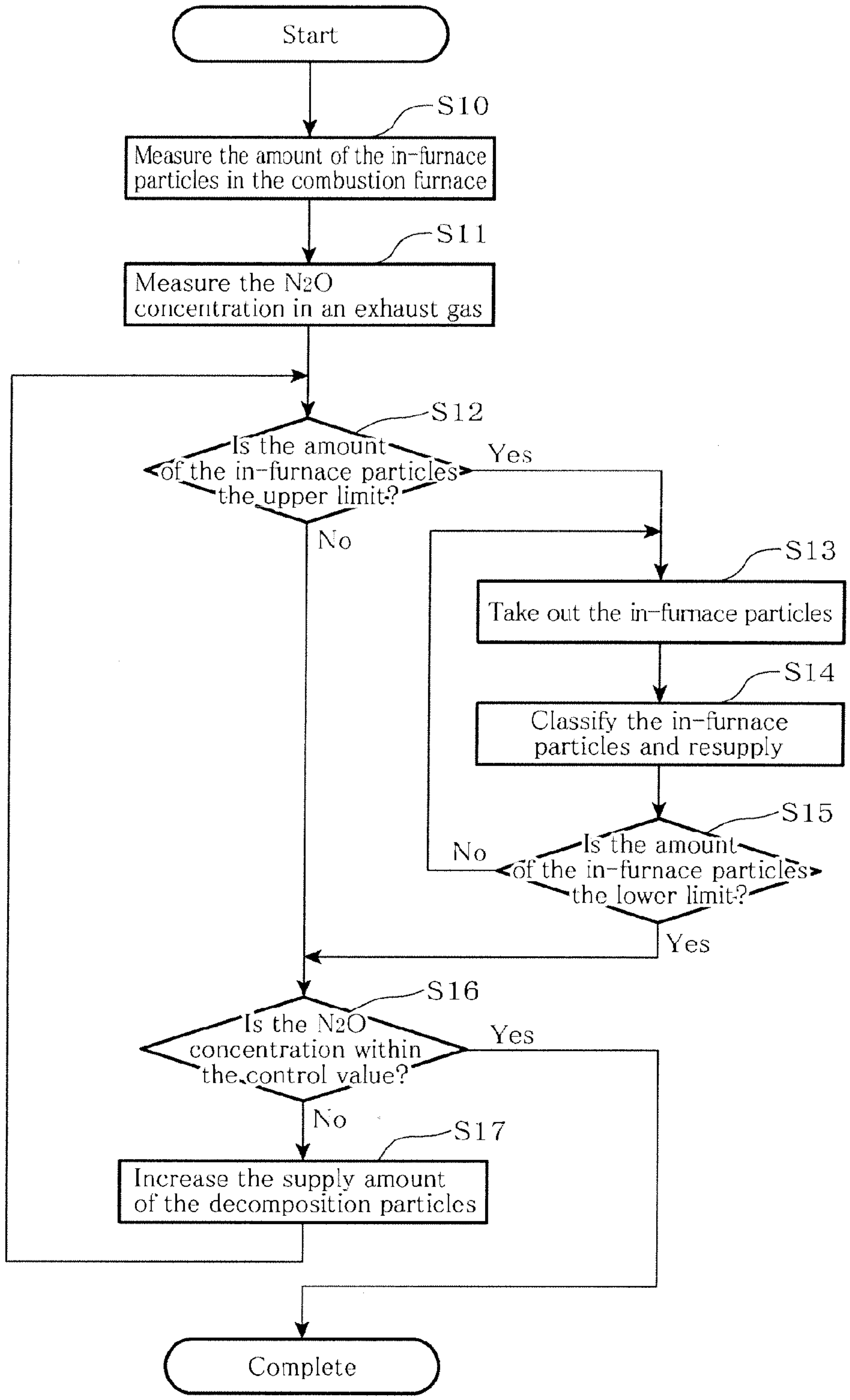


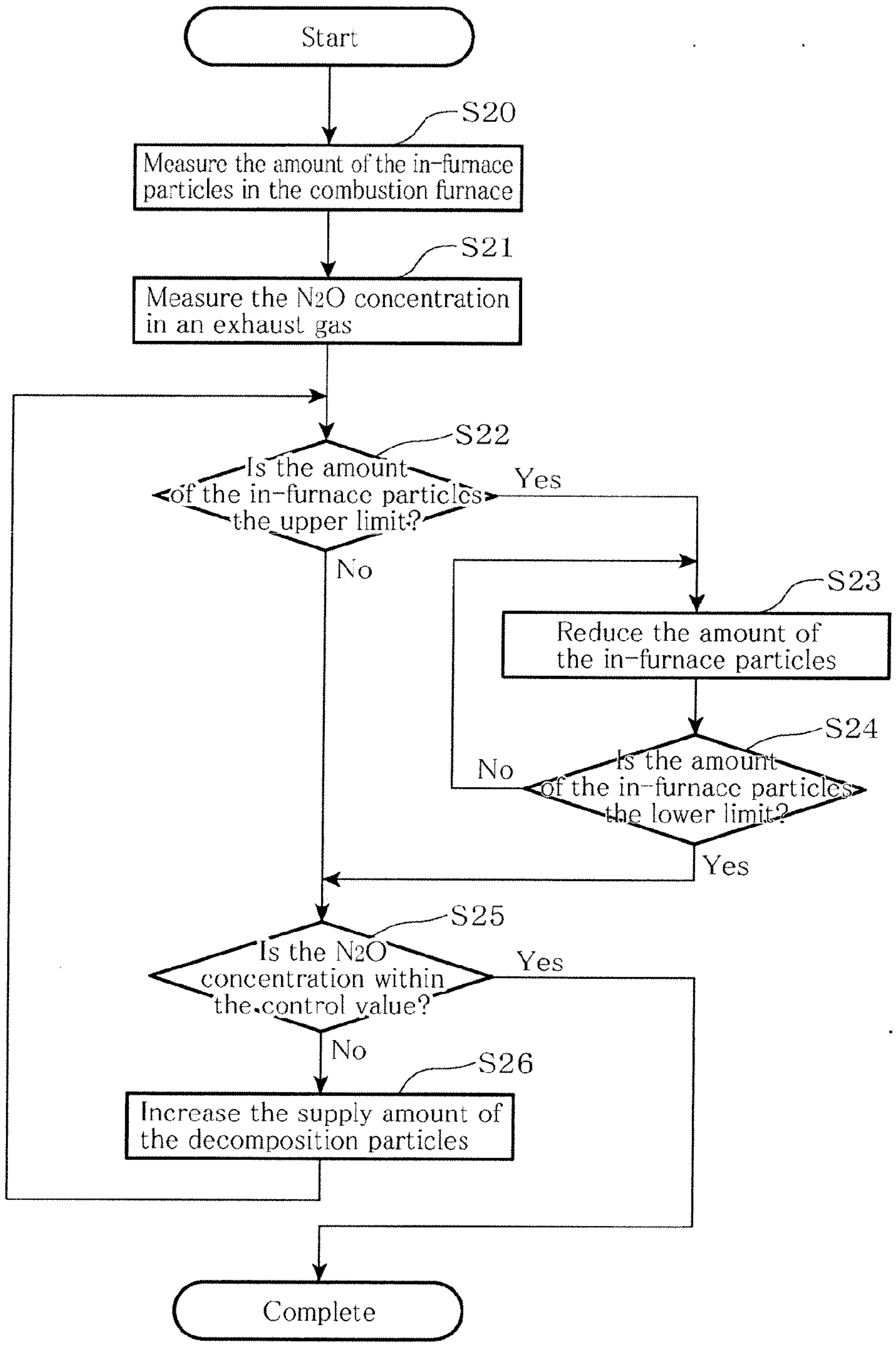
FIG. 1

FIG. 2



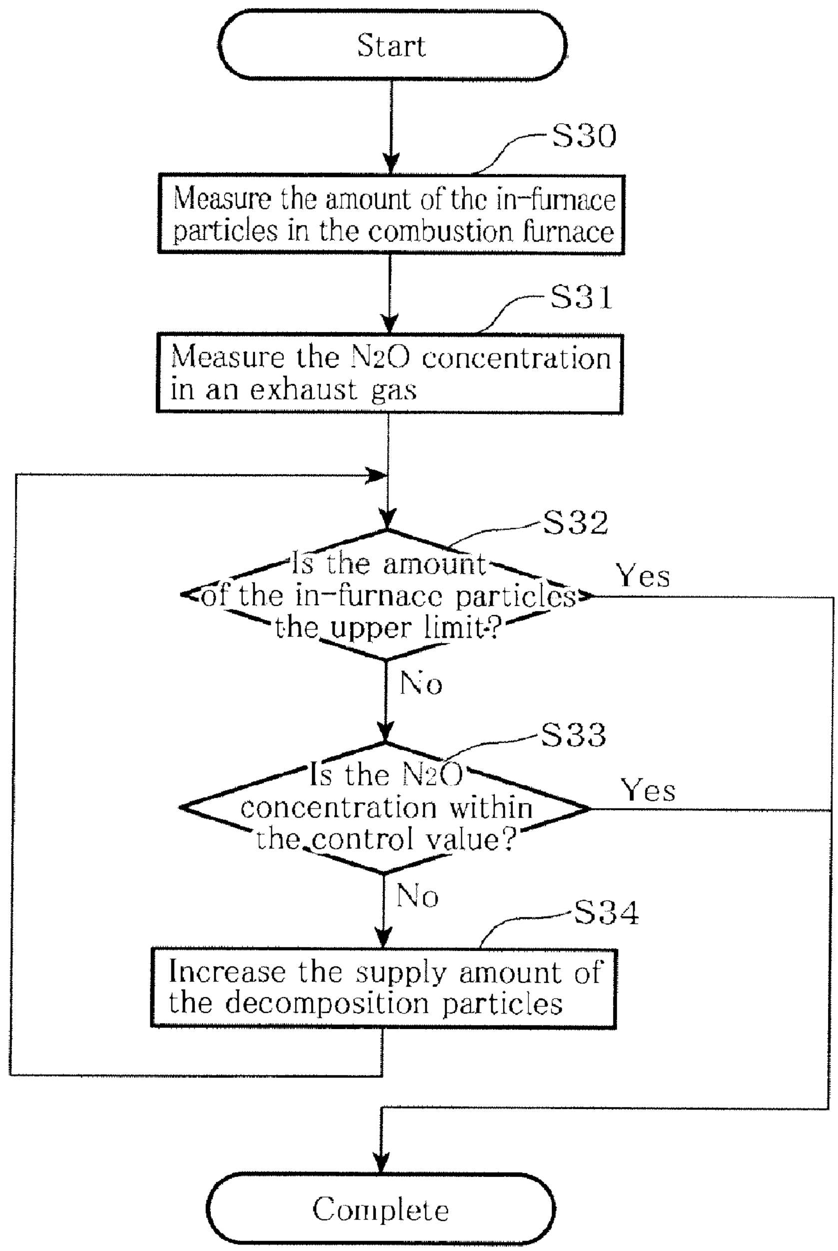
Start
S10
Measure the amount of the in-furnace particles in the combustion furnace
S11
Measure the N2O concentration in an exhaust gas
S12
Is the amount of the in-furnace particles > the upper limit?
Yes
No
S13
Take out the in-furnace particles
S14
Classify the in-furnace particles and resupply
S15
Is the amount of the in-furnace particles > the lower limit?
No
Yes
S16
Is the N2O concentration within the control value?
Yes
No
S17
Increase the supply amount of the decomposition particles
Complete

FIG. 3



Start
S20
Measure the amount of the in-furnace particles in the combustion furnace
S21
Measure the N2O concentration in an exhaust gas
S22
Is the amount of the in-furnace particles the upper limit?
Yes
No
S23
Reduce the amount of the in-furnace particles
S24
Is the amount of the in-furnace particles the lower limit?
No
Yes
S25
Is the N2O concentration within the control value?
Yes
No
S26
Increase the supply amount of the decomposition particles
Complete

FIG. 4


Start
S30
Measure the amount of the in-furnace particles in the combustion furnace
S31
Measure the N2O concentration in an exhaust gas
S32
Is the amount of the in-furnace particles the upper limit?
Yes
No
S33
Is the N2O concentration within the control value?
Yes
No
S34
Increase the supply amount of the decomposition particles
Complete

COMBUSTION APPARATUS IN WHICH EMISSION OF N2O IS CONTROLLED, AND METHOD FOR CONTROLLING EMISSION OF N2O

TECHNICAL FIELD

[0001] The invention relates to a combustor in which nitrogen nitride (N_2O) is generated when a specific nitrogen-containing fuel is combusted. In particular, the invention relates to a combustor which controls emission of N_2O and a method for controlling emission of N_2O.

BACKGROUND ART

[0002] N_2O is a substance which causes global warming, and hence, as in the case of CO_2, emission thereof is controlled as one of substances of which the generated amount is required to be reduced.

[0003] N_2O is known to be generated by combusting a nitrogen-containing substance at low temperatures. In particular, a high concentration of N_2O is emitted from a circulating fluidized bed combustor which combusts fuels such as coal, polluted sludge, and biomass, which contain a large amount of nitrogen, at lower temperatures, and the decrease in the amount of N_2O has been required.

[0004] So, the inventors have effectively decomposed and removed N_2O from exhaust gas by the supply of alumina N_2O-decomposing particles catalytically cracking N_2O into the circulating fluidized bed combustor (Patent Document 1).

RELATED ART DOCUMENT

Patent Document

[0005] Patent Document 1: JP-A-H06-123406

SUMMARY OF THE INVENTION

Subject to be Solved by the Invention

[0006] However, since the circulating fluidized bed combustor can combust various materials including coal, heavy oil, coal cokes, biomass, industrial wastes or the like, the amount of emitted N_2O varies depending on the type of a fuel supplied into the circulating fluidized bed combustor.

[0007] In order to offset such a variation in the amount of emitted N_2O, the control of the amount of the N_2O-decomposing particles supplied into the circulating fluidized bed combustor according to the amount of emitted N_2O was required the N_2O-decomposing particles combustion zone.

[0008] Further, the circulating fluidized bed combustor repeatedly combusts a fuel by a cyclic process. Specifically, the fuel and a fluidizing medium (silica sand, for example) are combusted with a fluidized state. After combustion, circulating particles (which are mainly coal ash and the fluidizing medium, but also contain parts of unburned char) are recovered from combusted materials and returned into a combustion zone. The heat exchange between the fluidizing medium and circulating water is conducted, leading to the generation of vapor which serves as a source of power for operating devices such as a turbine installed downstream.

[0009] In such a combustor, in order to ensure stable power generation of a turbine, the amount of vapor generated must be controlled to remain steady.

[0010] In order to control the vapor generation, the amount of circulating particles is preferred to being constant. Especially, in order to ensure an appropriate combustion state, the amount of particles containing circulating particles in the combustion zone is required to combustion zone be constant.

[0011] When these an excessive amount of the N_2O-decomposing particles are fed into the combustor, the amount of circulating particles will be ill-balanced because, as in the case of a fluidizing medium such as silica sand, the N_2O-decomposing particles as a circulating particle circulate in the circulating fluidized bed combustor, and as a result, the stabilization of vapor generation cannot be ensured.

[0012] Further, the activity of the N_2O-decomposing particles is gradually decreased with time. Therefore, when fresh N_2O-decomposing particles are added to N_2O-decomposing particles which have previously been dwelled in the circulating fluidized bed combustor, not only the total amount of circulating particles is increased, but also cumulative N_2O-decomposing particles which are of less activity cause being less efficiency of decomposing N_2O.

[0013] The invention has been proposed in order to solve the above-mentioned problems, and is aimed at controlling emission of N_2O efficiently by supplying an appropriate amount of the N_2O-decomposing particles. In particular, regarding a circulating fluidized bed combustor in which a fuel and a predetermined fluidizing medium are combusted while being fluidized, and circulating particles which have been collected from a combusted material are returned to the inside of a combustion zone, the invention is aimed at providing a combustor in which the emission of N_2O is controlled and a method for controlling the emission of N_2O with keeping the constant amount of the circulating particles in the combustion furnace.

Means for Solving the Subject

[0014] In order to attain the above-mentioned object, the combustor which controls emission of N_2O of the invention is a combustor which controls emission of N_2O generated upon combustion of a predetermined nitrogen-containing fuel, comprising:

[0015] a supply means which supplies the particles being capable of decomposing N_2O in the combustor;

[0016] a concentration measurement means which measures the concentration of N_2O contained in an exhaust gas; and

[0017] a control means which compares the measured N_2O concentration value with a predetermined control value and controls the supply amount of the N_2O-decomposing particles based on these comparison results.

[0018] The method for controlling emission of N_2O of the invention is a method for controlling emission of N_2O in which the N_2O-decomposing particles being capable of decomposing N_2O are supplied to a combustor in which N_2O is generated when a predetermined nitrogen-containing fuel is combusted, thereby to control emission of N_2O, comprising the steps of:

[0019] measuring the concentration of N_2O contained in an exhaust gas; and

[0020] comparing the measured concentration of N_2O with a prescribed control value and controlling the supply amount of the N_2O-decomposing particles based on these comparison results.

Advantageous Effects of the Invention

[0021] According to the combustor in which emission of N_2O is controlled and the method for controlling emission of

N_2O of the invention, emission of N_2O can be suppressed efficiently due to the supply of an appropriate amount of the N_2O-decomposing particles. In particular, in a circulating fluidized bed combustor in which a fuel and a prescribed fluidizing medium are combusted while being fluidized and circulating particles collected from a combusted material are returned to a combustion zone, emission of N_2O can be controlled with keeping the constant amount of the circulating particles in a combustion zone.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] FIG. **1** is a schematic diagram showing the configuration of a circulating fluidized bed combustor according to one embodiment of the invention;

[0023] FIG. **2** is a flow chart showing the method for controlling emission of N_2O in the circulating fluidized bed combustor according to one embodiment of the invention;

[0024] FIG. **3** is a flow chart showing the method for controlling emission of N_2O in the circulating fluidized bed combustor according to one embodiment of the invention having no classification device; and

[0025] FIG. **4** is a flow chart showing the method for controlling emission of N_2O in the circulating fluidized bed combustor according to one embodiment of the invention having no amount-reduction means.

MODE FOR CARRYING OUT THE INVENTION

[0026] A preferred embodiment of the combustor which controls emission of N_2O according to the invention will be explained below with reference to the drawings.

[0027] FIG. **1** is a schematic diagram showing the configuration of the combustor according to this embodiment, and FIG. **2** is a flow chart showing the method for controlling emission of N_2O in the combustor according to this embodiment.

[0028] The combustor according to the invention is a circulating fluidized bed combustor in which combustion is conducted while repeating circulation. Specifically, a fuel and a fluidizing medium such as silica sand are combusted while being fluidized and circulating particles which are collected from a combusted material are returned to the combustion zone.

[0029] It is known that this circulating fluidized bed combustor emits a large amount of N_2O by combusting, at low temperatures (for example, 600 to 900° C.), coal or sludge as a fuel, which contains a large amount of nitrogen. However, by supplying to the combustion zone an appropriate amount of the particles being capable of decomposing and activating N_2O while measuring the concentration of N_2O contained in an exhaust gas, emission of N_2O can be efficiently controlled. The constitution of the circulating fluidized bed combustor according to the invention will be explained below with reference to FIG. **1**.

[0030] As shown in FIG. **1**, the circulating fluidized bed combustor **1** according to this embodiment is composed of a fuel supply part **2**, a N_2O-decomposing particles supply part **3**, a combustion zone **4**, pressure gauges **4*a*** and **4*b***, a cyclone **5**, a heat exchanger **6*a***, an external heat exchanger **6*b***, a dust collector **7**, a duct **8**, a N_2O concentration meter **8*a***, a withdrawal part **9**, a control part **10** which controls them, or the like.

[0031] In the figure, the dotted line indicates the state of connection between the control part **10** and each part and each device, and the flow of signals.

[0032] The fuel supply part **2** is provided with a hopper **2*a*** which accommodates a fuel and a desulfurizing agent which removes a sulfur compound contained in the fuel in such a manner that they can be supplied to the combustion zone **4** separately, and a supply device **2*b*** which supplies a fuel in such a manner that the amount of a fuel supplied to the combustion zone **4** and the amount of a desulfurizing agent are controlled separately.

[0033] As the fuel according to this embodiment, in addition to coal, various fuels including heavy oil, coal cokes, biomass, waste plastics, waste tires, industrial wastes, polluted sludge and sludge can be used.

[0034] As the desulfurizing agent, a substance containing Ca and Mg such as limestone, quicklime, calcium hydroxide, dolomite, lime cake, concrete sludge, shell and paper making sludge can be used. Of these, lime cake is particularly preferable.

[0035] The N_2O-decomposing particles supply part **3** is provided with a hopper **3*a*** which stores the N_2O-decomposing particles to be supplied to the combustion zone **4** and a supply device **3*b*** which supplies the N_2O-decomposing particles to the combustion zone **4** after controlling the amount thereof.

[0036] As the N_2O-decomposing particles of this embodiment, alumina-based particles such as porous alumina, activated alumina, γ-alumina and active bauxite, silica-based particles such as silica gel, calcium-based particles such as lime stone, dolomite, freshly-mixed concrete sludge and a sludge cake thereof, lime cake and concrete and clay mineral-based particles such as activated clay, zeolite, sepiolite, fluid catalytic cracking (FCC) catalyst, and a waste material containing the same can be used. It is preferred that the particle size of the N_2O-decomposing particles be about 0.001 mm to 5 mm.

[0037] As the supply device **3*b***, a gravity supply device such as a chute, a gate, a rotary feeder, a ross chain feeder and a rock hopper, a mechanical supply device such as a belt feeder, a screw feeder, a chain feeder, an epron feeder and a table feeder, a vibration supply device such as a vibrating feeder and a shaking feeder, and a fluidizing supply device such as a blow tank, an ejector and an air slider.

[0038] The N_2O-decomposing particles can be stored not only in the hopper but also in a container such as a banker, a silo and a bottle.

[0039] The combustion zone **4** is a fluidized bed combustion zone in which a fuel supplied from the fuel supply part **2** is used as fuel particles after pulverizing or as it is, and these fuel particles, a desulfurizing agent, a fluidizing medium such as silica sand, and the N_2O-decomposing particles supplied from the decomposition particle supply part **3** are fluidized by air introduced from the lower part of the combustion zone to allow them to combust. A combusted material which is combusted in this combustion zone **4** is sent to the cyclone **5**.

[0040] The pressure gauge **4*a*** measures the pressure of the lower part of the combustion zone **4**, and the pressure meter **4*b*** measures the pressure of the upper part of the combustion zone **4**. The amount of in-furnace particles which are present in the combustion zone and contain circulating particles is the weight which can be calculated from a difference in pressure measured. Therefore, in this embodiment, the pressure difference in the combustion zone **4** is taken as the amount of in-furnace particles, and is monitored by the control part **10**.

[0041] The cyclone **5** is a separator which generates an eddy current of air, and separates circulating particles and a combustion gas from a combusted material by the centrifugal force of the eddy current. The circulating particles are composed of un-combusted carbon particles which are not combusted, coal ash, a fluidizing medium, a desulfurizing agent, the N_2O-decomposing particles or the like, and are again returned to the combustion zone **4**. On the other hand, the combustion gas is sent to the dust collector **7**.

[0042] The dust collector **7** removes ash from the combustion gas, and the duct **8** discharges an exhaust gas.

[0043] The N_2O concentration meter **8***a* measures the concentration of N_2O in an exhaust gas. This measured value is transmitted to the control part **10**.

[0044] As the N_2O concentration meter **8***a*, it is preferable to use a continuous measuring device utilizing the chemiluminescence method or the non-scattering and infrared absorption method.

[0045] The heat exchanger **6***a* conducts heat exchange between circulating water which is flown from the outside and air and in-furnace particles in the combustion zone **4**. The heat exchanger **6***b* conducts heat exchange between circulating water which is flown from the outside and the circulating particles.

[0046] By these heat exchangers, it is possible to heat and boil circulating water and allow vapor to be generated from a boiler, which is not shown.

[0047] The withdrawal part **9** is a device which withdraws part of the in-furnace particles including circulating particles from the combustion zone **4**, thereby to reduce the amount of the in-furnace particles (amount-reduction means).

[0048] Here, the in-furnace particles mean particles which are present in the combustion zone **4** at a certain point of time. The particles present in the combustion zone **4** include particles which accumulate in the furnace as they are without becoming circulating particles. Therefore, the in-furnace particles is defined as the total of these accumulating particles and part of circulating particles which are present in the combustion zone **4** at this point of time.

[0049] The amount of in-furnace particles which are taken out by this withdrawal part **9** is controlled by the control part **10**.

[0050] Further, the withdrawal part **9** is provided with a classification device **9***a* which extracts the N_2O-decomposing particles from the in-furnace particles which have been taken out, and returns the extracted N_2O-decomposing particles to the combustion zone **4** (extraction/re-supply means).

[0051] As the classification device **9***a*, a sieving classification device having a mesh size which enables the N_2O-decomposing particles to be classified, a natural sedimentation classification device, a dry classification device such as a cyclone and an air separator and a wet classification device such as a liquid cyclone and a hydraulic separator.

[0052] Extraction of the N_2O-decomposing particles can be conducted as follows.

[0053] For example, when the N_2O-decomposing particles are extracted by means of a sieving classification device, two types of a sieve differing in mesh size are used. The mesh size of one sieve is allowed to be the minimum particle size of the N_2O-decomposing particles, and the mesh size of the other sieve is allowed to be the maximum particle size of the N_2O-decomposing particles. The in-furnace particles which have been taken out are sieved by two types of sieve, whereby particles of which the particle size is larger than the minimum particle size of the N_2O-decomposing particles and smaller than the maximum particle size of the N_2O-decomposing particles can be extracted easily as the N_2O-decomposing particles.

[0054] All or part of the N_2O-decomposing particles thus extracted is returned to the combustion zone **4**.

[0055] Due to the provision of the classification device **9***a*, the amount of the in-furnace particles can be reduced without reducing the amount of the N_2O-decomposing particles. As a result, the amount ratio of the N_2O-decomposing particles among the in-furnace particles can be increased, and emission of N_2O can be effectively suppressed by the N_2O-decomposing particles remaining in the combustor.

[0056] As a supply device to be used when the extracted N_2O-decomposing particles are returned to the combustion zone **4**, a supply device which is similar to the above-mentioned supply device **3***b* can be used.

[0057] The control part **10** (control means) is connected to each part and each device of the combustor, and is composed of DCS (distributed control system) having a central processing unit (CPU). The control part controls supply of a fuel based on the vapor generation amount which has been set, controls by monitoring the combustion state, and monitors the concentration of emitted N_2O to control emission of N_2O.

[0058] Control for suppressing emission of N_2O will be explained below in detail.

[0059] Control to suppress emission of N_2O is conducted based on a measured value (N_2O concentration) of the N_2O concentration meter **8***a*.

[0060] The control part **10** monitors the N_2O concentration (0 to 500 ppm, for example), and compares it with a prescribed control value (100 ppm, for example). The control part **10** controls the supply device **3***b* depending on whether the N_2O concentration exceeds this control value, whereby the amount of the N_2O-decomposing particles to be supplied is increased or decreased.

[0061] For example, if the N_2O concentration exceeds this control value, the control part **10** controls the supply device **3***b* so that the amount of the N_2O-decomposing particles to be supplied is increased. As a result, if the N_2O concentration is within the control value, the amount of the N_2O-decomposing particles to be supplied is decreased.

[0062] By decreasing and increasing the amount of the N_2O-decomposing particles while monitoring the N_2O concentration, emission of N_2O can be effectively controlled by an appropriate (i.e. not too large or not too small) amount of the N2O-decomposing particles.

[0063] Further, the control part **10** monitors a difference in pressure between the pressure gauge **4***a* and the pressure gauge **4***b* (for example, 1.0 kPa to 2.5 kPa) as the amount of the in-furnace particles. In order to ensure stable combustion and stable vapor generation amount, it is preferred that the amount of the in-furnace particles be a constant value. The control part **10** compares the amount of the in-furnace particles with the prescribed control value, and, depending on whether or not the amount of the in-furnace particles exceeds this control value, decreases and increases the amount of the N_2O-decomposing particles.

[0064] Specifically, if the amount of the in-furnace particles exceeds the upper limit (2.5 kPa, for example) irrespective of the fact that the N_2O concentration exceeds the prescribed value, the following control is conducted.

[0065] If the in-furnace particle amount exceeds the upper limit, the control part controls the above-mentioned withdrawal part **9**, and takes out the in-furnace particles in an amount corresponding to the amount exceeding the upper limit. Then, the control part controls the above-mentioned classification device **9***a*, extracts the N_2O-decomposing particles from the in-furnace particles which have been taken out and re-supply to the combustion zone **4**, whereby the amount ratio of the N_2O-decomposing particles relative to the amount of the circulating particles can be increased.

[0066] At this time, simultaneously with or separated from the control of the classification device **9***a*, the control part can control the supply device **3***b* to increase the amount of the N_2O-decomposing particles. In this case, due to the control of the supply device **3***b*, new N_2O-decomposing particles which are especially high in decomposition activity are supplied, and, as a result, emission of N_2O can be controlled while effectively reducing the amount of the in-furnace particles. Such a control is effective when the amount of the in-furnace particles significantly exceeds the upper limit value and the N_2O concentration significantly exceeds the control value.

[0067] Next, the method for controlling the N_2O emission in the circulating fluidizing bed combustor according to this embodiment will be explained with reference to the flow chart shown in FIG. **2**.

[0068] The method for controlling the N_2O emission shown below is conducted by a method in which the central processing unit (CPU) controls each part of the combustor based on the input signals of the control part **10** according to the program stored in a predetermined storing means of the control part **10**.

[0069] First, the control part **10** measures the amount of the in-furnace particles in the combustion zone **4** as the difference in pressure between the pressure measured by the pressure meter **4***a* and the pressure meter **4***b* (S**10**), and also measures the concentration of N_2O in an exhaust gas (S**11**). Meanwhile, it is assumed that the control part **10** monitors this amount of the in-furnace particles all the time.

[0070] Further, the control part **10** judges whether the amount of the in-furnace particles exceeds the upper limit (S**12**), and if the in-furnace particles exceed the upper limit (S**12**-YES), the control part controls the withdrawal part **9** to extract the in-furnace particles (S**13**), and then controls the classification device **9***a* to extract the N_2O-decomposing particles from the in-furnace particles which have been taken out, and all or part of the N_2O-decomposing particles which have been extracted are re-supplied to the combustion zone **4** (S**14**).

[0071] Then, the control part **10** judges whether the amount of the in-furnace particles reaches the lower limit (S**15**), and if the amount of the in-furnace particles is not the lower limit (S**15**-NO), the control part further takes out the in-furnace particles to repeat the above-mentioned procedure.

[0072] The in-furnace particles are taken out until the amount of in-furnace particles reaches the lower limit value, and at the same time, the N_2O-decomposing particles are extracted and re-supplied to the combustion zone **4**. In this way, while attempting the stabilization of the combustion state and the vapor generation amount, the N_2O-decomposing particles remaining in the combustor are effectively utilized, whereby emission of N_2O can be suppressed efficiently.

[0073] If the amount of the in-furnace particles does not exceed the upper limit (S**12**-NO), or the amount of the in-furnace particles becomes the lower limit (S**15**-YES), whether the N_2O concentration is within the control value or not is judged (S**16**).

[0074] If the N_2O concentration is not within the control value (S**16**-NO), the control part **10** controls the supply device **3***b*, and increases the supply amount of the new composition particles having a high decomposition activity (S**17**). As a result, only by extracting and re-supplying the N_2O-decomposing particles of which the decomposition activity has been lowered, even in the case where the concentration of N_2O is not within the control value, emission of N_2O can be suppressed without fail by supplying new the N_2O-decomposing particles.

[0075] Thereafter, while monitoring the amount of in-furnace particles, the above-mentioned procedure is repeated until the N_2O concentration becomes within the control value (S**12**).

[0076] On the other hand, if the N_2O concentration is within the control value, the control part **10** completes the procedure (S**16**-YES).

[0077] In this way, the N_2O concentration can be kept within the control value without supplying an excessive amount of the N_2O-decomposing particles by supplying an appropriate amount of the N_2O-decomposing particles which corresponds to the measured N_2O concentration.

[0078] According to the method for controlling the N_2O emission in this embodiment, emission of N_2O can be suppressed while monitoring the amount of the in-furnace particles, whereby emission of N_2O can be efficiently suppressed while ensuring stable combustion and vapor generation amount.

[0079] Next, the method for suppressing emission of N_2O in the case where the classification device **9***a* cannot be provided for reasons of the configuration of the combustor in the above-mentioned embodiment will be explained with reference to the flow chart in FIG. **3**.

[0080] Meanwhile, this circulating fluidizing bed combustor is set on the assumption that an amount-reduction means which reduces the amount of the in-furnace particles in the combustor such as the withdrawal part **9** which takes out part of the in-furnace particles from the combustion zone **4** is at least provided.

[0081] First, the control part **10** measures the amount of the in-furnace particles in the combustion zone **4** (S**20**), further it measures the N_2O concentration in an exhaust gas (S**21**) as in the case of the flow chart shown in FIG. **2** (S**20**).

[0082] The control part **10** judges whether the amount of the in-furnace particles exceeds the upper limit (S**22**), and if the amount of the in-furnace particles exceeds the upper limit (S**22**-YES), the amount of the in-furnace particles is reduced by the amount-reduction means such as the withdrawal part **9** or other amount-reduction means (S**23**). As a result, the control part **10** judges whether the amount of the in-furnace particles reaches the lower limit (S**24**), and if the amount of the in-furnace particles is not the lower limit (S**24**-NO), the amount of the circulating amount is further reduced. The above-mentioned procedure is repeated (S**23**).

[0083] If the amount of the in-furnace particles does not exceed the upper limit (S**22**-NO) or the amount of the in-furnace particles becomes the lower limit (S**24**-YES), judgment is conducted whether the N_2O concentration is within the control value or not (S**25**) is judged.

[0084] If the N_2O concentration is not within the control value (S**25**-NO), the control part **10** controls the supply device **3***b* to increase the supply amount of the N_2O-decomposing particles (S**26**). Thereafter, while monitoring the amount of the in-furnace particles, the above-mentioned procedure is repeated until the N_2O concentration becomes within the control value (S**22**). When the N_2O concentration is within the control value, the control part **10** completes the procedure (S**25**-YES).

[0085] In this way, the N_2O concentration can be kept within the control value without supplying an excessive amount of the N_2O-decomposing particles by supplying an appropriate amount of the N_2O-decomposing particles which corresponds to the measured N_2O concentration.

[0086] By the above-method for suppressing emission of N_2O, emission of N_2O can be suppressed while monitoring the amount of the in-furnace particles. Therefore, emission of N_2O can be suppressed while monitoring the amount of the in-furnace particles, whereby emission of N_2O can be efficiently suppressed while ensuring stable combustion and vapor generation amount.

[0087] Next, the method for suppressing emission of N_2O in the circulating fluidizing bed combustor in the case where not only the withdrawal part **9** but also the amount-reduction means which reduces the amount of circulating particles cannot be provided for reasons of the configuration of the combustor be explained with reference to the flow chart in FIG. **4**.

[0088] First, the control part **10** measures the amount of the in-furnace particles in the combustion zone **4** (S**30**), and measures the N_2O concentration in an exhaust gas (S**31**).

[0089] Then, the control part judges whether the amount of the in-furnace particles exceeds the upper limit (S**32**), and if the amount of the in-furnace particles exceeds the upper limit (S**32**-YES), the procedure is completed since the amount of the N_2O-decomposing particles cannot be increased.

[0090] On the other hand, if the amount of the in-furnace particles does not exceed the upper limit (S**32**-NO), whether the N_2O concentration is within the control value (S**33**) is judged.

[0091] If the N_2O concentration is not within the control value (S**33**-NO), the control part **10** controls the supply device **3***b*, thereby to increase the supply amount of the N_2O concentration (S**34**). Thereafter, while monitoring the amount of the in-furnace particles, the above-mentioned procedure is repeated (S**32**). When the N_2O concentration becomes within the control value, the control part completes the procedure (S**33**-YES).

[0092] In this way, the N_2O concentration can be kept within the control value without supplying an excessive amount of the N_2O-decomposing particles by supplying an appropriate amount of the N_2O-decomposing particles which corresponds to the measured N_2O concentration.

[0093] As mentioned above, even if such amount-reduction means is not provided, emission of N_2O can be suppressed while monitoring the amount of the in-furnace particles, whereby emission of N_2O can be efficiently suppressed while ensuring the stable combustion and the vapor generation amount.

[0094] As mentioned above, by the circulating fluidizing bed combustor in which emission of N_2O is suppressed and the method for suppressing emission of N_2O according to this embodiment, while keeping constant the amount of circulating particles which circulate in the combustor, in particular, the in-furnace particles including the circulating particles present in the combustion zone, emission of N_2O can be efficiently suppressed by supplying an appropriate amount of the N_2O-decomposing particles.

[0095] Preferred embodiments of the combustor in which emission of N_2O is controlled and the method for controlling emission of N_2O of the invention are explained hereinabove, the combustor in which emission of N_2O is controlled and the method for controlling emission of N_2O are not limited to the above-mentioned embodiment, and it is needless to say various modifications are possible within the scope of the invention.

[0096] For example, in the combustor in which emission of N_2O is controlled according to this embodiment, the N_2O-decomposing particles are supplied singly. However, the N_2O-decomposing particles may be supplied in a mixture of a fuel and/or a desulfurizing agent.

[0097] The place where the N_2O-decomposing particles are supplied is not limited the combustion zone **4**, and the N_2O-decomposing particles can be supplied from any place where a fuel gas can be in contact with the N_2O-decomposing particles such as the cyclone **5**, the heat exchanger **6**, a particle circulating apparatus a loop seal and a fluoroseal, and pipes connected them.

[0098] The amount-reduction means which reduces the amount of the circulating particles is not limited to the withdrawal apparatus part **9** which takes out part of the in-furnace particles including the circulating particles. For example, the amount of the desulfurizing agent which serves as the circulating particles may be adjusted by controlling the supply device **2***b*. Further, the amount of the circulating particles can be reduced by a method such as selecting a fuel so that a fuel which is less likely to be ash remaining un-combusted is supplied, sieving a fuel so that a fuel with a small particle size can be supplied or providing an amount-reduction means for reducing the supply amount of a fluidizing medium such as silica sand. These methods are used singly or in combination.

[0099] Further, the combustor of the invention can be applied not only to the circulating fluidized bed combustor but also to all combustors in which N_2O is generated such as an atmospheric fluidized bed combustor, a pressurized fluidized bed combustor and a bubbling fluidized bed combustor.

INDUSTRIAL APPLICABILITY

[0100] The invention can be widely applied to a combustor in which nitrogen-containing coal or an industrial waste is combusted as a fuel, whereby N_2O is generated.

1. A combustor which controls emission of N_2O generated upon combustion of a predetermined nitrogen-containing fuel, comprising:

a supply means which supplies the particles being capable of decomposing N_2O in the combustor;

a concentration measurement means which measures the concentration of N_2O contained in an exhaust gas; and

a control means which compares the measured N_2O concentration value with a predetermined control value and controls the supply amount of the N_2O-decomposing particles based on these comparison results.

2. The combustor which controls emission of N_2O according to claim **1**, wherein the combustor is an apparatus in which the fuel and a specific fluidizing medium are combusted while being fluidized and circulating particles which have been collected from a combusted material are returned to a combustion zone,

the apparatus comprising a particle amount measuring means which measures the amount of in-furnace particles including circulating particles which are present in the combustion zone, and

the control means comparing the measured amount of in-furnace particles with a prescribed control value, and controls the supply amount of the N_2O-decomposing particles based on these comparison results.

3. The combustor which controls emission of N_2O according to claim **2**, which further comprises an amount-reduction means which reduces the amount of the circulating particles, wherein the control means compares the measured amount of in-furnace particles with a prescribed control value, and controls the reduction amount of the circulating particles based on these comparison results.

4. The combustor which controls emission of N_2O according to claim **3**, which comprises an withdrawal means which takes out the in-furnace particles from the combustion zone as the amount-reduction means, wherein the control means compares the measured amount of in-furnace particles with a prescribed control value and controls the reduction amount of the in-furnace particles based on these comparison results.

5. The combustor which controls emission of N_2O according to claim **4**, which further comprises an extraction means which extracts the N_2O-decomposing particles from the in-furnace particles which have been taken out and re-supply means which re-supplies the extracted N_2O-decomposing particles to the combustion zone.

6. The combustor which controls emission of N_2O according to claim **5**, wherein the extraction means classifies the in-furnace particles which have been taken out and extracts the N2O-decomposing particles.

7. A method for controlling emission of N_2O in which the N2O-decomposing particles being capable of decomposing N_2O are supplied to a combustor in which N_2O is generated when a predetermined nitrogen-containing fuel is combusted, thereby to control emission of N_2O, comprising the steps of:

measuring the concentration of N_2O contained in an exhaust gas; and

comparing the measured concentration of N_2O with a prescribed control value and controlling the supply amount of the N_2O-decomposing particles based on these comparison results.

8. The method for controlling emission of N_2O according to claim **7**, wherein the combustor is a circulating fluidized bed combustor in which the fuel and a specific fluidizing medium are combusted while being fluidized and circulating particles which have been collected from a combusted material are returned to a combustion zone, which further comprises the steps of:

measuring the amount of in-furnace particles which are present in the combustion zone, and

comparing the measured amount of in-furnace particles with a prescribed control value and controlling the supply amount of the N_2O-decomposing particles based on these comparison results.

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