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(54) **Eljárás maradékanyagok elégetésére**

Az európai szabadalom ellen, megadásának az Európai Szabadalmi Közlönyben való meghirdetésétől számított kilenc hónapon belül, felszólalást lehet benyújtani az Európai Szabadalmi Hivatalnál. (Európai Szabadalmi Egyezmény 99. cikk(1))

A fordítást a szabadalmas az 1995. évi XXXIII. törvény 84/H. §-a szerint nyújtotta be. A fordítás tartalmi helyességét a Szellemi Tulajdon Nemzeti Hivatala nem vizsgálta.

Description

The present invention relates to a method for the combustion of a waste material. The invention is used in particular in the combustion of contaminated liquids which cannot be disposed of in a purification plant.

Liquids which are contaminated with inorganic and organic constituents and cannot be recycled or disposed of in purification plants due to poor biodegradabilily have to be disposed of by thermal techniques by means of combustion reactions. Conventionally, waste of this type is combusted with air as an oxidiser in a supporting flame. For this purpose, the contaminated liquid is transferred into the gas phase by atomisation and evaporation, mixed with air and heated to temperatures of between 850 °C and 1400 °C. In this case, the organic substances oxidise completely to CO_2 and H_2O, and sulfur oxidises to SO_2. Inert, inorganic substances in the form of powder or in a liquid phase are obtained as products. Although the reactions of most of the constituents proceed exothermically, due to the high and often fluctuating water concentrations, the combustion is for the most part not autothermal, i.e. additional support fuels are required. Conventionally, these liquids are therefore combusted in mono-combustion installations comprising vertically arranged, stationary furnaces which can be firedfrom above.

Since the contaminated liquids are usually contaminated with solid substances and/or polymerisable products, inwardly mixing and outwardly mixing atomising nozzles having a large nozzle cross section are used to inject the contaminated liquids. Air or steam is usually used as the atomising medium. When using mechanicalatomisers or steam atomisers, the liquid is atomised into droplets having diameters of between 200 µm and 400 µm. This relatively large diameter of the droplets is disadvantageous, since said droplets would need to dwell in the flame for a relatively longtime in order to be completely evaporated. When using steam as an atomising medium, said steam can constitute up to 10 % of the flue gas volume and the reaction of the flame with the oxygen is impeded. Simple mechanical atomiser nozzles are not used, since these tend to become blocked due to the solid substances in the contaminated liquids.

Due to the contaminations in the liquids, the flue gas from the combustion process is also contaminated with substances in the form of powders and gases, such as SO_2, Cl, CO, NO_x, which have to be removed from the flue gas in a complex manner. The complex cooling and purification of the flue gas is largelyresponsible for the high operating costs of combustion installations. The volume of the resulting flue gas is thus the limiting factor of the combustion process.

It is known to supply oxygen to the combustion process in order to increase the efficiency of the combustion process when the volume of flue gas remains the same, wherein the proportion of nitrogen in the flue gas is reduced and the proportion of the other flue gas components such as carbon dioxide, water vapour and sulfur dioxide is increased. However, an increase in the oxygen content also results in an increase in the combustion temperature, for which combustion installations are often not designed. The proportion of carbon monoxide is reduced by the increase in temperature, since it oxides completely. In addition, the proportion of nitric oxide is disadvantageously increased by the rise in temperature. The additional oxygen is fed into the combustion chamber by oxygenating the combustion air, by direct injection into the flame or the reaction space, or via separate oxygen burners.

DE 2506438 A1 discloses a method for thermally cracking waste sulfuric acid. Said document discloses that the sulfuric acid is injected into an ultrasonic field and reacted to form a gas containing SO_2. This method could not succeed in the market due to material problems and the high level of technical complexity required for the implementation thereof, which leads to high maintenance requirements and reduced service lives.

DE 2548110 A1 discloses a method for the combustion of liquid waste materials, in which compressed air and the waste material are supplied for combustion via an ultrasonic atomiser.

It is therefore an object of the invention to solve at least some of the problems which have been outlined in relation to the prior art and in particular to provide a method which increases the efficiency of combustion of liquids without increasing the volume of flue gas.

These objects are achieved by a method according to the features of the independent claim. Additional advantageous embodiments of the invention are provided in the dependent claims. The features which are described in detail in the claims can be combined in any desired technologically feasible manner and can be supplemented by illustrative facts from the description, wherein additional variants of the invention are demonstrated.

The method according to the invention for the combustion of a liquid waste material is characterised in that an operating medium having an oxygen content of more than 90 vol.% (% by volume), preferably technically pure oxygen, and the waste material is supplied for combustion via at least one ultrasonic atomiser. By means of the operating medium, ultrasonic waves are generated and the waste material is finely atomised. The operating medium thus has two functions. Firstly, said medium generates ultrasonic waves which atomise the waste material into fine drops which have a diameter of between 50 µm and 100 µm, thus resulting in a greater total surface area of the waste material. Secondly, the operating medium (technically pure oxygen) is available as a reactant of the finely atomised waste material. The combustion process can thus be carried out more efficiently. The method according to the invention provides a combustion process with drops of the waste material to be combusted which have a smaller diameter and a gas which has an increased oxygen content without increasing the temperature of the combustion process, the volume of flue gas or the emission of oxides beyond the limits of the operating conditions.

As an operating medium, a gas mixture having an oxygen content of more than 90 vol.% is used, preferably technically pure oxygen having an oxygen content of over 99 vol.%, preferably more than 99.9 vol.%. It is also advantageous that the oxygen concentration in the furnace can be adapted to the combustion parameters such as amount of waste material, temperature, amount of flue gas

and/or gas concentration during the combustion process. The amount of operating medium to be supplied can preferably be varied between the amount required for atomisation, the amount of oxygen required for complete combustion or any desired amount beyond that.

An ultrasonic atomiser is understood to mean a two-fluid nozzle to which both the waste material and the operating medium are supplied. The operating medium is supplied to the ultrasonic atomiser in such a way that in a resonance chamber of the ultrasonic atomiser, ultrasonic waves are preferably induced with frequencies of between 20 kHz and 100 kHz, which waves are directed to a region in front of the ultrasonic atomiser. The waste material passes out of the ultrasonic atomiser in the form of drops and is atomised further in front of said atomiser by the ultrasonic waves. The waste material is combusted by reaction for example with the operating medium. A liquid waste material is understood to mean a waste material which is in the form of a liquid in standard conditions and which cannot be purified further by a purification plant. In particular, the waste material comprises liquids having organic and/or halogenous constituents, having toxic constituents, having alkali salts and the like. The waste material has a calorific value of more than 0 MJ/kg (megajoules per kilogram), preferably more than 0.5 MJ/kg, and less than 30 MJ/kg, in particular less than 10 MJ/kg. Liquid waste materials are understood to mean waste materials of the type which are produced in particular when processing for example agricultural chemicals, pharmaceuticals, plastics materials, dyes, superabsorbents, etc., in particular of the type which cannot be recycled or disposed of in purification plants due to poor biodegradability. This applies in particular to waste materials having difficult-to-crack organic and inorganic compounds, chlorinated solvents, acids, halogenated hydrocarbons or waste containing halogens such as spent oils which are contaminated with PCBs. Toxic constituents are understood to mean substances of the type which, even in small doses, cause damage to humans, animals and/or plants. Waste materials having a low calorific value of between 0 and 25 MJ/kg, preferably of between 0.5 and 5 MJ/kg are understood to mean in particular liquids which cannot be combusted sufficiently efficiently in commercial furnaces. Conventional fuels are understood to mean in particular

fuels such as natural gas and fuel oil. Conventional liquid fuels such as oil are not waste materials within the meaning of this invention.

The combustion is promoted by a main burner to which at least one supporting fuel is supplied. The main burner is used to sustain a flame and/or to maintain a combustion temperature. The main burner can be a conventional burner which is operated using a supporting fuel and optionally using air, oxygenated air or pure oxygen.

It is particularly preferred for the supporting fuel to be a conventional fuel. Supporting fuels are particularly preferably waste materials having a high heating value, such as solvents and alcohols or conventional fuels.

According to an advantageous embodiment of the method, a supporting fuel is added to at least one of the following elements:

a) the main burner and
b) the waste material

when a predefinable limit temperature is exceeded during combustion.

This advantageously makes it possible to add the supporting fuel only when the temperature of the combustion or in the furnace is so low that there is a risk of the flame being extinguished. In this way, it is possible to save on supporting fuel. The addition of the supporting fuel, in particular oil and/or solvent, via the or together with the waste material, with which the supporting fuel can be mixed for example in a tank and/or in the line to the ultrasonic atomiser, advantageously promotes the combustion process and can relieve an optionally present main burner or make it possible to operate said burner with a desired load.

According to another advantageous embodiment of the method, a supporting fuel is added to at least one of the following elements:

a) the main burner and

b) the waste material

and the addition of the supporting fuel is regulated such that during combustion, the temperature is within a predefinable temperature range.

This makes it possible to carry out the method such that only so much supporting fuel is used that the combustion is kept within an optimum temperature range. This temperature range can be predefined for example such that the combustion takes place as effectively or completely as possible or such that the composition of the resulting flue gas and/or of the resulting slag satisfies a predefinable profile for example in relation to the proportions of contaminants.

The supporting fuel is added to at least one of the following elements:

a) the main burner and
b) the waste material

and the addition of the supporting fuel is controlled according to the water content of the liquid waste material.

It has become apparent that the water content of the liquid waste materials to be combusted is often substantially constant and has a strong influence on the amount of supporting fuel required. In this case, it is possible to simply adjust or control the amount of supporting fuel to be added by determining and monitoring the water content of the liquid waste material once or at regular intervals or constantly and by using said water content as a control parameter. In this way, the consumption of supporting fuel can advantageously be reduced.

According to another advantageous embodiment of the method according to the invention, an amount of operating medium which is greater than the amount required for atomisation is suppliedto the ultrasonic atomiser.

Therefore, in particular, at least some of the oxygen required for the combustion of the liquid and optionally of the supporting fuel can be supplied via the ultrasonic atomiser as part of the operating medium.

It is advantageous for the combustion temperature to be between 800 °C and 1600 °C, preferably between 850 °C and 1400 °C. In this case, the combustion temperature is understood to mean the temperature of the flue gas which is discharged.

It is particularly advantageous for the ultrasonic atomiser to be in the form of a Hartmann, Hartmann-Whistle or Helmholtz generator. The liquid to be atomised is supplied to the ultrasonic atomiser preferably in a central pipe and the operating medium is supplied in a pipe which is arranged concentrically therewith. The operating medium is conducted into a resonance chamber, where it generates ultrasonic waves having frequencies of between 20 and 100 kHz, which are directed to the region in front of the ultrasonic atomiser as a result of the suitable geometry thereof. The operating medium passes out through an annular gap and mixes with the liquid being discharged centrally in the form of drops. The liquid in front of the ultrasonic atomiser is atomised further as a result of the ultrasonic waves.

In other embodiments, the waste material being discharged centrally is firstly deflected by 90° and guided axially forwards out of the ultrasonic atomiser by the flow of operating medium.

The operating medium can also be guided centrally and deflected into the resonance chamber by a deflection plate, from which chamber the operating medium also leaves the ultrasonic atomiser. The waste material is guided in an outer pipe and passes out of the ultrasonic atomiser through an annular gap.

It is particularly advantageous for waste material and operating medium to be mixed downstream outside the ultrasonic atomiser. This prevents the operating medium and the waste material from reacting exothermically with each other in

the ultrasonic atomiser. The outwardly guided flame formed in this way does not place an overly great thermal strain on the ultrasonic atomiser.

It is particularly advantageous for the operating medium to be supplied to a resonance chamber of the ultrasonic atomiser at a velocity v_z, wherein the velocity v_z forms a quotient v_z/v_c with the acoustic velocity of the operating medium V_c which is between 0.9 and 1.1, preferably between 0.95 and 1.05, more preferably between 0.99 and 1.01. The acoustic velocity of the operating medium under normal conditions is meant, i.e. at a temperature of 20 °C and a pressure of 1.013 hPa. Said acoustic velocity is for example 316 m/sec for pure oxygen. The entry of the operating medium into the resonance chamber of the ultrasonic atomiser at acoustic velocity brings about particularly efficient generation of ultrasonic waves and particularly fine atomisation of the liquid.

In order to carry out the method, a furnace is proposed for combusting liquid waste materials using a combustion chamber and at least one ultrasonic atomiser, wherein the ultrasonic atomiser comprises an operating medium connection for supplying technically pure oxygen as an operating medium and a liquid connection for supplying the liquid waste material. The at least one ultrasonic atomiser is in the form of an outwardly mixing ultrasonic atomiser. The furnace is particularly suitable and designed for carrying out the method according the invention.

It is particularly advantageous for the furnace to comprise a main burner having a main burner axis and the at least one ultrasonic atomiser to have a longitudinal axis in the region in which the operating medium and the waste material are discharged and for the angle between the longitudinal axis and the main burner axis to be between 30° and 60°. The flame sides of the main burner and the ultrasonic atomiser are thus directed such that the flames mutually intersect. This has the advantage that the main burner can be additionally be switched on when a critical temperature is missed or when the flame of the ultrasonic atomiser is extinguished so that the combustion process can be sustained.

It is also advantageous for a plurality of ultrasonic atomisers to be arranged symmetrically on walls of the combustion chamber. In this case, symmetrically means that the ultrasonic atomisers are arranged at an equal distance from one another in a horizontal plane on a periphery of the combustion chamber or are arranged at an equal distance from one another in the vertical direction. A higher throughput of waste material can be achieved by using two ultrasonic atomisers. The ultrasonic atomisers can preferably comprise different resonators.

The details disclosed for the method according to the invention can be transferred and applied to the furnace.

The invention and the technical background will be described below by way of example with reference to the drawings. It should be noted that the drawings show particularly preferred variants of the invention, but are not limited thereto. In the drawings:

Fig. 1 is a longitudinal section of a first embodiment of a furnace;

Fig. 2 is a longitudinal section of a second embodiment of a furnace according to the invention;

Fig. 3 is a longitudinal section of a first embodiment of an ultrasonic atomiser;

Fig. 4 is a longitudinal section of a second embodiment of an ultrasonic atomiser; and

Fig. 5 is a longitudinal section of a third embodiment of an ultrasonic atomiser.

Fig. 1 is a longitudinal section of a first embodiment of a furnace 7 for combusting a liquid waste material. At the upper end of a combustion chamber 8, a main burner 4 comprising both a supporting fuel connection 5 and an oxidiser connection 11 is arranged. Ultrasonic atomisers 1 are arranged on the walls of the combustion chamber 8. The ultrasonic atomisers 1 each comprise a

liquid connection 2 for supplying the liquid waste material and an operating medium connection 3. The main burner 4 has a main burner axis 9 and the ultrasonic atomiser 1 has a longitudinal axis 10 which are arranged such that they intersect at an angle of between 30 and 60°. The ultrasonic atomisers 1 are preferably arranged symmetrically on the walls of the combustion chamber 8. This means that the ultrasonic atomisers 1 are arranged at an equal distance from one another in a vertical plane 20 on the periphery of the combustion chamber 8, and there is an equal angle between the longitudinal axis 10 and the main burner axis 9 in each case. A flue gas outlet 12 is connected in the lower region of the combustion chamber 8. In addition, a slag outlet 13 is present at the lowestpoint of the combustion chamber 8.

During the combustion process, a liquid waste material to be combusted, more particularly a contaminated liquid, is supplied via the liquid connection 2, and an operating medium containing at least 90 vol.% oxygen, preferably technically pure oxygen, is supplied via the operating medium connection 3, to the ultrasonic atomiser 1. This supply is carried out in such a way that the operating medium induces ultrasonic waves in the ultrasonic atomiser 1, which waves are directed into the combustion chamber 8. The liquid and the operating medium pass out of the ultrasonic atomiser 1 into the combustion chamber 8, wherein the waste material is atomised. After being discharged from the ultrasonic atomiser 1, the drops of waste material are atomised further by the ultrasonic waves so as to produce drops having a diameter of from 50 µm to 100 µm. The fine drops of waste material react with the oxygen and the constituents present in the liquid completely oxidise in the process. If the temperature is not sufficient to sustain the combustion process due to the reaction of the oxygen with the atomised liquid, the temperature can additionally be increased or maintained by the main burner 4. A supporting fuel such as natural gas, fuel oil and/or a solvent is then supplied to the combustion chamber 8 via the supporting fuel connection 5. In addition, air, comprising oxygenated air or pure oxygen, can be supplied to the combustion chamber 8 via the oxidiser connection 11.

The flue gases formed during the combustion process can be supplied to a flue gas treatment means via the flue gas outlet 12. Solid or liquid slag can be removed from the combustion chamber 8 via the slag outlet 13.

Fig. 2 is a longitudinal section of a second embodiment of the furnace 7. The reference signs correspond to the previously introduced reference signs and only the differences to the previous embodiment are shown. In the second embodiment, the ultrasonic atomiser 1 is arranged in the main burner 4. The main burner axis 9 and the longitudinal axis 10 of the ultrasonic atomiser 1 thus correspond.

Fig. 3, 4 and 5 are longitudinal sections of various embodiments of an ultrasonic atomiser 1 which can be used to carry out the method according to the invention and which are known as a Hartmann generator, a Hartmann-Whistle generator and a Helmholtz generator.

In the embodiments according to Fig. 3 and 4, the waste material is supplied to the ultrasonic atomiser head 19 via a central, tubular liquid feed pipe 17. The operating medium, technically pure oxygen, is supplied to the ultrasonic atomiser head 19 through an operating medium feed pipe 18 which is arranged concentrically around the liquid feed pipe 17. In the embodiment shown in Fig. 3, the waste material passes directly out of the liquid feed pipe 17 into the combustion chamber 8 and can roughly atomise in the process. The operating medium is supplied into the resonance chamber 6 at high velocity, wherein ultrasonic waves are generated which are directed in front of the ultrasonic atomiser 1 due to the conical widening 15 in the direction in which the waste material and the operating material are discharged. The operating medium passes out of the ultrasonic atomiser 1 into the combustion chamber 1 through an annular gap 14 and mixes with the roughly atomised waste material. As a result of the ultrasonic waves, the atomised drops of liquid are made even smaller such that they have a diameter of between 50 and 100 µm.

In the embodiment according to Fig. 4, the liquid waste material (the liquid) is firstly deflected outwards by 90° by a deflection device 16 and is carried back in

the original discharge direction by the operating medium, which is discharged through the annular gap 14. A more bulbous flame by comparison with the embodiment according to Fig. 3 is thus produced.

In the embodiment according to Fig. 5, the operating medium is guided in an inwardly arranged operating medium feed pipe 18, and the waste material is guided in an outer liquid feed pipe 17. In addition, in this embodiment, after being discharged from the central operating medium feed pipe 18, the operating medium is deflected by the deflection device 16 into the resonance chamber 6, where it induces ultrasonic waves which are directed towards the combustion chamber 8 due to the conical widening 15. The operating medium is discharged with velocity components radially to the longitudinal axis 10 of the ultrasonic atomiser 1. The waste material being discharged through the annular gap 14 is carried along by the operating medium,which is being discharged, and roughly atomised. The waste material is then atomised more finely in the ultrasonic field of the ultrasonic atomiser 1.

The advantages of the invention will be shown with reference to two comparative examples.

In comparative example 1, different process waste waters and liquid organic residues having a high heating value are combusted as a waste material from acrylic acid and butyl acrylate production in a waste water combustion installation according to the prior art using compressed air as the atomiser medium. The waste water combustion installation comprises a steam-cooled vertical combustion chamber having a square cross section of approximately 4 m^2 and a height of 10 m. The main burner is arranged in the centre of the furnace roof. Since the combustion does not take place autothermally, approximately 1200 kg/h of organic residues having an average heating value of approximately 28100 kJ/kg, approximately 170 m^3/h of natural gas and approximately 13300 m^3/h of primary and secondary air are combusted by the main burner as supporting fuels for combusting two amounts of waste water, one basic and one acid. The basic and acid waste waters to be combusted are guided into the combustion chamber separately from each other in each case

via two conventional atomiser nozzles. The atomiser nozzles are installed under the main burner in the combustion chamber wall symmetrically to one another and at an angle of inclination of approximately 30° to the burner axis.

In the case of a maximum possible amount of waste water of approximately 1203 kg/h, the flue gas purification is working to its full hydraulic capacity. In the combustion reaction, approximately 20100 kg/h of flue gas is thus produced at a temperature of 907 °C. The flue gas contains approximately 5.5 vol.% oxygen, 66.6 vol.% nitrogen, 9.7 vol.% carbon dioxide, 19.0 vol.% water vapour, 18 mg/m^3 carbon monoxide and approximately 108 mg/m^3 nitrous gases. After dwelling in the combustion vessel for approximately 2.7 seconds, the combustion gases are quenched by immersion in water and are supplied to a flue gas purification plant. The limiting factor of this combustion installation is the dwelling time of the flue gas at a temperature of 907 °C and thus the mass flow of flue gas.

In order to increase the throughput of acid and basic waste water in this combustion installation, all four conventional atomiser nozzles are replaced with ultrasonic atomisers, wherein according to the invention, pure oxygen, or also oxygenated compressed air or purecompressed air is used as an operating medium.

By means of this modification to the combustion installation, it waspossible to operate the combustion installation continuously and without an increase in power. Ultrasonic atomisers according to Fig. 4 wereused as the ultrasonic atomisers and a bulbous liquid mist wasproduced. The waste water wasintroduced centrally into the ultrasonic atomiser. The amount of waste water wasincreased to a total of 2,280 kg/h of basic and acid waste waters. In order to keep the amount of reaction gas constant, the amount of combustion air wasreduced to 12200 m^3/h and approximately 600 m^3/h of pure oxygen, both as an atomiser medium and an additional oxidiser, wasadded via the four ultrasonic atomisers. In order to merely atomise the amount of waste water, approximately 360 m^3/h of oxygen alone would be sufficient. The excess amount of oxygen is thus additionally used to boost the combustion power.

By adjusting the amount of natural gas to approximately 85 m^3/h and the organic residues to approximately 1,730 kg/h, a combustion temperature of 911 °C wasgenerated in the vessel. The flue gas wascomposed of approximately 5.4 vol.% oxygen, 58.1 vol.% nitrogen, 12.3 vol.% carbon dioxide, 24.1 vol.% water vapour, 5 mg/m^3 carbon monoxide and approximately 112 mg/m^3 nitrous gases.

With the samedwelling time of approximately 2.7 seconds and the same amount of reaction gas, the combustion capacity of said combustion installation is thus increased by approximately 44 % and the rated thermal input is increased from 9.4 MW to 11.3 MW.

In comparative example 2, in a waste water combustion installation according to the prior art, two different waste waters from pharmaceutical and fine chemical pre-production are disposed of by thermal techniques. Solvents having an average heating value of approximately 21,700 kJ/kg, fueloil S and approximately 11,200 m^3/h of primary and secondary air weresupplied to the combustion chamber through a main burner as additional fuel. The combustion chamber has a rectangularcross section of approximately 6.7 m^2 and a height of approximately 7 m. Approximately 400 kg/h of solvents and approximately 25 kg/h of fueloil S wereadded as supporting fuel. A conventional outwardly mixing compressed air atomiser nozzle wasinstalled in the centre of the burner as the atomiser nozzle.

The solvent and the fueloil S wereinjected into the flame through 5 fuel nozzles in each case which were arranged concentrically around the waste water atomiser nozzle. Whennecessary, the flue gases were heated to a flue gas temperature of at least 850 °C by a fueloil burner. At the bottom of the combustion chamber, liquid salt slag wasremoved through an opening. With the present combustion installation, at most approximately 2,000 kg/h of waste water could be combusted with an average heating value of approximately 2,830 kJ/kg, wherein approximately 17,500 kg/h flue gas wasproduced at a temperature of approximately 920 °C. The flue gas is composed of approximately 4.9 vol.% oxygen, 64.0 vol.% nitrogen, 9.0 vol.% carbon dioxide,

21.8 vol.% water vapour, 12 mg/m^3 carbon monoxide and approximately 579 mg/m^3 nitric oxide. The flue gas wascooled in a waste heat boiler and subsequently purified by a Venturi and radial scrubber and an electrostatic precipitator.

In order to increase the throughput of waste water at a constant volume of flue gas and the same temperature of the flue gas, the present compressed air atomiser wasreplaced with an ultrasonic atomiser for adding oxygen as an operating medium to the waste water as a waste material. In the case of a throughput of oxygen of approximately 760 m^3/h, the amount of additional oxygen required for the combustion wasblown into the combustion chamber at the same time via the ultrasonic atomiser, wherein the amount of primary and secondary air wasreduced to approximately 9,400 m^3/h. According to the stipulated flue gas temperature of approximately 920 °C, the amount of solvent wasadjusted to approximately 627 kg/h. The flue gas wascomposed of approximately 4.7 vol.% oxygen, 51.6 vol.% nitrogen, 11.0 vol.% carbon dioxide, 32.4 vol.% water vapour and 22 mg/m^3 carbon monoxide. The concentration of nitric oxide wasreduced to approximately 184 mg/m^3.

When the dwelling time of approximately 2.0 seconds is otherwise the same and the amount of flue gas is the same, the waste water combustion capacity of the combustion installation was able tobe increased by approximately 62 %. The rated thermal input increased from 8.8 MW to 10.7 MW.

The method according to the invention makes it possible to combust a liquid waste material (a contaminated liquid) particularly effectively. A combustion process is provided with drops of the liquid to be combusted which have a smaller diameter and at the same time oxygen as an oxidising agent without increasing the temperature of the combustion process, the volume of flue gas or the emission of oxides beyond the limits of the operating conditions.

List of reference numerals

1	ultrasonic atomiser
2	liquid connection
3	operating medium connection
4	main burner
5	supporting fuel connection
6	resonance chamber
7	furnace
8	combustion chamber
9	main burner axis
10	longitudinal axis
11	oxidiser connection
12	flue gas outlet
13	slag outlet
14	annular gap
15	conical widening
16	deflection device
17	liquid feed pipe
18	operating medium feed pipe
19	ultrasonic atomiser head
20	vertical plane

713353/DO

SBGK
Szabadalmi
Ügyvivői Iroda

SZABADALMI IGÉNYPONTOK

1. Eljárás folyékony maradékanyag elégetésére, amelyben egy legalább 90 térfogatszázalék oxigéntartalmú munkaközeget és az égetés maradékanyagát legalább egy ultrahang porlasztón (1) keresztül vezetjük be, amely munkaközeggel ultrahanghullámokat keltünk, és a maradékanyagot finomra porítjuk, az égetést egy főégetővel (4) mozdítjuk elő, amelyhez legalább egy égésfenntartó tüzelőanyagot vezetünk, amely égésfenntartó tüzelőanyagot hozzáadjuk a következő elemek legalább egyikéhez:

a) a főégető (4) és

b) a maradékanyag,

és az égésfenntartó tüzelőanyag hozzáadását a folyékony maradékanyag víztartalmának függvényében szabályozzuk.

2. Az 1. igénypont szerinti eljárás, amelyben az égésfenntartó tüzelőanyagot hozzáadjuk a következő elemek legalább egyikéhez:

a) a főégető és

b) a maradékanyag,

ha az égetéskor nem érünk el egy előre megadható határ-hőmérsékletet.

3. Az 1. vagy a 2. igénypont szerinti eljárás, amelyben az égésfenntartó tüzelőanyagot hozzáadjuk a következő elemek legalább egyikéhez:

a) a főégető és

b) a maradékanyag,

és az égésfenntartó tüzelőanyag hozzáadását úgy szabályozzuk, hogy az égetéskor a hőmérséklet egy előre megadható hőmérsékletet-tartományban van.

4. Az előző igénypontok egyike szerinti eljárás, amelyben az égésfenntartó tüzelőanyag egy hagyományos tüzelőanyagot foglal magában.

5. Az előző igénypontok egyike szerinti eljárás, amelyben az ultrahang porlasztóhoz (1) a munkaközegből akkora mennyiséget vezetünk, amely nagyobb, mint a porlasztáshoz szükséges mennyiség.

6. Az előző igénypontok egyike szerinti eljárás, amelyben az égetési hőmérséklet 800°C és 1400 °C között van.

7. Az előző igénypontok egyike szerinti eljárás, amelyben az ultrahang porlasztón (1) kívül elvégezzük a maradékanyag és a munkaközeg elkeverését.

8. Az előző igénypontok egyike szerinti eljárás, amelyben a munkaközeget v_z sebességgel vezetjük az ultrahang porlasztó (1) rezonancia-kamrájához (6), amely v_z sebesség a munkaközeg v_c hangsebességeivel akkora v_z/v_c hányadost képez, amely 0,9 és 1,1 között van.

(A meghatalmazott)

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SBGK Szabadalmi Ügyvivő Iroda
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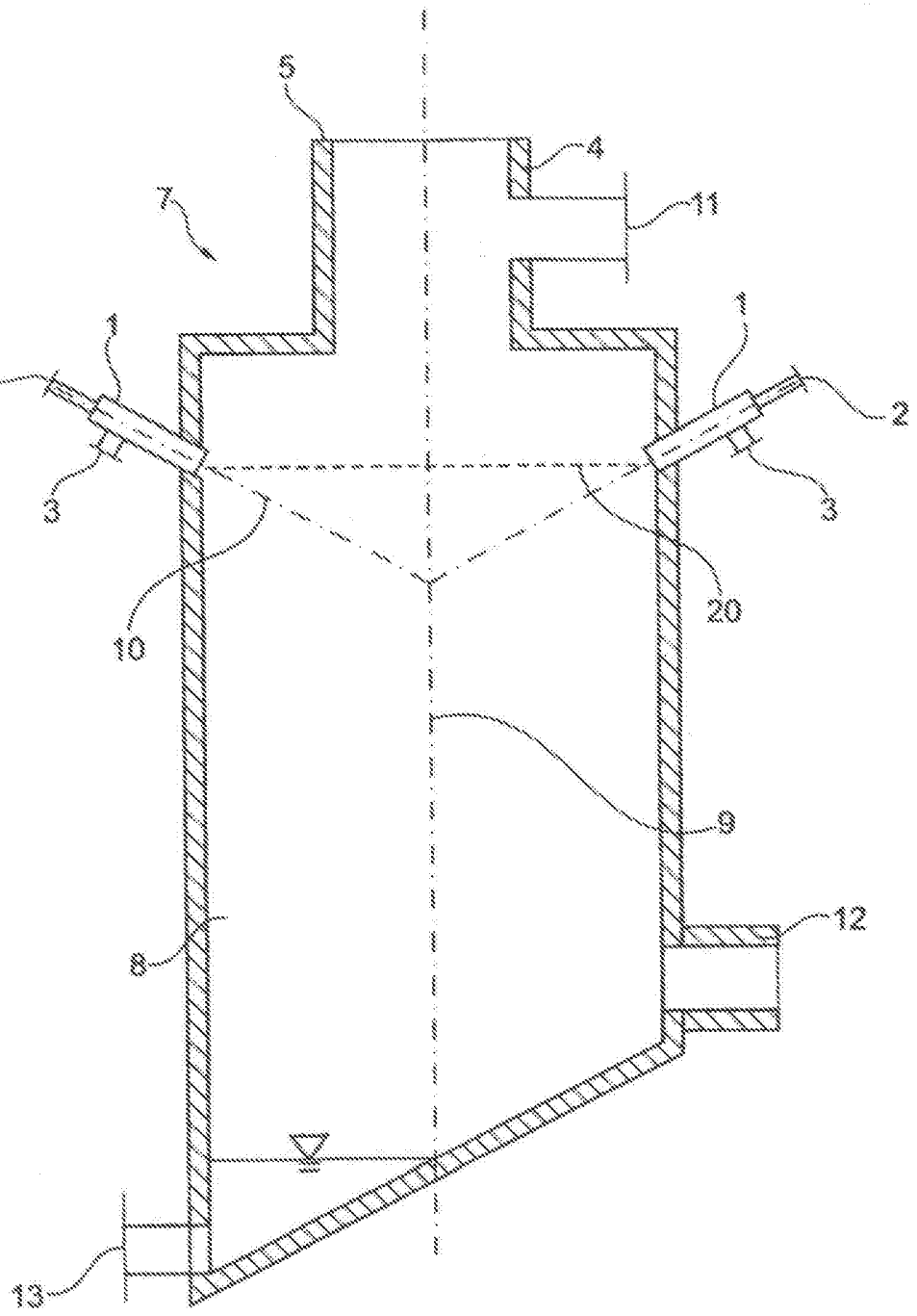


Fig. 1

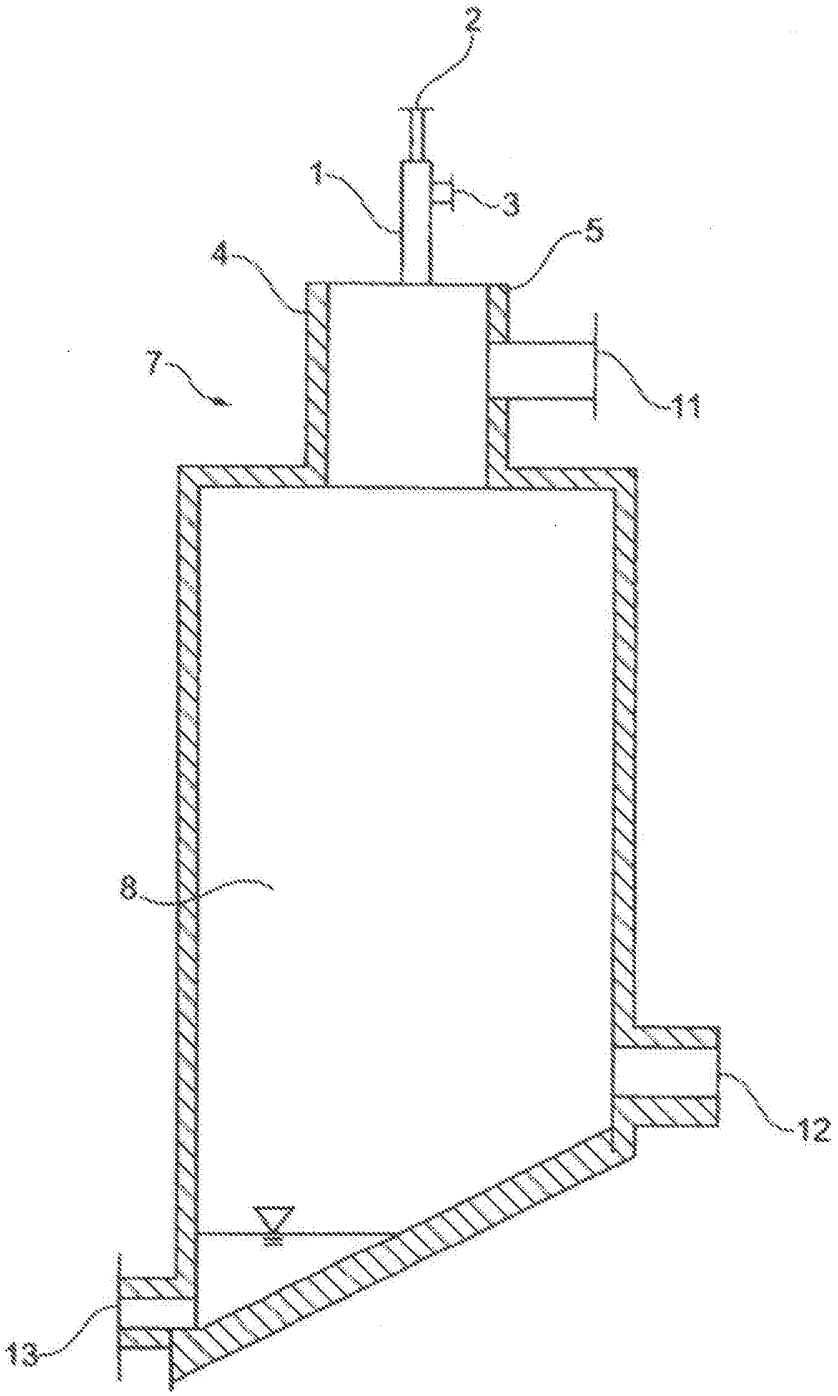


Fig. 2

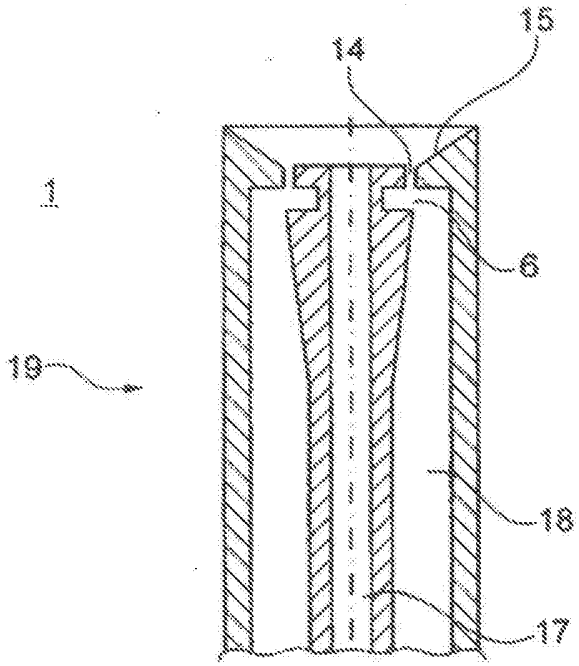


Fig. 3

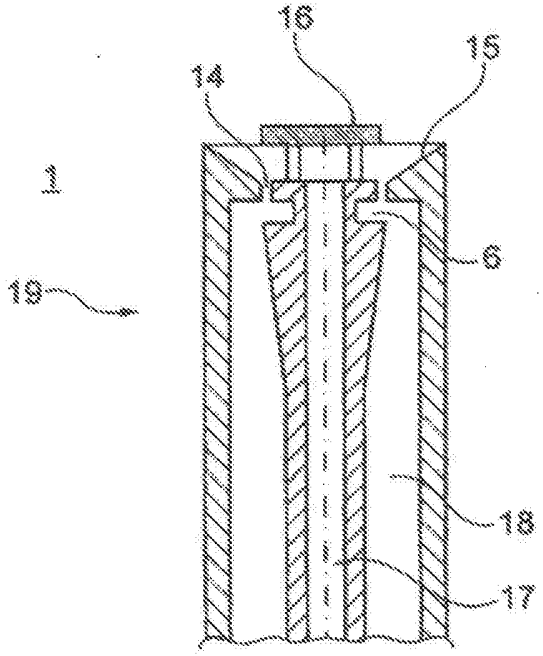


Fig. 4

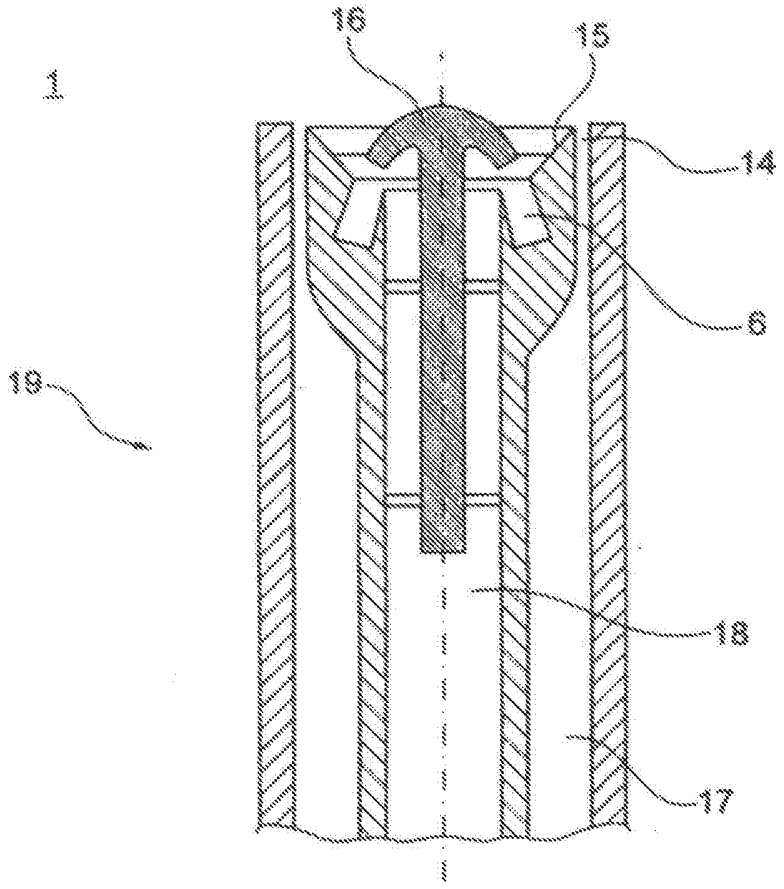


Fig. 5