



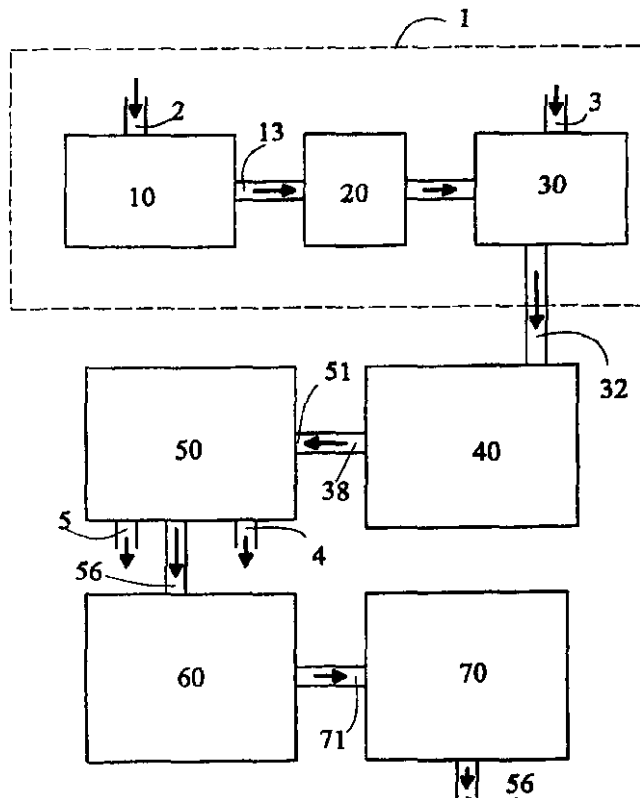
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(54) Title: METHOD AND APPARATUS FOR THE PREVENTION OF GLOBAL WARMING, THROUGH ELIMINATION OF HAZARDOUS EXHAUST GASES OF WASTE AND/OR FUEL BURNERS

(57) Abstract

The invention concerns a method for the prevention of global warming through elimination of hazardous exhaust gases of waste incinerators and/or fuel burners. The method involves the following steps: a) introducing fuel and/or combustible waste from a burner into a complete combustion reactor (30) with a first and second reactor chamber and igniting the fuel and/or combustible waste, b) introducing fuel and/or waste into an incinerator apparatus (10), c) evaporating/gasifying at least a portion of the fuel and/or waste in the incinerator apparatus (10), d) accelerating the vapours and/or gases generated from the fuel and/or waste and introducing the vapours and/or gases into the first and/or second reactor chamber of the complete combustion reactor (30), e) atomizing the vapours and/or gases in the first and/or second reactor chamber of the complete combustion reactor (30), f) guiding the exiting flue gases from the complete combustion reactor (30) into a flue gas condenser (50), and condensing the solid and condensable particles from the flue gas, and finally g) completely recycling the cleaned exhaust gas, particularly the CO₂ content of the exhaust gas, preferably as fertiliser. The invention further relates to an apparatus for performing the method of the invention.



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METHOD AND APPARATUS FOR THE PREVENTION OF GLOBAL
WARMING, THROUGH ELIMINATION OF HAZARDOUS EXHAUST GASES
OF WASTE AND/OR FUEL BURNERS

5 **Technical Field**

The present invention relates to a method and apparatus for the prevention of global warming, through elimination of hazardous exhaust gases of waste and/or fuel burners. The apparatus of the invention utilises a so-called complete combustion reactor for reducing the contents of nitrogen oxides and sulphur oxides in
10 combustion gases. This reactor comprises a post-combustion second reactor chamber to be connected together with or after a first reactor chamber.

Background Art

15 A major problem in the combustion of liquid and solid fuels is the content of sulphur oxides and nitrogen oxides present in the flue gas. Thus many attempts have been made to reduce this oxide content, both by flue gas cleaning and by catalytic treatment of the exhaust gases. The efforts resulted in strong reduction of the noxious components in the exhaust gases, but the amount of CO₂ in the flue gas did
20 not decrease. CO₂ emission is one of the main causes of the greenhouse effect contributing to the world-wide threat of global warming, therefor it is of utmost importance to reduce or eliminate the emitted CO₂ in combustion processes.

Swedish Patent 7804761-0 (SE-B-413,158) discloses an apparatus for the
25 combustion of a mixture of gaseous or particulate, combustible material and combustion air. This apparatus is used for combusting various gaseous or particulate materials containing carbon or carbon compounds, in such a complete manner that the combustion gases emitted are practically free from soot, carbon monoxide and hydrocarbon residues. It is, however, not disclosed in the patent specification how
30 the CO₂ emission of the apparatus may be reduced, together with a reduction of the contents of nitrogen oxides and sulphur oxides in combustion gases.

DE-A-3,014,590 discloses a pre-combustion chamber for an oil- or gas-fired, fan-supported burner. This pre-combustion chamber serves to shape the generated flame and to retard it before entering the combustion chamber. This apparatus thus serves
5 as an intermediary between the burner and the combustion chamber. There is no teaching for using the reactor for the evaporation or gasification of waste, or concerning the reduction of the CO₂ output.

US-P-5,041,268 discloses a complete combustion reactor and a method to burn
10 waste with a system using two complete combustion reactors. The disclosed apparatus is suitable for a clean burning of the waste, but the CO₂ emission problem is still not solved. In particular, it is not disclosed how the non-gaseous components of the exhaust gases may be efficiently removed from the flue gases.

15 The object of the invention is to reduce or eliminate the flue gas exhausts of combustion processes, in a manner which maintains the high efficiency of the combustion process, but makes it possible to reduce the output CO₂ or other gas components contributing to the global warming phenomenon. At the same time it is an object of the invention to improve the efficiency and the overall cleanness of the
20 process where possible, and to provide a method and apparatus where the complete cleaning or recycling of the combustion residues is possible.

Summary of the Invention

According to the invention, these objects are achieved by a method comprising the
25 following steps:

a, introducing fuel and/or combustible waste from a burner into a cylindrical, thin walled complete combustion reactor with a first and second reactor chamber and igniting the fuel and/or combustible waste,

b, introducing fuel and/or waste into an incinerator apparatus,

30 c, evaporating/gasifying at least a portion of the fuel and/or waste in the incinerator apparatus,

d, accelerating the vapours and/or gases generated from the fuel/and or waste and introducing the vapours and/or gases into the first and/or second reactor chamber of the complete combustion reactor,

e, atomizing the vapours and/or gases in the first and/or second reactor chamber of the complete combustion reactor,

f, guiding the exiting flue gases from the complete combustion reactor into a flue gas condenser, and condensing the solid and condensable particles from the flue gas, and finally

g, completely recycling the cleaned exhaust gas, particularly the CO₂ content of the exhaust gas, preferably as fertiliser.

In the following patent specification the term „complete combustion reactor” is used for denoting a special form of a combustion reactor having a cone-formed partition, which separates the cylindrical reactor chamber into a first reactor chamber or combustion chamber, and a second reactor chamber or post-combustion chamber. Such a reactor is described among others in the US patents No. 3,460,916, No. 4,262,609 and No. 5,041,268.

Preferably a fluidised bed, roaster, kiln, oven, waste incinerator or waste burning plant is used as incinerator apparatus. In a particularly useful application, less than 12%, preferably less than 10% water is additionally introduced into the first and/or second reactor chamber of the complete combustion reactor. The water may be added artificially, to keep a certain reaction balance, but may also be naturally included in the waste to be burned. This is the case with the burning of contaminated slam, or spilled oil from sea shores or collected directly from the water.

For an improved cleaning of the flue gas, it is foreseen that

a, the flue gases exiting the complete combustion reactor are introduced into a second complete combustion reactor, and

b, the flue gases exiting from the first complete combustion reactor are combusted as fuel in the second complete combustion reactor in a complete combustion process.

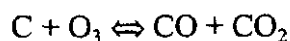
- 5 In an advantageous embodiment the complete combustion reactor is positioned within a tank containing fuel and/or waste, and the fuel and/or waste in the tank is evaporated/gasified by the heat generated by the complete combustion reactor. In order to improve the uniform evaporation or gasification, it is preferred that the fuel and/or particularly the waste is being moved and/or mixed and/or stirred during
10 the evaporation/gasification.

In certain cases thermoelectric semiconductors are placed on the outer periphery of the first and/or second complete combustion reactor, and electric energy is produced by the thermoelectric semiconductors.

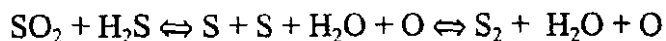
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Advantageously, the recycling of the cleaned exhaust gas, preferably CO₂, is made by bubbling up in water for alga, rice or biomass production, or by compressing in steel tubes.

- 20 Under certain circumstances, the complete combustion process in the complete combustion reactor is based on the following formulae:



25



- In a possible variation of the method of the invention the remaining gaseous components of the flue gas following the combustion in the first or second complete combustion reactor are passing through a cleaning unit. The cleaning unit may be a
30 third complete combustion reactor, where the remaining gaseous components are combusted completely.

The invention also concerns an apparatus for incinerating and/or combusting fuel and/or waste, particularly for performing the method according to the invention to prevent global warming. The inventive apparatus comprises the following:

- 5 a, a closed waste and/or fuel incinerator apparatus with a gas collector region,
- b, a first complete combustion reactor having a first reactor chamber and a second reactor chamber,
- c, gas accelerator means connecting the gas collector region of the incinerator apparatus with the first and/or second reactor chamber of the complete combustion
- 10 reactor,
- d, flue gas condenser means connected to the exhaust opening of the complete combustion reactor,
- e, flue gas cleaner means connected to the exhaust opening of the complete combustion reactor,
- 15 f, flue gas recycling means connected to the output of the flue gas cleaner means.

In a preferred embodiment the apparatus comprises a second complete combustion reactor, and second connecting means connecting the exit opening of the complete combustion reactor with the inlet of the second complete combustion reactor.

20

Preferably, the first and/or second complete combustion reactor is positioned in a tank containing fuel and/or waste. It is especially useful if the tank is cylindrical in the horizontal cross-section, and the first complete combustion reactor is placed vertically in the tank, its vertical central axis being concentric or eccentric in

25

In a particularly advantageous embodiment, the apparatus comprises thermoelectric semiconductors positioned on the outer periphery of the first and/or second complete combustion chamber.

30

Preferably the exhaust condenser is comprising two cones with a common vertical central axis, with their tip pointing towards each other, and a lime absorbing filter placed under the cones in the path of the solid and/or fuel condensate.

- 5 Optionally, the apparatus may comprise a gas cleaning unit after the output of the first or second complete combustion reactor or the exhaust condenser. In a preferred embodiment the cleaning unit comprises a third complete combustion reactor, where all residual non-oxidised compounds are oxidised or reduced to pure or inert form.

10 **Brief Description of Drawings**

The invention will now be described in more detail hereinbelow with reference to the accompanying drawings, which, by way of example only, illustrate a preferred embodiment of the method and apparatus according to the invention.

In the drawings

- 15 FIG. 1 is a schematic chart showing the steps of the method of the invention, and at the same time the structure of the apparatus according to the invention,
FIG. 2 is a cross-section of the incinerator apparatus used in the invention,
FIG. 3 is a cross-section schematically showing the structure of the complete combustion reactors used in the invention,
20 FIG. 4 is a cross-section schematically showing the structure of the gas condenser means used in the invention,
FIG. 5 is a cross-section schematically showing the structure and the working principle of the gas recycling means used in the invention.

25 **Best Mode for Carrying out the Invention**

Fig. illustrates the sequence of the steps taken in the method according to the invention, and at the same time shows the structural elements of the apparatus of the invention.

- 30 As a first step, fuel and/or waste is introduced in a first complete

combustion reactor, and the fuel and/or combustible waste is ignited and burned. The structure and the working of the complete combustion reactor will be explained with reference to Fig. 3. Thereafter, or parallel with the first step, fuel and/or waste is introduced into an incinerator apparatus 10. In this preferred embodiment, the incinerator apparatus 10, the first complete combustion reactor 30 and the gas accelerator means 20 are all part of an incinerator plant 1, which will be described in Fig 2.

At least a portion of the fuel and/or waste is evaporated and/or gasified in the incinerator tank 10, and through the gas outlet 13 the gases or vapours generated from the fuel/and or waste are accelerated in the gas accelerator means 20, from where the vapours and/or gases are introduced into the first and/or second reactor chamber of the complete combustion reactor 30. Here, the molecules of the vapours and/or gases are at least partly atomised, i. e. split up by chemical and physical processes into constituting atoms or smaller molecules.

Via the flue gas outlet 32 and the flue gas inlet 51, the flue gas from the complete combustion process in the complete combustion reactor 30 is guided into the gas condenser means 50, where

the solid and condensable particles from the flue gas are condensed and extracted from the flue gas, and removed from the process through the condensate outlet 4.

Any residual condensed water and remaining fluids are removed through the water outlet 5. The structure of the gas condenser means is shown in Fig. 4. The method of the invention finally completely recycles the cleaned exhaust gas, particularly the CO₂ content of the exhaust gas in the gas recycling means 70. The cleaned exhaust gases are entering the gas recycling means 70 through the gas inlet 71, and the remaining inert gases, mainly nitrogen, are leaving the process through gas outlet 6. The principle of an embodiment of the gas recycling means is shown in Fig. 5.

Optionally, the method of the invention and the apparatus may include the second complete combustion reactor 40 and/or the exhaust gas cleaner means 60. The complete combustion reactor 40 is placed between the flue gas outlet 32 of the first complete combustion reactor 30 and the inlet 51 of the gas condenser means 50. The function of the complete combustion reactor 40 is to further atomise or burn the

contents of the flue gas leaving the first complete combustion reactor 30. Depending on the type of fuel and waste burned in the apparatus, the second complete combustion reactor 40 may be left out completely.

5 The gas cleaner means 60 is after or before the gas condenser means 50, but before gas recycling means 70. The gas cleaner means 60 may be constructed as a known catalytic cleaner, but in the preferred embodiment it is third complete combustion reactor, somewhat smaller than the previous complete combustion reactors. The function of the gas cleaner means 60 is to remove or break up the non-burning or
10 inert gaseous components of the flue gas exiting from complete combustion reactor 30 or complete combustion reactor 40. For most materials the burning process in the complete combustion reactor 30 ensures a complete combustion, so the exiting flue gases after the gas condenser means 50 contain only CO₂ beside clean N₂. Therefore, in most cases the gas cleaner means 60 may be left out as well.

15 Fig. 2 shows an incinerator plant 1, where the first steps of the method of the invention are performed. In this embodiment, the incinerator plant 1 includes the incinerator apparatus 10, the accelerator 20 and the first complete combustion reactor 30 shown in Fig. 1. The incinerator plant 1 has an incinerator tank 11, preferably with a circular horizontal cross-section, and a closed volume 14.
20 Somewhat eccentrically placed in the volume is a vertical complete combustion reactor 30, i. e. the axis 39 of the complete combustion reactor 30 does not coincide with the axis of the tank 11. The upper region of the tank is designated as the gas collector region 17. The complete combustion reactor 30 comprises first and second
25 reactor chambers 34 and 35, and the fuel and/or combustible waste is blown into the first reactor chamber 34 by burner 31. The exhaust gases from the complete combustion reactor 30 leave through flue gas outlet 32. The functioning of the complete combustion reactor 30 is explained with reference to Fig. 3.

30 Returning to the incinerator plant 1, it is understood that the incinerator apparatus of the invention is here embodied by the tank 11, where the waste and/or fuel is

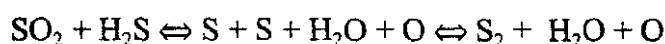
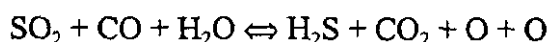
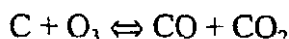
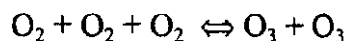
incinerated by the heat generated by the complete combustion reactor 30. It must be noted that other types of incinerators are also applicable. In certain other, not illustrated embodiments a fluidised bed, roaster, kiln, oven, waste incinerator or waste burning plant may be used as well as the incinerator apparatus 10. In these latter embodiments the flue gases of the incinerator apparatus are collected and fed through an accelerator 20 into the complete combustion reactor 30. As will be explained below, the natural turbulence of a complete combustion reactor will in most cases act as an accelerator 20, but other known means to accelerate the flue gases of the incinerator apparatus are also foreseen.

The upper part of the volume 14 is formed as a gas collector region 17, being connected with the tube 13 to the second reactor chamber 35 of the complete combustion reactor 30. The tank 11 also comprises stirring and/or mixing means 12, which may be rotated to mix the fuel/and or waste in the tank 11. The fuel and/or waste is introduced into the tank 11 through input 16. The shown embodiment is especially suitable for the burning of discarded rubber tyres and similar waste having a high polluting potential. The waste in the closed volume 14 of the tank 11 is evaporated by the heat generated by the first complete combustion reactor 30. The gases and vapours which develop during the evaporation are collected in the gas collector region 17, and led through the gas outlet 13 into the second reactor chamber 35 of the complete combustion reactor 30.

The gas and the vapours are accelerated by the reactor processes in the second reactor chamber 35 of the complete combustion reactor 30, i. e. in this embodiment the accelerator 20 is second reactor chamber 35 of the complete combustion reactor 30. Other means for accelerating the exhaust gas are suitable as well, e. g. an air pump and appropriately formed nozzles in the tube which constitutes the flue gas outlet 32.

The residuals and ashes of the evaporation process are removed via outputs 15 into ash room 18. For safety, the ash room 18 is provided with a chimney 19, which is normally closed down.

The evaporated waste emanating from the tank 11 are burned up completely or almost completely in the complete combustion process within the complete combustion reactor 30. Such a complete combustion process is described in detail in US patent No. 5,041,268. In addition to the known formula disclosed in this process,
 5 it has been found that under appropriate conditions the following formula for the combustion of sulphuric substances are also applicable:



Especially noteworthy is the formation of ozone, which is explained by the multiple reflections of the infrared radiation on the inner walls of the reactor chambers.

If the waste to be burned includes relatively large amounts of chlor, it is advisable to
 15 keep the process under low-oxidation or under-stoichiometric conditions, in order to avoid the oxidation of the chlor into dioxines.

In the specific embodiment shown, the efficiency of the incinerator plant 1 is further increased by the application of thermoelectric semiconductors 21. These are so-called Peltier-elements, which produce electric current if the two sides thereof have
 20 different temperature. In Fig. 2, only a few such elements are depicted, but theoretically the whole external surface of the shell 33 may be covered with such thermoelectric semiconductors 21. In practice, the temperature difference on the two sides of the semiconductors 21 may be as much as 300 C°, and approximately 20-
 25 15% of the thermal energy dissipated through the shell 33 may be directly converted into electrical energy in this manner. The generated electricity may be used readily to drive the mechanical parts of the incinerator plant 1, e. g. the injector of the burner 31 or the stirring means 12. Of course, the semiconductors 21 may be applied on the outer surface of the shell 43 of the complete combustion reactor 40 as well,
 30 or on the corresponding outer shell of the complete combustion reactor embodying the gas cleaner unit 60.

Depending on the type of the waste of fuel burned in the incinerator plant 1, it may be necessary to perform an afterburning of the flue gas exiting from the first complete combustion reactor 30. This afterburning is made in the complete combustion reactor 40.

5

The arrangement shown in FIG. 3 shows the structure of the complete combustion reactor 40, which is a reactor for reducing the contents of nitrogen oxides and sulphur oxides in combustion gases. The complete combustion reactor 30 and the complete combustion reactor used as the gas cleaner unit 60 have an identical
10 structure, but the dimensions and minor technical details may be different. The reactor 40 has a casing or wall 42, and a generally cylindrical shell 43 and a dome-shaped outlet end 47 associated therewith. The dome-shaped outlet end 47 has a central outlet opening 44, which is covered by the outlet cover 45, leaving a gap for the gases exiting through the outlet opening 44. At one end of the shell 43 is an inlet
15 end, where the burner 31 is located. Inside the casing 42, there is provided a conical partition 41 which has its apex directed towards the outlet end 47. The shape of the reactor casing 42, the outlet end 47, and the placement of the conical partition 41 are of central importance for the functioning of the complete combustion reactor 40. At the outlet end 47 of the reactor, there is provided an inlet funnel 46 which leads the
20 exhaust gases from a combustion chamber (e. g. from the gas collector region 17) into the second reactor chamber 35, so that the exhaust gases will be introduced at a suitably high velocity. The fuel entering the reactor from the fuel inlet 48 through the burner 31 is directed towards the conical inner side of the partition 41. Around the casing 42, there is provided a further casing or shell 43. The gap 39 between the
25 casing 42 and the shell 43 is connected at the bottom to an outlet pipe 38. In a typical embodiment, the casing 42 and the outlet cover 45 are made of high-grade ceramics, while the shell 43 is made of steel. Under operation, the shell 43 and the outlet cover 45 are heated by the intense infrared radiation of the casing 42, and the heat is radiated further by the shell 43. E. g. in the incinerator plant shown in Fig. 2, the evaporation and/or gasification of the waste in the tank 11 are done by the heat
30 produced in the complete combustion reactor 30, and radiated by the shell 33.

When using the complete combustion reactor according to FIG. 3, it is advantageous to have the exhaust gases from inlet funnel 46 arrive in the second reactor chamber 35 at a high velocity. In the second reactor chamber 35 the gas velocity is increased, and in the resulting oxidation process the residual carbon monoxide and other noxious gases will oxidise into carbon dioxide or become atomised, and this oxidation and atomisation will develop in the first and second reactor chambers. From the outlet opening 44, the flue gases enter into the gap 39 between the casings 42 and 43 where afterburning and treatment of sulphur oxides and nitrogen oxides are performed.

The principle of the working of the complete combustion reactor is described in detail in e. g. US patent No. 5,041,268. Here we mention only that the complete combustion reactor creates ideal turbulence for final oxidation of all hydrocarbon materials, with a controlled low partial pressure in the gas phase to achieve a sufficient contact time with hot catalytic surfaces in the first and second reactor chambers. The hot contact surfaces initially consist of the material in the partition 41. Behind this concave partition, in the second reactor chamber 35, there is thus a slower turbulence in a reducing atmosphere in order to obtain the necessary production of carbon monoxide for the process, e.g. for reducing the sulphur content in the combustion gases. In stoichiometric combustion, sulphur deposits by more than 90% as sulphur droplets which have been sublimated during the cooling. This sulphur content is condensed from the flue gas in the gas condenser unit 50. As mentioned before, the structure of the complete combustion reactor 30 is almost identical to the complete combustion reactor 40 explained with reference to Fig. 3. It must be noted that the complete combustion reactor 30 is larger, i. e. it is longer and wider than the complete combustion reactor 40. Due to its large size, the complete combustion reactor 30 may be constructed of several segments, as shown in Fig. 2.

The flue gas exiting the complete combustion reactor 30 or the complete combustion reactor 40 is led into the gas condenser 50, in order to separate the fluid and solid particles from the flue gas, so that only gaseous substances go on to the last stage of the recycling process in the recycling unit 70.

- 5 A possible embodiment of the gas condenser 50 is shown in Fig. 4. Here the main part of the condenser is the two hollow cones 58, which are placed on top of each other with a common vertical central axis, and their tips 59 are pointing towards each other. The flue gas enters the condenser via the flue gas input 51, and pumped through the cones with high velocity by the motor 52 and fan 53. The solid and
10 fluid particles in the gas are collected in a lime stone block 54, placed under the cones in the way of the gas stream.

The gas, which has been lightly compressed by the pressure, will expand in the expansion chamber 55, where the condensed water is separated via the water outlet 57.

- 15 The gaseous fraction of the flue gas exits through the flue gas outlet 56, and is led into the gas recycling unit 70, or optionally first through a gas cleaning unit 60. The gas cleaning unit may be a third complete combustion reactor, the principle of which is explained with reference to Fig. 3. Optionally, an other known filter-type of catalytic cleaner unit may be used as well. It must be emphasised, however, that
20 in most cases the two first complete combustion reactors 30 and 40 burns the evaporated fuel or waste completely, and there is no need for an additional cleaning unit.

- Fig 5. illustrates the principle of a preferred embodiment of the gas recycling unit
25 70. The unit is constructed as a large-scale basin for growing algae, biomass, rice or other water-culture plants. The basin is enclosed by water-tight walls 76, but natural lakes are also suitable. The plants 75 are growing in the basin, and utilise the water, which latter is fertilised by the CO₂. The CO₂ is injected in the basin via gas inlet 71, which latter is connected to the tubing 72, which is provided with holes 73. The
30 CO₂ gas is bubbling up through the holes 73 in the form of bubbles 74, and are absorbed in the water of the basin. The CO₂-enriched water acts as excellent and

cheap fertiliser, providing large yields. Ultimately, the CO₂ emission of the waste or fuel combustion process is largely eliminated in this manner, or at least substantially reduced.

- 5 In another possible realisation of the method according to the invention, the CO₂ content of the flue gas is separated, if necessary further purified by chemical and/or physical methods, and compressed in steel tubes (not shown) for further use.

- 15 -

Claims:

1. Method for the prevention of global warming through elimination of hazardous exhaust gases of waste incinerators and/or fuel burners, comprising the following steps:

a, introducing fuel and/or combustible waste into a cylindrical, thin walled complete combustion reactor with a first and second reactor chamber and igniting the fuel and/or combustible waste,

b, introducing fuel and/or waste into an incinerator apparatus,

c, evaporating/gasifying at least a portion of the fuel and/or waste in the incinerator apparatus,

d, accelerating the vapours and/or gases generated from the fuel/and or waste and introducing the vapours and/or gases into the first and/or second reactor chamber of the complete combustion reactor,

e, atomizing the vapours and/or gases in the first and/or second reactor chamber of the complete combustion reactor,

f, guiding the exiting flue gases from the complete combustion reactor into a flue gas condenser, and condensing the solid and condensable particles from the flue gas, and finally

g, completely recycling the cleaned exhaust gas, particularly the CO₂ content of the exhaust gas, preferably as fertiliser.

2. Method according to claim 1, wherein a fluidised bed, roaster, kiln, oven, waste incinerator or waste burning plant is used as an incinerator apparatus.

3. Method according to claim 1 or 2, wherein less than 12%, preferably less than 10% water is additionally introduced into the first and/or second reactor chamber of the complete combustion reactor.

4. Method according to claim 1 to 3, wherein

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a, the flue gases exiting the complete combustion reactor are introduced into a second complete combustion reactor, and

b, the flue gases exiting from the first complete combustion reactor are combusted as fuel in the second complete combustion reactor in a complete combustion
5 process.

5. Method according to claim 1 to 4, wherein the complete combustion reactor is positioned within a tank containing fuel and/or waste, and the fuel and/or waste in the tank is evaporated/gasified by the heat generated by the complete combustion
10 reactor.

6. Method according to claim 4, wherein fuel and/or waste is fed continuously and/or periodically into the tank.

15 7. Method according to claim 1 or 6, wherein the fuel and/or particularly the waste is being moved and/or mixed and/or stirred during the evaporation/gasification.

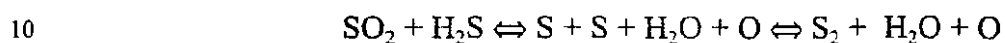
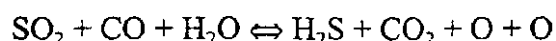
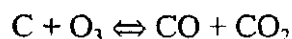
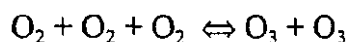
8. Method according to any one of the claims 5 to 7, wherein the solid remains of the fuel and/or waste are continuously and/or periodically removed from the tank.

20 9. Method according to any one of the claims 1 to 8, wherein the evaporation/gasification of the waste is performed in low oxidation or under-stoichiometric conditions.

25 10. Method according to any one of the claims 1 to 9, wherein thermoelectric semiconductors are placed on the outer periphery of the first and/or second complete combustion reactor, and electric energy is produced by the thermoelectric semiconductors.

11. Method according to any of the claims 1 to 10, wherein the recycling of the cleaned exhaust gas, preferably CO₂, is made by bubbling up in water for alga, rice or biomass production, or by compressing in steel tubes.

- 5 12. Method according to any one of the claims 1 to 11, wherein the complete combustion in the complete combustion reactor utilises the following formula:



13. Method according to any one of the claims 1 to 12, wherein the remaining gaseous components of the flue gas following the combustion in the first or second complete combustion reactor are passing through a cleaning unit.

15

14. Method according to claim 13, wherein the cleaning unit is a third complete combustion reactor, and the remaining gaseous components are combusted completely in the third complete combustion reactor.

- 20 15. Apparatus for incinerating and/or combusting fuel and/or waste, particularly for performing the method to prevent global warming according to claim 1, comprising
- a, a closed waste and/or fuel incinerator apparatus with a gas collector region,
 - b, a first complete combustion reactor having a first reactor chamber and a second reactor chamber,
 - 25 c, gas accelerator means connecting the gas collector region of the incinerator apparatus with the first and/or second reactor chamber of the complete combustion reactor,
 - d, flue gas condenser means connected to the exhaust opening of the complete combustion reactor,
 - 30 e, flue gas cleaner means connected to the exhaust opening of the complete combustion reactor,

f, flue gas recycling means connected to the output of the flue gas cleaner means.

16. Apparatus according to claim 15, comprising a second complete combustion reactor, and second connecting means connecting the exit opening of the complete
5 combustion reactor with the inlet of the second complete combustion reactor.

17. Apparatus according to claim 15 or 16, wherein the first and/or second complete combustion reactor is positioned in a tank containing fuel and/or waste.

10 18. Apparatus according to claim 17, wherein the tank is provided with mixing and/or stirring means for moving and/or mixing and/or stirring the fuel and/or waste in the tank.

19. Apparatus according to claim 17 or 18, wherein the tank is provided with input
15 and/or output means for periodically and/or continuously feeding fuel and/or waste into the tank and for periodically and/or continuously removing solid and/or fluid remains from the tank.

20. Apparatus according to any one of the claims 17 to 19, wherein the tank is
20 cylindrical in the horizontal cross-section, and the first complete combustion reactor is placed vertically in the tank, its vertical central axis being concentric or eccentric in relation to the vertical central axis of the tank.

21. Apparatus according to any one of the claims 15 to 20, comprising
25 thermoelectric semiconductors positioned on the outer periphery of the first and/or second complete combustion chamber.

22. Apparatus according to any one of the claims 15 to 21, wherein the exhaust
30 condenser is comprising two cones with a common vertical central axis, with their tip pointing towards each other, and a lime absorbing filter placed under the cones in the path of the solid and/or fuel condensate.

23. Apparatus according to any one of the claims 15 to 22, comprising a gas cleaning unit after the output of the first or second complete combustion reactor or the exhaust condenser.

5

24. Apparatus according to claim 23, wherein the cleaning unit comprises a third complete combustion reactor.

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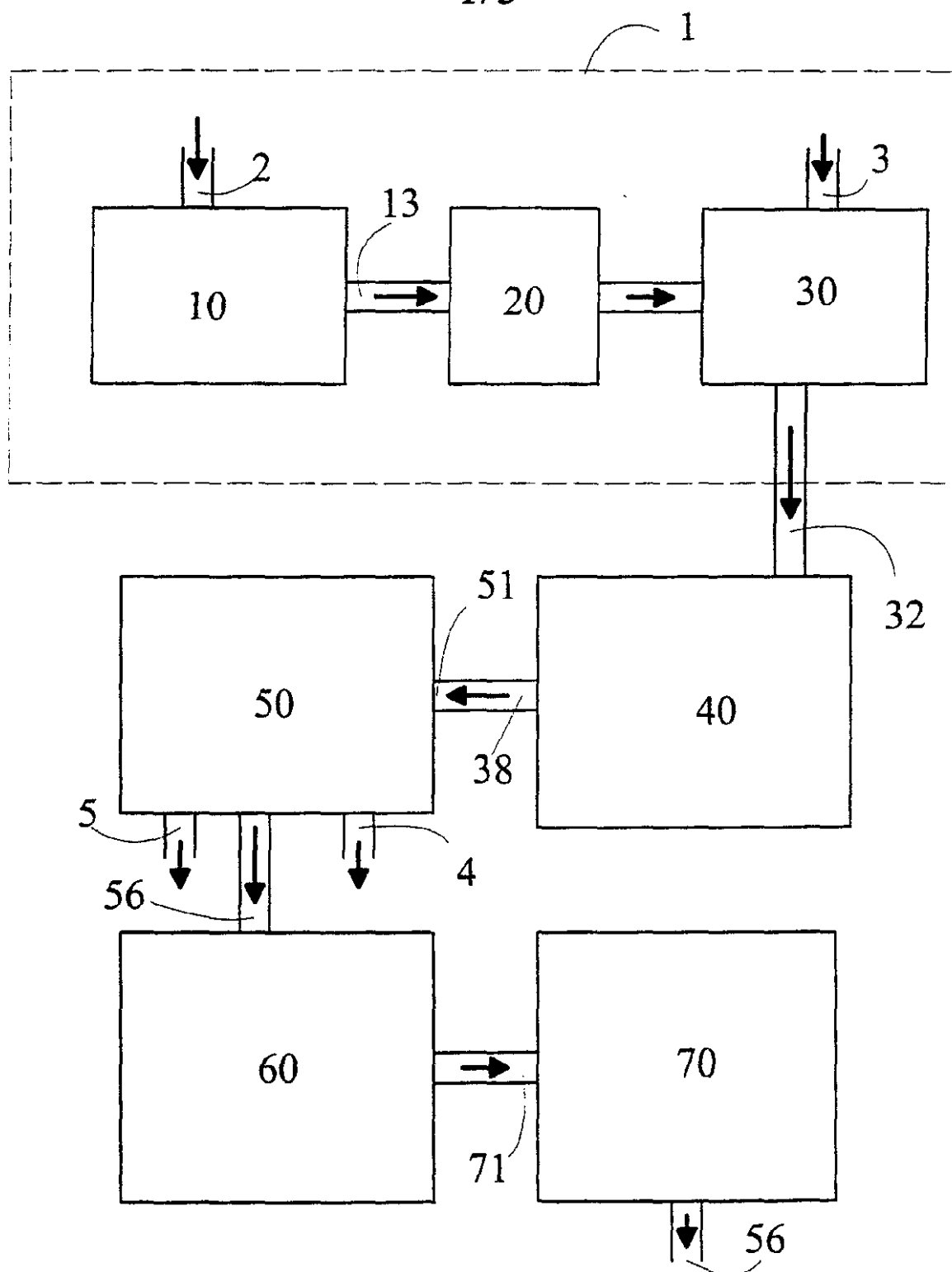


Fig. 1.

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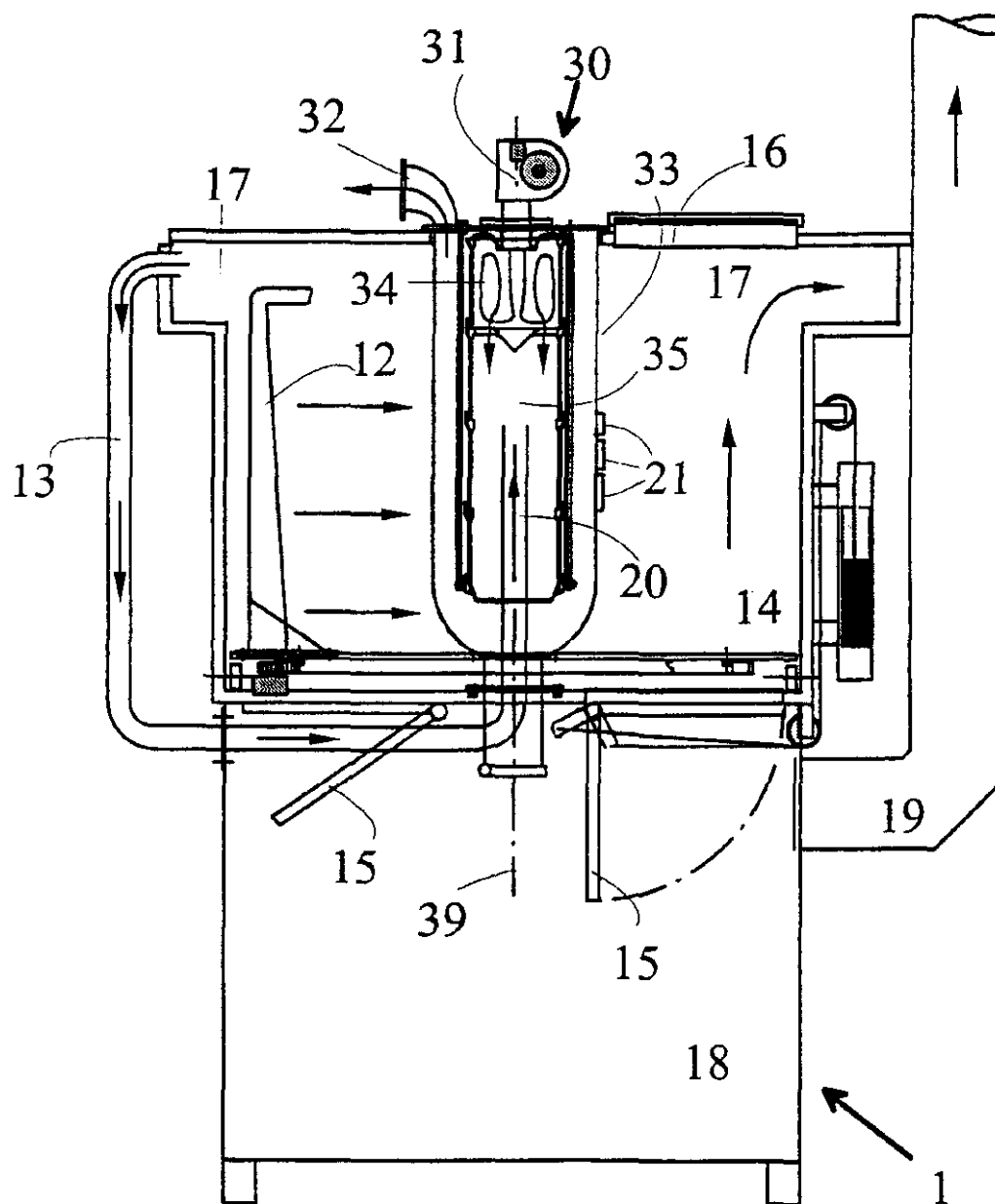


Fig. 2.

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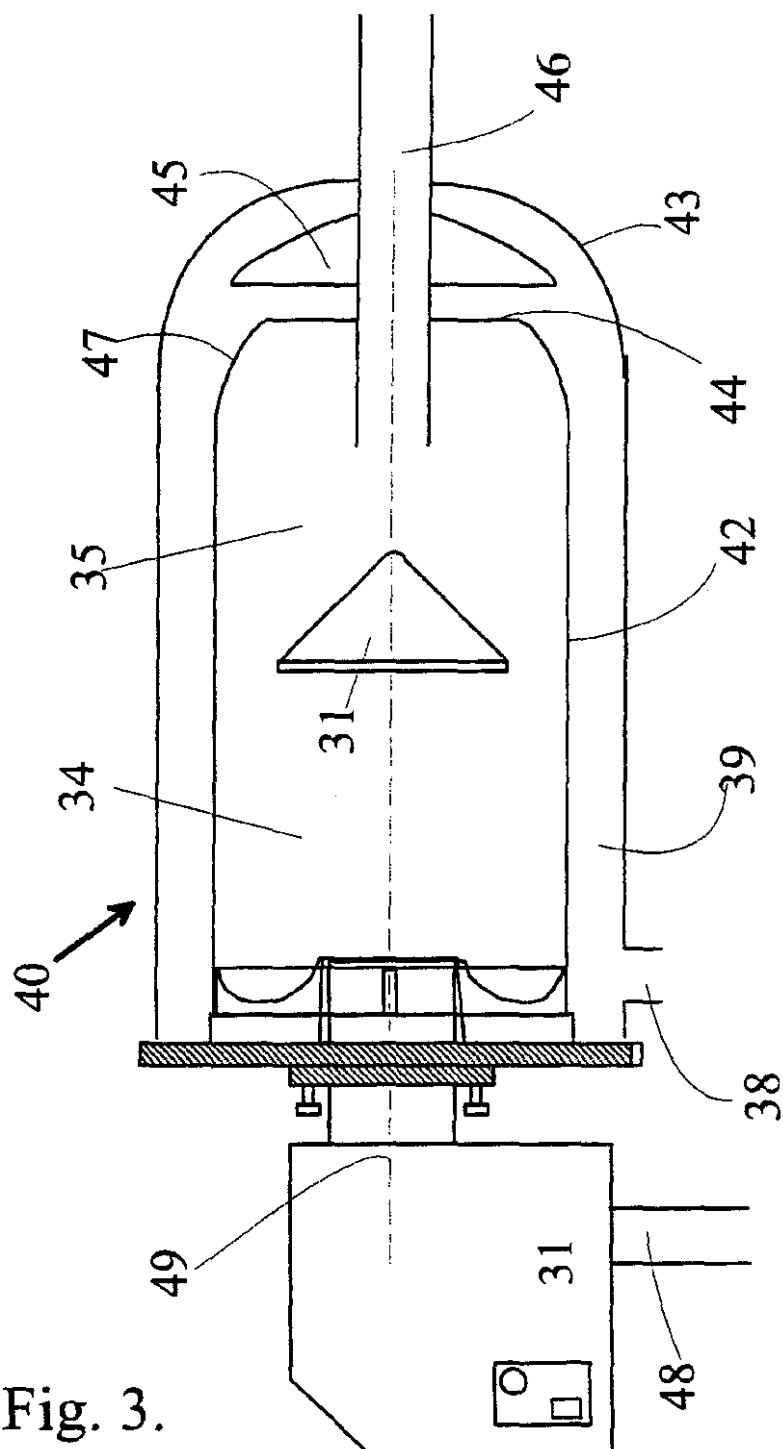


Fig. 3.

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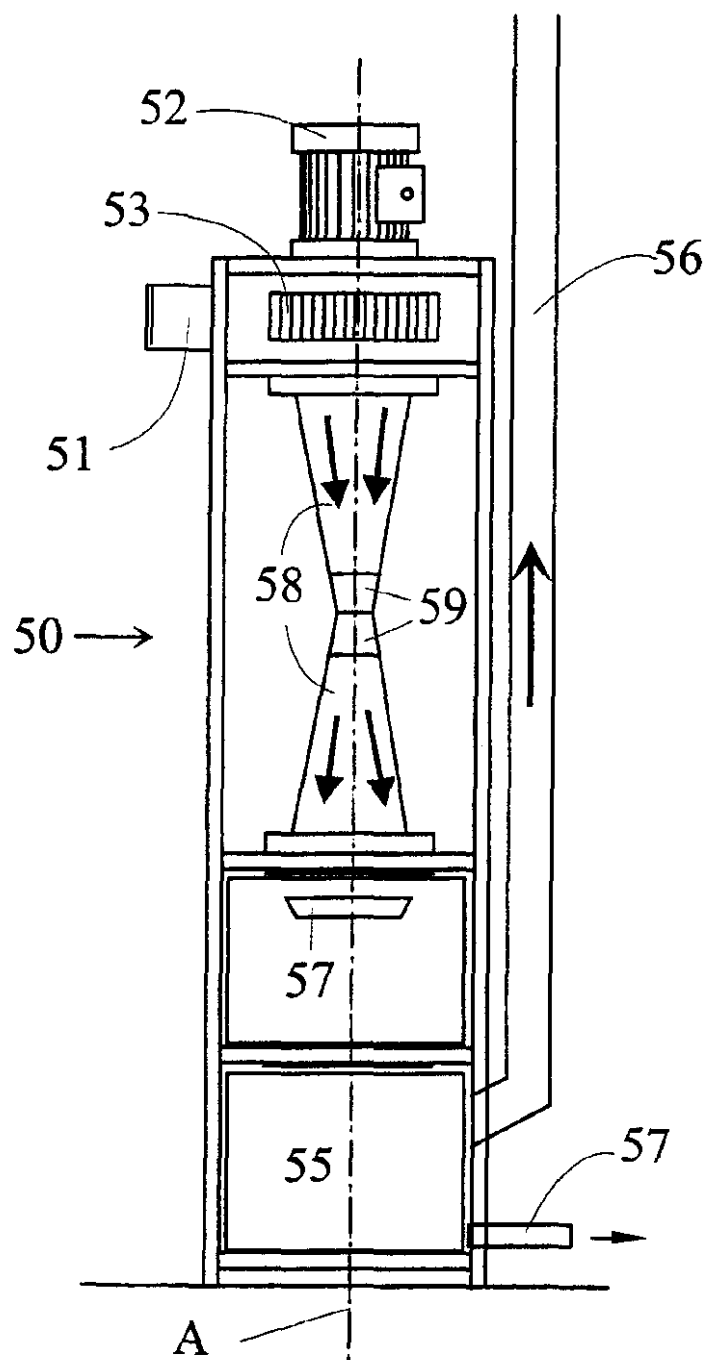
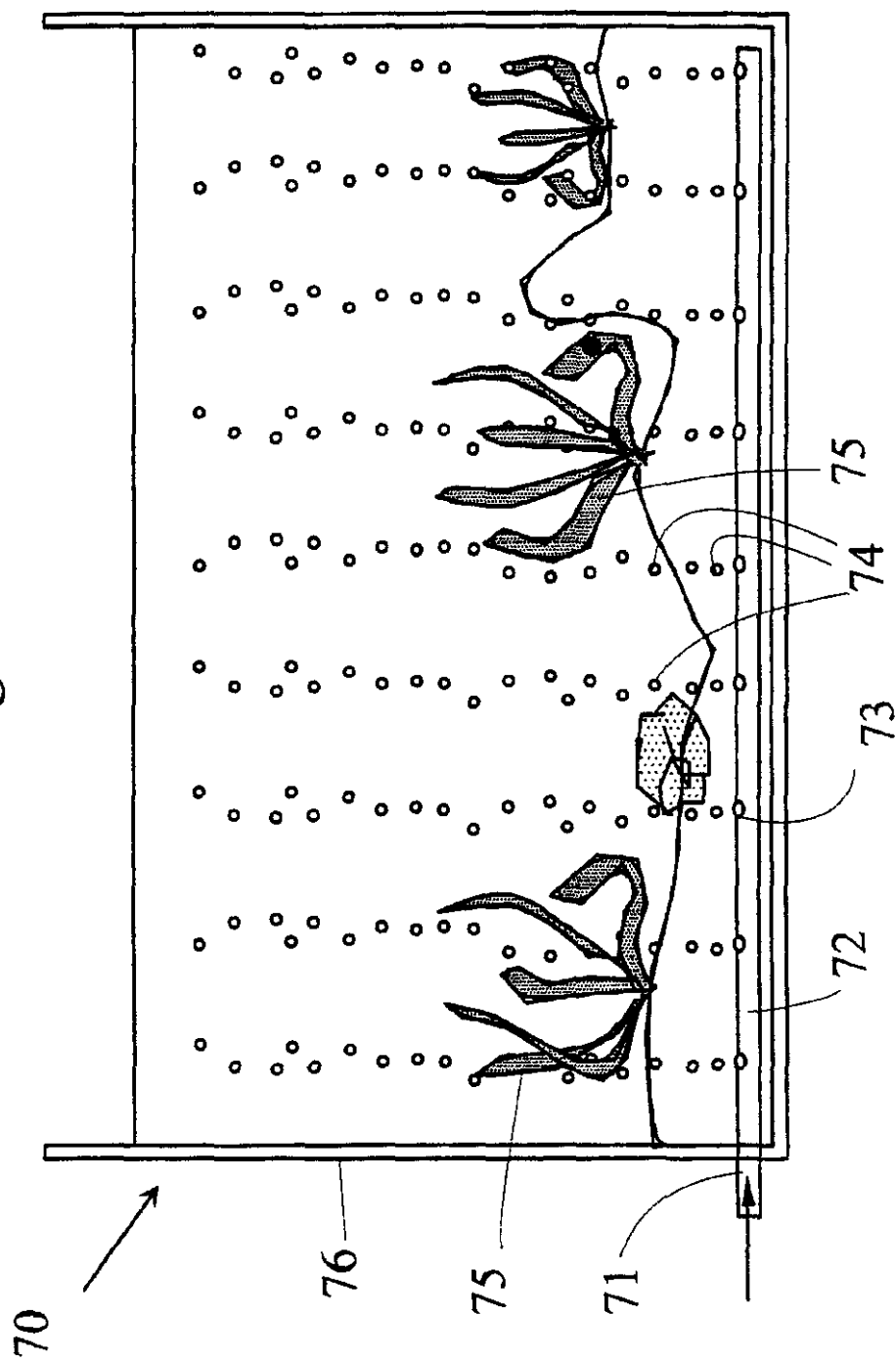


Fig. 4.

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Fig. 5.



INTERNATIONAL SEARCH REPORT

Int. l. Application No
PCT/HU 99/00029

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 F23G5/027 F23G5/16

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)
IPC 6 F23G F23J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	US 5 732 571 A (HATAMI RASI ET AL) 31 March 1998 (1998-03-31)	1,2,9,13
A	column 1, line 5 - line 15 column 2, line 23 - line 44 column 3, line 8 - line 29 column 3, line 60 - column 4, line 2 column 5, line 39 - line 44; figure 1 ---	15
Y	EP 0 535 260 A (WILLE HEINZ) 7 April 1993 (1993-04-07)	1,2,9,13
A	column 5, line 45 - column 6, line 7 column 6, line 25 - line 29 column 8, line 39 - column 9, line 21; figures 1,12,13 ---	15
A	GB 1 401 207 A (EBARA INFILCO) 16 July 1975 (1975-07-16) page 2, line 89 - page 3, line 55; figure ---	1,4,5,17
	-/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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"&" document member of the same patent family

Date of the actual completion of the international search

8 July 1999

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INTERNATIONAL SEARCH REPORT

Int'l. Patent Application No.

PCT/HU 99/00029

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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Abstract:

本发明涉及一种通过减少废物焚化炉和/或燃料燃烧器有害气体的排放而防止全球变暖的方法。该方法包括如下步骤：1. 将燃料和 / 或可燃性废物从一个燃烧器导入到一个完全燃烧反应器 (30) 中，该完全反应器具有一个第一和第二反应器室，然后点燃燃料和 / 或可燃性废物；2. 将燃料和 / 或废物导入到一个焚化炉设备 (10) 中；3. 在焚化炉设备 (10) 中蒸发 / 汽化至少一部分燃料和 / 或废物；4. 对产生自燃料和 / 或废物的蒸汽和 / 或气体进行加速并将蒸汽和 / 或气体导入到完全燃烧反应器 (30) 的第一和第二反应器室；5. 对完全燃烧反应器 (30) 的第一和 / 或第二反应器室内的蒸汽和 / 或气体进行雾化；6. 将完全燃烧反应器 (30) 的排出废气导入到废气冷凝器 (50) 中并对废气中的固体和可凝结颗粒进行冷凝；7. 完全再循环干净的废气，特别是其中的 CO_2 ，优选地作为肥料。本发明进一步涉及实施上述方法的设备。