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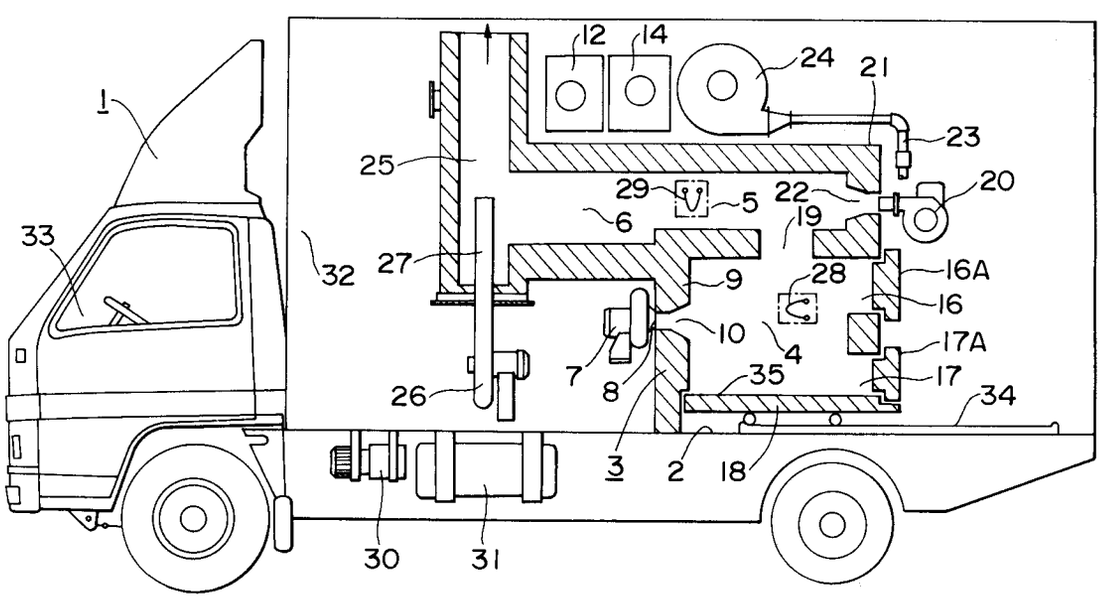
(54) Mobile type medical refuse incinerating vehicle.

(57) An incinerator (3) is mounted on a vehicle (1) which is adapted to carry thereon medical refuse, and a main burner (7) in which oil or water is suitably injected is provided in a main furnace (4) of this incinerator. Medical refuse discarded from medical facilities and suspected to cause secondary infection or direct infection is collected and is then at once disposed in the incinerator so as to be burnt.

FIG.1



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Background of the Invention

The present invention relates to a mobile type medical refuse incinerating vehicle.

Some of medical refuses discarded from medical facilities such as hospitals or the like is contaminated with several kinds of disease-causing germs such as viruses or the like, and possibly causes secondary infection which should be therefore prevented by suitably disposing the medical refuse. It goes without saying that the incineration of such medical refuse is a simplest safe countermeasure.

Conventionally, most of such medical refuse is collected, for example, by refuse collecting vehicles which pass around through hospitals, and is then accumulated in a predetermined space where the medical refuse is charged into an incinerator for burning up it.

However, the medical refuse includes various kinds of matters such as syringe barrels made of plastic, polyvinyl chloride or the like, syringe needles, dripping chemical bottles, tubes, incombustible cotton, and the like which are made of various kinds of materials. In particular, the burn-up of the one made of polyvinyl chloride is very difficult since it emits, during being burnt up, a great deal of noxious gas which is the main culprit behind pollution.

Further, since certain kinds of medical refuse have a substance which is of a high burning calory or a low burning calory, and accordingly, if the various kinds of medical refuse were burnt together in a mixed condition, an incinerator would be overheated and be damaged.

Explanation will be made of this problem with reference to graphs A and B shown in Fig. 5.

In such a case that a certain kind of medical refuse is charged in an incinerator in order to incinerate it at a rate of 30 Kg/hour or 5 kg in every 10 minute, the temperature of burnt gas in the incinerator reaches about 1,200 deg. C within 3 to 5 minutes as shown by graph A, and accordingly, the incinerator is overheated.

Further, as shown by graph B, the quantity of gas generated by the combustion amounts to about 30 m^3 after about 4 minutes elapse, and accordingly, the incineration of the medical refuse cannot be made even though the an after-burning furnace is provided. In this case, a great deal of gas would be emitted.

As mentioned above, conventional burn-up methods have offered disadvantages such that an incinerator would be overheated and damaged, and therefore, it is difficult to sufficiently cope with abrupt change in quantity of generated gas since changes in combustion of the refuse is remarkable, and so forth.

Summary of the Invention

The present invention is to provide a mobile type medical refuse incinerating vehicle adapted to go mainly to medical facilities such as hospitals, health centers or the like so as to collect medical refuse which is discarded therefrom and which is suspected to cause primary or secondary infection, and to burn up the collected medical refuse in an incinerator mounted on a vehicle after it is charged into the incinerator.

According to the present invention, an incinerator for medical refuse is mounted on a vehicle which carries thereon medical refuse, the incinerator comprising a main burning furnace and an after-burning furnace communicated with each other, and a main burner in which oil or water is injected being changed over therebetween, is provided in a main furnace. In this arrangement, an oil feed type rotary burner may be used as the above-mentioned main burner, having a three-way valve for selectively changing over the injection of air, oil and water.

Further, a drive cabin is provided on the above-mentioned carrier vehicle, and accordingly, the carrier vehicle can self-travel under the control of the driver.

Thus, since the incinerator is mounted on the medical refuse carrier vehicle, medical refuse which has been collected by the vehicle going around through the medical facilities such as hospitals or the like, can be readily charged and burnt up in the incinerator, and accordingly, it is possible to reduce the steps of disposal thereof so as to remarkably decrease the risk of secondary infection while enhancing the working efficiency.

Further, lime water is used as the water to be injected from the above-mentioned main burner. Hydrogen chloride generated by the combustion of medical refuse is turned into calcium chloride by injecting this lime water into the main burning furnace, it is possible to prevent emission of noxious gas. In this case, the lime water may be obtained by mixing hydrated lime or calcium hydroxide in water.

In this incinerator, ignition flame and secondary air are injected into the after-burning furnace from an after-burner, and accordingly, the ignition flame and the secondary air are forced to make contact with unburnt gas led from the main burning furnace so that the unburnt gas is perfectly burnt up, thereby it is possible to control the volume of generated gas at a constant value.

The after-burning furnace is connected thereto with a flue which is in turn connected thereto an exhaust pipe having an upper portion opened to the atmosphere, and an ejector extending from an exhaust fan disposed below the exhaust pipe is

inserted into the exhaust pipe in order to smoothly discharge the gas.

Further, various kinds of collected medical refuge are charged into the main burning furnace mounted on the carrier vehicle by a constant volume at each time while oil is injected in a sprayed condition from the main burner in order to burn up the medical refuse.

If the temperature of the inside of the main burning furnace abruptly increases due to a thermal variation phenomenon caused by a high burning calory inherent to the medical refuse to be burnt, water is, for a while, injected in a sprayed condition from the main burner so as to regulate the temperature of the inside of the furnace in order to control a set temperature.

On the contrary, if the combustion temperature is low since the burning calory is low, oil is injected from the main burner. Accordingly, the combustion temperature of the main burning furnace is increased so that the temperature of the furnace is controlled in a set temperature range in order to maintain the volume of generated gas at a constant value. Since the operation of the main burner is changed over as such, thermocouples are arranged in the main burning furnace and the after-burning furnace in order to measure temperatures in the furnaces, respectively.

With this arrangement, it is possible to prevent the incinerator from being overheated, and to efficiently burn up medical refuse always at a constant combustion temperature with a constant volume of combustion gas while preventing occurrence of pollution.

If the incinerator is integrally incorporated with the after-burning furnace so that unburnt gas generated in the main burning furnace is completely burnt by ignition flame and secondary air from the after-burner, the unburnt gas is turned into the one with non-pollution before it is emitted into the atmosphere.

Further, a hearth carriage having on its upper surface a hearth is provided in the bottom section of the above-mentioned main burning furnace, which is adapted to travel on rails laid on the bottom section of the cargo bed so as to be pulled out outside of the main burning furnace, and accordingly, the disposal of incinerated ash can be facilitated. Brief Description of the Drawings:

Fig.1 is a schematic sectional view illustrating an incinerator on a refuse carrier vehicle according to the present invention;

Fig. 2 is a plan view illustrating the incinerator shown in Fig. 1:

Fig. 3 is a front view illustrating the incinerator shown in Fig. 1;

Fig. 4 is a right side view illustrating the incinerator shown in Fig. 1;

Fig. 5 is characteristic graphs showing a comparison between the prior art and the present invention; and

Fig. 6 is a principal explanatory view illustrating a three-way valve in a main burner.

Description of the Preferred Embodiments

A medical refuse incinerating vehicle 1 comprises a drive cabin 33 in the front section thereof, and accordingly, can self-travel under the control of the driver. The vehicle 1 includes in its rear section a rear cargo bed 2 on which an incinerator 3 is mounted. The incinerator 3 incorporates a main burning furnace 4, an after-burning furnace 5 and a flue 6. The after-burning furnace 5 is located above the main burning furnace 4, and the flue 6 is connected to the after-burning furnace 5.

The main burning furnace 4 is disposed in the lower section of the incinerator 3, and a main burner 7 is attached to the outer surface of one side wall of the main burning furnace 4. An injection nozzle 8 in the main burner 7 is disposed in an injection through-hole 10 formed in the wall member 9 of the main burning furnace 4. Further, this main burner 7 is an oil feed type rotary burner having a three-way valve 11 for selectively injecting air, oil and water, being changed over (refer to Fig. 6).

An oil tank 12 is disposed above the above-mentioned incinerator 3, and accordingly, with the use of the water head thereof, the fuel oil is fed into an oil feed port 13 of the above-mentioned three-way valves 11 in the main burner 7.

Adjacent to the oil tank 12, a water tank 14 is arranged. Since the water tank 14 is arranged above the incinerator 3, water can be fed into a water feed port 15 in the three-way valve 11 in the main burner 7 with the use of the water head of the water tank 14.

The above-mentioned three-way valve 11 is adapted to be changed over under remote manual control, but can be changed over automatically by an automatic control system added thereto.

A refuse charge port 16 is formed in the rear side wall of the main burning furnace 4, and is adapted to be opened and closed by double doors 16A. In stead of using the double doors, a vertical slidable door can be used for opening and closing the charge port 16.

An ash take-out port 17 is formed below the charge port 16, being communicated with the main burning furnace 4, and is adapted to be opened and closed by double doors 17A.

A hearth carriage 18 having, on its upper surface, a hearth is disposed in the bottom section of the main burning furnace 4. The hearth carriage 18 can travel on rails 34 laid on the bottom section of

the cargo bed 2. Accordingly, after the completion of incineration, the ash take-out port 17 is opened so as to enable the hearth carriage 18 to be pulled out from the main burning furnace 4.

Further, a draw port 19 is formed in the boundary wall between the main burning furnace 4 and the after-burning furnace 5 thereabove so that the main burning furnace 4 and the after-burning furnace 5 are communicated with each other through the draw port 19.

An after-burner 20 is attached to the outer surface of the rear wall member 21 of the after-burning furnace 5. This after-burner 20 is disposed in an injection through-hole 22 formed in the wall member 21. Oil is injected from the after-burner 20.

Further, adjacent to the after-burner 20, an air-blowing nozzle 23 is arranged, which is connected thereto with a blowing fan 24. Further, ignition flame generated from burning oil, and secondary air fed from the air-blowing nozzle 23 are forced to make contact with unburnt gas led from the main burning furnace 4 through the draw port 19. This contact causes perfect combustion of the unburnt gas.

Thus, if the burning calory inherent to the medical refuse which is burnt in the main burning furnace 4 is low so as to cause occurrence of incomplete combustion which results in generation of unburnt gas, the after-burner 7 is used to completely burn up the unburnt gas in the after-burning furnace 5. Accordingly, the volume of exhaust gas is controlled before emitting the same into the atmosphere.

An exhaust pipe 25 having its upper part opened to the atmosphere is connected to the above-mentioned flue 6, being communicated therewith. An ejector 27 which extends from an exhaust fan 26 disposed below the exhaust pipe 25 is inserted into the exhaust pipe 25. This exhaust pipe 25 allows the burnt gas to be smoothly discharged from the furnace.

Thermocouples 28, 29 are disposed in the main burning furnace 4 and the after-burning furnace 5, respectively, so as to measure the temperatures of the insides of the main burning furnace 4 and the after-burning furnace 5.

A generator 30 and a fuel tank 31 for storing fuel to be fed into an engine for the carrier vehicle 1 are arranged underneath the floor of the rear cargo bed 2.

Further, a control board section 32 on which several control panels are laid is provided in the front section of the rear cargo bed 2.

The above-mentioned water tank 14 is filled merely therein with water. However, calcium hydroxide is sometimes charged therein so as to prepare lime water (a solution of calcium hydroxide, $Ca(OH)_2$). This lime water is injected into the main burning furnace 4 from the main burner 7. This injection causes hydrogen chloride generated by the combustion of the medical refuse to be turned into calcium chloride, and accordingly, it is possible to prevent noxious gas from being discharged into the atmosphere. The formula of this chemical reaction is given as follows:

$$Ca(OH)_2 + 2HCl \rightarrow CaCl_2 + 2H_2O$$

Although it has been explained in the above-mentioned embodiment that oil and water are selectively injected from the main burner 7 by changing over the three-way valve 11, the main burner 7 may be, of course, used exclusively for the oil while an additional injection nozzle (which is not shown) for exclusively injecting the water is provided. It is essential to selectively inject the oil and the water into the main burning furnace 4.

Explanation will be hereinbelow made of the operation of the above-mentioned embodiment.

An estimation is made such that corrected refuse is burnt at a rate of, for example, 30 kg/hour, that is, 5 kg for every 10 minutes, and that the incinerator 3 is operated under a condition in which the incinerator 3 is prevented from being overheated, and in which the volume of generated gas is restrained within a predetermined range.

When the medical refuse is charged into the incinerator 3, the temperature of the main burning furnace 4 increases so as to produce burnt gas. Should the burning calory of the medical refuse be high, the incinerator would be overheated if the combustion is continued further.

Accordingly, it is necessary to control the combustion so as to prevent the main burning furnace 4 from being overheated, by measuring the temperature of the main burning furnace 4 with the use of the above-mentioned thermocouple 28. This control can be made by changing over the three-way valve 11 for the main burner 7 so as to stop the injection of the oil or to inject the water in a sprayed condition, instead of the oil. Through these steps, the temperature of the main burning furnace 4 can be maintained to be constant, as shown by a graph C in Fig. 5. At this time, the volume of burnt gas caused by the combustion in the after-burning furnace 5 is controlled so as to be constant as shown by a graph D.

On the contrary, if the burning calory is low due to a high incombustibility inherent to medical refuse, the combustion becomes insufficient. In this case, the three-way valve 11 for the main burner 7 is changed over so as to inject oil in order to promote the combustion, and accordingly, the temperature of the main burning furnace 4 is adjusted to a high value. At this time, the volume of burnt gas is held to be constant, as shown by the graph

D.

Claims

1. A mobile type medical refuse incinerating vehicle characterized in that an incinerator for incinerating medical refuse is mounted on a medical refuse carrier vehicle, said incinerator comprising a main burning furnace and an after-burning furnace which are communicated with each other, and a main burner for injecting oil and water into said main burning furnace in such a manner that said oil and water is selectively changed over, is provided in said main burning furnace.

2. A mobile type medical refuse incinerating vehicle as set forth in claim 1, wherein lime water is used as said water, and the lime water is injected into said main burning furnace from said main burner so as to turn hydrogen chloride which is produced by combustion of the medical refuse, into calcium chloride.

3. A mobile type medical refuse incinerating vehicle as set forth in claim 2, wherein calcium hydroxide is mixed into said water so as to prepare said lime water.

4. A mobile type medical refuse incinerating vehicle as set forth in claim 1 or 2, wherein said main burner is an oil feed type rotary burner, and incorporates a three-way valve for selectively changing over the injection of air, the oil and the water.

5. A mobile type medical refuse incinerating vehicle as set forth in any one of the preceeding claims, wherein ignition flame and secondary air are injected into an after-burner so that said ignition flame and said secondary air are forced to make contact with unburnt gas led from said main burning furnace, which is therefore burnt up.

6. A mobile type medical refuse incinerating vehicle as set forth in any one of the preceeding claims, wherein thermocouples are provided in said main burning furnace and said after-burning furnace so as to measure temperatures of the insides of said furnaces, respectively.

7. A mobile type medical refuse incinerating vehicle as set forth in any one of the preceeding claims, wherein said carrier vehicle self-travels under control of a driver.

8. A mobile type medical refuse incinerating vehicle as set forth in any one of the preceeding claims, wherein a flue having an exhaust pipe having its upper part opened to the atmosphere, is connected to said main burning furnace, and an ejector extending from an exhaust fan is inserted into said exhaust pipe.

9. A mobile type medical refuse incinerating vehicle as set forth in any one of the preceeding claims, wherein a hearth carriage having, on its upper surface, a hearth, is provided in the bottom section of said main burning furnace, said hearth carriage travels on rails laid on the bottom section of said cargo bed so that said hearth carriage can be pulled out from said main burning furnace.

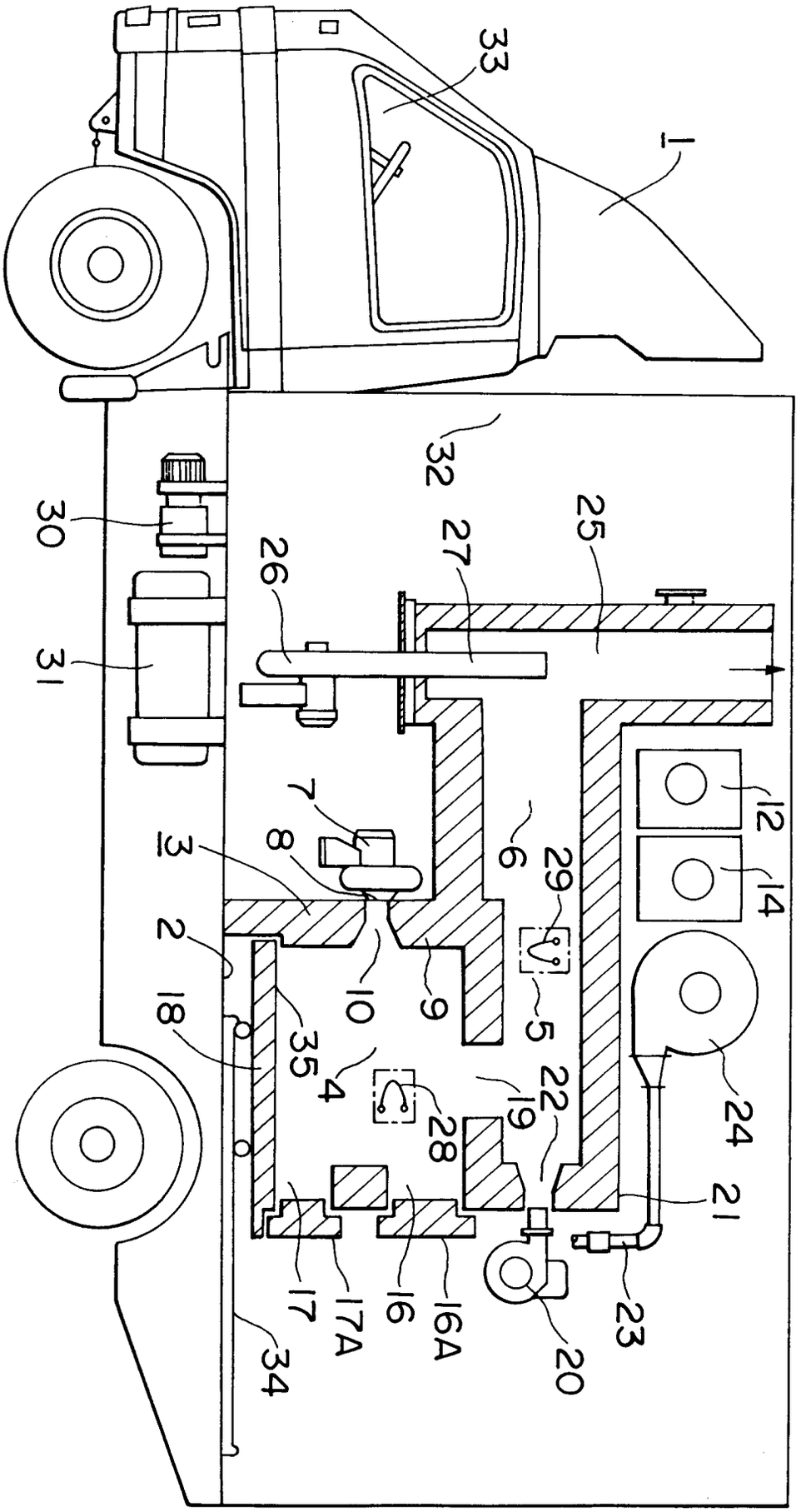
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FIG.1

FIG.2

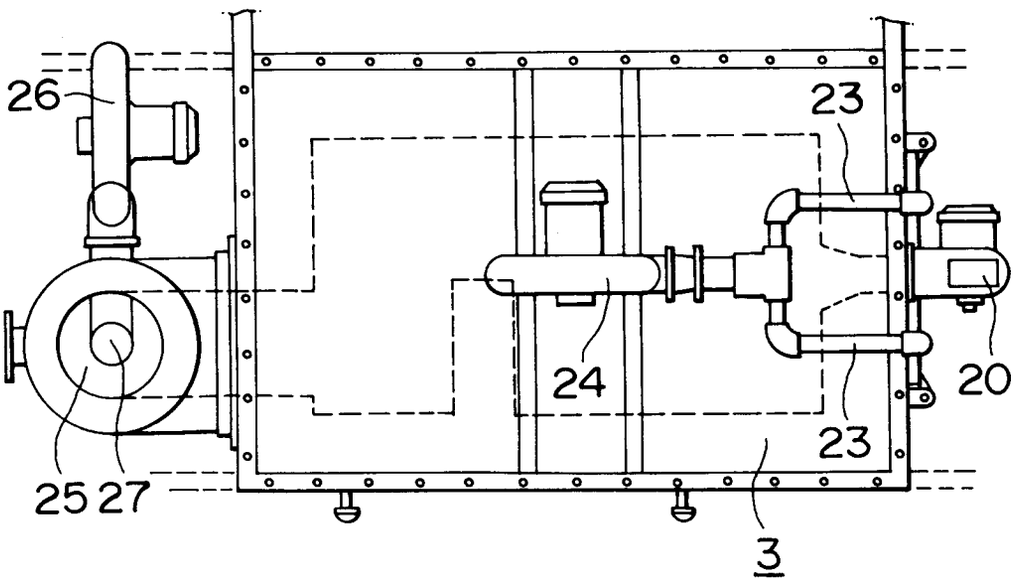
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FIG.3

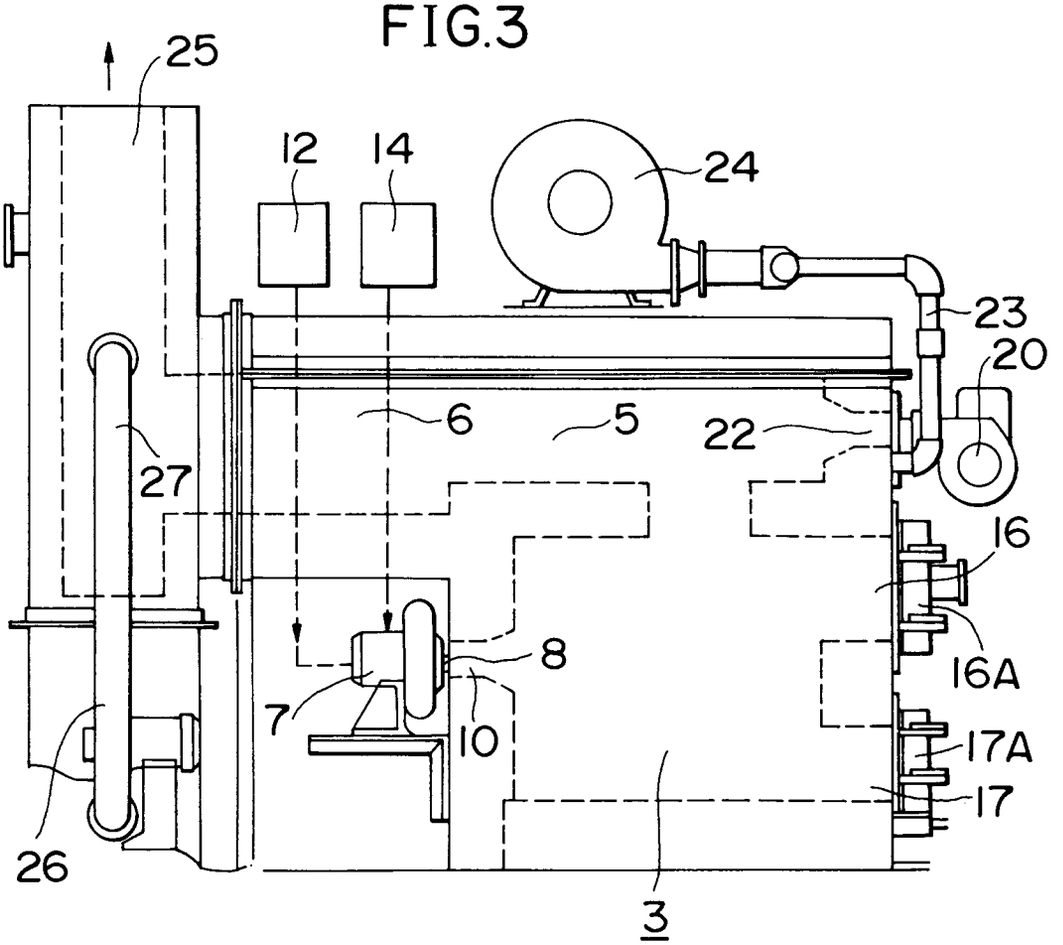
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FIG.4

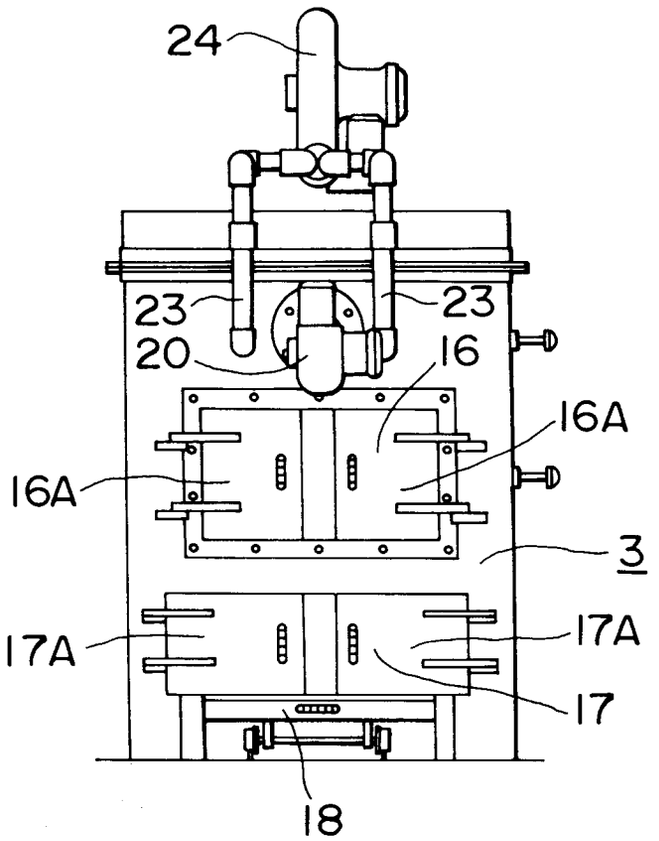


FIG.6

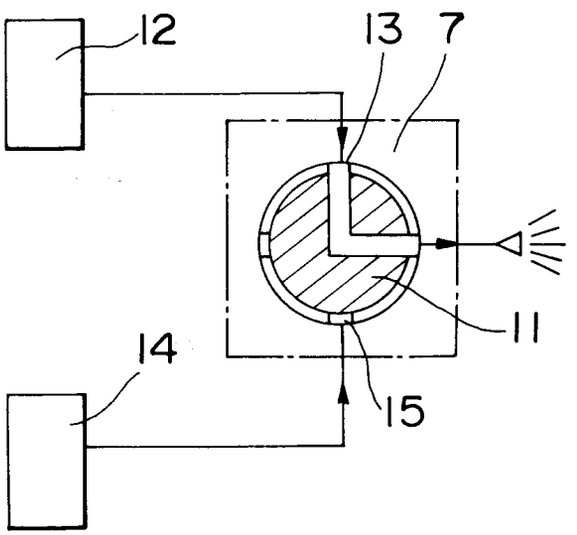
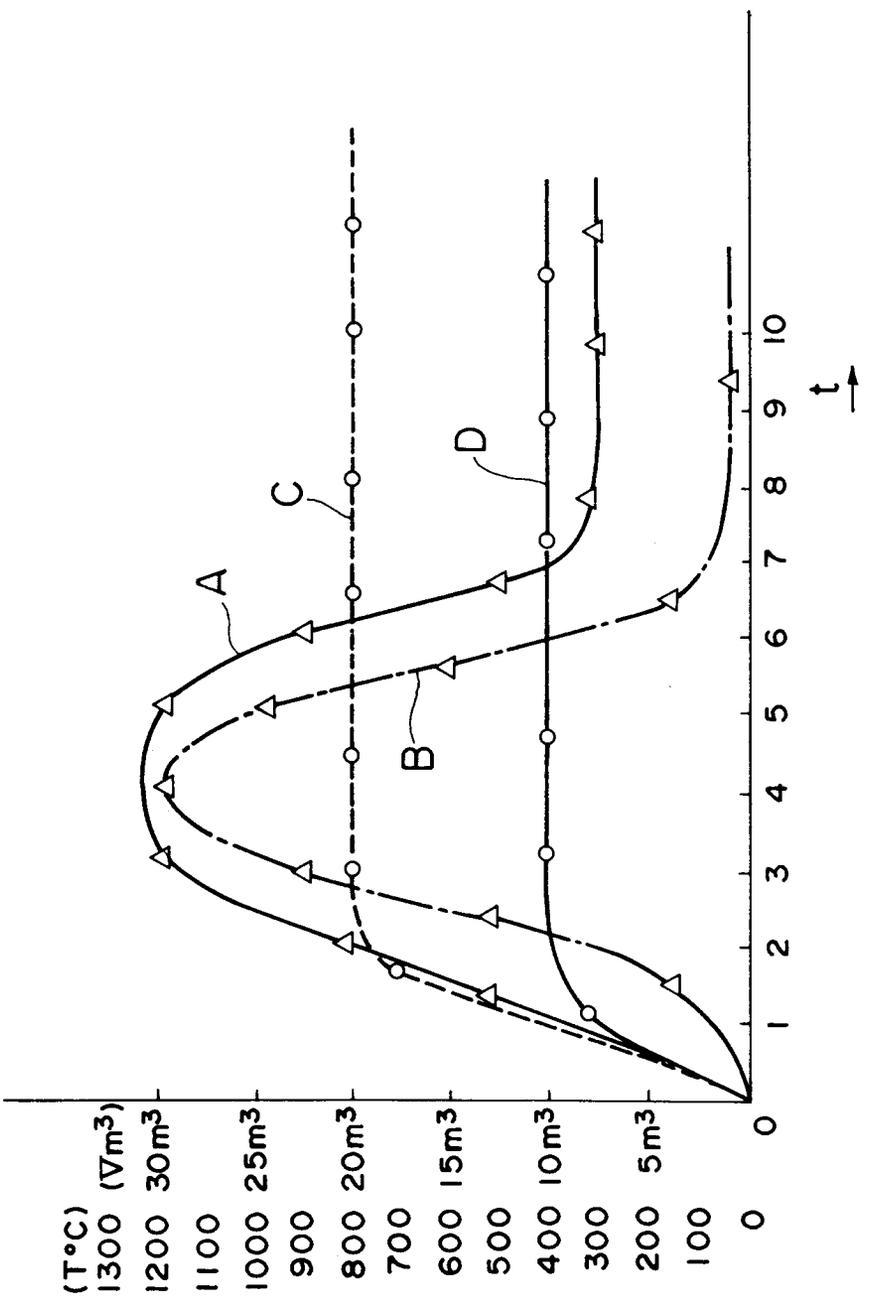


FIG.5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EUROPEAN SEARCH REPORT

Application Number

EP 91 12 1923

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	FR-A-2 649 782 (HURET) * page 3, line 1 - line 8; figure 2 *	1,5,6	F23G5/40 F23G5/16 F23L7/00 F23J7/00
A	FR-A-2 213 456 (PICARD) * page 1, line 5 - page 2, line 12; figures 1,2 *	1,5,6,8	
A	GB-A-2 070 212 (THE INCINERATOR COMPANY) * page 3, line 112 - page 4, line 18 * * page 4, line 82 - line 104; figures 1,4 *	1,5,8	
A	US-A-3 595 181 (ANDERSON) * column 2, line 69 - column 3, line 61; figure *	1,5,6	
A	GB-A-2 056 656 (STEINMULLER) * abstract; claims 1,6 *	2,3	
A	US-A-4 627 365 (TSENG) * column 2, line 6 - column 3, line 52; figures 1-3 *	1,5,7	TECHNICAL FIELDS SEARCHED (Int. Cl.5) F23G F23L F23J
A	GB-A-2 131 154 (EX-CELL-O) * abstract; figure *	4	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22 JULY 1992	COLI E.

CATEGORY OF CITED DOCUMENTS

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