

[54] MOBILE REFUSE INCINERATOR

[72] Inventor: Louis Marie Rousseau, Neuville Sur Saone, France

[73] Assignee: Felix Bauer, Lyon, France

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[30] Foreign Application Priority Data

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[51] Int. Cl.....F23g 5/06

[58] Field of Search.....110/8 R, 14, 19

[56] References Cited

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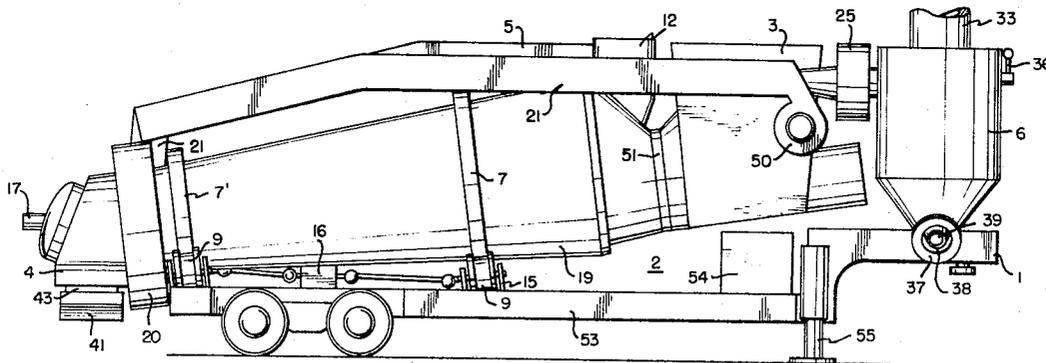
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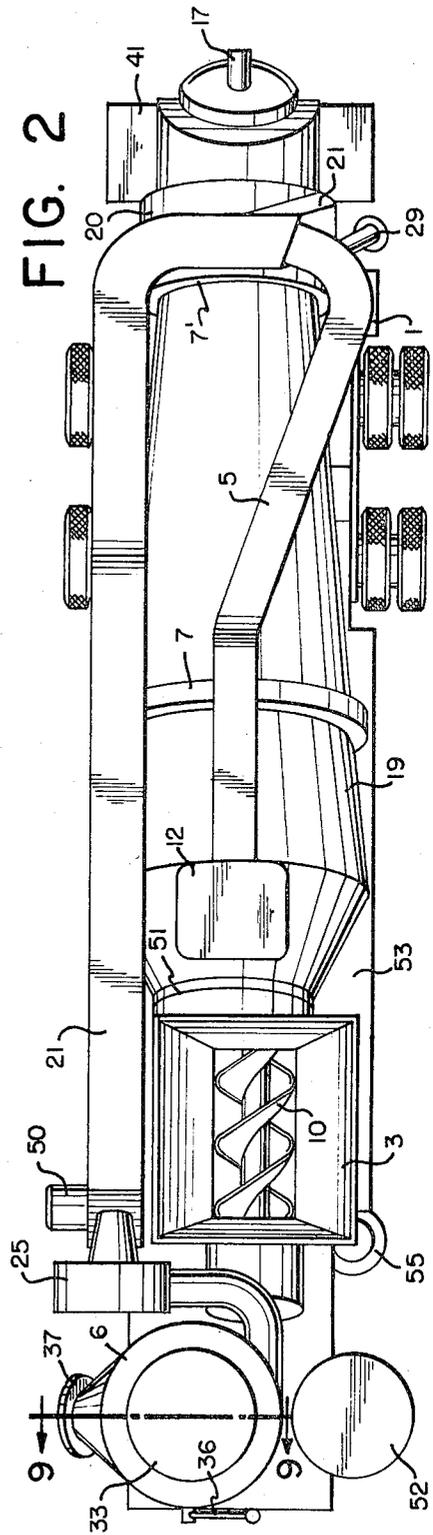
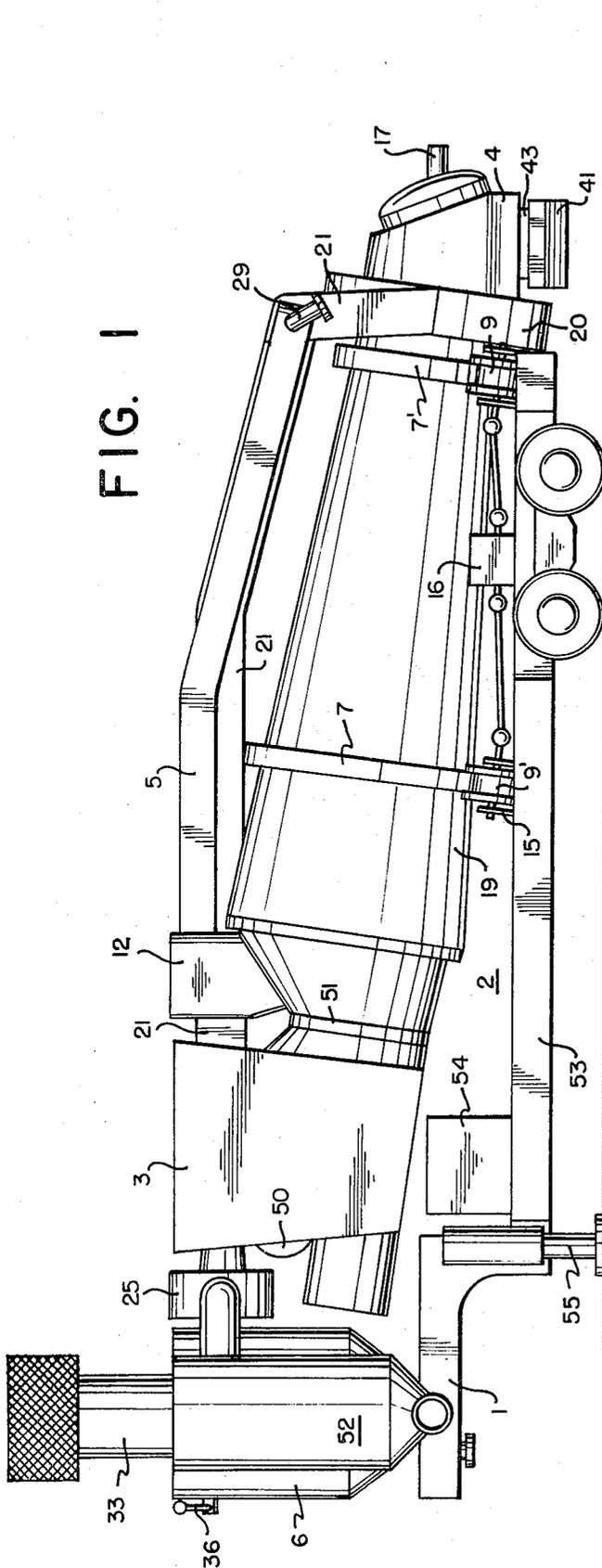
Primary Examiner—Kenneth W. Sprague
Attorney—Tab T. Thein

[57] ABSTRACT

Mobile refuse incinerator having a furnace which includes a stationary post-combustion chamber portion, which first receives the refuse to be incinerated, and an axially aligned rotatable drum portion, followed by a stationary ash-bin section with a burner for igniting and reducing the refuse. The drum portion is preferably conical and becomes narrower toward the rear end of the furnace. Appropriate seals are provided, with interengaging fixed and rotary parts, for ensuring air-tightness between the rotatable and stationary parts. A decantation cyclone may be provided for the burnt gases, including a mechanism for cleaning the escaping gases and discharging the collected dust. The furnace is provided with ducts for the combustion air, the fresh air, as well as the gases produced by the incineration of the refuse.

10 Claims, 9 Drawing Figures





INVENTOR.
LOUIS MARIE ROUSSEAU

BY *Jab Hein*

AGENT

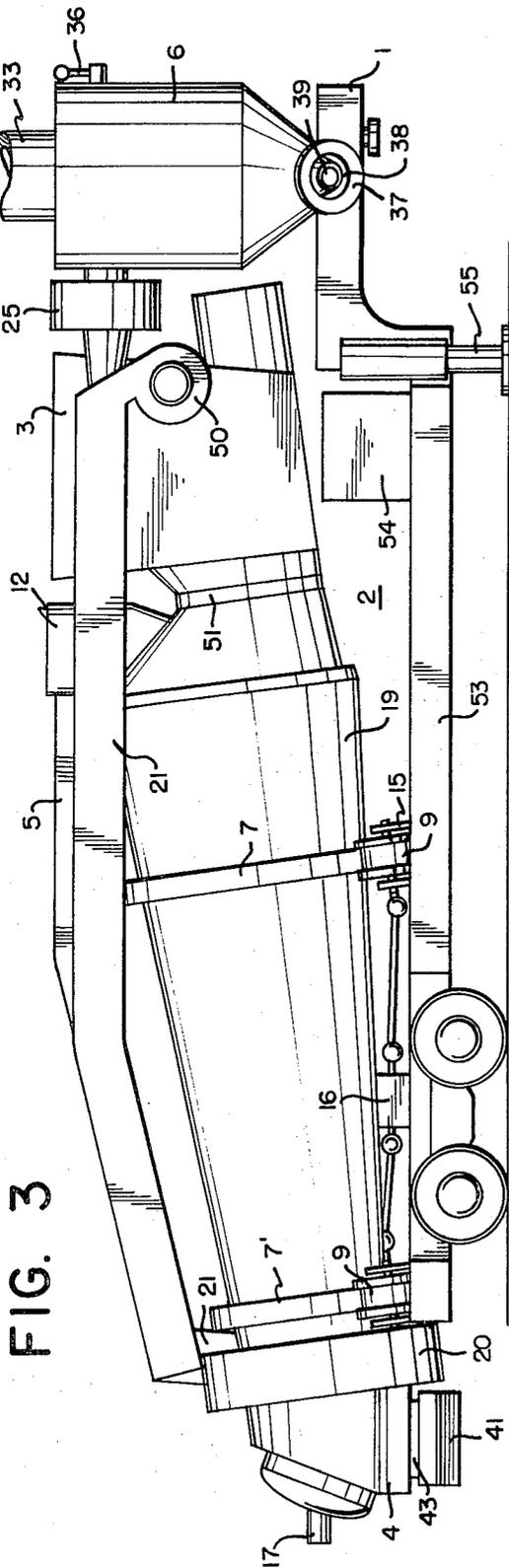


FIG. 3

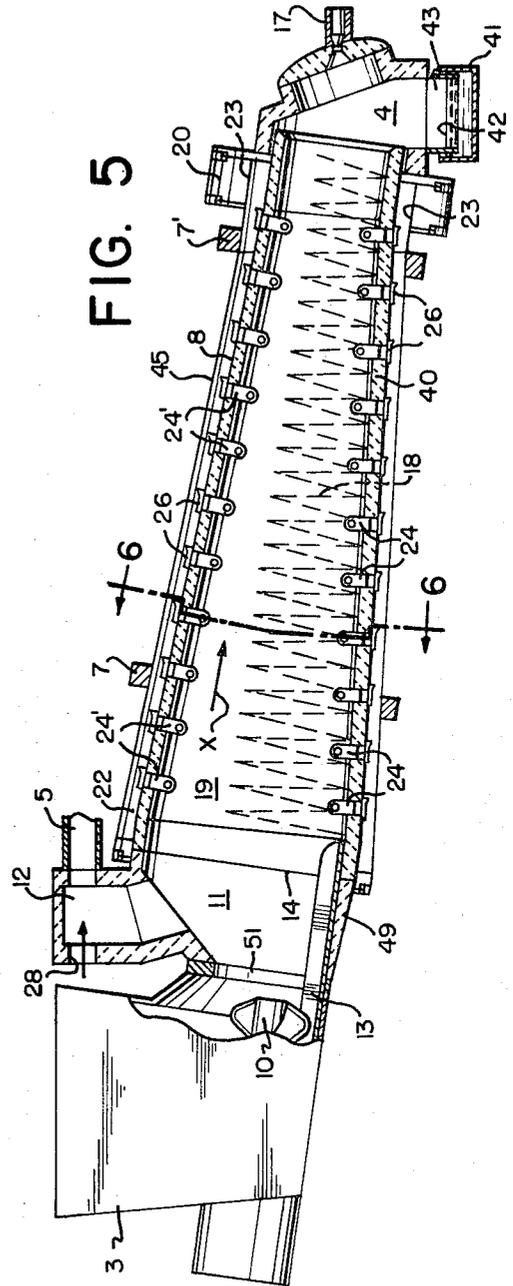


FIG. 5

INVENTOR.
LOUIS MARIE ROUSSEAU

BY

Zeb Heim

AGENT

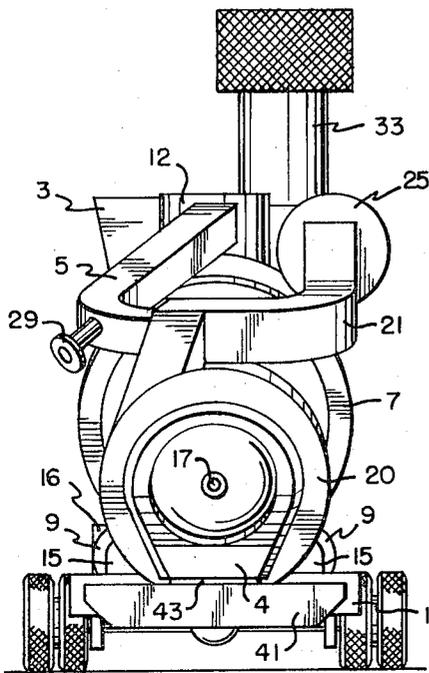


FIG. 4

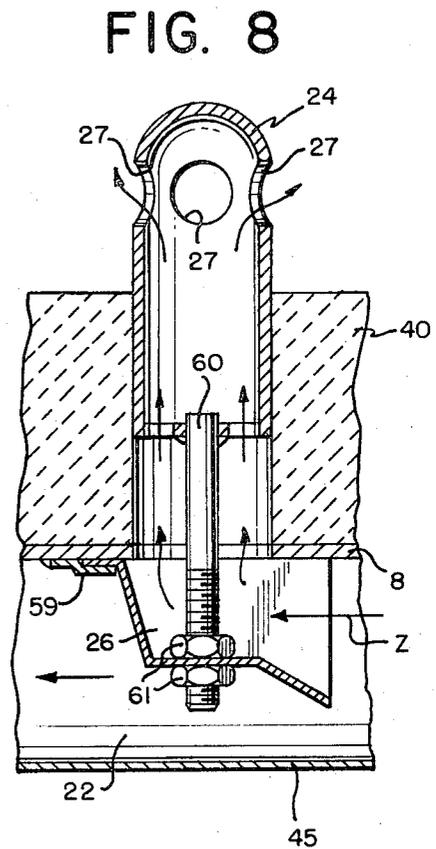


FIG. 8

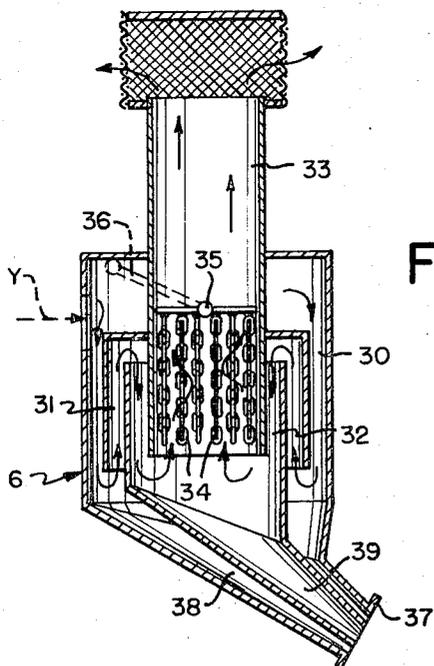


FIG. 9

INVENTOR.
LOUIS MARIE ROUSSEAU

BY *Jab Hein*

AGENT

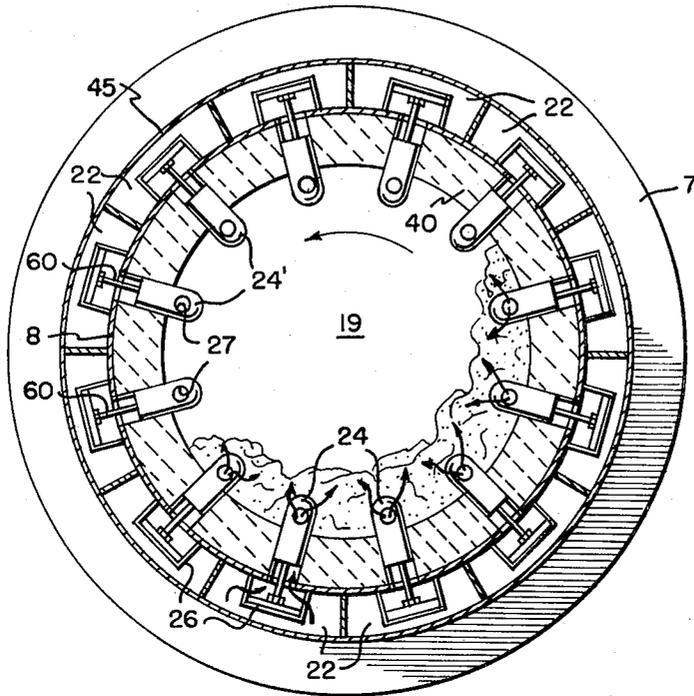


FIG. 6

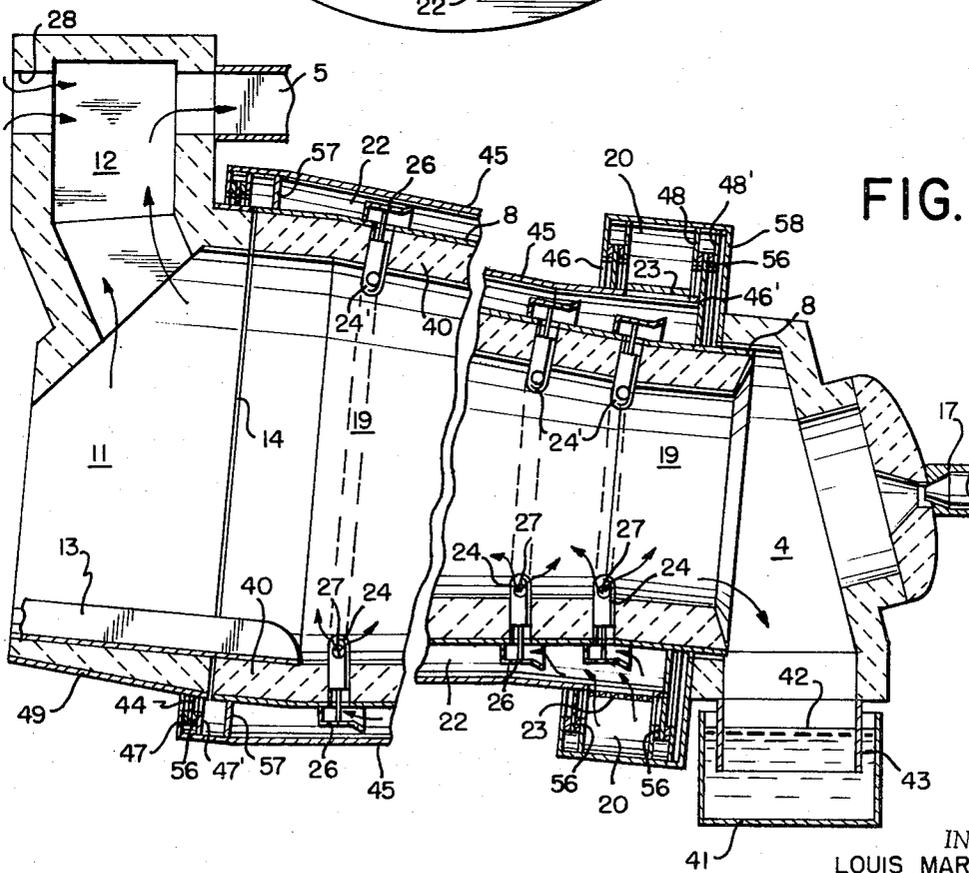


FIG. 7

INVENTOR,
LOUIS MARIE ROUSSEAU

BY

Jobheim

AGENT

MOBILE REFUSE INCINERATOR

The invention relates to improvements in mobile devices and equipments for the incineration of household and industrial refuse.

It becomes more and more difficult to find grounds where to dump household and industrial refuse and residual mud from town and factory waste water and the like. The more or less appropriate places suitable for this purpose are rarer and rarer, and the number of miles separating the points of collection necessitate the use of vehicles which must cover distances which increase the price of an operation already sufficiently expensive. This problem of useless runs is the same when fixed existing incineration works are foreseen. But the problem must be studied with great attention when several grouped localities needing such an installation are concerned.

Besides, certain sea-side or winter resorts only need an incinerator during some months. If the acquisition of an incinerator is already a heavy expense for a municipality which within a score has the same number of inhabitants every month all the year round, the same effort cannot be demanded from those resorts as the cost of the destruction of their refuse would be multiplied by 3 or 4.

It is therefore urgently necessary to solve these problems. A solution which from the economical point of view allows a reasonable investment and a reduced running cost; a solution which from technical and practical points of view leads to a satisfactory result, that is, the mobility of the incinerator as a simple trailer and a low proportion of unburnt material.

In present installations the cylindrical shape of the furnace requires that it must be inclined at a certain angle to secure the displacement of the refuse products. This inclination has the inconvenience of necessitating the use of a buttress of considerable size to resist the thrust of the weight of the furnace at this angle.

On the other hand the cylindrical construction gives a uniform mass and volume. The weight entails necessarily a high cost of the structure. While the volume of the combustion chamber in the incinerator is normal in the refuse input end, it becomes too important as the products move and become incinerated. This too large a space above the refuse has for result to expand the gas which allows only a feeble turbulence (hence a nuisance for combustion) when an important quantity of calories is needed for the rise in temperature (900° to 1,100° C) in the furnace, and the maintaining of this temperature during its use.

The refuse whose calorific value lessens as the burning takes place is incapable of supplying the calories. The continuous use of a burner is then necessary and this does not enhance the reduction of the cost of the operation.

The present invention concerns improvements to mobile rotary-drum furnaces, usually called incinerators, dealing with thermal treatment of household and industrial refuse and mud from town and factory waste water and the like. The object of this invention is to render mobile an incineration equipment in order that with the same installation refuse may be incinerated on the dumping grounds, or to treat on the spot mud of a filtering station, to name just a few examples of useful application.

According to important features of the present invention, these improvements are characterized by:

1. The construction of an original furnace allowing its mounting on a trailer or semi-trailer whose dimensions correspond with international traffic regulations.
2. The conical shape of the furnace as just described, ensuring a regular travel of the refuse products incinerated, towards an ash-bin, which allows:
 - a. the processing of different refuse products;
 - b. the use of a furnace whose volume decreases as the products are burnt;
 - c. the presence of an additional controllable air inlet becoming lesser as the products are reduced;
 - d. the concentration of strong air turbulence over the refuse;
 - e. the needing of less calories for the rise in temperature on starting, and the keeping of this temperature during operation;
 - f. the keeping of the lower part horizontal or nearly so which position needs no important buttress for supporting the furnace, and also allowing the passage of mud;
 - g. the considerable reduction of the diameter of the run-way;
 - h. the needing of less concrete and other materials for the construction;
 - i. the use of a reduced-diameter air distributor;
 - j. the having of a rotary gasket to insure tightness on the ash-bin side, and to have the latter of smaller size;
 - k. the reduction of the number of vents; and
 - l. the rendering of refractory concrete stronger due to the conical shape of the furnace.
3. The possibility of the use of removable, interchangeable and adjustable vents which permit:
 - a. The penetration of the necessary oxygen for combustion in the heart of the mass of refuse to be burnt. These protruding vents are equally of use for the moving and mixing of the refuse as it is tumbled inside the rotating conical furnace portion.
 - b. Their being fed by fresh air by means of conduits placed on the outside of the furnace and thus allowing to lower the external temperature of the same.
4. The use of the chassis of the trailer as a support for the furnace and the accessories.

Other objects, features and many of the attendant advantages of the invention will be readily appreciated as the same becomes better understood by reference to the following detailed description, when considered with the accompanying drawings, wherein

FIG. 1 is a longitudinal side view of a preferred, exemplary embodiment of the inventive mobile refuse incinerator;

FIG. 2 is a top plan view of the device shown in FIG. 1;

FIG. 3 is a longitudinal side view of the device as seen from the side opposite to that of FIG. 1;

FIG. 4 is an end elevational view of the device as viewed from the right-hand end in FIG. 1 of the drawings;

FIG. 5 is a somewhat schematic vertical lengthwise section of the rotary furnace portion in the device;

FIG. 6 is a transversal cross-sectional view of the furnace portion along line 6 — 6 of FIG. 5;

FIG. 7 is a vertical lengthwise sectional view, with parts broken away, on an enlarged scale as compared to the right-hand end of FIG. 5;

FIG. 8 is an enlarged vertical sectional view of a portion of FIG. 7, for better illustration of one of the vents; and

FIG. 9 is a similarly enlarged vertical sectional view of a cyclone and chimney forming part of the device, along line 9 — 9 of FIG. 2.

In the somewhat schematic drawings, and particularly in FIGS. 1 to 6 thereof, numeral 1 identifies a chassis or frame of a semi-trailer used for mounting the illustrated preferred embodiment of the inventive mobile refuse incinerator; 2 generally designates a furnace; 3 is a hopper for loading the refuse to be incinerated; 4 is an ash-bin; 5 is a gas duct or conduit; and 6 is a burnt-gas decantation cyclone (shown in detail in FIG. 9).

Two run-ways 7, 7' are fixed on an inner jacket 8 of a conical rotary drum 19, in the position shown in FIG. 1. An outer jacket 45 will be described somewhat later. These two run-ways rest on four rollers 9 fixed on frame 1 at point 15. The rollers are driven by a mechanical device 16 which is conventional. Rollers 9 give cone or drum 19 a rotary movement about its own center by the intermediary of run-ways 7, 7'.

Hopper 3 may be fed by a crane, a loader on wheels or by any other suitable means, and it includes in its lower part a screw conveyor 10 which introduces the refuse to be incinerated in a post-combustion chamber 11 (see the enlarged FIG. 5).

Chamber 11 has in its upper part a gas evacuating conduit or opening 12 for exhausting the produced gas. In its lower part a tray 13 is provided to remove or pass rubbish beyond a joint 14 shown between the fixed part of the furnace 2, namely chamber 11, and its mobile or rotary part, that is cone or drum 19. The passage of refuse in chamber 11 considerably reduces the percentage of moisture.

Simultaneously with this the drying refuse is ignited by a burner 17 at the rear end of the furnace (see right-hand ends of FIGS. 1 to 3, 5 and 7). From drum 19 burnt gases reach chamber 11 in a direction opposite to that of the refuse, due to the pressure reduction caused by a smoke extractor 25. This post-combustion zone being submitted to very high temperatures, the gas is cleaned of its still combustible elements. They are evacuated by conduit 12 in gas duct 5.

The refuse matter to be burnt, introduced by tray 13 (FIG. 5) into conical rotary drum 19, moves in the direction of arrow X as an effect of a mechanism 18, shown in broken lines, and leaves the furnace at its rear end, and falls in the form of ashes in a water vessel or basin 41, by way of ash-bin 4.

Combustion air which has been previously warmed up and fed by a blower 50 enters an air distributor 20 (FIGS. 1 to 4) by an air passage or conduit 21 which partly surrounds gas duct 5 in a heat-exchange relationship. The air is supplied to the interior of distributing ducts 22 (FIGS. 5 to 8), enclosed between inner jacket 8 and ventilating ducts 45 constituting the earlier-mentioned outer jacket 45, by means of adjustable vanes 23. Through these ducts air for combustion, caught by cowls 26, reaches lower vents 24. It penetrates the

center of the refuse to be incinerated by the way of openings 27 at the inner ends of vents 24, as shown in FIGS. 6 and 8. Vanes 23 have openings which permit only the vents 24 to receive air for combustion which reach into the refuse to be burnt.

Top vents 24', provided in a manner similar to the lower vents 24, may equally receive combustion air if increased combustion so requires. The flow of fresh air through a refractory body 40 surrounding conical rotary drum 19 permits its temperature regulation.

As vents 24 protrude into the inner space of drum 19, they contribute to the intermixing of the refuse which is tumbled or rolled around in the furnace as it is rotated (best seen in FIG. 6). The combustion air is introduced through terminal openings 27 right into the refuse mass as it is being tumbled.

It should be noted that the same burner 17 is used in order to incinerate refuse of low calorific value which has already been employed for starting the furnace fire.

Conduit 12 has in its upper part an opening 28 (FIGS. 1 to 4 and 7) intended to supply fresh air to cool the gases emanating from furnace 2. This mixture sucked in by smoke extractor 25 ensures, during its passage in the interior of conduit 21, the warming of air intended for combustion. Before reaching extractor 25 the length of the conduit 21 through which the air has to travel permits good heat exchange with duct 5, thus contributing to further lowering its temperature so as not to impair the efficiency of the smoke extractor. Besides, a first filtering of gas takes place on the walls of conduit 5, and an opening 29 permits the purge of any slime which might be produced (see FIGS. 1, 2 and 4).

Gas (see arrow Y) blown back by extractor 25 into cyclone 6 (FIG. 9) must pass baffles 30, 31, 32 before reaching a chimney 33. This chimney includes in its lower part a curtain 34 of hanging chains, the curtain assisting in a final cleaning of the gas. This curtain is mounted on a shaft 35 so that it can freely swing, which permits to shake the same by means of a lever 36 in order to get rid of any dust and deposit which has accumulated. A discharge gate 37 (see FIGS. 2 and 9) ensures the evacuation of ashes falling into cones 38, 39.

The ashes leaving drum 19 fall in ash-bin 4 and then in water basin 41 (FIGS. 5, 7). The ashes are then cooled, and the water level 42 obtained by an air lock 43 ensures that the air-tightness of the furnace is maintained since air might impair the proper adjustment of the combustion. The removal or evacuation of ashes may be continuous or intermittent, depending on the size of the device.

Air-tightness of the revolving parts of furnace 2 (namely drum 19 and ducts 45) with respect to the stationary parts, namely chamber portion 11 and ash-bin 4, is ensured by gaskets as shown in FIGS. 5 and 7. A gasket 44 is fixed to a jacket 49 of chamber 11, passing between two rotary soft flanges 47, 47' while these latter are fixed to ventilation ducts or outer jacket 45. A circular element 57 joins jackets 45 and 8 (see FIG. 7) to close ducts 22. A rotary gasket 46 fixed to ducts 45 and a gasket 46', also fixed to ducts 45, as well as jacket 8 pass between stationary soft flanges 48, 48', fixed to air distributor 20, the latter being in turn fixed to ash-bin 4 by means of a member 58. Flanges 47, 47',

48, 48' are fitted at their edges with copper bands 56 rubbing lightly on gaskets 44, 46, 46'. This continuous contact ensures air-tightness

Post-combustion chamber 11 is isolated from hopper 3 by a circular jacket 51 (FIG. 5) in which water circulates. The water avoids that a high temperature be transmitted to hopper 3.

In FIG. 8 numeral 60 indicates a rod welded or otherwise secured at one end to vent 24 and having the other end threaded. Two nuts 61 secure each vent 24 and cowl 26 to jacket 8. A lug 59 welded to jacket 8 holds vents 24 and cowls 26. Arrow Z shows the flow of combustion air.

In FIGS. 1 to 3, numeral 52 identifies a fuel tank, at 53 there are water tanks and 54 is a generating set supplying electric current, necessary for the operation of the mobile refuse incinerator so as to render it completely self-contained. Hydraulic struts 55 ensure the stability of the equipment and assist in providing the necessary inclination.

Those skilled in the art will understand that the preferred embodiment of the inventive mobile refuse incinerator permits, for the first time, the incineration of rubbish or refuse for example by grouped town syndicates or by large towns where dumping grounds exist, and the reduction of mileage in unloading the collecting vehicles. Due to this mobility the smallest boroughs can now get rid of their refuse by incineration according to hygienic rules, by making use of the inventive device.

It should be understood, of course, that the foregoing disclosure relates only to a preferred, exemplary embodiment of the invention, and that it is intended to cover all changes and modifications of the example described which do not constitute departures from the spirit and scope of the invention.

What I claim is:

1. A mobile refuse incinerator comprising, in combination, a chassis, a furnace supported by said chassis and including a stationary chamber portion and an axially aligned, rotatable, conical drum portion narrower at its rear end which is remote from said chamber portion, thereby providing an inner volume in said chamber portion which decreases substantially at the same rate as the refuse is being incinerated therein and as its calorific value diminishes, at least one jacket provided along and around said drum portion, vents disposed about the periphery of said drum portion for feeding combustion air into said furnace, said vents protruding into the refuse being incinerated, a circular element around said drum portion for receiving combustion air through said at least one jacket, and a burner at the rear end of said furnace for igniting and reducing the refuse, said vents having air outlets near their innermost ends, for feeding the combustion air into the mass of refuse as it is tumbled inside said drum portion during the rotation of the latter, thereby effecting thorough reduction and incineration of the refuse, while the protruding vent portions contribute to the intermixing of the tumbled refuse.

2. The mobile refuse incinerator as defined in claim 1, further comprising at least two rollers supported by said chassis and adapted to rotate said drum portion, two fun-ways fixed to the latter, intermediate the same and said rollers, and drive means for rotating said drum portion by way of said rollers and said run-ways.

3. The mobile refuse incinerator as defined in claim 1, further comprising a fuel tank, water tanks, and a generating set on said chassis, the latter for supplying electric current to the incinerator.

4. The mobile refuse incinerator as defined in claim 1, further comprising struts at least under the forward portion of said chassis to insure stability, and being adapted to provide inclination for said furnace if necessary.

5. The mobile refuse incinerator as defined in claim 1, further comprising a semi-trailer on which the incinerator is mounted by way of said chassis.

6. A mobile refuse incinerator comprising, in combination, a chassis, a furnace supported by said chassis and including a stationary chamber portion and an axially aligned rotatable drum portion, at least one jacket provided along and around said drum portion, vents disposed about the periphery of said drum portion for feeding combustion air into said furnace, a circular element around said drum portion for receiving combustion air through said at least one jacket, and a burner at the rear end of said furnace for igniting and reducing the refuse, wherein said drum portion is conical and becomes narrower toward said rear end of the furnace, remote from said chamber portion, and further comprising a mechanism for advancing the refuse from said chamber into said drum portion, and a stationary ash-bin for collecting ashes from said rear end of the furnace, including a water basin below said ash-bin, for cooling the ashes, said burner being disposed substantially in the center of said ash-bin.

7. The mobile refuse incinerator as defined in claim 6, wherein said at least one jacket includes an inner and an outer jacket, further comprising gaskets including fixed and rotary disks disposed between at least two soft rotary and stationary flanges having at their edges metal bands in light frictional engagement with said disks, in the upper part of said furnace said fixed disks being mounted on said chamber portion and passing between said rotary flanges, secured to said outer jacket, while in the lower part of said furnace said rotary disks are fixed on said drum portion between said stationary flanges, said gaskets being provided for securing air-tightness between said rotatable drum portion and the stationary parts, namely said chamber portion and said ash-bin.

8. A mobile refuse incinerator comprising, in combination, a chassis, a furnace supported by said chassis and including a stationary chamber portion and an axially aligned rotatable drum portion, at least one jacket provided along and around said drum portion, vents disposed about the periphery of said drum portion for feeding combustion air into said furnace, a circular element around said drum portion for receiving combustion air through said at least one jacket, a burner at the rear end of said furnace for igniting and reducing the refuse, and a decantation cyclone for burnt gases, equipped with baffles and having on its top a chimney fitted with means for cleaning the escaping gases, the latter including in the lower part of said cyclone a chain curtain, for catching dust and other deposits, said curtain being mounted on a swingable shaft operable by a lever for shaking off the dust, said cyclone having at its base two substantially symmetrical cones closed by a gate, for respectively collecting and discharging the dust.

9. A mobile refuse incinerator comprising, in combination, a chassis, a furnace supported by said chassis and including a stationary chamber portion and an axially aligned rotatable drum portion, at least one jacket provided along and around said drum portion, vents disposed about the periphery of said drum portion for feeding combustion air into said furnace, a circular element around said drum portion for receiving combustion air through said at least one jacket, a burner at the rear end of said furnace for igniting and reducing the refuse, a hopper associated with said chamber portion, for loading the refuse to be incinerated, and a worm screw mechanism in the lower part of said hopper, for moving the refuse into said chamber portion, wherein said drum portion is surrounded with a refractory wall through which pass said vents, the latter being removable, controllable from outside and protruding in the interior of said furnace in order to mix the refuse, further comprising cowls fitted to said vents, distributing ducts in the region of said at least one jacket for catching the combustion air, said cowls protruding into said distributing ducts, an annular distributor which conveys the combustion air, adjustable shutters forming part of said distributor, and ventilla-

tion ducts constituting said at least one jacket and associated with said shutters, only the vents which reach into the refuse to be incinerated receiving the combustion air.

10. The mobile refuse incinerator as defined in claim 9, further comprising a tray in the lower part of said chamber portion for the refuse from said stationary chamber portion into said rotatable drum portion, a gas evacuating conduit in the top part of said chamber portion, said conduit having an opening for the supply of fresh air, to cool the gases emanating from said furnace, a smoke extractor connected to said gas conduit, a gas duct intermediate said gas conduit and said smoke extractor, passing from said chamber portion to said distributor, a combustion air conduit, leading to said rear end of the furnace, a blower to force the air, warmed up in the region of said hopper, into said air conduit, which latter is in heat exchange relationship with said gas duct, the latter passing at least partly therein, and an annular water jacket providing heat insulation between said chamber portion and said hopper.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,682,117

Dated August 8, 1972

Inventor~~(s)~~ L. M. Rousseau

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 5, third line from end (claim 2, line 4), change "fun-ways" to -- run-ways --; and

column 8, line 7 (claim 10, line 3), after "portion" change "for" to -- for guiding --.

Signed and sealed this 19th day of December 1972.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patent