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Dingwell

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[54] **INCINERATORS**

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[52] **U.S. Cl.** ..... **110/7 S,** 431/163, 431/278, 431/353

[51] **Int. Cl.** **F23g 7/00**

[58] **Field of Search** ..... 110/7 R, 7 S, 8 R, 8 C; 431/163, 278, 353

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Primary Examiner—Kenneth W. Sprague

[57] **ABSTRACT**

An incinerator is disclosed consisting of at least one oil burner having its fuel composed at least in part of waste oil and atomized by steam. The burner is axially positioned in an outwardly flared, elongated combustion chamber through which a large volume of air is eddied to cooperate with the steam in vaporizing the oil. Non-liquid wet wastes are conveyed through a dryer to the combustion chamber via a collector. The combustion chamber includes an auxiliary chamber provided with an oil burner and opening into a refuse collecting chamber having a vertical stack equipped with after burners. Other types of waste may also be discharged into the auxiliary combustion chamber. The disclosed embodiment of the invention also includes a battery of such burners with their combustion chambers in communication with a plenum in the air delivery system.

11 Claims, 11 Drawing Figures

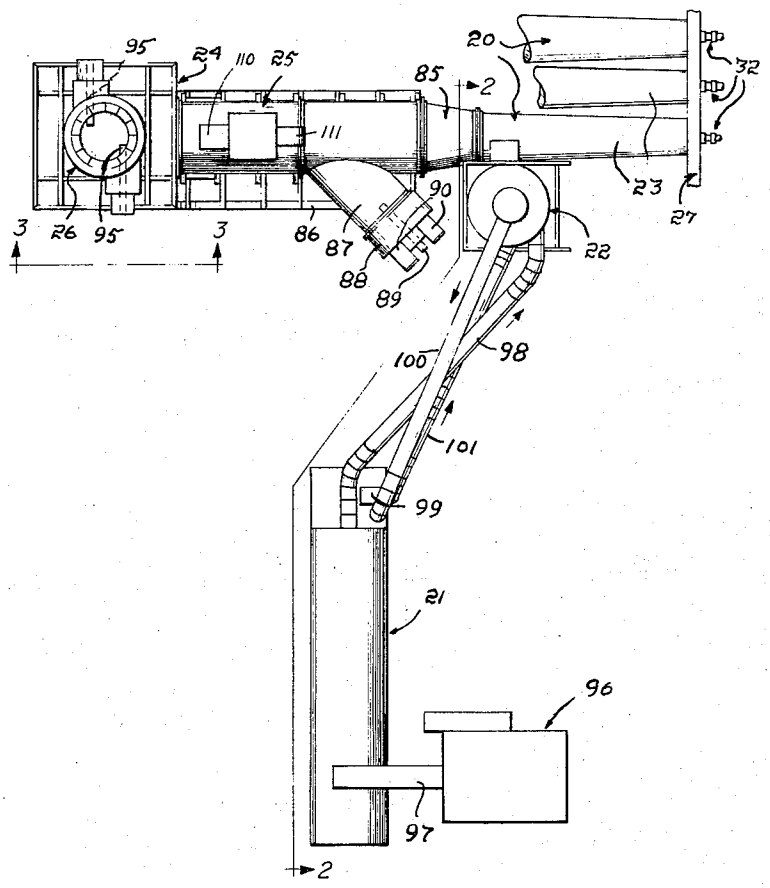
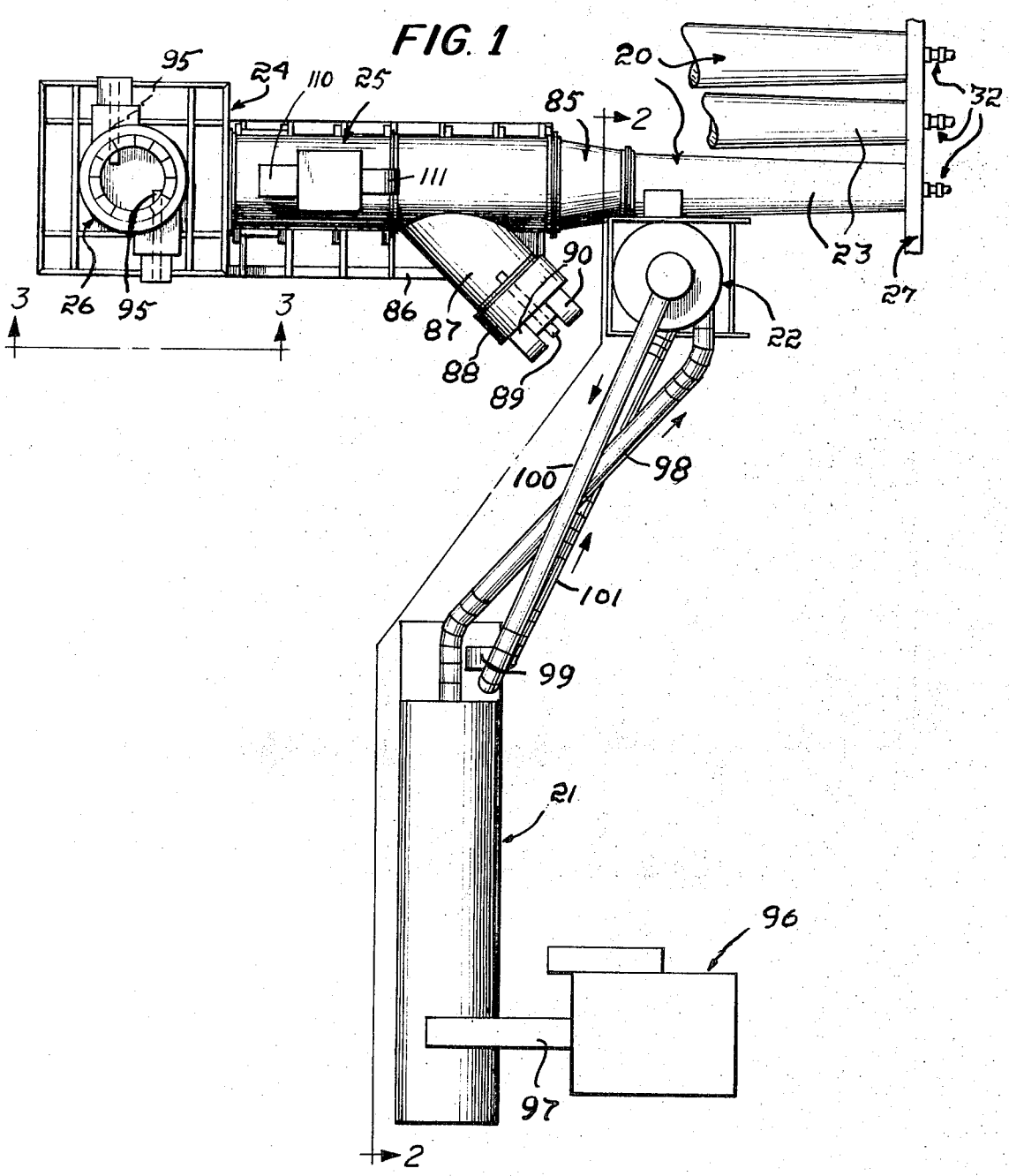


FIG. 1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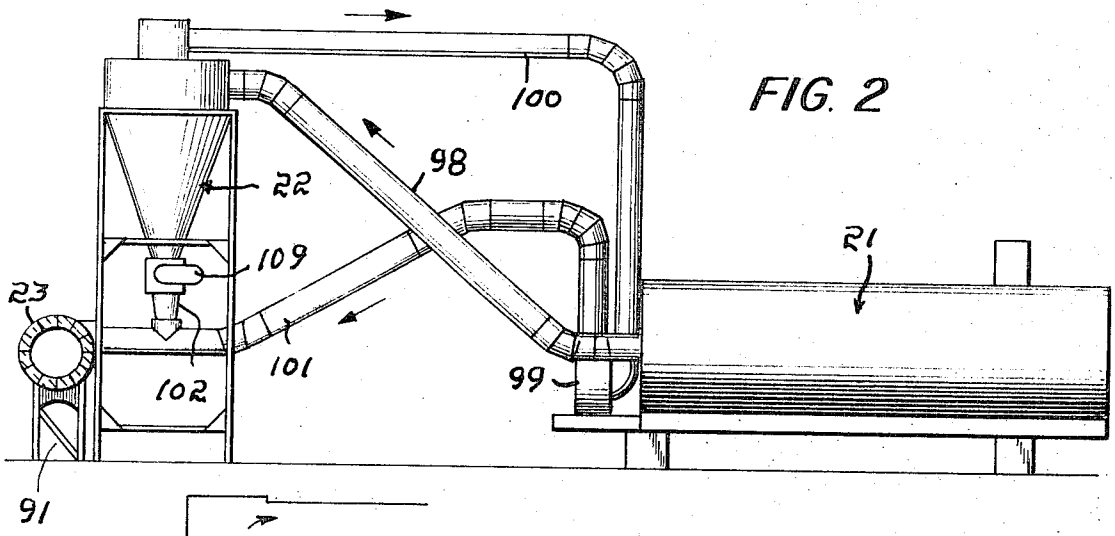


FIG. 2

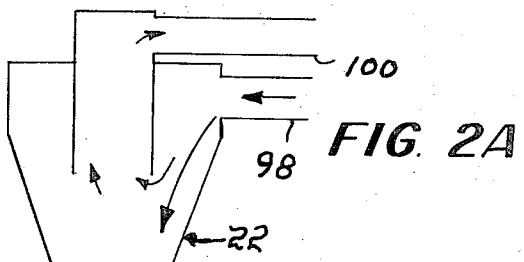


FIG. 2A

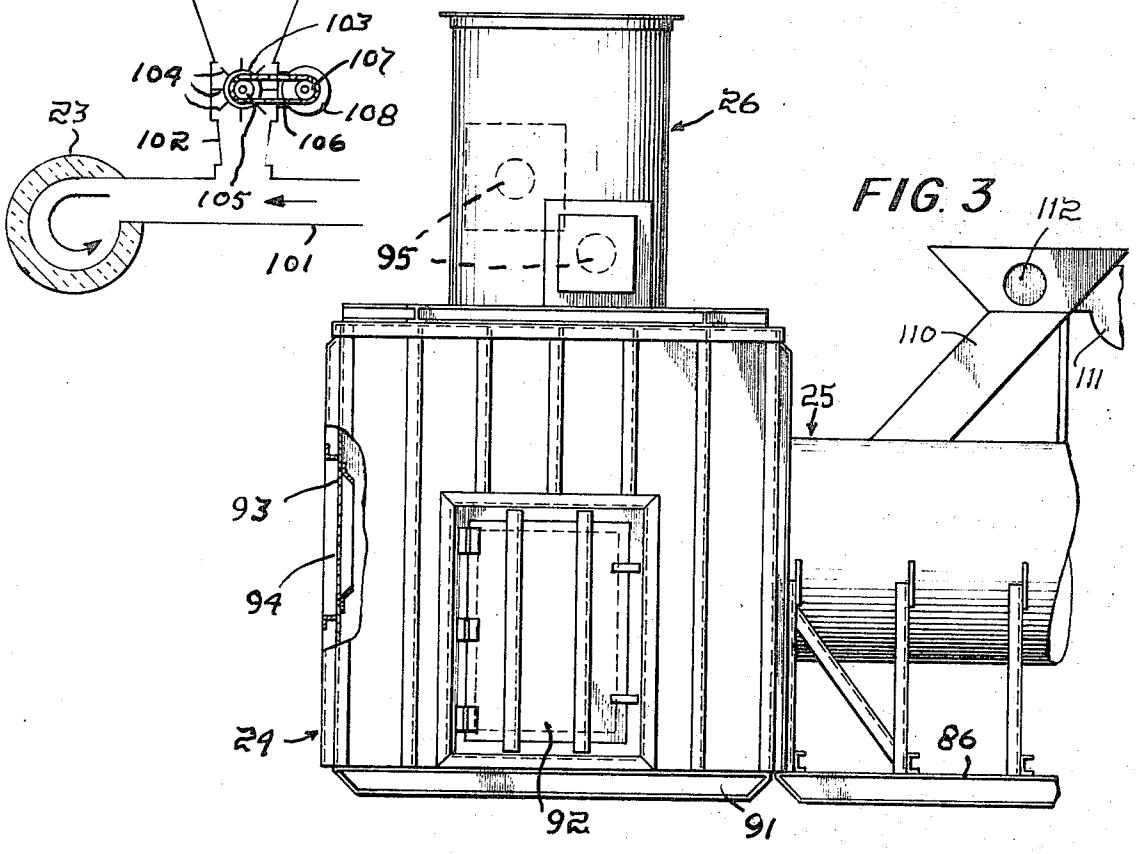


FIG. 3

FIG. 4

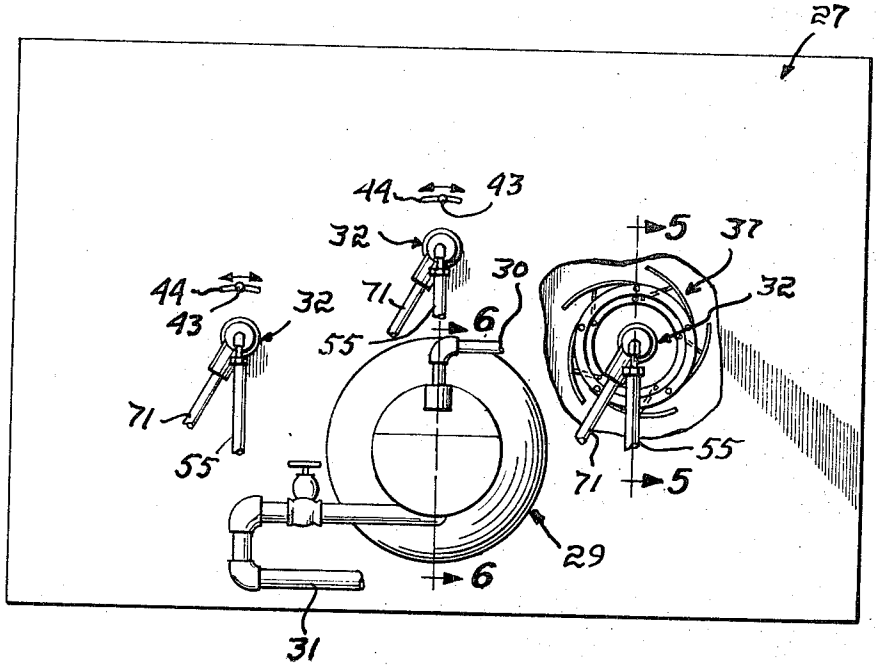


FIG. 5

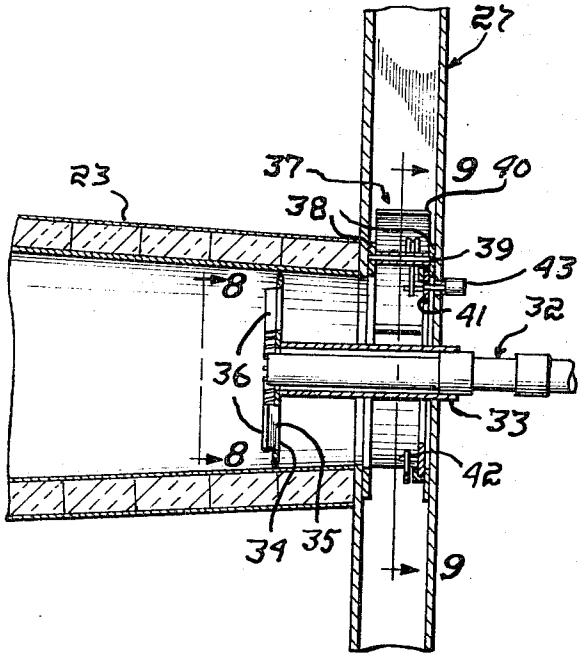


FIG. 6

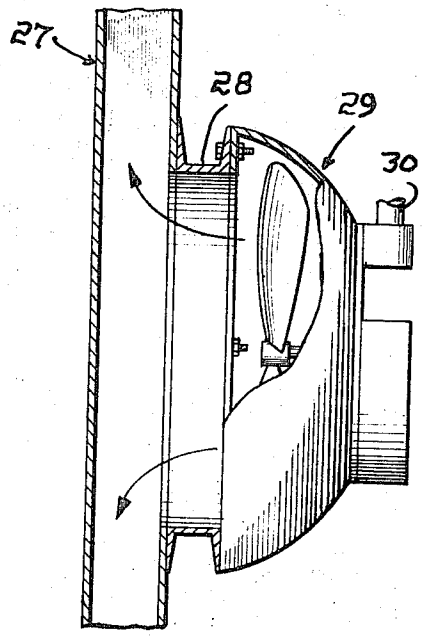
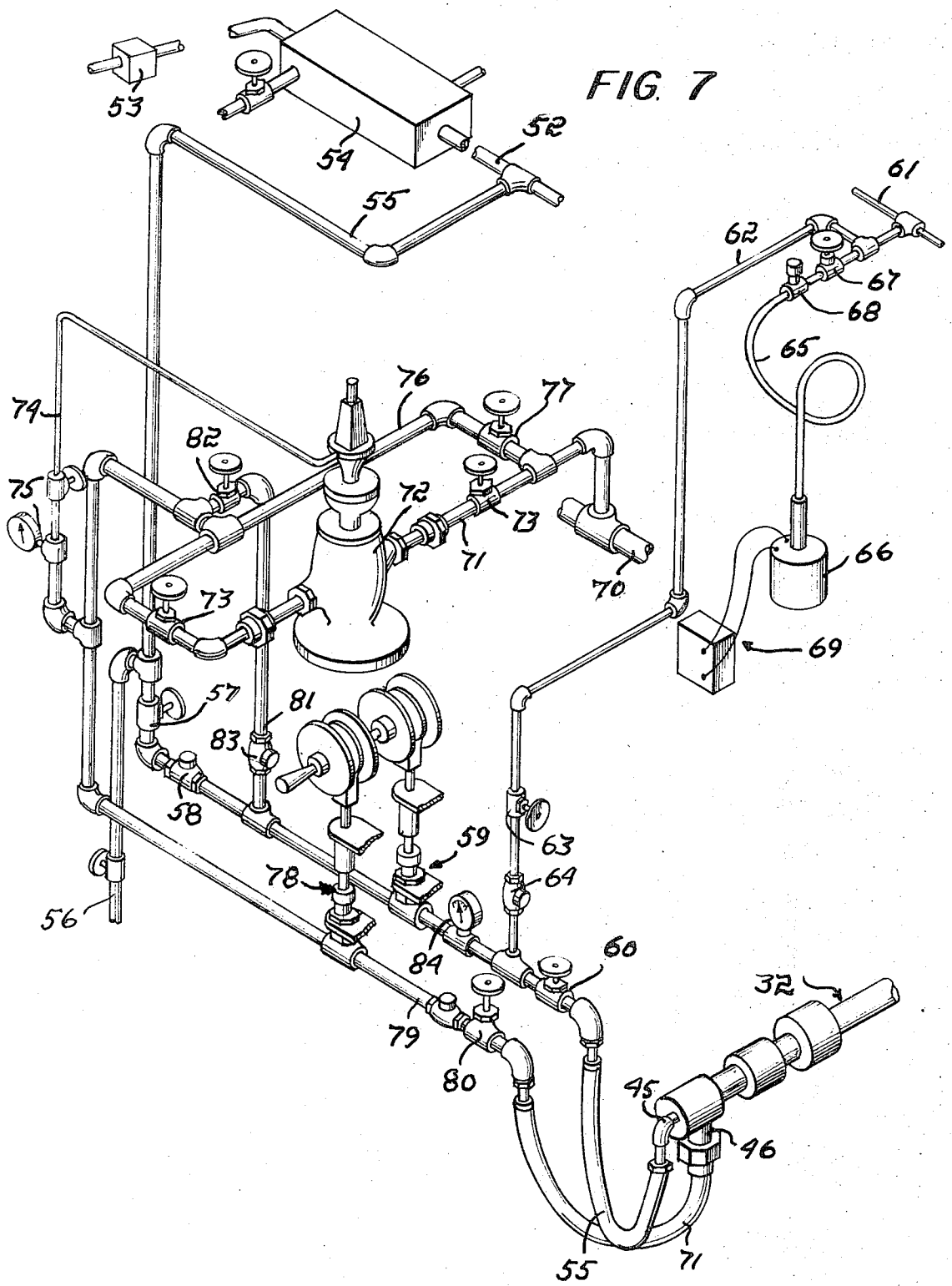


FIG. 7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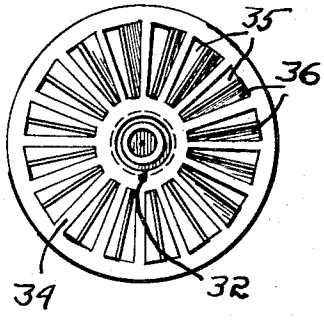

FIG. 8

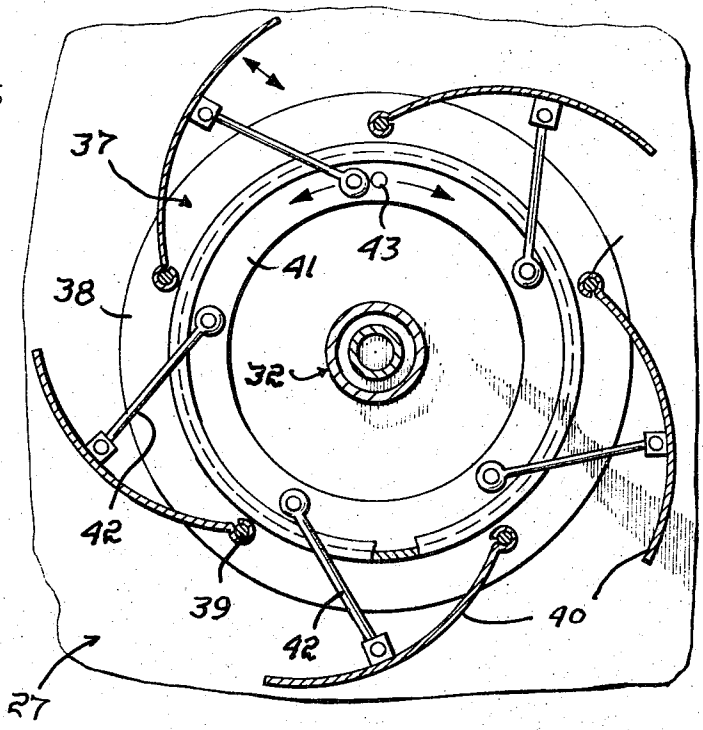

FIG. 9

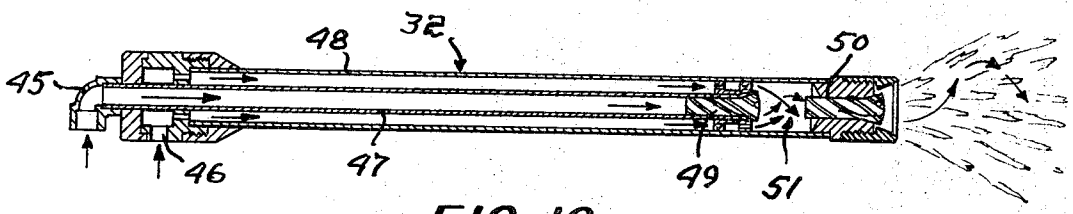

FIG. 10

INCINERATORS

BACKGROUND OF THE INVENTION

While almost everyone is well aware that there is a wide range of pollution problems, many specific disposal problems are less commonly appreciated such as those relating to waste oils, oily wastes, oil-carrying and oil-saturated materials, and various other liquids, solids, and semi-solids that must or can be incinerated and materials that even if they cannot be completely burned can be broken down by heat into forms more suitable for disposal.

One example of such disposal problems is that represented by used crankcase oil of which substantial volumes regularly accummulate at garages and service stations and for which there is presently no market except in those few areas where rerefineries exist. Collection services are usually available but the disposition of such oil presents problems since, if conventionally burned, an oily smoke results.

The dangers of oil spills are featured as are the difficulty of effecting "clean ups" after they occur but a troublesome consequence is the disposal of oil that cannot be reclaimed, oil-saturated hay or other materials used to absorb the oil on the shores, and oil-coated seaweed.

In addition, there are many other wastes that, at present cannot be processed without becoming a pollution factor in one way or another. Examples of such wastes are septic tank cleanouts and manures that cannot be readily converted to fertilizers that are suitable for use, oil tank flushings, and out-dated medicaments, some of which cannot be burned but are examples of materials that can be so broken down or processed by heat that they can be safely disposed of with other non-combustible residues.

THE PRESENT INVENTION

A principal objective of the present invention is to provide a primary incinerator usable by itself to incinerate waste oils or in combination with and as a means for at least partially incinerating waste materials delivered into its combustion chamber from a dryer or other source.

Another principal objective of the invention is to provide an incinerator plant consisting of a primary incinerator in communication with a waste collector having a stack. The primary incinerator provides in its combustion chamber a spinning gas stream and the plant includes means to deliver into the combustion chamber materials to be incinerated and a specific objective is to provide that such materials be introduced into the combustion chamber as a stream to cause or assist the spinning of the hot gas stream therein and supplementing the air supply.

A further objective of the invention is to provide the combustion chamber with an auxiliary oil burner and to employ an auxiliary combustion chamber between it and the waste collector.

Yet another objective of the invention is to incorporate in the stack of the collector a pair of after-burners arranged and disposed to cause the spinning of the exhaust stream.

Another objective of the invention is to provide an incinerator having a combustion chamber into which an oil burner extends, the oil burner of a type in which

the fuel is discharged as a spinning, steam-atomized stream enveloped at its muzzle end by a spinning, oil-atomizing air stream.

Yet another principal objective of the invention is to provide a waste oil incinerator consisting of an oil burner of a type having its fuel atomized by steam and air and axially located within an outwardly and forwardly tapering combustion chamber through which a substantial but adjustable air stream is established by a blower. The fuel supply includes both waste oil and commercial grade fuel oil sources, each provided with adjustable controls as is the steam source. Both the atomized fuel and the air stream are eddied or spun, desirably both in the same direction.

Another objective of the invention is to provide a battery of such incinerators having a common plenum in which there is a damper control for regulating the air supply for each incinerator or for isolating that incinerator from the plenum.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the invention is illustrated by the accompanying drawings in which

FIG. **1** is a somewhat schematic plan view of an incinerator in accordance with the invention;

FIG. **2** is a section taken approximately along the indicated line **2—2** of FIG. **1**;

FIG. **2A** is a somewhat shcematic view of the collector;

FIG. **3** is a fragmentary view, on an increase in scale, taken approximately along the indicated line **3—3** of FIG. **1**;

FIG. **4** is a view of the inner wall of the plenum with the oil and steam conduits and part of that wall broken away;

FIG. **5** is a section, on an increase in scale, taken approximately along the indicated line **5—5** of FIG. **4**;

FIG. **6** is a section, also on an increase in scale, taken approximately along the indicated line **6—6** of FIG. **4**;

FIG. **7** is a somewhat schematic view of the oil and steam delivery system limited to that of but one of the primary incinerators to simplify the drawings;

FIG. **8** is a view taken approximately along the indicated line **8—8** of FIG. **5**;

FIG. **9** is a section taken approximately along the indicated line **9—9** of FIG. **5**; and

FIG. **10** is a longitudinal section of a commercially available oil burner that has proved effective in use.

THE PREFERRED EMBODIMENT OF THE INVENTION

The preferred embodiment of an incinerator plant in accordance with the invention consists of a battery of primary incinerators generally indicated at **20,** a dryer unit generally indicated at **21** feeding a collector, generally indicated at **22** and from which dried material is discharged into the combustion chamber **23** of one of the incinerators **20** which chamber is placed in communication with a refuse collector **24** by an auxiliary combustion chamber **25.** The refuse collector **24** has a stack **26.** The primary and auxiliary combustion chambers, the refuse collector and its stack are each conventionally lined with fire brick.

Turning first to the battery of primary incinerators **20,** see particularly FIGS. **4 – 9,** a plenum **27** that is or may be part of a wall of a control room, not shown,

which, in practice houses a boiler providing a steam supply in the neighborhood of one hundred pounds gauge pressure. The inner wall of the plenum has an annular flange **28** for the support of a blower **29** and providing a port into which its discharge port opens. The blower **29** is shown as of a turbine type and driven by steam with a steam infeed pipe **30** and valve controlled exhaust **31.** The blower port is located below but spaced substantially equally from each of three identical, forwardly and outwardly tapering combustion chambers **23** shown as of circular cross section, each having an oil burner, generally indicated at **32** and shown in detail in FIG. **10.** Each oil burner **32** is removably held axially of its combustion chamber **23** by a tubular receiver **33** that is supported at its rear end by the rear wall of the plenum **27** and at its front end by a disc **34** fitting the combustion chamber **23** and providing a transverse partition. The muzzle of each burner **32** is exposed forwardly of the disc **34** and each disc has radial ports **35** provided with vanes **36** so inclined as to impart a rotary or spinning motion to the air stream passing through it, see FIGS. **5** and **8.**

Each oil burner **32** has, within the plenum **27,** an encircling damper assembly, generally indicated at **37.** As may best be seen in FIGS. **5** and **9,** each damper assembly **37** has annular supports **38** mounted on the interior surfaces of the plenum walls interconnected by rods **39,** each hingedly supporting an arcuate vane **40.** The vanes **39, 40** are so dimensioned that in their closed position, each rests on the hinged end of the next adjacent vane to encircle an oil burner **32.** A rotatable ring **41** within the support **39** on the inner plenum wall has a series of arms **42** pivotably connected thereto, one arm for each vane and pivotally connected to the central portion of its inner surface. The ring **41** is provided with a shifter **43** extending through an arcuate slot **44** in the inner wall of the plenum and of such length that the shifter may be turned in one direction to swing the vanes **40** outwardly and in the other direction to draw them inwardly so that each combustion chamber **23** not only has a means for adjusting the volume of air supplied thereto by the blower **29** but also may be isolated from the plenum air in the event it is to be placed out of service.

Each oil burner **32** is shown as having an axial oil inlet **45** and, forward thereof, a steam inlet **46.** While any oil burner may be used in which steam is employed to ensure the correct atomization of the particular oil to be burned and capable of completely burning the fuel used therewith, those manufactured by the DeVoe Anti-Pollution Burner Corporation of Portland, Me., have proved satisfactory in use. See U.S. Pat. Nos. 3,176,921 and 3,556,408.

Each such burner, see FIG. **10,** has an axial inner tube **47** within and spaced from its outer barrel **48** with the inlet **45** in communication with the tube **47** which has a fuel spinner **49** of the same hand as the fuel spinner **50** at the muzzle of the barrel **48.** The steam inlet **46** is in communication with the space between the tube **47** and the barrel **48.** The steam inlet **46** is in communication with the space between the tube **47** and the barrel **48.** The space between the spinners **49** and **50** provides a chamber **51** into which both fuel and steam is delivered with the fuel being thereby subject to being atomized with the discharged fuel stream enveloped in a spinning air stream that also assists in so atomizing the oil that it is in prime condition for complete combustion.

While the burners **32** will of course function properly with commercial grades of fuel oil, one important feature of the invention is that various waste oils, crankcase oil, for one example, or salvaged oil even if not completely freed of water, for another example, may be efficiently and completely burned and usefully employed to incinerate other materials, for one example, or to generate steam, for another example.

To this end, see FIG. **7,** a main oil supply conduit **52** from a waste oil tank, not shown, and provided with filtering means **53** extends through a steam operated heater **54** enabling the oil to be preheated up to about 250°F depending on the viscosity of the fuel to be burned, such heating being particularly necessary with oils equivalent to Nos. 5, 6, and 7 fuel oils. The conduit **52** includes branch lines **55,** one for each burner **32** but with only one shown to simplify the drawings. Each branch fuel line **55** is connected to the oil inlet **45** of the appropriate one of the burners **32** and is provided with, in the order named, a valve-controlled line **56** to return oil to the source tank, a shut off valve **57,** a check valve **58,** a volume control valve **59** and a valve **60.**

An auxiliary oil conduit **61** from a tank, not shown, for a commercial grade of fuel oil is also provided with branch lines **62,** one for each burner **32** and connected to its branch line **55** and having a volume control valve **63** and a check valve **64.** Each branch line **62** is also provided with a line **65** to a pilot burner **66** for the associated oil burner **32** and provided with a manually operated valve **67** and a solenoid operated valve **68** for remote control purposes with the ignition circuit for the pilot burner indicated generally at **69.**

A steam line **70** has a branch line **71** for each burner **32** and connected to its steam inlet **46.** Each branch line **71** is provided with a reducing valve **72** located between shut-off valves **73** and a loop **74** for the pressure gauge **75.** There is also a conduit **76** bypassing the pressure reducing valve **71** and provided with a shut-off valve **77** that is opened should the valve **72** require servicing or replacement, the valves **73** then being closed. Each line **71** also has an adjustable valve **78,** a check valve **79** and a shut-off valve **80.** A branch line **81** normally closed by a valve **82** is in communication with the oil conduit **55** between the valves **58** and **59** for use in purging that line, when needed and the line **81** also has a check valve **83,** the several check valves preventing back flows in the lines in which they are incorporated.

From the above description of the main incinerators **20,** it will be seen that oil and steam volumes and proportions delivered to each burner **32** may be controlled as needed as can the amount of regular fuel oil and air required to provide complete combustion.

In practice, the operation of the primary incinerators **20** depends on the condition and quality of the waste oil to be delivered to their burners **32.** The preheater **54** has the important function of ensuring that the viscosity of the oil is within a range suitable for the burners. For that reason, each oil line **55** is provided with a temperature gauge **84** in order that the operator may set the valves to return oil to the tank through the line **56** if its viscosity is too high. Some waste oils can be burned cleanly by themselves while others may require

the addition of auxiliary fuel oil in varying proportions.

The complete combustion of the waste oils in a primary incinerator results from the atomization of the fuel by spinning streams and air streams in a combustion chamber that is outwardly and forwardly tapered with all components regulatable to ensure optimum combinations. While in practice, a taper for the combustion chambers **23** in the order of 30° has proved satisfactory, the taper angle may be varied substantially as can the cross sectional areas of the chambers **23** relative to their oil burners **32.** As the disclosed embodiment of the invention is concerned with complete combustion in a wide range of uses with fuel varying greatly in quality, the chambers **23** are dimensioned to insure that sufficient air may be delivered therethrough under any conditions as thermal efficiency is secondary to the objective that complete combustion be attained under even the most unfavorable conditions.

The auxiliary combustion chamber **25** is shown as cylindrical and of a diameter greater than that of the outlet end of the primary incinerator **20** of which it is a part, necessitating the use of an intermediate frustoconical transition section **85.** The auxiliary chamber **25** is mounted on a base **86** and has a laterally disposed cylindrical housing **87** whose axis defines an acute angle with that of the chamber **25** with respect to the hot gas flow therethrough. The housing **87** is closed by a detachable end section **88** axially supporting an auxiliary oil burner **89** and and blower **90.**

The waste or refuse box or chamber **25** has a base **91** and is provided with a cleanout door **92** in one side and a service door **93** in its outer end wall provided with an inspection port **94** in a position permitting the operator to see through the chamber **25** into the primary incinerator **20** with which it is in communication. The stack **26** of the refuse box **24** is of circular section and its wall supports a pair of oppositely disposed, vertically spaced, parallel oil burners **95** each substantially tangential with respect to the inner surface of the stack **26** thereby to effect a spinning of the exhaust gases. The burners **95** and the burner **89** may be of any type that completely burns its fuel. Desirably, they are of the type in which the atomized fuel is spun.

The incinerator plant as thus far detailed is adapted to receive in its primary incinerator **20** materials that are to be incinerated, or to be broken down by heat for disposal purposes. In the illustrative embodiment of the invention, such materials are sufficiently wet, semi-solid wastes or waste materials that are too wet to burn so that the incinerator requires the use of the dryer unit **21.** While the dryer **21** may be of other types, in practice, it is of a conventional drum type receiving wet materials from a load-receiving hopper by means of a conveyor, the hopper and conveyor are shown schematically in FIG. **1** and indicated at **96** and **97,** respectively.

The dried material is transferred into the upper end of the collector **22** through a conduit **98,** the transfer being effected by suction. To achieve that result, see FIGS. **2** and **2A,** the intake of a blower **99** is connected to an intake conduit **100** extending downwardly into the collector **22** well beyond the discharge end of the conduit **98.** The outlet of the blower **99** includes a conduit **101** with which the discharge **102** of the collector **22** is in communication. As may be seen in FIG. **2A,** the escape of dried material through the discharge **102** is controlled by a rotatable gate **103** provided with a series of radial blades **104.** The gate **103** has its shaft provided with a sprocket **105.** A drive chain **106** is trained about the sprocket **105** and the sprocket **107** on the shaft of a motor **108,** desirably of a variable speed type. The chain and sprockets are protected by a guard **109.** The conduit **101** opens into the combustion chamber **23** substantially tangentially with respect to its inner surface to convey the dried material in an air stream that assists the spinning of the flame and ensures the exposure of the dried material thereto. The above arrangement is also effective in withdrawing gases formed in the dryer **21** and delivering them into the chamber **23** where they burn. In the disclosed embodiment of the invention, no means are disclosed for separating the dried materials from the gases in the conduit **101.**

In order that materials can be incinerated without first passing through the dryer **21,** the auxiliary combustion chamber **25** supports a closed chute **110** opening into it and provided with a blower **111** and a port **112** through which materials may be delivered as by a conveyor, not shown. Under many conditions of use, it is not necessary to use the burners **95** as combustion is usually completed in the auxiliary chamber **25.**

From the foregoing it will be appreciated that incinerator means are provided capable of incinerating a wide range of materials even where waste oils are utilized in the primary burners with the waste oils constituting low cost fuel for uses of which incinerating is but one example.

I claim:

1. An incinerator for waste oils comprising an outwardly and forwardly tapering combustion chamber and an oil burner within the rear part of the chamber, means supporting said burner axially of the chamber, an oil supply in communication with the burner and including a valve controlled waste oil supply conduit and a valve controlled supply conduit for a commercial grade of fuel oil, and means to provide a spinning stream of atomized fuel at the muzzle of the burner, said means including separate steam and air delivery means both including adjustable controls and with one in communication with the oil within the burner and the other in communication with the chamber and operable to provide a stream extending therethrough and enveloping the muzzle of the burner.

2. The incinerator of claim **1** in which the steam delivery means is in communication with the oil within the burner and the air delivery means is in communication with the chamber.

3. The incinerator of claim **2** in which at least the air delivery means includes means to effect a spinning air stream at the muzzle of the burner.

4. The incinerator of claim **1** in which both the air delivery and the stream delivery means include means to effect the spinning of the respective fluids before they merge at the muzzle of the burner.

5. The incinerator of claim **4** in which the spinning means effect the spinning of the fluids in the same direction.

6. The incinerator of claim **1** in which both oil supply conduits and the steam delivery means include check valves in order to prevent back flows.

7. The incinerator of claim **1** in which the supporting means includes a tubular receiver extending axially into the rear end of the chamber, the oil burner is remov-

ably supported thereby, and the receiver includes vaned ports and provides a partition rearwardly of the muzzle of the burner with vaned ports effecting a spinning of the air delivered through said ports.

8. A waste oil incinerator plant comprising a battery of forwardly and outwardly tapering combustion chambers, a plenum with which the rear portion of each chamber is in communication, air delivery means in communication with the interior of said plenum, oil burners, one for each combustion chamber and positioned axially thereof with its rear end extending through the plenum, and damper means for each combustion chamber and operable to place the interior of the plenum in communication therewith, an oil supply conduit in communication with each burner and including a waste oil branch and a branch for a commercial grade of fuel oil, both branches including adjustable valves, and a steam conduit in communication with each burner and operable to subject the oil supplied thereto to an atomizing action and including an adjustable valve.

9. The waste oil incinerator plant of claim **8** in which each oil supply branch and the steam conduit include check valves.

10. The waste oil incinerator plant of claim **8** in which there is a tubular receiver for each oil burner, each receiver extending transversely through the plenum with its rear end supported thereby and the appropriate oil burner is removably held by the receiver.

11. The waste oil incinerator plant of claim **10** in which each tubular receiver includes a disc providing a barrier within the associated combustion chamber and the disc includes vaned ports admitting air through it but causing the admitted air to spin in a predetermined direction.

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