

[54] INCINERATOR

[72] Inventors: **Bela A. Szilagyi**, Whitestone; **Allan L. Brent**, New York; **Pal Greguss**, Rego Park, all of N.Y.

[73] Assignee: **Modern Pollution Control, Inc.**, Long Island City, N.Y.

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[58] Field of Search **110/8, 8 A, 8 C, 10, 18, 18 C**

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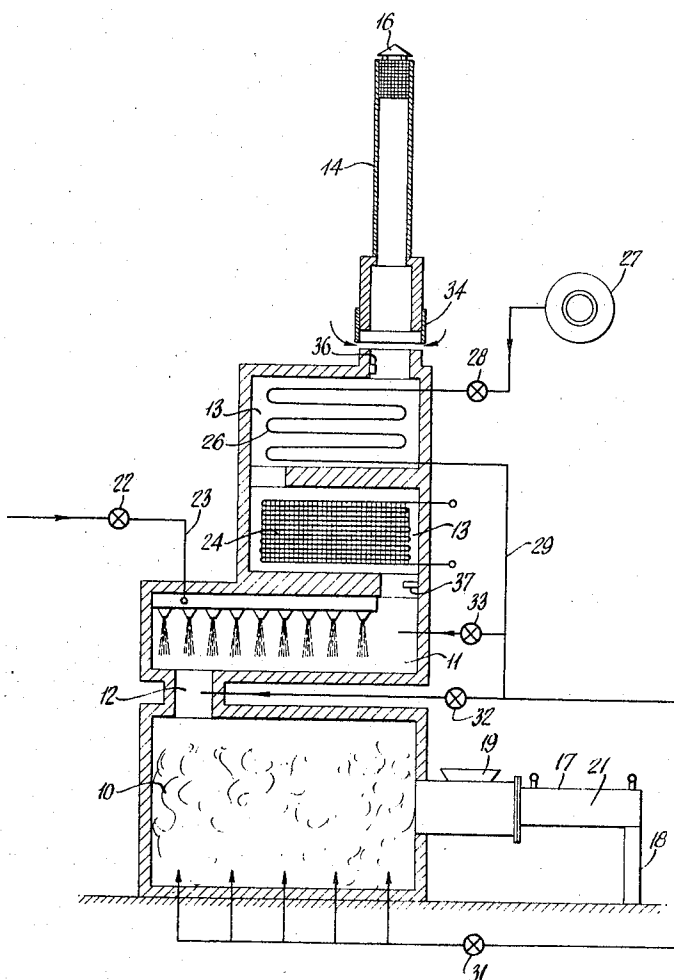
Primary Examiner—Kenneth W. Sprague
Attorney—Lerner, David & Littenberg

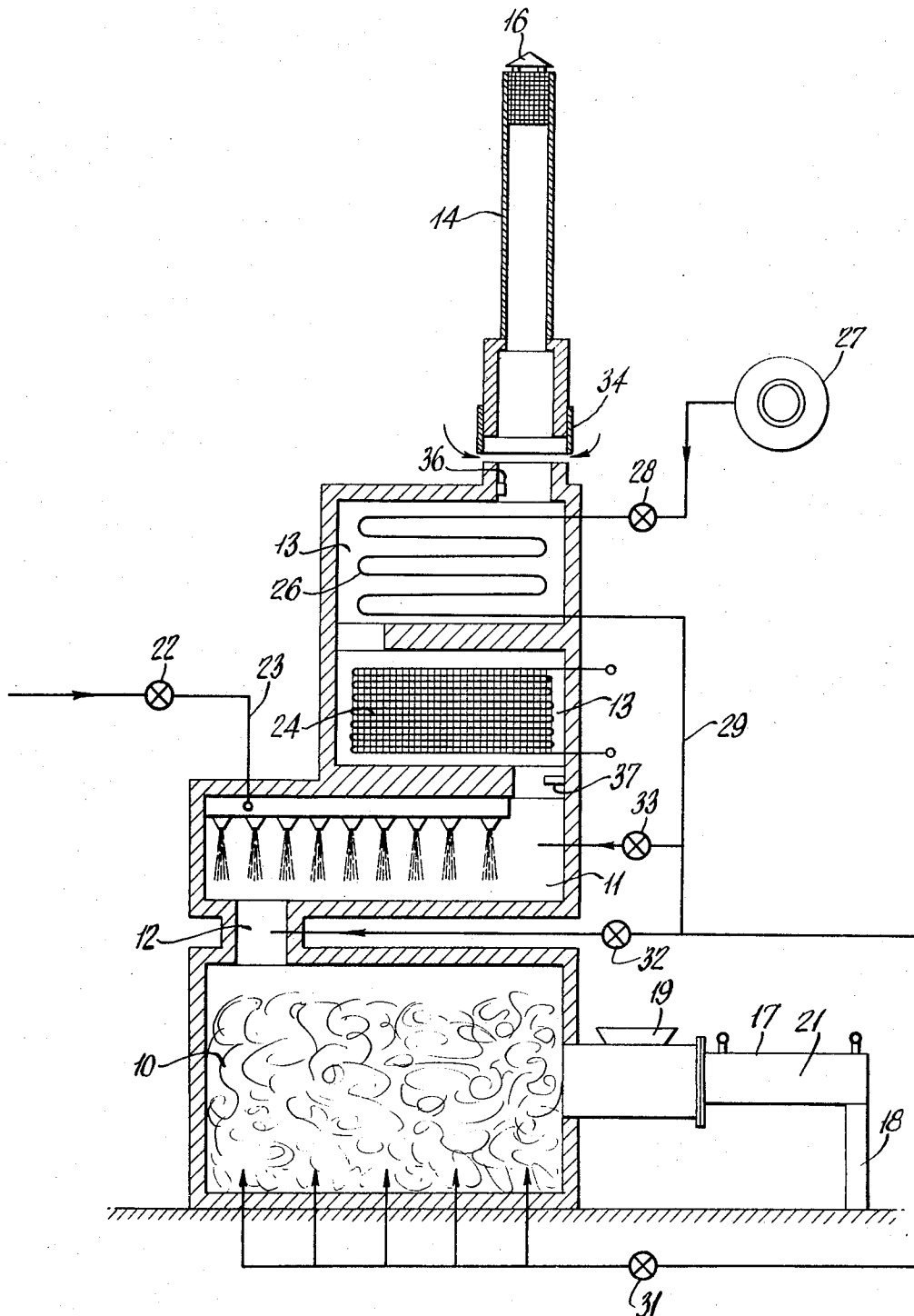
[57] ABSTRACT

An incinerator is disclosed which burns garbage so that the hydrocarbon materials therein are completely burned leaving only carbon dioxide and water as end products. A primary burning chamber of the incinerator is employed for burning the raw garbage giving off incompletely burned gases and fly-ash and soot which pass into a secondary burning chamber. The secondary burning chamber is lined with a refractory material which reflects incident and emits secondary radiation in the infrared region of the spectrum.

A method of operating the incinerator is also disclosed for bringing and maintaining the temperature of combustion in the secondary chamber such that the materials burning therein will emit radiation in the infrared portion of the spectrum. In this way, the refractory will give off radiation in the infrared spectrum to aid in heating the fly-ash insuring complete combustion in the secondary chamber.

2 Claims, 1 Drawing Figure





INVENTORS
 BELLA A. SZILAGYI
 ALLAN L. BRENT
 BY PROF. PAL GREGUSS
Lerner, David, & Littenberg
 ATTORNEYS

INCINERATOR

FIELD OF THE INVENTION

This invention relates to incinerators and particularly to incinerators which employ secondary burners to aid in complete combustion.

BACKGROUND OF THE INVENTION

The clean and efficient disposal of garbage is rapidly becoming an overwhelming problem. In the past, areas of land were merely set aside as garbage dumps where solid waste generated by a population would be dumped. As population density has increased and land become more valuable, it is becoming clear that garbage can no longer be piled up.

In areas adjacent to large bodies of water, garbage is often piled on barges and dumped off shore. After long periods of time, it has been found that the dumping of waste even in oceans is beginning to have profound impact upon our environment.

One method of garbage disposal which has been used in areas of dense population is incineration. The incineration of garbage reduces the amount of solid waste which eventually must be disposed of. Often garbage is incinerated before it is piled in a dump or deposited in the water. Aside from reducing the volume of disposed of solids, incineration reduces the chemical activity of the garbage and therefore reduces the effect that the solid waste has upon its surroundings.

Existing incinerators do burn garbage, reducing the chemical activity thereof and the volume to be disposed of. They do not however completely burn the garbage so that as a by-product they produce air pollution in the form of carbon monoxide and fly-ash and soot.

Air pollution is a problem which is equally as serious in industrialized areas as garbage disposal.

In an attempt to minimize the unwanted by-products of incineration, garbage disposal incinerators have been built with afterburners in an attempt to complete the combustion of the material coming out of the primary incinerating chamber. The afterburners have reduced the air pollution caused by garbage incineration but not sufficiently. Present incinerators even with afterburner, produce fly-ash out of their smoke stacks.

Many attempts have been made to completely burn the gases and fly-ash coming out of the primary burner into the secondary chamber. When complete combustion was not obtained, more oxygen was added to aid in the oxidation process. It was soon discovered that the addition of more oxygen to aid in complete combustion resulted in greater quantities of fly-ash remaining unburned in the secondary chamber. A second problem that has arisen in trying to increase the oxygen supply in secondary chambers of incinerators is the size increase in the secondary chamber as the volume of oxygen is increased.

Therefore, it is an object of this invention to provide an improved incinerator which employs a secondary burner to aid in complete combustion.

It is a further object of this invention to provide an incinerator which burns garbage so that the hydrocarbon materials therein are completely burned leaving only carbon dioxide and water as end products.

It is still a further object of this invention to provide an incinerator having a relatively small secondary burning chamber with a simplicity of operation.

BRIEF DESCRIPTION OF THE INVENTION

With these and other objects in view, the present invention contemplates an incinerator which includes a primary chamber for burning solid materials to provide gaseous and solid end products. The gaseous end products are capable of sustaining further combustion and contain particles of the solid end product suspended therein. The particles of the solid end product are also capable of sustaining further combustion. The gaseous end product with the particles suspended therein is passed into a secondary chamber for further combustion. The secondary chamber has an inner surface which is made from a material emitting secondary radiation in the infrared spectrum when excited by primary radiation.

The temperature in the secondary chamber is maintained so that combustion of the end products therein will emit significant amounts of radiation in the infrared spectrum. This radiation will be partially reflected off the inner surface of the secondary chamber and partially absorbed thereby. The absorbed radiation will excite the inner surface to emit secondary radiation in the infrared spectrum back into the chamber along with the reflected radiation.

Since gases are transparent to infrared radiation and solid particles are not, this energy will be concentrated onto the solid particles aiding in breaking them down so that complete combustion will be obtained in the secondary chamber.

DESCRIPTION OF THE DRAWING

The sole FIGURE is a sectional view of an incinerator constructed in accordance with the teachings of this invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawing, we see an incinerator having a primary chamber 10 and a secondary chamber 11. The primary chamber 10 is connected by a flue or passageway 12 through to a secondary chamber 11 for receiving gases therefrom and passing them out through a smoke stack 14. A spark arrester 16 terminates the smoke stack 14 to prevent burning materials from leaving the stack.

An automatic feeding mechanism 17 enclosed in a weatherproof housing 18 is connected to feed waste materials such as garbage into the primary chamber 10. The automatic feeding mechanism 17 has a waste feeding chute 19 into which materials to be burnt are fed. A ram 21 is periodically activated to compact the garbage and feed it into the primary chamber 10.

The secondary chamber 11 is made from a refractory material which partially reflects radiation in the infrared spectrum and emits secondary radiation in the infrared spectrum.

Along the top of the secondary chamber 10 are a plurality of jets for supplying gas to the secondary chamber through a valve 22 and a pipe 23 from a source not shown.

The heat exchanger 13 has an upper portion and a lower portion. The lower portion includes a coil of pipe 24 for carrying water to remove heat from gases passing therethrough. The upper portion includes a coil of pipe 26 for heating ambient air passed therethrough. This air is used in the incinerator to conserve heat ener-

gy by supplying hot air rather than air at ambient temperature to the incinerator. A blower 27 forces the air through the coils 26. A valve 28 is connected to the outlet of the coil 26 to control air supplied back to the incinerator. A blower 27 forces the air through the coils 26. A valve 28 is connected to the outlet of the coil 26 to control air supplied back to the incinerator. An air line 29 brings air to the flue 12 between the primary chamber 10 and the secondary chamber 11 and to the underside of the primary chamber 10. A valve 31 controls the flow of underfire air while a valve 32 controls the supply of air through the flue 12. A valve 33 controls the supply of air to the secondary chamber 11. By supplying air into the flue 12, the materials coming from the primary chamber to the second chamber are mixed with the air therein so that the flue 12 operates to mix or carborate the end products of combustion from the primary chamber with air.

A barometric damper 34 is installed at the base of the smoke stack 14 to allow ambient air to come in the stack from the bottom to reduce the flow rate of gases through the incinerator increasing dwell time in the secondary chamber helping achieve complete combustion.

A velocity sensor 36 is mounted in the flow path of gas below the barometric damper 34 to measure the flow rate of gases through the incinerator. The sensor 36 may be attached to a meter for operator observation or into an automatic contact system to adjust the barometric damper.

A temperature sensor 37 is mounted in the incinerator to measure the temperature of the secondary chamber. This sensor may also be connected to a meter for direct reading by an operator or tied into an automatic control system for regulating the air and gas supplied to the incinerator.

In operation, the secondary chamber 11 is preheated to a temperature of approximately 1,900° F (1,700° F to 1,900° F) before combustion is initiated in the primary chamber 10. The preheating is accomplished by introducing a mixture of about 10 percent gas and 90 percent air into the secondary chamber 11. As the temperature of the secondary chamber approaches 650° F, there will be a tendency of the temperature to level off. If this occurs, a reduction in the percentage gas being applied to the secondary chamber will tend to start the temperature increasing in the secondary chamber again.

Before the secondary chamber reaches the appropriate preheated temperature to begin combustion in the primary chamber, the automatic feeding mechanism 17 is activated to feed garbage into the primary chamber 10. When the secondary chamber 11 reaches the appropriate preheated temperature, the garbage in primary chamber 10 is ignited. The garbage burning in the primary chamber 10 will give off, in most cases, water vapor, hydrocarbon gases, carbon monoxide, carbon dioxide, soot, and fly-ash. The substances given off by the burning garbage pass through the flue 12 to be more completely burned in the secondary chamber 11.

If the water vapor content in the gases given off from the burning in the primary chamber 10 is high, there will be a tendency for the temperature in the secondary chamber to drop. If this occurs, more gas is added to

the secondary chamber to bring the secondary chamber back up to its appropriate temperature.

By continuously adjusting the gas and air so that sufficient energy is being generated to drive off moisture with the air content relative to the burning material as close to theoretical air as possible, maximum temperature can be maintained in the secondary chamber 11. This maximum temperature will insure that the materials burning in the secondary chamber will emit substantial radiation in the infrared spectrum.

The infrared radiation hitting the inner wall of the secondary chamber 11 will be partially reflected and partially absorbed by the inner wall. The energy absorbed by the inner wall of the secondary chamber 11 would normally be wasted energy. In this invention, however, the inner wall of the secondary chamber 11 is lined with a material which emits secondary radiation in the infrared region. Therefore, the energy absorbed by the inner wall is not completely dissipated thereby but a substantial portion thereof is returned to the secondary chamber 11 in the form of infrared radiation.

The infrared radiation both reflected and secondarily emitted is of particular importance in the secondary chamber 11 to help brake down the solid particles of soot and fly-ash suspended in the gases burning therein. In order to burn a material, it must first be mixed with an oxidizing agent. The soot and fly-ash are particles having surfaces in contact with the oxidizing agent, but the centers thereof cannot burn until exposed to oxidation. The infrared radiation will pass through the burning gases with very little being absorbed thereby. The solid particles, on the other hand, will absorb the infrared radiation. Therefore, this radiation is concentrated on the solid particles which will thus be broken up if clean combustion is to be obtained.

Other systems have been devised to insure burning of the gas at as near theoretical air as possible. For example see U.S. Pat. No. 2,797,746.

It should be understood that the above embodiment is merely illustrative of the principles of this invention and other embodiments will become obvious to those of ordinary skill in the art and light thereof.

What is claimed is:

1. In an incinerator:

a primary chamber for burning solid materials to provide gaseous and solid end products; said gaseous end product being capable of supporting further combustion and containing particles of said solid end product suspended therein; said particles of said solid end product being capable of sustaining further combustion;

a secondary chamber for burning said gaseous end product and said particles of solid end product suspended therein to provide a clear end product; said secondary chamber having an inner surface made from a material which emits secondary radiation in the infrared spectrum;

means for connecting said primary chamber to said secondary chamber to pass said gaseous end product and said particles of solid end product from said primary chamber to said secondary chamber;

said connecting means including:

carburetor means for mixing air with said gaseous and solid end products; and

a heat exchanger for transferring heat energy from said clean end product to air supplied to said carburetor means.

2. In the incinerator as defined in claim 1:

a smoke stack mounted atop said secondary chamber; and

a barometric damper mounted between said smoke stack and said secondary chamber.

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