United States Patent

[11] 3,557,722

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[54] **INCINERATING METHOD AND APPARATUS**
5 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **110/8,** 110/179
[51] **Int. Cl.** **F23g 7/00**
[50] **Field of Search** 110/7all, 8A, 179, 10, 18; 263/28

[56] **References Cited**

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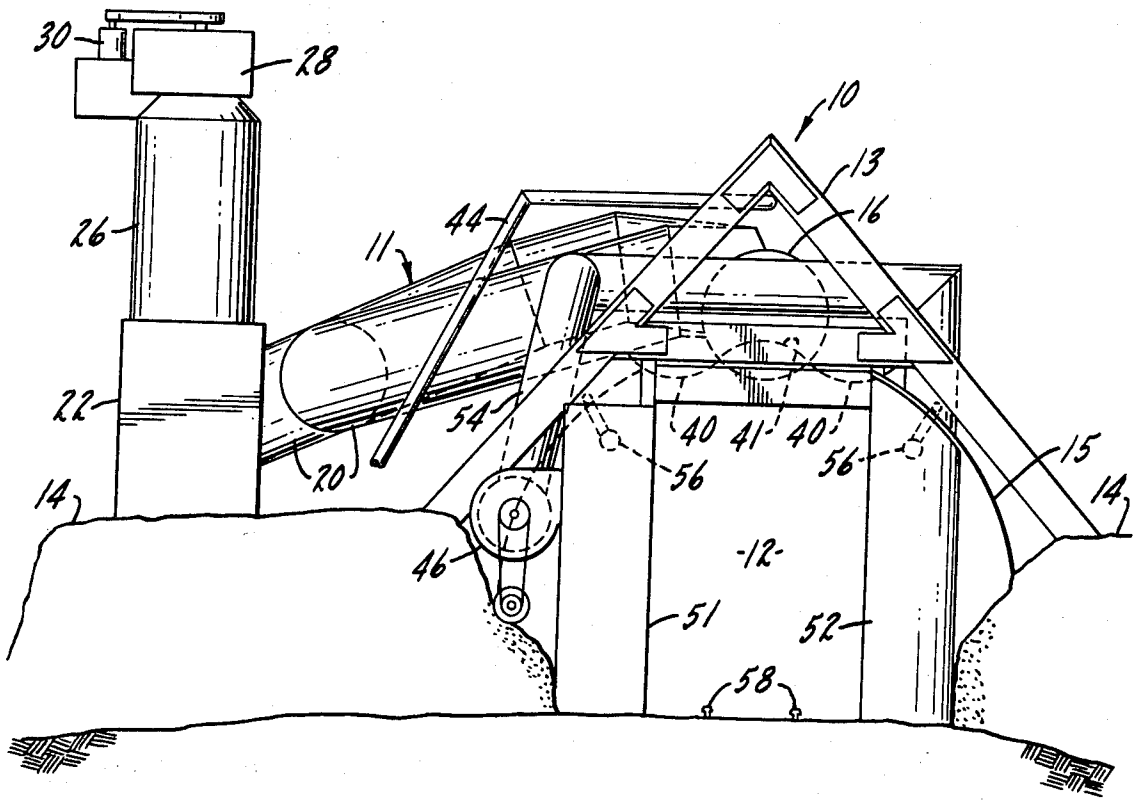
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Primary Examiner—Kenneth W. Sprague
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ABSTRACT: Method and apparatus are provided for incinerating combustible materials while minimizing delivery of contaminants to the atmosphere. In carrying out the method, air is preheated and introduced into the combustion chamber to feed the fire. Preferably the air is preheated to at least about 300° F., and the combustion products are heated to at least about 600° F., or most preferably to at least about 1000° F. Water droplets are preferably introduced into the combustion chamber during incineration, and the products of combustion may be passed through a moving stream of water. The apparatus includes an elongated incineration housing, means for introducing preheated air, and combustion products removal means. Preferably, the air-preheating means also forms means for recirculating air past the entrance and exit openings in the housing. Means are preferably provided for introducing water droplets into an upper portion of the housing and for burning and scrubbing the combustion products.



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SHEET 1 OF 2

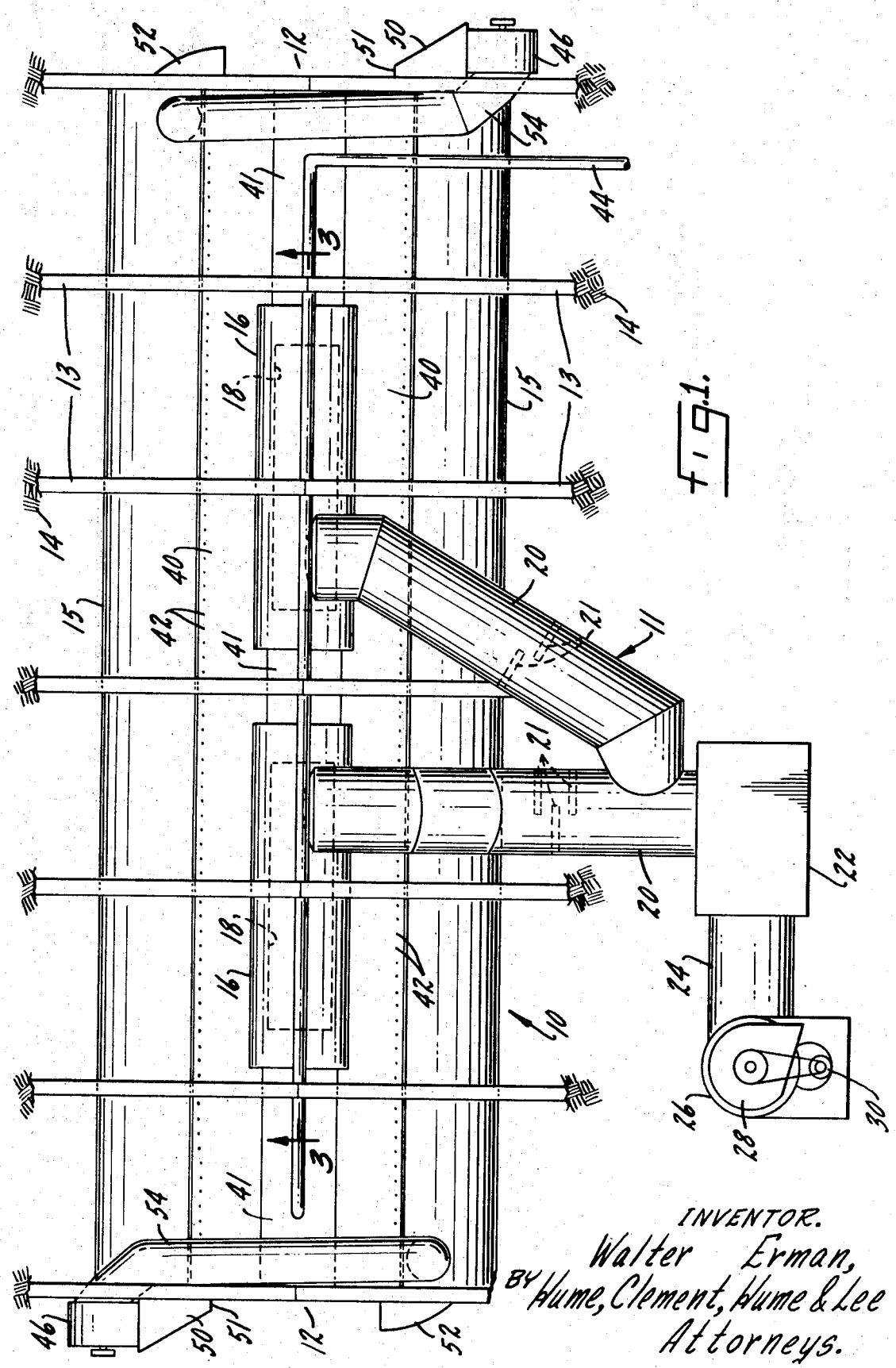


FIG. 1.

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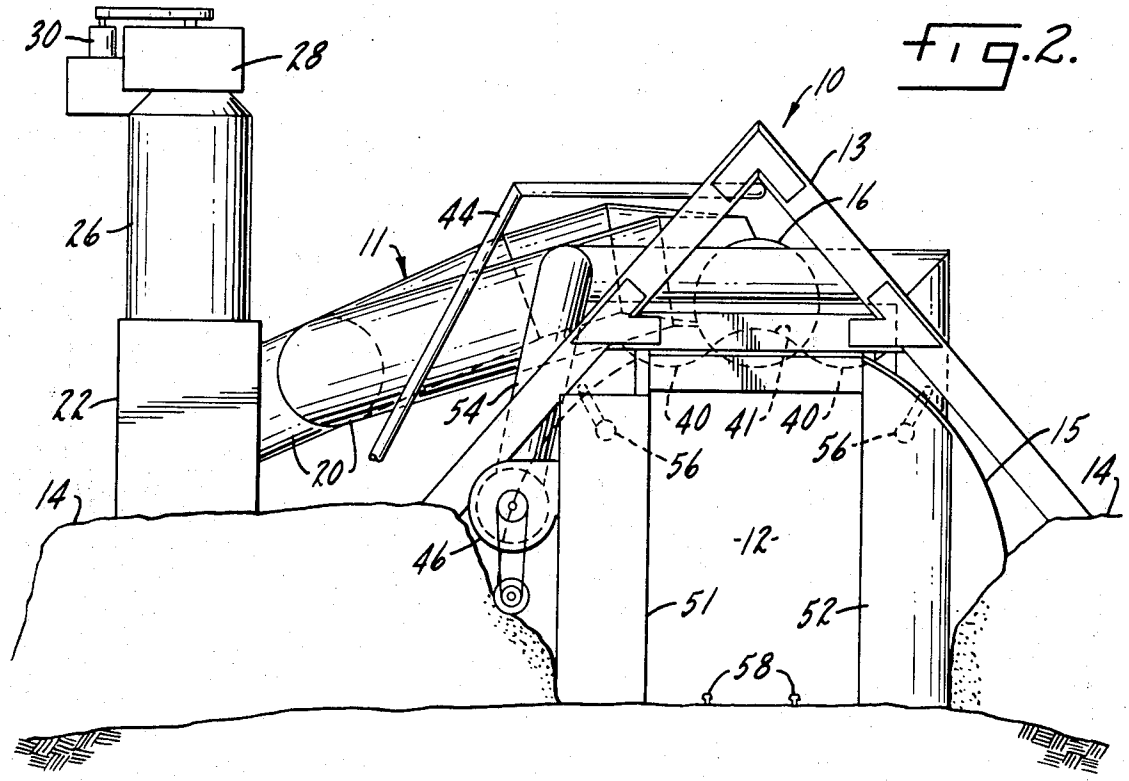


Fig. 2.

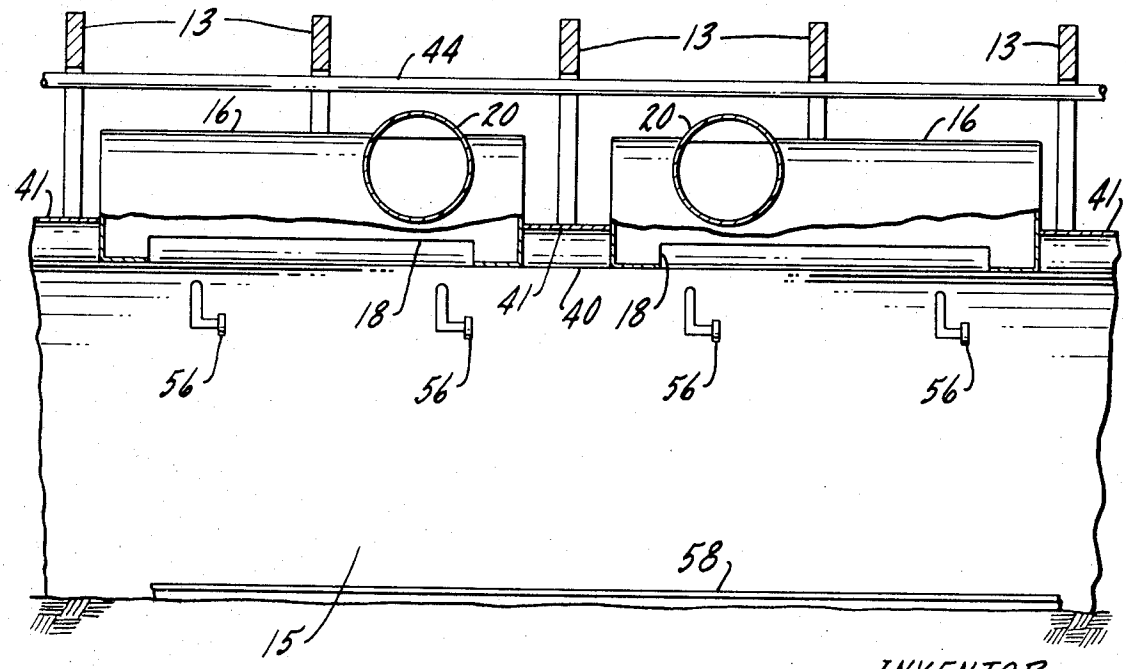


Fig. 3.

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INCINERATING METHOD AND APPARATUS

The present invention relates to improvements in air pollution control, and more specifically to an improved incinerating method and apparatus.

Incineration is a commonplace technique for removing unwanted combustible material in the scrapping of railroad rolling stock, automobiles, and the like, as well as for disposing of material such as garbage. Incineration yields a number of gases along with liquid and/or particulate materials, all of which are referred to collectively as "products of combustion." Included are primarily particulate carbon and its gaseous oxides, carbon monoxide and carbon dioxide, as well as other products, depending on the nature of the materials being incinerated. Often, products of combustion include such compounds as sulfur and nitrogen oxides, as well as unburned or partially burned petroleum products and other incompletely oxidized organic materials.

While carbon dioxide is odorless and harmless, the other products of combustion will contaminate the atmosphere unless they are intercepted and removed or oxidized to a harmless form. A variety of basic methods for removal of oxidation or contaminants is well-known, including electrostatic precipitation, oxidizing or "afterburning" the combustion products to form harmless oxides, and washing to remove particles and to dissolve liquid or gaseous contaminants. It is the object of the present invention to provide an improved method and apparatus for incinerating materials while minimizing delivery of such contaminants to the atmosphere.

Generally, the present invention relates to an incinerating method and apparatus wherein combustible materials are introduced into a chamber for incineration. It has been found that incineration at high temperatures aids in the destruction of contaminants, and that sufficiently high temperatures may be achieved by introducing preheated air into the chamber during the incineration process. The products of combustion formed are removed from the chamber and delivered to the atmosphere significantly reduced in contaminants.

In its basic form, the apparatus includes a combustion housing having preheating means for introducing preheated air into the chamber and combustion products removal means for removing products of combustion.

The invention, both as to its organization and method of operation, taken with the objects and advantages thereof, will be best understood by reference to the following detailed description taken in conjunction with the drawings in which:

FIG. 1 is a plan view of an embodiment of the present invention;

FIG. 2 is an a end view of the device who shown in FIG. 1; and

FIG. 3 is a partial cross section view taken along lines 3–3 of FIG. 1.

In carrying out the method of the present invention, combustible materials are introduced into an incineration chamber and burned while preheated air is simultaneously introduced. Preferably, the air is preheated to a temperature of at least about 300° F. The introduction of preheated air into the chamber will generally produce a burning temperature sufficiently high to heat the products of combustion to at least about 600° F. If the burning temperature is not high enough, the products of combustion may be heated in a separate step. Preferably, the products of combustion are heated to a temperature of at least about 1,000° F. within the chamber in order to obtain relatively complete destruction of gaseous and particulate contaminants.

In addition to heating at relatively high temperatures, it is also preferred that a fine spray of water droplets be introduced into an upper portion of the incineration chamber. Of course, this water must be introduced at a rate below that which would put out the fire or cause it to burn at such a low temperature that production of incompletely oxidized contaminants is increased. The introduction of water droplets aids in removing contaminants that would otherwise be delivered to the atmosphere by making ash and other particulate materials heavier, and thus causing them to settle to the bottom of the chamber, while also tending to dissolve and remove odor-causing contaminants. The latter is a particularly important advantage when odoriferous materials such as garbage are being incinerated. It is usually unnecessary to remove the water from the bottom of the chamber, since most of it is absorbed by the solid products of combustion on the chamber floor. However, the liquid may be drained from the chamber floor if necessary.

Referring now to the drawings, FIG. 1 shows an apparatus embodying the features of the present invention. While the apparatus shown is intended primarily for use in incinerating combustible materials on railroad rolling stock as a step in obtaining scrap and salvage materials, it could, with slight, obvious modification, be used for the incineration of garbage, automobiles, and other materials producing particulate and gaseous contaminants upon incineration. The apparatus includes an incineration housing, generally indicated by reference numeral **10**, and a combustion products removal system generally indicated by reference numeral **11**.

The incineration housing **10** is basically an elongated structure having openings **12** in the opposite ends. As best shown in FIG. **2**, the structure is externally suspended from a plurality of A-frame members **13** having their ends embedded in the earth **14** and supporting a pair of sidewalls **15**. Such external suspension prevents the A-frame members **13** from being subjected to heat. The sidewalls **15** are made preferably of sheet metal, and have an upward and inward slope. Located on top of the apparatus are a pair of smoke collectors **16** of generally horizontal, cylindrical configuration, having smoke ports or openings **18** on the underside thereof.

The combustion products removal system **11** includes a pair of flues **20** communicating with the smoke collectors **16** and leading to the inlet port of an afterburner **22**. The flues **20** preferably contain internal baffles **25** to remove any large particulate contaminant carried into them. The outlet port of the afterburner **22**, is connected to a second flue **24** leading to a scrubbing tower **26**. Located at the top of the scrubbing tower **26** is an exhaust fan **28** driven by a motor **30**. It is the function of the exhaust fan **28** to draw gases through the incineration housing **10** as well as the combustion products removal system **11**, including the flues **20**, the afterburner **22**, and the scrubbing tower **26**.

The afterburner **22** and the scrubbing tower **26** are of conventional design, as will be familiar to those skilled in the art. Both are optional in the present invention, depending upon the amount of contaminants that must be removed from the combustion products and the temperatures obtained during incineration. If the incineration temperature is sufficiently high, an afterburner may not be needed. The afterburner **22** heats the gaseous products to a temperature of at least about 600° F., and preferably at least about 1,000° F. Much higher temperatures can be obtained, depending upon the particular design of the device. The scrubbing tower **26** delivers a downwardly flowing stream of water past the combustion products, and is effective in removing most particulate or gaseous contaminants that may remain in the combustion products.

In the preferred embodiment the incineration housing **10** will be water-cooled, obviating the need for refractory lining materials. The cooling system generally comprises a pair of concave water retainers **40** running the entire length of the sidewalls **15**. The water retainers **40** form a portion of the roof of the incineration housing **10**, the remainder being covered by the smoke collectors **16** and three convex roof portions **41**. The water retainers **40** have outer edges which extend over the uppermost portion of the sloped sidewalls **15**. The outer edges of the water retainers **40** have openings **42** that allow water to flow out of the retainers **40** over the sidewalls **15**, providing a cooling function. The water retained in the retainers **40** provides maximum cooling at an upper portion of the incineration housing **10** where it is needed most. Water is delivered to the retainers **40** by a cooling water feed line **44** at the top of the incineration housing **10**, suspended at the apex

of the A-frame members 13, and extending for the major portion of the length of the incineration housing 10. The cooling water feed line 44 has openings (not shown) in the underside thereof to spray water over the top of the housing 10, cooling the smoke collectors 16 and convex roof portions 41 before running into the water retainers 40. While most of the water will evaporate, that which does not is collected in suitable troughs (not shown) located at the base of the sidewalls 15 and recirculated through the system or delivered to a drain (not shown).

Referring to FIG. 2 taken together with FIG. 1, the ends of the incineration housing 10 have openings 12 which provide air intakes as well as a place for introducing an and removing combustible materials from the housing 10. Each opening 12 has an air recirculating system for delivering a stream of air across it. After it has been delivered past the opening 12, the air is collected and a portion is recirculated past the opening 12. The air-recirculating system includes a blower 46 which delivers air to a distribution housing 50 which distributes the air from the fan 46 to a narrow, vertical outlet slit 51. The slit 51 extends the entire height of the opening 12, and directs the air into the incineration housing 10. Some of this air, along with some of the air as it is delivered past the opening 12, will be taken into the housing 10 as a result of the suction caused by the exhaust fan 28. The remainder is removed from an upper portion of the housing 10, adjacent to the air collector 52, by a recirculation pipe 54 and delivered to the intake port of the fan 46. This air, which will have been heated by its exposure to the fire in the housing 10, will be recirculated through the distribution housing 50 past the opening 12. Of course, air that is taken into the incineration housing 10 will be replaced at the openings 12 by outside air.

Besides preheating the air, the use of recirculating air at the openings 12 permits the continuous introduction and removal of materials in the incineration housing 10 without any need for doors to prevent delivery of contaminants to the atmosphere.

When the incinerator is located out of doors, the distribution housing 50 and the collector 52 are preferably rotatable through a small arc about a vertical axis in order to permit adjustment for wind conditions so that the incinerator can operate at maximum efficiency. Of course, if the incineration housing 10 is shielded from the wind, such adjustment is not generally necessary.

Referring to FIG. 3, the interior of the incineration housing 10 preferably includes water spray nozzles 56 for introducing water droplets in the form of a fine mist or fog into the interior of the housing 10. In the embodiment shown, the interior also includes rails 58 for delivering rolling stock to the device.

In operation, the material to be incinerated, such as railroad rolling stock intended for scrap, is delivered to the device on the rails 58, and is preferably ignited after it is in the interior. After the incinerating process have has reached equilibrium, the air moving between the air distribution housing 50 and the collector 52 at the ends of the incineration housing 10, will have reached a temperature of at least about 300° F. As the rolling stock is burned, the temperature within the apparatus generally reaches at least about 600° F., and preferably at least about 1,000° F., and many of the products of combustion are destroyed by these high temperatures. Others settle to the floor, carried by the water spray from the spray nozzles 56. Since most of the spray from the nozzles 56 is either vaporized or absorbed by particulate products of combustion, it is not generally necessary to provide drain means for removing this water from the interior of the incineration housing 10.

The remaining products of combustion enter the smoke collectors 16 through the smoke ports 18 and are delivered to the combustion products removal system 11. The combustion products then travel through the flues 20 past the baffles 21, where a further ; portion of the solid materials is removed. The remaining products of combustion continue to the afterburner 22, where they are burned. The temperature in the afterburner must be at least about 600° F., and preferably at least about 1,000° F., for efficient operation. Finally, any products of combustion that may remain are largely dissolved or physically removed when the materials pass through the scrubbing tower 26, where a downwardly moving stream of water is passed through the products of combustion. The gases that remain, which are relatively free of contaminants, are drawn out of the apparatus by the fan 28 and delivered to the atmosphere. The rate of passage of gases through the apparatus, and thus the overall rate of combustion may be controlled by the speed of the fan 28.

When the rolling stock (not shown) within the apparatus has been completely incinerated, it is removed, while more rolling stock is inserted into the opposite end, providing for continuous operation.

Clearly, the apparatus of the present invention has many applications with slight modifications that will be obvious to those skilled in the art. For example, garbage could be continuously delivered to the apparatus on a stainless steel or other nonflammable conveyor. Because of the recirculating air design, of the openings 12, continuous operation is possible, while delivery of contaminants and odors to the atmosphere is prevented.

While the embodiments described herein are at present considered to be preferred, it will be understood that various modifications and improvements may be made therein and it is intended to cover in the appended claims all such modification and improvements as fall within the true spirit and scope of the invention.

I claim:

1. An incinerator comprising: an elongated incineration housing having oppositely disposed entrance and exit openings; means for recirculating air past said openings; collecting means located in a upper portion of said housing for collecting combustion products from materials burned within said housing; combustion products removal means including a withdrawal means for withdrawing products of combustion from said housing; afterburning means in said combustion products removal means for burning products of combustion; water spray means in an upper portion of said housing; and cooling means for passing water over the exterior of said housing and said collecting means.

2. The incinerator of claim 1 wherein said housing has generally upwardly and inwardly sloped sidewalls and is suspended from external frame members.

3. The incinerator of claim 2 wherein said cooling means includes water retention means for retaining a portion of said water over an upper portion of said housing.

4. An incinerator comprising: an elongated incineration housing having oppositely disposed entrance and exit openings; means for recirculating air past said openings; collecting means located in an upper portion of said housing for collecting combustion products from materials burned within said housing; combustion products removal means including a withdrawal means for withdrawing products of combustion from said housing; afterburner means in said combustion products removal means for burning products of combustion; and cooling means for passing water over the exterior of said housing and said collection means.

5. The incinerator of claim 4 wherein said cooling means includes water retention means for retaining a portion of said water over an upper portion of said housing.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,557,722 Dated January 26, 1971

Inventor(s) Walter Erman

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

Column 1, line 49, delete "who"

Column 3, line 13, delete "an"

Column 3, line 21, after "12", delete "," and insert --The air is delivered past the opening 12 to a collector 52, which al extends the entire height of the opening 12,--

Column 3, line 54, delete "have"

Column 4, line 3, delete ";"

Signed and sealed this 11th day of May 1971.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

WILLIAM E. SCHUYLER, JI
Commissioner of Patent