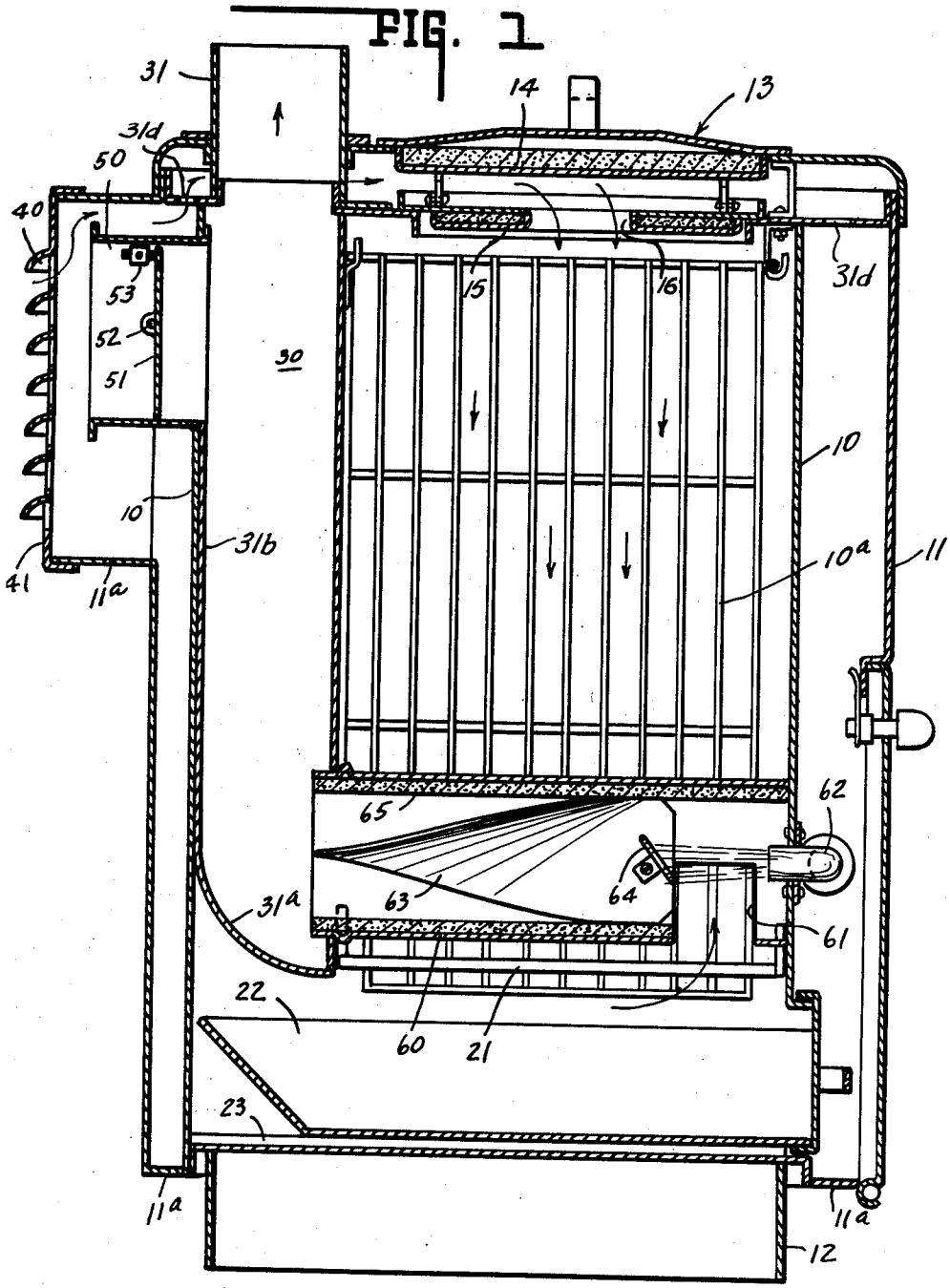
Aug. 19, 1958 K. F. TRIGGS 2,847,951

INCINERATOR

Filed Nov. 7, 1955 2 Sheets-Sheet 1

FIG. 1




INVENTOR.
KENNETH F. TRIGGS.

BY

Lockwood, Galt, Woodard & Smith.
ATTORNEYS.

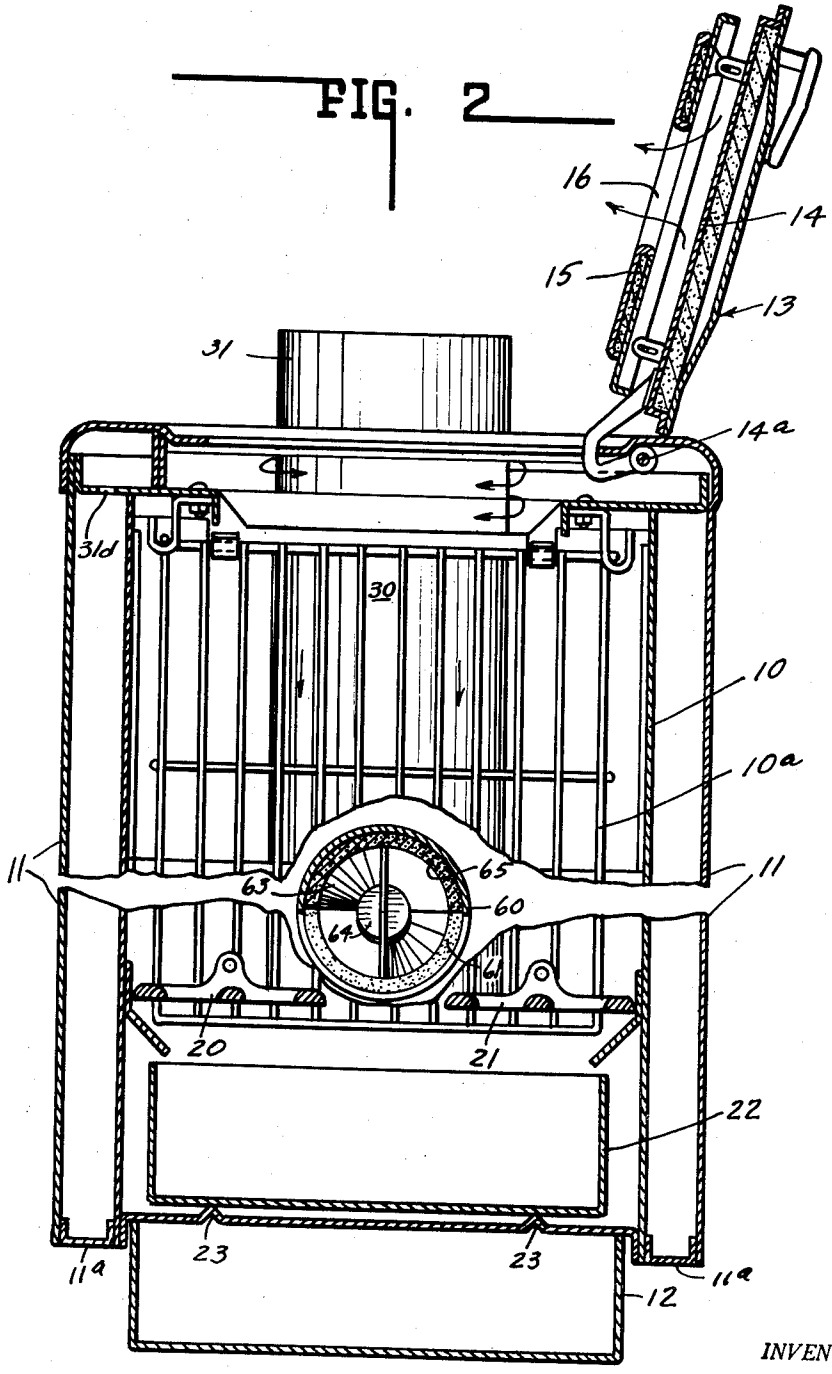
Aug. 19, 1958 K. F. TRIGGS 2,847,951

INCINERATOR

Filed Nov. 7, 1955

2 Sheets-Sheet 2

FIG. 2




INVENTOR.
KENNETH F. TRIGGS.

BY
Lockwood, Galt, Woodard & Smith,
ATTORNEYS.

United States Patent Office 2,847,951 Patented Aug. 19, 1958



2,847,951

# INCINERATOR

Kenneth F. Triggs, Huntington, Ind., assignor to The Majestic Company, Inc., Huntington, Ind., a corporation

Application November 7, 1955, Serial No. 545,236

4 Claims. (Cl. 110—8)

This invention relates to down-draft incinerators and is particularly directed to burners for efficiently disposing of burnable refuse with a minimum temperature rise in the exhaust flue thereof and with a minimum of smoke and obnoxious odors.

The smoke, vapor, and gases which rise from a fire of solid-fuel are composed of a mixture of water vapor, flying ash, and carbon particles which are liberated and carried away by the air currents as the solid pieces of fuel gradually rise to combustion or flame temperature. Such volatile products of combustion are, according to this invention, trapped and burned before they are admitted to the exhaust flue so that the flue gases are effectively cleaned.

Incinerators are often charged with large masses of relatively damp refuse. Considerable air and heat is required to dry the mass sufficiently to burn. Unfortunately during the drying phases large quantities of smoke is given off. As the mass dries out, the amount of air required for combustion is decreased and the temperature of the flue gases rises. In incinerators heretofore, the temperature rise often becomes dangerously high. Hence, there is the undesirable condition of the incinerator charge giving off objectionable quantities of smoke during the beginning of the burning operation and then proceeding to dangerously high temperatures near the end of the burning operation.

An object of this invention is an incinerator which removes smoke and volatile products of combustion from the exhaust gases.

Another object of this invention is an incinerator which will not "smoke" and yet which will produce reasonably low, safe flue temperatures.

The objects of this invention are attained by a combustion chamber within a casing having grates at the bottom and an air intake opening at the top. The exhaust flue communicates with the bottom interior of the combustion chamber through a smoke consuming tube, the walls of the tube being heated by a fluid fuel burner to a temperature well above the burning temperature of smoke given off from the materials in the combustion chamber. The air intake to the incinerator is selectively divided between two paths, one path being traced in through the top of the combustion chamber, downward through the combustion chamber, laterally along the smoke-consuming tube, and hence upwardly through the flue. The other path by-passes the first path so that air in selective quantities enters the flue directly and hence reduces the quantity of air entering the top of the combustion chamber. The amount of by-passed air is a function of the temperature and velocity of the gases in the flue.

The above-mentioned and other features and objects of this invention and the manner of attaining them will become more apparent and the invention itself will be best understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawings, wherein:



Fig. 1 is a vertical sectional view through the incinerator of this invention; and

Fig. 2 is a vertical sectional view at right angles to the view of Fig. 1.

In the incinerator shown in Figs. 1 and 2 the combustion chamber for receiving the refuse or other fuel to be burned is comprised of the casing **10**. In the particular incinerator shown, the casing is generally tubular in configuration, is upstanding and has walls preferably fabricated from relatively heavy gauge sheet steel. A basket **10***a* of refractory steel wire may, if desired, be suspended in the casing to hold the charge from the wall of the casing. Enclosing the casing is a light weight jacket **11** supported at the lower end on stand **12** and having a fuel loading door 13 at the top. The fuel loading door, more specifically described in the patent appplication, Serial Number 473,282, filed December 6, 1954, entitled "Incinerator," and assigned to the assignee of this application, comprises a panel **14** hinged at **14***a* on the jacket and carrying a baffle plate **15**. The baffle plate **15** and panel **14** are spaced apart so that air may move between the two plates and pass downwardly through the opening **16** in the center of the baffle plate.

Grates **20** and **21**, preferably of the dump or shaker type, are hinged to the front and back walls of the casing **10** near the lower end of the casing. Below the grates is placed the ash receiving pan **22** slidable through an opening in the lower front panel of casing **10**. Telescoping flanges on the ash pan and casing opening are employed to make a reasonably tight draft seal at the opening. Ridges **23** may be embossed in the floor of the casing to facilitate insertion and withdrawal of the ash pan.

The exhaust flue **30** extends vertically upward along the inside of the rear wall of the casing **10** and may comprise a sheet metal duct whose rear wall **31***b* may be welded to the adjacent sidewall of casing **10**. The attachment nipple **31** for joining to the stovepipe or stack is aligned with the flue **30** by means of an appropriately formed plate **31***c* supported by the casing **10**. The jacket **11** is large enough to enclose the casing **10** and to stand away from the walls of the casing to provide a dead air space for heat insulation. The jacket may be enameled or otherwise decorated for pleasing appearance. In the particular embodiment illustrated, the jacket is joined draft-tight by flange **11***a* to the bottom end of the casing.

The only air opening to the incinerator, except that which supplies combustion air to an auxiliary burner to be described, is the air intake port **40** in the jacket wall opposite the upper end of flue **30**. Conveniently, air intake port **40** may comprise louvers of measured opening size stamped in the cover plate **41** of the jacket portion **11***a*. As indicated by arrows in Fig. 1, air flows through the intake port and through openings **31***d* formed in the plate **31***c* to the area above the plate.

According to an important feature of this invention, the draft opening **50** is made in the rear wall of the flue opposite the air intake port **40**. Conveniently, the draft opening comprises a short nipple, as shown, having a balanced draft valve **51** pivoted on shaft **52** and eccentrically weighted by adjustable weight **53**. The draft opening **50** is aligned with the air intake port so that when damper **51** is opened, varying proportions of the air entering the air intake port **40** will move directly into the flue. When the damper is closed, new air entering the air intake port **40** travels through the openings **31***d*, around the flue nipple **31**, and into the space at the top of the jacket, between the plates **14** and **15** and hence downwardly

through opening 16. From opening 16 the new air passes downwardly through the fuel charge in the combustion chamber of the casing.

According to still another important feature of this invention, the only exit for the combustion chamber in casing 10 is through the smoke-consuming tube 60. Tube 60 is of refractory sheet steel, is of a cross sectional size commensurate with the size of flue 30 and communicates at its rear end with the flue. For structural reasons the smoke-consuming tube is preferably welded or otherwise secured at opposite ends to the front and rear walls of casing 10. Further, the tube is, as shown in Fig. 2, centrally disposed in the bottom of the combustion chamber, slightly above the level of the grates 20 and 21. The inlet end of the smoke-consuming tube communicates with the combustion chamber of casing 10 preferably through a semi-circular window 61 cut in the underside of the tube. Ashes and other solid material hence cannot drop into the tube. The outlet end of the smoke-consuming tube communicates substantially draft-tight with the flue 30. The lower end of the sheet metal duct forming flue 30 is curved at 31*a* to close off the flue from the ash pit, so that the flue communicates with the combustion chamber only through the tube 60, to be more fully described below.

The interior of the smoke-consuming tube is heated by an auxiliary source of fuel. The auxiliary heater contemplated here is designed for fluid-type fuel such as the gas burner 62. The nozzle of the burner is aligned with the center of the tube and is supported in the wall of the casing 10. The purpose of the auxiliary source of heat is to raise the walls of the smoke-consuming tube to above a smoke burning temperature. This temperature is preferably at a white or bright red heat. Hence, when the smoke from the combustion chamber of casing 10 enters window 61 and contacts the walls of the tube, the smoke immediately burns. The flying ash and small carbon particles as well as carbon monoxide and various vapors and gases from the combustion chamber are consumed so that the flue discharge is substantially free of odor and visible smoke.

To insure that the smoke passing through the smoke consuming tube contacts the high temperature surfaces, the spiral baffle 63 is disposed in the tube. The spiral baffle in one practical embodiment comprises a sheet of stainless steel twisted, as shown, into a half turn spiral. Such a baffle imparts a spiraling motion to the gases entering window 61, as well as the flame of burner 62, and moves these gases toward the inner surface of the wall of the tube. The baffle, of course, rises to the temperature of the tube and increases the hot surface area in the tube against which the smoke must travel. To reduce the axial velocity of the flame and to direct the flame toward the tube walls, the baffle plate 64 also of stainless steel or refractory metal, is reverted to the front end of the spiral baffle directly in the path of the flame of nozzle 62.

According to another and important feature of this invention, the interior of the smoke-consuming tube is brought to a temperature well above the smoke-consuming temperature before the charge of fuel in the combustion chamber of casing 10 rises to either "smoke" or "burning" temperature. This is effectively accomplished by lining the interior wall of the smoke-consuming tube with a fire-clay lining 65. Such clay is preferably of the highly refractory fire-clay variety, has considerable heat inertia and is a good heat insulator. Hence, the application of the flame from burner 62 may quickly raise the interior temperature of the tube to smoke-consuming temperature before the heat of the burner drive smoke and vapor from the solid fuel charge above. Other means of heat insulating the tube may be employed. For example, an expanded steel screen fitted over the top surface of the tube may be attached to the tube to hold the solid fuel out of contact with the tube.

Assume that the combustion chamber of casing 10 is loaded with a mass of damp refuse. When the burner 62 is ignited, the interior of the smoke tube rapidly rises to a high temperature. The heat from the tube slowly raises the temperature of the damp refuse to dry the material and gradually raise that material to ignition temperature. During this time the smoke from the fuel charge is drawn downwardly around the tube 60, upwardly through window 61, and rearwardly into contact with the hot spiral baffle and tube walls. At this stage the velocity upward in the flue 30 and the temperature is relatively low and damper 51 remains closed. That is, all of the air taken in at the air intake port 40 passes into the combustion chamber through the opening 16 at the top of the chamber and downwardly through the damp fuel charge. As the moisture content of the charge reduces and burning increases, the volume and temperature of the smoke and gases entering tube 60 increases. But, as the flue gas velocity increases, the damper 51 begins to open. This accomplishes two purposes, the volume of air to the combustion chamber is partially by-passed directly to the flue and the combustion chamber air is reduced. Secondly, the by-passed air is cool and tends to hold down the temperature of the gases in the flue. Hence, the temperature of the flue gases can be held within relatively narrow, safe limits throughout the burning of the damp charge in casing 10.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and considerations and, accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

The invention claimed is:

1. A down-draft incinerator comprising an upstanding tubular casing, a jacket enclosing said casing, a refuse receiving door at the top of the casing, means forming an air intake opening through the top of said casing between the interior of the casing and the interior of said jacket, a grate across the bottom of said casing, a smoke-consuming tube across the bottom of said casing, a fluid-fuel burner extending into said tube, an updraft flue, said flue communicating with said smoke-consuming tube, an air intake port in said jacket, a draft opening in said flue, said intake port communicating with said air intake opening to the casing and with said draft opening, and a balanced weight damper in said draft opening to regulate the relative amounts of air which moves into said casing and directly into said flue.

2. In combination in a down-draft fuel burner, a tubular casing forming a combustion chamber, grates at the bottom of the casing and means forming an air inlet opening at the top, a closed flue, an elongated smoke-consuming tube in the grate-end of the casing sealed at one end to said flue and communicating at the other end only with the combustion chamber of said casing to provide a draft passage consisting of said air inlet opening, said casing and said tube, a fluid-fuel burner extending into said tube, and an air by-pass opening in said flue with a damper responsive to air pressure in the flue.

3. In combination, a burner, a sheet-metal tubular casing upstanding and with grates at the bottom of the casing, means forming an air intake passage at the top of said casing, a flue disposed vertically along one side of said casing and communicating with the space in the lower portion of the casing, said flue having a draft opening adjacent the upper end of the casing, a balanced damper in the draft opening; a jacket enclosing said casing, flue and draft opening substantially draft-tight, said jacket having an air intake port opposite said draft opening and communicating with said air intake opening and the top of said casing.

4. A burner of the class described comprising a tubular upstanding sheet-metal casing with an air inlet passage at the top of the casing, grates across the bottom end of said casing, a flue interiorly of and disposed along one side of said casing, a smoke-consuming tube in the bottom

portion of said casing and communicating at opposite ends, respectively, with said flue and with the combustion chamber in said casing, a jacket enclosing substantially air-tight said casing and flue, a draft opening in said flue above said smoke-consuming tube, a balanced damper in said draft opening, said jacket having an air intake port opposite the draft opening of said flue so that air entering said port is selectively divided between said draft opening and an air inlet passage to the top of said casing.



**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 2,545,625 | McKinley | Mar. 20, 1951 |
| 2,641,206 | Stout | June 9, 1953 |
| 2,646,758 | Greemen | July 28, 1953 |
| 2,711,139 | Martin | June 21, 1955 |