

Nov. 23, 1965

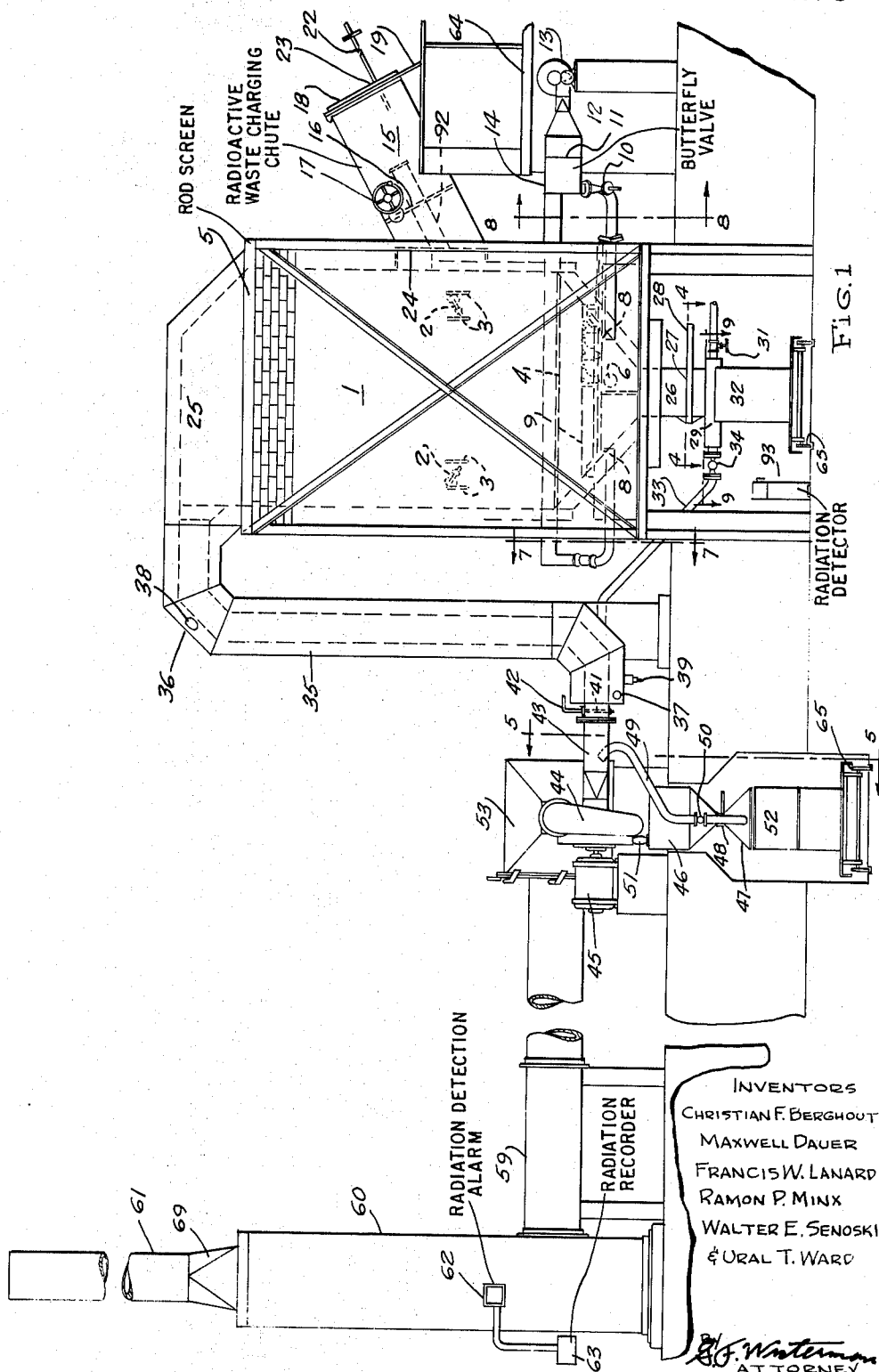
C. F. BERGHOUT ETAL

3,218,997

RADIOACTIVE WASTE MATERIAL INCINERATOR

Filed Feb. 6, 1963

4 Sheets-Sheet 1



Nov. 23, 1965

C. F. BERGHOUT ET AL

3,218,997

RADIOACTIVE WASTE MATERIAL INCINERATOR

Filed Feb. 6, 1963

4 Sheets-Sheet 2

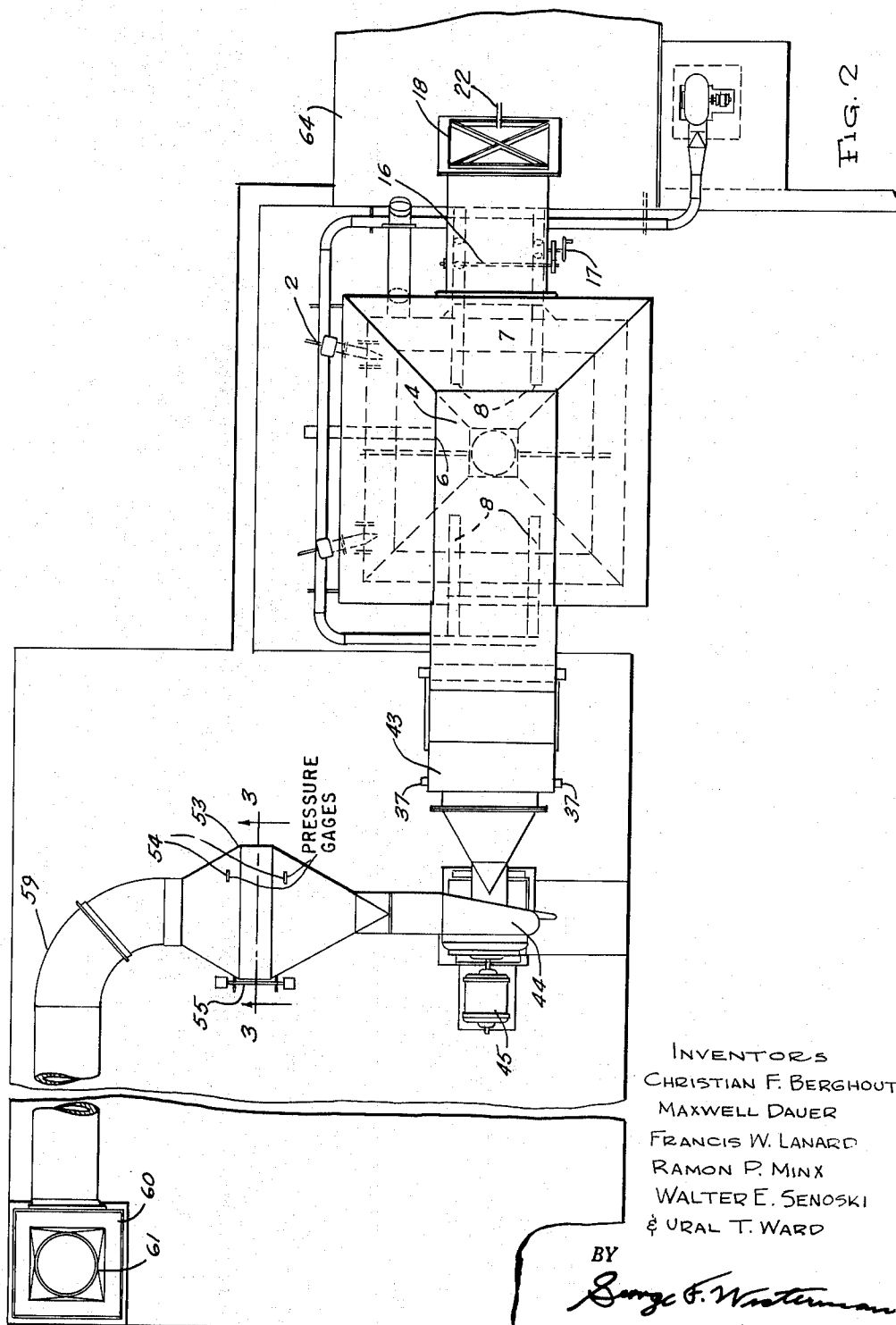


FIG. 2

INVENTORS
CHRISTIAN F. BERGHOUT
MAXWELL DAUER
FRANCIS W. LANARD
RAMON P. MINX
WALTER E. SENOSKI
& URAL T. WARD

BY

George F. Wooten
ATTORNEY

Nov. 23, 1965

C. F. BERGHOUT ET AL

3,218,997

RADIOACTIVE WASTE MATERIAL INCINERATOR

Filed Feb. 6, 1963

4 Sheets-Sheet 3

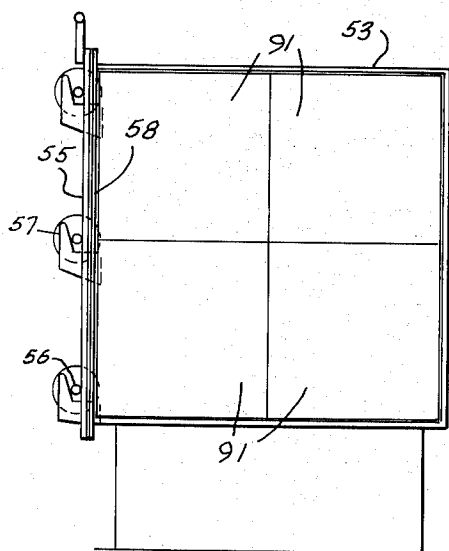


FIG. 3

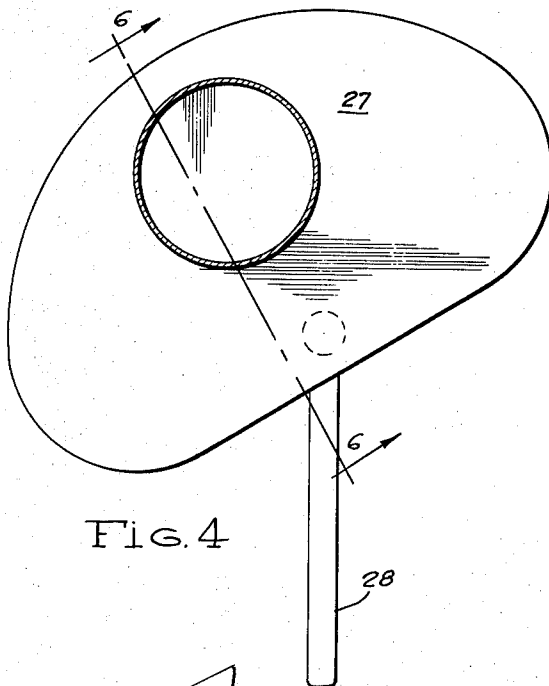


FIG. 4

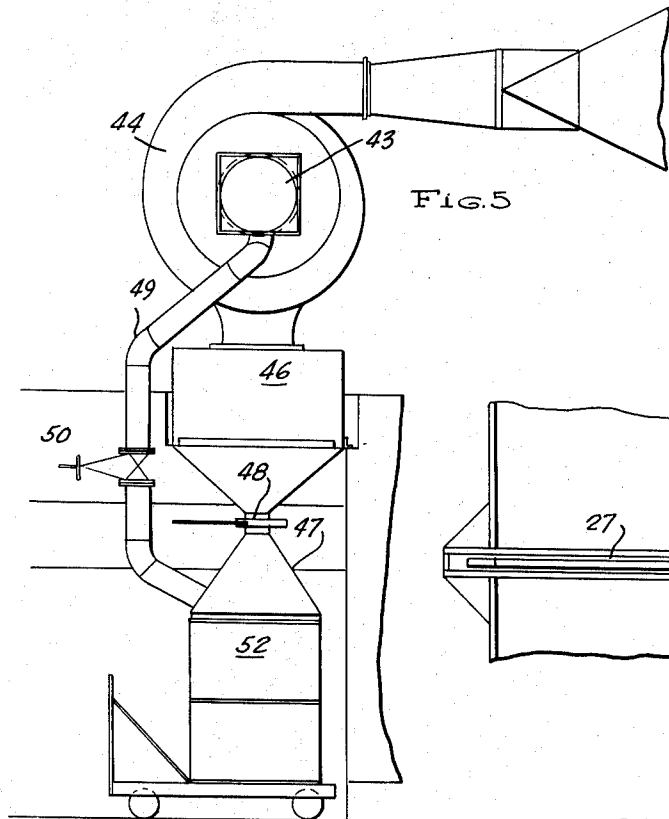


FIG. 5

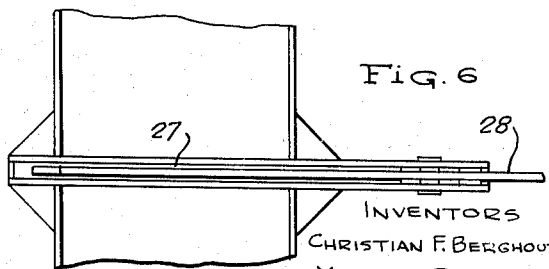


FIG. 6

INVENTORS
CHRISTIAN F. BERGHOUT
MAXWELL DAUER
FRANCIS W. LANARD
RAMON P. MINX
WALTER E. SENOSKI
& URAL T. WARD

By *George F. Wasterman*
ATTORNEY

Nov. 23, 1965

C. F. BERGHOUT ET AL

3,218,997

RADIOACTIVE WASTE MATERIAL INCINERATOR

Filed Feb. 6, 1963

4 Sheets-Sheet 4

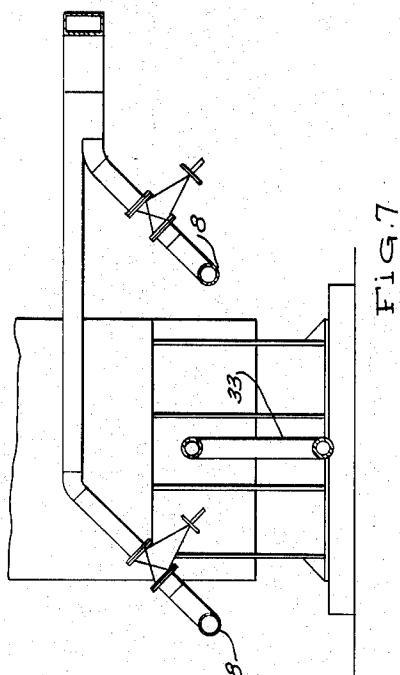


FIG. 7

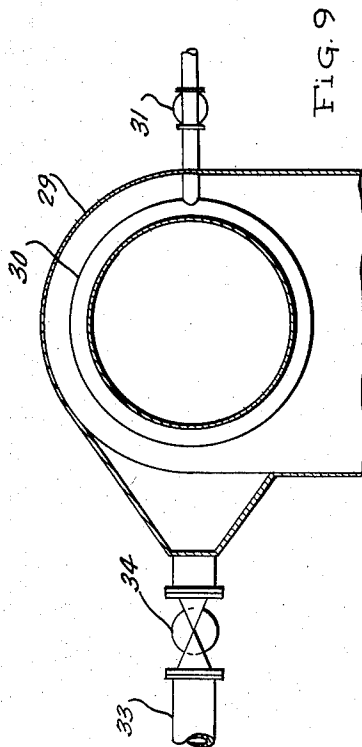


FIG. 9

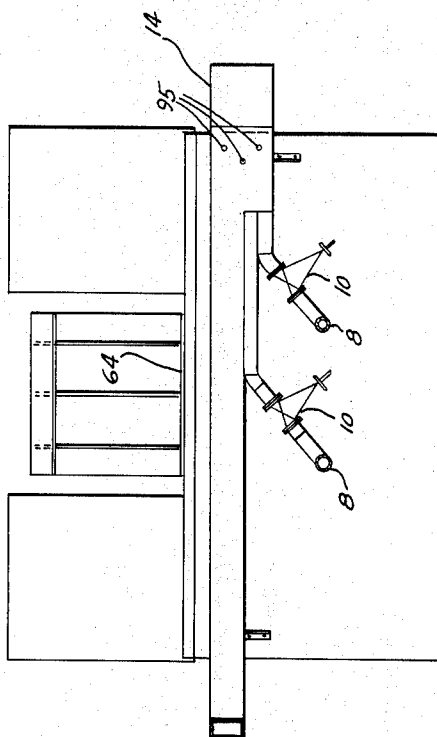


FIG. 8

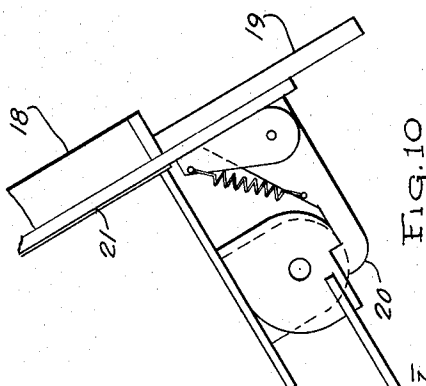


FIG. 10

INVENTORS
CHRISTIAN F. BERGHOUT
MAXWELL DAUER
FRANCIS W. LANARD
RAMON P. MINX
WALTER E. SENOSKI
& URAL T. WARD

By *George F. Westerman*
ATTORNEY

1

3,218,997

RADIOACTIVE WASTE MATERIAL INCINERATOR
Christian F. Berghout, Lutherville, Md., Maxwell Dauer,
Miami, Fla., Francis W. Lanard, Silver Spring, Md.,
Ramon P. Minx, Woodbridge, Va., Walter E. Senoski,
Pittsburgh, Pa., and Ural T. Ward, Ester, Mo., assignors
to the United States of America as represented by the
Secretary of the Army

Filed Feb. 6, 1963, Ser. No. 256,774

5 Claims. (Cl. 110—18)

(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment to us of any royalty thereon.

The present invention relates to incinerators and more particularly to incinerators for the disposal of combustible radioactive waste material.

The increasing use of radioactive material throughout the world presents an increasingly critical problem of disposal of radioactive contaminated materials. Such of these radioactive materials as are combustible, may be much more easily disposed of if they can be subjected to incineration and the consequent reduction in volume. This incineration can be accomplished if the release of hazardous amounts of radionuclides into the environment can be prevented.

Accordingly, it is an object of this invention to provide an incinerator for combustible radioactive waste material which is so designed as to prevent the release of hazardous amounts of radionuclides into the environment while at the same time providing easy collection means of the radioactive ash for disposal thereof.

Another object of this invention is to provide a radioactive waste material incinerator which may be operated with the least possible exposure of the operating personnel to radionuclides.

Other objects and advantages will be apparent to those skilled in the art upon reference to the following descriptions and the accompanying drawings in which:

FIG. 1 is an elevational view of the preferred embodiment;

FIG. 2 is a plan view of the preferred embodiment;

FIG. 3 is a view taken on the line 3—3 of FIG. 2;

FIG. 4 is a view taken on the line 4—4 of FIG. 1;

FIG. 5 is a view taken on the line 5—5 of FIG. 1;

FIG. 6 is a view taken on the line 6—6 of FIG. 4;

FIG. 7 is a view taken on the line 7—7 of FIG. 1;

FIG. 8 is a view taken on the line 8—8 of FIG. 1;

FIG. 9 is a view taken on the line 9—9 of FIG. 1; and

FIG. 10 is a detailed view of a charging door as used in this embodiment.

Briefly the incinerator comprises a closed system silo-type combustion chamber for the mass burning of combustible radioactive material, having a refractory, iron shaking grates, and two fuel injection burners; a charging chute; a concrete hood; a discharge chute surrounded by a steel water jacket; a dynamic precipitator with discharge hopper; a filter container; and a stack.

Referring in detail to the preferred embodiment of this invention as depicted in the accompanying figures, combustion chamber 1 has an exterior construction of common brick and an interior construction of fire brick. It is equipped with a refractory 7, two sections of shaking grates 4, and two fuel injection burners 2. The fuel injection burners are air to gas type and are protected by bent rods 3. Grates 4 rest on a 30-pound rail 9 which is mounted in the refractory 7 to prevent the warping of castings. At the top of the combustion chamber is a rod screen 5 of a mesh of approximately 1½ inches with rods of ¼ inch in diameter, the function of which is to prevent heavy

2

particles of fly ash from entering the system. Below the grate is air inlet 6 through which, by means of a 6 inch diameter pipe, additional make up air for burning may be introduced. Inlet 6 has a complete shutoff back pressure valve for safety. Air inlet 6 is supplementary to the principal air make up system which introduces, through air vents 8, the primary air supply for the combustion. In this embodiment, four 3 inch air vents 8 are provided, each vent being equipped with a shutoff valve 10 to be used in the event of pressure blow back. In addition, a regulating butterfly valve 11 is provided to control the air flow and to provide a complete shutoff until the individual vents have been closed. The air itself is provided by blower 12 which is belt driven from motor 13. Air is transmitted from blower 12 to vent 8 by means of rectangular dust 14 (shown in detail in FIG. 8.) which is provided with air control vanes 95.

Combustible radioactive material is introduced into the combustion chamber through charging chute 15. Charging chute 15 is compartmented to reduce the hazard of direct blow back of contaminated dust, smoke particles, and heat. To provide this compartmentation, the chute is equipped with an inner door 16 through which protrudes observation port 92. The outer door 18 is hand operated by a lifting handle 19 and self-locking thumb latch 20 as shown in detail in FIG. 10. The door is equipped with a heavy neoprene gasket 21 to insure a tight seal. Chute 15 is also provided with pusher rod 22 which is operated through an opening in door 18 having a flexible rubber gasket 23 which provides an air tight seal. In this embodiment chute 15 is connected to the incinerator combustion chamber 1 by bolts preset in the frame of the chamber. A gasket 24 is provided to insure a seal between chute 15 and chamber 1.

Over combustion chamber 1 is concrete hood 25 which is of heat-resistant reinforced concrete.

Connected with refractory 7 under the grate of combustion chamber 1 is discharge chute 26, which, in this embodiment, is a one foot six inch diameter pipe having a rotating plate goggle valve 27 with handle 28 to provide quick and easily controllable dumping of the ash refuse. Below goggle valve 27 is dust hood 29 into which is incorporated circular spray nozzle 30 (see FIG. 9) having a plurality of ¼ inch diameter holes directed to converge at a 90° spray angle below the nozzle. This spray nozzle, controlled by valve 31 is for the purpose of spraying the ash refuse as it is dumped into drum 32 for disposal. In the course of dumping approximately 55 gallons of radioactive ash into the disposal drum 32, it has been found desirable to spray approximately 5 gallons of water. Radioactive dust is evacuated from dust hood 29 through dust tube 33 which is opened by valve 34 only when dumping is taking place.

Connected to hood 25 and surrounded by steel water jacket 35 is duct 36 which forms a passage for combustion products from combustion chamber 1 into the precipitation and filtration systems described below. The size of the air duct in this embodiment is one foot by 3 feet. Water jacket 35 is provided with two 2-inch water inlets 37, each having a double check valve at each inlet to prevent back drainage. At the top of the water jacket are two 3-inch water outlets 38 allowing easy drainage from the uppermost portion of the water jacket. A drain plug 39, at the base of the water jacket, provides for easy flushing and cleaning. At the end of air duct 36 within water jacket 35 is damper 41 with handle 42 for the regulation of air flow. Air duct 36 is connected to the dynamic precipitator described below by transition assembly 43 which makes the air passage smaller, in this embodiment, from one foot by three feet to one foot by one foot and again from a rectangular to a cylindrical passage.

The dynamic precipitator 44 shown in this embodiment is a rotary blower type precipitator operating at approximately 1200 r.p.m. at a rate of 4,000 c.f.m. with a total pressure of 5 inches. It is driven by 7½ horsepower motor 45.

From the dynamic precipitator the exhaust precipitate is discharged into hopper 46 through precipitator outlet 51. Hopper 46 is equipped with a rotating goggle valve 48 to allow controlled discharge of the precipitate which passes from the valve through hopper extension 47 to collection drum 52. Dust tube 49 connects hopper extension 47 with transition assembly 43 and accomplishes the removal of excess dust during the dumping operation. Wedge gate valve 50 is maintained in the closed position and opened only during the dumping operation. In this embodiment hopper 46 is constructed of ¼ inch steel and is mounted in concrete walls.

From the dynamic precipitator the exhaust gasses pass through filter assembly 53, a desirable, but not essential feature of the incinerator, which comprises an enlargement in the exhaust conduit, containing a plurality (in this embodiment 4) of 1,000 c.f.m. ceramic type filters 91 bound tightly by an asbestos belt. On one side of the assembly is door 55 (shown in detail at FIG. 3). The asbestos belt described above is looped on the door side in order to allow for easy removal of the filters. Pressure gages 54 are provided on either side of the filter elements. Door 55 is weighted and hinge mounted. It is equipped with bars 56 which fit into sloping brackets 57 in order to bear the door tight against the filter housing. Gasket 58, a neoprene gasket, is fastened to the door and provides a seal between the door and the housing. Guide bars (not shown) are used to guide the filter in place. Gages 54 indicate, by the amount of pressure showing thereon, whether or not the filters are plugged.

Exhaust is conducted from the filter assembly to the stack by means of duct 59, which in this embodiment, is constructed of ¼ inch steel plates, reinforced. The size of the duct is increased over that between hood 25 and assembly 43 to provide for a decrease in velocity of the exhaust. In this embodiment the duct is 24 inches square. Such a decrease in velocity is desirable in order to increase the efficiency of the radiation monitor alarm system in the stack.

The stack is comprised of lower section 60 and upper section 61. Section 60 is of common brick, reinforced. It contains radiation detector alarm system 62 and recorder 63. The detector alarm system is used to indicate the presence of excessive alpha, beta, or gamma particles being released into the air. Recorder 63 maintains a constant record of the amount and intensity of radiation released into the air. Stack section 60 has in the illustrated embodiment, an inside measurement of 2 feet 6 inches by 2 feet 6 inches.

Stack section 61 is, of course, rigidly secured to the top of section 60 and has transition means 69 to provide a transition from 2 feet 6 inches square to 2 feet diameter (cylindrical).

The incinerator is also provided with loading ramp 64 and trolley cars 65 for easy handling of contaminated refuse.

Wherever it is necessary throughout the system and particularly at the discharge hoppers, portable radiation detection and recording devices 93 may be set up when a radiation check for contamination is desired.

Substitutions of equivalents within the scope of this invention are readily foreseeable. For example an electrostatic precipitator may be used in lieu of or in addition to the dynamic precipitator or filter system.

We claim:

1. An incinerator for combustible radioactive material comprising:
 - (a) a combustion chamber having charging means for radioactive waste material, fuel injection means, means to support said material, and air supply means;
 - (b) controlled ash disposal means at the base of and contiguous to said combustion chamber including an ash chute, a control valve in and for said ash chute, means for liquid spraying of the ash in said chute, and dust removal means for disposal of dust created by discharge of said combustion chamber;
 - (c) dynamic precipitation means for purifying waste gases emitted from said combustion chamber;
 - (d) controlled precipitation disposal means contiguous to said precipitation means and including a valve controlled hopper and dust removal means;
 - (e) a stack; and
 - (f) exhaust conduit means between said combustion chamber and said dynamic precipitation means and between said dynamic precipitation means and said stack.
2. The incinerator of claim 1 further including a radiation detector alarm and recording device mounted in said stack.
3. The incinerator of claim 1 further including a radiation detection system at said ash disposal means.
4. The incinerator of claim 1 further including gas filtration means between said combustion chamber and said stack along said exhaust conduit means.
5. The incinerator of claim 1 wherein said exhaust conduit means between said combustion chamber and said dynamic precipitation means is water cooled.

References Cited by the Examiner

UNITED STATES PATENTS

881,549	3/1908	Clements	110—17
1,155,492	10/1915	Krenz	110—18
2,033,685	3/1936	Coutant	110—10 X
2,102,427	12/1937	Lloyd et al.	110—8
2,767,804	10/1956	Foley	55—104
2,816,621	12/1957	Weaver	55—419
2,987,459	6/1961	Labeyrie et al.	

FREDERICK L. MATTESON, JR., *Primary Examiner*,
JAMES W. WESTHAVER, *Examiner*,