United States Patent

Cahill, Jr.

[15] **3,668,833**

[45] **June 13, 1972**

[54] APPARATUS AND METHOD FOR INCINERATING RUBBISH AND CLEANING THE SMOKE OF INCINERATION

[72] Inventor: **William Francis Cahill, Jr.,** 8 Danecroft Avenue, Greenville, R.I. 02828

[22] Filed: **Aug. 25, 1970**

[21] Appl. No.: **66,682**

[52] **U.S. Cl.**.....**55/7,** 23/2 C, 23/277 C, 55/94, 55/97, 55/126, 55/259, 110/8 A, 110/18 R, 110/119

[51] **Int. Cl.**.....**B01d 50/00**

[58] **Field of Search**.....55/10, 2, 84, 94, 97, 124, 55/126, 134, 259; 110/8 A, 18 R, 119; 23/277 C, 284, 285, 2 C

[56] **References Cited**

UNITED STATES PATENTS

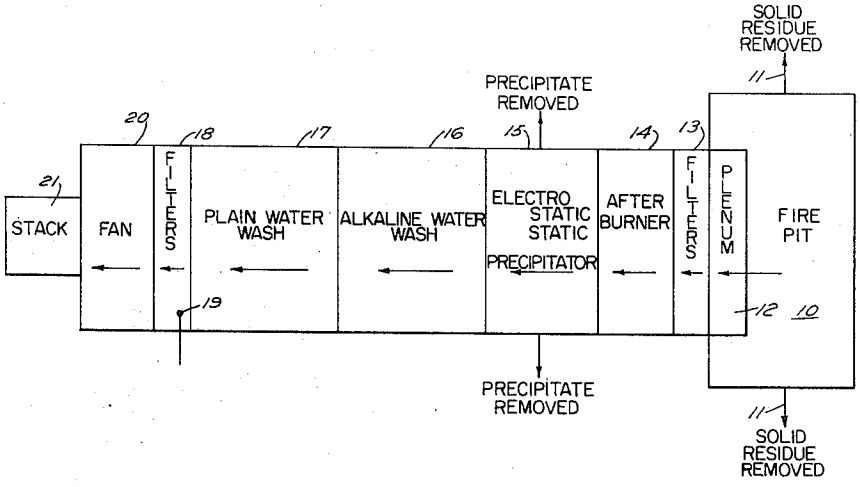
2,746,563	5/1956	Harlow	23/2 C
3,258,897	7/1966	Mayer et al.	55/152
3,522,000	7/1970	Kinney	23/284
3,572,264	5/1971	Mercer	110/119
3,601,069	8/1971	Mancuso	110/8 C

Primary Examiner—Bernard Nozick
Attorney—William Frederick Werner

[57] **ABSTRACT**

This specification discloses apparatus for carrying out a method of incinerating rubbish and cleaning the resultant smoke. The apparatus comprises essentially a fire pit, a plenum where smoke is collected, a filter, an after burner, an electrostatic precipitating chamber, an alkaline water wash, a plain water wash, a filter, and a motor driven exhaust fan which passes clean gas to a stack.

14 Claims, 4 Drawing Figures



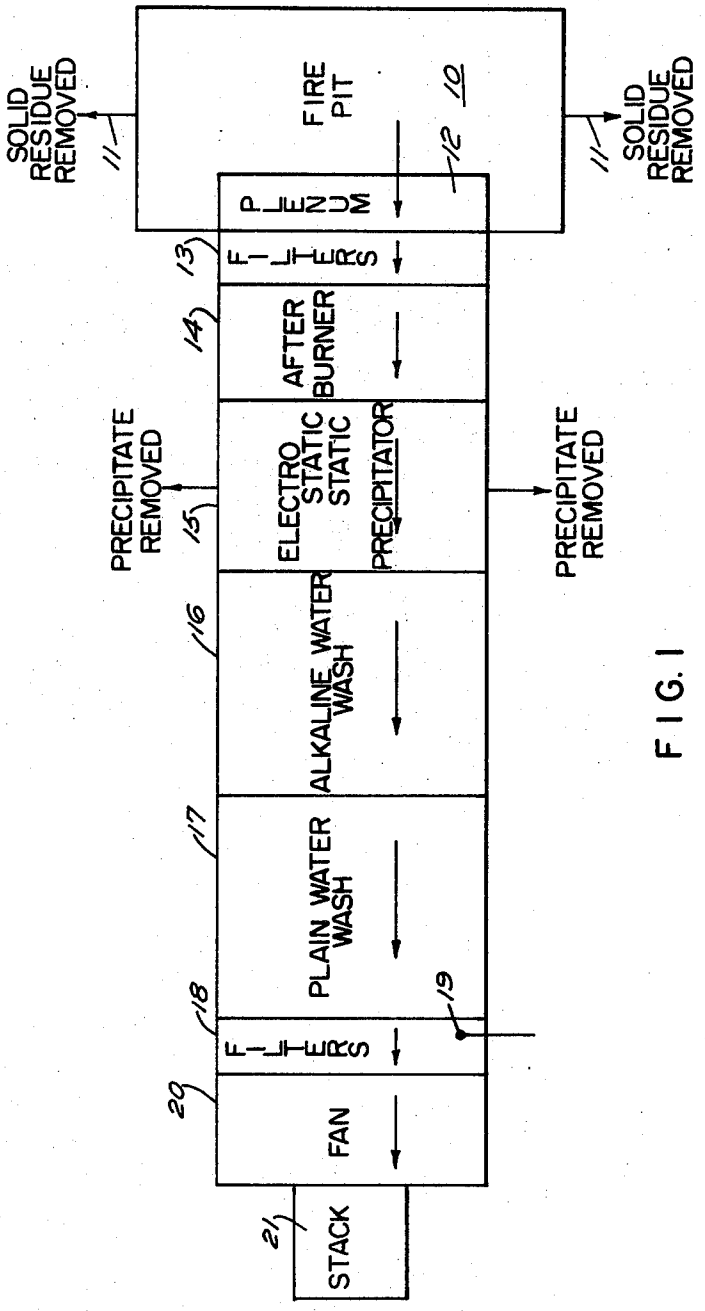


FIG. 1

INVENTOR
WILLIAM FRANCIS CAHILL, JR.
BY
William Frederick Kenney
ATTORNEY

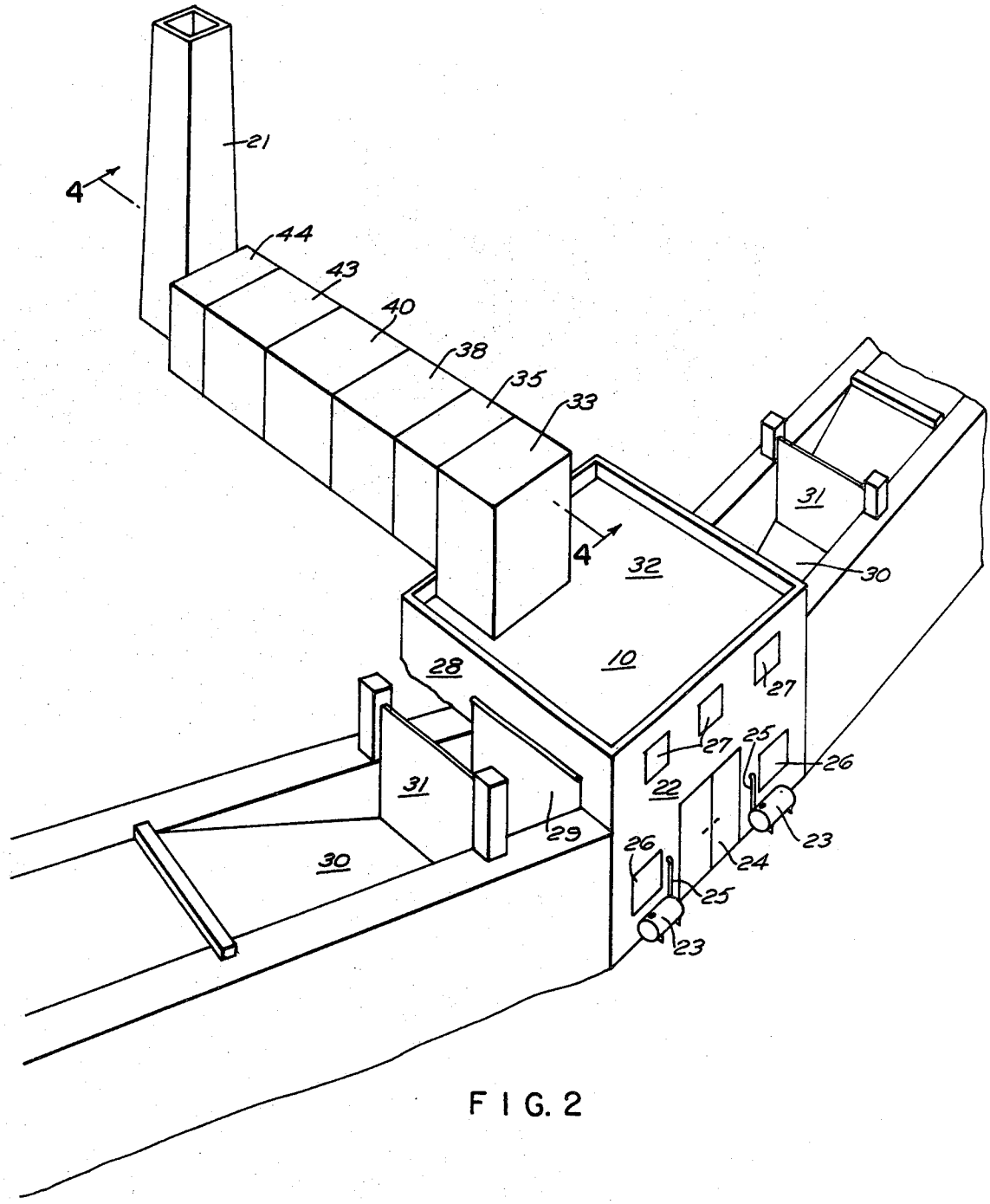


FIG. 2

INVENTOR

WILLIAM FRANCIS CAHILL, JR.

BY

William Frederick Werner

ATTORNEY

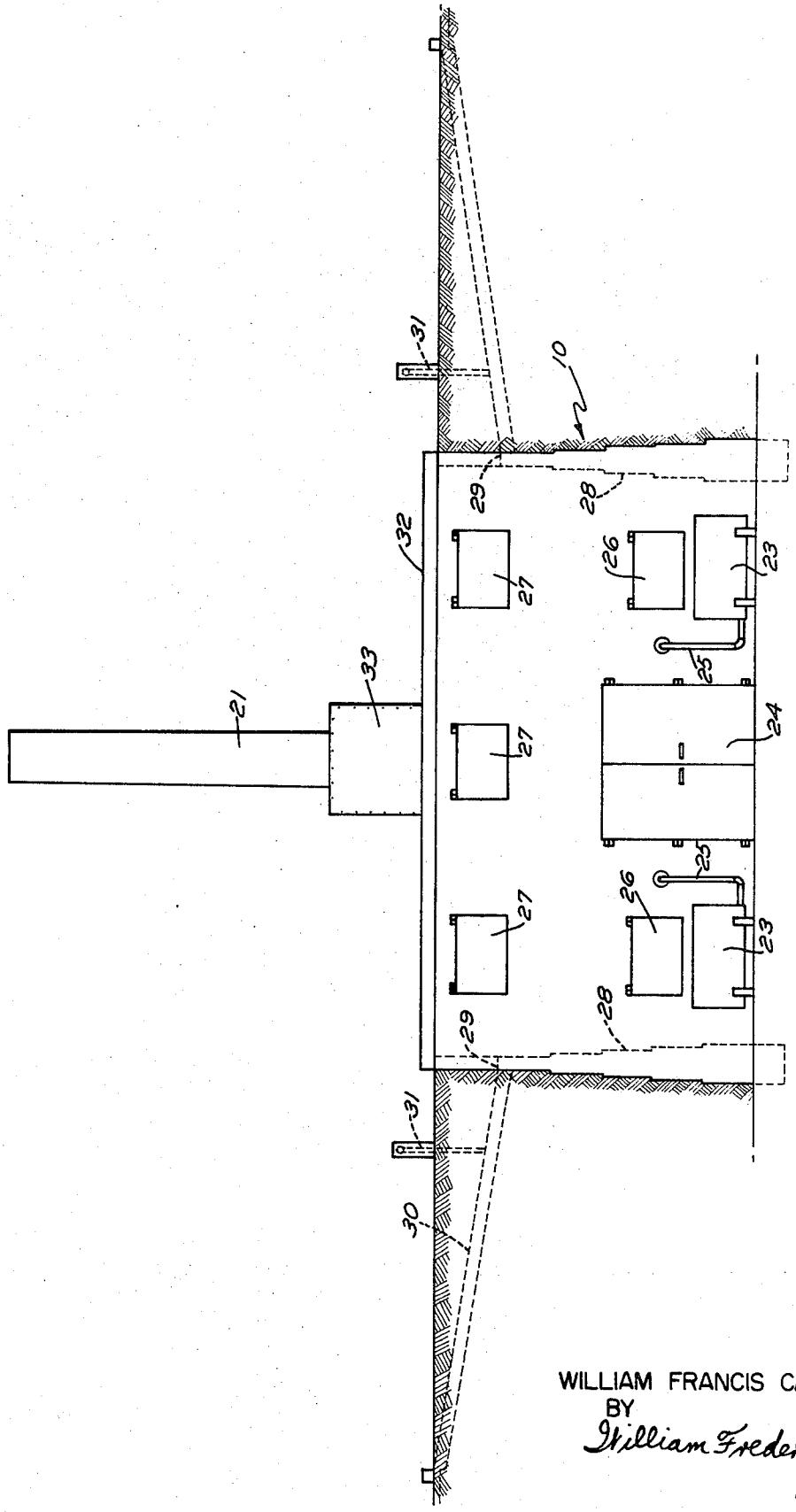


FIG. 3

INVENTOR
WILLIAM FRANCIS CAHILL, JR.
BY
William Frederick Kerner
ATTORNEY

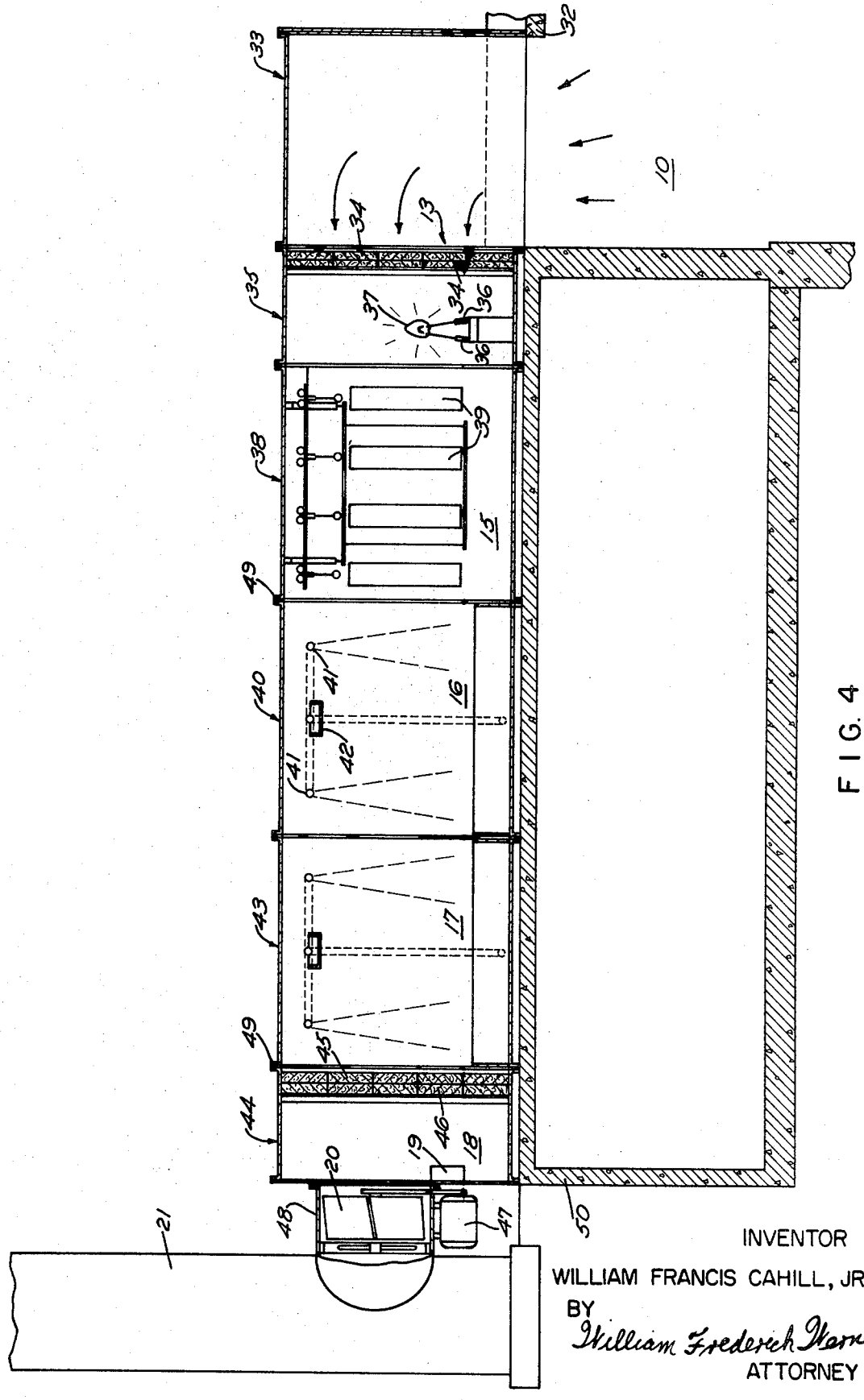


FIG. 4

INVENTOR
WILLIAM FRANCIS CAHILL, JR.
BY
William Frederick Warner
ATTORNEY

APPARATUS AND METHOD FOR INCINERATING RUBBISH AND CLEANING THE SMOKE OF INCINERATION

The present invention relates to the incineration of trashes, rubbish, and other forms of combustible waste and is concerned primarily with a novel method and apparatus for cleaning the smoke generated by the combustion of such materials whereby it is exhausted into the atmosphere as clean gas.

BACKGROUND OF THE INVENTION

At the present time the public is aroused to the dangers of pollution. Perhaps the most important aspect of this peril is the pollution of the atmosphere around large cities. Another problem is the disposal of all forms of waste. Many types of waste contain some materials which are susceptible of being consumed by combustion and converted into ash. Thus some waste often contain glass and metal which may be reclaimed for future use rather than being deposited in a dump.

A classic example of waste of this character is an automobile which has been wrecked or junked. The upholstery, tires, and other combustibles may be incinerated to remove them from the metal which may be reclaimed as scrap and the glass which can be recycled to fulfill a useful purpose.

The disposition and reclaiming of all forms of waste, such as municipal trash and rubbish, industrial waste, and the like by a method which includes incineration, immediately creates the problem of polluting the air by the smoke of incineration. While those working in this field have attempted to clean this smoke, it is believed the results so far achieved are not satisfactory to the degree required.

OBJECTS OF THE INVENTION

With the foregoing conditions in mind, the invention has in view the following objects.

1. To provide a method of and apparatus for incinerating all forms of waste to reclaim incombustible components thereof and convert the combustible components to ash and smoke, and clean the smoke to exhaust it to the air as clean gas.

2. To provide, in a method and apparatus of the type noted, a fire pit which receives the waste and which has associated therewith a plenum or smoke collecting chamber.

3. To provide, in apparatus of the character aforesaid, a fire pit which is adapted for installation at least partially underground together with chutes for charging waste thereinto.

4. To provide, in apparatus of the kind described, a plurality of smoke treatment chambers, arranged in series and connecting the plenum to a stack.

5. To provide, in apparatus of the character noted, smoke treatment chambers that are constructed as individual modules which may be constructed "off site" and transported to the area of the fire pit where they are installed.

6. To include, in a method of the type described, the step of monitoring the treated smoke just before it enters the stack.

Various other more detailed objects and advantages of the invention such as arise in connection with carrying out the above noted ideas in a practical embodiment will in part become apparent and in part be hereinafter stated as the description of the invention proceeds.

SUMMARY OF THE INVENTION

The foregoing objects are achieved by providing a fire pit which is preferably installed underground and which has associated therewith chutes for charging the pit with waste. The fire pit is covered and on one side of the roof is a plenum in which smoke is collected. Adjacent to the plenum is a filter assembly and then an after burner chamber. Following the latter is an electrostatic precipitator chamber together with means to remove the precipitate. Next in line is an alkaline water wash followed by a plain water wash. The treated smoke is then drawn through a filter assembly and passed to a stack. A monitor is included in the chamber in which this last filter is located.

For a full and more complete understanding of the invention, reference may be had to the following description and accompanying drawings wherein:

FIG. 1 is a flow sheet which illustrates diagrammatically the method of the subject invention;

FIG. 2 is a perspective, largely diagrammatic of an incinerator installation in which the method may be conducted;

FIG. 3 is a view in end elevation of the fire pit; and,

FIG. 4 is a longitudinal vertical section through the incinerator and smoke treating apparatus being taken about on the plane of line 4—4 of FIG. 2.

Referring now to the drawings wherein like reference characters denote corresponding parts and first more particularly to FIG. 1, the method will be described.

All forms of waste, both municipal and industrial are charged into a fire pit **10**. All combustible components of the waste is consumed by burning. This combustion may be facilitated by a forced air draft and the injection of oil.

Ash and other solid residues are removed from fire pit **10** from time to time as represented by arrows **11**. Smoke is collected from fire pit **10** in a plenum **12**. This is accomplished by a draft generated by a motor driven fan as will be later described. This draft may be in the nature of 30,000 cubic feet per minute.

The smoke now passes through a filter assembly **13** which may comprise two coarse filter which remove large particles from the smoke. The filtered smoke now passes to an after burner chamber **14** in which it is subjected to a temperature on the order of 6,000° F. created by an arc flame. Entrained particles and gases are burned by this high temperature.

From the after burner the smoke passes to an electrostatic precipitating chamber **15** in which an electrostatic precipitator operates at a potential of 140,000 volts. This causes particles to be picked up and removed to the side of the chamber from which they are periodically removed by mechanical brushes or manually.

The smoke now is subjected to an alkaline water wash represented at **16**. This wash neutralizes any acid fumes and also collects particles which may still be entrained in the smoke. The pH of the wash is controlled by an electrometric pH meter on the outside of the chamber.

A chamber **17** which is a duplicate of chamber **16** houses a plain water wash. Clear water used at station **17** picks up particles still remaining in the smoke. A second filter assembly is shown at **18** and includes both mechanical and chemical filters. A continuous air testing monitor **19** is located in the chamber housing filter assembly **18**. A motor driven fan is represented at **20** and is effective to create the draft that draws the smoke from fire pit **10** through the various stages of the method and passes it to a stack **21** as clean gas which may be exhausted to the atmosphere without danger of pollution.

Referring now to FIGS. **2** and **3**, the construction of the free pit **10** will be described. The construction illustrated is particularly adapted for underground installation which is desirable when it is considered that many forms of waste often include explosives. By having the fire pit mainly underground, the danger of explosives is minimized.

Fire pit **10** includes a rear wall **22** on the exterior of which are mounted oil tanks **23**. It is also provided with a clean out door **24** which may be availed of when it is desired to charge the fire pit with a large object such as a wrecked automobile. Lines **25** extend from oil tanks **23** to the interior of pit **10** where oil is injected into the burning mass of waste. Above oil tanks **23** are fire doors **26**. Extending across rear wall **22** just below its upper edge are three cooling doors **27** which may be selectively opened as occasion demands.

Side walls of pit **10** are shown at **28** in FIG. **3**. Each wall **28** is formed with a charging opening **29** and communicating with each opening **29** is a chute **30**. Each of the latter is provided with a vertically reciprocating safety gate **31**.

A roof **32** covers fire pit **10** and mounted thereon is structure **33** constituting plenum **12** of FIG. **1**. The bottom of plenum structure **33** opens onto the interior of fire pit **10**.

Referring now to FIG. 4, plenum structure 33 includes an open side in which filter assembly 13 is mounted. Assembly 13 comprises two coarse filters 34 which preferably are mechanical.

After burner station 14 is shown as provided by a module 35 which houses electrodes 36 which generate arc 37.

The electrostatic precipitator at 15 is also constructed as a module 38. Suspended in the latter are a plurality of precipitators 39 which receive electric current at a potential of 140,000 volts.

Station 16 for the alkaline water wash is provided by a module 40. Housed in the latter are spray heads 41. An electrometric pH meter 42 is preferably mounted on the exterior of module 40.

Module 43 is similar in structure to module 40 and houses the spray heads which perform the plain water washing at station 17.

A module 44 houses filter assembly 18 and the fan represented diagrammatically in FIG. 1 at 20. It is believed to be desirable that one of the filters of assembly 18 be mechanical and the other chemical. Thus, filter 45 is a mechanical filter and filter 46 is chemical.

A motor 47 is mounted on module 44 and drives fan 20. A conduit 48 connects module 44 to stack 21.

As illustrated in FIG. 2, plenum structure 33 is built as a module. This module, like modules 35, 38, 40, 43 and 44 are formed with flanges 49 which facilitate their assembly as illustrated in FIG. 4. Normally the assembled modules are supported by a foundation 50.

The manner in which the apparatus of FIGS. 2, 3 and 4 function is believed to be obvious from the description of the method as set forth above in conjunction with FIG. 1.

While a preferred specific embodiment of the invention is hereinbefore set forth, it is to be clearly understood that the invention is not to be limited to the exacts steps, constructions and devices illustrated and described because various modifications of these details may be provided in putting the invention into practice.

What is claimed is:

1. In the disposal and reclaiming of components of refuse, the method comprising the steps of:
   a. depositing refuse including combustible and incombustible components in a fire pit,
   b. burning the combustible components in said fire pit,
   c. removing the incombustible components from said fire pit,
   d. collecting smoke generated by the burning of said combustible components in a plenum,
   e. passing the smoke from said plenum through a coarse filter assembly under the influence of a forced draft,
   f. burning particles and gases in said smoke in an after burner chamber to which the smoke is passed by said draft,
   g. precipitating particles from the smoke by electrostatic precipitation in a chamber into which the smoke is delivered by said draft,
   h. washing the smoke in an alkaline water wash,
   i. washing the smoke in a plain water wash,
   j. passing the smoke through a second filter assembly; and
   k. passing the filtered smoke into a stack from which it is exhausted to the atmosphere as clean gas.

2. The method of claim 1 together with the steps of periodically removing precipitate from the chamber in which electrostatic precipitation takes place.

3. The method of claim 1 in which the character of the smoke is continuously monitored before it is passed to the stack and the nature of the filters altered in accordance with information derived from the monitoring.

4. The method of claim 1 in which the after burning is carried out by an electric arc at a temperature on the order of 6,000° F.

5. The method of claim 1 in which the electrostatic precipitation is carried out under a potential on the order of 140,000 volts.

6. In apparatus for burning and reclaiming incombustible components of refuse,
   a. a fire pit,
   b. a plenum for collecting smoke generated by combustion in said fire pit,
   c. a coarse filter assembly adjacent to said plenum,
   d. an after burner chamber adjacent to said filter assembly and including electric arc generating means,
   e. a chamber adjacent to said after burner chamber and housing an electrostatic precipitator,
   f. a chamber adjacent to that housing said electrostatic precipitator and including spray heads for alkaline water,
   g. a chamber adjacent to that housing the spray heads for alkaline water and including spray heads for plain water,
   h. a second filter assembly adjacent to said last mentioned chamber,
   i. a fan for creating a forced draft that draws smoke into said plenum and through said chambers,
   j. power means for driving said fan; and
   k. a conduit for passing smoke from said second filter assembly to a stack from which the cleaned smoke is exhausted to the atmosphere.

7. The apparatus of claim 6 in which the plenum and chambers are constructed as independent modules and later assembled at the site of the fire pit.

8. The apparatus of claim 6 in which the fire pit includes a clean out door and chutes for charging refuse into said fire pit.

9. The apparatus of claim 6 in which a portion of the fire pit is installed underground.

10. The apparatus of claim 6 together with means for removing precipitate from the sides of the chamber housing the electrostatic precipitator.

11. The apparatus of claim 6 in which the coarse filter assembly comprises two coarse filters.

12. The apparatus of claim 6 together with an electrometric pH meter mounted on the chamber housing the spray heads for alkaline water.

13. The apparatus of claim 6 together with a continuously operating monitor mounted in the module containing the second filter assembly.

14. The apparatus of claim 6 in which the second filter assembly includes both mechanical and chemical filters.

* * * * *