July 10, 1962 J. W. HEBERT 3,043,246

DOMESTIC REFUSE AND GARBAGE INCINERATORS

Filed Nov. 29, 1957 2 Sheets-Sheet 1

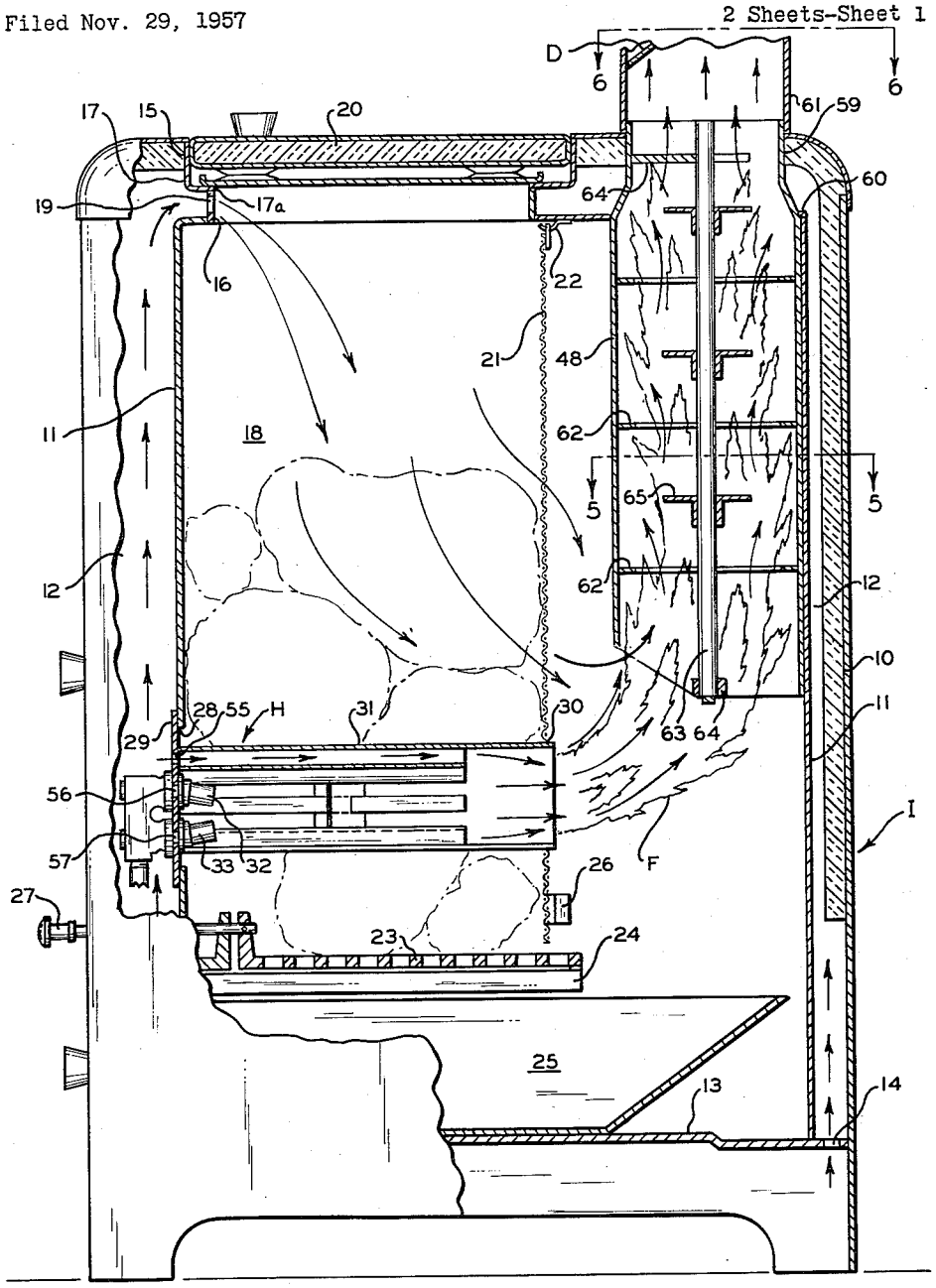


FIG. 1

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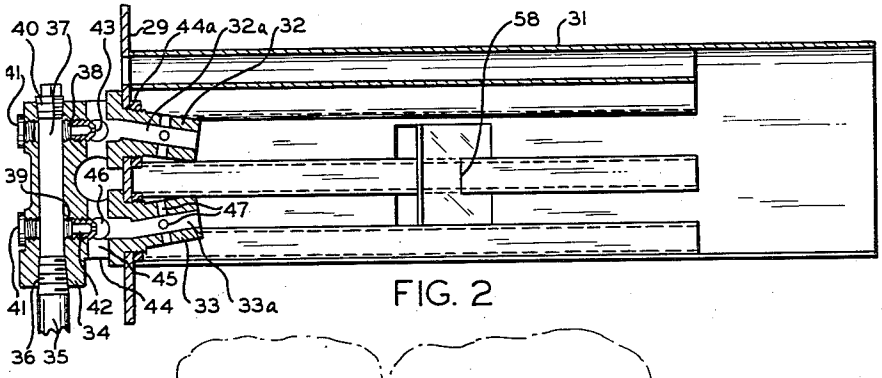


FIG. 2

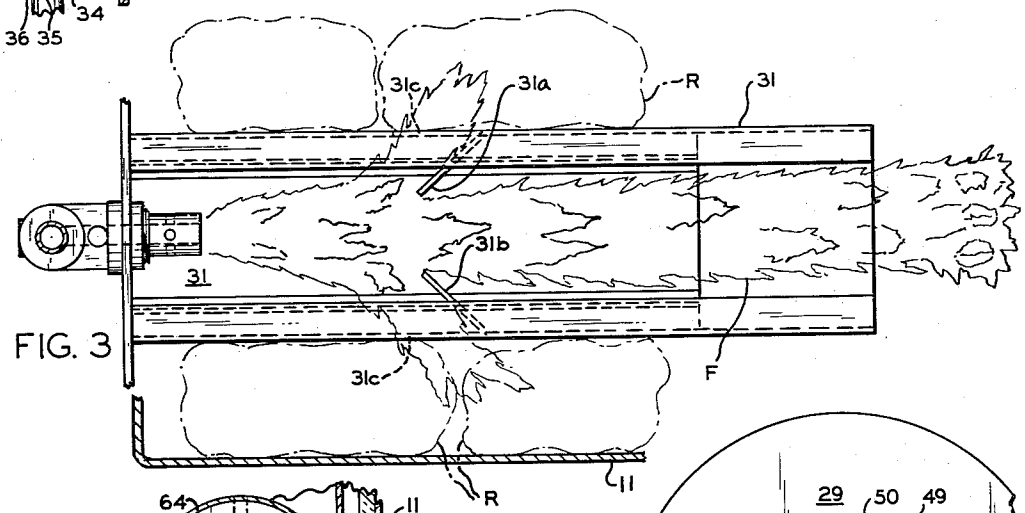


FIG. 3

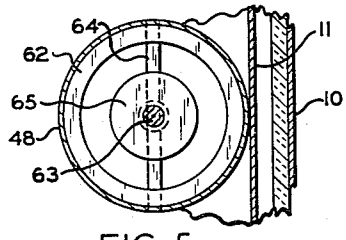


FIG. 5

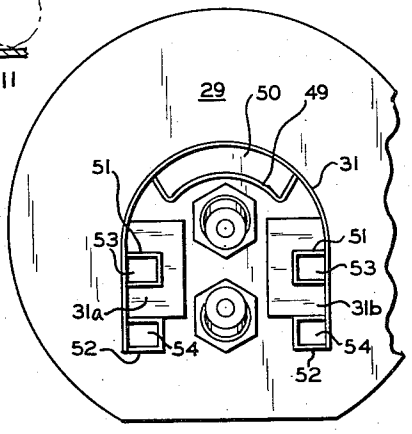


FIG. 4

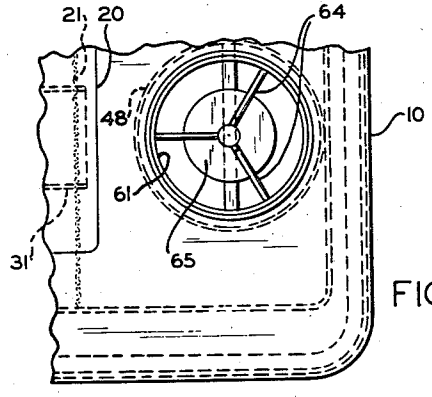


FIG. 6

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3,043,246
DOMESTIC REFUSE AND GARBAGE INCINERATORS

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4 Claims. (Cl. 110—8)

This invention relates to domestic refuse and garbage incinerators so constructed as to burn odoriferous gases and combustibles in the off gases from the material incinerated and to methods of incinerating garbage and refuse and the by-products thereof.

It is well known that in the normal operation of conventional domestic incinerators which are employed to burn trash, garbage, and the like, within a building, that smoke, odor bearing fumes, and particulate matter are given off as the by-products of combustion and are discharged to atmosphere. In many populous areas ordinances have been enacted to prohibit the discharge of odor bearing fumes, smoke, soot, and the like, and accordingly the manufacturers of incinerators have for many years sought to design an economically practical incinerator which would not only do a thorough job of combusting the solid materials charged to it but would also combust the undesirable by-products of incineration. Various incinerators have been designed and tested for years and it has been discovered only recently that incinerators having catalytic oxidation elements located in the path of the off gases of incineration will satisfactorily burn the odoriferous fumes and combustible gases. So far as I am aware, incinerators having catalytic oxidation elements were the first incinerators capable of burning the combustibles in the off gases with any degree of efficiency which were designed and offered on the market. These units incinerate virtually all types of wet or dry combustible waste, including vegetable waste, meats, feathers, carpet sweepings, rags, paper, wax cartons, suet, slaughtered poultry, grain, sawdust, large bones, wool, skins, hair, and the like, and efficiently and successfully burn these materials without exhausting objectionable odors and fly ash into the atmosphere.

While this type of unit performs in an extremely efficient manner, its cost is quite high and accordingly I have sought to design an incinerator and method of combusting a wide variety of refuse which would be more economical to manufacture and assemble and could be offered at a lower price. The instant application is a continuation in part of application Serial No. 602,813 filed August 8, 1956, by John W. Hebert, now Patent No. 2,993,454 and has for its primary object the development of an incinerator in which virtually perfect combustion can be obtained without catalytic elements or a secondary or auxiliary burner.

Recently an incinerator has been designed which locates an auxiliary burner communicating with a main burner for burning trash and refuse in the path of off gases of incineration. However, this incinerator has been found to be only about fifty percent efficient in combusting the off gases. In the design mentioned there are probably many reasons for the low efficiency of the unit, which makes no provision for mixing a flame with the gases of incineration, does not effectively provide air for primary combustion of the off gases, and creates a plurality of small flames at burner ports which are rendered relatively ineffective and easily snuff out when the off gases are proceeding at considerable velocities.

One of the prime objects of the instant invention is to provide an incinerator which is so designed that the flow of the off gases can be controlled and the flame so intermixed with the off gases, which are broken up, that a complete combustion of combustible gases and particles occurs.

Another object of the invention is to provide an incinerator including a unitary, high pressure, high output burner which delivers flame both to the refuse charging chamber and to a secondary chamber which is employed for combusting the off gases.

Another object of the invention is to provide an incinerator including a burner of the character described which incorporates means for providing secondary air to the portion of the flame which is directed into the off gas combustion chamber or casing.

Still another object of the invention is to provide an incinerator of the type described with a burner unit extending through a refuse combustion chamber and opening adjacent a secondary combustion chamber of restricted size into which a selected portion of the flame from the burner is directed.

A further object of the invention is to provide an incinerator for completely combusting trash and garbage which includes burner means directing more of its flame to a secondary combustion chamber in which the off gases are combusted during the initial stages of incineration when the drying refuse and garbage emits odor bearing gases at a relatively more rapid rate and in greater volume than during the actual incineration of the material.

Another object of the invention is to design an incinerator incorporating means for supplying relatively fresh air to the flame entering the secondary combustion chamber, apart from the air within the refuse combustion chamber, since it is highly desirable that the amount of air entering the refuse combustion chamber be controlled so that burning does not proceed at too rapid a rate and the volume of off gases is not too great for the unit to effectively handle.

With the above and other objects in view, the present invention consists in the combination and arrangement of parts hereinafter more fully described, illustrated in the accompanying drawing, and more particularly pointed out in the appended claims, it being understood that equivalent changes may be made in the various elements which comprise the invention without departing from the spirit thereof or the scope of the appended claims.

In the drawings:

FIGURE 1 is a partly sectional, side elevational view of the incinerator which I have designed to virtually completely combust a wide variety of refuse and garbage.

FIGURE 2 is a fragmentary, sectional, side elevational view through the burner shield and burner assembly only.

FIGURE 3 is an inverse plan view of the burner shield and burner assembly.

FIGURE 4 is a rear elevational view thereof.

FIGURE 5 is a sectional plan view taken on the line 5—5 of FIGURE 1; and

FIGURE 6 is a top plan view taken on the line 6—6 of FIGURE 1.

Referring now more particularly to the accompanying drawings, in which I have shown a preferred embodiment of the invention only, a letter "I" generally indicates an incinerator of down draft design which includes an insulated outer casing 10. Mounted within the casing or housing 10 and perimetrally spaced from the side walls and top thereof is an inner casing 11 which defines an air passage 12 between the walls of the inner and outer casings. The bottom 13 of the incinerator at the front and back thereof has openings 14 communicating with the passage 12 which permit air to flow into the passage 12 from outside the incinerator in the usual manner. The inner and outer casings 10 and 11 are provided with top openings 15 and 16 respectively and a door frame 17 sup-

ported in the opening 15 has a throat section 17*a* extending into the opening 16 in the inner casing, permitting air from the passage 12 to flow into the primary refuse and garbage combusting chamber 18 through openings 19.

Mounted to swing outwardly in the same manner as is the charging door in Patent No. 2,696,178 is the insulated charging door 20 through which packages of refuse and garbage may be charged to chamber 18 in the usual manner. A perforate wall 21 pivotally mounted on a hook 22 supported on the upper wall of the unit casing 11 forms the back of chamber 18 and a grate 23 reciprocated on guides 24 fixed to the side walls of the inner casing 11 above an ash door 25 forms the bottom of the refuse chamber 18. Stops 26 maintain the screen 21 in position in the usual manner and a handle 27 is provided on grate 23 so that the same may be manually actuated as desired.

The incinerator described thus far is to the extent described identical with the incinerator shown in the previously mentioned parent applications and similarly has an opening 28 formed in the front wall of casing 11 through which a hood and burner means assembly H extends. As shown in particular detail in FIGURES 2 and 3, assembly comprises a front plate 29 which overlies the marginal edge of opening 28 and may be secured to the front wall of inner casing 11 in any acceptable manner. Mounted on the plate 29 and extending inwardly therefrom sufficiently so that its inner end enters an opening 30 formed in the screen 21 is a generally U-shaped (FIG. 4) burner shield 31 which is inverted so as to be open at its lower end. Burner nozzles 32 and 33 supported by the plate 29 extend into the tube-like shield 31 and as will be seen these burner nozzles 32 and 33 are integral components of a burner assembly which includes an outer manifold 34 into which a fuel gas supply line 35 may be threaded as at 36. The manifold 34 includes passage 37 communicating with threaded passages 38 and 39 which lead to the passages 32*a* and 33*a* in the nozzle members 32 and 33 respectively. The upper end of passage 37 is closed by a threaded member 40 and the outer ends of passages 38 and 39 are closed by threaded members 41 as shown. Threaded members 42 in passages 38 and 39 have reduced orifices 43 extending into a neck section 44 of the burner assembly which has enlarged vertical ports 45 and transverse ports 46 admitting primary air for combustion to the neck portion 44 to be mixed with the gas issuing at a high velocity through reduced orifices 43. Nuts 44*a* secure the burner assembly in position on the plate 29. Also ports 47 are provided in the nozzle members 32 and 33 as shown which are of smaller diameter than the main nozzle passages 32*a* and 33*a* from which the gas issues at such a rate and under such pressure that it forms a very hot flame of sufficient length to extend up into a secondary combustion chamber 48 mounted in the rear of the inner casing 11 behind screen 21.

It is important that such a flame be provided with adequate primary air in order to be efficient and effective and the burner shield of the instant design includes an upper channel plate 49 defining with the wall of housing 31 an air duct 50, and pairs of side channel members 51 and 52 defining with the wall of housing 31 pairs of ducts 53 and 54 which are all closed to the burner nozzles 32 and 33 and extend nearly to the end of burner shield 30 as shown in FIGURE 1. The duct 50 has a passage 55 supplying it with fresh air from the perimetral passage 12 and similar openings 56 and 57 in plate 29 supply the pairs of ducts 53 and 54 with air from passage 12.

Intermediate the ends of housing 31 sections 31*a* and 31*b* of the side wall 31 are struck inwardly to provide openings 31*c* in the walls of casing 31 through which parts of the flame F can be directed. The deflectors 31*a* and 31*b*, in fact, split off a portion of the flame as shown in FIGURE 3 and direct it outwardly to the refuse and bagged garbage R, which is piled along the sides of the burner shield 30. The ducts 53 extend through openings 58 (FIG. 2) provided in deflector plates 31*a* and 31*b* and so, together with ducts 50 and 54, deliver a supply of air around the periphery of the flame F, which is accordingly intensely hot.

The housing 48, which extends vertically through openings 59 and 60 in the upper walls of the housings 10 and 11 respectively, is open to the inner casing 11 and refuse combustion chamber 18 only at its lower end, which is adjacent to the mouth of shield 30. The cylindrical casing 48 is, of course, of considerably restricted diameter with respect to the inner casing (FIG. 6) and thus provides a restricted flow path for the off gases of drying and incineration which must literally pass through a continuous wall of flame extending most of the length of casing 48 in order to reach the flue 61 which leads from the incinerator to a suitable chimney or the like and atmosphere. Provided in the casing 48 at spaced intervals are annular rings 62 and an axially extending, depending rod or shaft 63 supported by spokes 64 at its upper and lower ends mounts spaced apart disks or targets 65, which terminate to provide with the rings 62 a tortuous, sinuous flow path for the off gases. The rings 62 and 65 tend to break up and slow the flow of the off gases and also tend to break up the flame F so that a thorough mixing or blending of the very hot flame and flue gases occurs in the chamber 48. During this mixing portion of the cycle which is essential to a thorough combustion of the combustibles in the flue gases, another important result is accomplished by forcing the flue gases to take a tortuous flow path in that non-combustible particles carried by the flue gases are caused to strike the rings 62 and 65 and the inner surface of the wall 48 and tend to drop out to the ash drawer 25.

The chamber 48 will, of course, be of a size to properly mix the off gases from the burning refuse with the flame and available air or oxygen in the proper proportions so that all of the smoke and odor is destroyed in the secondary combustion chamber prior to passing the gases to the flue 61. Further the tortuous flow path will be of such length that a thorough intermixing occurs and the velocity of the gases is controlled so that they do not pass off before proper mixing can take place. Of course, the amount of air reaching both combustion chambers 18 and 48 is also controlled so that the combustion does not occur at too rapid a rate for the unit to handle.

Because duct 48 which is equidistant from the side walls of inner casing 11 is cylindrical in shape it has great strength and is not subject to distortion under high temperatures. Also there are no pocketed corners and the whole of the chamber is available as a flow path for the gases. There are no restrictions in the secondary combustion chamber 48 which cause the off gases to back up nor do the fires in the main combustion chamber or secondary chamber get out of control because of uncontrolled drafts or the like in the unit.

The burner used is of the type which must supply in excess of thirty thousand B.t.u.'s per hour and is so designed that during the burning of the refuse in the chamber 18 about two thirds of the heat is being supplied at the mouth of the housing 30 in the flame that enters the secondary combustion chamber 48. This burner is a gas burner which must operate with the usual supply of gas available in the home, of course, which is normally supplied at a pressure of 6–8 inches water column. The plates 31*a* and 31*b* normally divert about one third of the flame. During the initial stage of incineration, however, when the heaviest odors are being given off, as the garbage and refuse dries, a greater percentage of the heat energy is being supplied to the flame at the mouth of the burner housing 30 to consume these odors since the refuse is packed around the openings 31*c* in the side walls of the burner housing 31 until ignition actually takes place and the flame spreads through the refuse in the chamber 18.

In operation the refuse and garbage is charged to the incinerator before the burner is ignited in the usual man-

ner and is usually supplied in paper bags which are stacked around the burner B. Loose refuse may also be charged to the chamber 18 and tends to pack in, of course. With only the openings 31c in the sides of burner shield 31 the incineration cycle is slowed and the heavy gases given off in the drying portion of the incineration cycle are effectively consumed by the flame F. As the material begins to ignite more of the flame is, of course, available at the openings 31c but the temperature at the mouth of housing 48 and within housing 48 is sufficiently increased so that a complete combustion of combustibles in the flue gases is achieved. The rings or discs 65 may be designated targets which break up the flame and the off gases and thoroughly intermix them so that a complete combustion can be achieved. The orifices 43 in the nozzle assembly are such that a volume of gas capable of delivering over thirty thousand B.t.u.'s of energy can be burned without a pressure drop and sufficient primary air is provided through openings 45 and 46 to support the hot torch-like flame which is produced. The ducts 50, 53 and 54 provide a perimeter of secondary air around the flame which passes to the housing 48 during incineration and the disk-like targets 65 tend to knock down fly ash and other particles in the off gases so that they do not pass out of the unit. The disks 65 and rings 62 in the chamber 48 subdivide both the concentrated stream of off gases and the flame and direct portions of both laterally at an angle to their normal flow path. This is a different result than is obtained by simply providing a non-linear chamber 48 or flow path which is not interrupted by internal obstructions.

The conventional barometric damper D which is shown in FIGURE 1 in the flue 61 will provide additional control of the flow of gases through chamber 48 and it has been found that with the instant unit flue temperatures are less than with the catalytic units previously referred to.

It should be apparent that I have developed an incinerator which can be placed on the market at a competitive cost with conventional units which do not achieve a combustion of the off gases of incineration and do not conform to ordinances in effect in many of our cities. While for purposes of illustration one form of this invention has been disclosed, other forms thereof may become apparent to those skilled in the art upon reference to this disclosure and therefore this invention is to be limited only by the scope of the appended claims.

In the claims:

1. In an incinerator for combusting refuse, garbage, and the like; a casing; wall means forming a primary combustion chamber and a generally vertically disposed secondary combustion chamber portion within said casing; a hood and burner means assembly within said primary combustion chamber, said assembly including a generally longitudinally extending hood portion extending toward and communicating with said secondary chamber portion; said assembly also including burner means supported in said primary chamber within the hood portion, having a fuel issuing surface portion with a generally longitudinal axis issuing a fuel fluid in an axial, generally longitudinal stream providing an elongate, torch-like flame under and axially of the hood portion directed toward said secondary combustion chamber portion; said hood portion extending a substantial distance longitudinally beyond said fuel issuing surface portion of the burner means to protect the flame; grate means in the primary chamber below said burner means for supporting refuse, garbage, and the like adjacent the said hood and burner means assembly; a flame dividing member supported within the secondary chamber generally centrally thereof and being spaced, around at least a substantial part of its perimeter, from the wall means forming the secondary chamber; a substantially closed duct on said assembly extending longitudinally within said hood portion and having one end open through said casing to admit primary air and the opposite end open at a location substantially outward axially of the fuel issuing surface portion near the end of said hood portion nearest said secondary chamber to supply said air to the flame at the said end of the hood portion; said secondary chamber portion having an open section of reduced area relative to said primary chamber admitting combustion gases in concentrated flow to said secondary chamber; said hood portion having an open section near said open section of the secondary chamber portion, and the space within said hood portion longitudinally outward of said fuel issuing surface portion being sufficiently unobstructed, to pass at least a portion of said flame from said hood portion to said open section of the secondary combustion chamber portion to impinge on said flame dividing member; and flue means connected with said secondary chamber near the upper end thereof and leading away therefrom out of said casing; said secondary chamber, except for said open section, being normally substantially closed to said primary combustion chamber to prevent the reentry of combustion gases to the primary chamber.

2. In an incinerator for combusting refuse, garbage, and the like; a casing; wall means forming a primary combustion chamber and a generally vertically disposed secondary combustion chamber portion within said casing; a hood and burner means assembly within said primary combustion chamber, said assembly including a generally longitudinally extending hood portion extending toward and communicating with said secondary chamber portion; said assembly also including burner means supported in said primary chamber within the hood portion, having a fuel issuing surface portion with a generally longitudinal axis issuing a fuel fluid in an axial, generally longitudinal stream providing an elongate, torch-like flame under and axially of the hood portion directed toward said secondary combustion chamber portion; said hood portion extending a substantial distance longitudinally beyond said fuel issuing surface portion of the burner means to protect the flame; grate means in the primary chamber below said burner means for supporting refuse, garbage, and the like adjacent the said hood and burner means assembly; a substantially closed duct on said assembly extending longitudinally within said hood portion and having one end open through said casing to admit primary air and the opposite end open at a location substantially outward axially of the fuel issuing surface portion near the end of said hood portion nearest said secondary chamber to supply said air to the flame at the said end of the hood portion; said secondary chamber portion having an open section of reduced area relative to said primary chamber admitting combustion gases in concentrated flow to said secondary chamber; said hood portion having an open section near said open section of the secondary chamber portion and the space within said hood portion longitudinally outward of said fuel issuing surface portion being sufficiently unobstructed to pass at least a portion of said flame from said hood portion to said open section of the secondary combustion chamber portion; and flue means connected with said secondary chamber near the upper end thereof and leading away therefrom out of said casing; said secondary chamber, except for said open section, being normally substantially closed to said primary combustion chamber to prevent the reentry of combustion gases to the primary chamber.

3. In an incinerator for combusting refuse, garbage, and the like; a casing; wall means forming a primary combustion chamber and a secondary combustion chamber portion within said casing; a hood and burner means assembly within said primary combustion chamber, said assembly including a generally longitudinally extending hood portion extending toward and communicating with said secondary chamber portion; said assembly also including burner means supported in said primary chamber substantially immediately under the hood portion, having a fuel issuing surface portion with a generally longitudinal axis issuing a fuel fluid in an axial, generally longitudinal

stream providing an elongate, torchlike flame under and axially of the hood portion directed toward said secondary combustion chamber portion; said hood portion extending a substantial distance longitudinally beyond said fuel issuing surface portion of the burner means to protect the flame; grate means in the primary chamber adjacent said hood and burner means assembly for supporting refuse, garbage, and the like adjacent the said hood and burner means assembly; a substantially closed duct within said assembly, under said hood portion and laterally outward of said fuel issuing surface portion, having one end open through said casing to admit primary air and the opposite end open at a location axially remote from said fuel issuing surface portion within the end of the hood portion nearest the secondary chamber to supply said air to the flame; said secondary chamber portion having an open section of reduced area relative to said primary chamber admitting combustion gases in concentrated flow to said secondary chamber; said hood portion having an open section near said open section of the secondary chamber portion and the space within said hood portion longitudinally outward of said fuel issuing surface portion being sufficiently unobstructed to pass at least a portion of said flame from said hood portion to said open section of the secondary combustion chamber portion; and flue means connected with said secondary chamber and leading away therefrom out of said casing.

4. In an incinerator for combusting refuse, garbage, and the like; a casing, at least part of which comprises a primary combustion chamber; communicating wall portions forming a generally vertically disposed secondary combustion chamber within said casing and a hood in said primary chamber leading generally horizontally in a direction generally toward the lower portion of said secondary chamber; burner means supported within the hood, having a fuel issuing surface portion with a generally longitudinal axis issuing a fuel fluid in an axial, generally longitudinal stream providing an elongate, torch-like flame

under and axially of the hood directed toward said secondary combustion chamber; said hood extending a substantial distance longitudinally beyond said fuel issuing surface portion of the burner means to protect the flame; grate means in the primary chamber adjacent said hood for supporting refuse, garbage, and the like adjacent the said hood and burner means; a substantially closed duct on said hood extending longitudinally with said hood and having one end open through said casing to admit primary air and the opposite end open at a location axially remote from said fuel issuing surface portion within the end of said hood nearest said secondary chamber to supply air to the flame at the said end of the hood; said wall portions forming the hood and secondary chamber being open one to another to pass flame from the hood to the secondary chamber and being open to said primary chamber to admit combustion gases to said secondary chamber; and flue means connected with said secondary chamber near the upper end thereof and leading away therefrom out of said casing; said secondary chamber being normally substantially closed to said primary combustion chamber at its upper end to prevent the reentry of combustion gases to the primary chamber.

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