United States Patent

[11] **3,552,332**

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[54] **INCINERATOR**
7 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **110/8,** 110/19
[51] **Int. Cl.** **F23g 5/12**
[50] **Field of Search** 110/8, 8A, 8C, 18, 18C, 19

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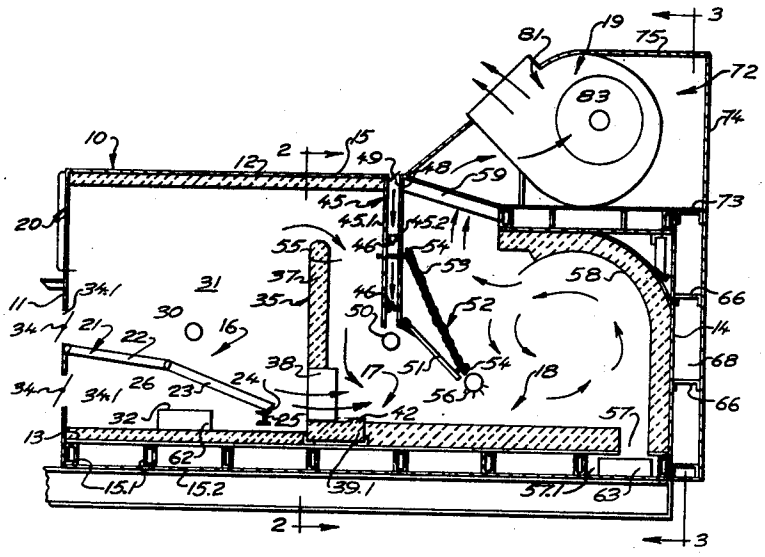
ABSTRACT: An incinerator having a primary burner for receiving waste to be burned and a secondary burning chamber and settling chamber through which the smoke and gasses from the primary burning chamber successively pass. A suction fan is provided at an outlet in the settling chamber to provide a draft and a heat retentive baffle member is positioned between the primary and secondary chambers in the path of the waste gasses and smoke to divide and preheat the gasses and smoke flowing from the primary chamber into the secondary chamber.



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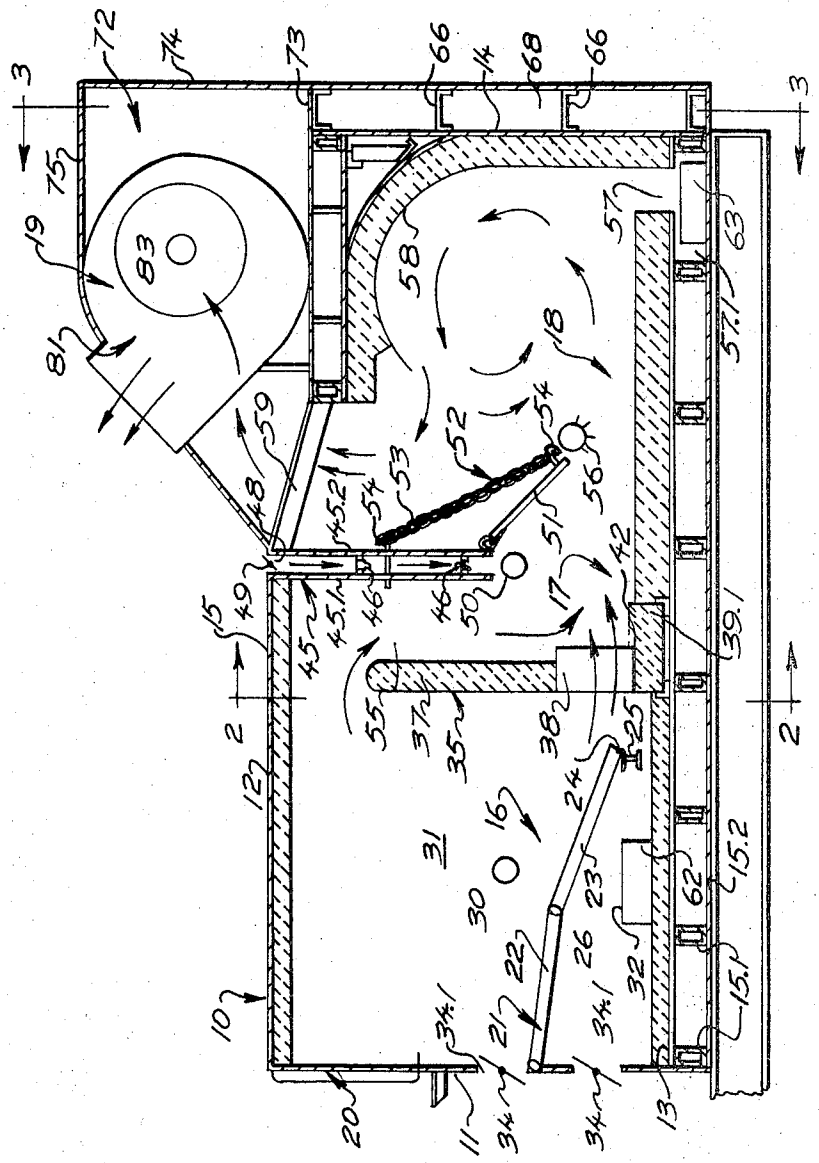

Fig. 1

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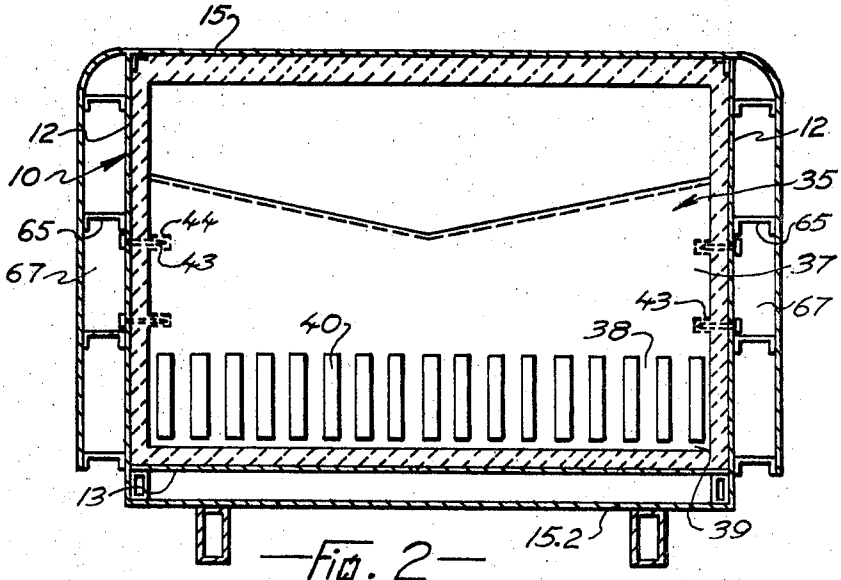

Fig. 2

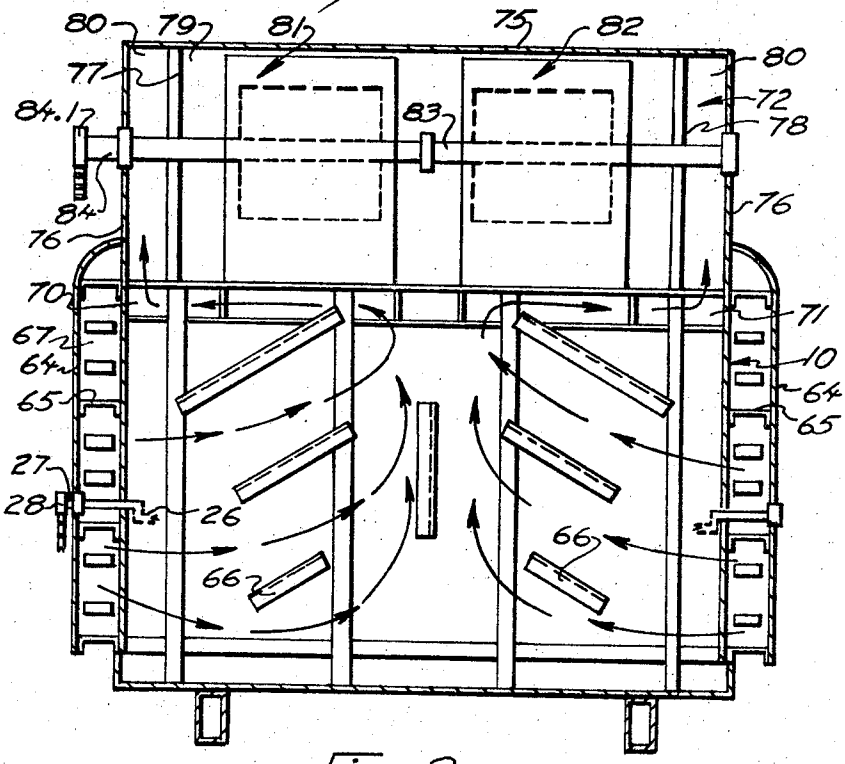

Fig 3

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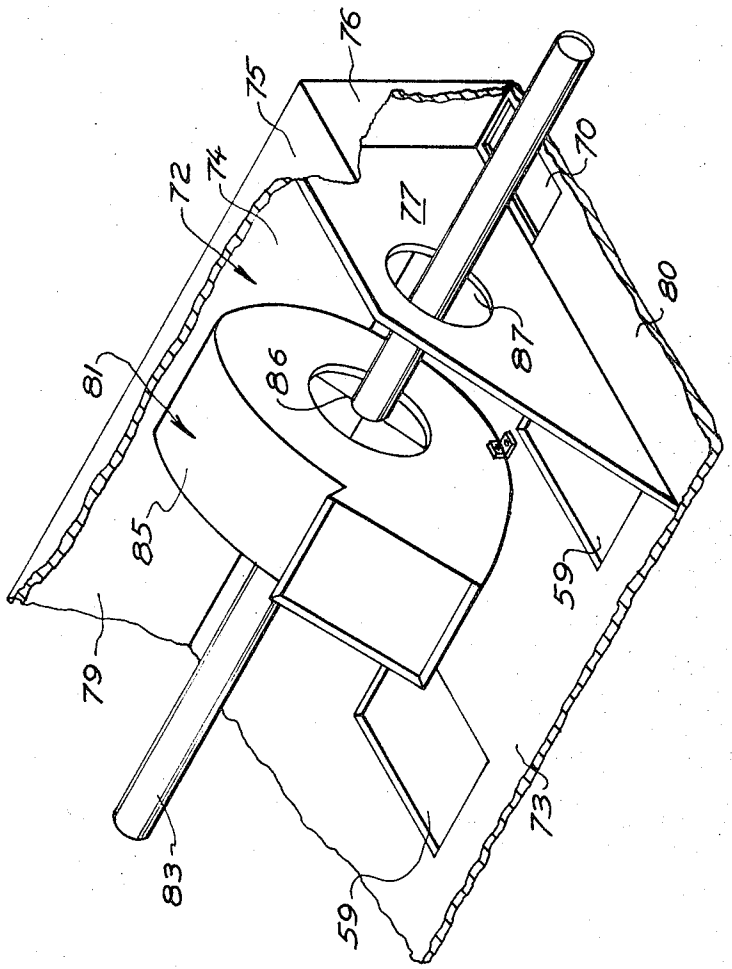

Fig 4

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INCINERATOR

BACKGROUND OF THE INVENTION

This invention pertains to incinerators and more particularly to the municipal incinerators amenable for transportation from site to site.

In the field of municipal incineration it is generally the practice to establish one incineration site for a generally large area in which an incinerator is permanently installed. These permanent incinerators are generally very large so as to have a high burning capacity. In order to provide for efficient burning so as to avoid air pollution by smoke and gasses these permanent incinerators must be operated relatively continuously. As is well known continuous operation permits the incinerator to retain its heat and thereby avoids the usually heavy issuance of smoke and the like which normally occur when an incinerator is first ignited.

In order to maintain these permanent incinerators in continuous operation it is therefore necessary to maintain a constant supply of municipal waste. Where municipalities are sparsely populated garbage trucks and the like which are employed to gather municipal waste must travel relatively great distances. This, it will be appreciated, is uneconomical in view of the extended unproductive travelling time of the garbage or waste collecting equipment.

It is possible, of course, to establish numerous incinerating sites through a municipal area however here again, in order to provide for continuous operation of the incinerators the number of collecting vehicles required and costs involved may be prohibitive.

SUMMARY OF THE INVENTION

The present invention provides a municipal incinerator which although suitable for a permanent installation in a permanent burning site is highly amenable to transportation from site to site without substantial loss of heat. The present invention, therefore, permits waste material to be burned at varied and distantly spaced apart sites and at varied times so as to reduce the number of collecting vehicles required.

The incinerator of the present invention is also designed so as to be economical to construct and operate and which, unlike most municipal incinerators of prior design, removes substantially all the fly ash and heavier particles from the products of combustion so as to permit municipal incineration to be carried out or undertaken in a relatively heavily populated area.

The incinerator of the present invention also is so designed so as to permit transportation in a heated condition and yet provide reasonable protection against damage to person and property whilst in transit from site to site.

In accordance with the foregoing the municipal incinerator of the present invention includes an elongated casing having a feed opening for feeding waste to be incinerated at one end and having a suction means at the other end for discharging products of combustion to atmosphere, a primary burning chamber communicating with the feed opening and having means for igniting said waste, a secondary burning chamber communicating with said primary chamber having burners therein, a settling chamber communication with the secondary burning chamber and suction means and heat retentive baffle means at the inlet and outlet of said secondary burning chamber arranged in the path of the products of combustion passing therethrough to maintain said secondary burning chamber in a heated condition for a prolonged period of time after the cessation of the passage of heated products of combustion therethrough.

The settling chamber is provided with an arcuately shaped baffle to obtain cyclonic movement of the products of combustion passing therethrough so as to separate substantially all of the solid products of combustion from the gasses thereof before the latter pass through the suction means. The incinerator is also provided with a jacket in spaced relation to the casing to provide a passage open at one end and communicating with the suction means at the other end, for the passage of cooling air therethrough.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a central sectional side view of the incinerator,

FIG. 2 is a sectional view taken along line 2–2 of FIG. 1,

FIG. 3 is a sectional view taken along line 3–3 of FIG. 1,

FIG. 4 is a fragmented perspective view illustrating a portion of the suction means of the incinerator.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring to the drawings and in particular to FIGS. 1, 2 and 3 thereof the incinerator includes a horizontally elongated casing 10 of steel plate construction having an overall rectangular configuration having a front wall 11, sidewalls 12, floor 13 and rear wall 14 and roof 15.

The interior of the casing including the floor 13 sidewalls 12 roof 15 and rear walls 14 is lined in a known manner, with a suitable refractory material such as fire brick. The casing is carried on cross members 15.1 secured by welding or riveting to the floor 13 said cross members 15.1 resting on and secured to a lower base plate 15.2 which extends the full length of and the full width of the entire floor. The space between the floor and the base plate is entirely closed by the sidewalls 12 which project downwardly below the floor.

In general the casing is divided fore and aft into a primary burning chamber 16 in which the waste is initially ignited, a secondary burning chamber 17 through which the products of combustion including ash and unburnt combustibles and gasses pass, and a settling chamber 18 constructed and arranged to obtain separation of fly ash and heavier particles from gasses. Suction means 19 located at the aft end of the casing and ported into the settling chamber 18 discharges the products of combustion from said settling chamber into atmosphere and at the same time provides a draft through all chambers.

The front wall 11 is provided with a feed opening 20 into which wastes to be burned are injected into the primary burning chamber. The waste may be fed in batches or may be continuously fed through a feed hopper, not shown, positioned over said feed opening.

Hingedly connected to front wall 11 immediately below the feed opening 20 is a grate 21. This grate, which extends the full width of the casing is forward of a pair of hingedly interconnected upper and lower sections 22 and 23, respectively. The upper section slopes upwardly from its connection at the lower section and is hingedly connected to the front wall of the casing below the feed opening therein. The lower section 23 slopes downwardly from its connection with the upper section and has its lower end 24 slidably resting on a cross beam 25 extending between and connected to the sidewalls 12 and spaced above the floor 13. Each of the upper and lower sections of the grate is preferably formed of a plurality of parallel bars extending longitudinally of the casing.

Both sections of the grate, at their juncture, rest upon a cross shaft 26 which is rotatably journaled in the sidewalls of the casing as an eccentric. One end 27 of the cross shaft extends outwardly of the casing and is provided with a sprocket 28 which is chain driven from a suitable source of power, not shown, rotation of the sprocket thus causing rotation of the cross shaft 26 and consequent vibratory motion of the grate.

A pipe burner 30 extends the full width of and above the grating and is so arranged as to direct flame downwardly upon the waste passing thereover.

It will be seen that the grate divides the primary burning chamber into an upper incinerating portion 31 and a lower ash pit 32. Valves 34, preferably of the butterfly type and which can be manually adjustable, are positioned at air intake openings 34.1 in the front wall to regulate the flow of air into the primary burning chamber 16.

Positioned rearwardly of the grate and spaced from the latter is a heat retentive baffle 35. This baffle, in fact,

separates the primary burning chamber 16 and secondary chamber 17. Baffle 35 extends the full width of the casing and is vertically elongated resting on the floor and being spaced downwardly from the roof 15. The baffle which is of massive construction and relatively thick is formed of a refractory material such as silicone carbide and has an upper solid baffle portion 37, a central louvered portion 38, the latter confronting the lower end of the lower portion of the grate, and a hearth section 39. The louvered portion 38, as seen in FIG. 1 is thicker than the baffle portion and is provided with a plurality of longitudinally extending vertically elongated narrow passages 40. The hearth section 39 is thicker than the louvered portion 38 and has an upwardly extending and arcuately shaped after edge portion 42. The baffle is firmly connected to the sidewalls 12 by means of extensible studs 43 which are screwed into suitable sockets 44 formed in the baffle.

Located behind and in spaced relation to the solid baffle portion 37 of the baffle 35 and depending from the roof 15 is a vent assembly 45. This vent assembly comprises a pair of thick steel plates 45.1 and 45.2 arranged in spaced apart side by side relationship connected as by short lengths of channel section 46. The vent assembly is arranged with the steel plates extending vertically said plates being connected to the roof on opposite sides of an opening 48 formed in the roof 15 of the casing. The lower ends of the plates 45.1 and 45.2 terminate a short distance above the louvered portion 38 of the baffle. At its upper end the vent assembly is provided with an air regulator 49 which has a butterfly type of valve which can be manually operated to regulate the flow of air therethrough.

Positioned immediately below the lower end of the vent assembly is transversely extending pipe burner 50 which is arranged to direct flame downwardly into the secondary burning chamber. Hingedly mounted at the lower edge of plate 45.2 is a baffle 51 which is formed of a thick plate of refractory material preferably of silicone carbide.

Baffle 51 is angularly adjustable by means of an adjusting assembly 52. This assembly 52, as shown, can be simply a pair of hooks 54 connected to baffle 51 and plate 45.2 between which a chain 53 is extended.

It will be seen that the secondary burning chamber has two inlets from the primary burning chamber one of the inlets being by way of the passages 40 through the louvered portion 38 of baffle 35 and the other inlet being by way of a passage 55 which is formed by the baffle portion 37 of the baffle 35 and the vent assembly 45. The outlet of the secondary burning chamber is the space between the floor of the casing and baffle 51. A pipe burner 56 which extends transversely of the casing is positioned at the lowermost edge of baffle 51.

The vent assembly 45 and baffle 51, it will be observed, form a dividing wall between the secondary burning chamber and settling chamber 18. This settling chamber 18, the after end of which is formed by the rear wall 14 has an opening 57 formed in the floor 13 adjacent the juncture of the latter and the rear wall 14 to provide an ash pit 57.1 and has an arcuate afterroof portion 58 which extend forwardly towards the vent assembly 45. The settling chamber is also vented as at 59 in to the suction means 19.

Clean out openings 62 and 63 in the sidewalls of the casing permit ashes to be removed from the ash pit portion of the primary burning chamber and the ash pit 57.1. These openings 62 and 63 are provided with doors not shown by means of which both ash pits can be cleaned as required.

The sidewalls 12 rear wall 14 of the entire casing and the roof overlying the settling chamber are covered by an exterior skin or jacket 64. This jacket which is formed of thin sheet metal is carried on channel members 65 which extend longitudinally of the sidewalls from front to rear thereof and on short sections of channel members 66 secured to the rear wall 14 of the casing. This jacket provides a pair of side passages 67 extending completely over the sidewall of the casing and provides a rear passage 68 the latter communicating with both side passages. The rear passage is ported into the suction means through ports 70 and 71.

The suction means includes a housing 72 which is mounted over the roof of the settling chamber 18 and extends the full width of the latter. This housing has a floor 73 a vertical rear wall 74 and a top wall 75 and end walls 76. This casing is divided transversely by interior walls 77 and 78 to provide a central chamber 79 and end chambers 80. A pair of centrifugal throw blowers 81 and 82 are mounted in the central chamber on a common shaft 83 extending between and journaled in the end walls 76, said shaft having at one end 84 a sprocket 84.1 by means of which said shaft may be rotatably driven from the same power sourced driving the cross shaft 26.

The suction means is best seen in FIG. 4 wherein one blower 81 and a portion of a housing 72 is illustrated. It will be seen that the blower 81 has a scroll case 85 and a centrifugal fan 86 arranged to draw air axially into the scroll case and discharge tangentially therefrom through a suitable opening in the housing 72. Interior wall 77 is provided with an aperture 87 to provide communication between the chamber 80 and central chamber 79 so that upon operation of the blower hot gas drawn from the settling chamber and cooler air drawn between the casing 10 and jacket will intermix in central chamber 80 before being discharged into the atmosphere.

In operation, waste combustible material fed into the primary burning chamber is ignited by the flame from pipe burner 30. As the grates vibrate the burning waste moves away from the feed opening over the grates, the ashes dropping downwardly therethrough into the ash pit 32. Smoke and gasses from the burning waste are drawn into the secondary burning chamber through passages 40 in the louvered portion of the baffle 35 and over the baffle portion 37 and down into the secondary burning chamber through the passage 55. Due to the arcuate edge portion 42 of the louvered portion 39 gasses smoke and unburnt particles passing through the passages 40 are deflected upwardly into the flame emanating from pipe burner 50. Likewise products of combustion passing through passage 55 also pass through flame from said last mentioned pipe burner. The smoke and gasses which pass through the flame emanating from pipe burner 50 will impinge upon baffle 51 which deflects them downwardly as they enter the settling chamber.

As the products of combustion including ash, smoke and gasses move along the floor of the settling chamber their velocity decreases permitting most of the heavier particles and fly ash to settle out and be carried by the slowly moving gasses to the opening 57 to permit the latter to drop into the ash pit 57.1. The hot gasses and solid particles which have not been trapped in the ash pit then move upwardly over the rear wall of the casing and over the arcuately shaped after roof portion 58 of the settling chamber. The arcuate configuration of the latter causes a cyclonic movement of the gasses and particles therein. The solid particles, due to centrifugal forces, will be thrown outwardly and downwardly towards the floor where they are again swept towards the opening 57 and the ash pit 57.1. It will be appreciated therefore that substantially all solid particles are removed from the products of combustion before they pass through the suction means and are discharged into atmosphere.

Consumption of substantially all combustible materials is ensured by the novel design of the secondary burning chamber 17. The baffle 35 not only provides a highly heated surface, for igniting any unburnt particles impinging thereon but also preheats all the products of combustion which enter the secondary burning chamber. Further ignition of unburnt particles is obtained through the provision of the pipe burner 50 and an extra supply of oxygen via vent assembly 45.

The products of combustion will also impinge upon the baffle 51 the surface of which is heated by pipe burner 56.

The design of baffle 35 also reduces the chances of a possible overloading of the secondary burning chamber by large emissions of smoke which is released when certain types of waste such as rubber are ignited. The length of the path followed by the products of combustion which flow upwardly over the baffle portion 37 and down through passage 55 into

the secondary burning chamber is longer than the path followed by said products into the secondary burning chamber through the louvered portion **38** of the baffle **35**. Heavy smoke caused by the burning of rubber or the like in the primary burning chamber will therefore be partially divided. The portion of said smoke flowing through the passages **40** of the louvered portion **38** and the portion flowing over the upper edge of baffle portion **37** and down through passage **55**, due to the difference in length of the two paths, will follow each other, successively, through the secondary burning chamber so as to permit the burners and the heated surfaces associated therewith to efficiently obtain substantially complete combustion of unburnt material passing therethrough.

The incinerator, as previously mentioned, may be permanently located. However it is more economically used when it is transported from site to site about a municipality. The incinerator can be mounted upon a suitable wheeled transporting assembly, not shown, and quite safely transported over municipal roads without endangering person or property.

It can be located at a burning site in a relatively heavily populated area. As the incinerator depends, for draft, upon blowers which are located at its outlet it always operates under negative pressure so that the heated gasses will only issue from the blowers to be discharged upwardly into the atmosphere. Furthermore, during its operation cooling air is drawn through the passages provided by the jacket and casing so that the outer surface of the entire incinerator is relatively cool. Nearby combustible objects such as fences, trees, and the like are thereby not endangered during the operation of the incinerator. Furthermore, the provision of the massive baffle **35** and baffle **51** maintain the secondary burning chamber in a heated condition during transportation of the incinerator from site to site. Cold starts are, therefore, avoided so as to substantially reduce the amount of smoke which would ordinarily be emitted.

I claim:

1. A portable incinerator including:

an elongated casing having means at one end for feeding combustible wastes therein and having suction means at the other end for discharging products of combustion into the atmosphere;

a primary burning chamber at said one end of the casing having ignition means for initially igniting waste;

a settling chamber, having a floor at said other end of the casing and having means for separating gasses and solid particles carried by said gasses, said settling chamber opening into said suction means;

a secondary burning chamber having an inlet and outlet disposed between and communicating with both said first mentioned chambers; and

heat retentive baffle means at the inlet and outlet of said secondary burning chamber for maintaining the latter in a heated condition when the incinerator is transported from site to site, the baffle means at the inlet of the secondary burning chamber including an upper, vertically disposed portion having a transverse upper edge extending above the secondary burning chamber and a lower, louvered portion confronting said secondary burning chamber so as to provide two paths of different length for the passage of the products of combustion from the primary burning chamber to the secondary burning chamber.

2. Structure as defined in claim **1** wherein the baffle means at the outlet of the secondary burning chamber includes a plate located in the path of the products of combustion, and being angularly disposed for deflecting the products of combustion passing from the secondary burning chamber towards the floor of the setting chamber.

3. Structure as defined in claim **1** wherein the settling chamber has a discharge port spaced above the floor and a baffle disposed between said discharge port and floor in the path of the products of combustion, said baffle having a curved deflecting face for causing cyclonic movement of the products of combustion before the latter pass from the settling chamber so as to cause separation of gasses and solid particles in said products of combustion.

4. Structure as defined in claim **1** including a jacket extending from end to end of the casing in spaced relation to the latter, said jacket forming a passage, said passage being open adjacent said one end of the casing and communicating with the suction means at the other end of the casing so that cool air is drawn between said casing and said jacket when the suction means is operated.

5. Structure as defined in claim **4** wherein the suction means includes a housing mounted on the casing over the discharge port and communicating with the passage, and a blower in the housing arranged to discharge therefrom to atmosphere so that the products of combustion entering said housing are mixed with the air entering through the passage before being discharged to atmosphere.

6. Structure as defined in claim **1** wherein the heat retentive baffle means is formed of a refractory material.

7. Structure as defined in claim **6** wherein the refractory material is silicone carbide.