INCINERATOR SYSTEM FOR DRY WASTE MATERIAL

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References Cited
UNITED STATES PATENTS
2,702,013 2/1955 Atteberry

3,516,370 6/1970 Stribling
3,773,000 11/1973 Applegate
3,785,303 1/1974 Hopkins
3,797,414 3/1974 Ahrend

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ABSTRACT

An incinerating apparatus having a curtain of air under pressure inclined downwardly into a fire pit and above the waste inlet to support combustion and to prevent the discharge of pollutants into the atmosphere.

5 Claims, 6 Drawing Figures
INCINERATOR SYSTEM FOR DRY WASTE MATERIAL

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to the disposal of waste material and relates specifically to an incinerator for burning dry combustible waste material in a manner to support substantially complete combustion and to prevent the discharge of smoke and other pollutants into the atmosphere.

2. Description of the Prior Art

In the past, the burning of waste material was a common practice since it was an easy and inexpensive way to dispose of such material. However, the burning of waste material produced smoke including unburned carbon and other pollutants which have been found to be detrimental to the health of humans and other plant and animal life. In recent years, the U.S. Government, as represented by the Environmental Protection Agency, has established rules and regulations for controlling the introduction of pollutants into the atmosphere so that most open burning is no longer permitted. As a result, it has been necessary to dispose of the waste material by other means, such as regional sanitary landfills and the like. Due to the objectionable nature of a sanitary landfill, as well as the increase in population which has caused the value of land and the taxes thereon to increase a substantial amount, it is sometimes necessary to transport the waste material many miles to less populous areas for disposal. This, of course, has substantially raised the cost of the disposal of waste materials.

Some efforts have been made to dispose of waste materials in a more economical manner including by incineration in which air under pressure has been introduced into a fire box or pit in order to support combustion, as well as to raise the temperature and cause the material to burn more rapidly. However, these prior art devices normally have been used for liquids such as waste petroleum products, chemicals, and the like, or solid carbonaceous fuels such as coal which have provided substantially different problems. Some examples of the prior art are the U.S. Pat. Nos. to Culver 1,931,181; Hennessey 3,033,134; Lytton et al 3,039,151; Ball et al 3,483,832; and Davies 3,704,676.

SUMMARY OF THE INVENTION

The present invention is embodied in an incinerator system for a cotton gin or the like which includes a collector-separator connected to various areas of a cotton gin by a plurality of air ducts so that lint and other waste material can be collected throughout the gin and discharged by air under pressure into the collector-separator. Within the collector-separator the heavier waste material falls by gravity to a discharge conveyor while the air is vented through an air duct at the top of the separator. The solid waste material is removed from the collector-separator by the conveyor and is discharged into the lower portion of an elongated distributor within which the waste material is spread out and is discharged through an elongated downwardly inclined nozzle into a fire pit. Simultaneously air under pressure from the upper portion of the separator is introduced into the upper portion of the distributor and such air is discharged through an elongated nozzle overlying the material nozzle and inclined downwardly at an angle into the fire pit. The air under pressure being discharged from the distributor forms a curtain of air which extends entirely across the fire pit and overtakes the burning waste material. At the opposite side of the pit the curtain of air is diverted so that it swirls into the mass of burning waste material to support substantially complete combustion of such material as well as to cause the material to burn at a higher temperature. Since pollution laden heat tends to rise, the curtain of air under pressure causes the smoke and pollutants to remain within the pit so that they do not escape to the atmosphere.

It is an object of the invention to provide an incinerator system for burning the dry waste material of a cotton gin which utilizes air under pressure from the air lift means within the gin to cause substantially complete combustion of waste material from the gin while preventing the introduction of smoke and other pollutants into the atmosphere.

Another object of the invention is to provide an incinerator apparatus including a fire pit and a distributor having a first portion for introducing waste material into the pit and a second portion for projecting a curtain of air under pressure into the pit and above the waste material being introduced thereinto.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view illustrating one application of the invention.
FIG. 2 is a vertical section thereof.
FIG. 3 is an enlarged section on the line 3–3 of FIG. 2.
FIG. 4 is an enlarged section on the line 4–4 of FIG. 2.
FIG. 5 is a perspective with portions broken away illustrating the apparatus for distributing the dry waste material.
FIG. 6 is an enlarged section on the line 6–6 of FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With continued reference to the drawings, most cotton gins are provided with a plurality of air ducts 10 which may be connected to a central air pressure supply (not shown) for airlifting lint and other waste material to a waste disposal area such as a railroad car or the like so that such waste material can be moved to a distant location for disposal. If desired, each of the ducts may have an independent fan or other source of supply of air under pressure for removing lint and other waste material from the gin.

With particular reference to FIGS. 1 and 2, the present invention includes a collector-separator 11 having upright side walls 12, a top wall 13, and a bottom wall 14. Each of the air ducts 10 communicates with the interior of the collector-separator 11 through openings 15 located in the upper portion of the side walls 12 so that air under pressure as well as lint and other waste material are discharged into the collector-separator. In the drawings the air is represented by broken line arrows 16, while the lint and other waste material is represented by full line arrows 17.

An inwardly and downwardly inclined generally frustoconical partition 18 is located at the lower portion of the collector-separator 11 and such partition terminates at a central opening 19 which extends through the bottom wall 14. When the air with the lint and other
waste material entrained therein is discharged into the collector-separator 11, the velocity of the air is sharply reduced while the pressure remains substantially constant so that the waste material falls out of suspension and gravitates to the bottom of the collector-separator where such material is discharged through the opening 19. An enclosed conveyor 22, such as an auger, endless belt, or the like, is located below the opening 19 for removing the solid particles of waste material discharged from the collector-separator 11. As illustrated in FIG. 2, the conveyor 22 includes an auger 23 located within a housing 24 and such auger includes a shaft 25 driven by a power plant 26 through a speed reducer 27.

The end of the conveyor 22 remote from the collector-separator 11 discharges waste material into the neck 28 of an elongated distributor 29 having upper and lower compartments 30 and 31, respectively, which are separated by a partition 32. The partition 32 includes a portion 33 which extends through the neck 28 so that the upper and lower compartments extend through the neck. With particular reference to FIG. 4, the lower compartment 31 may be provided with a bearing 34 to rotatably support the end of the auger 23.

Within the lower compartment 31 of the distributor 29, a pair of outwardly diverging partitions or walls 35 which are provided near the neck 28 to opposite ends of the lower compartment so that waste material discharged into the lower compartment by the conveyor can spread out along the entire length of the distributor. An elongated nozzle or chute 36 is located along the distributor 29 on the side opposite the neck 28 and such nozzle is inclined downwardly at an angle of approximately 30° for discharging waste material from the distributor in a generally downward direction.

At the top of the collector-separator 11, an air discharge duct 37 communicates with the interior of the collector-separator so that air can escape therefrom. Since the cross-sectional area of the air duct 37 is substantially less than the area of the collector-separator 11, the velocity of the air passing through the air duct is substantially increased. The opposite end of the air discharge duct 37 communicates with the neck 28 of the distributor 29 generally in alignment with the upper compartment 30 so that air under pressure passes from the collector-separator 11 into the distributor 29. An elongated downwardly inclined air nozzle 38 is located along the entire length of the distributor 29 and is adapted to discharge a curtain of air in a downward direction from the upper compartment 30 of the distributor. In practice the opening within the air nozzle constitutes a slit, the total area of which is less than the cross-sectional area of the air discharge duct 37, so that the velocity of the air being discharged from the upper compartment is greater than the velocity of the air entering the upper compartment. As soon as the air is discharged from the nozzle 38, the pressure of the air drops to atmospheric pressure, however, the velocity of the air causes such air to flow in a layer or curtain.

As illustrated best in FIGS. 1 and 2, the distributor 29 is located along one edge of an open fire box or pit 40 having wall structure 41 of metal, fire brick, or other heat resistant material, or such pit could be a well defined hole in the earth. Ordinarily, the distributor 29 and the open pit 40 are of substantially the same height. Preferably the wall 42 opposite the distributor 29 is generally arcuate so that the curtain of air from the air nozzle 38 impinges on such wall and is diverted in a generally swirling motion back toward the central portion of the pit.

In order to assist in spreading the dry waste material within the lower compartment 31, the partition portion 33 within the neck 28 is provided with an opening 43 providing communication between the upper and lower compartments. A trap door or valve plate 44 has one end mounted on a hinge 45 and such trap door may be selectively operated to open or close the opening 43. A pair of opposed guide members 46 are mounted on the upper surface of the trap door and such guide members retain a slide 47 so that the slide can move longitudinally of the trap door. The slide 47 is connected by a swivel connection 48 to an operating screw 49 which extends upwardly through a threaded boss 50 in the upper portion of the neck 28 and terminates in an operating handle or wheel 51. The trap door 44 is adapted to open toward the direction of airflow through the air discharge duct 37 so that when the trap door is open a small portion of the air under pressure passing through the air discharge duct is diverted into the lower compartment 31 to cause the dry waste material to spread out throughout the lower compartment.

If desired, a damper 52 having an operating handle 53 may be provided in the air discharge duct 37 to control the passage of air through the discharge duct.

In the operation of the device, air under pressure having lint and other waste material from the cotton gin entrained therein is discharged into the collector-separator 11 where the air pressure remains substantially constant but the velocity is sharply reduced so that the solid waste material falls by gravity to the bottom of the collector-separator while substantially clean air is discharged through the air discharge duct 37 at the top of the collector-separator. The solid waste material which falls to the bottom of the collector-separator 11 is discharged by the conveyor 22 into the lower compartment 31 of the distributor 29 where such material is spread out and is discharged through the nozzle 36 into the pit 40. At the beginning of operation, the damper 52 is closed to interrupt the passage of air through the discharge duct 37 and a small amount of waste material is discharged into the pit and ignited in a conventional manner. Then, after the damper 52 is opened so that air passes through the discharge duct 37 into the upper compartment 30 where the velocity of such air is increased as it passes through the air nozzle 38 so that such air forms a curtain or blanket of air which extends substantially entirely across the pit 40. A small portion of the air passing through the discharge duct 37 normally is diverted by the trap door 44 into the lower compartment 31 to assist in spreading and discharging the waste material through the nozzle 36 and below the curtain of air from the nozzle 38. At the opposite side of the pit the curtain of air impinges on the wall structure of the pit and is caused to return to the central portion of the pit in a swirling action which provides oxygen to support substantially complete combustion of the waste material within the pit as well as to cause the material to burn at a higher temperature. Since the curtain of air is located above the fire, any smoke or other pollutants which rise from the pit are caught in the airflow of the curtain and returned to the pit so that substantially no smoke or pollutants are discharged into the atmosphere.

We claim:

1. Apparatus for burning dry waste material within an open pit comprising a collector-separator, means for
introducing dry waste material and air under pressure into said collector-separator, the dry waste material and the air being substantially separated from each other within said collector-separator, distributor means spaced from said collector-separator, conveyor means connecting the lower portion of said collector-separator with said distributor means for moving dry waste material from said collector-separator to said distributor means, first nozzle means on said distributor means for discharging waste material from the distributor means into the open pit, air duct means connecting the upper portion of said collector-separator with said distributor means for moving air under pressure from said collector-separator to said distributor means, second nozzle means on said distributor means for discharging air at high velocity from said distributor means into the open pit, said second nozzle means overlying said first nozzle means and extending substantially the full length of the pit, whereby the air discharged from said distributor means through said second nozzle means forms a curtain of air above the waste material in the pit and is diverted into the waste material to support combustion when the material is ignited as well as to substantially prevent the discharge of pollutants into the atmosphere.

2. The structure of claim 1 in which said conveyor means includes a housing, an auger rotatably mounted within said housing, and means for driving said auger.

3. The structure of claim 1 in which said distributor means includes a generally horizontally disposed partition dividing said distributor means into upper and lower compartments, said conveyor means and said first nozzle means communicating with said lower compartment, and said air duct means and said second nozzle means communicating with said upper compartment.

4. The structure of claim 3 in which said partition has an opening, trap door means located adjacent to said openings, and means for operating said trap door means to open and close said opening to selectively provide communication between said upper and lower compartments.

5. Apparatus for burning waste material comprising a collector-separator, at least one first air duct for introducing waste material suspended in air under pressure into said collector-separator, the waste material falling out of suspension within said collector-separator and gravitating to the lower portion thereof, conveyor means for discharging the waste material from the lower portion of said collector-separator, an elongated distributor, a generally horizontally disposed partition dividing said distributor into upper and lower compartments, said conveyor means communicating with the lower compartment for introducing waste material thereinto, first nozzle means communicating with the lower compartment for discharging waste material therefrom, open pit means located adjacent to said distributor for receiving the waste material from said first nozzle means, a second air duct extending from the upper portion of said collector-separator to the upper compartment of said distributor for introducing air under pressure into said upper compartment, second nozzle means extending substantially the full length of said distributor and overlying said first nozzle means, said second nozzle means being inclined downwardly to discharge air from said upper compartment across and into said pit, whereby the air under pressure from said second nozzle means forms a curtain above the open pit and impinges on the wall structure thereof and then is diverted into the waste material to support combustion of the waste material when the waste material is ignited.