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H. J. CATES, JR., ET AL

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MIXING CHAMBER FOR THE END OF AN INCINERATOR ROTARY KILN

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2 Sheets-Sheet 2

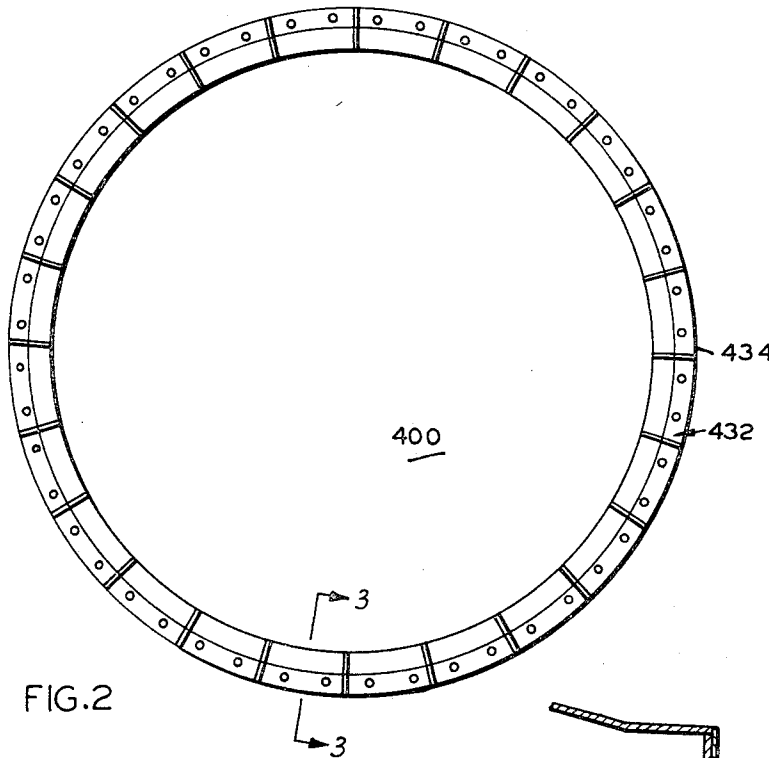


FIG. 2

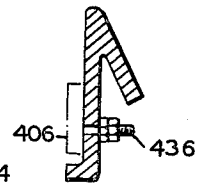


FIG. 3

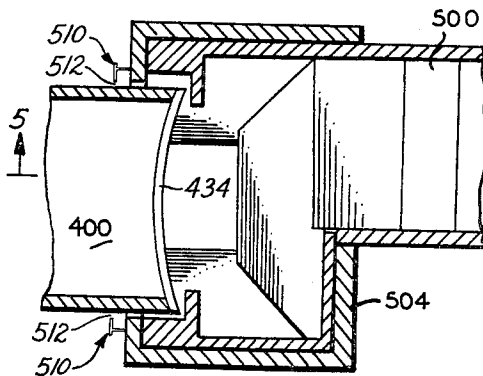


FIG. 4

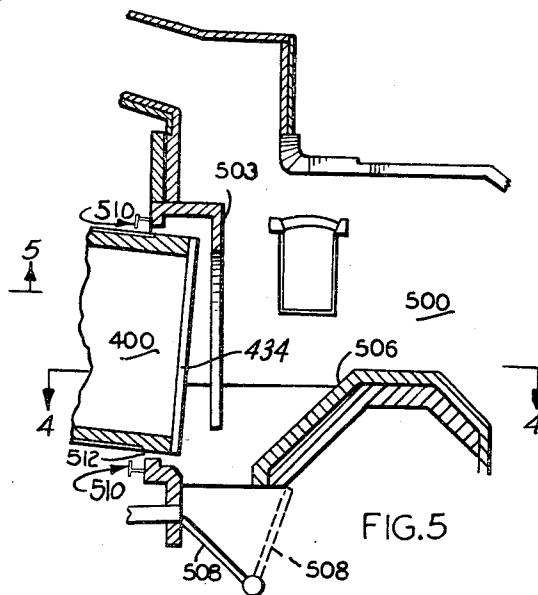


FIG. 5

INVENTORS
HENRY J. CATES, JR.
BY TOM ROSENBERG

Patent Attorney
ATTORNEY

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MIXING CHAMBER FOR THE END OF AN INCINERATOR ROTARY KILN

Henry J. Cates, Jr., De Kalb County, and Tom Rosenberg, East Point, Ga. (both of 416 Walton Bldg., Atlanta, Ga. 30303)

Original application Apr. 8, 1965, Ser. No. 455,357, now Patent No. 3,317,202, dated May 2, 1967. Divided and this application Oct. 19, 1966, Ser. No. 601,256

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U.S. Cl. 23—277

2 Claims

ABSTRACT OF THE DISCLOSURE

An arrangement for the discharge end of a rotary kiln employed in a continuous incineration operation as for example in a refuse incinerator for a city. A hood arch arrangement adjacent the discharge end of a rotary kiln extends downwardly in front of the kiln to protect the discharge end from the reflective heat which would be created in the mixing chamber into which the kiln discharges. An arrangement of an offset wall acts as a baffle to cause turbulence of the gases as they pass from the rotary kiln. A bridge wall acts as a baffle and a deflector and directs gases from the end of the rotary kiln back towards the gas flow from the kiln.

This is a division of application Ser. No. 455,357, filed Apr. 8, 1965, now Patent No. 3,317,202.

CROSS-REFERENCE TO RELATE IT TO APPLICATION AND PATENTS

Parent application Ser. Nos. 56,015 and 455,357 respectively U.S. Patents Nos. 3,212,465 and 3,317,202.

BACKGROUND OF THE INVENTION

The field of the invention including the patent classification and a description of the prior art including references to specific prior art, where appropriate, may be found from reading the above noted patents issued from the parent applications of this present application.

FIG. 1 is a vertical cross-sectional view through a typical plant using the method and apparatus of the present invention with the air and gas flow shown by light lines with arrowheads thereon.

FIG. 2 is a front elevational view of the nose ring casting of the rotary kiln.

FIG. 3 is a cross-sectional view of the nose ring casting taken substantially along lines 3—3 in FIG. 2.

FIG. 4 is a diagrammatic, perspective view of the mixing chamber used with the rotary kiln.

FIG. 5 is a cross-sectional diagrammatical view of the mixing chamber shown in FIG. 4 in conjunction with a diagram of the end of the rotary kiln.

Referring initially to FIG. 1 of the drawings for a description of the plant and the operation thereof as a whole and the relationship between the individual elements of the plant as well as the air flow and hot gas flow therein, it is seen that the refuse 40, which is stored outside the plant, is picked up periodically from time to time by means of a traveling crane 42, or by a conveyor system (not shown) or any other suitable means, and fed in increments into the entrance to the plant 50, through a chute 52 having diverging walls 54, 56 and a bottom which is connected to a drying chamber designated by number 100. Chamber 100 has positioned for operation therein a pair of drying grates 102, the details of which will be described later on under the heading "Drying Grates."

In the following description, various number groups have been assigned to particular elements, to-wit: the

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plant itself and component structure are identified in the group between "50 and 99," all of the numbers in the "100" group refer to drying grate parts, while the ignition grate chamber and ignition grate structures are identified in the "200" and "300" group, the rotary kiln and attendant structure and parts are identified in the "400" group and the mixing chamber and its structure is identified in the "500" group, except for that portion of the chamber which is actually a part of the plant structure and for some parts which may overlap different groups. The duct work and other connections which are located between two elements will carry the group legend depending upon which group it is more closely associated with from the standpoint of clarity.

Leading from the incoming chute 52, there is a sand seal joint structure identified generally as 58, and which will be described later on with particular emphasis on the details of construction. The refuse 40, dumped through the chute 52, falls into the first chamber of the plant 50 which is a pre-drying chamber 100 having drying grates 102 located therein. Refuse dropped on top of the uppermost drying grate 102 is continuously circulated and moved down the stair-step arrangement of the grates which are reciprocated by a power-driven connection means that will be described later. Following the pattern of FIG. 1, it is seen that the refuse is carried down the upper and lower drying grates and dropped into the ignition chamber 200 which has the ignition grates 202 located therein. For the time being, the details of the grates 202 will not be discussed and will be covered later on under the particular heading of "Ignition Grates."

The upper portion of the ignition chamber 200, represented by the numeral 204, connects on one side with the drying chamber 100 and connects to the rotary kiln 400 by a particular seal plate arrangement 320. This seal 320 assures an air seal between the ignition grates 200 and rotary kiln 400; and has arranged transversely thereacross a flat baffle arch 206. In the pre-drying period, the refuse is pre-dried beneath the feed chute as it is moved slowly by means of the movable grates 102 toward the second or ignition chamber 202. The movable grates 102 of the drying chamber 100 alternate between stationary grates, as will be apparent hereinafter, and the arrangement includes two continually moving and reciprocating grate sections mounted on a slight angle with the horizontal to provide a downward movement and to cause a tumbling action which gives the advantage of exposing all refuse surface to hot gases for pre-drying. In FIG. 1, as pointed out hereinbefore, the light lines with arrowheads thereon and the indicia *a*, represent generally the flow of air and gases throughout the plant, and it is noted that the hot gases and air which flow from above the ignition grates 202 are directed back somewhat into the pre-drying chamber 100 above the pre-drying grates 102, thereby aiding the drying of the refuse passing thereacross. The movement of these gases and this air from the ignition grates 102 is aided measurably by the presence of the baffle arch 206 located above the ignition grates 202.

In conjunction with the ignition grates 202, in order to provide air which is necessary for good combustion of the refuse, there is suitable duct work 204 extending vertically in the building space below the drying grates 102 and attached to the upper end of the ignition grates 202 drawing primary air through a blower 210 and passing it by force through the duct work 204 into the sides and beneath the ignition grates 202, as will be more apparent hereinafter. It is this air from the duct work 204 which passes under, then up through the ignition grates 202 and bed of refuse and across the ignition grates 202 thus mixing with the gases produced thereat and rising above the bed of refuse. Additional air is

taken off from the duct system and released over the burning bed of refuse by the over fired air system 205 on both sides of the chamber 202 involving a particular arrangement of ignition assembly which will be described later on. The refuse is moved along the ignition chamber by use of the movable grate sections, which alternate between stationary grate sections. The duct system 205 provides air over the refuse bed. The duct system is located on both sides of chamber 200 and the air flow is controlled by dampers.

The baffle arch 206 is constructed from suitable fire brick and structural material over the ignition grate chamber and serves as a deflector to direct the hot gases over the bed of refuse on the drying grate.

The gases are then directed across the top of the baffle 206 and through a structural passageway 60 formed in the building structure into the chamber 500 to be described later on. Some gases from beneath the baffle 206 pass up through a small passageway 62 and join in the chamber passageway 60 with the gases passing there-through. As the refuse passes across the ignition grates 202, the grates are protected by a special construction of the sidewall castings to protect the side walls 212 of the ignition chamber 200 from the burning of the refuse. In addition, the side wall castings 212 are protected from the heat of the chamber by the forced draft air that passes back of them and cools the castings. The particular supports for the grates and the operation thereof, including a rocker arm method or a wear shoe method, will be described later.

From the ignition grates 202, whereon the refuse is constantly agitated and turned downwardly, the burned material is dropped into the rotary kiln 400 for the remainder of the burning operation. Kiln 400 is connected to the chamber 200-300 and driven by a particular gear arrangement 402 which will be described in detail in conjunction with a description of the rotary kiln parts and it will suffice for the present to say that the kiln is rotating constantly and is supplied with burned material from the ignition grates 202 and with a quantity of hot gases and air entering the kiln directly from the surface of the bed of the burning refuse. The remainder of the burning of the refuse takes place within the kiln 300 and the discharge end of the ignition chamber is protected from the heat by castable refractory mounted on a discharge casting arrangement, the details of which will appear later. The hot gases that result from the burning of refuse in the ignition chamber 200 are utilized for pre-drying of the refuse in the drying chamber and are odorless in character. To remove the odor from these gases, they are directed over the rotary kiln by the by-pass duct 60 which spills the gases into the chamber 500 following the rotary kiln discharge end. This chamber 500 mixes the gases at a sufficient temperature to remove the odor from the hot gases. The mixing chamber 500 is so designed to cause turbulence by means of the bridge wall 506 within the chamber 500 and the offset wall 504 of the chamber according to a more detailed description to follow. The refuse, as it is received by the rotary kiln 400, is tumbled to expose all surfaces of the refuse to the hot gases and to complete the burning of the refuse. The rotary kiln is driven by a main drive gear which meshes with a girth gear mounted around the rotary kiln. The ash, as it is discharged from the end of the rotary kiln 400, is dumped into the diversion gate housing 502 which drops ash onto a diversion gate 508 and into one of several residue conveyors. When properly installed and operated, the incinerator unit or plant shall be capable of operating entirely satisfactorily without manual stoking and shall produce a fine, completely consumed residue or ash.

ROTARY KILN

According to the previous description of the method and apparatus, the rotary kiln 400 receives the burned

refuse from the incinerator ignition grates 202 and completes the combustion of this material, reducing it to a fine ash. Kiln 400 is an elongated, cylindrical affair which is supported for rotation about its central longitudinal axis by means of supports 402, 404 attached to a rotary kiln support independent of the building structure and rotatably supporting the shell 406 of the kiln 400. In addition, a particular type of support and seal 408 supports the outer or discharge end of the kiln while another arrangement of seal and girth gear support 410 supports the entrance end of the kiln 400 and retains said kiln 400 and shell 406 in communication with the discharge casting 230 on the ignition grates to receive the burned refuse therefrom.

The special mounting feature of the girth gear and seal arrangement 410 is particularly noteworthy and will be described now in detail. The shell 406 of the kiln 400 has surrounding it and arranged in concentric alignment, an outer girth gear 412, having teeth 414 about the periphery thereof and receiving from a power driven drive gear (not shown) a continuous gear driving relationship which is designed to turn the cylindrical, rotary kiln 400. Because of the heat generated inside of the rotary kiln 400, the steel shell 406 has the tendency to expand and contract. To keep a constant, even meshing of the drive gear and girth gear 412, it becomes important to employ some method of compensating for the fluctuation of the kiln shell 406.

A plurality of spring plate mounting assemblies 418 are attached with one end 420 thereof to the shell of the kiln 406 and having the other end thereof, 422, pivotally attached by a pin 424 to a position inside of the girth gear 412. Reference to FIG. 1 discloses that each of the assemblies 418 consist of an elongated bar or strap member 426 having one end thereof welded to a bracket assembly 428 having the pivot pin 424 attached therein. The other end of the bar 426 is welded to the shell of the kiln 406 at a diagonal position from the position of pin 424 on the girth gear 412. The girth gear 412 drives the kiln 400 through the connection made by the pivotal attachment of the bar 426 from its position on the inside of girth gear 412 to its welded position on the shell of the kiln 406. However, when the shell 406 expands or contracts, the expansion and contraction is of no serious consequence, since it is, in effect, absorbed or compensated by an equal movement of the bars 426 about their respective pins 424. This eliminates or substantially reduces the warping and destruction of the shell 406 from the changes in temperature.

The discharge end at 408 of the kiln employs a particular advantageous arrangement of discharge castings 432 protecting the end of kiln 400 in the opening in the wall through which the kiln discharge the ash and burned residue.

The terminal end 434 of the kiln 400 is provided with a plurality of the nose ring castings 434 arranged in radial relationship and forming a complete closed circle on the end of the kiln. Each of the castings 432 is independent of the other and may be removed from the kiln by unscrewing a bolt assembly 436 which retains the individual nose ring castings 432 in place on the end of the kiln 400.

MIXING CHAMBER

The mixing chamber shown in FIGS. 4 and 5 is represented generally by the number group "500" and as is seen in FIG. 1, the mixing chamber assembly 500 receives the residue and ash from the end of the rotary kiln 400. FIGS. 4 and 5 are diagrammatic views in reduced size in order to show the particular relationship of the mixing chamber and in conjunction with the end of the rotary kiln 400. A hood arch arrangement 503 extends from an attached position above the end of the rotary kiln 400 and downwardly in front of the kiln 400 to protect the discharge end castings 432 of the rotary kiln from the reflected heat of the mixing chamber 500. The particular ar-

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 rangement of the offset wall 504 acts as a baffle to cause turbulence of the gases as they pass out of the rotary kiln 400. A bridge wall 506 acts as a baffle and deflector and as a deflector, it directs gases from the end of the rotary kiln 400 back toward the gas flow from the rotary kiln, thereby aiding in producing turbulence in the mixing chamber. Proper turbulence within the mixing chamber is essential for proper mixing of the combustion and by-pass gases and for complete combustion.

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 A plate seal 510, part of the mixing chamber that encases the outlet end of the rotary kiln 400, employs the unique feature of a small gap 512 in the circular plate seal 510 which allows cool air to be let in around the discharge castings and in conjunction with the particular shape of the hood arch 503 aids in protecting these castings from extensive heat. 15

The siftings hopper 600, located under the drying grates 102, as mentioned in connection with the ignition grates 200, comprises an open-top, elongated hopper 602 with a closed bottom. A power driven screw conveyor 606 conveys the droppings and siftings from the drying grates 100 onto the top and rear of the ignition grates 200. 20

A water seal chamber 700 beneath the ignition grates 200 is filled with water to the approximate water line shown in FIG. 1. It has submerged therein the entrance end of a long trough having a long screw conveyor therein. The purpose of this is to collect small hot ash that falls through the ignition grates stringers 240, 242 and to quench the ash as it falls into the screw conveyor 706 by which it is conveyed to the diversion gate housing 508 at which point it falls into residue conveyors (not shown). The water seal in chamber 700 maintains the air that is under the grates 200 coming from the force draft duct system in the ducts 226 and 228. The hopper eliminates manual collection of the ash and constantly reinjects the ash into burning process. 25 30 35

We claim:

1. In an incinerator mixing chamber having one end of a rotary kiln extending therein and which kiln has an arcuate terminal edge around a kiln opening therein, said kiln dumping burned material from the bottom discharge thereof, and there being radiant heat generated within said mixing chamber which could adversely affect the end of said kiln,

(a) a plate seal encasing the end of said kiln next to said mixing chamber to help seal same from said mixing chamber and said plate seal being slightly spaced from said kiln and having a small gap therein permitting air to circulate and to help cool the discharge end of said kiln, and

(b) a refractory hood arch in said mixing chamber spaced from said kiln, said hood arch extending about said arcuate terminal kiln edge except for the lower discharge portion thereof from which said burned material is discharged and said hood arch protecting the discharge end of said rotary kiln from the radiant heat which is generated within the mixing chamber.

2. The mixing chamber in claim 2: a bridge wall sloping and extending at an angle from beyond the discharge end of said kiln and providing a baffle which deflects and directs gas from the direct end of the rotary kiln back towards the gas flow from the rotary kiln.

References Cited

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JAMES H. TAYMAN, JR., Primary Examiner

U.S. Cl. X.R.

23—279; 110—8, 14; 263—16, 22, 32; 285—134