ABSTRACT: There is disclosed new and improved mechanical charging equipment for rotary incinerating kilns. This equipment renders it possible for sludges and/or viscous, pasty and/or semisolid and fluid waste materials to be fed into such incinerators indifferently, regardless of their condition at delivery, whether in bulk or containers.
MECHANICAL EQUIPMENT FOR CHARGING SLUDGE AND/OR SEMISOLID AND FLUID WASTE MATERIAL INTO ROTARY INCINERATING KILNS

BACKGROUND OF THE INVENTION

The present invention relates to new and improved equipment for charging sludges and/or viscous, pasty and/or semifluid waste materials into rotary kilns or the like with the intention of bringing about their incineration therein.

The use of rotary kilns as incinerators for sludgy viscous, pasty and/or semifluid waste materials, hereinafter conveniently referred to as refuse, either alone or together with solid refuse, is well known and practiced in the art of refuse destruction. It has hereby been found that the combustion process of such materials is very much prompted and favored by a homogeneous mixture of the various materials to be incinerated, and that such homogeneous mixture may be best achieved prior to the actual incineration, that is, during charging into the incinerator.

Although such materials are usually received in very different states, with regard to both their consistency and their containers, they have to be fed into the incinerator through a single charging aperture, this aperture usually being provided with a funnel or hopper or with some similar device and with an adjoining chute leading into the kiln proper.

The refuse to be incinerated is usually handled by means of grab-crane, gripping some 30—70 cu. ft. at a time. This means that intermittent amounts of this volume have to pass at a time through the charging funnel or hopper and the following chute. On the other hand, due to the limited width of the kiln proper, the devices mentioned above can be only of comparatively small cross section, unable to "swallow" the amounts delivered by the grab-crane. This unfailingly leads to bridging or clogging in the charging path, resulting in irregularities in the combustion process, and with the kiln eventually being placed out of service due to lack of feeding.

Another problem arising in this connection is that, in most cases, the refuse to be incinerated is received in metallic bins, drums or barrels which have to be recovered and returned to the owners, therefore have to be emptied—a most difficult and troublesome affair.

The charging process is moreover complicated by the fact that the various kinds of refuse are usually received batchwise at regular hours of the day, so that the kiln is fed at a time with, for instance, only very fluid but with a thick and pasty one, all of which renders quite elusive the recommended homogeneous mixture. This is the case, even when intermediate storing is undertaken, which however in most cases is impossible. Thus optimum conditions cannot be ensured for the incineration process.

SUMMARY OF THE INVENTION

Accordingly, it is a primary object of the present invention to provide improved mechanical charging equipment for incinerators which effectively overcomes the drawbacks of the prior art structures mentioned above.

Another, more specific object of the present invention aims at the provision of improved mechanical charging equipment for refuse which handles the refuse in a manner leading to improved combustion thereof, while simplifying the handling and charging of the refuse to thereby provide for a more efficient and uniform combustion process.

Yet a further substantial object of the present invention relates to the provision of an improved mechanical charging device for rotary incinerating kilns or the like which is relatively simple in construction, extremely reliable in operation, requires a minimum of supervision, can operate in such a manner that there is very little likelihood of having to interrupt the incineration process due to malfunction of the charging equipment, and wherein the refuse or waste materials handled by the charging equipment are processed in such a way that substantially uniform and efficient combustion techniques are achieved.

Now, in order to implement these and still further objects of the invention, which will become more readily apparent as the description proceeds, the present invention concerns itself with charging equipment, especially charging equipment which is particularly suitable for use in conjunction with rotary kilns employed for the incineration of sludges and/or viscous, pasty and/or semifluid refuse. According to the invention this charging equipment incorporates a stationary receiving trough of substantially circular shape. An equally circular distribution plate is located above the bottom of the trough and is mounted to be rotatable about a substantially vertical axis. According to a preferred construction of the invention there is provided at least one screw-conveyor which is disposed radially and nearly horizontally above the distribution plate. This screw-conveyor protrudes across the sidewall of the receiving trough, terminating in convenient relative position to the receiving devices of the rotary kiln. Furthermore, suitable electrical drive means are provided for both the distribution plate and the screw-conveyor.

BRIEF DESCRIPTION OF THE DRAWING

The invention will be better understood and objects other than those set forth above, will become apparent, when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawing wherein:

FIG. 1 is a schematic representation, in longitudinal sectional view, of the charging end of a rotary kiln equipped with the inventive charging equipment.

FIG. 2 schematically shows in a cross-sectional view taken along the line II-II of the FIG. 1 details of a portion of the modified form of inventive charging equipment.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Describing now the drawing, it will be understood that FIG. 1 illustrates, in the exemplary embodiment shown, an incinerator in the form of a rotary kiln 11, the front end of which is equipped with a charging hopper 9 and a feeding chute 10 constituting the stationary charging equipment for the solid refuse which is to be combusted. This refuse is conveniently supplied into the charging hopper 9 by means of a suitable grab-crane 12 which unloads therein.

As further evident by referring to FIG. 1, the invention contemplates the provision of a substantially circular receiving trough 1 which embodies an equally circular and horizontal bottom 1a provided with the substantially circular sidewall 2. The upper portion 2' of the receiving trough 1 is widened to provide a suitable taper, as shown. The size of this receiving trough 1, that is to say, the diameter of its bottom 1a, is advantageously selected in accordance with the incineration capacity of the rotary kiln 11. This receiving trough 1 and its supporting frame structure 3 constitute the stationary components of the inventive equipment. The refuse which is to be incinerated, whether it be sludgy, viscous, pasty and/or semifluid in consistency, is discharged into this receiving trough 1 by suitable means, which will be considered in greater detail hereinafter, such means being completely appropriate for the condition or state of the refuse when received.

If such refuse is delivered in bins, drums, barrels or similar containers or receptacles, these containers are then hoisted by a suitable elevator 8 fitted with a tilting attachment of any known design at its upper end, so that they can be emptied into the receiving trough 1 by a convenient chute or similar device. When received in bulk, the refuse is handled by the
grab-crane 12 for delivery into the receiving trough 1 by known techniques.

Inside the receiving trough 1 and at a certain distance above its bottom 1a, a flat and circular distribution plate 5 is located in substantially horizontal position. This distribution plate 5 is rotatably supported by a pivot 6 substantially at the center of the receiving trough 1. A suitable electric drive 20 serves to selectively rotate the distribution plate 5 in both directions at infinitely variable speeds. At some distance above the rotating distribution plate 5 there is provided a substantially horizontal conveyor 7, here shown as being of the endless screw type. The screw-conveyor 7, in turn, is equipped with a suitable schematically illustrated electric drive 21, whereby the rotating speed of said conveyor 7 is rendered infinitely variable independently of that of the distribution plate 5. When considered in relation to the pivot 6 of the rotating distribution plate 5, such screw-conveyor 7 is located in radial position.

The external end of screw-conveyor 7 protrudes across and through the sidewall 2 of the receiving trough 1. The protruding end of screw-conveyor 7 is enclosed within a duct-shaped housing 7a, tightly fitted to the sidewall 2, and leading into the feeding trough 10 of the rotary kiln 11. The helix and the speed of rotation of the screw-conveyor 7 are such as to ensure continuous feeding of refuse into the rotary kiln 11, the refuse following the path 1—7—7a—10—11 as described above, while the size of said screw-conveyor 7, i.e. its diameter is chosen in accordance with the throughput to be handled. The position of the conveyor 7 above the rotating distribution plate 5, that is, the vertical clearance between them is infinitely variable and the discharge housing 7a is of corresponding cross-sectional shape and size, to allow for a sufficient range of vertical setting or adjustment.

The inventive charging equipment functions as follows:

After the grab-crane 12 unloads its contents into the receiving trough 1, a heap of refuse is formed on the distribution plate 5 which is more or less pronounced according to the consistency of the refuse handled. Similarly, by means of the tilting elevator 8 fluid refuse is poured from containers onto the distribution plate 5, where it is spread in a more or less flat patch.

The distribution plate 5 which is rotated at a convenient speed brings the heaps and patches of refuse into contact with the screw-conveyor 7, which previously has been set at a convenient clearance. By virtue of this and with the screw-conveyor in rotation, the refuse is withdrawn gradually from the receiving trough 1, to be fed into the kiln 11 at a rate corresponding to the kiln’s incinerating capacity. It may be noted that owing to the clearance between the screw-conveyor 7 and the distribution plate 5, only part of the refuse lying on said plate is being withdrawn as described above, while the remainder is left on said plate, thereby lengthening the time for its mixture with the next refuse to come. Possible lumps or local accumulations or other similar phenomena are flattened by the repeated effect of the screw-conveyor, so that a practically homogenous material is obtained on said distribution plate, the inventive equipment acting as a mixer.

In order to handle refuse of tari-like or extremely viscous consistency, the rotating plate 5 may be heated by means of steam, hot water or electricity, such heating means generally being schematically indicated by reference character 5a.

The charging equipment heretofore described and essentially comprising the receiving trough 1, the rotating distribution plate 5 and the screw-conveyor 7 may be installed to work either alone or in combination with the charging equipment 9, 10 for solid refuse, thus enabling all kinds of refuse to be fed into the rotary kiln 11.

As an alternative to the heretofore illustrated and described embodiment shown in FIG. 1 of the drawing, it is possible to carry out a different layout and arrangement as such is essentially contemplated in FIG. 2. In this modification of the charging equipment, there are employed two screw-conveyors 22 and 23 which are located side-by-side and approximately parallel to one another. These two screw-conveyors advantageously are constructed to possess opposed helices and are driven so that they rotate in opposite directions of rotation or opposed senses. Moreover, the protruding ends of the two screw-conveyors 22 and 23 outside the receiving trough 1 can be located within a common duct-like shaped housing 24 which leads the refuse over the chute 10 or other suitable device into the rotary kiln 11 of FIG. 1. Moreover, these screw-conveyors can be equipped with separate discharge paths or with their discharges collected into a single chute, such as shown by the chute 10 in FIG. 2. As a result of said modification a more intensive mixing and homogenizing effect may be achieved.

It should be apparent from the foregoing detailed description, that the objects set forth at the outset to the specification have been successfully achieved.

1 claim:

1. Mechanical charging equipment for charging sludge and/or viscous, pasty and/or semifluid waste materials into incinerating furnaces, especially into rotary kilns, comprising a stationary and substantially circular receiving trough, said receiving trough incorporating a sidewall means and a bottom portion, a substantially circular and flat distribution plate disposed substantially horizontally above said bottom portion of said receiving trough and rotatably supported by a central pivot, electrical drive means for rotating said distribution plate in both directions of rotation, at least one conveyor means of the endless screw type, electrical drive means for driving said conveyor means, said conveyor means being located in an approximately horizontal and radial position above said distribution plate, said drive means for said distribution plate and said drive means for said conveyor means enabling the rotational speeds of said distribution plate and said conveyor means to be infinitely varied independently of one another, said conveyor means incorporating a discharge end protruding across said sidewall means of said receiving trough and assuming a position capable of communicating with the rotary kiln, a feeding chute arranged at said rotary kiln, an enclosed substantially duct-shaped housing provided externally of said receiving trough and tightly fitted to said sidewall means of said receiving trough, said duct-shaped housing surrounding the protruding portion of said conveyor means and leading the refuse via said feeding chute into said rotary kiln.

2. Mechanical charging equipment as defined in claim 1, further including an additional conveyor means of the endless screw type having its helix and rotational sense opposed to the first-mentioned conveyor means, both said conveyor means being located in approximately side-by-side relationship and approximately parallel to one another within said substantially duct-shaped housing leading the refuse via said feeding chute into said rotary kiln.

3. Mechanical charging equipment as defined in claim 1, further including means for heating said distribution plate.

4. Mechanical charging equipment as defined in claim 1, wherein said central pivot is arranged substantially at the central region of said receiving trough.