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METHOD OF AND APPARATUS FOR DISPOSING OF REFUSE AND GARBAGE

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This invention relates to improvements in methods of and apparatus for disposing of refuse and garbage, and the principal object of the invention is to evolve a method and produce an apparatus by means of which refuse and garbage may be disposed of in a manner to minimize the labor and expense of handling and disposing of that material.

Prior to this invention the handling and disposing of refuse and garbage in large quantities has been extremely difficult and expensive, and has involved numerous problems that were not satisfactorily solved by any of the known methods of disposing of refuse and garbage. The greatest difficulty met was in the disposal of the garbage which, because of its bulk and weight, as well as the odors and the condition of the mass to be handled, caused the task of disposing of said material to be an expensive and a most undesirable one.

The liquid constituents of garbage usually amount to about 75% of the mass, and for this reason prior to this invention it was not practicable to economically consume said material in an incinerator, as the combustion of the wet mass produced a large volume of smoke with offensive odors which were widely distributed to points distant from the incinerator. In accordance with the present invention I burn the garbage but I do not attempt to burn said garbage while it is in a wet condition. On the other hand, I first subject the wet garbage to a drying out process, whereby most of the moisture is extracted from said garbage. After the garbage has been subjected to the drying out process mentioned, it is in a more or less dry condition, and as a result will readily burn when deposited on the bed of burning fuel.

The apparatus disclosed in the present application is intended for burning both refuse and garbage, and an extremely important feature of the invention is that the burning refuse constitutes the fuel for burning the garbage. In other words, during the disposal of the refuse this material is performing a useful function in that it is providing a bed of burning material upon which the garbage is deposited and consumed.

With the foregoing and other objects in view, the invention comprises the novel construction, combination and arrangement of parts hereinafter more specifically described

and illustrated in the accompanying drawing, wherein is shown the preferred embodiment of the invention. However, it is to be understood that the invention comprehends changes, variations and modifications which come within the scope of the claims hereunto appended.

Fig. I is a vertical section of my improved apparatus for disposing of refuse and garbage.

Fig. II is a cross section on line II—II of Fig. I looking in the direction indicated by the arrow.

In the drawing, A designates my improved apparatus for incinerating refuse and garbage and comprises a housing 1 in the lower portion of which an endless traveling chain grate 2 is located. The endless traveling chain grate is arranged between the side walls 3 of the housing 1 and is supported partly by bars 4 located immediately below the fuel-supporting portion of the grate and partly by bars 5 on which the lower portion of the grate travels. Additional supports are formed by a roll 6 at the rear of the grate and a suitable number of sprocket wheels 7 secured to an operating shaft 8 at the front of the grate. The shaft 8 may be operated in any suitable manner to cause the grate to travel in the direction indicated by the arrows in Fig. I. The chain grate comprises endless rows of grate links 9 pivoted together by means of pivot rods, and being so arranged relative to each other that spaces are provided between said links through which draft may pass to induce the combustion of the material on the upper flight of said grate. Interposed between the upper and lower flights of the endless chain grate 2 is an elongated draft box 10, which extends longitudinally of said chain grate and is open at the top so that draft may be discharged through the fuel-supporting portion of the grate. Arranged in the upper portion of the draft box 10 is a plurality of inclined walls 11, and associated with said inclined walls are pivotally mounted dampers 12, said pivoted dampers being capable of being adjusted so that the passage of draft through the fuel-supporting portion of the grate may be regulated.

13 designates the front wall of the housing 1 which, of course, connects with the side walls 3 of said housing, the lower portion of said front wall being offset in a horizontal direction from the upper portion 13'

thereof to provide an opening 14. Arranged parallel with the end wall 13 is a wall 15 which comprises an upper vertically movable portion 15' and a lower fixed portion 16. The opposite side walls 3 of the housing 1 are provided with vertically arranged slots or guideways 17, the side marginal portions of the upper movable portions 15' of the wall 15 are arranged in said slots, whereby said portion 15' may be moved vertically relative to said side walls of the housing 1. By referring to Fig. II of the drawing it will be seen that the upper portion 15' of the wall 15 comprises a hollow rectangular frame 18, through which cooling fluid is caused to pass, and a plurality of tiles 19 which are so arranged relative to each other that spaces 19' are provided through which air may pass. Arranged between the upper and lower legs of the rectangular frame 18 is a plurality of fluid conductors 20 which communicate with the interior of the rectangular frame. The conductors 20 are extended through openings formed in the tiles 19, and when the apparatus is in use cooling fluid passes through the rectangular frame 18 and through the fluid conductors 20 to prevent the wall portion 15' from being readily burned out. To provide for the circulation of cooling fluid through the rectangular frame 18 and the conductors 20 I provide connections 21 which pass through vertical slots in the wall of the housing and are attached to suitable flexible fluid conductors (not shown).

The lower fixed portion 16 of the wall 15 extends from one side wall 3 of the housing to the opposite side wall and comprises a pair of hollow members 22 in communication with each other and a plurality of tiles 23. The hollow members 22 are provided with connections 24 which extend through a side wall 3 of the housing, so that cooling fluid may be passed through said hollow members 22.

As already stated, the upper portion 15' of the wall 15 is capable of moving vertically within the housing 1, and to provide means for effecting this vertical movement I employ a pair of flexible conductors 24, which are attached to the movable wall portion 15' at the upper portion thereof and pass over drums 25 fixed to a rotatable shaft 26. The rotatable shaft 26 is provided with a worm wheel 27 which is fixed thereto, and said worm wheel has associated with it a worm 28 mounted on and fixed to a suitably supported rotatable shaft 29. The shaft 29 is provided with a bevel gear 30 which meshes with a bevel gear 31 fixed to a rotatable shaft 32, said shaft 32 being provided with a hand wheel 33 whereby said shaft may be conveniently rotated. In view of the mechanism just described, it is plain that the wall portion 15' may be moved upwardly by rotating the hand wheel 33 and it is plain that when this is done the bottom face of the lowermost leg of the rectangular frame 18 may be raised above the fixed portion 16 of the wall 15 to provide a space between said fixed portion and said movable portion of the wall 15.

34 designates a hopper, the lower end of which is arranged at the opening 14 whereby material discharged into said hopper will be deposited within the space between the end wall 13 of the housing and the wall 15 and between the side walls 3 of said housing. Located above the hopper 34 is the discharge end of a conveyor housing 35, within which an endless conveyor 36 is arranged. The conveyor 36 is of the usual type and comprises a pair of pulleys, only one of which is shown, and an endless belt which travels over said pair of pulleys. The pulley 37, which is one of the pair of pulleys of the conveyor, is located immediately above the hopper 34 and is a magnetic pulley, consequently any magnetic material which may be mixed in with the refuse and which is carried upwardly by the conveyor will be attracted by said magnetic pulley and will be deposited upon the lower wall 35' of the conveyor housing 35 instead of being discharged into the hopper, as would be the case in the absence of the magnetic pulley. 38 designates a pivoted damper which prevents the free passage of draft through the conveyor housing 35 and into the housing 1.

Arranged at the rear of the furnace is an ashpit 39 in which is located a body of liquid, and 40 designates the rear wall of the furnace which extends downwardly into the ashpit 39, the lower end portion of said rear wall being submerged in said body of liquid. 41 designates an ignition arch which is arranged above the rearmost portion of the endless chain grate, said ignition arch being made of a suitable refractory material whereby heat will be radiated to the bed of burning material, thus improving the combustion of said burning material. 42 designates a passageway through which the products of combustion from within the combustion chamber B pass to a stack 43.

44 designates a plurality of air conductors which are partially arranged within the passageway 42 so that the products of combustion passing through said passageway will come into contact with said conductors. The air conductors 44 are preferably inverted U-shaped, and the end portions of said conductors are extended through the lower wall of the passageway 42. The ends of the inverted U-shaped air conductors 44 are open, and the rearmost ends of said conductors are in communication with the outer atmosphere while the forward ends of said conductors communicate with an air conductor 45, so that air which passes

through said conductors from the outer atmosphere will be discharged into said conductor 45. The conductor 45 extends forwardly of the apparatus and has a branch 46 which extends downwardly to the box 10 associated with the endless chain grate 2, the open end of said branch 46 being in communication with said draft box. 47 designates a second branch which extends downwardly from the conductor 45 and is in communication with the interior of the draft box 10. The points at which the branches 46 and 47 discharge air into the draft box 10 are so positioned relative to each other that said draft will be distributed throughout the length of the draft box.

Thus far I have described only that portion of my improved apparatus which is utilized to dispose of refuse. In the operation of this portion of the apparatus refuse is deposited on the conveyor 36 at the lower end thereof, and said refuse is carried upwardly and is discharged into the hopper 34, excepting, of course, any magnetic substance in said refuse, which magnetic substance will be attracted by the magnetic pulley as already described and will be deposited upon the lower wall 35' of the conveyor 35. The compartment produced by the side walls of the housing, the end wall 13 and the wall 15 functions as a cupola C into which the refuse is deposited, the endless traveling chain grate constituting the bottom wall of the cupola. At the beginning of the operation of the apparatus it is, of course, necessary to build a fire within the cupola C, and thereafter as the refuse is admitted into the cupola it is ignited so that a fire is maintained in said cupola at all times while the apparatus is in operation. The cupola thus forms an ignition chamber for the delivery of burning fuel to the main combustion chamber. The endless chain grate 2, as has already been stated, travels in the direction indicated by the arrows in Fig. I, consequently burning material is drawn from the bottom of the cupola and travels toward the rear of the grate, at which point the ashes resulting from the burning of said material will be discharged into the pit 39 where the fluid within said pit will cool said ashes and permit convenient handling thereof.

As the material on the upper flight of the endless chain grate 2 burns the products of combustion will pass from the combustion chamber B, through the passageway 42 and through the stack 43. The rapid passage of the products of combustion in the direction indicated by the feathered arrows in Fig. I will draw air from the draft box through the spaces between grate links 9, and also the suction created by said rapid passage of the products of combustion will draw air from the outer atmosphere through the air conductors 44, through the conductor 45 and through the branches 46 and 47 to the draft box 10. It has been stated that the hot products of combustion come into contact with the air conductors 44, as said products of combustion pass to the stack 43, hence the air passing through the conductors 44 will be preheated and will be delivered to the draft box in this condition. It is apparent, therefore, that this preheated air will have the effect of greatly improving the combustion of the material on the chain grate.

It may be desired to feed more material from the cupola C to the chain grate 2 than will pass between the fixed wall 16 and the upper face of the chain grate 2. In this event by merely rotating the hand wheel 33 I may raise the lower face of the vertically movable wall portion 15' above the top face of said fixed wall 16, thus providing a space between said elements through which burning material may pass from the cupola. In this way the capacity of the apparatus is greatly increased.

Referring now to the portion of my apparatus by which garbage is handled, 50 designates an endless conveyor which is constructed very much like the endless chain grate 2 already described, said endless conveyor comprising a great number of links pivoted together to produce an endless conveyor which is supported partly by bars 51 located immediately below the upper flight of the endless conveyor and partly by bars 52 on which the lower flight of said conveyor travels. In addition to this the conveyor is supported by a roll 53 at one end of the conveyor and a suitable number of sprocket wheels 54 at the opposite end of said conveyor, said sprocket wheels being mounted on an operating shaft 55 which may be operated in any suitable manner to cause the conveyor to travel in the direction indicated by the arrows in Fig. I.

56 designates an air box which is interposed between the upper and lower flights of the endless conveyor 50, said air box being open at the top so that air may be discharged through the spaces between the pivoted links of the conveyor. Associated with the air box 56 is an air conductor 57 which is in communication with the interior of said air box so that air which passes through said conductor will be discharged into said air box. 58 designates the blower which is associated with the conductor 57, and 59 designates a conductor which is in communication with the passageway 42 and with the interior of said blower.

60 designates a hopper, the discharge end of which is arranged immediately above the endless conveyor 50 whereby material dumped into said hopper will be deposited upon the upper flight of said endless conveyor.

veyor. Located above the hopper 60 is the discharge end of an endless conveyor 61. The endless conveyor 61 is of the type comprising a pair of pulleys over which an endless belt passes, one of the pulleys of said conveyor, which pulley is designated by the reference character 62 in the drawing, being magnetized so that any magnetic substance which may be in the garbage will be attracted by said magnetic pulley and will be deposited on the wall 63, thus preventing said magnetic substance from being discharged into the hopper 60. 64 designates an upstanding wall which is associated with the ignition arch 41 and which is arranged immediately adjacent to the discharge end of the endless conveyor 50. 65 designates an opening formed through the ignition arch 41 through which garbage may be discharged from the endless conveyor 50.

In the operation of my improved apparatus as a refuse and garbage incinerator, that portion of the apparatus which handles the refuse operates as already described, during which time a bed of burning refuse will be traveling rearwardly at all times. During this time also a fire will be maintained in the cupola C, draft being drawn into and through said cupola and through the spaces 19' in the wall portion 15' by the draft within the combustion chamber of the apparatus. The burning of the refuse in the manner described will result in great heat being generated within the combustion chamber B, and the products of combustion will follow the course indicated by the arrows in Fig. I. At the same time garbage is being deposited on the endless conveyor 50 and this garbage is traveling slowly through the heated interior of the housing 1, the hot products of combustion passing immediately over said garbage. At all times when the apparatus is in operation the blower 58 is drawing hot gases from the passageway 42, through the conductor 59, and said hot gases are forced by the blower through the conductor 57 to the air box 56, whence said gases are forced through the spaces between the links of the endless conveyor 50 and through the garbage on said conveyor. It is plain from this that the garbage will be very rapidly dried out by the passage therethrough of the hot gases. When the garbage reaches the discharge end of the endless conveyor 50 it is discharged through the opening 65 and drops through the exceedingly hot combustion chamber B and falls upon the bed of burning refuse on the endless chain grate 2. If any moisture remains in the garbage when it is discharged from the endless conveyor 50 said moisture will disappear as the garbage is falling through the hot combustion chamber B, and as a result substantially dry garbage will fall upon the bed of burning refuse on the

chain grate 2 and will be entirely consumed before it reaches the rear end of said chain grate, where it is discharged into the pit 39 in the form of fine ashes.

From the foregoing it is plain that in the use of my improved apparatus the refuse which is being incinerated constitutes the fuel for incinerating the garbage, and because there is much ashes in the refuse which contains 25% to 40% pure carbon, said refuse will make a very efficient fuel.

I claim:

1. A furnace comprising a traveling grate, and an upstanding fuel compartment within which burning fuel is located, the fuel-supporting portion of said traveling grate being so located with respect to said fuel compartment as to constitute the bottom wall thereof and said traveling grate being adapted to carry burning fuel away from the bottom of said fuel compartment, said fuel compartment being provided with a wall having a fixed portion and a movable portion above said fixed portion, said movable portion of said wall being capable of being adjusted to provide a space between said movable portion and said fixed portion of said wall.

2. A furnace comprising a traveling grate, and an upstanding fuel compartment within which burning fuel is located, the fuel-supporting portion of said traveling grate being so arranged with respect to said fuel compartment as to constitute a bottom wall thereof, said fuel compartment being provided with a wall having a fixed portion spaced apart in a vertical direction from the fuel-supporting portion of said traveling grate to provide a space through which burning fuel may be drawn from said fuel compartment by said traveling grate, and said wall of said fuel compartment having a movable portion located above and capable of being adjusted vertically with respect to said fixed wall portion to provide a space between the bottom of said movable portion of said wall and the top of the fixed portion thereof.

3. The herein described method of incinerating refuse and garbage which comprises causing refuse to be carried along in the form of a bed of burning material, forcing air through said bed of burning material to improve the combustion thereof, causing garbage to be carried along in the form of a bed, forcing drying fluid through said bed of garbage to absorb the moisture therein, and then discharging said garbage upon said bed of burning refuse where it is consumed, and separately supplying garbage and refuse to the respective beds.

4. The herein described method of incinerating refuse and garbage which comprises causing refuse to be carried along in the form of a bed of burning material, heat-

ing air and then forcing said air through said bed of burning refuse to improve the combustion thereof, causing garbage to be carried along in the form of a bed of garbage, causing products of combustion resulting from the burning of said refuse to be forced through said bed of garbage to absorb the moisture therein, and then discharging said garbage upon said bed of burning refuse where it is consumed, and separately supplying garbage and refuse to the respective beds.

5. An incinerator comprising a combustion chamber provided with an inlet for the admission of combustible refuse and a chamber through which the refuse is conducted to said inlet, a traveling grate forming the bottoms of said chambers and inlet so as to carry the refuse into the combustion chamber, and a garbage drier comprising a traveling grate located above the first mentioned grate to discharge the dried garbage into

said combustion chamber, the discharge end of the garbage drier being remote from said inlet to provide for the delivery of dried garbage to the burning refuse. 25

6. An incinerator comprising a combustion chamber provided with an inlet for the admission of combustible refuse and a chamber through which the refuse is conducted to said inlet, a traveling grate forming the bottoms of said chambers and inlet so as to carry the refuse into the combustion chamber, a garbage drier comprising a traveling grate located above the first mentioned grate to discharge the dried garbage into said combustion chamber, the discharge end of the garbage drier being remote from said inlet to provide for the delivery of dried garbage to the burning refuse, and an ignition arch interposed between said traveling grates. 30 35 40

In testimony that I claim the foregoing I hereunto affix my signature.

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