June 18, 1946. C. W. NICHOLS 2,402,436

INCINERATING APPARATUS

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Fig. 1.

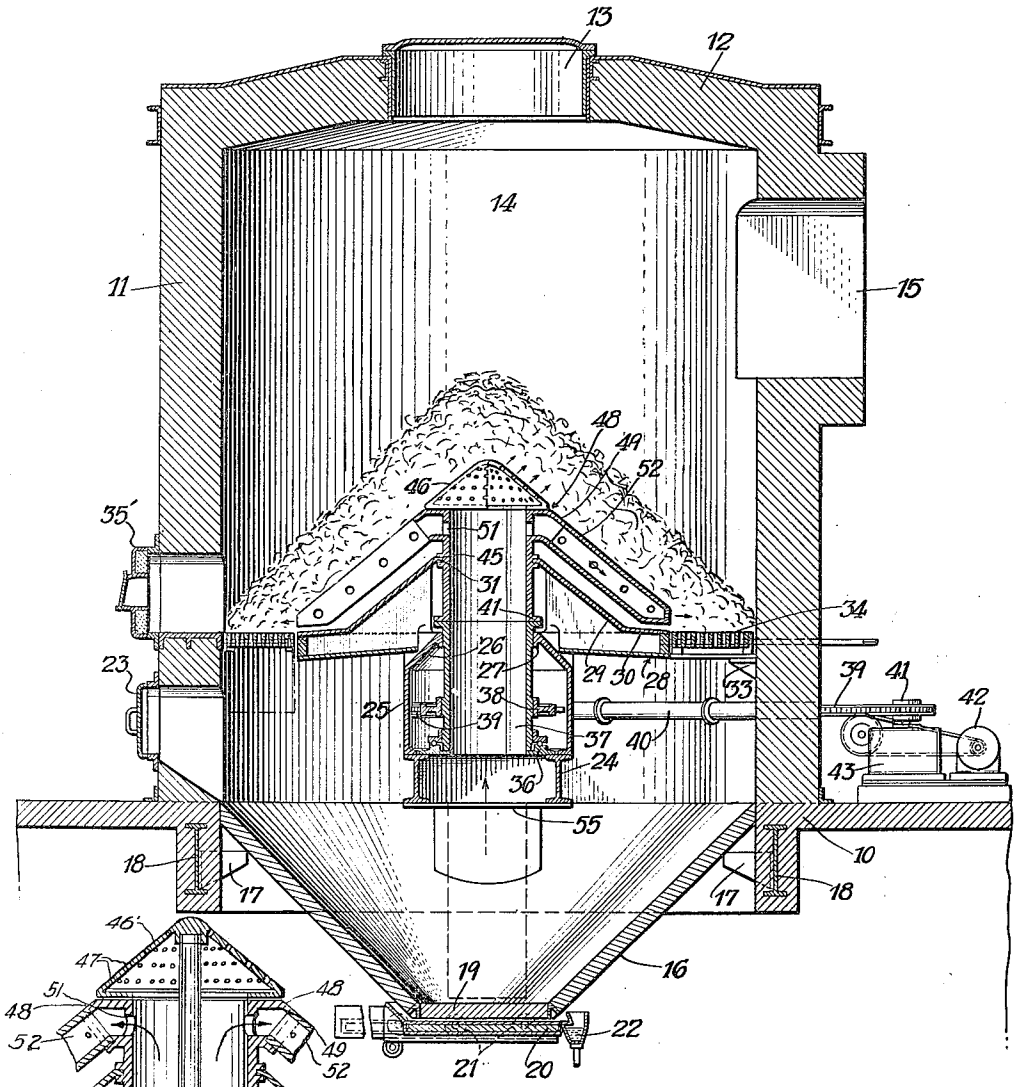


Fig. 5

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Fig. 2.

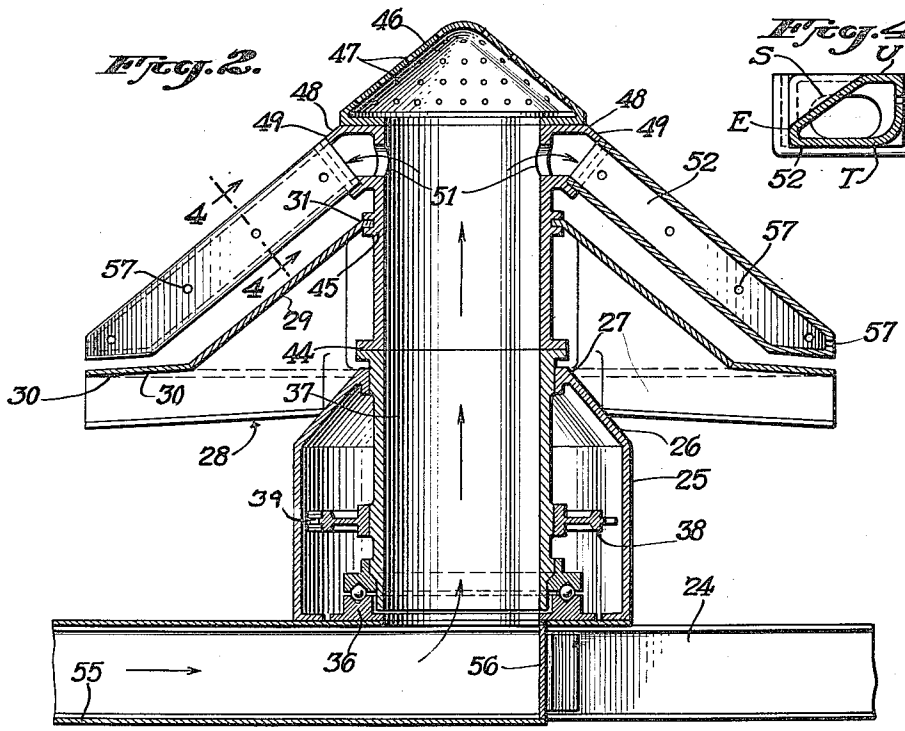
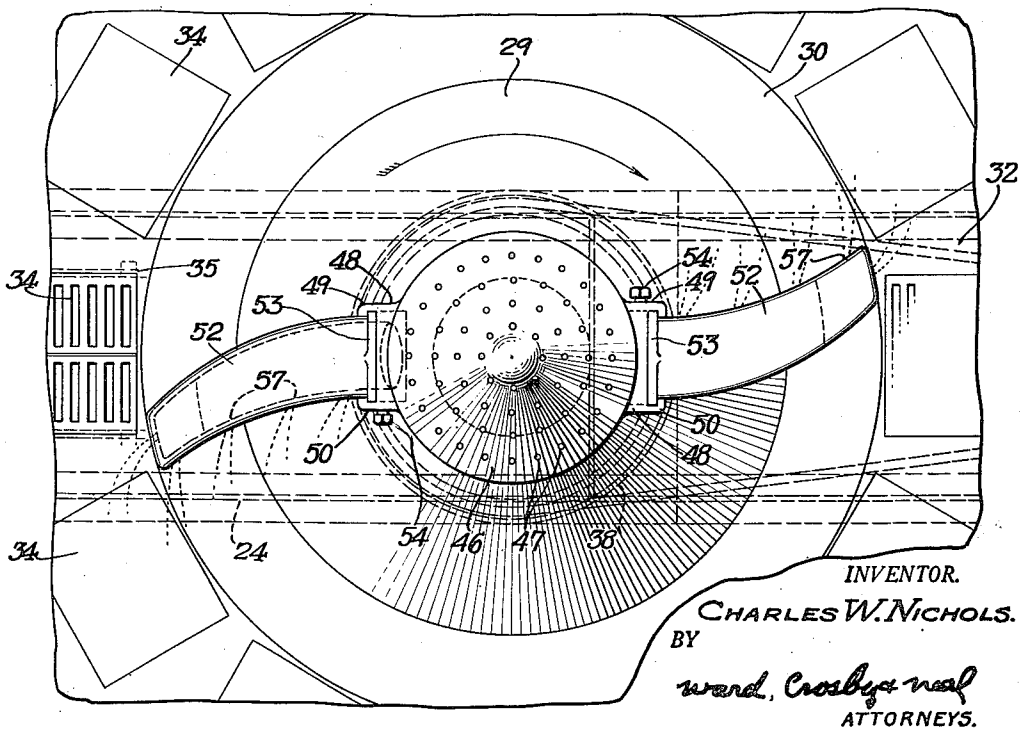


Fig. 4.

Fig. 3.



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Patented June 18, 1946 2,402,436

UNITED STATES PATENT OFFICE

2,402,436

INCINERATING APPARATUS

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Application April 5, 1945, Serial No. 586,710

7 Claims. (Cl. 110—13)

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This invention relates to furnace apparatus for incinerating waste material such for example as municipal waste including garbage, refuse and trash.

The apparatus of this invention is particularly adaptable for the rapid drying and thorough burning of waste material in relatively large quantities and of highly irregular characteristics, with substantially a minimum of expense and labor. Until recently, it has been the most common practice in burning garbage and trash, etc., to provide a grate in a simple furnace chamber, the waste material being dumped onto the grate and thereafter stoked by manual labor to the extent necessary to distribute the material over the grate and to allow access of air to various parts thereof from time to time. Such constructions have not only involved a considerable labor expense for frequent or continuous attention by one or more workmen, but the resulting drying and burning action on the grate is too irregular for uniform and thorough combustion. As a result, considerable smoldering occurs with consequent obnoxious odors, and the resulting ash is sometimes mixed with considerable unburned material.

In my U. S. Patent No. 2,232,556, granted February 18, 1941, there is disclosed apparatus which has proven highly successful for eliminating the above noted difficulties in installations of relatively small and medium sizes and under generally favorable conditions. According to the invention of said patent, incinerating apparatus is provided having a substantially horizontal hearth upon which the waste material is dried, together with a rotatable conical member equipped with horizontally-extending arms. The conical member as well as the horizontally-extending arms are constructed and arranged to agitate the waste material in such fashion as to gradually feed it toward grate areas surrounding the hearth where burning thereof occurs. At the same time, a current of air is passed through the aforesaid conical member and arms and out through apertures therein to promote a drying action and aid combustion. However, when using such a substantially horizontal hearth, particularly with large installations, the waste material in some cases may have a tendency to form a pile of such depth and mass at the central portion that the material within this portion of the pile may not be uniformly dried to the desired extent for prompt and thorough burning, as it is advanced outwardly toward the grate areas by rotation of the aforesaid conical member and horizontally-extending arms.

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The objects of this invention include the provision of an incinerator for eliminating or substantially minimizing the above noted difficulty in a simple, dependable manner. In accordance with the present invention, I provide an incinerator hearth, having non-horizontal, inclined surface portions. Preferably, the hearth or at least its central portion has a raised essentially conical configuration. Accordingly, when refuse or other waste material is placed upon the hearth, it tends to form a conical layer of more or less uniform and relatively shallow depth, as distinguished from a solid conical pile. The invention provides for passing a current of air, which may be preheated if desired, through all portions of the aforesaid conical layer of waste material to thoroughly and uniformly dry the same. Improved means is also provided for advancing portions of the waste material outwardly toward the grate portions surrounding the conical hearth where burning of said waste material occurs. Preferably, a rotatable hollow member is provided at the central portion of the hearth, this hollow member having one or more arcuately-extending stoking arms extending therefrom, the lower portion of rear arm being substantially parallel to the aforesaid conical surface of the hearth.

Further objects, features and advantages will clearly appear from the detailed description given below taken in connection with the accompanying drawings forming a part of this specification and illustrating by way of example one form of apparatus which may be used in carrying out the invention. The invention consists in such novel features, arrangements and combinations of parts as may be shown and described in connection with the apparatus herein disclosed.

In the drawings,

Fig. 1 is a vertical sectional view showing a furnace construction embodying the invention in a preferred form;

Fig. 2 is an enlarged vertical sectional view of the hearth portion of the furnace of Fig. 1;

Fig. 3 is an enlarged plan view of the hearth portion and accompanying parts as shown in Fig. 2;

Fig. 4 is a sectional view taken substantially along line 4—4 of Fig. 2 and showing certain details; and

Fig. 5 is a vertical sectional view showing a modification of the construction of Fig. 2.

Referring to the drawings in detail and par-

ticularly to Fig. 1, a suitable foundation 10 is provided on which cylindrical walls 11 may be supported. Such walls in turn, support a roof 12 having an inlet 13 at the middle thereof through which waste material to be treated may be introduced. In this manner, a furnace chamber 14 is provided which may have an outlet 15 in the cylindrical walls 11 for the escape of combustion gases. An ash hopper 16 is suitably supported by the foundation 10 at the lowermost portion of the cylindrical walls 11, for example, by a circular flanged member 17 together with an I-beam structure as at 18. The ash hopper 16 has an opening 19 at the lowermost portion thereof which is normally closed, as by a sliding ash gate 20 mounted on rollers 21 and engaging a stop 22 in its closed position. The ash gate 20, may, of course, be opened when it is desired to remove ashes or other material from the hopper 16. Access may also be had to the ash hopper 16 for cleaning or other purposes as through doors as at 23.

The foundation 10 also supports transversely extending I-beams 24, 24 on which a hollow cylindrical member 25 is mounted having a tapered upper portion 26 which may be flanged as at 27 to provide a bearing surface as will be hereinafter further explained. The tapered portion 26 of the cylindrical member 25 may if desired be made integral with the hearth which is shown at 28.

According to the invention, the upper surface of the hearth 28 comprises a central conical portion 29 which has a relatively large angle of inclination with respect to a horizontal plane, together with a peripheral conical portion 30 which has a relatively small angle of inclination with respect to the horizontal. For a purpose hereinafter described, the uppermost portion of the central conical surface 29 is flanged, as at 31. An outer annular member 32, Fig. 3, surrounds the hearth 28 and is supported in any suitable manner by the cylindrical walls 11, for example, by a plurality of brackets one of which is shown at 33, Fig. 1. Any desired number of grates 34, Figs. 1 and 3, may be mounted in suitable recesses provided therefor in the annular member 32. Preferably, the grates 34 are counter-balanced and pivotally mounted about one edge as indicated at 35, Fig. 3, in order to provide for dumping of clinkers, etc. Access may be had to the grates 34 as through doors as at 35', Fig. 1.

Due to the generally conical construction of the hearth 28, the waste material introduced through the inlet 13 tends to form a conical layer upon the hearth 28 of generally uniform depth, the peripheral and dried or partially dried portions of the pile extending out over the annular grate areas upon which the material is burned. The generally uniform depth of the aforesaid layer of waste material improves, to a great extent, the ease and rapidity with which the material is dried, as will more fully appear hereinafter.

The I-beams 24, 24 upon which the cylindrical member 25 is mounted, may also support a suitable ball bearing as at 36, having a rotatable hollow stem 37 mounted thereon which may be rotated in any suitable manner. Preferably as shown, a sprocket wheel 38 is fixed to the rotatable stem 37. A sprocket chain 39 may encircle a portion of the sprocket wheel 38, each stretch of the chain passing from the sprocket

through a suitable tubular casing as at 40 to a sprocket wheel 41 driven by a suitable motor 42 which is coupled thereto through a speed reducer 43.

The rotatable stem 37 further comprises a flange construction at 44 for connection of a separable upper stem portion and located just above the above mentioned flange 27 of the stationary cylindrical member 25. The construction of these parts including cylindrical member 25 and the chain tubes 40 is such as to effectively prevent dust and ash from entering the interior portions of the cylindrical member 25 which might result in damage to the bearings 36 or the driving mechanism. The upper rotatable stem portion may also have flanged portions as at 45 engaging the above mentioned flange 31 of the conical hearth 28 to provide an additional bearing.

A generally conically-shaped member 46, Figs. 1 and 3, is mounted at the top of the hollow rotatable stem 37 and secured thereto in any suitable manner. The conical member 46 has perforations therein as indicated at 47, these perforations or apertures being distributed at least over the upper surface areas of the conical member and, preferably, directed outwardly and rearwardly as compared with the direction of rotation of the rotatable stem 37 whereby the waste material will readily slide past without tending to enter and block the perforations against passage of air.

The hollow stem 37 may be provided in any suitable manner with supports for one or more hollow perforated stoking arms. To this end, the stem may have supporting members as at 48 each of which has a downwardly directed cylindrical end portion 49 which may be flanged as at 50, Fig. 3. The hollow stem may be formed with suitable openings 51, Fig. 2, for admitting air interiorly of the respective supporting members 48. An arcuate stoking arm 52 may be secured to each of the supporting members 48, in any suitable manner. Thus, for example, each stoking arm 52, Fig. 3, may be provided with a flange 53 which is adapted to engage the aforesaid flanges 50 interiorly of the cylindrical end portion 49 of the supporting member 48. Set screws may be provided as at 54 to firmly secure the stoking arms 52 within the respective supporting members 48. It will be apparent that the stoking arms 52 may be readily adjusted to various angular positions relative to the supporting members 48.

The outer end portions of the arcuate stoking arms 52 are preferably both curved in the same direction with respect to the normal direction of rotation thereof and of the hollow stem 37 (as indicated by the arrow, Fig. 3). With the arms curved and arranged in this way the layer of waste material is uniformly agitated and slowly advanced onto the grate areas upon slowly rotating the stem 37.

The stoking arms 52 preferably have a cross-section as indicated in Fig. 4, in which the leading edge E forms the apex of an acute angle comprising an upper section S and a lower section T which may be substantially parallel to the upper conical portion 29 of the hearth 28. As shown, the surface U of the stoking arm is parallel to the surface T while the surface V is substantially perpendicular with respect both to the surfaces U, T and to the upper conical portion 29 of the hearth.

Air may be supplied to the interior of the hollow stem 37 in any suitable manner. Thus, for example, a plate as at 55, Fig. 2, may be placed along the lower edges of the I-beams 24, 24 and a similar plate may be placed along the top thereof. The resulting duct may be closed off as at 56 and the other end thereof connected to a suitable fan or compressor, not shown. A current of air, which may be preheated if desired, may be passed through the hollow stem 37 to the perforations 47 in the conical member 46 and through perforations as at 57 in the stoking arms 52. As shown by Figs. 3 and 4, the perforations 57 are located on the trailing surface V of the arms 52. Thus, as the arms 52 rotate through the pile of waste material, portions of the material ride upon the inclined upper surface S and then drop off the rear edges of the arms, falling back onto the hearth through the streams of air introduced through the apertures 57.

Thus, as the arms periodically engage each section of the layer of waste material, the material is agitated vertically somewhat and allowed to fall through streams of heated air to insure a rapid and uniform drying action. At the same time, the conical member 46 is continuously rotating and constantly discharging heated air into the central upper portion of freshly admitted waste material. Due to the improved hearth construction, the pile is of generally uniform thickness throughout whereby a very rapid and thorough drying action is obtained.

As the stoking arms 52 rotate, portions of the waste material are gradually advanced toward the annular grate area 32 where burning thereof occurs, this movement being facilitated by the arcuate construction of the stoking arms. The inclination of the surface S of the arms 52 with respect to the hearth may be varied, as hereinbefore described, by angular adjustment of the arms within their sockets, to such an angle as to suitably advance and agitate the particular type of waste material being treated. It will be observed that such adjustments will vary the extent to which the rear portions of each arm protrude up into the pile of waste material and thereby vary the extent to which the waste material is agitated on each revolution of the arm. Because of the arcuate form of the arms, such adjustments will also vary the spacing between the outer ends of the arms and the hearth.

It will be apparent to those skilled in the art that the shape of the conical member or cap 46 may be varied without departing from the spirit and scope of the invention. Thus, for example, this member might be replaced by a generally flat perforated plate or it might be mounted upon a stationary internal support as shown at 60 in Fig. 5 and remain stationary during rotation of the stoking arms 52. Moreover, the conical member 46 may, in some cases, be replaced by an imperforate member for example, sufficient drying action then being afforded by the currents of air passing through the perforations 57 of the stoking arms 52.

The rotating assembly comprised in the conical member 46 and the arms 52, as is apparent from the drawings, may be of an exceedingly durable construction free of irregularly protruding parts and therefore avoiding any possibility that the rotating parts would become entangled in the irregular waste material.

While the invention has been described in detail with respect to a particular preferred example, it will be understood by those skilled in the art after understanding the invention that various changes and modifications may be made without departing from the spirit and scope of the invention, and it is intended, therefore, in the appended claims to cover all such changes and modifications.

What is claimed as new and desired to be secured by Letters Patent is:

1. In apparatus for drying and burning waste material, a furnace chamber, a grate area constructed and arranged for burning said waste material, means including a hollow perforated stoking arm for gradually advancing said waste material toward said grate area, means for passing a current of air through said perforated stoking arm to dry said waste material, and a generally conically shaped hearth area having the periphery thereof adjacent said grate area and over which said arm is adapted to thrust the dried material onto the grate area.

2. Incinerating apparatus for drying and burning waste material comprising, in combination, a furnace chamber having an annular floor section constructed and arranged for burning waste material, an upstanding rotatable hollow member comprising a perforated cap and having a hollow perforated stoking arm attached thereto for gradually advancing said waste material onto said annular floor section, means for passing a current of air through said hollow perforated stoking arm and said cap to thereby dry said waste material, and a generally conical hearth area having its lower peripheral portions adjacent the inner edge of said annular floor section, the upper portions thereof being adjacent said rotatable hollow member.

3. In apparatus for drying and burning waste material, a furnace chamber having an annular floor section comprising grate areas for burning said waste material, an upstanding rotatable hollow stem having an arcuately extending hollow perforated stoking arm attached thereto for slowly moving said waste material onto said grate areas, the outer end portions of said arcuate stoking arm being curved rearwardly with respect to the direction of rotation thereof, and a generally conical hearth area having the lower peripheral portions thereof surrounded by said annular grate areas and the upper portions thereof adjacent said rotatable hollow member.

4. In apparatus for drying and burning waste material, a furnace chamber having a substantially horizontal annular grate area, an upstanding rotatable hollow stem having a hollow perforated stoking arm attached thereto for gradually moving said waste material onto said grate area, the lower surface of said stoking arm being inclined with respect to the plane of said horizontal grate area, means for passing a current of air through said hollow perforated stoking arm to thereby dry said waste material, and a generally conical hearth area surrounded by said grate area, said hearth area being spaced from and substantially parallel to the aforesaid lower surface of said stoking arm.

5. In apparatus for drying and burning waste material, a furnace chamber having a floor section comprising grate areas for burning said waste material, an upstanding rotatable hollow stem, a perforated cap therefor, a plurality of arcuately extending hollow perforated stoking arms attached thereto for slowly moving said waste material onto said grate areas, means for passing a current of air through said cap and through said stoking arms for drying said waste material, and

a generally conical hearth area having the lower peripheral portions thereof adjacent said grate areas and the upper portions thereof adjacent said rotatable stem.

6. Incinerating apparatus for drying and burning waste material comprising a furnace chamber, the central floor area of said chamber comprising an upwardly extending conical and substantially imperforate hearth, an annular grate area surrounding said conical hearth, said hearth and grate area respectively being constructed and arranged for drying and then burning the waste material, means for discharging air into a pile of material on said hearth, including an upstanding rotatable hollow member mounted at the central portion of said hearth and having air discharge openings in its surface, and means extending adjacent said hearth, generally outwardly and non-radially from said member and rotatable therewith for advancing the lowermost and dried material of said pile gradually outwardly of said hearth onto said grate area.

7. Incinerating apparatus for drying and burning waste material comprising a furnace chamber, said chamber having a substantially circular stationary central floor area forming a hearth adapted to support at least the central portions of a pile of the waste material to be dried and burned, said hearth being surrounded by a stationary generally annular grate area within the bottom of the chamber, means for discharging air into such pile on said hearth including an upstanding internally supported hollow stationary and generally conical structure having an air discharge opening or openings in its surface, a rotatable hollow vertical shaft extending up through said hearth beneath said conical structure, and a plurality of arms extending outwardly from said shaft and rotatable therewith for advancing dried material at the under side of said pile gradually outwardly of said hearth onto said grate area.

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