

July 11, 1950

W. S. MARTIN ET AL
INCINERATOR WITH CENTRALLY SUPPORTED
SUPERIMPOSED AIR SUPPLY MEANS

2,514,657

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3 Sheets-Sheet 1

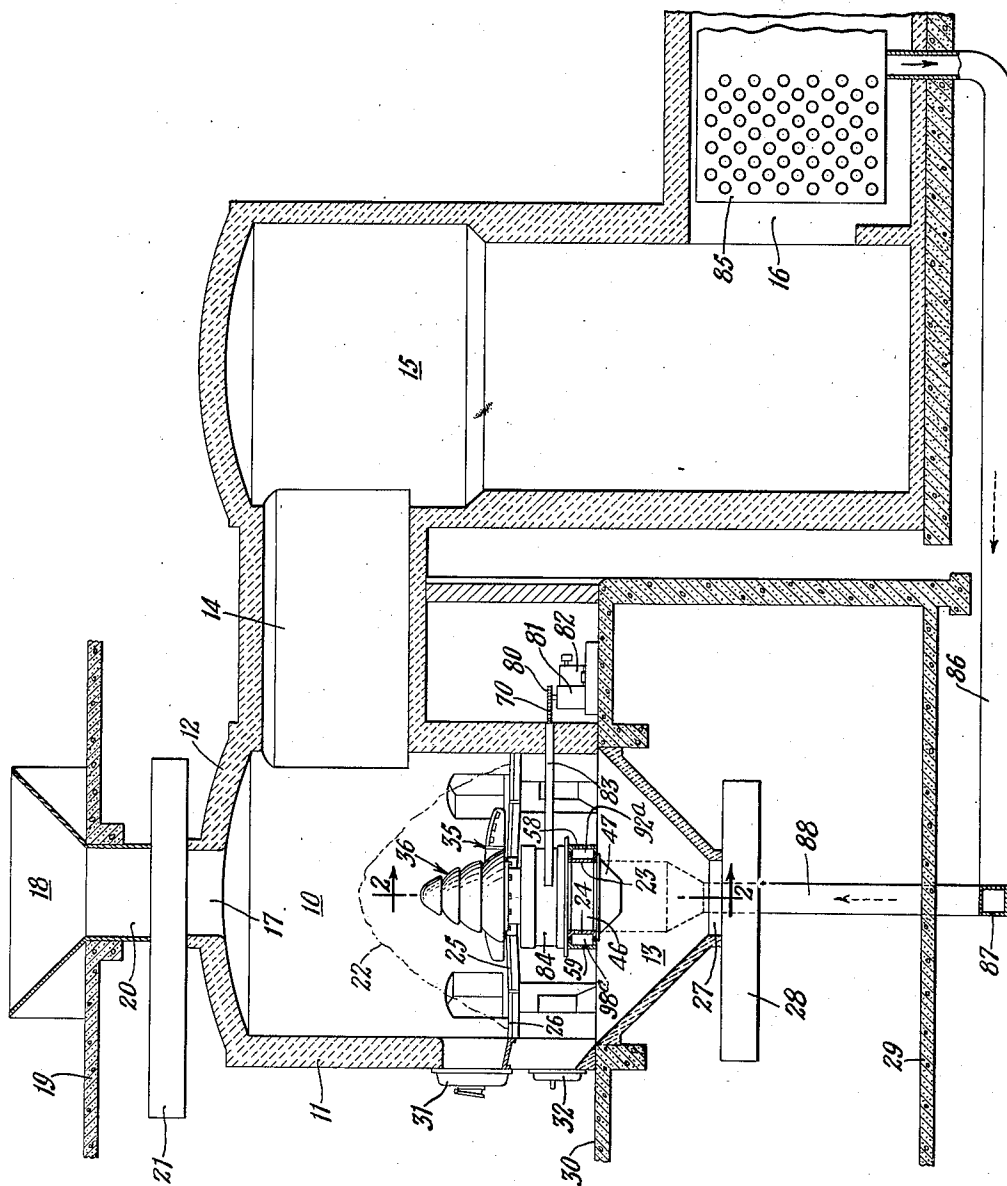


Fig. 1.

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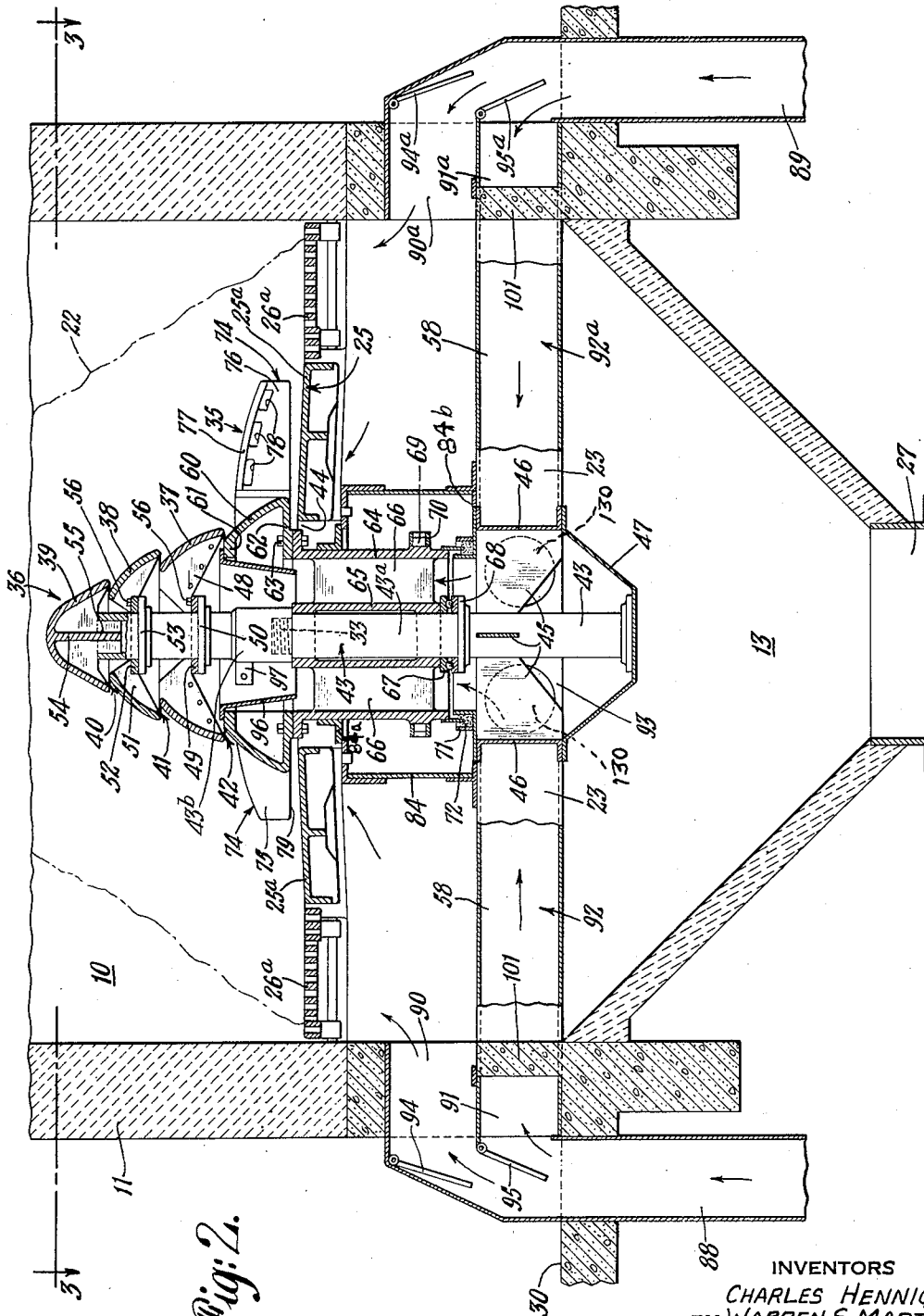


Fig. 2.

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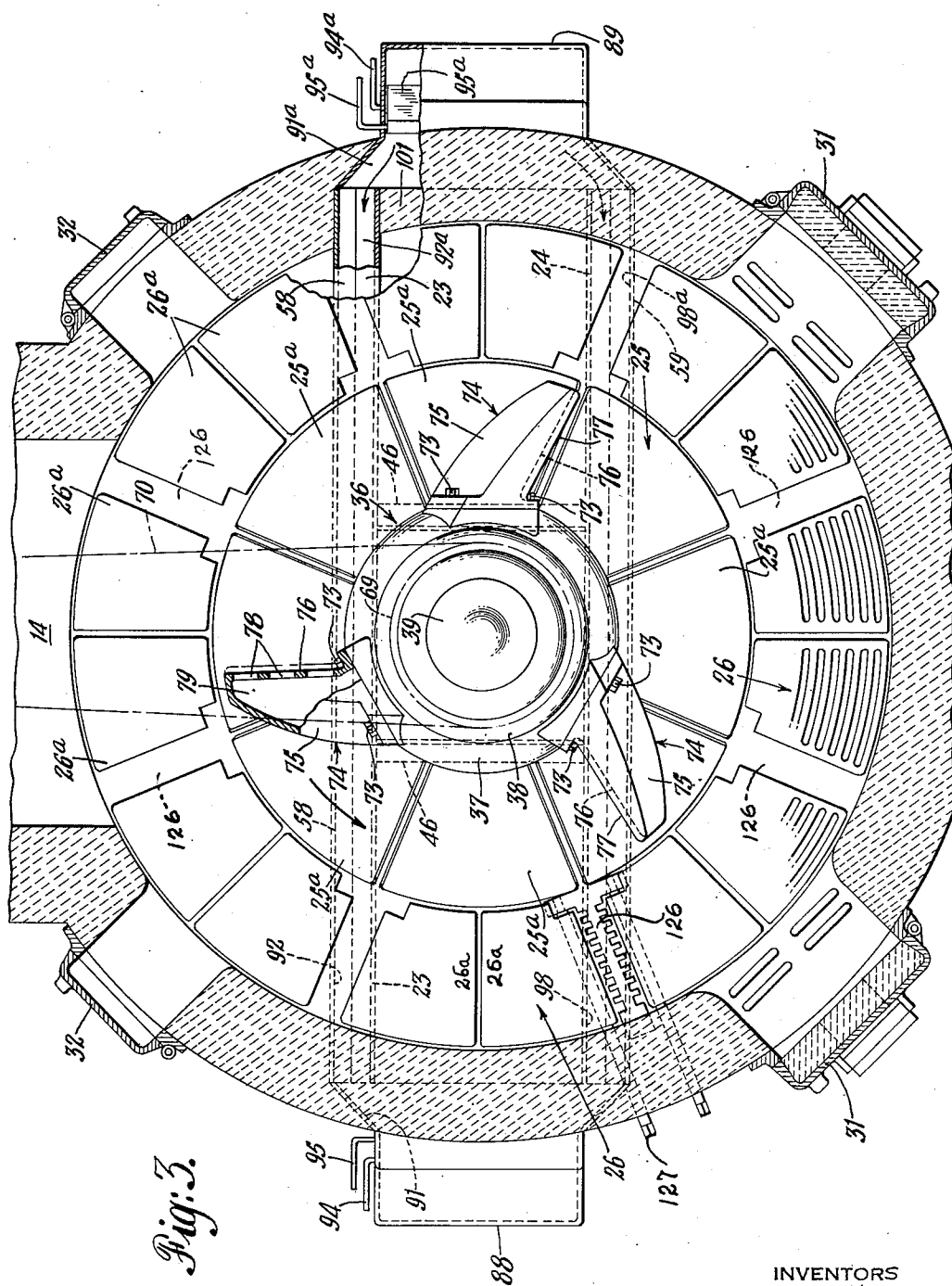


Fig. 3.

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UNITED STATES PATENT OFFICE

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INCINERATOR WITH CENTRALLY SUPPORTED SUPERIMPOSED AIR SUPPLY MEANS

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8 Claims. (Cl. 110—13)

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This invention relates to apparatus for incinerating rubbish and other like waste material as is capable of being disposed of by incineration.

It is not uncommon to dispose of trash, garbage, waste paper and the like which is cast away by populated communities by burning this rubbish in a furnace. There are, of course, various types and sizes of disposal plants but in any event, not infrequently, a furnace is provided within which to burn the rubbish. It is well known that the rubbish from a community varies in kind at different seasons and at different times. Ordinarily, the rubbish must be partially dried or desiccated in order to make it burn well. In the burning operation, the rubbish, garbage and trash need to be stirred up or stoked to allow air to get into the pile of rubbish in the furnace not only to support combustion but also to drive off excess moisture or dampness so that the combustible stuff will burn.

It is an object of this invention to provide an incinerator apparatus and stoker device so arranged as to mechanically stoke a pile of rubbish being burned in a furnace while causing a stream of air to pass through the rubbish serving to wholly or partially dry it while causing another stream of air to pass upwardly through a supporting grate onto which the partially dried rubbish is automatically moved from the pile and on which the burning is completed. The hot gases from the combustion are utilized if desired to heat the air going to the furnace and this results in increased overall efficiency of the rubbish disposal operations.

In accordance with a preferred form of the incinerator apparatus there is provided a cylindrically shaped fire-box having a charging port in its roof, a combustion chamber connected thereto which in turn is connected by a suitable flue to a chimney. The fire-box is provided with a circular hearth having a central opening to accommodate a rotary stoker device. Mounted in the annular area between the circular hearth and the cylindrical wall of the fire-box is an annular grate. Means are provided to rotate the stoker on a stationary vertical shaft which also carries an upwardly extending stationary tuyere member. Means are provided to supply air to the fire-box upwardly through the grate and also through the stoker mechanism. The rotating stoker mechanism is provided with a stationary "Christmas tree" head serving to bear the weight of the rubbish in the center of the pile where its weight is the greatest while at the same time serving as a tuyere through which air is carried

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into the pile. A normally closed ash-pit in the bottom of the fire-box, beneath the grate, also provides space for mounting a hollow rotatable shaft of the stoker mechanism and also a stationary shaft concentric therewith upon which is carried the "Christmas tree" tuyere head. The rotating shaft of the stoker is operated by a sprocket chain driven by a prime mover located outside the fire-box.

Although the novel features which are believed to be characteristic of the invention will be pointed out in the annexed claims, the invention itself as to its objects and advantages and the manner in which it may be carried out may be better understood by reference to the following description taken in connection with the accompanying drawings forming a part hereof, in which:

Fig. 1 is an elevation view in cross-section of an incinerator apparatus embodying the invention and showing the general arrangement;

Fig. 2 is an elevation view in cross-section through the lower end of the fire-box to larger scale, showing the stoker mechanism and tuyere head in greater detail; said view being on line 2—2 of Fig. 1; and

Fig. 3 is a plan view on line 3—3 of Fig. 2, partly broken away to better illustrate the construction of the arms of the stoker mechanism.

Referring now to the drawings, in which like reference characters indicate corresponding parts, there is shown a fire-box 10 having a cylindrical surrounding wall 11, roof 12 and ash-pit 13. Connected by a flue 14 is a combustion chamber 15 in turn connected to a flue 16 which may be connected to a chimney (not shown). The fire-box, combustion chamber and flue are of brickwork within a sheet steel casing. These are supported by steel frame members according to good engineering practice. This type of construction being generally well known, it is deemed superfluous to go into further detail in this regard.

The roof of the fire-box is provided with a central charging port 17 above which is a hopper 18 accessible from the charging floor level 19. The discharge chute 20 of the hopper 18 leads into the charging port 17 of the fire-box and is provided with a slidable gate 21 (shown conventionally). Manifestly, if the charging gate 21 is opened, such rubbish or trash as is in the hopper 18 will be charged through the chute 20 into the fire-box 10, the gate providing means for regulating the amount of rubbish 22 charged to the fire-box for burning at any particular time.

An annular hearth 25 is suitably supported in the lower part of the fire-box 10 and the area between the peripheral outside edge of the hearth 25 and the inner surface of the cylindrical wall 11 is provided with an annular grate 26. For convenience in construction and to facilitate repairs, the hearth may desirably be made in sector-shaped sections 25a and the grate in sector-shaped sections 26a. The grate sections are preferably of dump-grate type. They are mounted on a T-shaped radial supporting member 126 and may be manipulated by a grate bar 127. The ash-pit 13 is in the shape of an inverted truncated cone and terminates in an ash discharge chute 27 which is provided with a horizontally slidable gate 28 (shown conventionally). When this gate 28 is closed the ash-pit provides not only a chamber to collect ashes from the grate 26 but it also serves as an air chamber, the purpose of which is later described. Ashes may, from time to time, be discharged from the pit by opening the gate 28 which is accessible from the lower floor level 29. Accessible from the intermediate floor level 30 are a number of circumferentially spaced furnace doors 31 above and doors 32 below the grate for access to the interior of the fire-box.

Mounted in the center of the fire-box in its lower part is a stoker mechanism, designated generally by reference character 35. The stoker mechanism is surmounted by a stationary compound dome or head, which by reason of its shape and purpose is, for convenience of description, termed a "Christmas tree" tuyère head. This "Christmas tree" tuyère head is designated generally by reference character 36 and provides a tuyère through which air, preferably heated, is forced into the pile 22 of rubbish to partially dry it before it is finally moved by the stoker outwardly onto the grate 26 for final burning.

The tuyère head 36 (see Fig. 2) comprises a plurality of truncated hollow domes superimposed one above another in vertical alignment, the bottom truncated dome 37 being larger than a similar but smaller truncated dome 38 immediately above it. The dome 37 is preferably made up of two complementary half sections bolted together. These two hollow truncated domes 37 and 38 are capped by a hollow cap dome 39. The cap dome 39 is closed at its top; whereas the domes below it in vertical alignment are open at bottom and top. The three dome members 37, 38 and 39 are placed and held fixed one above the other as shown clearly in Fig. 2, so that there is an annular air port at the bottom periphery of each. Thus, at the bottom of cap dome 39 is an annular air port 40, at the bottom of dome 38 is an annular air port 41, and at the bottom of dome 37 is an annular air port 42. And it may be noted here that these air ports are under the lower peripheral edges of the domes each of which protects its air port as by an overhanging eave so that the ports can not become plugged from the rubbish piled in the fire-box on the "Christmas tree" tuyère head.

The "Christmas tree" head 36 is mounted on a hollow center post 43 which extends vertically through the central opening 44 of the annular hearth 25. This center post 43 is made in two sections: a lower section 43a and an upper section 43b secured together by a threaded connection 33. This center post 43 is secured to a spider having radially extending supporting legs 45, the legs being welded, bolted or otherwise secured to channel irons 46 and 23 and 24. It will be ob-

served (see Figs. 1 and 2) channel irons 46 are short lengths and extend from channel 23 to channel 24 and are secured thereto at their ends. Channel iron 23 has a complementary channel iron 58, the edges of their flanges abutting one another and welded to form air conduits 92 and 92a. Channel iron 24 has a complementary channel iron 59, the edges of their flanges abutting one another and welded to form an air conduit 98, 98a which runs parallel to air conduit 92, 92a. The purpose of these air conduits is explained further in detail hereinafter. The combined channels 23 and 58 and the combined channels 24 and 59 extend entirely across the fire-box and are supported in its walls. Together with channels 46 they form suitable supporting frame members to support the weight of the stoker 35 and "Christmas tree" tuyère head 36. The lower end of the center post 43 rests upon a pan 47 secured to the channel irons 46 and the conduit channels 23 and 24. This pan serves to stabilize the lower end of the post against sideways movement and also serves as a bottom closure for the stoker air chamber 93.

The dome 37 is provided with a spider 48 secured to a ring 49 which fits over the post 43 and rests upon an annular shoulder 50 on the post 43. In like fashion, dome 38 is provided with a spider 51 secured to a ring 52 which rests upon a shoulder 53 and cap 39 is provided with a spider 54 which rests upon the post; it being noted that the spider 54 is cut away at 55 to fit down into the hollow post 43b. These superimposed dome members are securely but removably attached to the post in any suitable manner and as shown bolts 56 are used.

Mounted for rotation beneath the stationary "Christmas tree" tuyère head is the stoker 35. It comprises a hollow truncated dome member 60, having an inturned horizontally extending annular flange 61 at the top and also an inwardly extending annular flange 62 at the bottom. Depending from this annular flange and bolted thereto, as by bolts 63, is an outer sleeve 64. It extends through the central opening 44 of the hearth. This outer sleeve 64 is secured to a concentric hollow shaft 65 by means of a spider comprising flat radial spokes 66. The hollow shaft 65 is mounted for rotation on the center post 43 and turns on a thrust bearing 67 resting upon an annular shoulder 68 secured to the post. A tooth ring 69 is secured to the sleeve 64 to accommodate a drive chain 70 for rotatably driving the sleeve and hence the stoker 35. It may be noted here that the lower end of the sleeve rotates in an annular channel 71 provided with a suitable seal 72.

The rotatable hollow dome member 60 has secured thereto, as by stud bolts 73, a plurality of circumferentially spaced, generally radially extending and rearwardly curved hollow stoker arms 74. As shown there are three such stoker arms. The interiors of these hollow stoker arms communicate with the interior of the hollow rotatable dome member 60. These arms are substantially flat on the bottom 75 and have an inclined leading face 75 and a trailing wall 76. The top of the leading face 75 extends slightly to the rear of the top of the trailing wall 76 to provide an eave 77 to protect the stoker arm air ports 78 in the top of the trailing wall 76 (see Fig. 2). It is to be observed that the leading faces are inclined rearwardly from bottom to top so that, as they are rotated with the hollow dome 60, they will travel into the pile of rubbish 22 as a plow

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and will agitate and stoke it while at the same time emitting air into the pile through the ports 78 as described hereinafter. Also the rubbish is gradually moved out from the foot of the pile by the rearwardly curved arms 74 onto the grate where burning is completed.

The stoker 35 is rotated by means of a chain 70 trained over the toothed ring 69 on the sleeve 64 and the drive sprocket wheel 80 of a variable-speed speed reducer 81 driven by a motor 82 which is located outside the fire-box on the floor level 30 (see Fig. 1). A casing 83 encloses the sprocket chain 70. A stationary cylindrical casing 84 surrounds the sleeve 64. This casing 84 is sealed at the top by a stationary angle ring 84a and also at its bottom by a plate ring 84b so as to keep dust from getting inside as far as possible.

To provide heated air to the fire-box, an air heater 85 is mounted in the flue 16. The hot combustion gases heat air which is forced through the air heater tubes by a blower (not shown) and the air is carried through an air duct 86 to a manifold 87 where the stream of air is divided and passes through air ducts 88 and 89 at either side of the fire-box. Air duct 88 leads into a port 90 into the air chamber 13 of the ash-pit and also into a port 91. The port 91 leads into each of the conduits 92 and 98, it being noted that the space between them is plugged by suitable brickwork 101. Similarly, conduit 89 leads into a port 90a into air chamber 13 and also into a port 91a, which leads into each of conduits 92a and 98a. Brickwork 101 is provided between these air conduits. There are a pair of ports 130 in the web of channel iron 23 leading into stoker chamber 93 and a corresponding pair opposite them in the web of channel 24 leading into stoker air chamber 93. Thus communication is provided for the passage of air through these conduits from the air heater into the stoker air chamber 93. Ports 90, 90a, 91 and 91a are provided with dampers 94 and 94a and 95 and 95a to regulate the relative amounts of air introduced into their respective air chambers. To divide the air stream from the stoker air chamber 93 and insure that proper relative amounts of air will pass through the stoker arms 74 and through the stationary tuyère head 36, a baffle 96 (see Fig. 2) extends downwardly from the top opening of hollow dome member 60 to the bottom opening. As will be noted in Fig. 2 the baffle is a hollow inverted truncated cone which is secured to the center post by a bracket 97.

Briefly, the operation of the incinerating apparatus is as follows: Rubbish charged to the hopper 18 is in turn charged to the fire-box 10 through the charging gate which is opened only at such times as it is desirable to charge more rubbish to the fire-box. The rubbish forms a pile on the hearth 25 above the stoker and tuyère head 36.

The rubbish is, of course, ignited and air is forced through the air conduit 86. When the apparatus gets under way the air is heated in the air heater 85 by the hot combustion gases passing through the flue 16 to the chimney (not shown). The dampers 94, 94a, 95 and 95a are regulated so that a part of the heated air passes into the ash-pit chamber 13, thence upwardly through the grate 26 where the rubbish at the foot of the pile has been moved outwardly onto the grate by the stoker 35 which is rotated by the motor 82. The stoker is rotated on its vertical axis at a relatively slow rate—of the order of five to ten revolutions per hour. By the time

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any unburned combustible material reaches the grate it is sufficiently dry to burn there. Another part of the air stream from the conduit 86 is passed into the stoker air chamber 93 through the conduits 92, 92a and 98, 98a, this chamber being closed but for the conduit inlets and the outlets into the stoker dome 60 and the tuyère head 36. Air entering the stoker dome passes out through the air ports 78 in the stoker arms into the pile and aids in the drying of the rubbish. The air entering the tuyère head passes out through the annular ports 40, 41 and 42 into the center portion of the pile to further aid in the drying of the rubbish. Such combustible gases as are driven off are burned in the combustion chamber 15 and the hot combustion gases then pass through the flue to heat incoming air passing through the air heater 85. As ashes and incombustible material are deposited in the bottom of the ash-pit, they may be removed from time to time through the discharge gate 28.

The terms and expressions which have been employed herein are used as terms of description and not of limitation and there is no intention in the use of such terms and expressions of excluding any equivalent of the features shown and described or portions thereof, but it is recognized that various modifications are possible within the scope of invention claimed.

What is claimed is:

1. An incinerator apparatus for burning rubbish which comprises a fire-box, a circular hearth in said fire-box having a central opening, a grate at the periphery of said hearth and surrounding said hearth, a rotatable stoker dome having hollow arms extending outwardly over said hearth for stirring a pile of rubbish on said hearth and for admitting air to overlying rubbish, an outer rotatable hollow sleeve connected to said stoker dome and extending downwardly through said central opening, a normally closed ash-pit below said grate, a stationary tuyère head surmounting said rotatable stoker dome, a vertical post concentrically mounted within said sleeve and supporting said tuyère head independently of said stoker dome, an inner sleeve within and secured to said outer sleeve and mounted to rotate about and in engagement with said post, a thrust bearing on which said sleeve arrangement is rotatable and which supports the weight of said stoker dome, power means to rotate said sleeves and hence said stoker dome and arms, means for supplying a stream of air to said grate, means including the annular passageway between said sleeves for supplying a stream of air to said stationary tuyère head and said stoker dome and arms.

2. An incinerator apparatus for burning rubbish which comprises a fire-box, a circular hearth in said fire-box having a central opening, a grate at the periphery of said hearth, a rotatable stoker dome having hollow arms extending outwardly over said hearth for stirring a pile of rubbish on said hearth and for supplying air into an overlying pile of rubbish, a hollow sleeve assembly, including an outer and a concentrically mounted inner sleeve and providing an annular passageway for air, connected to said stoker dome and extending downwardly through said central opening, a normally closed ash-pit below said grate, a stationary tuyère head surmounting said rotatable stoker dome, a stationary post within said inner sleeve and supporting said tuyère head, and providing a vertical shaft having a vertical bearing surface on which said inner

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sleeve rotates power means to rotate said sleeve assembly and hence said stoker dome and arms, means for supplying a stream of air to said grate and means including the passageway formed by said sleeves for supplying a stream of air to said tuyère head and to said stoker dome and arms, said tuyère head comprising a plurality of superimposed stationary hollow truncated conical domes and a capping dome, arranged in vertical alignment with a common axis and spaced apart to provide annular air ports between adjacent domes, each dome being of smaller diameter at the bottom than the one below it.

3. An incinerator apparatus for burning rubbish which comprise a fire-box, a flue connected to said fire-box for the passage of hot gases of combustion from burning the rubbish, a hearth in said fire-box having a central opening, a grate at the periphery of said hearth, a hollow rotatable stoker dome having hollow arms extending outwardly and horizontally over said hearth for stirring a pile of rubbish on said hearth, a hollow sleeve assembly connected to said stoker dome, said sleeve assembly comprising an outer sleeve depending from and rigidly secured to said rotatable stoker dome and extending downwardly through said central opening and an inner sleeve concentrically mounted in and secured to said outer sleeve, said inner and outer sleeves providing an annular air passageway into said rotatable dome, a normally closed ash-pit below said grate, a stationary tuyère head surmounting said rotatable stoker dome, a stationary post within said inner sleeve supporting said tuyère head independently of said rotatable dome and providing a bearing surface for said inner sleeve, power means to rotate said outer sleeve thereby to rotate said stoker dome, means including a first conduit for supplying a stream of air to said grate and means including a second conduit for supplying a stream of air to said annular passageway and thence to said stationary tuyère head, means in said flue connected to said conduit for heating said air by utilizing the heat of the hot gases of combustion, adjustable baffle means in said first and second conduits by which the relative amounts of air passing to said grate and to said passageway may be regulated and baffle means in said passageway by which the relative amounts of air passing to said hollow rotatable dome and to said tuyère head may be regulated, said tuyère head comprising a plurality of superimposed hollow truncated domes progressively smaller in size from bottom to top, said domes being arranged in "Christmas tree" fashion so that there is an annular space between the periphery of the bottom of each dome and the surface of the dome immediately below it.

4. A stoker and tuyère device for a rubbish burning furnace having a hearth with a central opening therein which comprises a hollow rotatable truncated dome mounted to rotate about a vertical shaft extending through the hearth opening, hollow arms secured to and extending outwardly from said rotatable dome and arranged to rotate in a horizontal plane over said hearth, a stationary tuyère head surmounting said rotatable dome, said tuyère head comprising a plurality of truncated tuyère domes superimposed one above another, each of said tuyère domes being smaller than the one immediately below it, said domes being vertically spaced to provide air ports between adjacent tuyère domes, a rotatable sleeve assembly comprising an outer sleeve fixed to and depending from said rotatable

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dome and an inner concentrically mounted sleeve fixed to said outer sleeve, said inner and outer sleeves extending through said opening and providing an annular passageway for air, a vertical stationary post mounted within said inner sleeve providing a vertical shaft about which said sleeve assembly rotates, said post serving to carry the weight of said stationary tuyère head and serving as a bearing surface for said inner sleeve, a thrust bearing carrying the weight of said rotatable dome and sleeves, means to rotate said sleeve assembly and hence said rotatable dome, and means to supply air to said domes through said annular passageway and thence through said ports.

5. A stoker and tuyère device for a rubbish burning furnace having a hearth with an opening therein, said stoker comprising a rotatable hollow truncated dome having an opening at its bottom and an opening at its top, hollow stirring arms adapted to sweep over the surface of said hearth secured to said rotatable dome and extending outwardly therefrom and having air ports in their walls, the interiors of said arms communicating with the interior of said rotatable dome, a rotatable hollow sleeve assembly rigidly secured to and depending from said rotatable dome and communicating with the opening in the bottom of said rotatable dome, said sleeve assembly extending downwardly through the opening in the furnace hearth and comprising an outer sleeve fixed at its upper end to said rotatable dome and a concentric inner sleeve anchored to said outer sleeve, a stationary post extending upwardly through said inner sleeve and providing a vertical bearing surface for said inner sleeve, a plurality of stationary superimposed truncated hollow domes carried by said post, each having an opening at its bottom and top and surmounting said rotatable stoker dome, and a capping dome crowning said truncated domes, said domes being vertically spaced to provide air ports at their bottom peripheral edges through which to pass air into rubbish piled on said hearth, a thrust bearing to carry the weight of said rotatable sleeve assembly and rotatable dome and means to rotate said sleeve assembly and hence the rotatable dome to which it is secured.

6. A stoker and tuyère device for a rubbish burning furnace having a hearth with an opening therein, which comprises a rotatable dome having an opening at its bottom and an opening at its top, hollow stirring arms adapted to sweep over the surface of said hearth secured to said rotatable dome and extending outwardly therefrom and having air ports in their walls, the interiors of said arms communicating with the interior of said rotatable dome, a rotatable stoker supporting assembly secured to and depending from said rotatable dome and extending downwardly through the opening in the furnace hearth, said assembly comprising an outer hollow sleeve and a concentrically mounted inner sleeve anchored to said outer sleeve, the annular space between said sleeves providing a passageway for a current of air to said rotatable dome, means to rotate said supporting assembly and hence said rotatable dome, a stationary tuyère head supporting post extending upwardly through the center of said opening, and a tuyère head carried on said post, said tuyère head comprising superimposed truncated hollow domes, each having an opening at its bottom and top and surmounting said rotatable dome, and a

capping dome closed at its top crowning said truncated domes, said domes being vertically spaced to provide air ports at their peripheral edges through which to pass air into rubbish piled on said hearth, said stationary post providing a bearing surface about which said inner sleeve rotates and serving to carry the weight of said tuyère head independently of said rotatable stoker dome, and a thrust bearing on which said stoker supporting assembly rotates and serving to carry the weight of said rotatable dome and arms.

7. A stoker and tuyère device for a rubbish burning furnace having a hearth with an opening therein, said stoker comprising a rotatable hollow truncated dome having an opening at its bottom and an opening at its top, hollow stirring arms adapted to sweep over the surface of said hearth secured to said rotatable dome and extending outwardly therefrom and having air ports in their walls, the interiors of said arms communicating with the interior of said rotatable dome, a hollow sleeve assembly having an outer sleeve secured at its upper end to and depending from said rotatable dome and having a concentric inner sleeve secured to said outer sleeve by webs, the annular space between said sleeves providing an air passageway, said passageway of the sleeve assembly communicating with the opening in the bottom of said rotatable dome, said sleeve assembly extending downwardly through the opening in the furnace hearth, a stationary post extending upwardly through the center of said inner sleeve and providing a vertical bearing surface on which said inner sleeve rotates a plurality of stationary superimposed truncated hollow domes above said rotatable dome and communicating with said passageway and carried by said post, each having an opening at its bottom and top and surmounting said rotatable dome, and a stationary capping dome closed at its top crowning said stationary truncated domes, said stationary domes being vertically spaced to provide air ports at their peripheral edges through which to pass air into rubbish piled on said hearth, a thrust bearing on which said sleeve assembly rotates and carrying the weight of said rotatable dome, arms and sleeve assembly, and means to rotate said sleeve thereby to rotate said rotatable dome and arms.

8. A stoker and tuyère device for a rubbish

burning furnace having a hearth with an opening therein, said stoker comprising a rotatable hollow truncated dome having an opening at its bottom and an opening at its top, hollow stirring arms adapted to sweep over the surface of said hearth secured to said rotatable dome and extending outwardly therefrom and having air ports in their walls, the interiors of said arms communicating with the interior of said rotatable dome, an outer hollow sleeve secured to and depending from said rotatable dome and communicating with the opening in the bottom of said rotatable dome, said outer sleeve being adapted to extend downwardly through the opening in the furnace hearth, an inner hollow sleeve concentrically mounted in and secured to said outer sleeve, a post extending upwardly through said inner sleeve and providing a bearing surface for said inner sleeve, a plurality of superimposed truncated hollow domes carried by said post in stationary position and forming a stationary tuyère head, each having an opening at its bottom and top and surmounting said rotatable stoker dome, a capping dome crowning said truncated domes, said domes being vertically spaced to provide air ports at their bottom peripheral edges through which to pass air into rubbish piled on said hearth, and a baffle extending downwardly from said tuyère head into said rotatable dome and terminating in said hollow outer sleeve and serving to direct air passing through said sleeve in relative amounts to said hollow rotatable dome and to said stationary tuyère head.

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