May 21, 1940. R. L. LINDEMUTH 2,201,780

STOKER

Original Filed March 9, 1935 3 Sheets-Sheet 1

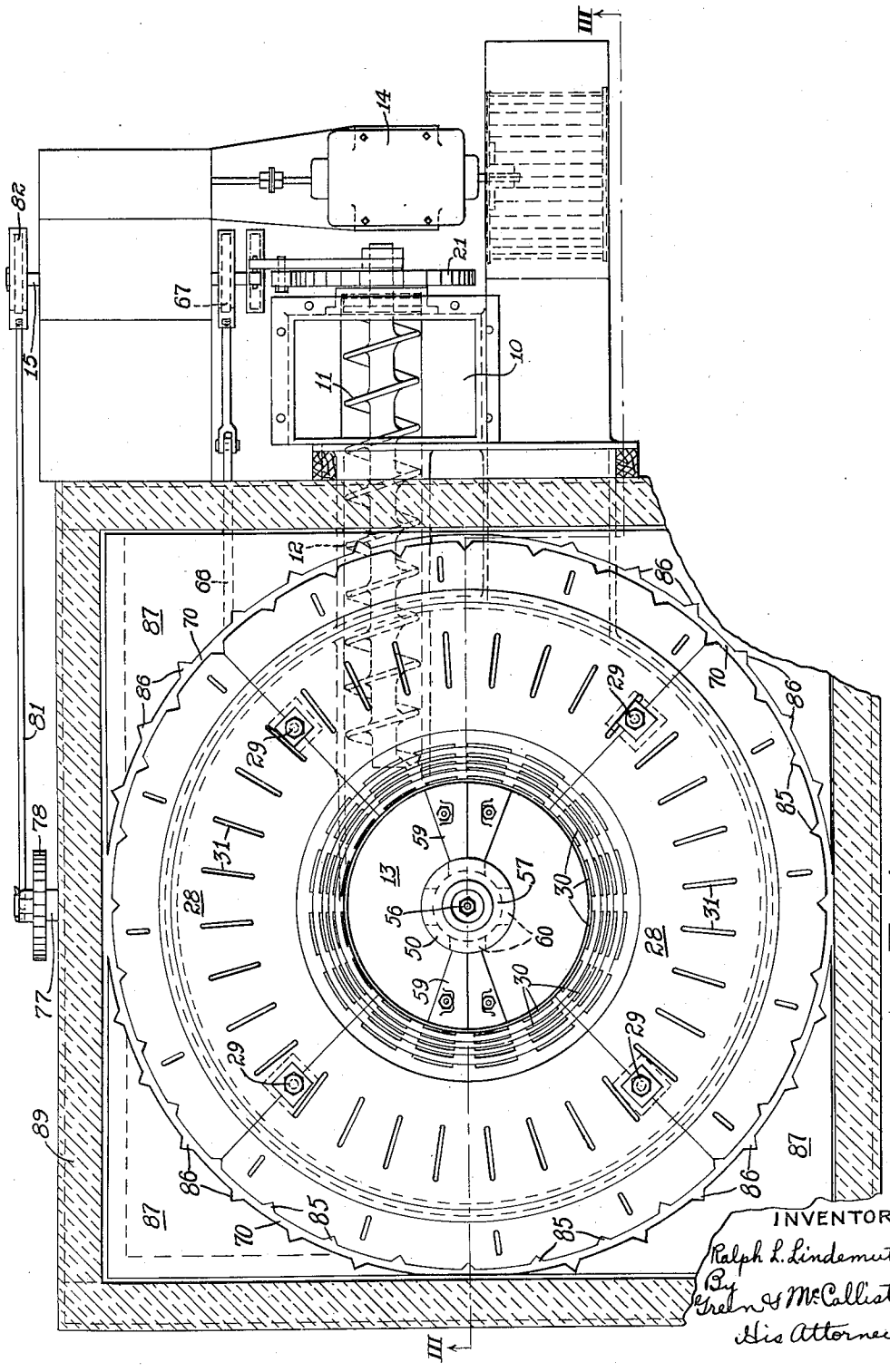


Fig. 1.

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Original Filed March 9, 1935 3 Sheets-Sheet 2

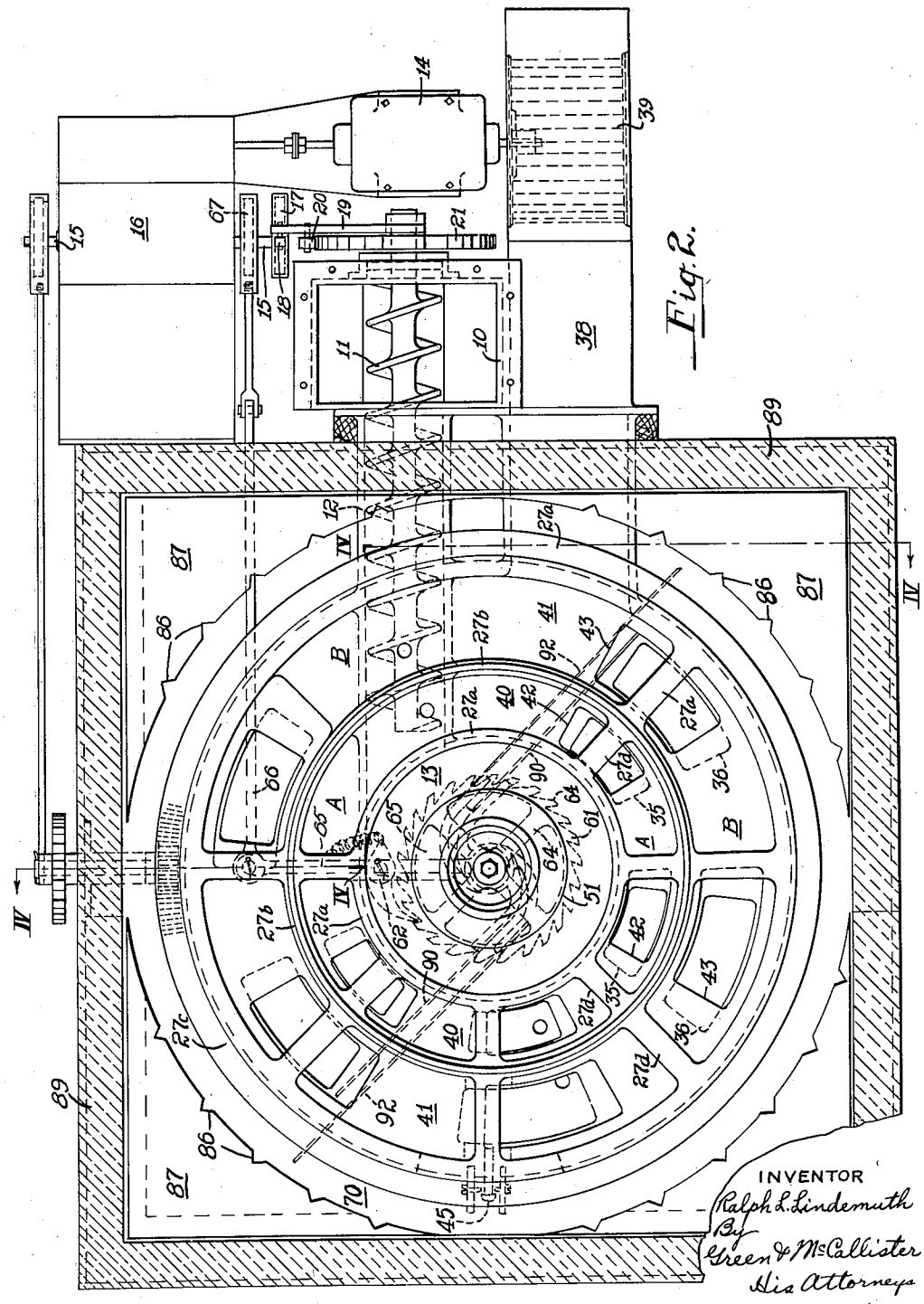


Fig. 2.

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STOKER

Original Filed March 9, 1935 3 Sheets-Sheet 3

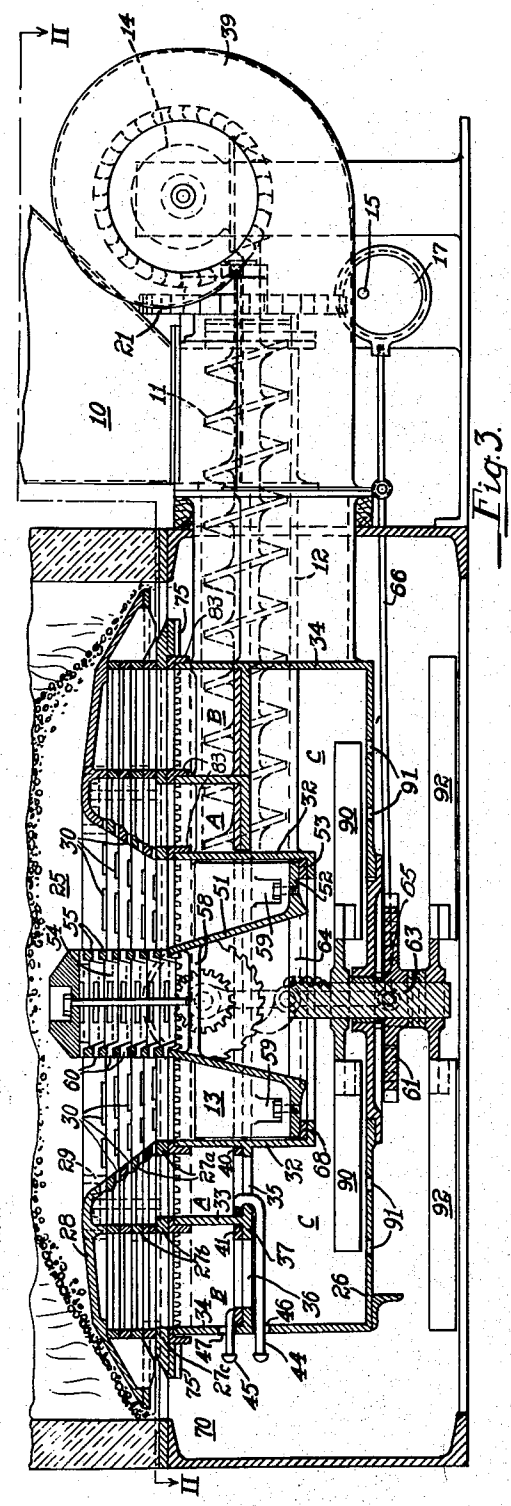


Fig. 3.

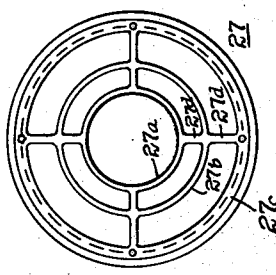


Fig. 5.

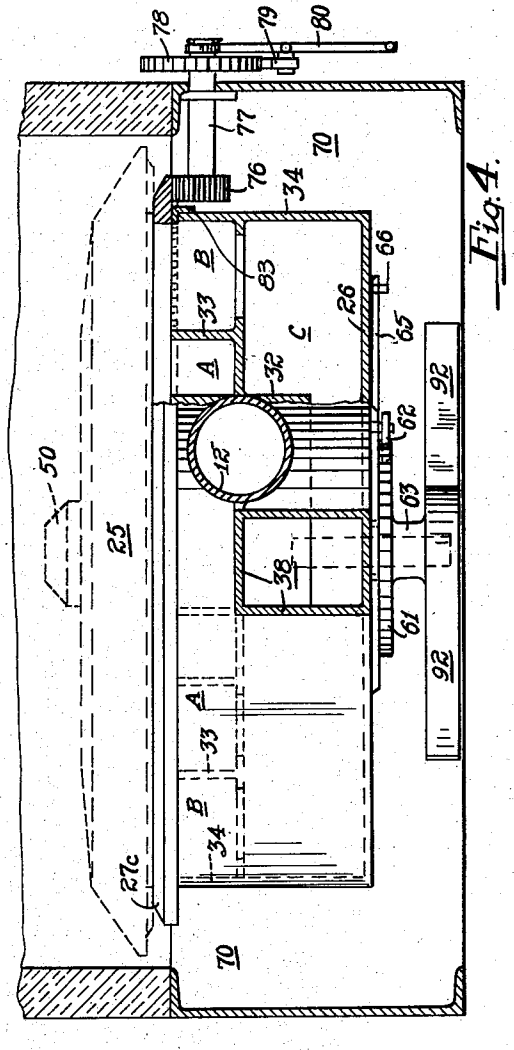


Fig. 4.

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Patented May 21, 1940 2,201,780

UNITED STATES PATENT OFFICE

2,201,780

STOKER

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Application March 9, 1935, Serial No. 10,235
Renewed May 2, 1939

16 Claims. (Cl. 110—45)

This invention relates to progressive feed stokers of either the underfeed or overfeed type, and more particularly to improvements in the construction of the retort of a stoker unit of either the single or multiple retort type for the purpose of materially increasing the active burning area of the stoker.

The principal object of the present invention is to provide a retort for a stoker which will meet the conditions essential to secure complete combustion of the fuel being introduced into the retort; which will prevent the formation of a coke plug in the retort; which will deliver air to the combustible fuel in sufficient quantities to burn all of the volatiles and in such a manner that it is properly mixed with the combustible fuel; and which will evenly distribute the fuel throughout the entire retort and prevent it from building up in a mound or peak over the retort.

Another object is to provide a stoker having a relatively large retort provided with means for delivering air in sufficient quantities to the fuel in the retort to secure complete ignition over the entire fuel bed irrespective of the load on the stoker.

A further object is to provide means for reducing the distance which the air must travel to completely penetrate the fuel in the retort of a stoker.

A further object is to provide means for delivering air directly to the middle of the retort and consequently materially reduce the distance the air must travel to completely penetrate the fuel over the retort.

A still further object is to provide a retort having a center tuyère or grate which cooperates with the side tuyères to deliver air to all parts of the fuel bed and thereby insure complete ignition of all the fuel over the retort and in the stoker.

These and other objects which will hereinafter be made apparent to those skilled in the particular art are accomplished by means of this invention, one embodiment of which is described in the following specification and illustrated in the accompanying drawings, in which:

Figure 1 is a top plan view of a stoker and retort made in accordance with the teachings of my invention;

Fig. 2 is a view in horizontal section of the stoker shown in Fig. 1, taken on lines II—II of Fig. 3;

Fig. 3 is a view in vertical section taken on line III—III of Fig. 1;

Fig. 4 is a sectional view taken on line IV—IV of Fig. 2, with the position of the stoker grates indicated by broken lines; and

Fig. 5 is a plan view on a reduced scale of one of the ring-like members forming the stoker grate.

In my improved stoker, I provide in addition to the ordinary stoker grate, a central active burning grate which is movably supported in the retort and is connected with the primary source of stoker air for the purpose of delivering air in sufficient quantities to the fuel in the retort to thoroughly mix with the volatiles given off by the fuel and cause complete ignition thereof. The movable retort grate is also provided with means for distributing the fuel evenly over the stoker grate and this is accomplished by combining pushers with the movable retort grate so that as it moves relative to the stoker grate, the fuel will be agitated or broken up and move over the stoker grates. I also provide multiple air zones in the stoker for the purpose of controlling the amounts of air delivered to each section of the stoker grate and to the retort grate whereby air in sufficient quantities to properly mix with the volatile gases will be delivered to the various sections of the burning grate and retort grate to thereby insure complete combustion of the fuel.

In an exemplification illustrated in the drawings 10 indicates a coal hopper from which coal is fed by a screw 11 through a duct 12 into a round retort 13. The duct 12, which enters the side of the retort, may be connected to the retort on the center line or on either side thereof. The screw 11 may be driven in any suitable manner and as shown, is driven by a motor 14 which is connected to a shaft 15 through suitable gears contained in a gear box 16. The shaft 15 carries an eccentric 17 which is connected by a vertical link 18 to one end of a lever 19 that has its other end pivoted on the outer end of the screw 11. This lever 19 has a spring-pressed pawl 20 pivotally mounted thereon which engages a ratchet wheel 21 keyed or otherwise secured to the screw 11. As the shaft 15 turns, the link 18 and lever 19 are moved up and down by the eccentric 17 and an intermittent turning movement is transmitted to the screw 11 whereby the fuel is moved from the hopper 10 into the retort 13.

The fuel delivered to the retort 13 is distributed over an annular grate 25 that is supported on an annular member 26 forming the stoker body. The grate 25 is composed of a series of

ring-like members 27 each of which has an inner, an intermediate, and an outer ring 27a, 27b, and 27c joined together by spacer bars 27d (Fig. 5). These rings which are adapted to be superimposed one over the other, are of gradually increasing internal diameters from the top to the bottom and are covered by a cap plate 28 that is fastened to the lowermost ring of the grate by bolts 29 having their heads countersunk in plate 28.

Each of the ring-like members 27 has portions of the inner ring 27a cut away at regularly spaced intervals to provide, when these members are assembled, a series of slots 30 forming tuyères adjacent the upper edge of the retort for directing air into the fuel contained in the retort. The cap plate 28 is also provided with slots 31 which form tuyères for directing air into the burning zone of the stoker.

When the members 27 are assembled, the rings 27a, 27b, and 27c form annular walls beneath the grate which coincide with annular walls 32, 33, 34, which are formed integrally with the stoker body 26 and divide the interior of the stoker into air zones A and B that are in communication with the wind box C of the stoker through slots 35 and 36, respectively, in a plate 37 joining the walls 32, 33, and 34 of the stoker.

Air for combustion is supplied to the wind box C through a duct 38 that connects it with a motor-driven forced draft fan 39 and the amount of air delivered to each of the zones A and B is controlled by annular damper plates 41, 40 which are turnably mounted on the plates 37 and have slots 42 and 43 therein respectively of the same size as the slots 35 and 36 in the plate 37. The slots 36 and 37 are so spaced that when damper plates 40 and 41 are in one extreme position, the slots 32 and 33 register with the slots 35 and 36 in the plate 37 and when in the other extreme position, the slots 35 and 36 are completely closed by the solid portions of the dampers. The damper plates 40 and 41 may be readily moved to regulate the size of the openings defined by slots 35—42 and 36—43 by moving handles 44 and 45 which are attached to the dampers 40 and 41 and extend through slots 46 and 47 in the wall 34 of the stoker body 26.

In order to distribute the fuel delivered to the retort 13 evenly over the grate 25 and prevent the formation of an upright coke plug therein, I provide a combined grate and pusher 50 which is movably mounted in the retort and has means for directing air into the fuel contained therein. The grate 50 comprises an annular hollow lower section 51 having an outwardly extending flange 52 which is turnably mounted on an inwardly projecting annular flange 53 on the bottom of the wall 32, and an upper section 54 which is formed from a series of rings 55 superimposed one over the other and held in place on the lower section 51 by a bolt 56 which extends through a top cover plate 57 and is threaded into a crossbar 58 on the interior of the lower section 51.

The flange 52 on the lower section 51 of the retort grate forms the bottom of the retort 13 and in order to distribute the fuel fed through the duct 12 into the retort on the center line or at either side thereof, wedge-shaped members 59 are secured to the lower section 51 which pick up the fuel, as the retort grate 50 is turned, and carry it around and upwardly in the retort into the ignition zone of the stoker.

To thoroughly and properly mix the fuel with air as it approaches the ignition zone, and to insure the presence of a sufficient amount of air at this zone to completely ignite the volatile gases given off by the fuel, each of the rings 55 is provided with recesses which when the rings are assembled, form tuyères 60 for directing air into the fuel in the retort.

Since the lower end of the section 51 of the grate 50 opens into the wind box C in the stoker body 26, it is apparent that each of the grate sections in the stoker is furnished with air from a common source.

While the retort grate 50 may be either continuously or intermittently rotated, as desired, to distribute the fuel in the retort over the grate 25, I prefer to drive the grate 50 intermittently when the fuel feed is intermittent and continuously when the fuel is being delivered to the retort continuously. In the drawings I have illustrated means for intermittently rotating the grate which comprises a ratchet and pawl arrangement 61—62. The ratchet wheel 61 is keyed or otherwise secured to a vertical shaft 63 which extends upwardly through the stoker body 26 and is connected at its upper end to a spider-shaped crossbar 64 on the interior of the lower section 51 of the grate 50. The pawl 62, which is pressed by a suitable spring against the teeth on the wheel 61, is pivotally mounted on a lever 65, one end of which is journalled on the shaft 63 and the other end is provided with a link 66 connected to an eccentric 67 on the motor driven shaft 15. To avoid wearing between the stoker body and the retort grate the flange 52 on the lower section of the grate 50 rides on an annular rubbing strip 68 made of a suitable metal, preferably heat resisting, that is positioned on the flange 53.

In order to agitate the fuel bed and move the fuel from the retort 13 over the grate 25 toward an ash chamber 70 and to effect a continuous ash and clinker discharge, I provide means for turning the grate 25. While the grate 25 may be continuously or intermittently rotated either in the same direction with or in the opposite direction from the retort grate 50, I prefer to impart an intermittent motion to the grate 25 when the fuel feed screw 11 and the grate 50 are operated intermittently. To rotate the grate 25, the lower side of the outer ring 27c of the lower grate member 27 is provided with a series of gear teeth 75 which mesh with a pinion 76 on the end of a suitably journalled horizontal shaft 77. The outer end of the shaft 77 has a ratchet wheel 78 secured thereto, and the wheel 78 and shaft 77 are periodically rotated by means of a spring-pressed pawl 79 which is pivoted to a lever 80 having one end journalled on the end of the shaft 77 and the other end pivotally connected by link 81 with an eccentric 82 on the motor-driven shaft 15. To avoid excessive wearing between the grate 25 and the stoker body 26, I prefer to cover the top of the stoker with annular metallic rubbing members 83 similar to the member 68, which cover the tops of the annular walls 32—33—34 and support the lower ring-like member 27 of the grate 25.

To continuously crush the clinker and ash formations delivered to the outer periphery of the grate by the rotary motion imparted to the grate, the outer periphery of the cap plate 28 is provided with a series of notches 85 which cooperate with a series of notches 86 in a crusher plate 87 that extends inwardly from the wall of the furnace over the ash chamber 70 and into cooperating relation with the edge of the cap plate 28. From this construction, it is apparent that as the

grate 25 moves relative to the crusher plate 87, the notches 85 on the plate 28 are moved into and out of registration with the notches 86 and a crushing action is secured therebetween which will eventually break up the clinker formation and cause it to drop into the ash chamber 70.

When installing my improved stoker in a square furnace 89, as illustrated, a separate crusher plate 87 is disposed in each corner of the furnace. The plates 87 are sloped toward the grate 25 to prevent an ash accumulation thereon. When the stoker illustrated in Figs. 1 to 5 is to be installed in a round furnace, the crusher plate may be of annular shape, or a series of spaced inwardly projecting crushing members may be secured to the furnace wall to secure the crushing action.

In order to discharge the fuel and ash siftings which may fall into the stoker body 26 through the tuyères 30—31 and 60, a set of scraper arms 90 may be secured to the shaft 63 which, as the retort grate 50 rotates, tends to collect the siftings and push them toward discharge openings 91 in the bottom of the stoker body. The shaft 63 also carries pusher arms 92 for collecting the ashes discharged into the ash chamber 70 in a suitable container or collector (none shown).

Further, with my central retort grate, air is delivered to the fuel in the retort at the point where it is most needed and this air in conjunction with that delivered through the side retort tuyères insures the presence of sufficient quantities of oxygen in the retort to properly mix with and completely ignite all the volatile gases as soon as they are given off by the fuel. With the immediate burning of these tarry gases, I not only prevent smoking, but I also secure enough additional heat to support combustion in the burning zone and maintain it at such temperature as will tend to quickly volatilize the fuel in the retort and prevent the building up of a "black center" over the retort. By burning substantially all the volatiles in the retort, the fuel delivered to the side grates is substantially pure carbon or coke which burns smokelessly, and therefore the work which must be done on the grate to completely reduce the carbon to ash, is materially reduced.

Another feature of my invention resides in controlling the quantity of air delivered to each section of the active burning grates. I prefer to have the center grate connected directly to the primary source of air and I control the pressure and quantity of air delivered to the retort grate by regulating the forced draft fan. The quantities of air delivered to the retort side tuyères and to the grate tuyères are controlled by the separate dampers and as a result, air is delivered to the various tuyères in the proper proportions to secure complete combustion at each section of the stoker.

What I claim as new and desire to secure by Letters Patent is:

1. An apparatus of the character described comprising a body having a substantially cylindrical wall, an inwardly projecting flange on the bottom of said wall, an annular grate rotatably supported on the top of said body, means for rotating said grate, a member rotatably mounted on the flange of said wall, the said wall and said member forming an annular retort therebetween, a grate carried by said member, means for introducing fuel tangentially into said retort, means on said member for distributing the fuel delivered to said retort over said first mentioned grate, and means cooperating with the outer edge of said annular grate on rotation thereof for breaking and discharging the resultant ash formation.

2. A progressive feed stoker comprising an outer circular grate section, an inner grate section concentric with said outer grate section and movable relative thereto, a body supporting said grate sections and having an annular retort therein, means for moving said inner grate relative to said outer grate, means for introducing fuel tangentially into the retort in said body and means associated with said inner grate for distributing the fuel introduced into said retort on the movement of said inner grate.

3. In a stoker, the combination comprising a body having an inner cylindrical wall and an outer wall spaced therefrom, a grate covering the space between said walls, means for turning said grate, a member movably supported within said cylindrical wall and closing the bottom thereof, said member having an upwardly projecting annular portion spaced from said inner wall to provide an annular fuel retort therebetween, a fuel delivery pipe extending through said outer wall and opening into said inner wall above said movable member, means carried by said movable member for distributing the fuel delivered to said retort and for mixing such fuel with air, means for moving said member, and means cooperating with the outer periphery of said grate for continuously discharging the ash formation from said stoker.

4. An apparatus of the character described comprising a body having an outer wall, a substantially cylindrical inner wall spaced from said outer wall and having an inwardly projecting flange on the lower end thereof, a grate spanning the space between said walls, means for rotating said grate, an annular member having an outwardly flared lower end supported on said flange of said inner wall and forming an annular retort therebetween, a pipe extending through ports in said walls and opening into said retort above the outwardly flared portion of said member, a screw rotatably mounted in said pipe for delivering fuel to said retort, a grate carried by said annular member, means for rotating said last mentioned grate, means associated with said grate for distributing the fuel delivered into said retort, and means cooperating with said first mentioned grate for breaking and continuously discharging the ash formation from said first mentioned grate.

5. Apparatus of the character described comprising a body having an outer wall and a substantially cylindrical inner wall spaced from said outer wall and defining a retort, a grate spanning the space between said walls, means for oscillating said grate, an annular member forming a bottom for said retort and having a supporting portion, a fuel delivery pipe extending through pipe ports in said walls and opening into said retort above the bottom thereof, a fuel distributing member carried by said annular member, a grate carried by the supporting portion of said annular member, and means for rotating said annular member, the fuel distributing member and the grate carried thereby.

6. An apparatus of the character described comprising a body having a substantially cylindrical wall defining a retort, an annular grate supported on the top of said wall, a movable member forming the bottom of said retort, a fuel delivery pipe tangentially connected to said wall and communicating with said retort above the

movable bottom thereof, means for conveying fuel through said pipe and into said retort, and means on said movable bottom member for distributing the fuel conveyed into said retort evenly over said grate.

7. A progressive feed stoker comprising a body having a cylindrical wall, a movable annular member supported by said body within said cylindrical wall, said annular member being spaced from said wall to provide an annular retort therebetween and having a section forming the bottom of said retort, a circular grate section supported on the cylindrical wall of said body, an inner grate section concentric with said outer grate section supported on said annular member, means for moving said annular member and the grate carried thereby, means for moving said outer grate, means for introducing fuel into the side of said retort, and means associated with said annular member for engaging and distributing the fuel delivered to said retort on movement of said member.

8. Apparatus of the character described comprising a body having an annular retort chamber therein, a grate mounted on the top of said body and surrounding said retort chamber, a member movably supported by said body within said chamber and forming the bottom of said retort, a grate carried by said movable bottom member, a fuel delivery conduit tangentially connected to said body and communicating with said annular retort chamber above the movable bottom thereof, means for conveying fuel through said conduit and into said retort, means on said movable bottom member for agitating the fuel conveyed into said retort and distributing the same over said grate, and means for moving said movable bottom member and the agitating means carried thereby.

9. In an underfeed stoker, a centrally located annular retort comprising a substantially cylindrical lower outer wall having an inwardly projecting annular flange adjacent its lower end, an outwardly flaring upper grate-like wall, a member mounted for rotation within and adjacent the bottom of said substantially cylindrical wall, supported by said annular flange, forming the bottom of the retort, and having a centrally located upwardly extending hollow portion provided with a grate-like top extending into the flared portion of the retort, means for feeding fuel into said retort through said substantially cylindrical wall above the retort bottom and means for rotating the retort bottom, its upwardly extending hollow portion and its grate-like top.

10. In an underfeed stoker, a centrally located annular retort comprising a substantially cylindrical lower outer wall, an outwardly flaring upper grate-like wall, a member mounted for rotation within and adjacent the bottom of said substantially cylindrical wall for closing the retort bottom and being provided with a centrally located upwardly extending hollow portion provided with a grate-like top, means for feeding fuel into said retort through said substantially cylindrical wall, means for rotating said member, its upwardly extending hollow portion and its grate-like top, and means carried by said member for agitating and elevating fuel within the retort.

11. In an underfeed stoker, a centrally located annular retort comprising a substantially cylindrical lower outer wall, an outwardly flaring upper grate-like wall, a member mounted for rotation within and adjacent the bottom of said substantially cylindrical wall, closing the bottom of the retort, and having a centrally located upwardly extending hollow portion provided with a grate-like top extending into the flared portion of the retort, means for feeding fuel into said retort through said substantially cylindrical wall above the retort bottom, and means for rotating said member, its upwardly extending hollow portion and its grate-like top.

12. In an underfeed stoker, an annular retort located centrally of the stoker and comprising a substantially cylindrical lower outer wall, an outwardly flaring upper grate-like wall, a member mounted for rotation within and adjacent the bottom of said substantially cylindrical wall forming the retort bottom; and having a centrally located upwardly extending hollow portion provided with a grate-like top extending into the flared portion of the retort, means for feeding fuel tangentially into said retort through said substantially cylindrical wall, means for rotating said member, its upwardly extending hollow portion and its grate-like top, and means carried by said member for agitating and elevating fuel within the retort.

13. In a stoker, a body having an inner substantially cylindrical wall and an outer wall spaced therefrom, a grate section covering the space between said walls, a member supported for rotation within said cylindrical wall and closing the bottom thereof; said member having an upwardly projecting hollow portion spaced from said cylindrical wall and with it forming an annular retort, a grate projecting upwardly from the top of said hollow portion, and a fuel delivery pipe extending through said wall and arranged to deliver fuel into the retort thus formed above said movable bottom.

14. In a stoker, a body having an inner substantially cylindrical wall and an outer wall spaced therefrom, a grate section covering the space between said walls, a member supported for rotation within said cylindrical wall and closing the bottom thereof; said member having an upwardly projecting hollow portion spaced from said cylindrical wall and with it forming an annular retort, a grate projecting upwardly from the top of said hollow portion, a fuel delivery pipe extending through said wall and arranged to deliver fuel into the retort thus formed above said movable bottom and means carried by said movable member for agitating and elevating the fuel within said retort.

15. In an underfeed stoker, an annular grate-like top portion, an annular retort located centrally of said top portion and having a substantially cylindrical lower outer wall portion, an upper outwardly flaring grate-like wall portion, a bottom closure member supported by said cylindrical wall, positioned for rotation within and adjacent its lower end and which has an upwardly extending hollow central portion open at its lower end to the stoker wind box and at its upper end is provided with openings for discharging air into the retort, means for feeding fuel into the retort through an opening in its lower outer wall portion, means for rotating the retort bottom closure member with its upwardly extending hollow central portion, and a clinker grinder adjacent the outer peripheral edge of the annular grate-like top portion of the stoker.

16. In an underfeed stoker, a centrally located annular retort having an outer wall which is substantially cylindrical in its lower portion, has an

inwardly extending support member adjacent its bottom, and which flares outwardly in its upper portion taking the form of a fuel burning grate, a member for closing the retort bottom which is supported by said support member and which carries an upwardly extending centrally located hollow member, open at its bottom to the stoker wind box, and having a grate-like top portion, means for feeding fuel tangentially into said retort through said substantially cylindrical wall portion and means for rotating the retort bottom closure member with its upwardly extending hollow member.

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