Feb. 9, 1937. W. D. BURTON 2,069,940

MECHANICAL STOKER

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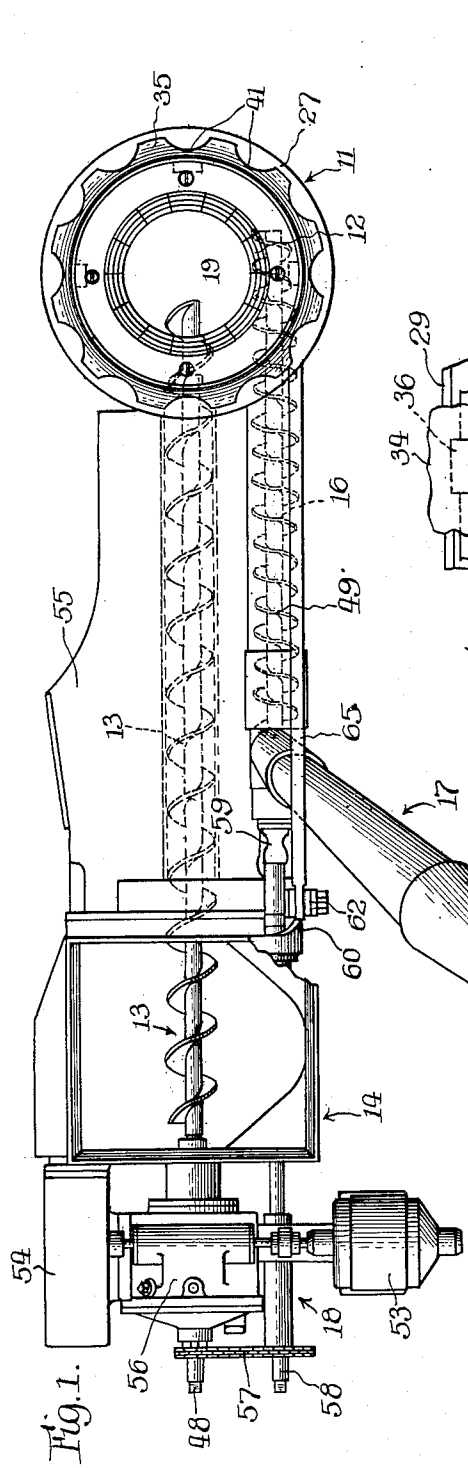


Fig. 1.

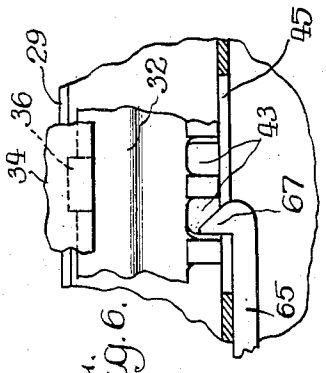


Fig. 6.

Fig. 2.

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Fig. 5.

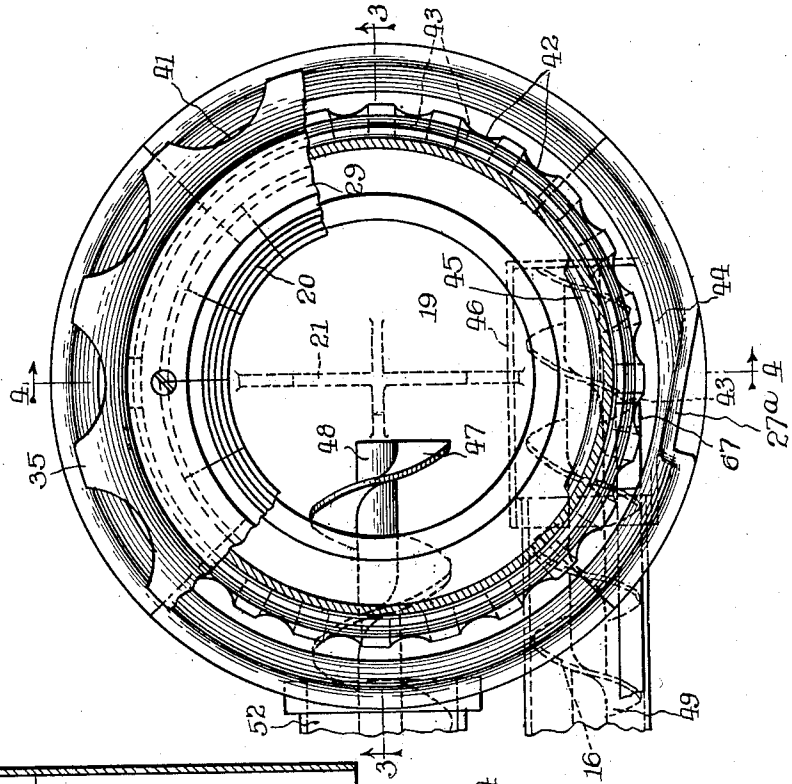


Fig. 3.

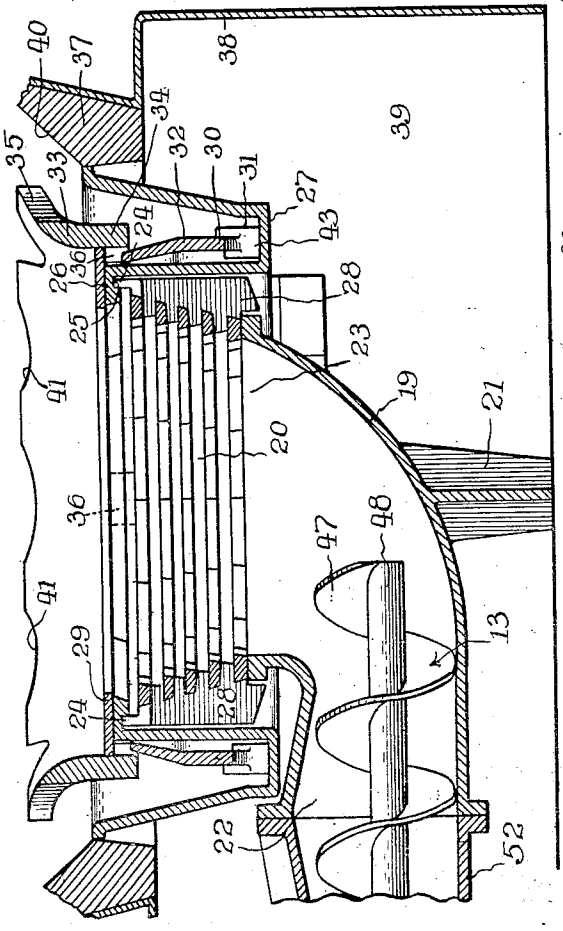
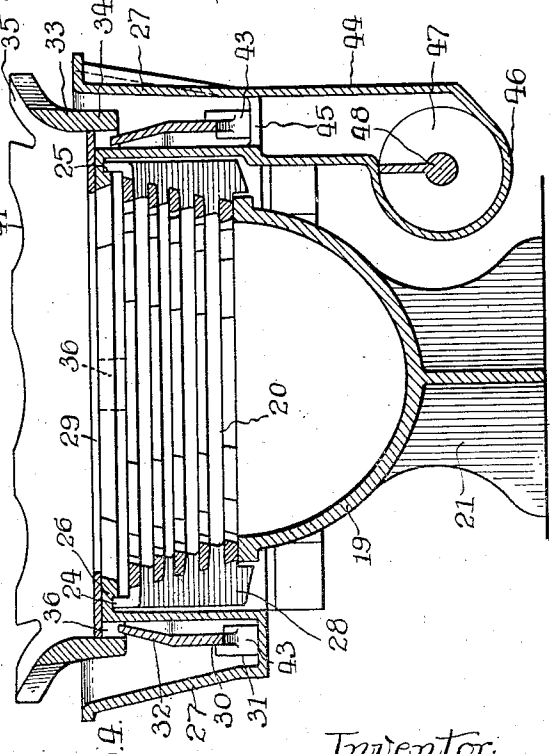


Fig. 4.



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UNITED STATES PATENT OFFICE

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MECHANICAL STOKER

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Application June 18, 1931, Serial No. 545,210

11 Claims. (Cl. 110—45)

The invention relates generally to mechanical stokers and is particularly applicable to stokers of the underfeed type.

A general object of the invention is to provide a new and improved stoker which is sturdy and simple in construction, is efficient in operation, and embodies a novel arrangement of automatically operating parts by which fuel is fed from a supply hopper, consumed, and the resulting ashes discharged at a conveniently accessible disposal point.

Another object of the invention is to provide in a mechanical stoker, a novel retort structure embodying improved means for facilitating the ejection of ashes therefrom.

More specifically stated, an object is to provide, in a circular retort for a stoker of the underfeed type, a rotating mechanism arranged to remove ashes and the like resulting from combustion of the fuel, which mechanism includes means for breaking the larger particles of ash, such as clinkers, into small pieces, means for conveying the ashes to a common pit, and a simple means for driving said mechanism.

A further object of the invention is to provide a construction having few parts, capable of ready assembly, repair or replacement and including a retort structure having an ash receptacle which may be fashioned as a single unit, as by casting.

Other objects and advantages will become apparent in the following description and from the accompanying drawings, in which:

Figure 1 is a plan view on a reduced scale of a mechanical stoker embodying the features of the invention.

Fig. 2 is a side elevation thereof also on a reduced scale.

Fig. 3 is a longitudinal vertical section through the retort structure taken substantially along the line 3—3 of Fig. 5.

Fig. 4 is a transverse vertical section along the line 4—4 of Fig. 5 and looking in the direction of the arrows.

Fig. 5 is a plan view of the retort structure.

In Figs. 1, 4 and 5 parts have been omitted to clarify the views.

Fig. 6 is a fragmentary detail of the drive for the moving parts of the retort.

While the invention is susceptible of various modifications and alternative constructions, I have shown in the drawings and will herein describe in detail the preferred embodiment, but it is to be understood that I do not thereby intend to limit the invention to the specific form disclosed, but intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

While the present invention is illustrated and will be described in connection with a mechanical stoker of the underfeed type, it will be understood that many of the features of the invention are applicable to types of stokers other than the underfeed type. Broadly, the preferred machine organization embodies a retort 11 having a centrally located fire pot 12 to which fuel is supplied from beneath by a feed screw 13 communicating with the bottom of the fire pot. Fuel is supplied to the feed screw from a suitable hopper 14. Associated with the fire pot in the retort is an ash collector arranged to receive ashes as they are discharged from the fire pot and to deliver such ashes to an ash pit 15 from which the ashes are removed by a second conveyer screw 16. The ash conveyer screw 16 delivers ashes to an elevating duct 17 so arranged that the force of the feed screw 16 is effective to cause ashes to pass through the elevating duct. A single prime mover or driving mechanism is operable to drive all of the moving parts of the organization.

Referring to the drawings, and with particular reference to Figs. 3, 4 and 5, the retort 11 is illustrated as embodying a generally well-known type of fire pot construction comprising a retort trough 19 and a tuyère structure 20. The retort trough 19 is supported by a pedestal 21 and has a laterally facing fuel inlet opening 22 and an upwardly facing fuel outlet 23. The tuyère structure 20 rests upon the upper margin of the trough about the outlet 23 and constitutes substantially a continuation of the trough. The fuel conveyer screw 13 extends into the trough through the inlet opening 22 to deliver fuel substantially to the center of the fire pot, the walls of the trough being flared outwardly and turned upwardly properly to direct the travel of the fuel.

In underfeed stokers, the combustion of the fuel occurs as the fuel passes upwardly through the tuyère structure and combustion continues upon what is termed a dead plate located at the upper edge of the tuyère structure and extending outwardly therefrom. Unburned residue, such as ashes, clinkers, etc., is ejected from the fire pot over the edge of the dead plate. The present development embodies a means for facilitating the removal of ashes from the fire pot and for crushing large particles of unburned residue to facilitate the ejection thereof from the device.

This means, as herein illustrated, comprises the following arrangement of parts: The tuyère, as is generally customary, is built up of a number of sections positioned side by side and each of these sections has a laterally disposed and upwardly extending projection 24 thereon which, when the parts are assembled, defines a circular series of projections encompassing the upper portion of the tuyère structure. These projections are arranged to engage in a suitable groove 25 formed in a laterally extending flange 26 provided on the inner leg of an upwardly opening

channel-shaped member 27. This member is preferably of U-shaped cross section and is of such depth that the bottom thereof is located below the bottom of the tuyère structure. Each section of the tuyère structure 20 carries an outwardly and vertically extending rib 28 arranged to abut against the inner leg of the frame 27 to add to the rigidity of the assembly. Mounted upon and secured to the upper surface of the lateral flange 26 is an annular ring 29 which constitutes a rim for the tuyère structure. The rim serves, in effect, as a dead plate and the inner peripheral edge thereof is substantially a continuation of the inner surface of the tuyère structure. The outer peripheral edge of the rim extends somewhat beyond the inner leg of the U-shaped frame 27.

The means which is employed in the present instance for facilitating the discharge of ashes from the fire pot and for crushing large particles of such ashes comprises a structure encircling or encompassing the fire pot and mounted in the frame 27 for rotative movement. The ash breaking feature is attained by providing a stationary part which cooperates with the rotating structure to crush the larger particles of ash therebetween. As may be most clearly seen in Figs. 3 and 4, this structure comprises an annular ring 30 loosely mounted in and bearing on the bottom of the frame member 27 for rotation relative thereto. The ring 30 has an enlarged lower portion 31 adapted to occupy most of the space between the side walls of the frame 27 at the bottom thereof, and an upper narrower flange-like portion 32 which extends upwardly within the frame approximately to the top thereof. The upper portion 32 carries a heavy extension ring 33 comprising a lower substantially cylindrical part 34, fashioned snugly to encircle the outer peripheral margin of the stationary ring 29, and an upwardly and outwardly flaring portion 35 constituting the rim of the fire pot over which ashes are discharged in the operation of the device. Any suitable means for drivingly securing the extension ring 33 to the ring 30 may be employed, such as the detachable connection herein shown in which the lower portion 34 of the ring carries a series of inwardly projecting lugs 36 arranged to be seated in properly positioned and complementary recesses formed in the upper margin of the flange-like portion 32.

Coacting with the extension ring 33, to crush clinkers and the like, is a stationary part 37 oppositely disposed in spaced relation to the ring 33 and encircling the outer leg of the frame member 27. In its preferred form, the part 37 comprises a relatively thick and massive plate carried by a suitable wall 38 which encloses the lower portion of the retort to provide an air chamber 39. The plate 37 is secured to the inner surface of the wall 38 and has an inwardly and downwardly sloping surface 40 thereon extending from a position above the rim of the outwardly flaring portion 35 on the ring 33 into abutment with the upper edge of the outer leg of the frame 27.

To facilitate the discharge of ashes over the rim of the ring 33 and to increase the effectiveness of the crushing action of the cooperating parts, the flaring portion 35 of the ring 33 has a plurality of regularly spaced marginal recesses 41 therein. In consequence of this arrangement of parts, clinkers and the like, as they fall from the rim of the ring 33, will be caught between said ring and the sloping surface 40 and crushed therebetween by the action of the relatively moving parts. Subsequently, these fragments, together with the particles of ashes which do not require crushing, will be directed into the channel of the frame 27 by the sloping surface 40.

As may be seen in Fig. 3, the outer leg of the frame 27 preferably has a pronounced slope inwardly toward the bottom of the frame and the flange-like portion 32 of the ring 30 slopes from top to bottom toward the outer leg of the frame, thus producing an ash-receiving channel, the width of which diminishes toward the bottom. Hence, the opposed portions of the frame and ring 30 cooperate further to reduce the size of the particles passing into the channel. The enlarged lower portion 31 of the ring 30 has a series of lateral and outwardly facing recesses 42 (Fig. 5) and a second series of vertical and downwardly facing recesses 43 (Fig. 6) therein. The downwardly facing recesses 43 serve as a part of the means for rotating the structure and both series of recesses 42 and 43 act to reduce the ash particles to an almost pulverized condition and also to collect the ashes from within the channel throughout the length thereof and to transfer such ashes to an ash pit. To insure against clinkers being carried continuously about the upper portion of the frame 27 by the ring 33, one side of the frame 27 may be provided with an inset portion 27a having a surface opposing the ring and sloping inwardly of the channel in the direction of rotation of the ring. This structure produces a restriction of the channel which positively prevents the movement of clinkers around the frame.

The ash pit, as may be seen in Fig. 4, is preferably disposed at one side of the frame 27 underlying the inset portion 27a and is of such construction that it may be formed integrally therewith. As illustrated, the ash pit is in the form of a closed receptacle 44 which depends below the bottom of the frame 27 and communicates with the channel therein through an opening 45 in the bottom of the frame. The lower portion of the ash pit carries a partially cylindrical enlargement 46 to receive the end of the ash conveyor screw 16, said screw being arranged to remove ashes from the ash pit as fast as they are deposited therein by the operation of the ash collecting structure. The ash conveyor screw 16 and the second conveyor screw 13 are similar and are of a well-known construction comprising, generally, spiral blades 47 carried by driven shafts 48, the screws of course being arranged and driven so that the fuel conveyor screw forces fuel into the retort while the ash conveyor screw removes ashes from the ash pit.

As may be seen in Fig. 2, the ash conveyor screw is disposed in a duct 49, one end of which is connected in registry with the enlargement 46 of the ash pit. Near its outer end, the duct 49 is in communication with the ash elevator duct 17 through an opening in the upper portion of the duct 49. The elevator duct 17 flares outwardly away from its connection with the duct 49 and at its upper end carries a hood 50 having a downwardly directed mouth 51 for discharging ashes into an underlying receptacle.

In its preferred relationship to the duct 49, the elevator duct (see Figs. 1 and 2) extends upwardly and outwardly of the horizontal and longitudinal, vertical planes of the duct 49 and also is angular with respect to the transverse vertical plane of the duct 49. In other words, the

elevator duct extends outwardly and away from the ash feed screw duct 49 in the general direction of feed of the screw. It has been found that, by this angular arrangement and flaring construction, ashes may be elevated through considerable distances by the normal or ordinary force of the feed screw 16. Elevation of the ashes in this manner is convenient, inasmuch as it eliminates the necessity of providing an ash pit and permits the ashes to be deposited directly, if desired, into a movable truck or the like, or into a stationary receptacle capable of being readily removed and replaced. Preferably, the feed screw 16 terminates in a reverse flight 16a (Fig. 2) to prevent packing of the ashes within the end of the duct 49 and to insure delivery thereof to the elevator duct 17. Preferably, a few turns of the ash conveyor screw next adjacent to the reverse flight 16a are fashioned of hardened steel in any suitable manner, as by treating the end of the screw after the unit has been assembled. This provides a structure having ample strength to stand the strain of elevating ashes through the elevator duct.

The fuel feed screw 13 extends between the hopper 14 and the retort through a suitable conduit or duct 52 and the ash and fuel ducts 49 and 52, respectively, are preferably disposed closely adjacent to each other and in parallelism for compactness.

A single prime mover may be provided for actuating all of the operating mechanisms. Thus, an electric motor 53 (Figs. 1 and 2) is utilized in the present instance and is preferably located adjacent the fuel hopper 14 and on the side thereof opposite the retort 11. The armature of the motor is connected operably with a fan or blower (not shown) located in a suitable housing 54 which supplies air through a conduit 55 to the air chamber 39 about the retort. This air flows in the usual manner through the openings in the tuyère structure. The armature of the motor is also connected, within the gear housing 56, with the shaft 48 for the fuel conveyer screw by suitable change speed mechanism. The end of the fuel conveyer shaft 48 is, in turn, connected as by a chain and sprocket connection 57 with a shaft 58 which is journalled to provide a continuation of the ash conveyer shaft 48 and is drivingly connected thereto through a well-known type of universal connection 59. By this arrangement, when the ash conveyer shaft is driven from the fuel conveyor shaft, the change speed mechanism within the housing 56 may include any well-known type of overload release device which will operate when either feed screw is subjected to an excess load.

One preferred form of means for driving the ash collector structure is best seen in Figs. 1, 2 and 6. Thus, the shaft 58 has a cam member 60 thereon which has a cam surface 61 facing toward the retort. A lever 62 is pivoted, as at 63, to a stationary part of the device and the lower end of the lever carries a cam follower 64 arranged to engage the cam surface 61. An arm 65 is pivotally secured (as at 65a) to the free end of the lever 62 to extend therefrom toward the retort 11 where it passes through an aperture 66 in the upper portion of the adjacent wall of the ash pit. The end of the arm 65 within the ash pit carries an enlarged head 67 (Fig. 6) constituting what may be termed a feed pawl and arranged to extend through the opening 45 in the bottom wall of the frame into engagement with the downwardly facing recesses 43 in the ring 30 which constitute a ratchet. Resilient means for maintaining engagement of the head 67 with the recesses 43 and for holding the cam follower 64 against the cam surface 61 is herein provided in the form of a helically coiled spring 68 centered about the pivot 65a. The ends of the spring, indicated 69, 70 bear against the arm 65 and lever 62 respectively to exert a force tending to separate the outer ends of the arm and lever whereby the head and cam follower are held in engagement with their cooperating parts. The cam surface 61 is formed to impart reciprocatory movement through the lever 62 to the arm 65 for driving the ash collector.

The operation of the device is as follows: The motor 53, being in operation, fuel is removed from the supply hopper 14 by means of the feed screw 13 and delivered to the retort trough 19 from which it is passed upwardly through the tuyère structure 20. Air from the blower is forced through the conduit 55 into the chamber 39 where it passes through the tuyère openings to supply air for combustion purposes. The fuel is ignited as it passes through the tuyère structure and is fully consumed before it reaches the top of the ring 33. The structure, comprising the rings 30 and 33, is constantly moved rotatably from the prime mover through the shaft 48, chain and sprocket connection 57, shaft 58, cam 60, lever 62, arm 65 and pawl and ratchet connection 67, 43. This rotary movement of the extension ring 33 agitates the coals within the upper portion of the fire pot and causes them to spread until the unconsumed particles of ashes and clinkers are forced over the edge of the flaring portion 35 to be deposited within the channel of the frame 27. The rotation of the rings 30 and 33 alike operate to pulverize the larger particles of unconsumed matter and the recesses 42 and 43 collect and deliver the finely pulverized matter to the ash pit 44. From the ash pit 44, the ashes are constantly removed by the ash conveyer screw 16 for delivery to the ash elevating duct 17 from which the ashes are discharged through the mouth 51 of the hood 50 into a suitable receptacle.

It will be apparent from the foregoing that a novel structure has been provided which is simple and entirely automatic in operation from the time the fuel is deposited in the hopper until the ashes are removed. The improved retort structure, in combination with the ash collector, eliminates the necessity of handling the ashes around the heated portions of the stoker and, in particular, eliminates the difficulties normally encountered in the removal of clinkers and the like.

I claim as my invention:—

1. A retort for a mechanical stoker comprising, in combination, a central fire pot having a bottom opening to receive fuel from a conveying means and an annular tuyère structure defining the upper portion of the fire pot, a laterally extending rim carried by the upper edge of said structure, a U-shaped frame encircling said structure with the open face thereof substantially in the plane of said rim, said frame having an ash pit at one side opening through the bottom wall thereof, an ash crushing and feeding mechanism rotatable relative to said frame and comprising a wide bottom ring bearing against the bottom of the frame, and a top ring encircling said rim and extending above and below said rim, and rigidly connected with said bottom ring, said top and bottom rings having laterally facing recesses therein for crushing and feeding

ashes, said bottom ring having downwardly facing notches therein, and a reciprocatory feeding arm arranged operatively and successively to engage said downwardly facing notches through the ash pit opening in said frame to drive the mechanism.

2. A retort for a mechanical stoker comprising, in combination, a central fire pot having a bottom opening to receive fuel from a conveying means and an annular tuyère structure defining the upper portion of the fire pot, a laterally extending rim carried by the upper edge of said structure, an upwardly extending and outwardly flaring ring encircling said rim and having the upper periphery thereof recessed to form an ash crusher, a receptacle for ashes underlying the recessed periphery, and means for driving said ring.

3. A retort for a mechanical stoker comprising, in combination, a central fire pot having a bottom opening to receive fuel from a conveying means and an annular tuyère structure defining the upper portion of the fire pot, a laterally extending rim carried by the upper edge of said structure, an upwardly extending and outwardly flaring ring encircling said rim, a stationary member encompassing said ring in spaced relation thereto and having an inwardly sloping surface positioned to receive ashes falling from the peripheral edge of said ring, said ring and surface being arranged to crush therebetween large particles passing thereto from the fire pot, means underlying said surface and ring for receiving ashes therefrom, and means for driving said ring.

4. A retort for a mechanical stoker comprising, in combination, a central fire pot having a tuyère structure defining the upper portion thereof, a rotatably mounted annular member closely encircling and extending upwardly from the upper margin of said structure and so arranged that ashes from the fire pot pass upwardly over the rim thereof, means providing a stationary surface spaced concentrically about said member and inclined inwardly and downwardly of the retort, and means for rotating said member.

5. In combination with a retort for a stoker, means for crushing large particles discharged from the retort comprising a rotating ring member positioned closely about said retort in bearing engagement therewith to receive ashes therefrom and having a notched outer peripheral rim over which said ashes are discharged, a concentrically spaced stationary member about said first mentioned member and located in crushing relation with said rim, and means for driving said rotating member.

6. An ash collecting means for a mechanical stoker having a retort comprising, in combination, a channel-shaped frame encompassing said retort to receive ashes discharged therefrom, an annular structure seated in said frame for movement relative thereto, said structure being arranged to extend above the upper edge of the frame, means on the bottom of the structure adapted to engage and conduct ashes deposited in said structure to a collection point, and means for driving said structure, said structure and the side walls of said frame being so arranged that the distance therebetween diminishes toward the bottom of the frame whereby ash particles of large size will be crushed by the relative movement of the members.

7. A retort for a mechanical stoker comprising, in combination, a central fire pot having a bottom opening to receive fuel from a conveying means and an annular tuyère structure defining the upper portion of the fire pot, a laterally extending rim carried by the upper edge of said structure, a U-shaped frame encircling said structure with the open face thereof substantially in the plane of said rim, said frame having an ash pit at one side opening through the bottom wall thereof, an ash crushing and feeding mechanism rotatable relative to said frame and comprising a wide bottom ring bearing against the bottom of the frame, and a top ring encircling said rim and extending above and below said rim, and rigidly connected with said bottom ring, said top and bottom rings having laterally facing recesses therein for crushing and feeding ashes, said bottom ring having downwardly facing notches therein, and means for coacting with said downwardly facing notches to drive the mechanism.

8. An underfeed retort for a mechanical stoker comprising, in combination, a central upwardly opening fire pot having a bottom opening to receive fuel from a conveying means and an annular tuyère structure defining the upper portion of the fire pot, an upwardly extending and outwardly flaring ring encircling the upper peripheral edge of said tuyère structure and having its upper periphery recessed to form an ash crusher, a receptacle for ashes underlying the recessed periphery, and means for driving said ring.

9. In a mechanical stoker having, in combination, a stationary underfeed retort, a stationary annular upwardly opening channel-shaped frame encircling the upper portion of said retort for receiving ashes therefrom, the interior of said frame being deep and relatively narrow and defining a circular trough having a localized discharge opening in its bottom wall, the sides of said trough spreading upwardly, a cylindrical ring member mounted in said trough for rotation on said wall and formed with lateral projections for conveying ashes to said opening, and means for driving said ring.

10. In coal burning apparatus, in combination, a retort comprising a stationary annular tuyère structure and a rotative ring encircling the upper portion of the tuyère structure and forming an upward continuation thereof, means for rotating said ring, and an ash receiving channel positioned beneath the outer periphery of said ring.

11. In a mechanical stoker having, in combination, a stationary underfeed retort, a stationary annular upwardly opening channel shaped frame encircling the upper portion of the retort for receiving ashes therefrom, the interior of said frame gradually narrowing from top to bottom and defining a circular trough having a localized discharge opening in its bottom wall, an inwardly extending offset portion of the outer wall of said frame providing a restriction of the channel adjacent the discharge opening in the frame, a ring member positioned for rotative motion in the channel, and means for driving said ring member.

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