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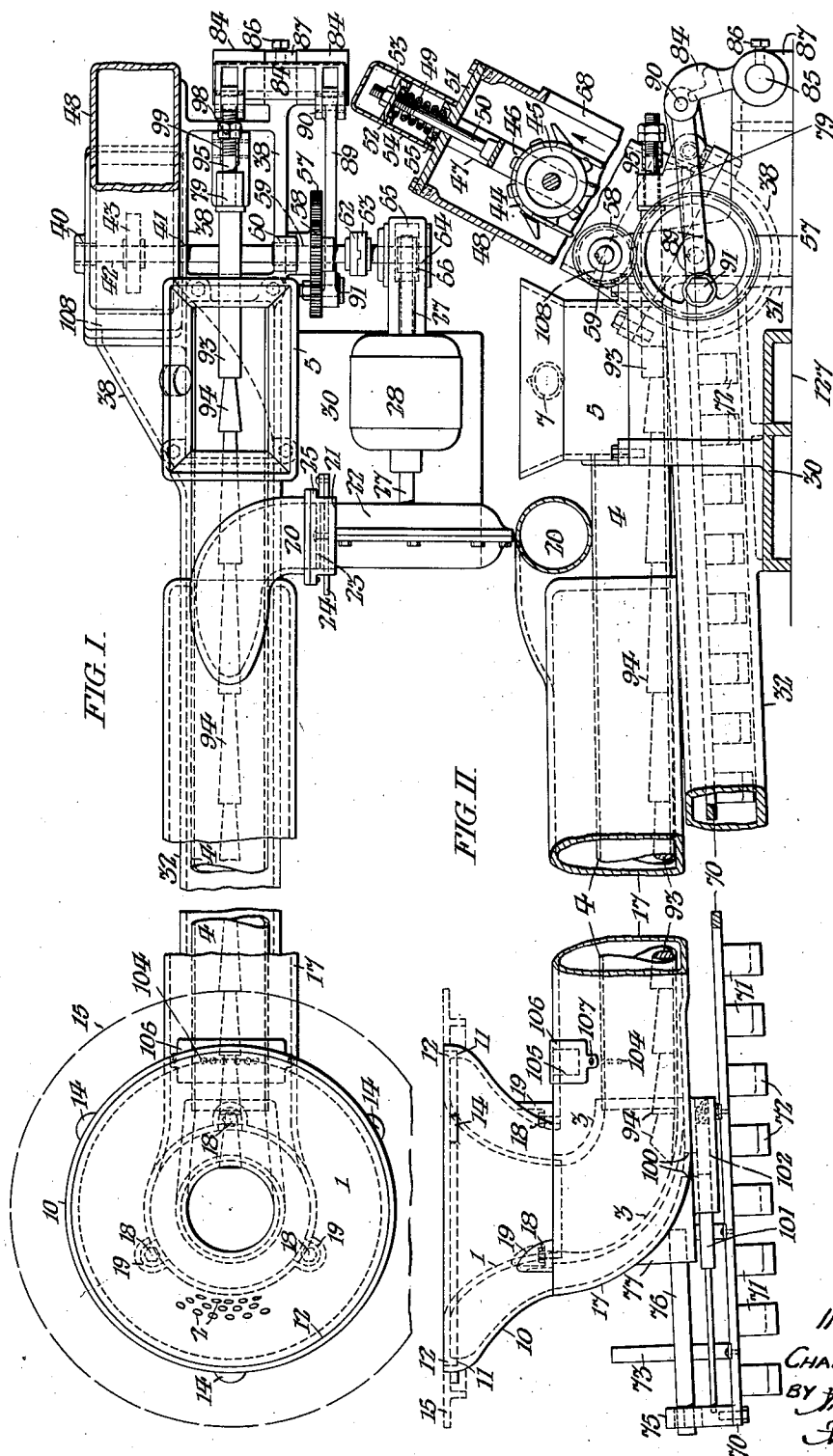
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1,992,149

AUTOMATIC STOKER

Filed June 20, 1932

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

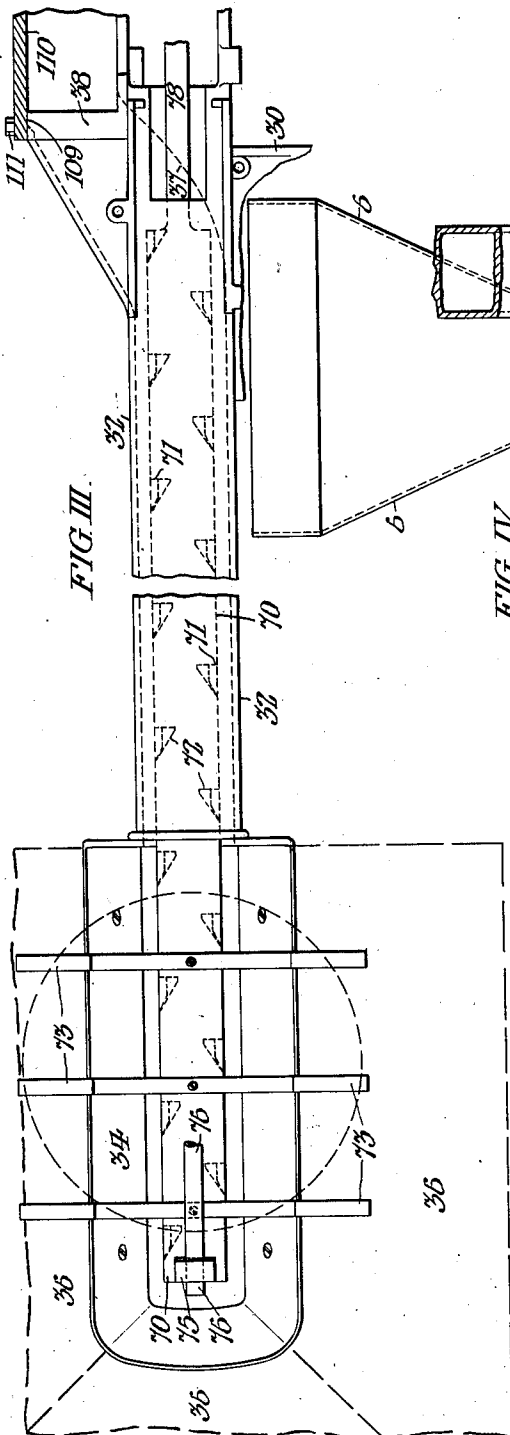
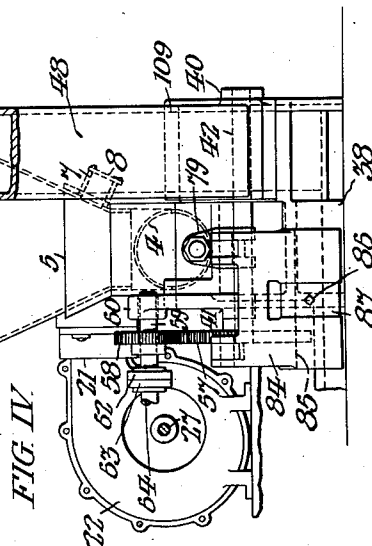
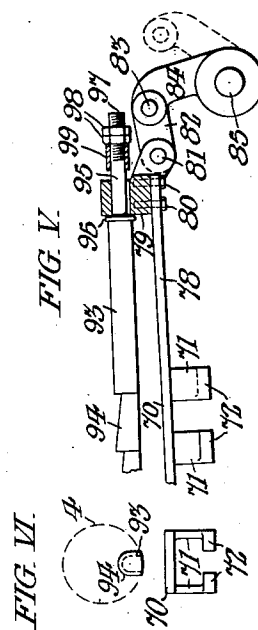


FIG. VI.

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FIG. VII.

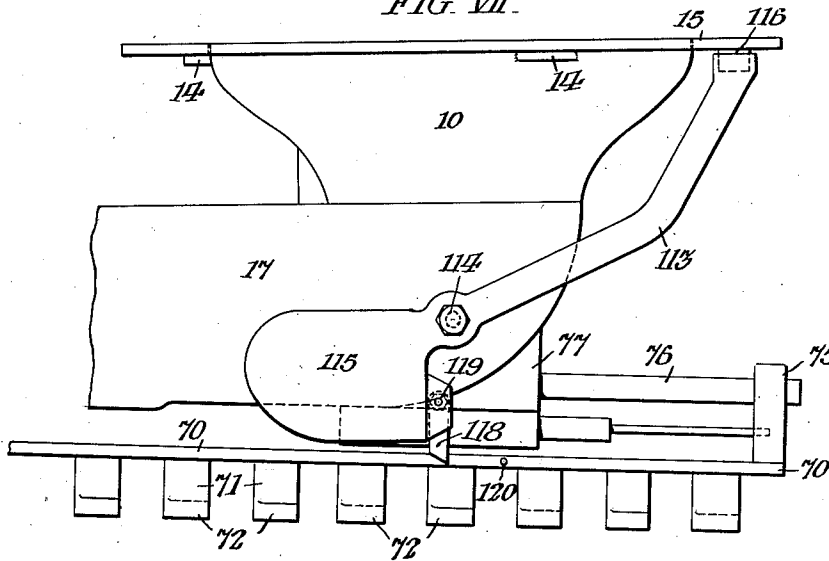


FIG. VIII.

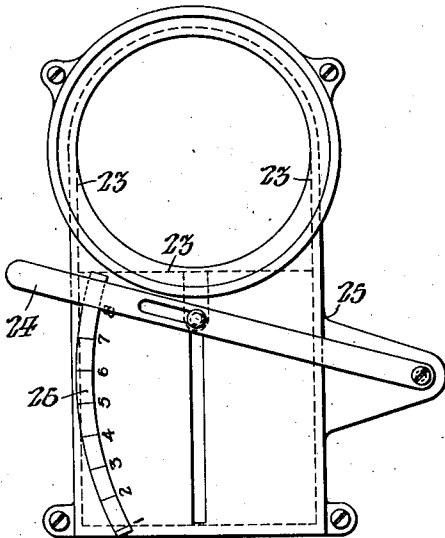
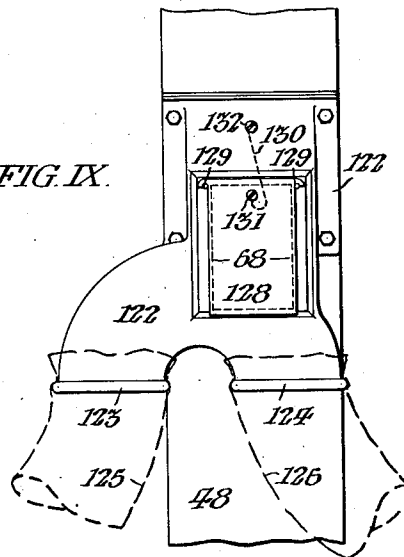


FIG. IX.



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UNITED STATES PATENT OFFICE

1,992,149

AUTOMATIC STOKER

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Application June 20, 1932, Serial No. 618,148

11 Claims. (Cl. 110—45)

My invention relates to a stoker including a burner bowl, means for forcibly progressing solid fuel and air to said bowl, to effect combustion of fuel in the bowl, and means for forcibly progressing ashes away from said bowl. In the form of my invention hereinafter described, a conduit housing, in rigid connection with said bowl, includes a fuel conduit connected with the bottom of the bowl, and a tubular air jacket around said fuel conduit for conducting air to the bowl exterior thereto. That air jacketed fuel conduit rests upon the top of an ash conduit and said fuel and ash conduits are respectively provided with reciprocating plunger conveyers to effect the progression of the fuel toward the bowl and the ashes away from the bowl. Said plungers are connected with an actuating mechanism which is common to them and which includes a rock shaft and lever linked to the ash conveyer plunger so as to effect reciprocation thereof with a constant stroke. However, said ash conveyer plunger is coupled to said fuel conveyer plunger so that the operation of the fuel conveyer is consequent upon the operation of the ash conveyer to reciprocate with a stroke which is adjustably variable at the will of the operator. Fuel is supplied to said fuel conduit through a hopper at the outer end thereof; air is supplied to said air jacket by a fan at the outer end thereof; and ashes are removed from said conduit by an endless chain elevator at the outer end thereof. Said elevator is supported upon chain wheels engaging the upper and lower bights thereof, that in the upper bight being idle but that in the lower bight being carried by a crank shaft, provided with a driven gear wheel which is engaged with a driving gear wheel operatively connected with an electric motor. Said driven gear wheel carries a crank stud which is operatively connected by a link with the lever on said conveyer rock shaft. The construction and arrangement are such that when said motor is energized, said ash elevator is operated at a constant rate and said ash conveyer plunger is reciprocated at a constant rate and said fuel conveyer plunger is reciprocated, as a consequence of the reciprocation of said ash conveyer but with a movement which is adjustably variable as aforesaid. The latter adjustment is to enable the operator to control the rate of supply of the fuel to the burner but always at a less rate than the operation of the ash conveyer and elevator so as to insure the elimination of the ashes from the stoker regardless of the rate at which the fuel is supplied thereto.

My invention includes the various novel features of construction and arrangement hereinafter more definitely specified, but the claims herein relate particularly to the arrangement of the conduits which facilitate the movement of the fuel, air, and ashes.

In said drawings, Fig. I is a fragmentary plan view of a stoker embodying my invention. Fig. II is a fragmentary side elevation of said stoker, some of the parts indicated in Fig. I being omitted. Fig. III is a plan view of the ash discharge conduit with the reciprocating plunger conveyer mounted therein. Fig. IV is a right hand end elevation of the stoker parts shown in Fig. II; the upper end of the ash elevator being omitted. Fig. V is a fragmentary side elevation of the outer ends of the fuel and ash reciprocating conveyers and the means for cooperatively connecting them. Fig. VI is a left hand end view of said conveyers shown in Fig. V. Fig. VII is a fragmentary elevation of the burner bowl and its appurtenances as seen from the side opposite to that shown in Fig. II, but on a larger scale. Fig. VIII is an elevation of the gate valve which is indicated at the discharge side of the air blower shown in Fig. I, but is shown on a larger scale in Fig. VIII. Fig. IX is a fragmentary elevation of the ash eliminator casing as seen from the right hand end of Figs. I and II, but on a larger scale, showing the safety outlet door.

Referring to Figs. I and II; the foraminous grate or burner bowl 1 which has, throughout its conical portion, perforations such as indicated at 2 in Fig. I to admit air to the fuel to be burned therein, is rigidly supported on the fuel conduit, which includes the elbow 3 and the cylindrical tube 4, the outer end of which is fixed in the hopper housing 5. Said housing 5, which is conveniently formed of cast metal, is adapted to normally rigidly support the removable fuel hopper 6, which is conveniently formed of sheet metal. Said hopper housing 5 has the discharge outlet 7, indicated in Figs. II and IV, provided with the normally closed door 8 so that if it is desired to remove the hopper 6 when it contains fuel, said door 8 may be opened and such fuel contents discharged through the outlet 7.

Referring to Figs. I and II; said burner bowl 1 and the fuel conduit above described are partly encased and supported by an air conduit including the air bowl 10 which has the annular shoulder 11 upon which the flange 12 of said burner bowl 1 rests. As indicated in Fig. I, said air bowl 10 has a circumferential series of three outwardly extending lugs 14 which are adapted to support a hearth ring 15 which is radially spaced from the wall of the combustion chamber far enough to permit ashes to fall over its perimeter, but may be of any desired diameter.

As shown in Figs. I and II, said air bowl 10 is supported by the air conduit 17 with which it is detachably rigidly connected, conveniently by the circular series of three tap bolts 18 which are seated in pocket flanges 19 at the lower edge of said air bowl 10. Said air conduit 17, which is conveniently formed of cast metal, has at the

outer end thereof, conveniently in unitary relation therewith, the air inlet elbow 20 which, as shown in Fig. I, is connected with the discharge outlet 21 of the rotary blower casing 22. Air is drawn into said casing 22 through an air inlet opening at the left hand side thereof in Fig. I, and the outlet from said casing is controlled by the gate valve 23 which is adjustable by the lever 24, to vary the volume of air supplied to the air bowl 10. Said lever is fulcrumed on the valve casing 25, and may be secured in adjusted position by the teeth of the arcuate ratchet 26. Air is drawn into said casing 22 and discharged through said air conduit 17 and bowl 10 by a rotary fan in said casing 22, carried by the armature shaft 27 of the electric motor 28. Said motor 28 is conveniently supported on the platform 30, formed as a horizontally extending flange on the base 31 of the tubular ash conduit 32.

As indicated in Fig. III, said tubular ash conduit 32 is rigidly connected with the ash pan 34 which is open at the top and has outwardly flaring walls extending beneath said burner bowl 1 and air bowl 10. Said ash conduit 32 and pan 34 are conveniently formed of cast metal, but I prefer to provide the walls of said pan 34 with sheet metal extensions 36 which may extend to the side walls of the ash pit in the furnace to which said stoker is appurtenant and which serve to direct the ashes which fall from said hearth ring 15 into said ash conveyer pan 34.

The inner wall of said ash conduit 32, at the outer end thereof, is curved, as indicated at 37 in Fig. III, to facilitate the discharge of ashes into the ash elevator base 38 which is conveniently formed as a casting in unitary relation with said ash conduit base 31 and flange 30.

As indicated in Figs. I and IV, said ash elevator base 38 has bearings 40 and 41 in which is journaled the shaft 42 which carries the chain wheel 43 which engages the lower bight of, and drives, the ash elevator chain 44. As indicated in Fig. II, the upper bight of said chain 44 is engaged by the idle chain wheel 45 which is journaled in the opposite sides of the inverted U-shaped bearing frame 46 which is mounted for adjustment, in the direction of length of the chain, in the slide-way 47 in the elevator casing 48 and is continually stressed upwardly by the spring 49. As indicated in Fig. II, said spring 49 encircles the plunger 50 which is rigidly connected with said bearing 46, and bears at its lower end upon the removable cover 51 of said elevator, and bears at its upper end against the abutment plate 52 which encircles said plunger 50 and is adjustable by the nut 53 which engages a screw thread on said plunger. I find it convenient to provide said spring 49 and its appurtenances with the removable dust cap 54 which detachably engages the upwardly extending flange 55 on said cover 51.

As indicated in Figs. I, II, and IV, said shaft 42 carries, at the outer end thereof, the driven gear 57 which is in mesh with the driving gear 58 on the countershaft 59 which is journaled in the bearing 60 rigidly connected with said base 38 and preferably cast integral therewith, as indicated by the dotted lines in Fig. II. The outer end of said counter-shaft 59 is provided with the coupling 62 engaging the coupling 63 on the shaft 64 of the worm gear 65 which engages the worm 66 on said armature shaft 27 of the electric motor 28, so that said shaft 42 is continuously turned to progress said ash elevator chain 44 in the direction of the arrow indicated in Fig. II whenever said electric motor 28 is energized and

with the effect of elevating in said casing 48 and discharging, through the opening 68 in the side thereof shown in Fig. II, all of the ashes which may be deposited in said elevator base 38. The ashes are conveyed to said base 38 from the ash pan 34 along the ash conduit 32 by the reciprocatory conveyer shown in Figs. II, III, V, and VI. Said conveyer includes the longitudinally reciprocatory bar 70 which is conveniently formed of a single metal casting comprising a flat plate with scraper arms 71 pendent from opposite sides thereof in staggered relation as indicated in Fig. III. As indicated in Figs. II, III, V, and VI, said scraper arms have wedge-shaped members 72 at their lower extremities disposed in oppositely counterpart relation with their narrow edges presented toward said burner bowl. Moreover, as indicated in Figs. II and III, said bar 70 carries, at its inner end, within said pan 34, upwardly extending and outwardly flared scraper strips 73 which are detachably rigidly connected therewith and extend in cooperative relation with the upwardly and outwardly flared extension walls 36 of said pan to loosen ashes which may tend to cling thereto, and causes the same to gravitate into said pan 34. As shown in Fig. II, the inner end of said ash conveyer bar 70 is provided with the bearing 75 which is fitted to slide upon the stud 76 which is rigidly mounted in the bearing 77 at the inner end of the air conduit 17. Said ash conveyer bar 70 has the stem 78 at the outer end thereof which carries the bearing bracket 79 which is rigidly but detachably connected therewith, conveniently by the tap bolts 80 indicated in Fig. V. Said bracket 79 is connected by the pivot 81 with the inner end of the link 82, the opposite end of which is connected by the pivot 83 with the rocker frame 84 which is mounted to oscillate on the shaft 85 which is fixed by the set screw 86 in the bearing bracket 87 on said elevator base 38, as indicated in Figs. I and II. Said rocker frame 84 is arranged to be oscillated to reciprocate the ash conveyer 70 in cooperative relation with the movement of the ash elevator chain 44, by the means indicated in Figs. I and II, including the link 89 which, at its outer end, is connected with said rocker frame 84 by the pivot 90 and, at its inner end, is pivotally connected with the crank stud 91 on said driven gear 57.

Means are provided to progress the coal or other fuel from said hopper 5 and thrust it upward into said burner bowl 1, including the reciprocatory conveyer bar 93 which, as indicated in Figs. I, II, and V, is shaped to form a longitudinal series of wedges 94 extending in said fuel conduit 4 with their narrow portions pointing outward so that, when said fuel conveyer bar 93 is thrust inwardly, the wider ends of said wedges 94 engage and thrust the fuel toward the burner bowl, but, when said conveyer bar 93 is drawn outwardly, it slips between the lumps of fuel without progressing them outwardly but merely thrusts them laterally. Such reciprocation of the fuel conveyer bar 93 is conveniently effected by reducing the outer end thereof to form a cylindrical stem 95 loosely fitted to slip through said bearing 79 but having a shoulder 96 adapted to receive the impact of said bearing when the latter is thrust to the left in Figs. I, II, and V. Said stem 95 is provided with the screw thread 97 for engagement with the pair of lock nuts 98 which serve as an adjustable abutment for a spacing sleeve 99 which may be made of any selected length to allow for lost motion between

said bearing 79 and said fuel conveyer bar 93; so that the stroke of said fuel conveyer may be varied in accordance with the amount of fuel desired to be fed to the burner bowl, but the movement of said fuel conveyer is always less than the movement of said ash conveyer so as to insure that all of the ashes formed by combustion of the fuel shall be discharged as they fall over the edge of the hearth ring 15.

I have found in practice that dust from the fuel forced up into the bowl 1 falls through the openings 2 in the sides of the bowl and tends to clog the air conduit 17 beneath the fuel conduit elbow 3. Therefore, in order to discharge such dust into the ash pan 34, I provide the dust outlet 100 in the bottom of said air conduit 17, as indicated in Fig. II, and mount the dust discharging plunger 101 to reciprocate across said opening 100 in the cylindrical bore 102 in the bottom of said air conveyer 17, and rigidly connect the outer end of said plunger 101 with the bracket 75 on the inner end of said ash conveyer 70. The effect of that arrangement is that each time the ash conveyer 70 reciprocates, it carries with it the plunger 101 to thrust from the bore 102, into the pan 34, a portion of the coal dust from the bottom of the air conveyer 17. The gravitation of the dust into the outlet 100 and bore 102 is facilitated by the pressure of the air within said conduit 17.

I also prefer to utilize the pressure of air from said air conduit 17 to insure the discharge of fuel gases from the conduit 4 into the bowl 1 to be consumed, by providing the conduit 4 with an arcuate series of openings 104 at the top thereof adjoining the elbow 3, as indicated in Fig. II, and, to afford access to those openings so that they may be cleaned if they become clogged, I form an arcuate opening 105 in the top of said air conduit 17 above said openings 104 and provide it with an arcuate cover 106 conveniently detachably connected with said air conduit 17 by screws 107.

Moreover, in order to facilitate inspection and repairs of the chain wheel 43 and the chain 44; I prefer to make that portion of the ash elevator base containing the bearing 40, indicated in Fig. I, as a removable plate 110, conveniently secured by bolts 111, as shown in Fig. III. Said plate is separable from the casings 38 and 48 along the line 108 indicated in Fig. I and the line 109 in Fig. IV.

I prefer to arrange the pendent wedge members 72 on the ash conveyer bar 70 with their outer surfaces parallel with each other and with the side walls of the ash conduit 32 at the opposite sides of said bar so that, in the movement of said bar toward the burner grate bowl 1, they dislodge the ashes from said side walls and thrust them toward the center of said conduit, so that they are engaged and progressed outwardly by the butt ends of said wedge members 72 when said bar 70 is moved away from said grate. However, that bar and the fuel conveyer bar 93 may be constructed and arranged otherwise than as above described, without detriment to the operation of the other elements of the apparatus above described.

The apparatus above described is adapted for the combustion of any kind of coal. However, coke has a tendency to form clinkers on the hearth ring 15 which do not readily gravitate therefrom into the pan 34 like ordinary coal ashes. Therefore, to facilitate the combustion of coke in the apparatus above described, I pre-

fer to provide the same with means for mechanically dislodging the clinkers from said ring 15. I have shown a convenient form of such means in Fig. VII wherein the hammer lever 113 is fulcrumed on the tap bolt 114 at the side of the air conduit 17 and provided with the counterweight 115 which normally presents said lever in the position shown in Fig. VII in which the block of resilient material 116, carried in a socket in the upper end of said lever 113, is in contact with said ring 15. Said lever 113 carries the latch 118 which is pivoted at 119 on said counterweight 115 so as to normally hang in the position shown in Fig. VII; in which position it is in the path of movement of the pin 120 which is rigidly connected with the ash conveyer bar 70. The construction and arrangement aforesaid are such that when said bar 70 is moved outwardly, to the left in Fig. VII, said pin 120 engages the latch 118 and tilts the lever 113 away from the ring 15 until said pin passes the lower point of said latch 118, whereupon the lever is released and the counterweight 115 thereon causes it to tilt back to the position shown in Fig. VII, striking said ring 15 a blow with such force as to dislodge the clinkers and cause them to fall from said ring into the subjacent pan 34. Upon reverse movement of said ash bar 70, to the right in Fig. VII, when the pin 120 encounters the latch 118, it merely uplifts the latch, idly, without moving said lever 118, thus permitting said pin to pass to the position shown in Fig. VII.

I find it convenient to provide the ash discharge opening 68 in the elevator casing 48 with the Y-fitting 122, having two discharge branches 123 and 124 in spaced relation, as shown in Fig. IX, for connection with respective flexible tubular conduits 125 and 126 conveniently formed of canvas, through which ashes discharged through the outlet 68 may be directed into respective receptacles resting upon the floor 127, indicated in Fig. II. Either or both of said conduits 125 and 126 may be rolled up upon said fitting 122 to render the respective branches 123 and 124 inoperative when desired. Moreover, I find that sometimes the ash receptacles are not removed when they are filled and, there being then no outlet for the ashes lifted to said discharge opening 68, the apparatus becomes clogged and stops. Therefore, I find it convenient to provide said outlet 68 with a safety door 128 by which it is normally closed, as indicated in Fig. IX, but said door is merely hung in its closed position upon parallel pins 129 projecting from said fitting 122 and is dislodged therefrom by any abnormal pressure of ashes within the elevator casing 48 so that when said branch outlets 123 and 124 are closed or obstructed in any way, said door 128 is dislodged and the ashes discharged through said outlet 68. In order to prevent said door 128 from being lost or mislaid, I prefer to permanently connect it with said casing 48 by a flexible connector 130, such as a chain or flexible wire, which is secured at its lower end to the door by the screw 131 and at its upper end to said fitting 122 by the screw 132, or other convenient attaching means.

Therefore, I do not desire to limit myself to the precise details of construction and arrangement herein set forth, as it is obvious that various modifications may be made therein without departing from the essential features of my invention, as defined in the appended claims.

I claim:

1. In an automatic stoker, the combination

with a perforated burner bowl; of means for conducting fuel to said bowl, including a hopper, a conduit connecting said hopper with said bowl, and a reciprocatory fuel conveyer bar having a longitudinal series of wedges, mounted to reciprocate in said conduit and beneath said hopper, with the thick ends of said wedges toward said bowl; means for conducting air to said bowl for mixture with said fuel, including an air conduit inclosing said burner bowl and part of said fuel conduit, and a rotary air blower in communication with the end of said air conduit remote from said bowl, for blowing air into said burner bowl through its perforations; means for conducting ashes away from said bowl, including an open topped pan extending beneath said bowl, an ash elevator casing, having a discharge opening near the top thereof, an ash conduit connecting said pan with said elevator casing, an endless chain conveyer in said elevator casing, and a reciprocatory ash conveyer bar having a longitudinal series of wedges, mounted to reciprocate in said pan and ash conduit, with the thick ends of the latter wedges toward said casing; a rocker frame operatively connected with both of said fuel and ash conveyer bars; and an electric motor operatively connected to said blower, ash chain conveyer, and rocker frame; whereby said conveyer bars are alternately operative to convey fuel and ashes and in respectively opposite directions and fuel, air, and ashes are progressed in coordinated relation by said motor.

2. Apparatus as in claim 1; including adjustably variable means operatively connecting said reciprocatory fuel conveyer bar with said rocker frame, for permitting a variable amount of lost motion of said rocker frame with respect to said bar; whereby both of said conveyer bars are reciprocated simultaneously, and in the same direction, but the stroke of said fuel conveyer bar is variable with respect to the stroke of said ash conveyer bar.

3. Apparatus as in claim 1, including means operatively connecting said reciprocatory fuel conveyer bar with said rocker frame, including a bracket carried by said ash conveyer bar and fitted to slide with respect to said fuel conveyer bar; and means on said fuel conveyer bar for adjustably limiting the relative motion of said bracket with respect thereto, permitting an adjustably variable extent of lost motion of said rocker frame with respect to said bar; whereby both of said conveyer bars are reciprocated simultaneously in the same direction but the stroke of said fuel conveyer bar is variable with respect to the stroke of said ash conveyer bar.

4. In an automatic stoker, the combination with a burner bowl; of means for alternately conducting fuel toward said bowl and conducting ashes from said bowl, including separate fuel and ash conduits; means for progressing fuel and ashes alternately and in respectively opposite directions in said conduits, including respective reciprocatory conveyer bars mounted to reciprocate in said conduits; a single rocker frame; means operatively connecting both of said conveyer bars to said rocker frame; and means for rocking said frame; whereby both of said bars are reciprocated in the same direction.

5. Apparatus as in claim 4, including means connecting said rocker frame with said ash con-

veyer bar for reciprocating that bar with an invariable movement; and adjustably variable means connecting said rocker frame with said fuel conveyer bar for reciprocating that bar with an adjustably variable movement; whereby the amount of fuel supplied to said burner bowl in a given time may be varied, while the capacity for discharge of ashes remains constant and adequate.

6. Apparatus as in claim 4; wherein the means for rocking said rocker frame include an electric motor, a wheel turned by said motor, a crank on said wheel, and a link connecting said crank with said rocker frame.

7. Apparatus as in claim 1; wherein the means connecting said motor with said chain conveyer include a shaft carrying a wheel with a crank, and the means connecting said motor with said rocker frame include a link connecting said crank with said rocker frame.

8. Apparatus as in claim 1; wherein the electric motor is directly connected with said blower by the motor armature shaft, and the means connecting said motor with said chain conveyer include a worm on said armature shaft, a worm gear engaging said worm and a shaft turned by connection with said worm gear and carrying a chain wheel, and the means for connecting said motor with said rocker frame include a crank carried by the shaft of said chain wheel and a link connecting said rocker frame with said crank.

9. In an automatic stoker, the combination with a grate; of means for conducting fuel to said grate, including a fuel conduit extending beneath it; means for conducting air to said grate for mixture with the fuel thereat, including an air conduit surrounding said fuel conduit beneath said grate; and means for eliminating dust from the space between said conduits, including a dust discharge outlet in the bottom of said air conduit with a bore extending transversely with respect to it, said dust discharge outlet and said bore being in open communication; a dust discharging plunger fitted to reciprocate in said bore; and means for reciprocating said plunger; whereby dust is alternately received in said bore from said air conduit and discharged from said bore as said plunger is reciprocated.

10. In an automatic stoker, the combination with a grate, having a peripheral flange for supporting ashes and clinkers at the perimeter of said grate; of means for conducting fuel to said grate, means for removing ashes from beneath said grate, including a reciprocatory bar; and means for dislodging ashes and clinkers from said grate, including a hammer lever, for striking the underside of said flange, and means carried by said reciprocatory bar for tilting and releasing said lever; and means for automatically reciprocating said bar, including an electric motor.

11. Apparatus as in claim 10; wherein the hammer lever carries a pivoted latch for its actuation by said bar; said latch being movable with the lever in one direction to tilt the latter and movable independently of the lever in the opposite direction, to permit movement of the bar without movement of the lever in the latter direction.

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