J. R. FORTUNE.

AUTOMATIC STOKER.

APPLICATION FILED NOV. 11, 1914.

1,243,055.

Patented Oct. 16, 1917.

4 SHEETS—SHEET 1.

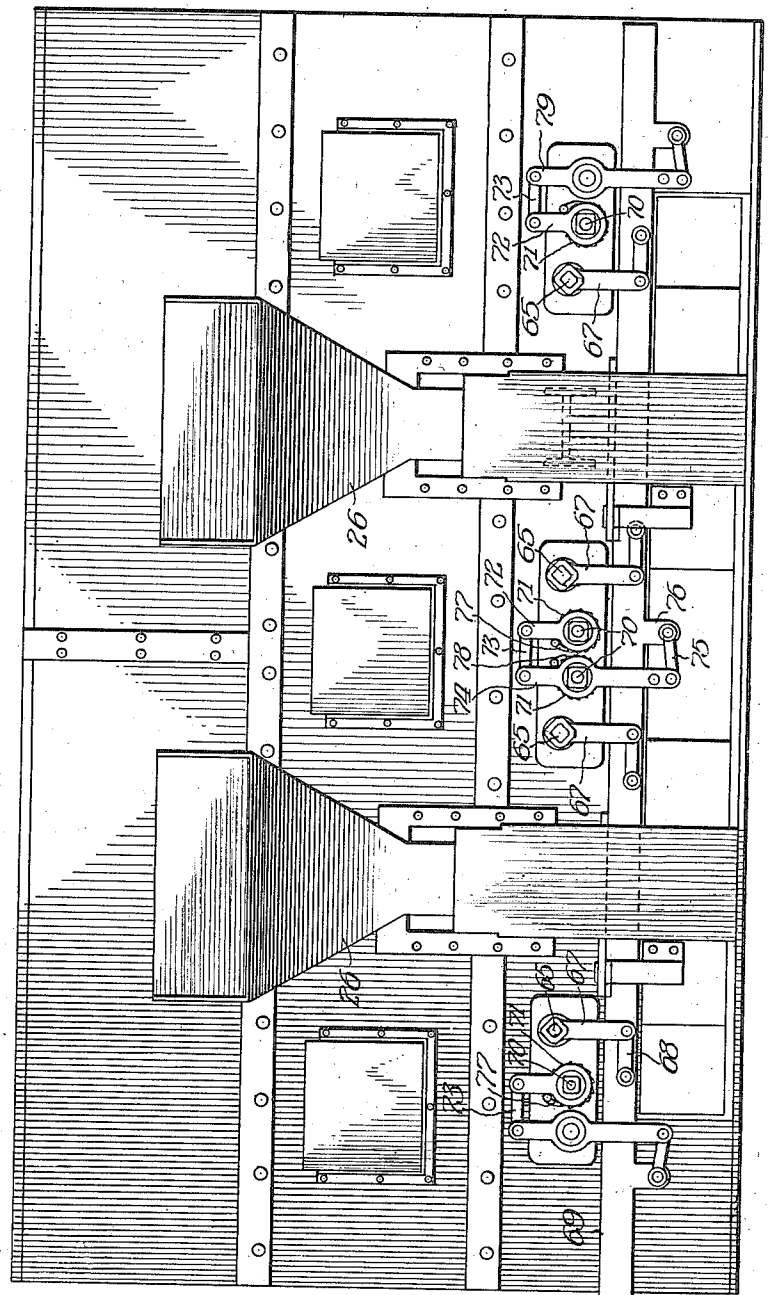


FIG. 1

Witnesses:
Fred. C. Davison
Eugene L. Niederhofer

Inventor
John R. Fortune
By Walter M. Fuller
Atty.

J. R. FORTUNE.

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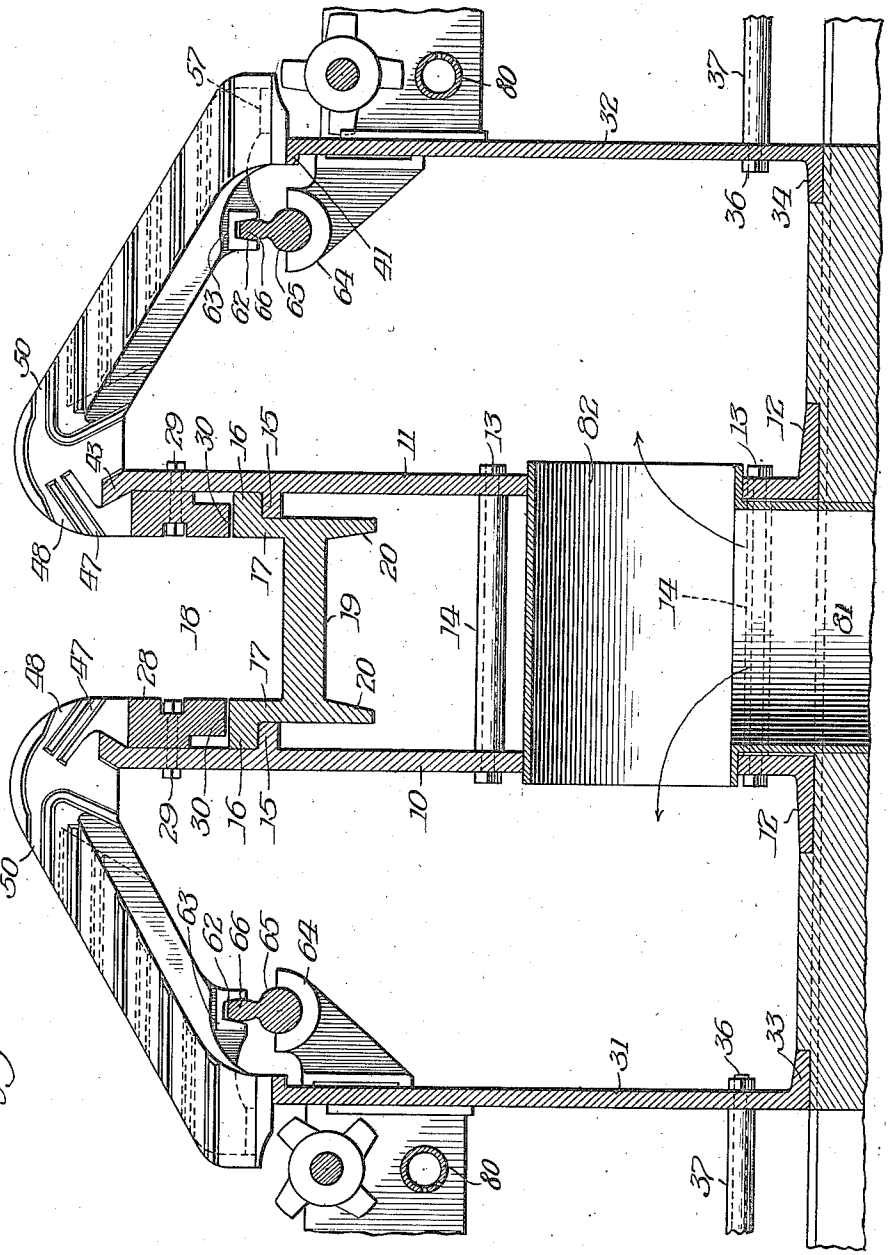


FIG. 2.

Witnesses:
Geo. C. Harrison
Eugene L. Nederhofer

Inventor
John R. Fortune
By Walter M. Fuller
Atty.

J. R. FORTUNE.

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4 SHEETS—SHEET 3.

Fig. 3.

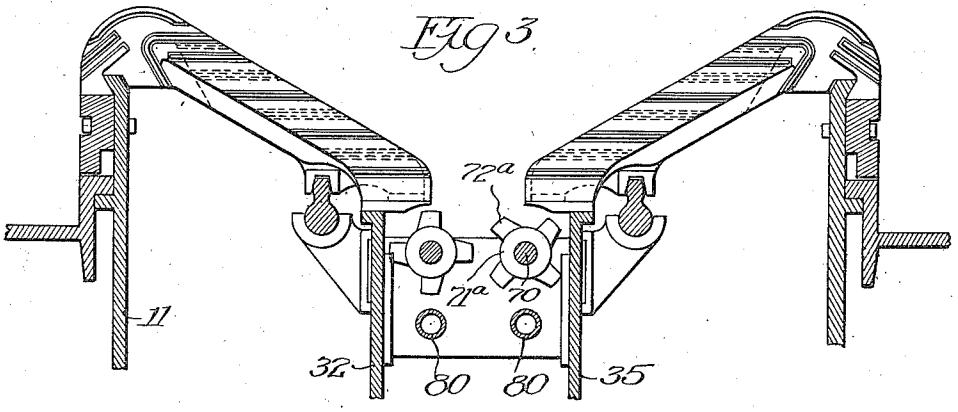


Fig. 4.

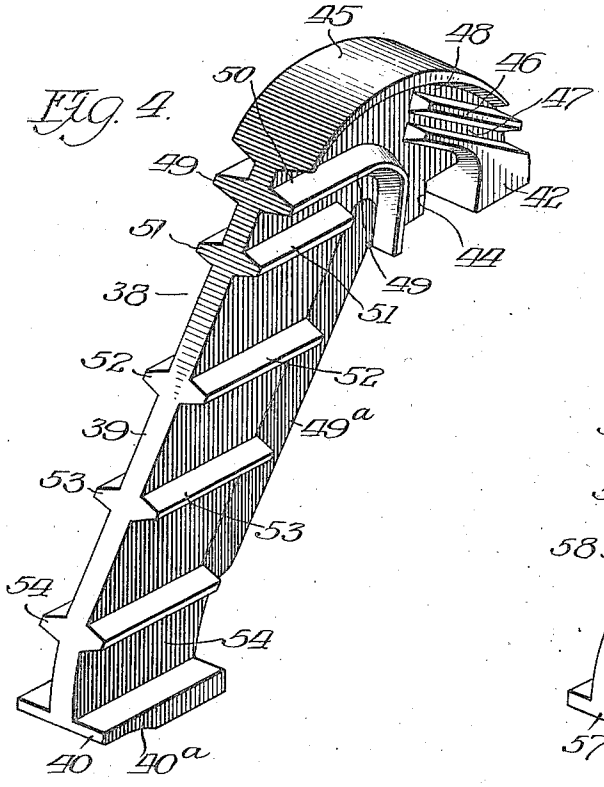
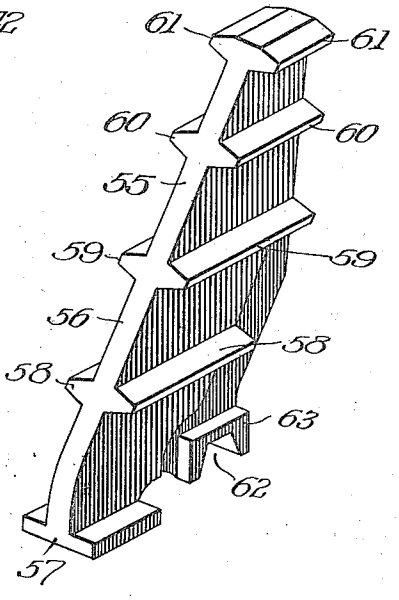


Fig. 5.



Witnesses:

Fred. C. Dewison.

Eugene L. Hickenlooper.

Inventor.

John R. Fortune

By. Walter M. Fuller

Atty

J. R. FORTUNE.

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4 SHEETS—SHEET 4.

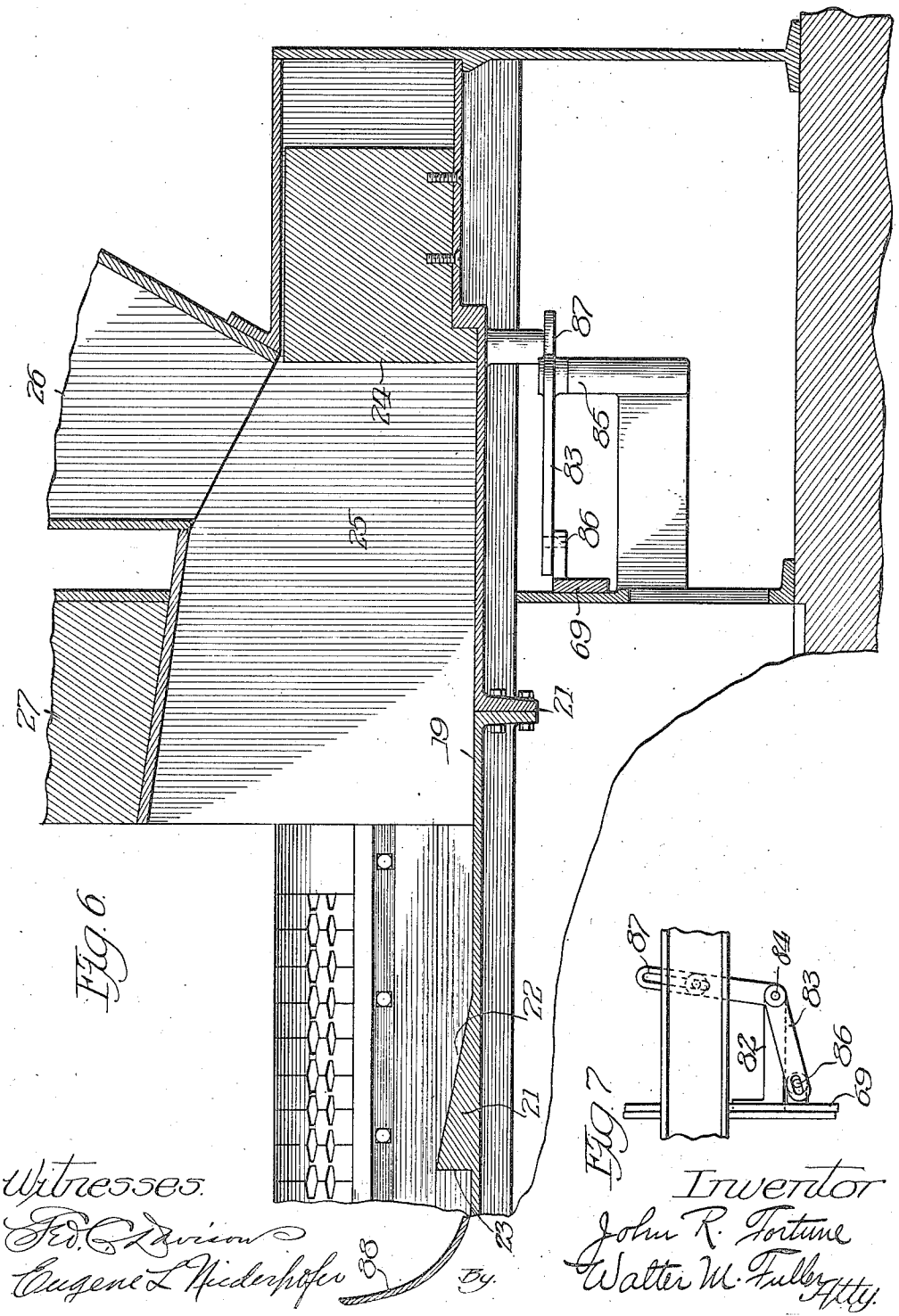


Fig. 6.

Fig. 7.

Witnesses.

Fred C. Davison

Eugene L. Niederhofer

Inventor

John R. Fortune

By Walter M. Fuller Atty.

UNITED STATES PATENT OFFICE.

JOHN R. FORTUNE, OF DETROIT, MICHIGAN, ASSIGNOR TO MURPHY IRON WORKS, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

AUTOMATIC STOKER.

1,243,055. Specification of Letters Patent. Patented Oct. 16, 1917.

Application filed November 11, 1914. Serial No. 871,480.

To all whom it may concern:

Be it known that I, JOHN R. FORTUNE, a citizen of the United States, residing at Detroit, in the State of Michigan, have invented certain new and useful Improvements in Automatic Stokers, of which the following is a specification.

This invention relates to underfeed furnaces in general, and more particularly concerns the association and relation of the fuel-retort to the grate surfaces and allied elements and the power-transmitting means for operating the movable parts or members.

In this application, I have presented in detail a furnace or stoker construction incorporating the invention in one of its preferred forms and those skilled in this art will appreciate the benefits and advantages accruing from combining together the parts of the device in the manner indicated so as to obtain an advantageous coöperation of the fuel-retort and its operating parts, the grate-members and their associated instrumentalities, the clinker-breakers, and the operating mechanism for all of these elements.

The accompanying drawings which form a part of this specification should be referred to in connection with the following detailed description in order to obtain a full understanding of the invention and its advantages, and in these drawings throughout the various views, like reference characters refer to the same parts.

In these drawings:

Figure 1 is a front view of a multiple furnace or stoker construction;

Fig. 2 is a vertical cross-section through one of these stoker structures;

Fig. 3 illustrates in vertical cross-section a portion of two of the fuel retorts and the adjacent inclined grates with their associated revoluble clinker breakers;

Fig. 4 is a perspective view of one of the stationary grate-bars;

Fig. 5 is a similar view of one of the movable grate-bars;

Fig. 6 is a central, longitudinal, vertical, fragmentary section through the center of one of the stoker-structures, and

Fig. 7 is a fragmentary plan view of the means employed for reciprocating the fuel-retort floor.

Referring first to Fig. 2 it will be observed that each of the pair of stoker constructions comprises two vertical, spaced, supporting-plates 10 and 11 provided at their lower edges with feet 12, 12, and held together by means of bolts 13, 13, surrounding which, between the plates, are spacing-spools or sleeves 14, 14. These plates 10 and 11 are provided on their inner faces with inwardly-projecting supporting-ledges 15, 15, on which slide the oppositely-projecting, outstanding, marginal ribs 16, 16 of the lower sections 17, 17, of the side-walls of the fuel retort 18, which are desirably cast integral with the retort floor or bottom-wall 19, the latter having depending from its opposite longitudinal edges strengthening and stiffening flanges 20, 20. This reciprocable portion of the retort is conveniently made in independent sections bolted together end to end, as at 21, only one of such joints, however, being shown in Fig. 6.

The retort floor is provided with one or more fuel-pushers 21 (Fig. 6), each having a top surface 22 of slight inclination sloping forwardly and downwardly and having also an abrupt rear face 23. The extreme forward end of the retort-bottom-wall has fastened thereto, so that it will slide therewith, a piston or plunger 24 (Fig. 6) operating in a front chamber or compartment 25 which receives fuel from the communicating hopper 26, the front wall 27 of the furnace being apertured so that there is direct communication between the hopper, compartment, and retort.

Above the parts 17, the upper portions of the retort side-walls 28, 28, are fastened or secured by means of bolts 29, 29, to the supporting-plates 10 and 11 so as to constitute upward extensions of the sections 17, the members 28 and 17 being substantially flush on their inner surfaces, as illustrated, and having between their adjacent faces the joints 30, permitting the parts 16, 17, 19 and 21 to reciprocate on the supporting-ledges 15.

Each stoker structure also has longitudinal supporting-plates 31 and 32 resting at 33 and 34 on the foundation, and secured to and spaced away from companion plates 35, with which they form vertical ash passages, by means of bolts and sleeves 36, 37.

As is clearly shown in Fig. 2, the grate-bars which receive at their tops the overflowing coal from the retort, are down-

wardly inclined in opposite directions at the two sides of the retort. Each of these grates consists of alternate stationary grate-bars and slidable bars.

Fig. 4 shows one of the stationary grate-bars 38 and indicates that it is composed of a main-body or plate-portion 39 provided at its lower edge with oppositely-extended flanges constituting a foot 40 adapted to rest on the thickened upper-edge portion 41 of the plate 31, 32 or 35, as the case may be. The under-face of this foot is cut away somewhat at 40[a] to accommodate the adjacent clinker-breaker, hereinafter described. It should be apparent, therefore, that the plates 31, 32 and 35 constitute not only the side-walls of ash-chutes, but also perform the function of grate-bearers. At its opposite end the grate-bar has a thickened portion or head 42 of the shape illustrated in the various figures which is positioned directly above one of the side-walls 28 of the retort, the upper-end of the grate-bar resting on the slightly inwardly-deflected upper-edge portion 43 of the plate 10 or 11 as the case may be, the bar being recessed at 44 for the accommodation of such part. At the upper end the stationary bar is rounded as illustrated and provided with a correspondingly-shaped rib or flange 45 projecting from both sides of the body-portion. Between the parts 45 and 42 the bar on each side has an outstanding downwardly inclined rib 46 providing between itself and the other parts two air passages or twyers 47 and 48. The inner edge of the grate-bar is reduced in thickness at 49[a] and the bar below the double-flange 45 is provided on each side with an outstanding bent-rib 49 which forms another air passage 50 between itself and the flange 45 on each side of the bar. Stated differently, the three air passages 47, 48, and 50 on each side of the bar communicate with the chamber or space between the downturned end of rib 49 and the adjacent portion of the enlargement 42. Each stationary grate-bar also has projecting from each side a plurality of horizontal ribs 51, 52, 53, and 54. It should be noted that the parts 40, 42, 46, 45 and 49 project from the body of the grate-bar equal amounts and that the ribs 51, 52, 53 and 54 project equal amounts, but less than that of the other parts by approximately one-half of the thickness of the plate-portion or web of one of the sliding grate-bars about to be described.

Each of the reciprocating grate-bars 55 comprises a web or plate body-portion 56 of the shape indicated in Fig. 5, having at its lower end a supporting-foot 57 extended in opposite directions from the body-portion. The movable-bar is also equipped on its sides with a plurality of oppositely-disposed, horizontal, slightly-tapered ribs 58, 59, 60, and 61, all as is clearly shown in Fig. 5. Also at the rear portion of the lower part of the bar there is provided a transverse recess or notch 62 in a thickened portion 63. The outer edges of the various projecting parts 57, 58, 59, 60, and 61, are all in the same plane, and the total width of any two corresponding ribs such as 60, 60, is substantially equal to the distances between the adjacent surfaces of the body-portions of two of the stationary grate-bars when in position.

The stationary grate-bars are assembled on their supports 41 and 43 with the edges of the feet 40 and the edges of the various ribs and thickened portions 49, 45, 46, and 42 in contact or approximately touching so that such ribs and enlargements unitedly form the passages 47, 48 and 50 for the conducting of air to the top-portions of the retort and the upper parts of the grates. The alternate movable grate-bars are accommodated between the adjacent assembled stationary grate-bars, each of the movable grate-bars having its foot 57 resting on the feet 40 of the pair of stationary-bars between which it is received, and the flanges 61 rest on the flanges 51 of the two bars, with the other flanges 58, 59 and 60 intermediately disposed between the flanges 54, 53, 52, and 51, the various ribs or flanges of both the stationary and movable bars forming ledges preventing the coal from sifting between the grate-bars and providing horizontal openings for the passage of air between the grate-bars.

In order to slide the groups of reciprocatory grate-bars in and out to facilitate the travel of the fuel down the grate-surfaces and to prevent the coalescing or agglomerating of the coal into unduly large masses or clinkers, there are supported on the inner faces of the plates 31, 32, and 35, bearings 64 accommodating rock-shafts 65, 65, each provided with a longitudinal rib or tooth 66 fitting in the alined notches or cavities 62 of the corresponding group or set of sliding grate-bars. These various shafts 65, as is shown in Fig. 1, project through the front wall of the furnace and each has fixed to its protruding-end a depending arm 67 connected by means of a link 68 to a common, sliding, operating-bar 69 reciprocated across the front of the furnaces by any suitable mechanism, such as an engine or electric motor, not illustrated. It will be readily understood that the sliding of the bar 69 is transmitted to the various shafts 65, causing them to rock in their bearings or seats 64 and reciprocating the sliding grate-bars for the purpose indicated.

At the lower end of each set of grate-bars and revolubly supported in suitable bearings in the ash and clinker passages between the plates 31 and 35 or 32 and 35, as the

case may be, I employ a shaft 70 having mounted thereon a clinker crusher or breaker 71ª provided with outstanding arms or teeth 72ª. As is clearly shown in Fig. 3, two of such clinker grinders are used where two sets of grates discharge their refuse into the same ash chute.

Each of the shafts 70 has its front end projecting forwardly through the furnace wall and to such end there is fastened a ratchet 71. In the case where the two shafts 70 are side by side, as in the center of the construction shown in Fig. 1, the one shaft has loosely mounted thereon an arm 72 connected by a link 73 to a lever 74 loosely fulcrumed on the companion shaft 70 and extending below the latter. Such lower end is connected by means of a link 75 to a downward extension 76 on the operating bar 69. Arm 72 is equipped with a pawl 77 coöperating with the corresponding ratchet-wheel 71, and the lever 74 has a like pawl 78 coacting with its companion ratchet-wheel. Obviously, therefore, as the operating-bar 69 reciprocates, the arms 72 and 74 rock in unison, and when swinging in one direction the one pawl 77, for instance, turns its shaft slightly by co-action with its ratchet, and on the reverse movement the pawl 78 effects a corresponding but opposite movement of its shaft 70.

At the ends of the furnace, where only one shaft 70 is present, as shown for instance in the right-hand portion of Fig. 1, the operating-mechanism is substantially the same, except that the lever 79 corresponding to the lever 74 is suitably fulcrumed, but is not equipped with a corresponding ratchet-wheel and pawl. Otherwise, the construction is substantially like that illustrated in the center of the figure.

Below each clinker grinder or crusher there is desirably located an apertured steam-pipe 80 to the issuing steam from which the ashes and clinkers are subjected. Exhaust steam from the stoker-operating engine may be used for this purpose and will serve to lengthen the life of the adjacent parts as well as soften the clinker and assist in the cleaning process.

Below each retort 18 an admission air-flue 81 is provided, which, by means of a transverse connection 82, discharges air, as shown by the arrows, into the two air-tight chambers beneath the oppositely-inclined grate-sections. A portion of such compressed air or air blast finds exit through the downwardly-inclined passages 47 and 48 into the upper portion of the fuel accommodated in the retort to facilitate its combustion. The remainder of the air passes out to the fuel on the grates through the passages 50 and the spaces between the horizontal ribs on the various grate-bars. This air, of course, promotes the fuel combustion and by flowing in close proximity to the heated parts, assists in cooling them and preventing them from acquiring a destructive temperature.

The sliding-bar 69 is also employed for reciprocating the floors or bottom-walls of the retorts and the connections between such bar and the retort-floors may be anything suitable for accomplishing the desired result. In the present instance I have shown for each retort or fuel distillation chamber a bell-crank lever 83, (Figs. 6 and 7) fulcrumed at 84 on a suitable support 82, the one arm of the lever having a pin and slot connection 86 with the sliding-bar 69, and the other arm having a pin and slot connection 87 with the floor or bottom-wall of the retort. Obviously, therefore, the travel of the bar 69 is employed for effecting the movements of all of the movable parts of the construction.

Operation: The operation of this improved mechanism takes place substantially as follows:

The coal in each hopper 26 falls by gravity into its corresponding chamber or compartment 25 from which it is gradually expelled or forced into the retort by the reciprocation of the plunger or piston 24 which travels with and is secured to the bottom-wall or floor of the retort. The coal is also fed rearwardly and upwardly by the movement of the pushers 21, the ascent of the fuel being facilitated by the curved-wall 88 at the rear of the retort. The coal is gradually forced upwardly by the incoming fuel fed into the bottom of the retort and its gases are driven off due to the heat to which it is subjected, such gases passing through the upper stratum of burning-fuel. As it reaches the upper part of the retort the coal is supplied by air delivered through the passages or twyers 47 and 48, which permits the combustion of the fuel and gases. In leaving the top of the retort the fuel overflows on to the oppositely-inclined grates down which it travels partly under the action of gravity and partly due to the reciprocations of the movable grate-bars. As it descends these grates it receives air for combustion through the openings 50 and also through the passages between the grate-bars. When it reaches the lower ends of the grates it is ground out by the clinker crushers or breakers 71ª and passes downwardly through the ash chutes.

It should be observed that all of these various moving parts facilitate and control the feed or travel of the fuel, which can be regulated by modifying their movements to correspond to the service required of the furnace and to the character of the fuel employed.

While I have herein set forth with some degree of particularity the various details

of construction of this particular embodiment of the invention, it is to be remembered that the latter is not restricted to these exact structural features, since many minor mechanical changes may be made therein without departing from the heart of the invention and without losing its principal advantages.

I claim:

1. In a stoker-construction, the combination of a fuel-retort, means to underfeed fuel thereto, an inclined-grate adjacent to said retort adapted to receive the fuel overflowing from said retort, said grate being composed of stationary and sliding grate-bars, the stationary-bars having supporting-feet at their lower-ends, the movable grate-bars being each accommodated between a pair of stationary grate-bars and having feet slidable on the stationary bar feet, and means to reciprocate said sliding grate-bars, substantially as described.

2. In a stoker construction, the combination of a fuel-retort, means to underfeed fuel thereto, an inclined grate adjacent to said retort adapted to receive the fuel overflowing from the retort, said grate being composed of stationary and sliding grate-bars, the stationary-bars having side-ribs and at their lower-ends supporting-feet, the movable grate-bars being each accommodated between a pair of stationary grate-bars and having side-ribs slidable on the ribs of the stationary-bars and feet slidable on the stationary-bar feet, and means to reciprocate said sliding grate-bars, substantially as described.

3. In a stoker-construction, the combination of a fuel-retort, means to underfeed fuel thereto, inclined grates on opposite sides of the retort adapted on their upper portions to receive the fuel overflowing from the retort, each of said grates being composed of stationary and sliding grate-bars, the sliding grate-bars being accommodated between and supported on the stationary bars, and means to operate said sliding grate-bars.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

JOHN R. FORTUNE.

Witnesses:
IDA M. YANKLE,
OLIN HARVEY.