

F. C. ARMSTEAD.
MECHANICAL STOKER FOR FURNACES.
APPLICATION FILED OCT. 18, 1906.

957,296.

Patented May 10, 1916

4 SHEETS—SHEET 1.

Fig. 2.

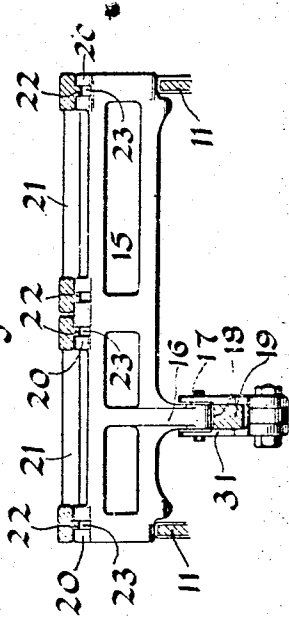
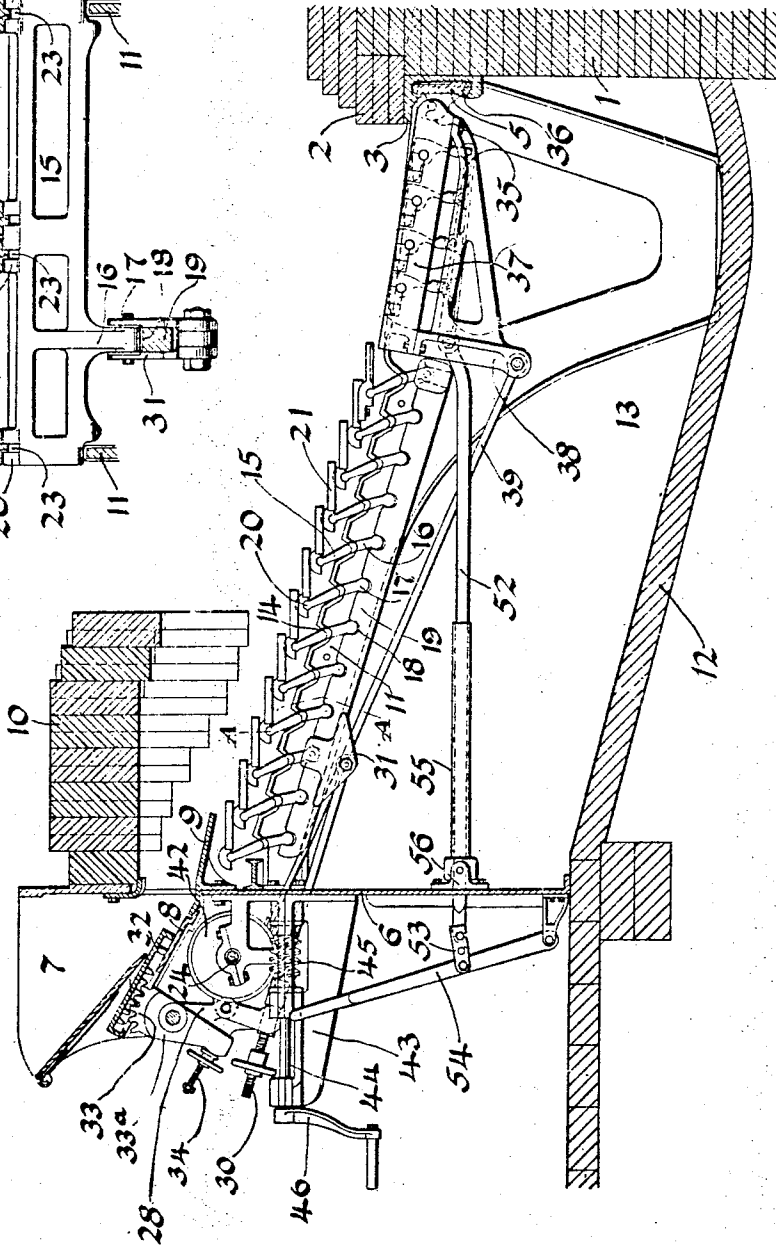


Fig. 1.



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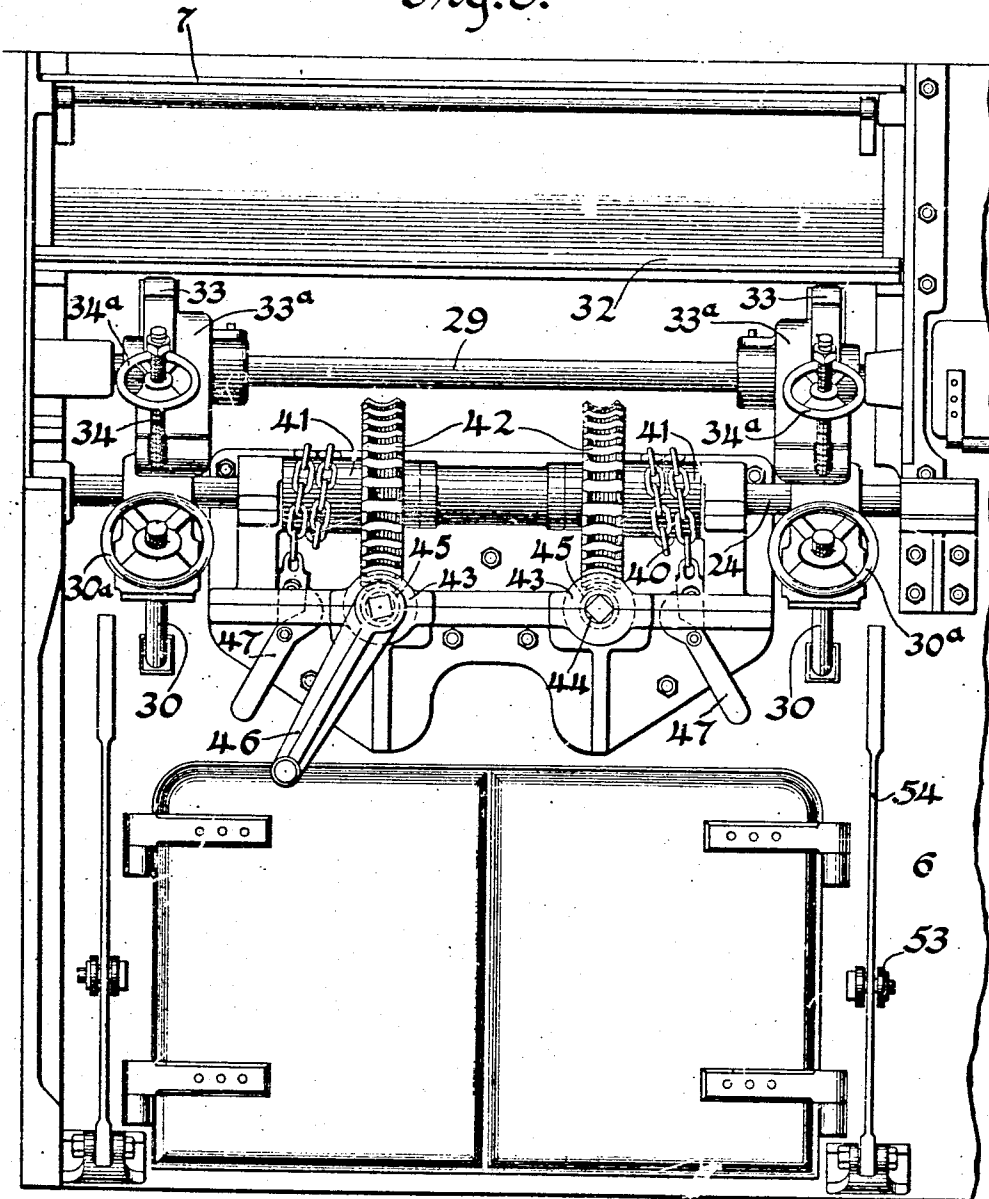
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48 SHEETS—SHEET 2.

Fig. 3.



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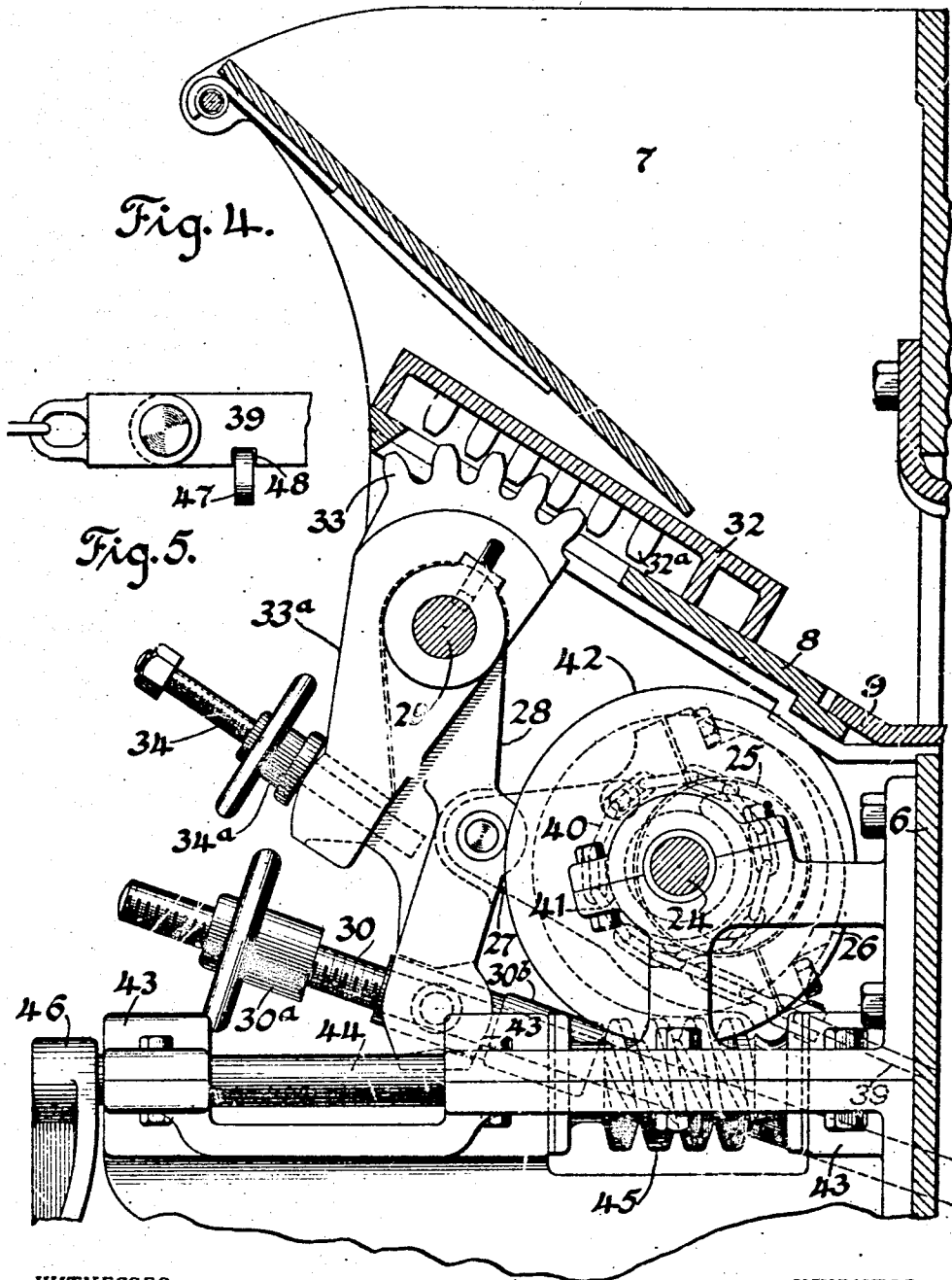
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4 SHEETS—SHEET 3.



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4 SHEETS—SHEET 4.

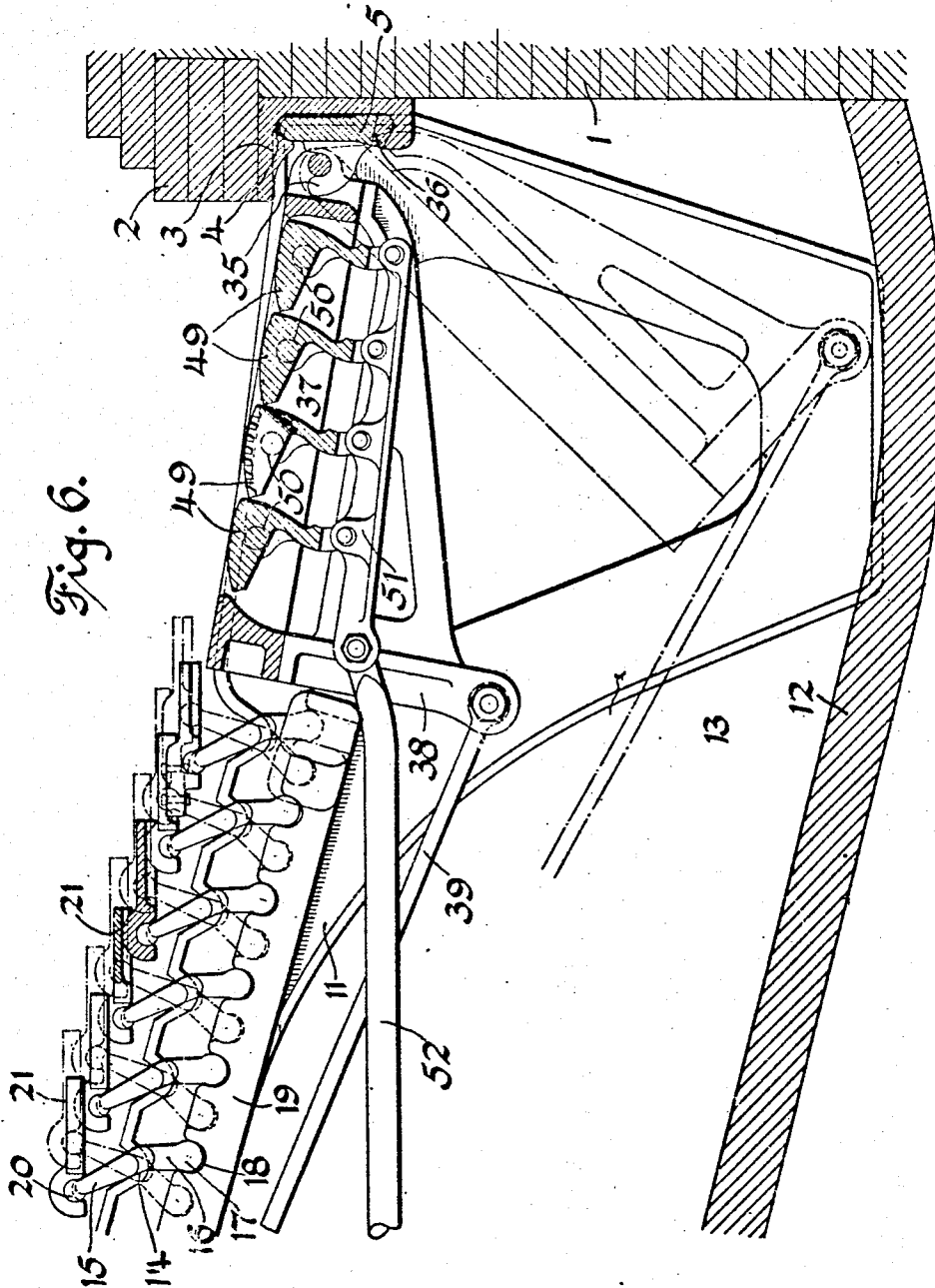


Fig. 6.

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UNITED STATES PATENT OFFICE.

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MECHANICAL STOKER FOR FURNACES.

957,296.

Specification of Letters Patent.

Patented May 10, 1910.

Application filed October 18, 1906. Serial No. 339,520.

To all whom it may concern:

Be it known that I, FRANK C. ARMSTEAD, a citizen of the United States, and a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have made a new and useful Invention in Mechanical Stokers for Furnaces, of which the following is a specification.

My invention relates to apparatus employed for automatically feeding fuel to furnaces, and particularly to that type of such apparatus which embodies a series of grate bars having a reciprocating or back and forth movement as distinguished from the type having grate bars mounted upon endless chains which move continuously in one direction.

One of the objects of my invention is to provide a stoking apparatus in which the fuel plates shall have an approximately horizontal back and forth movement, instead of a rocking or tilting movement, and which will therefore serve to force the fuel forward step by step instead of to merely drop it from each fuel plate to the next in the series, thereby enabling me to employ a grate which more nearly approaches a horizontal plane than is possible in grates with tilting plates.

Another object of my invention is to provide a simple, effective and reliable means for lowering and raising the dumping grate when desired.

A further object of my invention is to provide a simple and effective means for discharging material from the dumping grate without lowering the grate.

A further object of the invention is to provide a removable bearing bar for the dumping grate and an improved angle plate therefor, both of which shall be peculiarly adapted to the intended service.

In the accompanying drawings, illustrating my invention, Figure 1 is a view, partially in side elevation and partially in section, of a mechanical stoker embodying my improvements and portions of the furnace structure that are directly associated with the stoker mechanism. Fig. 2 is a detail, sectional view of a portion of the fuel-feeding grate along the line A—A of Fig. 1. Fig. 3 is an end elevation of the apparatus illustrated in Fig. 1. Fig. 4 is a side elevation of the principal parts of the operating mechanism located outside the furnace in connection

with a sectional view of the feeding device. Fig. 5 is a detail view of a locking device for the dumping grate operating mechanism. Fig. 6 is a side view of a portion of the mechanical stoker in connection with a dump grate shown partially in section for convenience of description.

The furnace, apart from the stoking apparatus which constitutes my present invention, may be of any suitable and approved type, as regards form and materials, and I have therefore shown in the drawings only so much of the furnace structure as will serve to illustrate the connection of my stoking apparatus therewith.

As indicated in Figs. 1 and 6, the inner end 1 and the bridge-wall 2 of the furnace are formed of fire brick, and in the angle formed between these two portions of the furnace, is located and securely anchored a metal angle plate 3, having a recess 4 to receive the dumping grate bearing bar 5, which will be more fully hereinafter described.

The front metal wall 6 of the furnace, having a hopper 7, a pusher-plate 8 and a dead-plate 9, may be of usual construction, such as is found, for example, in the well known Roney stoker. The coking arch, 10, formed of fire brick and extending back from the front plate over the grate, and the metal side bearers 11, which extend from the front plate 6 to the end wall 1 and rest, at their inner ends, upon the floor 12 of the ash-pit 13, may also be of usual construction, except that, as hereinbefore suggested, the angle which the upper edges of the side bearers make with a horizontal plane is considerably less than that which has heretofore obtained in stokers of this general character.

As here shown, each side bearer 11, two of which are employed for each series of stepped grate bars, is provided with a series of bearing recesses 14, in which rest the corresponding, rounded, lower edges of the ends of the grate bar frames 15. Each grate bar frame 15 is preferably of skeleton structure, as shown in Fig. 2, and is provided with a downwardly projecting arm 16, the end 17 of which is rounded, and these rounded ends fit into corresponding sockets 18 in an actuating bar 19. The upper edges of the grate bar frames are provided with rounded bosses 20, which fit into correspond-

ing recesses in the fuel plates 21. In order to prevent endwise movement of the fuel plates, they may be provided with tongues 22 that fit into corresponding recesses 23 in the bosses 20. The fuel plates may be corrugated and perforated, as set forth in my Patent No. 746,656, or have such other structural features and characteristics as may be found feasible or desirable. The inner end or edge of each fuel plate, beginning with the hopper end of the furnace, rests upon the outer end or edge of the next succeeding plate, but is not attached thereto.

Although the fuel plates have a loose, mutual engagement with each other, as stated, they have very little relative motion and are all moved back and forth in unison so as to push the entire body of fuel forward step-by-step and thus insure uniform combustion and a minimum amount of wear of the fuel plates and the grate bar frames. The back and forth movement of the fuel plates, as above set forth, may be effected by means which will be now described.

A main shaft 24, that may be operated by any suitable source of power, is provided with an eccentric 25, the strap 26 of which is connected, by means of an arm 27, to a lever 28. One end of the lever 28 is loosely supported upon a rock shaft 29 and the other has an opening through which loosely projects an actuating rod 30. At the outer side of the lever 28, the rod 30 is provided with an adjustable nut 30^a, and at the inner side of said lever, the rod is provided with a fixed shoulder or collar 30^b, the distance between the nut and the collar being normally such as to insure a considerable degree of lost motion. The inner end of the rod 30 is pivotally attached to a block or connecting member 31 that is bolted or otherwise securely fastened to the actuating bar 19 and preferably also to the arm 16 of one of the grate bar frames 15.

It will be readily seen that the means just described will effect the desired back and forth movement of the grate bars, that the shoulder 30^b will insure rearward movement of the grate bars to the same points under all conditions of operation and that the degree of forward movement may be varied by adjusting the nut 30^a to vary the amount of lost motion between the said parts and the lever 28.

For the purpose of feeding the fuel from the hopper to the grate, I provide a pusher 32 having a rack 32^a with which engages a gear segment 33. This gear segment is rigidly mounted upon the rock shaft 29 and is provided with an arm 33^a that is connected to the lever 28 by a screw threaded rod 34 having a nut 34^a by means of which the range of movement of the pusher may be adjusted. A more complete illustration and description of the mechanism just described

may be found in Patent No. 584,561, granted to Westinghouse, Church, Kerr & Company June 15, 1897, upon an application filed by W. R. Roney and W. W. Churchill.

The bearing bar 5 for the dumping grate is provided, at its ends, with lugs 35 having bearing recesses and is fastened in position in the recess 4 of the angle plate 3 by means of a removable key 36. The dumping grate frame 37 is provided with trunnions, which are supported in the bearing-recesses of the lugs 35, and, at its front end, has a downwardly projecting member 38 to the lower end of which is pivotally attached a raising and lowering rod 39. The outer end of the rod 39 is connected, by means of a chain 40, to a chain shackle which is fastened to a drum 41 that is the hub of a worm-wheel 42 which is loosely mounted upon the main shaft 24. Journaled in suitable bearings in a bracket 43 fastened to the front wall of the furnace, is a shaft 44 having a worm 45 that meshes with the worm-wheel 42. The end of the shaft 44 is squared to receive a detachable crank arm 46 by means of which it may be rotated and thus turn the worm-wheel to wind the chain around the drum, or to unwind the same therefrom, according as it is desired to raise or to lower the dumping grate.

In order to relieve the gearing from strain when not in use for raising or lowering the dumping grate, I provide a locking dog 47, which is pivoted to the bracket 43 so as to be swung inward and engage a notch 48 in the flattened end of the rod 39.

In Fig. 3 I have shown, side by side, duplicate sets of feeding-grate operating mechanism and of raising and lowering mechanism for the dumping grate, it being understood that the furnace there indicated is provided with two sets or units of stoker apparatus arranged side by side, the two units being alike except for "right and left" arrangement. Any desired number of side-by-side units may, of course, be employed, but whatever be the number, only one crank arm 46 need be provided unless it is desired to raise or lower two or more dumping grates at the same time. It will be understood without further illustration that the grates pertaining to the several stoker units of any installation may be arranged to operate in unison or in alternation, as may be desired, by properly adjusting the eccen- trics 25.

Inasmuch as a considerable amount of non-combustible material may collect upon the dumping grate that is in comparatively small particles or fragments, I provide means whereby the grate may be relieved of all such material without interrupting the service and without entailing the time and labor necessary to lower and raise the grate. This means comprises a plurality of grate

bars 49 individually pivoted near their upper surfaces, in the frame 37, as indicated at 50, and having their lower edges pivotally and loosely connected to a shaker bar 51, the front end of which is pivotally connected to the inner end of a connecting rod 52. The outer end of the rod 52 is detachably connected to one end of a link 53, the other end of which is pivoted to an operating lever 54 located outside the furnace. It will be seen, therefore, that by moving the operating bar backward and forward, the dumping grate bars may be rocked on their pivots and thus serve to dislodge or dump into the ash-pit 13 all non-combustible material which is not too large to pass between the spaces formed when the bars are tilted to their full extent.

In order to guard against interference of this apparatus with the raising and lowering of the dumping grate as a whole, I surround the rod 52 for a portion of its length with a tubular guard 55, the front end of which is pivoted to a bracket 56 attached to the furnace wall 6. It will thus be seen that when it is desired to lower the dumping grate, the link 53 is unlatched from the end of the connecting rod 52 and the latter is then free to be drawn inward through the furnace wall, but is prevented from dropping into the furnace pit by the guard 55 in which it is inclosed.

The several parts of the mechanism the structural features of which are not specifically illustrated may be of any well known and approved form, material and dimensions, and those parts which are specifically illustrated may be varied, as regards structural characteristics, to suit the convenience of the designer or user of the apparatus within considerable limits, and I therefore desire it to be understood that all such modifications or variations which do not materially change the mode of operation or result are within the scope of my invention.

What I claim as my invention is:

1. The combination with a furnace having a bridge wall a fuel feeding grate and dump grate at the inner end thereof, of an angle plate provided with a longitudinally-extending recess in one leg thereof and located between the dump grate and the bridge wall of the furnace, a bearing bar for the inner end of the dump grate frame, and a removable key for securing said bar in the recess of said angle plate.

2. In a self-feeding furnace having a bridge wall the combination with an angle plate provided with a longitudinally-extending recess in one leg thereof and located between the inner end of the furnace grate and the bridge wall thereof, of a bearing bar having longitudinally-projecting bearing lugs, of a dump grate having trunnions at its inner end supported on said bearing lugs, a removable key for securing said bar

in the recess of said plate, and means for lowering and raising said dump grate on said trunnions.

3. In a self-feeding furnace, the combination with a feeding grate, a main shaft, an intermediate mechanism for effecting the operation of the grate, of a hinge-supported dumping grate, a drum on the main shaft, a chain and a rod connecting said drum with the free end of said dumping grate, a worm gear for rotating said drum and a locking device to relieve the drum and worm wheel of strains when the dumping grate is in the normal position.

4. In a self-feeding furnace, the combination with an angle plate having a longitudinally-extending recess in one leg thereof, of a dump grate bearing bar and a removable key for securing said bar in said recess.

5. In a self-feeding furnace, the combination with an angle plate having a longitudinally-extending recess in one leg thereof, of a dump grate bearing bar and means for securing said bar in said recess.

6. In a self-feeding furnace, the combination with an angle plate provided with a recess in one leg thereof, of a bearing bar provided with dump grate supporting lugs and a removable key for securing said bar in said recess.

7. In combination in a mechanical stoker, a plurality of pivotally mounted grate bars arranged in stepped relation, a fuel plate pivotally mounted on each of said bars at one edge only and provided with a lug of substantially cylindrical section and projecting above the fuel surface of its plate for supporting the free edge of the next adjacent plate and for spacing said next adjacent plate.

8. In combination in a mechanical stoker, a plurality of oscillating grate bars arranged in stepped relation, and a fuel plate pivotally mounted on each of said bars and provided at the mounting edge with a lug projecting above the surface of its plate for supporting and spacing the free edge of the next adjacent fuel plate, whereby said fuel plates are maintained in substantially horizontal positions throughout the oscillations of said grate bars.

9. In combination in a mechanical stoker, a plurality of grate bars arranged in stepped relation, means for oscillating said grate bars, and a fuel plate pivotally mounted on each of said bars and provided at the mounting edge with a semi-cylindrical lug projecting above the fuel surface thereof for supporting and spacing the free edge of the next adjacent fuel plate.

10. In a mechanical stoker, a plurality of grate bars arranged in stepped relation, means for oscillating said grate bars, and a fuel plate pivotally mounted on each of said bars and provided at the edge with a pro-

jecting lug extending above the fuel carrying face of said plate at the rear edge thereof and supporting and spacing the free edge of the next adjacent plate whereby said fuel plates are maintained in substantially horizontal positions throughout the oscillations of said grate bar.

11. In combination with a furnace having a bridge wall a fuel feeding grate and a dump grate at the inner end thereof, of an angle plate secured to the bridge wall of the furnace and provided with a longitudinally extending recess in one leg thereof, a bearing bar on which said dump grate is pivotally mounted located within said recess, and a removable key for securing said bearing bar in said recess.

12. In combination with a furnace having a bridge wall a fuel feeding grate and a dump grate at the inner end thereof, of an angle plate provided with a longitudinally extending recess in one leg thereof and located between the dump grate and the bridge wall of the furnace, a bearing bar provided

with bearing lugs for supporting said dump grate located within said recess, an overhanging lug provided at the upper edge of said recess, and a removable key for securing said bar in said recess.

13. In combination with a furnace having a bridge wall a fuel feeding grate and a dump grate at the inner end thereof, of an angle plate provided with a longitudinally extending recess in one leg thereof, a bearing bar for the inner end of said dump grate located within said recess, an overhanging lug provided at the upper edge of said recess, and a removable key for raising said bearing bar so that it coöperates with said lug and is secured in said recess.

In testimony whereof, I have hereunto subscribed my name this 13th day of October, 1906.

FRANK C. ARMSTEAD.

Witnesses:

CHARLES W. MCGHEE.
E. W. MCCALLISTER.