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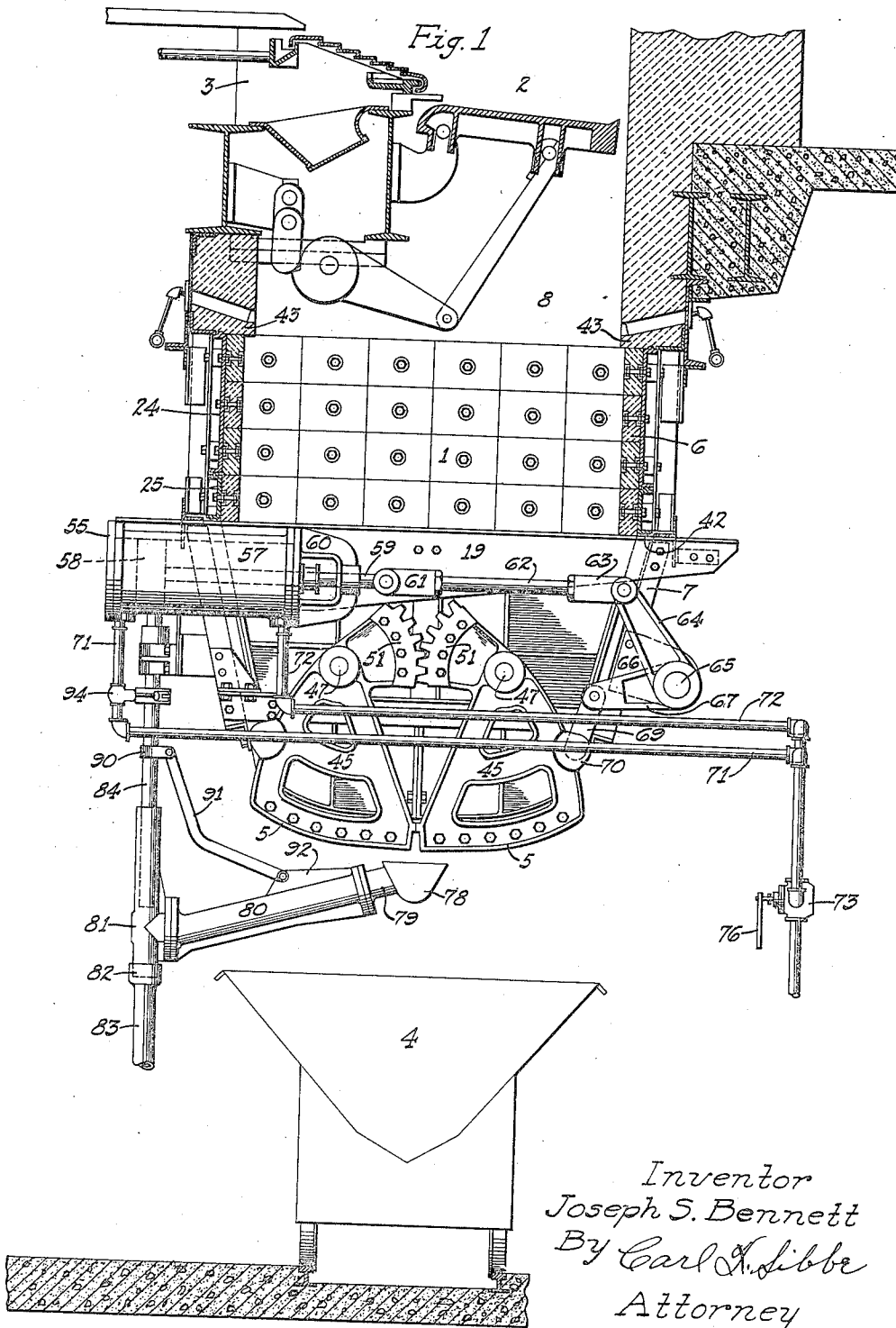
J. S. BENNETT

2,070,152

HOPPER

Filed Sept. 12, 1932

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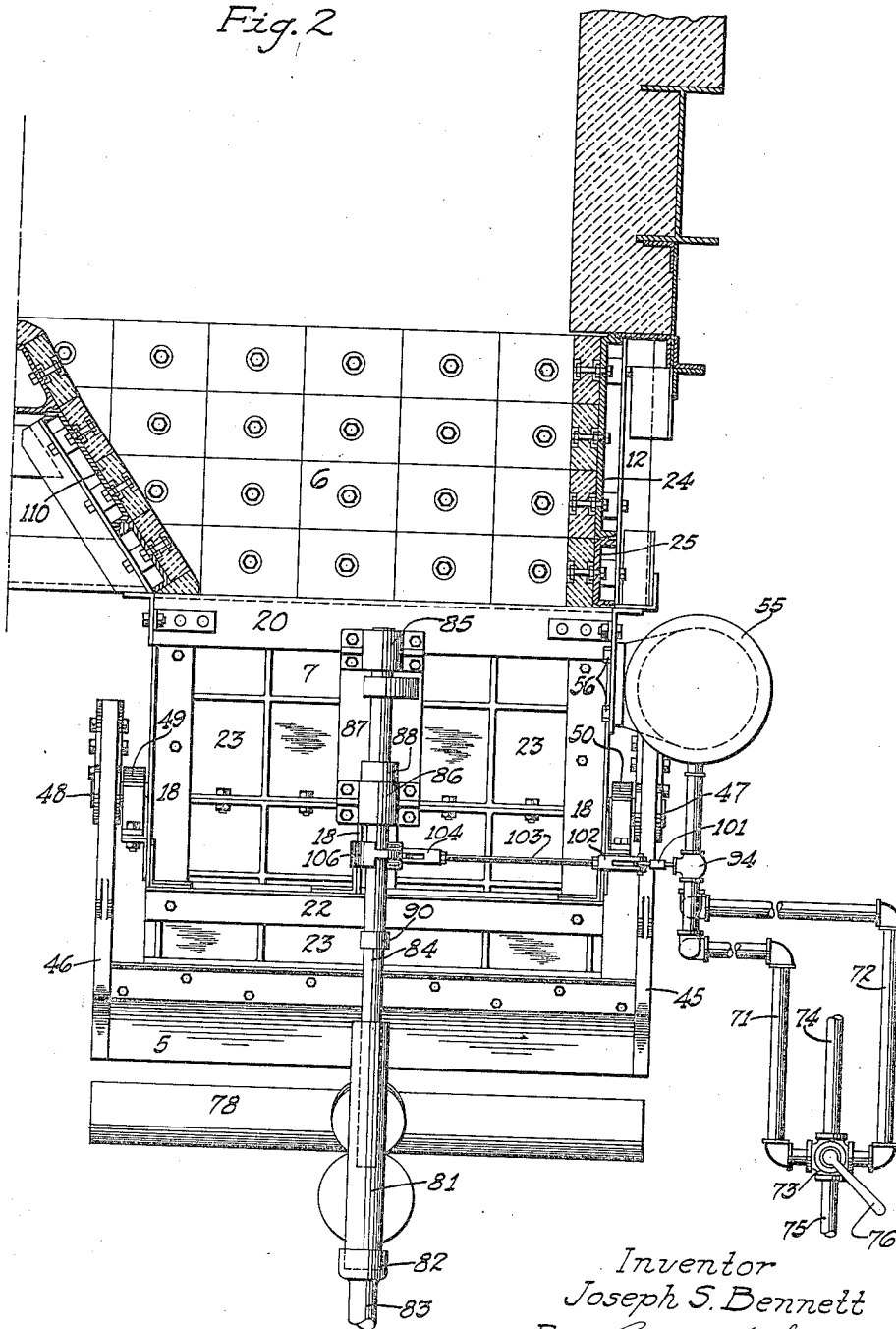
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Fig. 2



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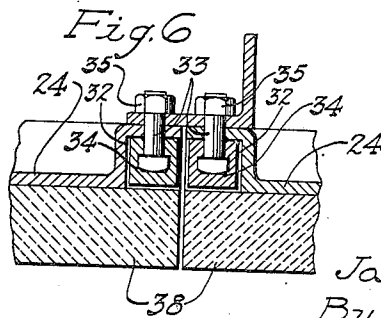
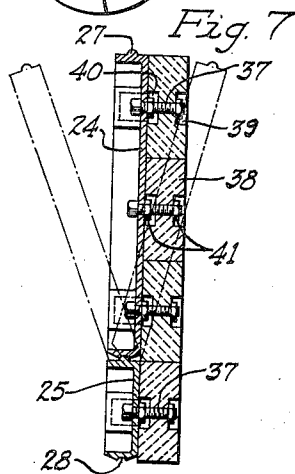
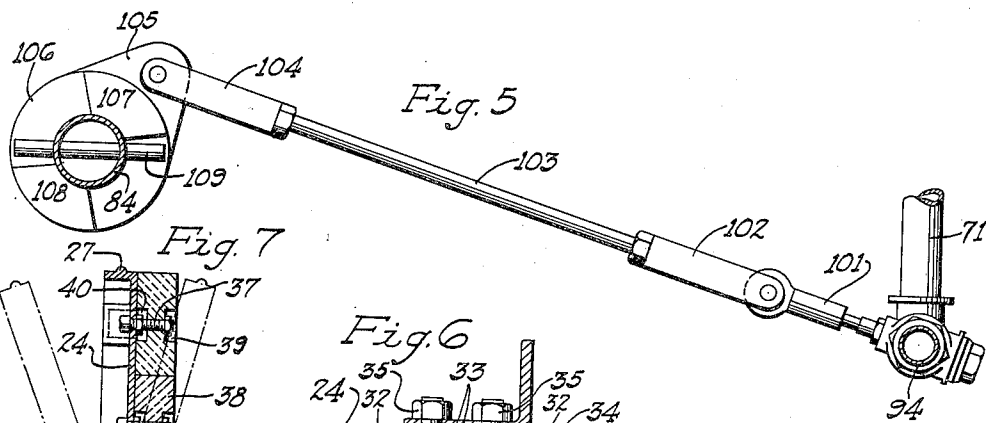
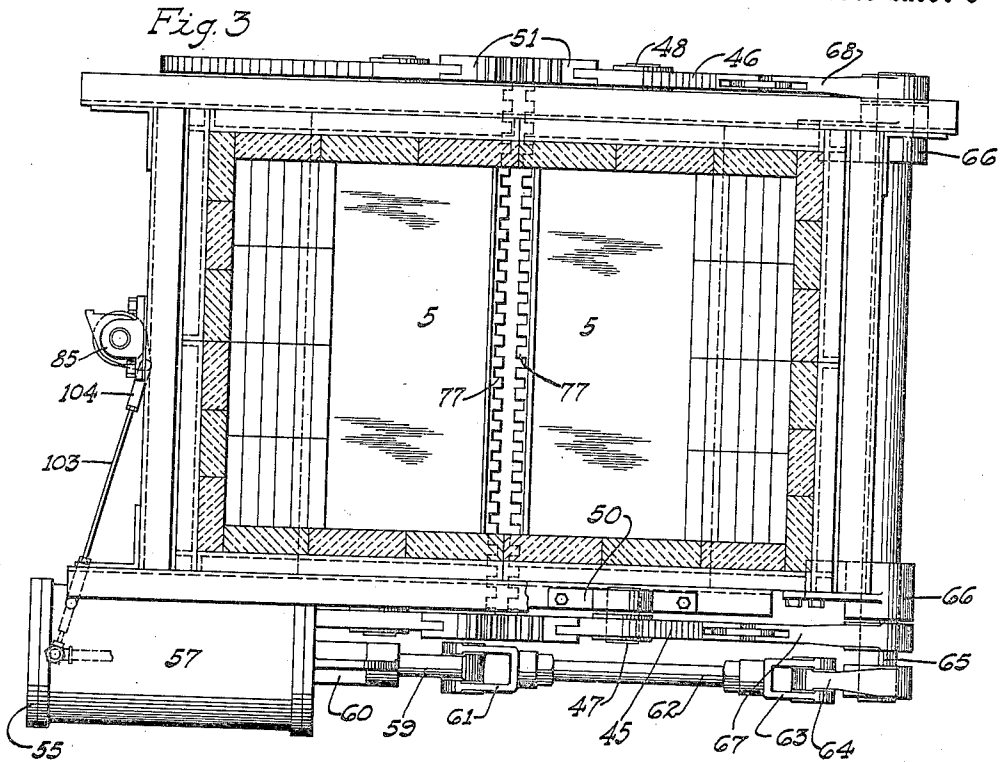
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4 Sheets-Sheet 3



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Fig. 8

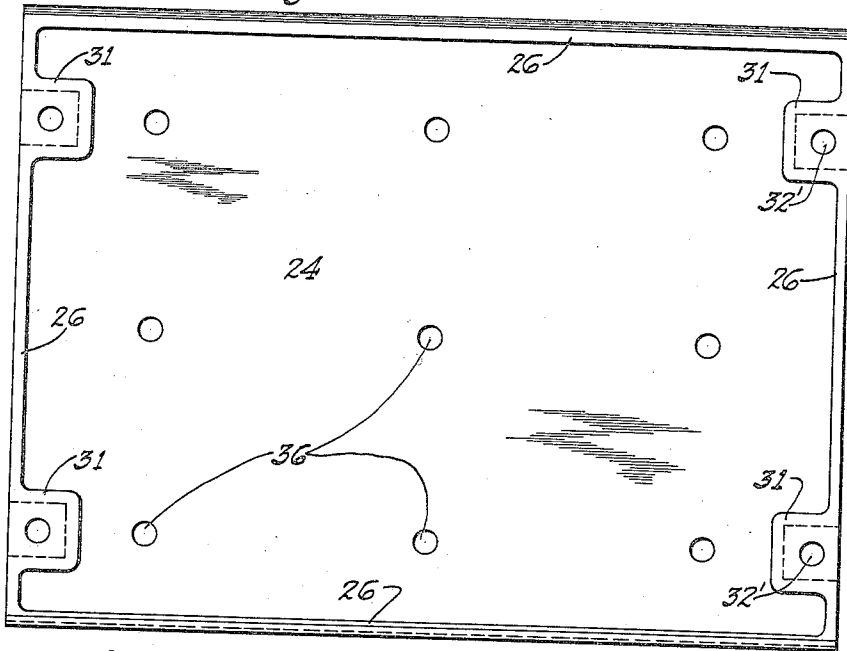


Fig. 9

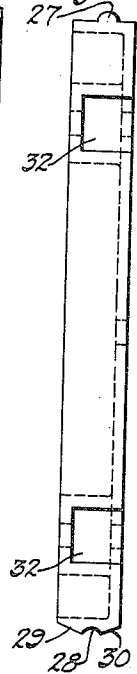


Fig. 4

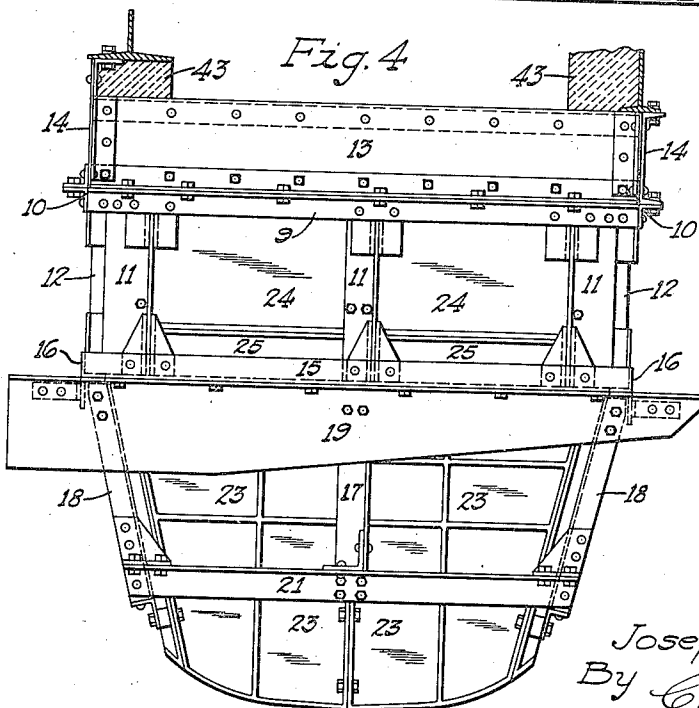
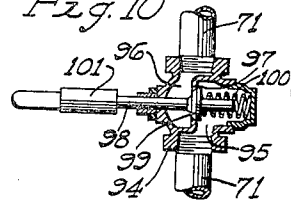


Fig. 10



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UNITED STATES PATENT OFFICE

2,070,152

HOPPER

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6 Claims. (Cl. 110—165)

This invention relates to hoppers, and more particularly to ash hoppers employed in boiler furnaces.

Hoppers of the stated character are usually constructed of a series of cast iron plates secured to a structural steel framework. In the past it has been the custom to design a new set of plates each time a hopper of a different size was required. The expense involved by such practice is obviously great since each time a new plate is designed a new pattern must be made and the general cost of assembly also is greater in that each hopper is different in construction from the ones previously built.

One object of the present invention is to provide plates of standard construction so that hoppers of various sizes may be built without necessitating the design and construction of new plates.

Another object is to provide a hopper of two main sections, one of which is of standard size and shape, the other of which may be varied in accordance with the dimensions of the ash pit of the furnace.

A further object is to provide the sectional plates of hoppers with hinged joints so that the slope of the walls of the hopper may be varied and yet maintain a water seal between the plates.

A still further object is to construct hoppers of standard plates of different sizes so that the depth of the hopper may be varied in accordance with the head room beneath the furnace.

A further object of this invention is to provide a bodily movable trough beneath the gates of a hopper thereby eliminating any obstruction in the path of the ashes discharging from the hopper.

A still further object is to provide an interlock between the trough and the gates of the hopper which compels movement of the former out of the path of the ashes before the gates may be opened.

A further object is to provide improved means for securing the sectional plates of the hopper to the structural framework.

Other and further objects will become apparent as the description of the invention progresses.

Of the drawings:

Fig. 1 is an end view partly in section showing the general construction of the hopper and the trough associated therewith, and the operating mechanism for the hopper gates.

Fig. 2 is a side view partly in section of the hopper and trough also showing the general arrangement of the operating mechanism for the hopper gates.

Fig. 3 is a plan view showing the normal posi-

tion of the hopper gates and the operating mechanism therefor.

Fig. 4 is an end elevational view of the hopper with the gates and operating mechanism therefor removed to show the general construction of the hopper.

Fig. 5 is a detail view of the control mechanism for the gate operating mechanism.

Fig. 6 is a sectional detail view showing the means for securing the cast metal plates of the hopper to the structural framework.

Fig. 7 is an enlarged sectional view showing the general construction of the cast metal plates of the hopper with refractory elements secured thereto.

Fig. 8 is an enlarged detail view showing the construction of one of the cast metal plates of the hopper.

Fig. 9 is an end view of the cast metal plate shown in Fig. 8.

Fig. 10 is a sectional view of one of the valves associated with the control mechanism for the ash hopper gates.

Referring to the drawings, the numeral 1 designates generally the hopper comprising the present invention, the present embodiment of which being employed in a stoker fired furnace 2. The ashes discharging from the stoker 3 enter the hopper 1 by gravity, from which they may be periodically dumped into a car 4 by simply opening the gates 5.

The hopper 1 comprises an upper section 6 and a lower section 7, the latter being of standard size and construction. Upper section 6 is suspended from the walls of the ash pit 3 in any suitable manner. In the present instance structural cross members 9 and 10 secured, respectively, to the upper ends of upright structural members 11 and 12 of the hopper 1, are secured to the structural supporting beams 13 and 14 for the walls of the ash pit 3.

The upper section 6 is secured to the lower section 7 of hopper 1 in a somewhat similar manner. As shown in Figs. 2 and 4, structural cross members 15 and 16 are respectively secured to the lower ends of upright members 11 and 12 of the upper section 6. The upright structural members 17 and 18 of the lower section 7 have secured at the upper ends thereof, respectively, structural cross members 19 and 20. Structural members 15 and 19 are secured together by rivets, bolts or by any other suitable securing means. Structural members 16 and 20 are secured together in a similar manner. The lower section 7 is also provided with structural cross

members 21 and 22 secured respectively, to the lower ends of upright members 17 and 18. The walls of the lower section 7 are composed of a series of cast iron plates 23 which are bolted at their abutting ends to upright members 17 and 18 and to cross members 19 and 20, as shown in Figs. 2 and 4. The lower plates 23 of the end walls are also bolted to each other, as shown in Fig. 4. The plates 23 comprising the side walls of section 7 are also bolted together as shown in Fig. 2. A suitable packing may be placed between the abutting ends of the plates 23 to prevent leakage of water or dust therethrough. The lower section 7, as was pointed out before, is of standard size and shape and is never varied. The upper section 6, however, is designed in accordance with the dimensions of the ash pit and the head room provided beneath the furnace, but the sectional plates comprising the walls thereof are of standard construction.

Referring to Figs. 1, 2, 4 and 6 to 9, it is seen that the walls of the upper section 6 are comprised of a series of cast iron plates 24 and 25. These plates are of rectangular construction and have substantially the same horizontal dimension. The vertical dimension of plates 24, however, is substantially twice as great as that of plates 25. Plates of these dimensions are provided so that the depth of the hopper may be varied in accordance with the head room conditions of any furnace. The inner surface of these plates is smooth while the outer surface is provided with a reinforcing rib 26 extending around the outer perimeter thereof.

As shown more clearly in Figs. 1, 7, and 9, the plates 24 and 25 are provided with a semi-circular rib 27 along the upper edge thereof, and a correspondingly shaped recess 28 extending along the lower edge. Beveled faces 29 and 30 are also provided adjacent the recess 28 of each plate. In assembly the plates 24 and 25 are so arranged that the rib 27 of one plate is fitted into the recess of the next lower plate. This construction not only provides a seal between the plates but permits the plates to be positioned at an angle with respect to each other and yet a sealed joint between the plates is maintained. Beveled surfaces similar to surfaces 29 and 30 may also be provided along the upper edge of each plate if it is desired. Such a construction would permit a wider range of angularity between the plates.

The plates 24 and 25 are secured to the upright structural members 11 and 12 by the securing means shown more particularly in Figs. 6, 8 and 9. Each plate 24 and 25 is provided with spaced bosses 31 near the ends thereof. Each boss 31 is formed with an enlarged rectangular recess 32 and an aperture 32' for receiving a bolt 33. As shown in Fig. 6, the plates 24 and 25 are secured to the upright members 11 or 12 at their vertical abutting edges. In the present instance the bolts 33 are provided with an enlarged substantially cubical cast iron head 34 which, when the bolt is secured in place, rests in the recess 32. To secure the plates to the upright members 11 and 12 the bolts 33 are simply inserted through apertures 32' and aligned apertures provided in uprights 11 or 12 and nuts 35, then draw the plates tightly into engagement with said uprights. The head 34 rests snugly against the seat of the recess and thus an effective seal is provided. A suitable packing may be provided in the recess if it is so desired.

The plates 24 and 25 are also provided with

a series of apertures 36 through which bolts 37 for securing refractory blocks 38 to the plates extend. As shown more clearly in Fig. 7, the refractory blocks 38 are also provided with apertures for receiving bolts 37, which terminate in enlarged aligned recesses 39 and 40 at the inner and outer sides thereof, respectively. These recesses receive nuts 41 which draw the refractory blocks tightly against the plates 24 and 25. Suitable packing may be placed in the recesses 39 and 40 to protect the bolts against the head of the ash and at the same time seal the joints to prevent leakage of water.

The upper plates 23 of the lower section 7 of hopper 1 are also provided with semi-circular ribs 42 along the upper edges thereof which fit into the recesses 28 of the lower plates 25 of the upper section 6. This construction forms an effective seal between the upper and lower sections of the hopper. The ribs 27 of the upper plates 24 of section 6 fit snugly in the masonry 43 to which the hopper is attached and thus an effective seal is also provided between the hopper and the ash pit.

These hinged joints permit the walls of the upper section 6 to be inclined at any desired angle from a vertical plane so that the upper edges thereof will fit the opening of the ash pit and still maintain a seal between the sections and also between the hopper and the ash pit. The perimeter of the lower end of section 6 must always be the same so as to fit the lower section 7 but the perimeter of the upper end varies in accordance with the opening of the ash pit. In case the side walls of section 6 are at an angle to the vertical plane it of course would be necessary to saw the side plates of the end walls to correspond with the inclination thereof but this may readily be done and therefore new plates need not be designed. The depth of the upper section may be varied by simply employing the proper number of plates 24 and 25. The sizes of these plates have been so chosen that any desired depth may be obtained.

The gates 5 constitute the bottom wall of the hopper. These gates are supported by side members 45 and 46 which in turn are journaled on pins 47 and 48, secured to brackets 49 and 50 extending upwardly from cross members 21. Each side member 45 and 46 has secured thereto a segmental gear 51 which meshes with the segmental gear 51 secured to the adjacent supporting member 45 or 46. It therefore is seen that any movement imparted to one of the gates 5 will cause an equal and opposite movement of the other. The mechanism for operating the gates 5 to open and closed position will now be described in detail.

Referring to Figs. 1, 2 and 3, a fluid motor 55 is suitably secured to cross member 19 by bolts 56. Motor 55 comprises a cylinder 57 having a piston 58 operating therein. A rod 59 connected to piston 58 is guided for reciprocation in a bracket 60 secured to the right hand end of cylinder 57, as viewed in Fig. 1. A coupling 61 is pivotally secured to the free end of piston rod 59 and has attached thereto one end of a rod 62. The other end of rod 62 is secured to a second coupling 63 which in turn is pivotally attached to an arm 64 secured to a shaft 65. Shaft 65 extends across the lower side of the hopper as shown in Fig. 3, and is journaled in brackets 66, 66 secured to and extending outwardly from the corner upright members 18. Arms 67 and 68 also secured to shaft 65 near the opposite ends of the latter, respective-

ly, have pivotally attached to the ends thereof, the upper end of links 69, 69, the lower end of said links being pivotally attached at 70, 70, to the supporting side members 45 and 46 respectively, of the right hand gate 5. By virtue of the connections just described, it is apparent that when piston 58 moves to the right (Fig. 1) the gates 5 will swing in opposite directions to open position and vice versa, when piston 58 moves to the left the gates will be returned to closed position. Pipes 71 and 72 are connected to the left and right hand ends, respectively, of cylinder 57. These pipes communicate with a four-way valve 73 of any suitable construction. An inlet pipe 74 and an outlet pipe 75 also communicate with valve 73. By this construction when hand lever 76 of valve 73 is turned in one direction fluid will enter the left hand end of cylinder 57 through pipe 74, valve 73, and pipe 71 causing piston 58 to move to the right, thus opening gates 5. The fluid displaced by movement of piston 58 will flow through pipe 72, valve 73, and discharge pipe 75. When lever 76 is moved in the opposite direction fluid enters the right hand end of cylinder 57 causing piston 58 to move to the left and consequently causing the gates 5 to be swung to closed position. The fluid displaced by piston 58 will now flow through pipe 71, valve 73, and outlet pipe 75. The specific construction of valve 73 forms no part of the present invention and any well known valve of this type may be used.

The inner edges of gates 5 are serrated as shown at 77 (Fig. 3), and are spaced some distance apart to permit the water employed to quench the ashes to drain from the hopper. This water flows into a trough 78 extending longitudinally of the hopper beneath this opening. Owing to this comparatively large opening some of the smaller particles of ash will also discharge from the hopper when the ashes first enter the same. This matter may be removed from the trough when the latter is moved out of operative position. By providing a large opening clogging thereof is practically eliminated. When a certain quantity of ash has entered the hopper the larger particles will have covered to a certain extent, this opening and these particles of ash act as a screen and prevent further leakage of ash from the hopper but the opening never becomes so clogged as to prevent water from discharging from the hopper. This construction is a departure from the older constructions wherein but small discharge outlet openings were provided. In such constructions it often happened that lumpy particles of ash would collect against the screen and cause other particles of refuse to cling thereto with the result that the passage would soon become clogged to such an extent that the water would discharge over the sides of the gates rather than into the trough. The present construction corrects such conditions in that the discharge opening is sufficiently large to always permit the water to properly drain from the hopper.

The trough 78 is of substantially U-shaped cross section and is provided with a discharge fitting 79 intermediate the ends thereof. This fitting is secured to a spout 80 which in turn is secured to a vertical extension 81. Extension 81 is pivotally supported in the enlarged upper end 82 of a drain pipe 83 which leads to the main drain of the plant.

A vertical shaft 84, suitably journaled in bearings 85 and 86 provided on a bracket 87, secured to a centrally disposed upright member 18, ex-

tends into vertical extension 81. A collar 88 secured to shaft 84, and resting upon bearing 86, holds said shaft against downward movement. A second collar 90 is secured to shaft 84 to which the upper end of a link 91 is attached. The lower end of link 91 is attached to a rib 92 extending upwardly from spout 80. Link 91 acts as a brace for trough 78 and, as will presently appear, forms the operating connection between the trough 78 and shaft 84. Trough 78 may be swung bodily about pipe 83 as a pivot, and through its connection with shaft 84 by link 91, the shaft will also be rotated by this movement of the trough.

In order to prevent damage to trough 78 in case the gates 5 were opened before it had been moved out of the path of the ash, an interlock has been provided which compels movement of the trough to a remote position before the gates can be opened.

Referring more particularly to Figs. 1, 3, 5 and 10, it will be observed that a valve 94 is provided in pipe 71, a short distance beneath fluid motor 55. Valve 94 comprises inlet and outlet passages 95 and 96 respectively, which are separated by an apertured partition 97. A plunger 98 having an enlarged portion 99 secured thereto is normally urged against said aperture by a spring 100. The flow of fluid through pipe 71 is thus normally prevented and consequently the gates 5 cannot be opened until plunger 98 has been moved to inoperative position. An extension 101 is secured to the outer end of plunger 98 to which one end of a coupling 102 is pivotally attached. The other end of coupling 102 has secured thereto one end of a rod 103, the other end of which being secured to a second coupling 104. Coupling 104 in turn is pivotally attached to a laterally extending ear 105 integral with a collar 106 loosely mounted on shaft 84. Collar 106 is provided with a pair of vertically extending projections 107 and 108 arranged diametrically opposite about shaft 84. A pin 109 extends through shaft 84, the outer ends of which project into the spaces between projections 107 and 108. From the construction of the parts just described it is seen that trough 78 can be swung to inoperative position only by movement of shaft 84 in a clockwise direction, as viewed in Figs. 3 and 5. Owing to the lost motion connection between projections 107 and 108 and pin 109, shaft 84 must be rocked a considerable distance before the pin 109 will engage projections 107 and 108 to rock collar 106, which through the connections previously described between it and plunger 98, will move the latter to inoperative position and thereby permit fluid to enter the left hand end of cylinder 57. When pin 109 engages projections 107 and 108 trough 78 will have moved clearly out of the path of the ash and the gates may then be opened by simply turning lever 76 of valve 73 in such a manner that fluid will enter the left hand end of cylinder 57 through pipe 71.

It will also be observed that by virtue of this interlock, it is necessary to actuate the gates to closed position before the trough is restored to normal position, since if the trough were first moved to normal position valve 94 would be closed and piston 58 would be held against movement by a hydraulic lock.

For the purpose of illustration but one hopper has been shown, it being apparent that any number may be employed as desired. Referring to Fig. 2 it is seen that the end wall 110 of the upper section 6 of the hopper inclines upwardly and outwardly. The end wall of the next adjacent

hopper (not shown) slopes toward this wall and is connected thereto at the upper end thereof, thus forming a bridge between adjacent hoppers. By this construction no dead spaces are provided between the hoppers. The number of hoppers employed in a stoker furnace depends upon the width of the stoker. In some of the larger stokers four such hoppers are employed.

While the hopper described herein is admirably adapted to fulfill the objects primarily stated, it is to be understood that it is not intended to confine the invention to the one form of embodiment herein shown, since it may be embodied in other forms all coming within the scope of the claims which follow.

What is claimed is:

1. In a hopper having end and side walls, movable means normally closing the bottom opening of said hopper, a movable trough normally positioned beneath said movable means, operating mechanism for said movable means including a fluid motor, a four-way valve controlling the operation of said motor, a second valve normally preventing operation of said motor, means connecting said second valve with said trough whereby movement of said trough a predetermined distance from normal position effects opening of said second valve, to condition said motor for operation.

2. In a device of the class described, the combination with a hopper, comprising side and end walls terminating in a discharge opening and movable closure means normally closing said opening, of a trough positioned beneath said closure means and in operative relation therewith, means for pivotally supporting said trough whereby the latter may be moved out of operative relation with said closure means, fluid pressure means for actuating said closure means, a valve normally preventing operation of said fluid pressure means, and means operatively connecting said valve to said trough whereby movement of the latter a predetermined distance actuates said valve to ineffective position, thereby conditioning said fluid pressure means for operation.

3. In a device of the class described, the combination with a hopper comprising side and end walls terminating in a discharge opening, closure means normally closing said discharge opening, and substantially horizontally disposed means for pivotally supporting said closure means, of a horizontally disposed trough positioned beneath

said closure means in operative relation therewith, a spout secured to said trough, a substantially vertical extension secured to said spout, and means for pivotally supporting said extension whereby said trough may be moved out of operative relation with said closure means.

4. In a device of the class described, the combination with a hopper, comprising side and end walls terminating at one end in a discharge opening, and movable gate sections normally closing said discharge opening, of a trough normally positioned immediately beneath said gate sections, means for pivotally supporting said trough, means normally at rest for moving said gate sections to open or closed position, and means for conditioning said last mentioned means for actuation upon movement of said trough a predetermined distance from its normal position.

5. In a device of the class described, the combination with a hopper comprising side and end walls terminating at one end in a discharge opening, and movable gate means normally closing said discharge opening, of a movable trough normally positioned immediately beneath said gate means, mechanism normally at rest for moving said gate means to open or closed position, and means for conditioning said operating mechanism for actuation upon movement of said trough away from its normal position beneath said discharge opening.

6. In a device of the class described, the combination with a hopper comprising, side and end walls terminating in a discharge opening, closure means normally closing said discharge opening, and substantially horizontally disposed means for pivotally supporting said closure means, of a substantially horizontally disposed trough positioned beneath said closure means, a spout secured to said trough, a substantially vertical extension secured to said spout, means for pivotally supporting said extension whereby said trough may be moved out of operative relation with said closure means, operating mechanism for said closure means, control means for said operating mechanism, and means connecting said control means and said trough for rendering said control means ineffective upon movement of said trough, a predetermined distance from its position beneath said closure means to condition said operating mechanism for actuation.

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