No. 835,106. PATENTED NOV. 6, 1906.

J. R. FORTUNE.

BOILER FURNACE.

APPLICATION FILED SEPT. 11, 1905.

2 SHEETS—SHEET 1.

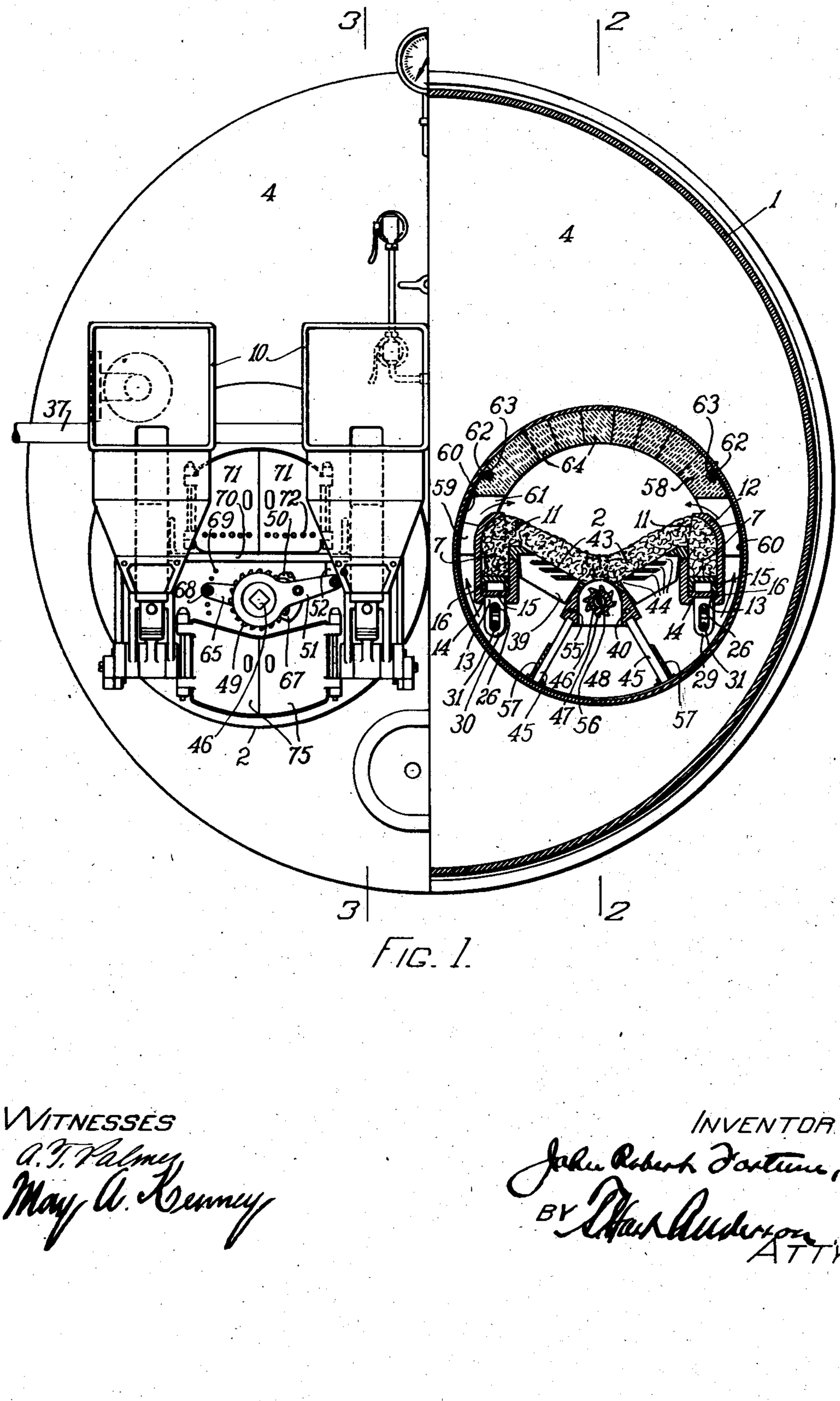

FIG. 1.

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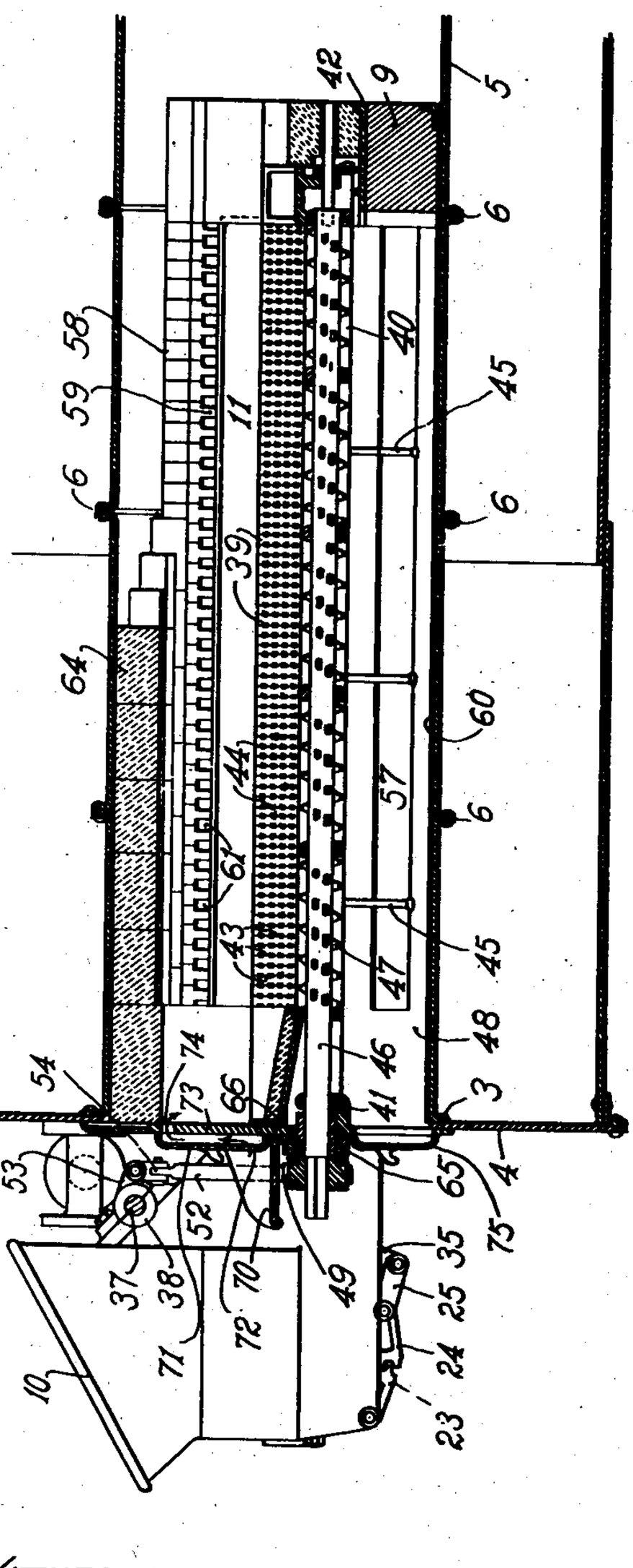

FIG. 2.

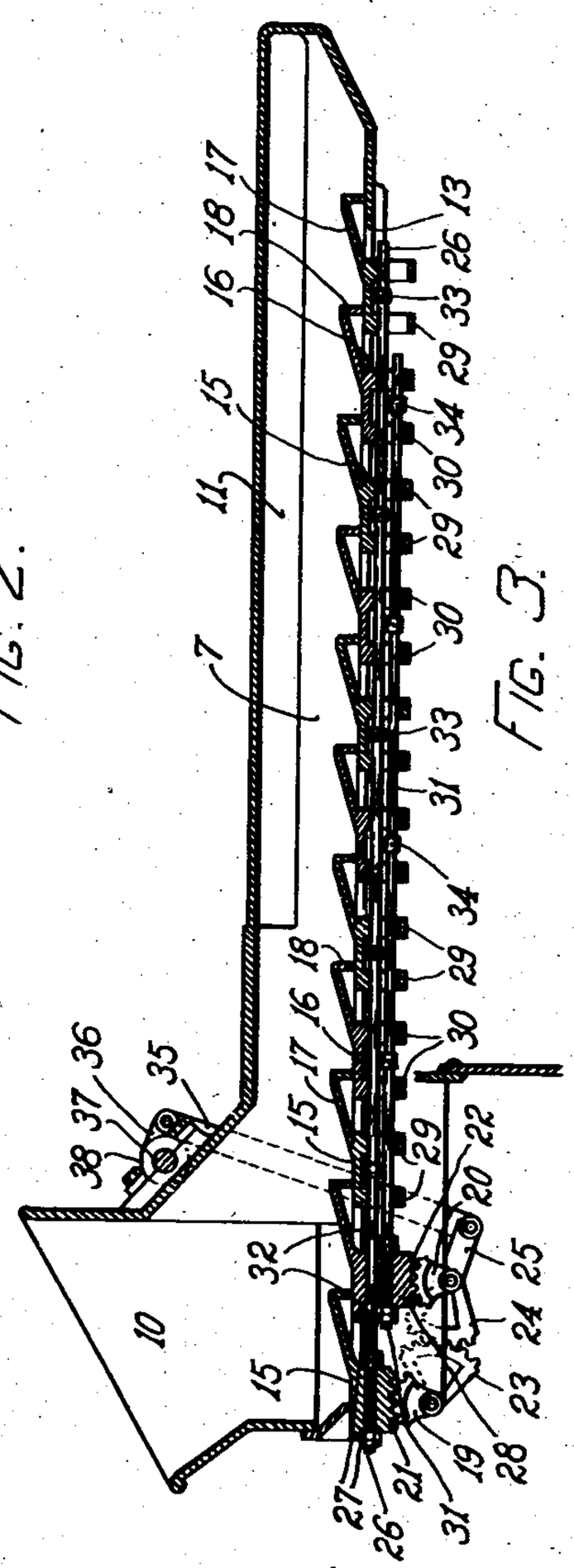

FIG. 3.

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UNITED STATES PATENT OFFICE.

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BOILER-FURNACE.

No. 835,106. Specification of Letters Patent. Patented Nov. 6, 1906.

Application filed September 11, 1905. Serial No. 277,802.

To all whom it may concern:

Be it known that I, JOHN ROBERT FORTUNE, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Boiler-Furnaces; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The present invention relates to improvements in boiler-furnaces, and more particularly to improved means for insuring the automatic feed and proper distribution of fuel to such furnaces.

The object of the present invention is to provide an automatic fuel-feeding apparatus for boiler-furnaces which shall be so constructed and arranged as to feed the fuel thereto regularly and evenly and maintain the height of the fire at a regular and predetermined height and generally to insure the proper combustion of the fuel and the gases generated thereby.

Further objects of the invention will appear in connection with the following description of its construction and mode of operation.

The invention, therefore, consists of the improvements in boiler-furnaces and fuel-feeding apparatus therefor, which will be hereinafter described and claimed.

The present invention is shown in the accompanying drawings, in which—

Figure 1 shows, in partial end elevation and partial vertical sectional views, a boiler equipped with my furnaces and stoking mechanisms. Fig. 2 shows a longitudinal sectional view through one of the furnaces, taken on the line 2 2 in Fig. 1. Fig 3 shows a longitudinal sectional view through one of the stokers, taken on the line 3 3 in Fig. 1.

Similar reference characters will be used throughout the specification and drawings to designate corresponding parts.

In the illustrated embodiment of my invention I have shown my improved furnaces and stoking mechanisms as being embodied in a so-called "Lancashire" boiler, in which 1 represents the outer shell, and 2 the improved furnaces and stoking mechanisms, of which there are two located within the shell of the boiler and suitably supported therein in any convenient manner—for instance, as by bolting them, as shown at 3, to the opposite end plate 4 of the boiler-shell.

Each of the furnaces consists of a cylindrical chamber 5, made up of cylindrical sections flanged and bolted together, as shown at 6, and within these cylindrical chambers are contained the grates and other parts of the furnaces, together with portions of the stoking mechanism.

The stoking mechanisms in the illustrated embodiment of my invention consist of feed-boxes 7, arranged upon opposite sides of the grate and extending parallel to each other and the grate, they being suitably supported at their inner ends upon a block 9 and at their forward ends by the front of the furnace and provided at their forward ends, outside of the front end plate 4, with open hoppers 10, into which the fuel will be shoveled and from which it will be fed into the feed-boxes 7 and discharged upon the grate and fire.

Each of the feed-boxes will be substantially rectangular in cross-section, as shown in the sectional view, Fig. 1, and will be provided with the discharge openings or slots 11 along the upper inner surfaces, and their upper surfaces will be curved inward, as shown at 12, Fig. 1, for a purpose to be hereinafter described.

Each of the feed-boxes 7 will be provided along its bottom with a longitudinal slot 13, narrower than the bottoms of the feed-boxes, thus providing the inturned supporting-flanges 14. (See sectional view, Fig. 1.) Upon these flanges 14 will be supported the reciprocating fuel feeders or pushers 15 and 16, each pusher being provided with an inclined fuel-elevating surface 17 and a substantially vertical fuel-pushing surface 18. (See Fig. 3 of the drawings.) These fuel-feeding pushers are arranged in two or more groups designed to have longitudinal reciprocating movements along the bottom of the hoppers 10 and feed-boxes 7.

As illustrated in the drawings, the fuel-feeding pushers are arranged in two groups, those marked 15 comprising one group and those marked 16 comprising the other group, and these two groups 15 and 16, as before stated, are arranged to have a simultaneous longitudinal reciprocating motion in opposite directions—that is to say, while the group 15 is moving toward the right, as the apparatus is illustrated in Fig. 3, the group 16 will be moved toward the left.

For the purpose of imparting this reciprocating movement to the groups of pushers any desired or suitable mechanism may be employed, that shown in the drawings, however, being the best form now known to me and comprising the segment-gears 19 and 20, engaging, respectively, with gear-teeth 21 and 22, formed upon the shanks of the initial pushers 15 and 16, respectively. (See Fig. 3.) The segment-gears 19 and 20 are connected to segment-gears 23 and 24, respectively, the segment-gear 24 being provided with a short arm 25, whereby it may be rocked, and thus through the segment-gear 23 transmit the rocking motion to the segment-gear 19, whereby the initial pushers 15 and 16 may be reciprocated in opposite directions.

For the purpose of imparting a like reciprocating movement to the other pushers of the groups of pushers the initial pusher 15 is provided with a rod 26, held thereto by nuts 27, which rod extends through a bearing 28 in the initial pusher 16 and thence through downwardly-extending slotted arms 29 of the pushers 15 and similar slotted arms 30 of the pushers 16, and the initial pusher 16 will be provided with a similar rod 31, held by nuts 32 to the shank of the initial pusher 16 and, like the rod 26, passing through the slotted arms 29 and 30 of the other pushers 15 and 16 of the series. The rod 26 will be provided with collars 33, fitting between the slotted arms 29 of the group of pushers 15, and the rod 31 will be provided with similar collars 34, fitting the space between the slotted arms 30 of the pushers 16.

From the foregoing description it will be observed that by means of the rods 26 and 31, respectively, and their connections with the pushers the entire group of pushers following the initial pushers 15 and 16 will partake of the reciprocating motions imparted to the initial pushers by the gears and segments before described and that as the group of pushers 15 moves in one direction the group of pushers 16 will simultaneously be moved in the opposite direction. It will be observed that the collars 33 and 34 are arranged to have some lost motion between the slotted arms of the pushers, and from this it follows that by making these collars either adjustable along their rods or else by the use of suitable washers limiting the play of any given one or more of the collars with relation to the slotted arms of the pushers the range of movement of these pushers may be varied, and it is the intention that the extent of movement of the pushers shall be reduced gradually from the forward toward the rear or from the left to the right, as shown in Fig. 3, so that the feed of the fuel shall be gradually reduced as it approaches the rear. Thus the pushers toward the left will deliver fuel to the succeeding pushers in the series of pushers and also will by their excess of movement cause the proper overflow of the fuel through the slot 11 into the fire and grate.

The action of the feeding-pushers is as follows: Supposing the hoppers to be filled with fuel and the groups of pushers reciprocating in opposite directions, those pushers which are moving toward the rear or inner end of the feed-boxes push the coal or fuel toward the inner end of the feed-boxes. The pushers which are moving in the opposite direction—that is to say, toward the hoppers—will by their inclined surfaces raise or elevate the mass of fuel and as they recede will leave a space in the mass of fuel into which the fuel which is being pushed by the other group of pushers will fall. Thus when the stroke is reversed the mass of coal will be pushed forwardly into the next succeeding pushers and toward the inner end of feed-boxes, and so on until it reaches a point where the pushers are not making so long a stroke owing to the adjustments before referred to. As the fuel approaches the inner end of the feed-boxes it is apparent that a portion of the fuel will not be fed onward so speedily as it is being fed at the front end of the stoker, and in consequence the mass of fuel as it approaches the rear end of the feed-boxes will be gradually added to, and in consequence the reciprocating movement of the pushers will give an upward movement to the whole body of coal above them by the accumulation of coal due to the gradual retardation of the feeding movement, and this accumulation and upward piling of fuel will cause it to pass out of the slots 11 and guided by the curved overhanging portions 12 of the feed-boxes the fuel will be deposited upon the fire and grate evenly and to a predetermined height, as shown in the sectional view, Fig. 1, the curved overhanging portions 12 of the feed-boxes leading the fuel onto the fire and grate.

For the purpose of rocking the arms 25 they will be connected, by means of links 35, to short crank-arms 36, fixed to a rock-shaft 37, supported to rock in suitable bearings 38 at the back of the hoppers, which shaft 37 will be given a rocking movement by any suitable power-driven mechanism. The shaft 37 will be connected to and operate the entire series of pusher mechanisms.

The grate of my improved furnace consists of bars 39, which are supported in an inclined position, as shown in the sectional view, Fig. 1, upon the inner wall of the feed-boxes 7 and upon a support or bearer 40, extending longitudinally through the furnace and supported at its forward end by a plate 41 and at its rear end by a bridge-plate 42. (See Fig. 2.) Each of the grate-bars 39 will be provided upon its opposite sides with ribs 43, bearing such angular relation to the longer parallel edges of the grate-bar that when the grate-bars 39 are supported as shown in sectional

view, Fig. 1, these ribs 43 will be in substantially horizontal planes, (see sectional view, Fig. 1 of the drawings,) and when the grate-bars are in position as shown in Figs. 1 and 2 these horizontal ribs 43, closely abutting each other, will form ducts or passages 44 and at the same time will prevent the fine coal or other fuel from falling through the grate, all of which will be clear from an inspection of the sectional view of Fig. 1 of the drawings. The bearer 40 will be also supported by the intermediate inclined supporting-standards 45.

Mounted in the bearer 40 is a clinker-bar 46, which, as shown, is provided with teeth 47 and which is arranged to rotate for the purpose of breaking up the clinker which will fall into the ash-pit 48. Preferably this clinker-bar 46 will have imparted to it intermittent step-by-step rotation, and this may be secured by a ratchet-wheel 49, secured to the angular forward end of the clinker-bar, and a rocking lever 51, mounted to freely rock upon the ratchet-wheel 49, which lever will be provided with a pawl 50, arranged to engage the ratchet-teeth of the ratchet-wheel 49, thus as the lever 51 is rocked imparting a step-by-step or intermittent turning movement to the clinker-bar.

Preferably the rocking movement of the lever 51 will be imparted from the shaft 37, to which said lever 51 is connected by a link 52, the link 52 being connected to the lever 51 by a universal joint (not shown) and to the crank-arm 53 by a universal joint 54.

From the foregoing it follows that as the shaft 37 is rocked to operate the reciprocating coal-pushers it will also, through the crank-arm 53 and its connections with the lever 51, rock the lever 51, thus through the pawl 50 imparting a step-by-step rotating movement to the clinker-bar, which will accordingly, by means of the teeth 47 thereon, break up the clinker and ash and cause it to fall into the ash-pit 48.

Preferably the bearer or support for the grate-bars 40 will be provided with longitudinal pipes or holes 55 and the clinker-bar with a similar pipe or hole 56, through which a current of water or air or other cooling medium may be passed, both for the purpose of prolonging the life of the bearer and clinker-bar and also for the purpose of cooling the clinker and making it more brittle, whereby it may be more readily broken up and removed from the fire by the clinker-bar.

Extending longitudinally along the furnace, below the grate and supported by the inclined supports 45, are the plates 57, forming beneath the feed-boxes suitable guards or dust-pits, in which is collected any combustible unconsumed fuel which may fall through the grate-bars or from the feed-boxes, and as such material accumulates it can be removed and shoveled back into the hoppers and again fed into the furnace. Resting upon the tops of the feed-boxes are the fire-bricks 58, each of which is formed as a segment of a circle and provided at its lower end with the rib 59, which, as shown in Fig. 1 of the drawings, passes down between the outer walls of the feed-boxes and an inner sheet-metal plate 60, and, as shown in Fig. 2, these ribs 59 when the fire-bricks 58 are in close contact form openings or air-passages 61, thus providing a circulation of air to the combustible gases discharged from the burning coal. These fire-bricks 58 are locked in position by the bars 62, attached to the sheet-iron plate 60, which engage recesses 63, formed in the back of the fire-bricks 58, the bricks being slid into position on the blocks or bars 62 from the front or the rear of the stoker.

Instead of the bars 62 being formed continuous they may be formed of a number of sections, each section being the length of the width of a single brick, and thus each alternate brick will be held by a section of the bar 62, while the adjacent or intermediate bricks will be held in position by the feed-boxes and the friction between their surfaces and the adjoining supported bricks.

At the forward part of the furnace and supported upon the bricks 58 are the segmental bricks 64, which extend entirely over the fire and grate and at the forward end of the furnace form an arch against which the gases or products of combustion in the forward part of the furnace will come in contact, and as this arch when the fire is burning becomes incandescent these gases and the products of combustion are thereby decomposed and readily united with the air admitted through the air passages or ducts 61. Such gases are of course at a very high temperature and will pass along the furnace at the top, and at the rear of the furnace where the arch is disconnected, these gases and products of combustion being of a very high temperature, will act in the same manner on the gases evolved from the fire as the incandescent arch does at the front of the furnace.

It is of course desirable to regulate the extent of movement imparted to the clinker-bar 46, and for this purpose there is provided a lever 65, pivotally mounted upon a boss or bearing 66, and which carries at one end a guard or shield 67, covering up a portion of the ratchet-teeth of the ratchet-wheel 49, and by adjusting the lever 65 with relation to the stroke of the pawl 50 this guard or shield 67 will hold the pawl out of contact with the teeth of the ratchet-wheel for a greater or less portion of the movement of the pawl. Thus the intermittent rotations of the clinker-bar 46 will be readily adjusted.

The position of the lever 65 and its adjustment will be maintained by means of a pin 68, which passes through a hole in said lever and into any one of a series of holes 69 in the front of the stoker. (See Fig. 1 of the drawings.)

For the purpose of preventing clinkers and coal falling into the mechanism for operating the clinker-bar there is provided a shield 70, extending across the front of the furnace and above the pawl-and-ratchet mechanism and just below the fire-doors 71. The fire-doors 71 will be provided with air-inlets 72 at their lower ends and upon their inner surfaces with liners 73, which will be provided with air-inlets 74 at their upper edges. Thus by the admission of air the liners are prevented from burning and at the same time air is admitted into the furnace. The furnace will also be provided with suitable ash-pit doors 75.

It is thought that the operation of my invention has been sufficiently disclosed by the foregoing description of its form and arrangement and that any further description of its operation will be found to be unnecessary.

Having described my invention, I claim as new and desire to protect by Letters Patent of the United States—

1. In combination, a boiler, a furnace, a hopper having a fuel-opening outside of the boiler, a feed-box connecting with the hopper, extending into the furnace and having a discharge-opening within the furnace, a plurality of overlapping pushers located within the feed-box and means for longitudinally reciprocating said pushers along said feed-box, substantially as described.

2. In combination, a boiler, a furnace, a hopper having a fuel-opening outside the boiler, a feed-box connecting with the hopper and extending into the furnace and having a discharge-opening within the furnace, a plurality of imperforate overlapping pushers located within the feed-box and comprising a plurality of groups of pushers, and means for alternately reciprocating the groups of pushers along said feed-box in suitable time relation and in an opposite direction to adjacent groups of pushers, substantially as described.

3. In combination, a boiler, a furnace, a hopper having a fuel-opening outside the boiler, a feed-box connecting with the hopper, extending into the furnace and having a discharge-opening within the furnace, a plurality of imperforate overlapping pushers located within the feed-box and arranged in two groups, the individual pushers in one group alternating with the individual pushers in the other group, and means for longitudinally reciprocating the groups of pushers along said feed-box, simultaneously in opposite directions, substantially as described.

4. In combination, a boiler, a furnace, a hopper having a fuel-opening outside of the boiler, a feed-box connecting with the hopper, extending into the furnace and having a discharge-opening within the furnace, a plurality of pushers located within the feed-box, means to longitudinally reciprocate said pushers, and means to independently vary the length of stroke of some of the pushers with relation to the length of stroke of others of said pushers, substantially as described.

5. In combination, a boiler, a furnace, a hopper having a fuel-opening outside the boiler, a feed-box connecting with the hopper, extending into the furnace and having a discharge-opening within the furnace, a plurality of longitudinally-reciprocating pushers located within the feed-box, a pair of reciprocating rods each rod connected with the alternate pushers and connected mechanism for reciprocating the rods simultaneously in opposite directions, substantially as described.

6. In combination, a boiler, a furnace, a hopper and its connected feed-box, the feed-box having a discharge-opening within the furnace, a pair of reciprocating rods, a plurality of pushers located within the feed-box and overlapping each other and the alternate pushers connected respectively with one of the reciprocating rods, substantially as described.

7. In combination, a boiler, a furnace, a hopper, a feed-box extending within the furnace and provided within the furnace with a discharge-opening, a plurality of overlapping pushers located within and arranged to reciprocate along said feed-box, reciprocating rods for operating said pushers and means whereby the movement of one of the pushers actuated by said rods may be adjusted independently of another of said pushers, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN ROBERT FORTUNE.

Witnesses:
T. HART ANDERSON,
MAY A. KENNEY.