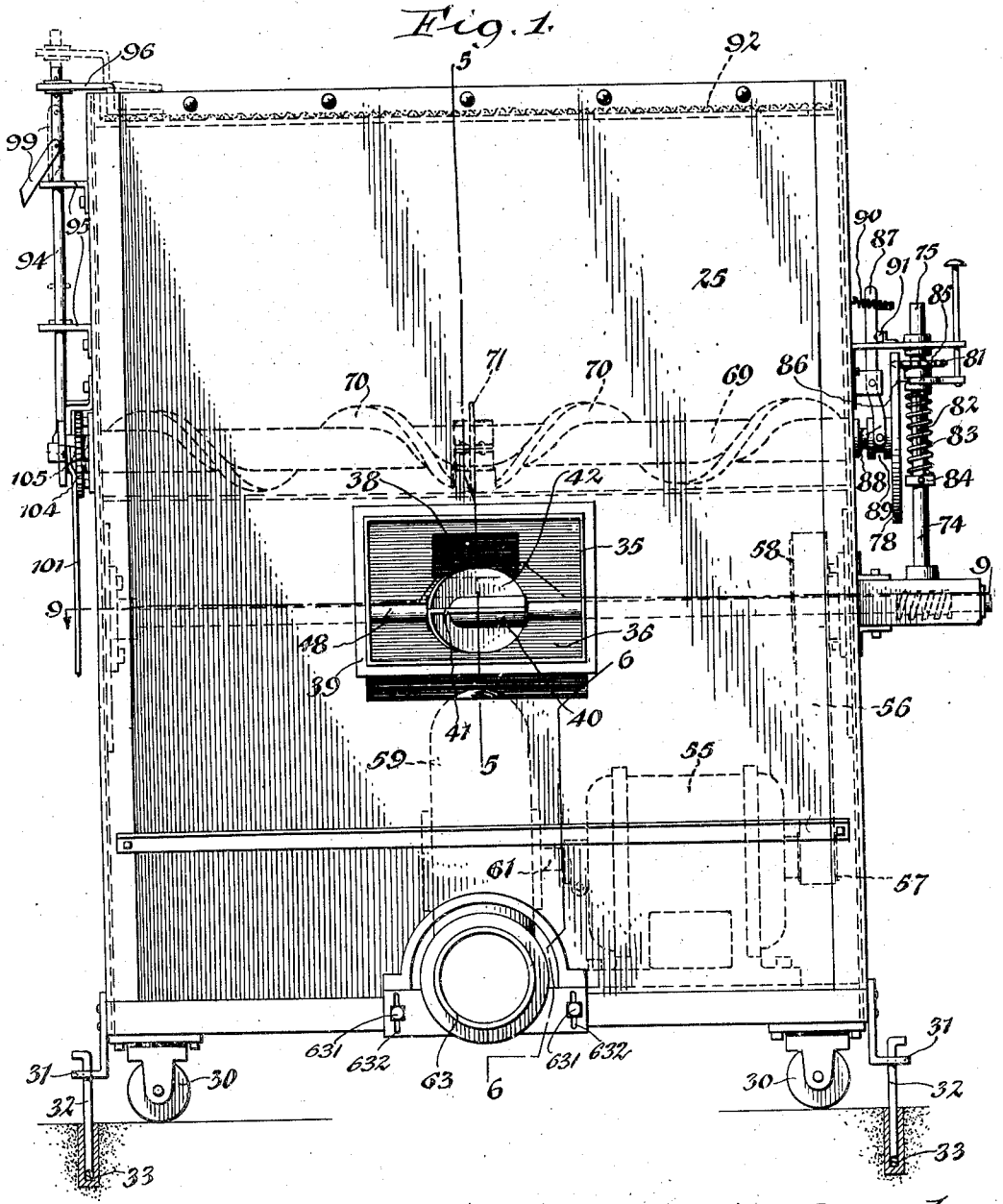
Dec. 25, 1928. 1,696,587

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STOKER

Filed Sept. 14, 1926 4 Sheets-Sheet 1

Fig. 1.




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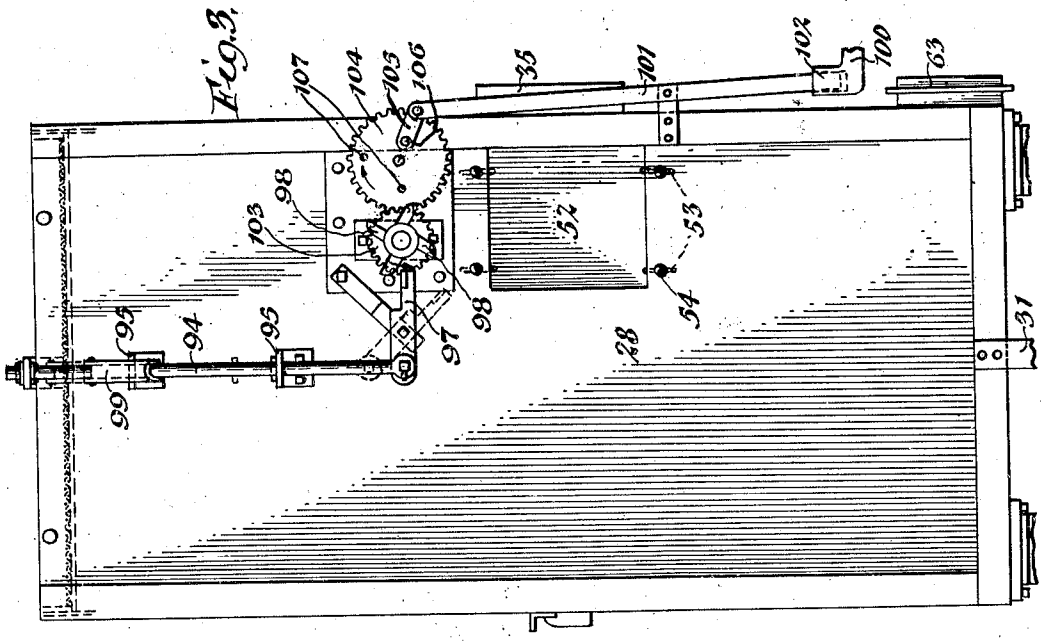
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Filed Sept. 14, 1926 4 Sheets-Sheet 2

Fig. 3.



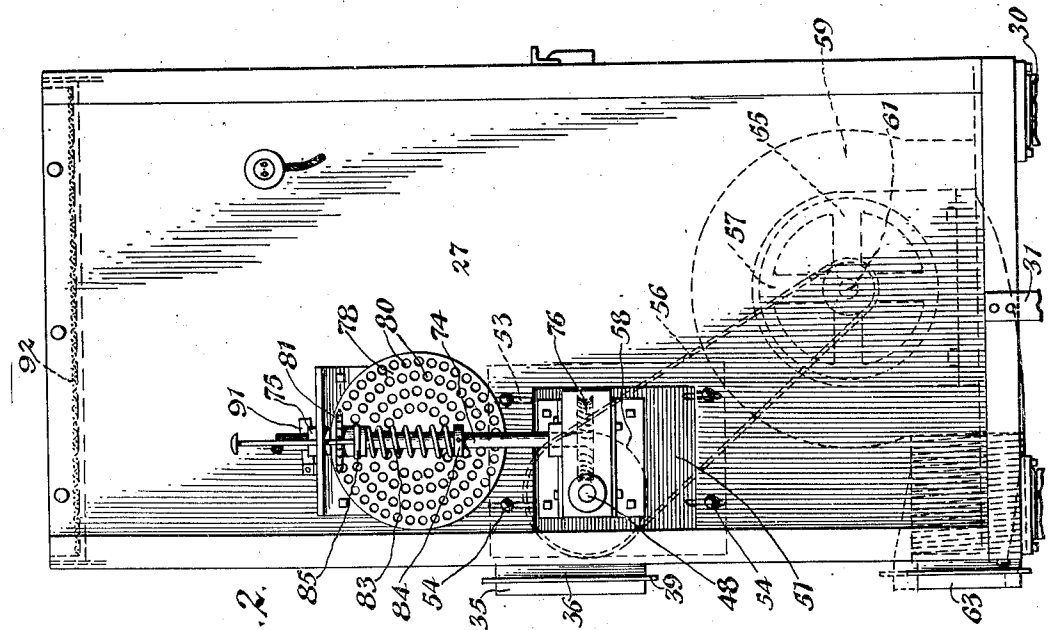




Fig. 2.

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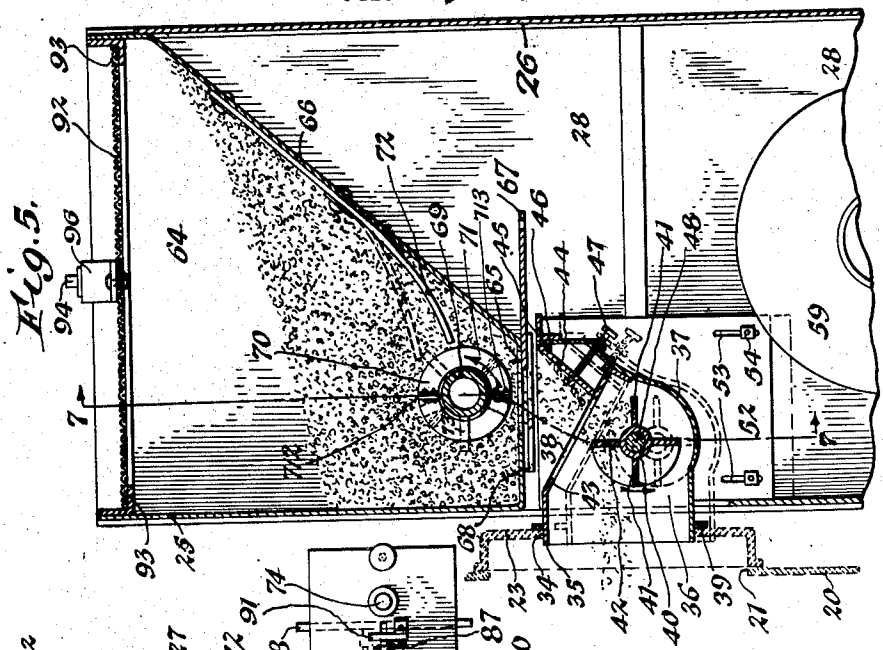


Fig. 5.

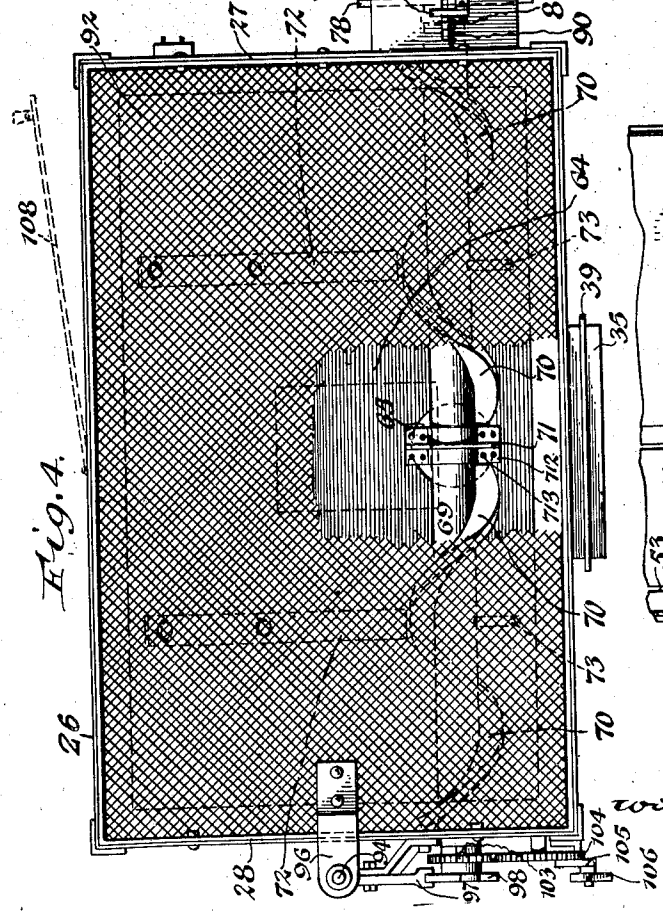


Fig. 4.

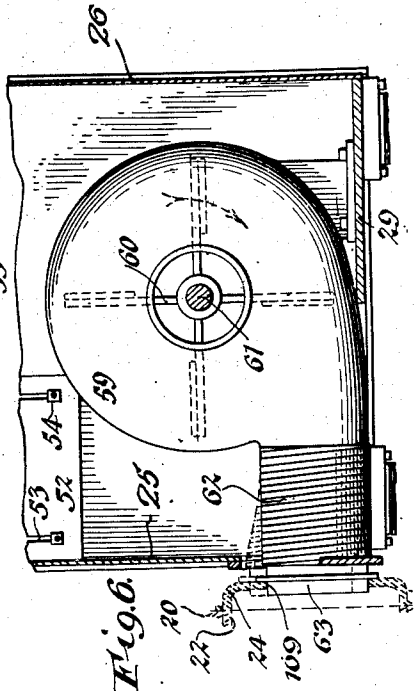


Fig. 6.

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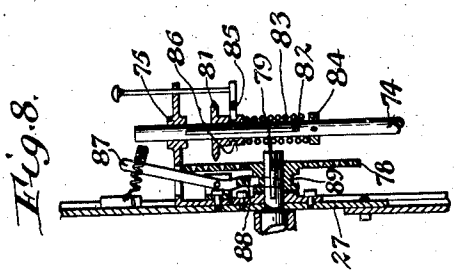


Fig. 8.

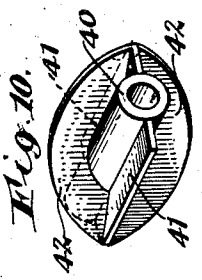


Fig. 10.

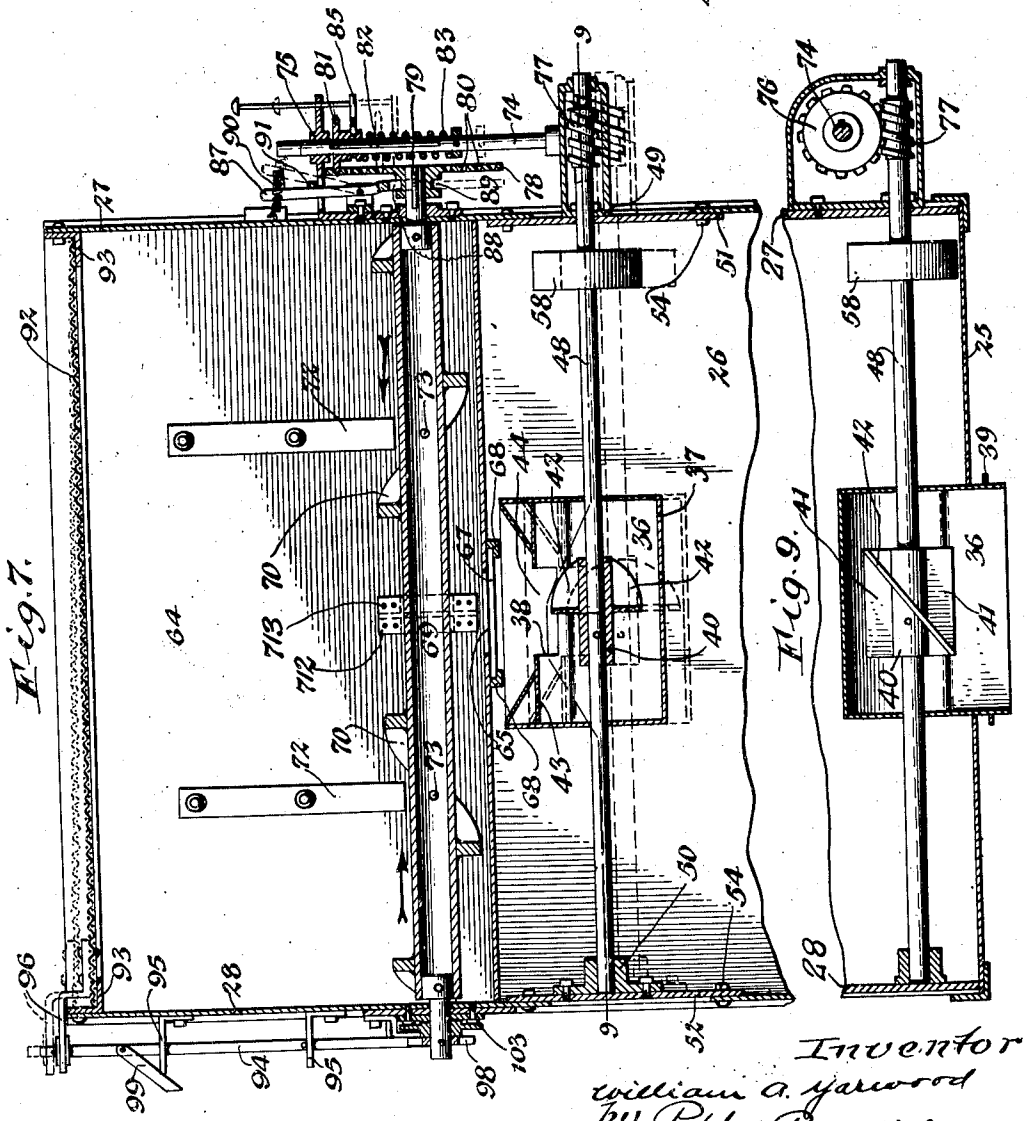


Fig. 7.

Fig. 9.

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# UNITED STATES PATENT OFFICE.

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## STOKER.

Application filed September 14, 1926. Serial No. 135,336.

This invention relates more particularly to an automatic stoker for feeding loose or granular fuel to furnaces in which the stoking mechanism is portable and movable into and out of operative relation to the furnace, but certain features of the same are also capable of use in a stoker which may be permanently installed in relation to the furnace.

The object of this invention is the provision of a stoker of this character which is positive in action, which will reliably and uniformly distribute the fuel over the bed of fire, and which can be readily and easily adjusted to suit different conditions.

In the accompanying drawings:

Figure 1 is a rear elevation of a stoker embodying my invention. Figures 2 and 3 are side elevations of the same viewed from the left and right hand sides thereof respectively. Figure 4 is a top plan view of the stoker, with part of the separating screen broken away. Figures 5 and 6 are vertical longitudinal sections taken on lines 5—5 and 6—6, Fig. 1, respectively. Figure 7 is a vertical longitudinal section taken on line 7—7, Fig. 5. Figure 8 is a fragmentary vertical section of the speed changing mechanism shown in Fig. 7, but in a different position. Figure 9 is a horizontal section taken on line 9—9, Fig. 1. Figure 10 is a perspective view of the paddle whereby the fuel is broadcast or distributed over the fire bed.

Similar characters of reference indicate like parts in the several figures of the drawings.

This stoker is applicable to furnaces of various types and constructions and it has therefore been deemed sufficient to merely indicate in the drawings, Figs. 5 and 6, a furnace having a rear wall 20 having an upper feed passage or opening 21 leading to the fireplace above the grate, and an ash passage or opening 22 leading to the ash pit below the grate, a feed door 23 for closing the feed opening, and an ash door 24 for closing the ash opening.

In its general construction this stoker comprises a main frame having the form of an enclosing casing, the upper part of which contains a storage bin for the fuel, and the lower compartment, an agitating mechanism arranged in the storage bin, and fuel delivery mechanism arranged in the lower compartment. The enclosing casing preferably comprises upright rear, front and side walls 25, 26, 27, 28, and a bottom 29 which partly closes the lower end thereof, these parts being constructed of sheet metal or other durable material. For convenience in shifting this casing and the parts mounted thereon as a unit into and out of its operative position relative to the furnace the same is mounted on wheel casters 30 adapted to run freely on the floor of the furnace room.

Means are provided for holding the casing and the stoker mechanism thereon in a definite position relative to the furnace when the parts are in operation, for which purpose detachably fastening means of any suitable character may be employed, those shown in the drawings consisting of brackets 31 mounted on the lower parts of the casing, retaining pins 32 movable vertically in said brackets, and sockets 33 arranged in the floor and adapted to receive said retaining pins. When these pins are interlocked with these sockets the stoker is positively held in the proper position relative to the furnace, but when these pins are withdrawn from the sockets, then the stoker may be moved away from the furnace so as to render the latter more accessible for inspection, cleaning and repairing.

In the central part of the fuel door of the furnace the same is provided with an opening 34 which is adapted to receive the discharge nozzle 35 on the rear side of a fuel delivery chamber 36, which latter has a curved lower side 37 and provided in its upper side with an inlet opening 38 for the admission of granular fuel such as fine coal. Around its rear end the nozzle is provided with a collar or flange 39 which is adapted to fit against the fuel door around the central opening therein and produce a tight joint therebetween.

Within the delivery chamber is arranged a paddle which rotates about a horizontal transverse axis whereby the fuel is not only ejected from the delivery chamber into the furnace in the form of a stream but the same is also broadcast horizontally so that it is spread and distributed uniformly over the fire bed of the furnace. In its preferred construction this paddle wheel comprises a hub 40, two radial blades or wings 41, arranged parallel with the axis of the hub, and projecting radially from diametrically opposite sides thereof, and two oblique blades or wings 42 projecting laterally from opposite sides of the hub, and arranged at right angles to said longitudinal radial blades, each of said oblique blades extending across the axis of

said hub from one side to the other, and both of said oblique blades being arranged in the same plane. This paddle wheel is revolved so that its upper side moves toward the outlet of the fuel delivery chamber whereby the granular fuel entering the upper part of the delivery chamber will be struck by the wings on the upper side of the paddle wheel and be thereby thrown through the outlet of the delivery chamber into the fire box of the furnace. As the paddle wheel rotates its longitudinal radial blades upon striking the fuel will deliver the same straight ahead, but when one of the oblique blades strikes the fuel the same will be thrown obliquely into the fire box toward one side thereof, and when the oppositely inclined oblique blade of the paddle wheel strikes the fuel the same will be thrown obliquely into the fire box toward the opposite side thereof, thereby causing the paddle to broadcast the fuel over the entire fire bed and insuring uniform burning of the fuel and steady generation of heat.

The top 43 of the fuel delivery chamber which contains the inlet openings 38 is preferably inclined forwardly so that fuel dropping on the same slides forwardly and falls on the front part of the paddle wheel, whereby the latter is enabled to deliver the most effective blow against the fuel for driving the same into the fire box. The extent which the fuel can thus move forwardly relatively to the paddle wheel may be regulated by an adjustable deflector 44 arranged in front of the fuel inlet of the delivery chamber and pivotally connected at its upper edge by a pin 45 or the like to an upward extension 46 of the fuel delivery chamber, and an adjusting screw 47 arranged in said extension and engaging with the lower part of the front side of said deflector, as shown in Fig. 5. By turning the screw 47 in one direction or the other the place at which the fuel is delivered to the paddle wheel by the deflector may be varied to suit different conditions.

The paddle wheel is revolved by mounting the same on a horizontal shaft 48 extending transversely through the side walls of the delivery chamber and journaled in bearings 49, 50 mounted on carrying plates 51, 52, which latter are mounted on the side walls of the casing so as to be capable of vertical adjustment on the casing and thereby enable the outlet of the fuel delivery chamber to be fitted to fuel doors of furnaces of various designs and locations. This adjustment is preferably effected by providing the carrying plates 51, 52, with vertical slots 53, which receive horizontal bolts 54 connected with the adjacent parts of the casing side walls, as shown in Figs. 5, 6, and 7.

The paddle wheel shaft 48 may be rotated by any suitable means, those shown in the drawings Figs. 1 and 2, consisting of an electric motor 55 mounted on the bottom of the casing and a driving belt 56 passing around a driving pulley 57 on the shaft of the motor and a driven pulley 58 on the paddle shaft 48.

In order to create a forced draft through the fire and cause the fuel to burn briskly means for supplying air under pressure to the ash pit are provided. These means include an air blower having a casing 59 arranged within the lower part of the main frame or casing and mounted on the bottom 29 and having its fan blades 60 mounted on a shaft 61 which forms an extension of the shaft of the motor 55. The outlet of the blower casing is a flexible extension 62, such as flexible metal hose or tubing, which latter terminates in a delivery nozzle 63 which fits into an opening 109 in the ash pit door 24. By this means the blower can be connected with furnaces for supplying air thereto notwithstanding that their ash pit doors are variously located, thereby enabling this apparatus to be readily installed without requiring special fittings to suit different locations of ash pit doors.

Within the upper part of the main frame or casing is arranged a storage bin or hopper 64 which is adapted to hold a supply of pulverized, granular or small sized fuel, such as coal, and which is provided in its bottom with an outlet 65, through which the granular fuel flows from the storage bin into the inlet of the delivery chamber. The outlet may be varied in size for controlling the flow of fuel therethrough as required by means of an adjustable closure which in this instance consists of a horizontally movable slide 67 guided in suitable ways 68 at the lower end of the storage bin.

The bottom of the storage bin is flat and the outlet of the same is in the central part of this bottom. In order to cause the fuel to flow freely through this outlet a conveyer is provided which propels the fuel inwardly from opposite sides of this bin along the bottom toward the outlet thereof, which conveyer may be of any suitable construction but preferably consists of a shaft 69 journaled in bearings on the side walls of the bin and provided with right and left conveyer flights or screws 70, 70, which carry the material from the sides of the bin to the outlet of the same. In order to prevent one of the screw conveyers from pushing the coal or fuel past the outlet opening 65 and interfering with the propulsion of fuel by the other screw conveyer a baffle is mounted on the propeller shaft between the opposing inner ends of the conveyer screws against opposite sides of which the fuel is pushed by these screws. This baffle preferably has the form of a disk which is arranged transversely on the conveyer shaft and divided diametrically into two sections 71, 71, which are secured to each other and against opposite sides of the conveyer

shaft so that the same can be readily replaced when worn out, without dismantling the machine.

For this purpose the baffle sections are provided on their opposing edges with laterally projecting radial flanges 712 which are detachably connected with each other by bolts 713. By this means these flanges serve the additional purpose of delivery wings which upon rotating with the conveyer shaft, cause the fuel which is forced against the baffle to be thrown downwardly from the bin through its outlet 65 and into the delivery chamber, thereby preventing the apparatus from becoming clogged at this point.

For causing the fuel to remain in a loose and free flowing condition in the bin on opposite sides of its outlet, means are provided for agitating the same, and also jarring the inclined rear wall 66 of the storage bin. In their preferred form these means consist of two agitating bars 72 of spring metal arranged in the bin on opposite sides of the outlet 65 and connected at their front ends with the front wall 66 of the bin and tappets 73, having the form of pins secured to the conveyer shaft and adapted during the rotation of the latter to lift the rear ends of the agitating bars and then suddenly release them, thereby stirring the coal and keeping the same from packing and flowing sluggishly. Although various means may be employed for revolving the bin conveyer, it is preferable to employ for this purpose a variable speed gearing which is interposed between the paddle wheel shaft and one end of the conveyer shaft. This change speed gearing may also be employed as a clutch for operatively connecting and disconnecting the conveyer with the driving mechanism and thus permit of arresting the feed of fuel to the furnace when there is a liability of feeding in excess of requirements, but still permitting the blower to operate in order to supply the air necessary for rapid and most efficient combustion. This combined clutch and change speed gearing, as shown in Figs. 1, 2, 4, 7, 8 and 9 is constructed as follows:

The numeral 74 represents an upright intermediate shaft which is capable of turning and sliding at its upper end in a bearing 75 on the adjacent wall of the casing while its lower end is provided with a worm wheel 76 meshing with a worm 77 on the paddle shaft. On the corresponding end of the conveyer shaft a driven gear wheel 78 is mounted by a spline 79 so that this wheel is capable of sliding on said shaft and also compelled to turn therewith. This wheel is provided with a plurality of concentric rows of gear openings 80 which may selectively be engaged with the teeth of a gear pinion 81 which is slidable lengthwise on the intermediate shaft 74 but compelled to turn therewith by a spline 82. This pinion is yieldingly held in its uppermost position by a spring 83 interposed between its underside and a collar 84 on the intermediate shaft and may be depressed by a handle guided on the frame and provided with a fork 85 engaging with an annular groove 86 in the hub of the gear pinion 81 for bringing the latter in line with the desired row of gear openings in the gear wheel 78. When this is done the latter may be shifted lengthwise of its axis for engaging the selected row of its gear openings with the driving gear pinion 81, this being preferably accomplished by a shifting lever 87 pivoted on the frame and provided on one arm with a fork 88 engaging with a groove 89 in the hub of the driven gear wheel 78 while its opposite arm is connected by a spring 90 with the frame for yieldingly holding the driven gear wheel 78 in engagement with the driving pinion 81. For the purpose of holding the driven gear wheel 78 positively in engagement with the driving pinion 81 a locking latch 91 is provided which is pivoted on the main frame and moved into engagement with the outer side of the upper arm of the shifting lever 87 after the parts have been shifted to the desired position, as shown in Figs. 2, 4 and 7 and thereby retain them against accidental displacement.

The fine coal to be fed automatically by the stoker to the furnace is introduced into the bin through the upper end thereof, but to ensure the best results means are provided for screening the coal as the same is delivered to the bin and effect a separation of larger particles which otherwise might interfere with the proper working of the apparatus and the distribution of the same over the bed of fire. The means for this purpose shown in the drawings are constructed as follows:

The numeral 92 represents a screen which extends over the inlet in the top of the coal bin and is loosely supported at its edges on inwarly projecting flanges 93 secured to the upper part of the coal bin. The coal to be fed to the furnace is deposited on this screen and that which is sufficiently fine passes through into the bin while the large lumps remain on top of the screen and are removed from time to time. To facilitate the screening operation the screen is vibrated or shaken and this is accomplished by a vertically reciprocating shaking rod 94 guided in brackets 95 arranged on the side of the bin and loosely connected at its upper end with a shaking arm 96 projecting laterally from one end of the screen, a rock lever 97 pivoted on the adjacent part of the bin and loosely connected with its front arm to the lower end of the shaking rod 94, and a tappet wheel arranged on the adjacent end of the conveyer shaft and having a plurality of tappets 98 adapted to engage successively with the rear arm of the rock lever 97, and thereby cause the screen to be intermittently

lifted and dropped so as to effect a separating action on the coal deposited thereon.

When the coal bin has been filled with fuel and it is desired to stop the vibration of the screen this can be done by a hold out latch 99 pivoted on the upper part of the shaking rod by a horizontal pin and adapted to hang idly along one side of the guide brackets 95 when the jarring mechanism is in operation, as shown in Figs. 1, 3 and 7, at which time the shaking lever is within reach of the tappets. When it is desired to stop the jarring action on the screen the shaking rod is raised by hand sufficiently higher than its normal upward stroke to permit of engaging the lower end of the holdout latch with the adjacent bracket, as shown by dotted lines in Fig. 1, in which position of the parts the rock lever 97 is turned so that its rear arm is out of the path of the tappets 98 and the latter are therefore unable to jar the screen.

This stoking apparatus may also be coupled with the reciprocating bar 100 forming part of the mechanism for shaking the grate of the furnace. Various means may be employed for this purpose, those shown in the drawings being satisfactory and consisting of an upright shaking lever 101 pivotally mounted on the stoker and detachably connected at its lower end with the shaking bar by providing the latter with a socket 102 which receives the lower end of said shaking lever, a driving gear pinion 103 secured to the conveyer shaft and meshing with a driven gear wheel 104 pivotally mounted on the adjacent part of the stoker frame, and a link 105 connecting the upper arm of the shaking lever 101 with a crank pin 106 on the side of the driven gear wheel 104, as shown in Figs. 1, 3 and 4.

As the conveyer in the coal bin turns the shaking lever 101 is also rocked and causes the shaking bar 100 and the parts of the furnace grate connected therewih to be shaken so that the ashes are dropped from the grate in the same measure that new fuel is deposited thereon. In order to permit of varying the shaking effect on the grate to suit different conditions the driven sprocket wheel 104 is provided with a plurality of openings 107 which are arranged different distances from the axis of this wheel so that by securing the crank pin 106 in one or the other of these openings the throw of the lever 101 and the shaking effect on the grate may be varied accordingly.

In order to render the interior of the enclosing casing accessible for inspection and repair purposes the front wall of the enclosing casing may be provided with a swinging door 108, as shown by dotted lines in Fig. 4.

When fitting this stoker to a particular furnace it is only necessary to raise or lower the outlet 35 of the delivery chamber to fit the coal door 34 and then tighten the clamping bolts and also raise or lower the outlet nozzle 63 of the blower, to fit the ash pit door and thus hold the latter in place by bolts or screws 631, passing through slots 632 in lugs on this outlet and into the frame. After these parts have been once adjusted, the same do not require another adjustment inasmuch as the stoker can be removed from the furnace and returned to its operative position without disturbing this adjustment.

I claim as my invention:

1. A stoker comprising a delivery chamber having an inlet and an outlet for granular fuel, and a paddle wheel rotatable in said chamber and having a longitudinal blade adapted to throw the fuel straight ahead and two oblique blades which are arranged in the same plane and on opposite sides of the axis of rotation and are adapted to throw the fuel obliquely in opposite directions.

2. A stoker comprising a delivery chamber having an inlet and an outlet for granular fuel, and a paddle wheel rotatable in said chamber and having two longitudinal radial blades projecting from diametrically opposite sides of the axis of the paddle wheel and two oblique blades projecting laterally from opposite sides of the axis of the paddle wheel and arranged at right angles to said longitudinal radial blades, each of said oblique blades extending across the axis of said paddle wheel and both of said oblique blades being arranged in the same plane.

3. A stoker comprising a main frame having side walls, a delivery chamber having a fuel inlet and a fuel outlet, a paddle wheel arranged within said chamber, a shaft carrying said paddle wheel and extending through said chamber and supporting the latter, bearings in which said shaft is journaled, and plates carrying said bearings and mounted for vertical adjustment on the side walls of the frame.

In testimony whereof I hereby affix my signature.

WILLIAM A. YARWOOD.