

July 2, 1935.

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2,006,357

FUEL FEEDING APPARATUS

Filed May 18, 1932

3 Sheets-Sheet 1

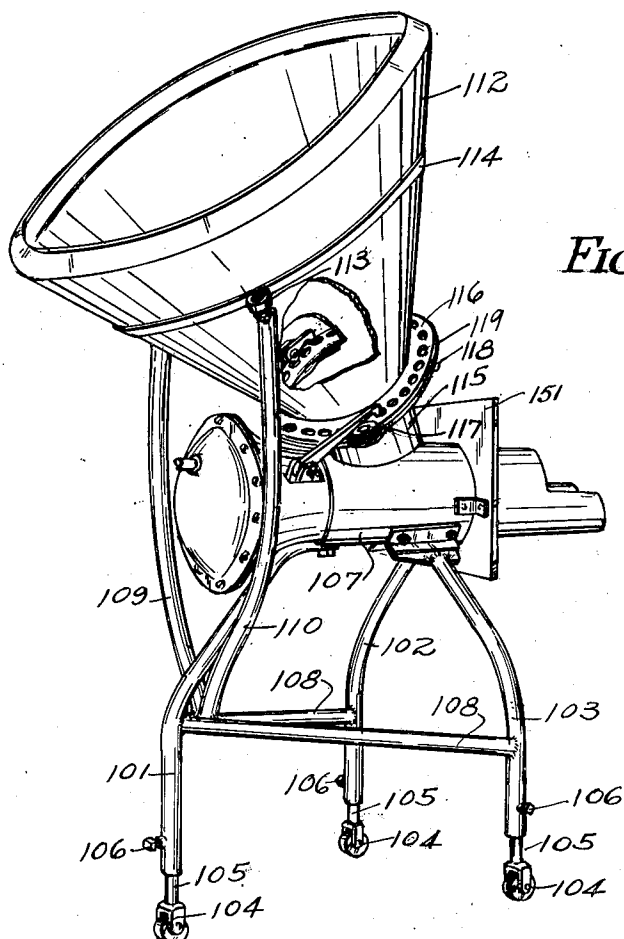


FIG. 1

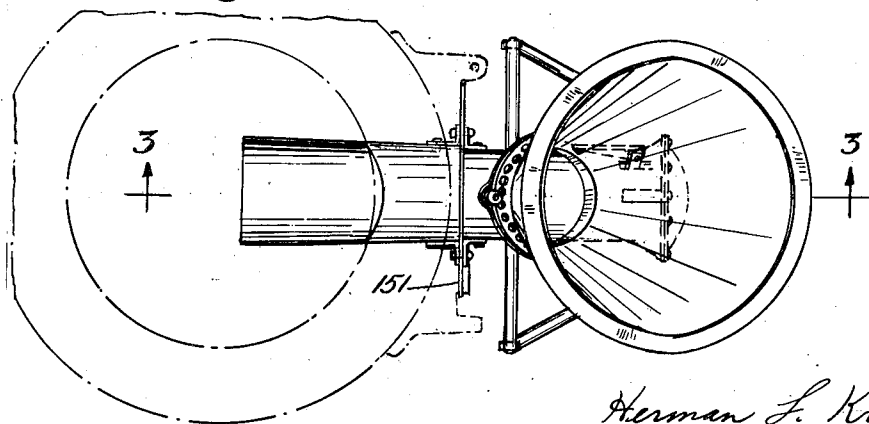


FIG. 2

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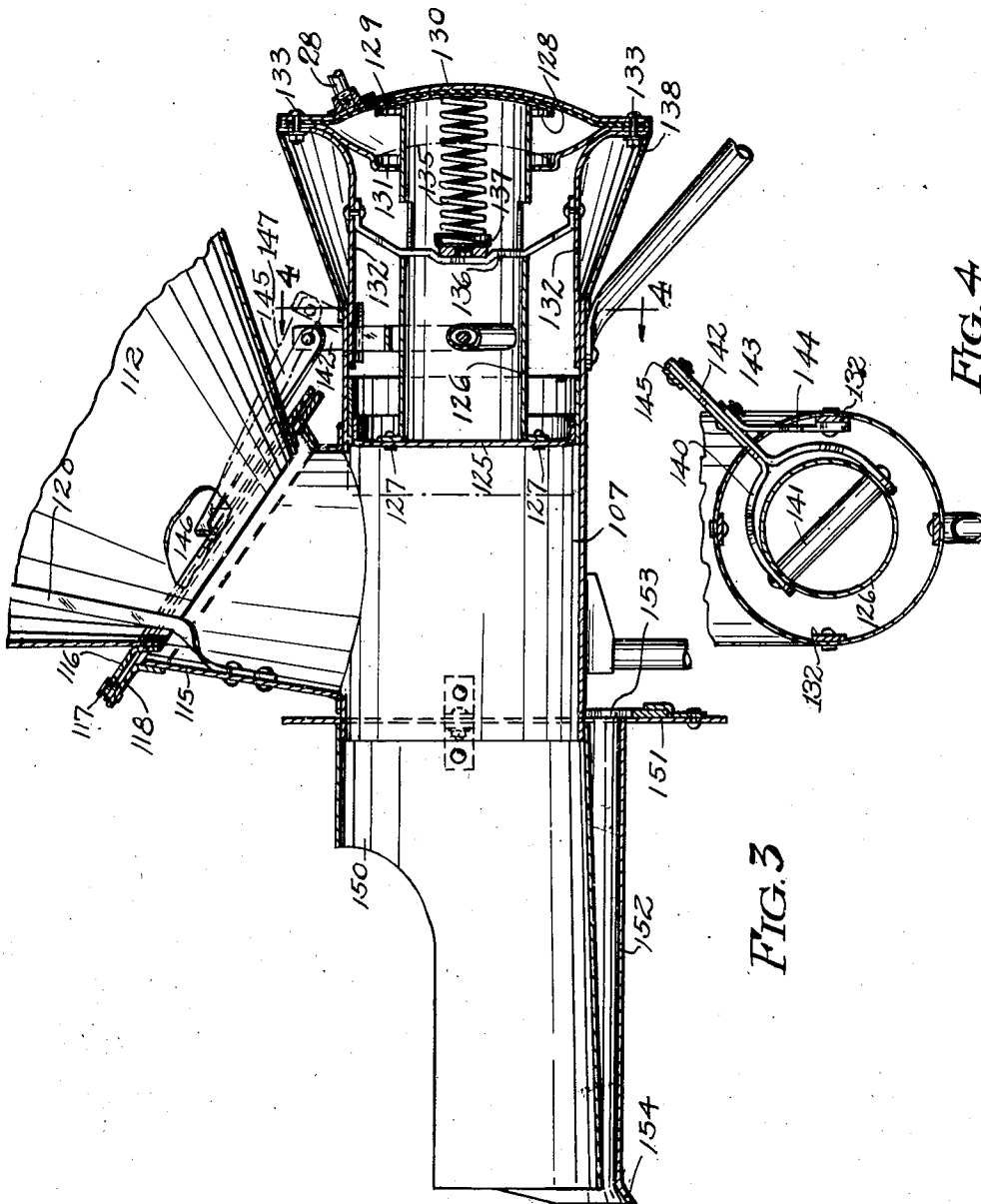
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3 Sheets-Sheet 2



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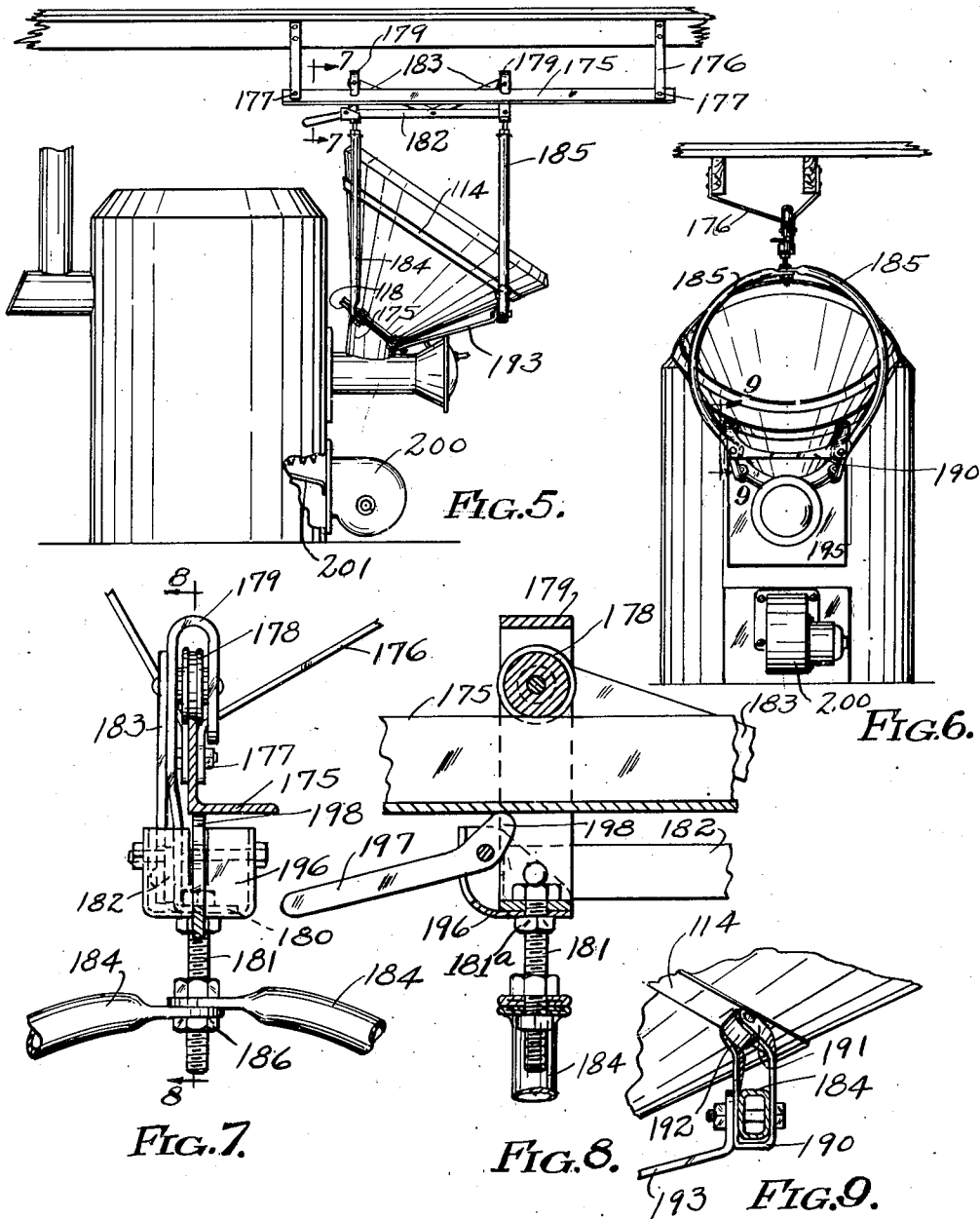
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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FUEL FEEDING APPARATUS

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Application May 18, 1932, Serial No. 611,985

8 Claims. (Cl. 110—101)

This invention relates to a fuel feeding system, and more particularly to stokers designed for use in connection with domestic heating systems.

In recent years a demand has arisen for a coal feeding system suitable for use in small installations which will give the user substantially the same convenience and even temperature as a gas or oil system and at the same time operate with the usual economy of coal. At the present time several more or less automatic stoking devices, intended especially for use in small or domestic installations are on the market. Such stokers have generally been quite satisfactory, but the expense of construction, installation, operation and maintenance has been so great as to substantially counter-act the economy gained by burning cheaper fuel. Accordingly, the general object of my invention is to provide a stoker which can be manufactured economically and installed readily in almost any usual type of furnace.

Other objects of my invention are to provide a stoker which can be manufactured almost entirely out of pressed metal; to provide a stoker which can be adapted to any ordinary furnace without change, except for slight adjustment which may be readily made; to provide an over-feed stoker of the plunger type, in which very small quantities of coal are fed with each stroke of the plunger and whereby a firebed of the desired thickness may be maintained with very little variation; to provide an over-feed stoker which may be moved into operating position before any ordinary furnace and which is provided with means for securely holding the stoker in position.

Other objects are to provide a stoker having a rotating hopper, whereby arching of the coal in the hopper is prevented and whereby the hopper may be disposed at a more accessible loading angle without preventing the coal from sliding into the coal-delivery tube; and to provide an overhead support for the stoker motor and the rotating hopper.

Further objects and advantages of my invention will become apparent from the following detailed description thereof, reference being had to the accompanying drawings. The essential characteristics are summarized in the claims.

Referring to the drawings, Fig. 1 is a perspective of the stoker; Fig. 2 is a top plan view of the stoker, in place before a furnace, the furnace being indicated by dot and dash lines; Fig. 3 is a section along the line 3—3 of Fig. 2; Fig. 4, is a vertical section, taken along the line 4—4, of Fig. 3; Fig. 5 is a side elevation showing a modified

form of my stoker in which an overhead support for the stoker is provided, and in connection with which a blower is employed to provide a forced draft; Fig. 6 is an elevation of the device shown in Fig. 5, viewed from the rear of the stoker and looking toward the furnace; Fig. 7 is a section taken along the line 7—7 of Fig. 5; Fig. 8 is a section as indicated by the line 8—8 of Fig. 7, and Fig. 9 is a sectional detail on the plane indicated by the line 9—9 on Fig. 6. In the description of the apparatus hereinafter set forth, I refer to that part of the stoker mechanism remote from the furnace as comprising "the rear" of the mechanism.

Briefly, my invention contemplates an over-feed stoker, mounted on a carriage or suspended from a trolley, which may be rolled up to position before any furnace, so that the fuel delivery tube or conduit will project through the furnace door and into the firebox. The coal is forced into the furnace by means of a plunger, which may be actuated by a diaphragm motor, or other convenient means for reciprocating the plunger, the plunger being disposed co-axially with the fuel delivery conduit, and working therein. A hopper is mounted above the fuel delivery conduit and coal is discharged by gravity from the hopper into the conduit and there the plunger forces it through the fire box door. In order to prevent arching of the coal and clogging of the hopper, in case a wet, or dust-proofed coal is used, the hopper is rotatably mounted, and is rotated by means of a ratchet connection driven by the stoker motor.

The motor in the present application is designed for only a very short stroke, generally less than one third of the distance across the opening of the hopper into the delivery tube or conduit. The motor may be controlled by an convenient mechanism, but the control mechanism forms no part of the present invention and is not illustrated herein.

The delivery tube may be cooled by an air jacket arrangement whereby cool air is admitted beneath the tube to prevent it from burning, the air entering from outside of the furnace. As the coal is gradually pushed into the delivery tube it falls onto a spreader member, and is distributed evenly throughout the furnace. The entire mechanism is constructed almost entirely from pressed metal parts, and is arranged so that it may readily be adapted to almost any design of furnace.

The stoker is designed so that it may be used in connection with any ordinary type of domestic furnace or boiler without making any substantial

changes or alterations in the furnace or in the stoker. I propose the use of a comparatively large hopper capable of holding sufficient fuel to heat an average size dwelling for from 24 to 36 hours during normally cold weather and this hopper is brought into revoluble relation to the fuel feed tube in such manner that the hopper and tube can be efficiently supported by a carriage means which is conveniently shiftable toward and away from the furnace fire door. In the drawings I show both an under carriage and an over carriage means for thus supporting the hopper and tube. To this end the stoker is mounted on a carriage formed of tubular members 101, 102 and 103. The lower portions of these tubular members are provided with rollers 104, having shanks 105, which telescope into the ends of the tubular members and which may be adjusted for various heights and held in place by means of set screws 106. The upper ends of the tubular members may be secured in any suitable manner to the stoker conduit 107. Braces 108 may be provided to strengthen the carriage, and hopper supporting members 109 and 110 may extend upwardly from the braces in order to assist in supporting the hopper 112. The upper ends of the hopper supporting members are preferably provided with rollers 113, which engage a reinforcing band 114 which extends circumferentially around the hopper.

In order to prevent arching of the coal in the hopper, the hopper is preferably rotatably mounted on a tubular connecting member 115. The hopper is supported by a flange ring 116 which engages rollers 117, mounted on a similar flange ring 116, which is secured to the connecting member 115. The flange ring 116 is perforated, as indicated at 119, for engagement with the hopper rotating mechanism, which will be hereinafter described. In order to break up any clogging of the coal in the hopper, a stationary slicing bar 120 (see Fig. 3) may be mounted in the connecting member 115. The bar projects upwardly into the lower portion of the hopper, and as the hopper slowly revolves, will function to break up any lumps or arching of the coal in the hopper, and thus secure a free flow of coal from the hopper through the connecting member 115 and into the conduit 107.

In order to force the coal through the conduit 107 and deliver it to the furnace, a plunger 125 is provided. In Fig. 3 the full line position of the plunger indicates its fully retracted position and the dot and dash lines indicate its advanced position. It will be noted that the plunger has a very short stroke in comparison with the width of the opening of the connecting member 115 into the conduit 107. The plunger 125 may be actuated by a tubular piston rod 126, which may be secured to the plunger in any suitable manner, as by rivets 127. The piston rod extends in a direction away from the furnace, and is provided at its end opposite the plunger with the convex member 128, which is adapted to engage a hydraulic diaphragm 129. The diaphragm is secured at its periphery to a hollow member 130, which forms a pressure chamber for the fluid which actuates the diaphragm. When water is admitted through the pipe 28 into the chamber formed by the hollow member, the diaphragm will be moved, thus forcing the piston to the left, as indicated in Fig. 3, and forcing coal through the conduit into the delivery tube 150 and thence to the furnace.

In order to prevent the piston from being moved too far to the left and also to prevent any damage to the diaphragm from the hydraulic pressure, I

have provided a stop 131, which surrounds the piston rod 126, and which is supported at the edges of the diaphragm by connection with the diaphragm and the member 130. The stop is engaged by the member 128 at the limit of the inward or coal-feeding stroke of the piston and prevents undue stretching of the diaphragm. In order to support the diaphragm and the members 129 and 131 in alignment with the conduit, a number of metal straps 132 may be provided. Such straps may be secured in any suitable manner to the outer end of the conduit 107, and are also secured, as by bolts 133, to the diaphragm mechanism.

The diaphragm is compressed and the plunger retracted by a spring 135, which is positioned within the hollow tubular piston rod. One end of the spring engages the member 128 and the other end is held against the action of the diaphragm by strap or bar members 136, which are suitably secured to opposite pairs of the straps 132. The straps 136 pass through suitable slots in the hollow tubular piston rod. The spring may be held in place by any convenient means, as by a cup 137, suitably secured to one of the straps 136.

This arrangement, wherein the diaphragm and piston are in substantial alignment, and wherein the retracting spring is disposed within the hollow tubular piston rod, provides a compact construction embodying important advantages. The spring is entirely enclosed and protected, and the hollow tubular piston rod has great rigidity, thereby preventing any side thrust of the plunger against the walls of the conduit 107. The entire mechanism, including the strap 132 and associated diaphragm parts, may be enclosed by a conical cover 138, which serves to keep out dirt from the interior of the mechanism, and also to prevent any possibility of injury to persons who are adjusting or operating the stoker. The construction is such that by removing the few bolts around the periphery of the conduit 107 the entire piston assembly and diaphragm mechanism may be removed for repair or replacement very easily and quickly.

The hopper rotating mechanism is indicated in Figs. 3 and 4, and power for rotating the hopper is derived directly from the piston rod by means of a yoke 140 suitably pivoted to a pin 141, which extends through the piston rod 126. Extending from the yoke is a projecting arm 142 which passes through a suitable slot in the conduit 107. The arm 142 is pivoted as at 143 to a bracket 144, which may be supported rigidly on one of the strap members 132. To the outer end of the arm 142 is secured a pawl 145, the end 146 of which engages the perforations in the flange ring 116. The end 146 of the pawl is shaped so that on the forward or fuel delivery stroke of the plunger and piston rod the hopper will be rotated by the rearward movement of the pawl 145. On the retracting movement of the piston rod and the forward movement (to the left in the drawings) of the pawl, the end of the pawl will ride out of one of the perforations in the ring 116 and drop down into the next perforation, to be in position for the next active stroke which will rotate the hopper another step.

The details of this mechanism are clearly shown in Fig. 1, and also in Fig. 1 there is shown a device for preventing the hopper from merely oscillating and for insuring continuous step-by-step rotation thereof. This mechanism comprises another pawl 147, which is pivotally

mounted on the opposite side of the hopper from the pawl 145, and which is arranged to allow rotation in a clockwise direction, as indicated in Fig. 1, and to prevent any rotation in a counter-clockwise direction. This pawl functions to hold the hopper against rotation during the return or inactive stroke of the pawl 145.

where the tubular members 185 are secured thereto, and which extend and are bolted to the flange member 118.

In order to deliver the coal to the proper position within the furnace, a delivery tube 150 may be secured to the conduit 107 at a point adjacent the door plate 151. The tube is flared slightly, as indicated in Figs. 2 and 3, so that the coal will slide easily through it. In order to prevent the delivery tube from becoming too hot, and also to prevent destruction by the fire and admit of its being made of light gauge sheet metal, the lower portion of the tube may be provided with a jacket 152, which surrounds substantially the lower half of the tube. The jacket is spaced away from the tube and communicates with the outside of the furnace through openings 153 in the door plate 151. When the stoker is in place and the furnace is in operation, the ordinary draft of the furnace will draw a sufficient quantity of air through the openings 153 to prevent the conduit from becoming overheated. This supply of air also aids in the combustion on the upper part of the fire. To protect the flaring end of the delivery tube, the jacket member 152 extends slightly beyond the end and is provided with a down turned lip portion 154.

In this modification the door opening is closed by a plate 195, which may be trimmed to fit the furnace. The stoker is moved into position and then locked by a wedging mechanism, which is shown in detail in Fig. 8. This mechanism comprises a bracket 196, secured to the carriage by the bolt 181, and nut 181a at the end of the carriage near the furnace. A lever 197 is pivotally mounted on the bracket and is arranged so that when the end of the lever is pulled downwardly the cam portion 198 of the lever will jam against the angle iron track member 175, and hold the carriage from movement away from the furnace. In installing a stoker with the overhead support, the preferred method is to first adjust the track 175 to approximately correct height by means of the straps 176, and thereafter make the final accurate adjustment by means of the nuts 186 on the bolt 181. The stoker may be readily placed in position before the furnace and locked against movement away from the furnace by means of the lever 197. This construction is convenient in that the floor is left clear of all obstructions and easy access may be had to the ash pit.

In connection with this modification of my invention I have shown a motor driven blower 200 for creating a forced draft. Preferably the blower is bolted or otherwise suitably secured to the ash pit door of the furnace. As indicated in Fig. 5, a baffle plate 201 is provided, to prevent the blast of air from the blower from stirring up the ashes in the ash pit. When a blower is employed, the electricity supplied to the blower motor may be controlled by any convenient thermostatic mechanism, which may also control the speed of the stoker motor.

From the foregoing description of preferred forms of my invention, it will be seen that I have provided a stoker which can be economically manufactured almost entirely from pressed metal, and can be adapted to any ordinary furnace without substantial change. It will also be seen that in my stoker, because of the rotating hopper, there will be very small chance of arching of the coal and consequent clogging of the furnace. Furthermore, because of the short stroke of the plunger, I have obtained an unusually efficient firing system which operates particularly well. By reason of this short stroke, it is possible to operate the plunger substantially continuously and to continuously feed small amounts of coal to the fire, which produces a very efficient form of combustion, and furthermore, by reason of the short stroke the hydraulic diaphragm is subject to no unusual strain and will last almost indefinitely without serious wear.

I claim:

1. In a stoker, the combination of a conduit adapted to deliver fuel to a furnace, and having an opening therein, a hopper adapted to contain a supply of fuel, a connection between said conduit and said hopper whereby fuel may be delivered to said conduit through said opening, a reciprocating plunger for forcing fuel through said conduit, a connecting rod for reciprocating said plunger, means for rotatably supporting said hopper and means for rotating said hopper comprising an arm actuated by said connecting rod, a pawl connected to said arm, a ratchet member secured to said hopper and adapted to be engaged by said pawl on one side of the hopper to rotate

In order to make the stoker adaptable to furnaces having doors of various sizes, to the door plate 151 is made of sheet metal which can be trimmed to fit the individual furnace.

Figs. 5 to 9 inclusive show a modified form of my invention, in which an overhead support for the stoker is provided. In connection with this modification I have also shown a blower for supplying air to the furnace. However, it is to be understood that the blower may be used with any form of the device.

In order to support the stoker motor and the hopper and associated mechanism, a track 175 comprising a piece of angle iron, may be suitably supported from the basement ceiling in any convenient manner, as by strap iron brackets 176. The brackets 176 may be bolted to the ends of the track, as indicated at 177. The carriage for supporting the stoker motor and hopper runs on pulleys 178, which are carried by U-shaped brackets 179, one leg of the U in the brackets being extended and bent, as at 180, to provide a support for the bolt 181. The pulleys are properly spaced, as by the member 182, and the diagonal braces 183.

The stoker mechanism is supported from the trolley by a pair of bowed tubular members 184, disposed in front of the stoker and adjacent the furnace and by another pair of bowed tubular members 185, disposed at the rear of the stoker and away from the furnace. The tubular members are adjustably secured to the bolts 181, as by nuts 186, and are bowed outwardly to avoid interference with the rotating hopper. The members 184 may be bolted directly to the flange portion 118 of the conduit connecting member 115, and as indicated in Fig. 9 the members 185 are bolted to a channel member 190, which is provided at its end with ears 191 for supporting rollers 192, which engage the reinforcing band 114 and assist in supporting the rotating hopper. The channel member and its associated roller are held in their proper position by members 193, which are secured to the channel at the point

the hopper in one direction, another pawl mounted on the opposite side of the hopper and adapted to engage said ratchet member and thereby to prevent rotation of the hopper in the opposite direction.

2. In a stoker, a conduit, adapted to deliver fuel to a furnace, a hopper adapted to contain a supply of fuel, means for rotatably supporting said hopper over said conduit and a connection for allowing a passage of fuel from said hopper to said conduit, reciprocating means for forcing fuel through said conduit to a furnace and means for rotating said hopper comprising a rocker arm actuated by said reciprocating means, a ratchet member secured to the lower portion of said hopper and having a series of perforations extending around the circumference thereof, a pawl adapted to engage said perforations on one side of said hopper, said pawl being actuated by said rocker arm whereby said pawl will rotate the hopper in one direction, a second pawl on the opposite side of the hopper from the first pawl, said second pawl being adapted to engage said perforations and thereby prevent rotation of the hopper in the opposite direction.

3. In a device of the character described, a conduit for feeding fuel to a furnace, a hopper rotatably mounted above said conduit and adapted to supply fuel thereto, a fuel feeding plunger in the conduit, means for reciprocating the plunger, ratchet means operated by said plunger reciprocating means for rotating said hopper in one direction and a second ratchet means for preventing the rotation of the hopper in the opposite direction.

4. In a device of the character described, a conduit adapted to extend into a furnace, means for forcing fuel through said conduit and into the furnace, a rotating hopper disposed above said conduit and communicating therewith to supply fuel thereto means connecting the hopper and the fuel forcing means for causing revolving movement of the hopper, a carriage for supporting said conduit and said hopper in the proper relation to a furnace, means for rotatably supporting said hopper comprising a flanged ring at the lower end thereof, anti-friction means engaging said ring, said anti-friction means being supported by said conduit and means for supporting the hopper intermediate its ends comprising members extending upwardly from the supporting carriage for the conduit and provided at their ends with rollers adapted to engage said hopper.

5. In a device of the character described, a conduit adapted to extend into a furnace, a supporting carriage therefor, means operating in said conduit for feeding fuel to a furnace, a rotatable hopper for supplying fuel to said conduit means

extending between the fuel feeding means and the hopper for revolving the hopper when the fuel feeding means is actuated and anti-friction means for rotatably supporting said hopper, said supporting means being mounted on the conduit and adapted to engage the lower end of said rotatable hopper and other hopper engaging means supported by the supporting carriage and engaging said rotatable hopper at a point remote from the lower end thereof.

6. In a device of the character described, the combination of a conduit adapted to extend into a furnace, a fuel feeding means disposed therein over-head trolley means for supporting said conduit, a rotatable hopper mounted on the conduit to supply fuel to said conduit and means extending between the fuel feeding means and the hopper for rotating the hopper when the fuel feeding means is actuated, and means for rotatably supporting said hopper comprising rollers supported by said conduit and adapted to engage the lower end of said rotatable hopper, and rollers supported from said trolley means and adapted to engage said rotatable hopper at a point remote from the lower end thereof.

7. In a stoker, a horizontally disposed delivery tube adapted to deliver fuel to a furnace, and having a top opening therein, intermediate its ends, a hopper for containing a supply of fuel, a base member secured to the top of the tube for establishing a connection between said hopper and said opening, a piston disposed in one end of the tube for forcing fuel through said tube and into the furnace, a piston rod therefor, said hopper being revolvably mounted on said base member and mechanism extending from said piston rod to the hopper for causing a revolving movement of the hopper when the piston is caused to move.

8. In a stoker, the combination of a substantially horizontally disposed conduit adapted to deliver fuel to a furnace, and having an opening therein intermediate its ends, a hopper adapted to contain a supply of fuel, a base member for supporting the hopper and secured to the top of the conduit for establishing a connection between said conduit and said hopper through said opening, whereby fuel may be delivered from the hopper to said conduit through said opening, a reciprocating plunger for forcing fuel through said conduit, a connecting rod for reciprocating said plunger, and means for rotating said hopper when the plunger is actuated, comprising an arm actuated by said connecting rod, a pawl connected to said arm and a ratchet member secured to said hopper and adapted to be engaged by said pawl on one side of the hopper to rotate the hopper.

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