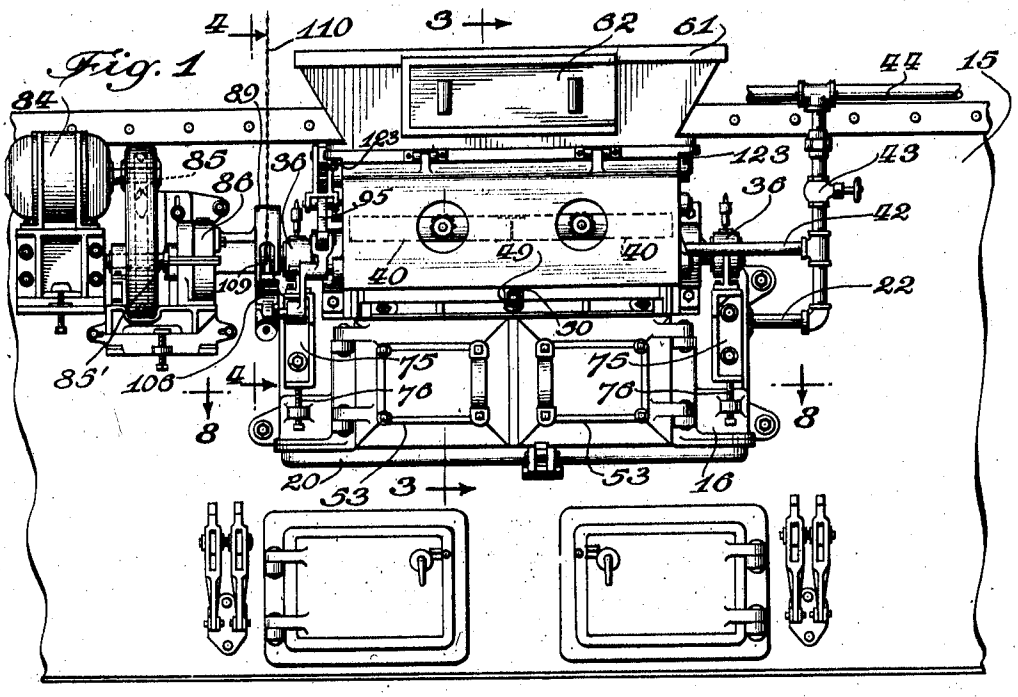
Feb. 7, 1939. R. W. FOSTER 2,146,469

MECHANICAL STOKER

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Fig. 1



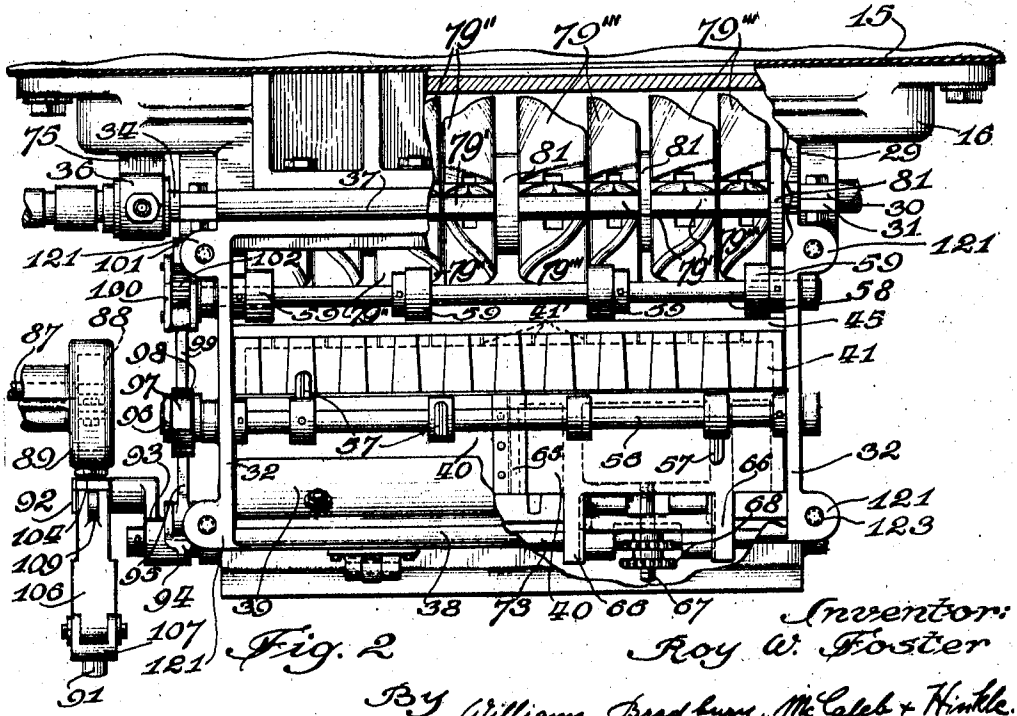


Fig. 2

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MECHANICAL STOKER

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Fig. 3

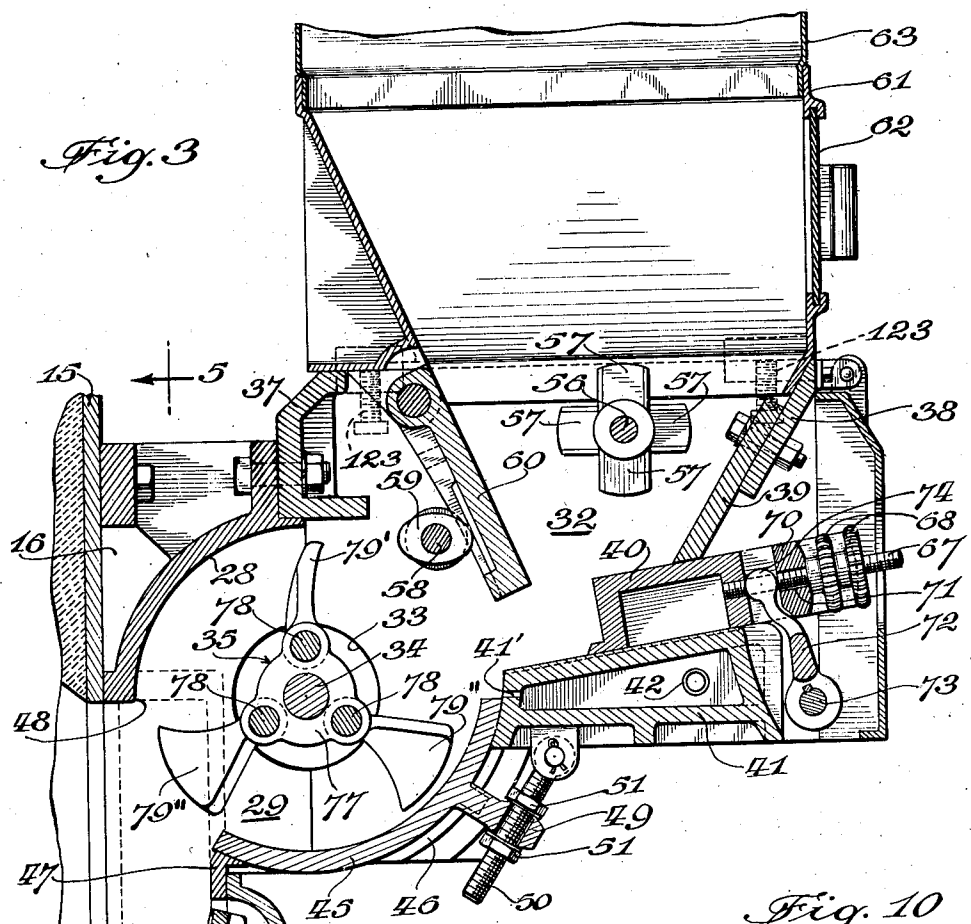


Fig. 9

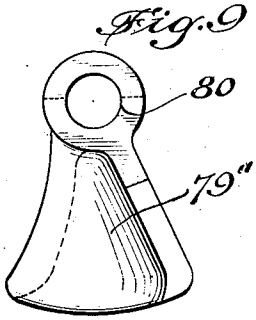


Fig. 10

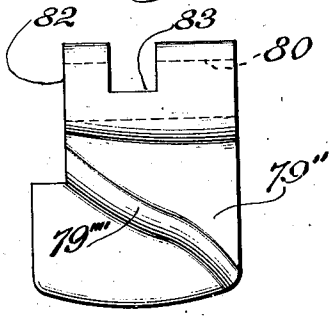
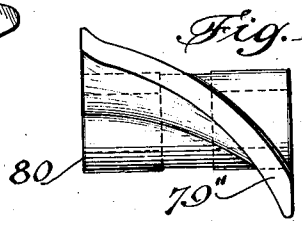


Fig. 11



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MECHANICAL STOKER

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Fig. 8

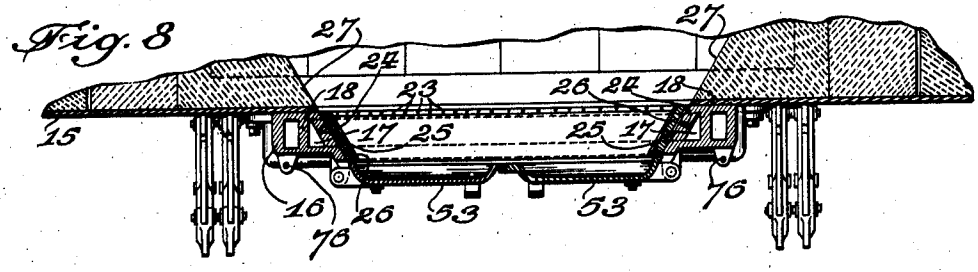
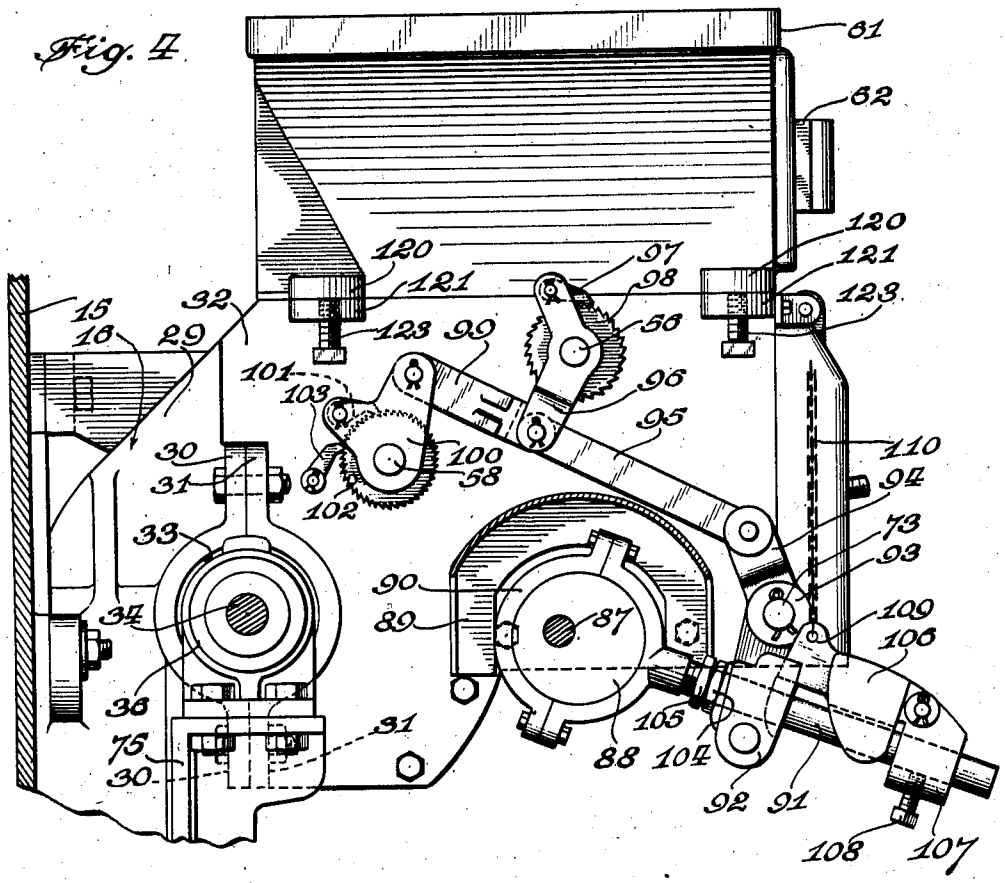


Fig. 4



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Fig. 5

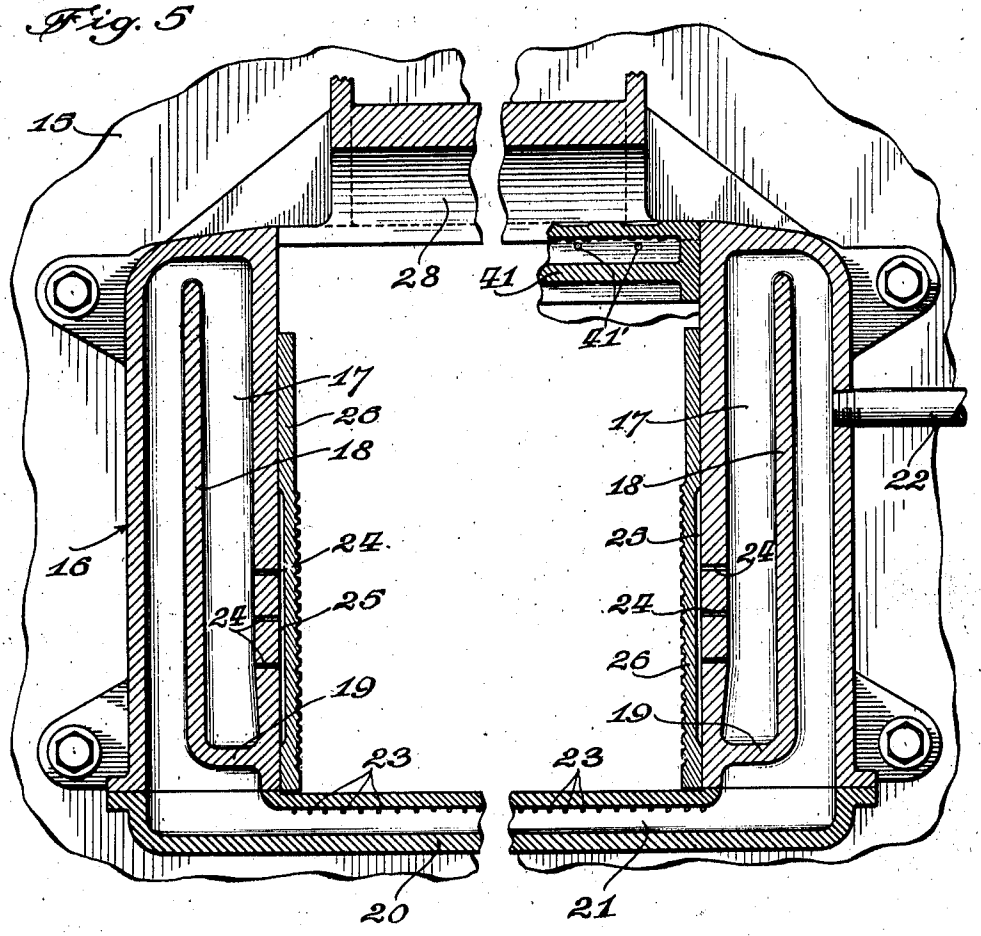


Fig. 6

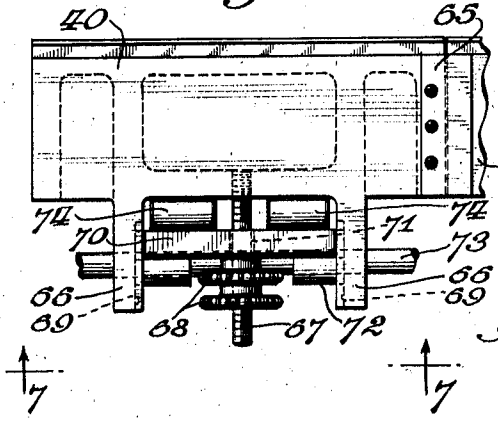
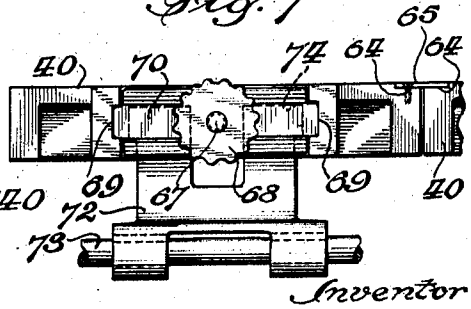


Fig. 7



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UNITED STATES PATENT OFFICE

2,146,469

MECHANICAL STOKER

Roy W. Foster, Ottawa, Ill., assignor, by mesne assignments, to Reconstruction Finance Corporation, Chicago, Ill., a corporation of United States

Application January 24, 1936, Serial No. 60,592

8 Claims. (Cl. 110—115)

This invention relates to mechanical stokers and particularly to mechanical stokers of the spreader type in which the coal is projected into the furnace above the fire level and is distributed over the bed of fuel therein.

One of the objects of the invention is to provide an improved mechanical stoker.

A further object of the invention is to provide a mechanical stoker which is simple and inexpensive to construct and which is efficient in operation and capable of operating for prolonged periods without the necessity of repairs or adjustments.

A further object of the invention is to provide a simple control for a mechanical stoker whereby part of the stoker may be rendered inoperative to facilitate the cleaning of part of the fire while feeding the rest of the fire.

A further object of the invention is to provide a mechanical stoker equipped with air chambers adapted for the dual purpose of cooling the stoker and supplying preheated air to the fire for the consumption of solid fuel fed by the stoker.

A further object of the invention is to provide an improved reel construction for a spreader stoker.

A further object of the invention is to provide a stoker with improved means for preventing choking or bridging of the solid fuel.

A further object of the invention is to provide a simple control for a mechanical stoker whereby the rate of supply of coal may be easily adjusted precisely.

A further object of the invention is to provide a mechanical stoker having an improved drive interrupter whereby the supply of solid fuel may be interrupted by automatic control devices operated by pressure or temperature or in any other suitable manner.

Other objects, capabilities and advantages will readily be understood from the following description of a preferred embodiment thereof, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a front elevational view of a furnace equipped with my improved stoker;

Fig. 2 is a plan view of a stoker, partly broken away to show the reel and other parts of the mechanism;

Fig. 3 is a sectional elevation through the stoker, taken on the line 3—3 of Fig. 1;

Fig. 4 is an end elevation of the stoker, as viewed on the line 4—4 of Fig. 1;

Fig. 5 is a sectional view through the stoker supporting member, the section being taken on the line 5—5 of Fig. 3;

Fig. 6 is a detail plan view of one of the pusher bars and associated parts;

Fig. 7 is an elevational view thereof, viewed in the direction 7—7 of Fig. 6;

Fig. 8 is a sectional plan view, taken on the line 8—8 of Fig. 1, and

Figs. 9, 10 and 11 are detail views of the reel plates.

Referring to the drawings, the stoker is mounted directly upon the front plate 15 of the furnace. The stoker is carried by an inverted U-shaped casting 16 which is shown in section in Fig. 5. As shown in that figure, the U-shaped casting 16 is bolted directly to the front plate 15. Each of the side members of the U-shaped casting constitutes a hollow chamber 17 which includes a central partition 18 which terminates short of the upper end of the chamber 17 and is connected at its lower end to the inner wall by means of a web 19. The two chambers 17 in the opposite legs of the U-shaped member 16 are connected across by means of a lower member 20 which is provided with a duct 21 whereby the two chambers 17 are put into free communication. Compressed air is supplied to the chamber 17 by means of a pipe 22 and this air passes through the duct 21 and through the passages established by the partitions 18 so that the casting is thoroughly cooled and the air is preheated. The preheated air passes into the fire box through a series of openings 23 formed in the member 20 and also through openings 24 in the side walls of the U-shaped member.

The openings 24 communicate into spaces 25 formed on the inner side of plates 26. As best shown in Fig. 8, the plates 26 diverge inwardly and the spaces 25 are arranged to discharge their air along the diverging walls of the furnace 27. As is best shown in Fig. 3, the openings 23 discharge air into the fire box at the sill so that any fuel which falls on the sill is immediately consumed, and excess fines are blown into the furnace.

The upper or transverse portion of the inverted U-shaped member 16 comprises a concave wall portion 28 which serves as the upper portion of the reel housing, as best seen in Fig. 3. The inverted U-shaped member 16 also comprises end walls 29 which form parts of the end walls for the reel housing. The U-shaped casting 16 is provided with flanges 30 to which are bolted flanges 31 of the end walls 32. The end walls 29 and 32 unite to provide openings 33 through which the shaft 34 of the reel 35 passes. These openings are sufficiently large to admit air which serves to keep the shaft 34 cool and prevent undue heating of the bearings 36. The two end walls 32 are connected by an integral bar 37 which is bolted to the upper end of the inverted U-shaped member 16, as best shown in Fig. 3. The end walls 32 are also connected by an integral wall member 38 which slopes inwardly and downwardly from the upper rear corners of the end walls 32.

The sloping wall 38 has bolted thereto an extension member 39 which terminates adjacent the upper surfaces of the two pusher bars 40. The pusher bars 40 are inclined downwardly to a slight extent and slide upon the upper surface of a box 41 which is secured in air-tight fashion to the two end walls 32. An air pipe 42 is tapped into one of the end walls 32 so as to supply air under pressure into the box 41. The pipe 42 communicates with the pipe 22 and the air supply to both of these pipes is controlled by the valve 43. The air under pressure is supplied from any suitable source by a pipe 44 to any desired number of stokers, which may be arranged in series. The rear end of the box 41 is curved to receive the movable housing member 45 which cooperates with the wall 28 to provide the housing for the reel 35. This housing member 45 is supported upon the front wall of the box 41 and on arcuate rails 46 carried by the end walls 32 and its rear end passes freely above a transverse bar 47 which connects the two limbs of the U-shaped member 16, and serves as a door stop.

Between the reel housing members 28 and 45 is the discharge throat 48. The size of this throat can be varied at will by merely moving the housing member 45 upon its supports. The housing member 45 is provided with a projecting arm 49 through which passes freely a threaded rod 50 which is pivotally mounted on the box 41. Nuts 51 mounted on the rod 50 are in engagement with the arm 49, as shown in Fig. 3. It will be clear that by merely moving the nuts 51 upon the rod 50 the housing member 45 can be positioned as desired.

As will be seen in Fig. 3, the reel 35 discharges fuel into the upper portion of a furnace opening 52. Doors 53 are mounted upon the limbs of the U-shaped member 16. These doors preferably meet in the center and are preferably arranged in overlapping relation. The upper edges of the doors rest against the bar 47 and their lower edges rest against the conduit member 20. By means of these doors the whole fire or one-half of it, as desired, may be cleaned and, as will hereinafter be more fully described, the supply of fuel to that side may be cut off very simply without interfering with the supply of fuel to the other half of the furnace. The doors 53 are provided with openings 54 for the admission of air which is sub-divided by a perforated liner plate 55.

Some distance behind the walls 38 and 39 a horizontal shaft 56 is rotatably mounted in the end walls 32. At various positions along its length the shaft 56 has fingers 57 pinned to or otherwise rigidly mounted upon the shaft 56. During the operation of the stoker, the shaft 56 is rotated progressively and the fingers 57 serve to disturb the coal and enable it to move downwardly towards the pusher bars 40. A horizontal shaft 58, also rotatably mounted in the end walls 32 at a position behind and above the pusher bars 40, carries a series of cams 59. These cams 59 engage a plate 60 which is pivotally mounted on the lower rear edge of the hopper member 61. This hopper member is built so that it fits into the opening defined by the two end walls 32 and the two side walls 37 and 38. The hopper member 61 is provided with ears 120 which overlie ears 121 carried by the end walls 32. Screws 123 are threaded into openings in the ears 121. By actuating the screws 123 the hopper member 61 may be raised to a certain extent and the clearance between the lower end of the gate 60 and the box 41 may be thereby adjusted to adapt the stoker for use with different fuels.

The portion of the body of the machine which supports the hopper 61 and which includes the reel housing element, the box 42, the walls 32 and the elements 37, 38 and 39 is referred to in certain of the claims for the purpose of convenience as the "main assembly".

The hopper member 61 includes a removable gate 62 which may be removed in the event that a large piece of coal is accidentally placed in the hopper member together with the fine coal which is normally used in the stoker. The shafts 56 and 58 are rotated by driving means which will hereinafter be described, and it will be understood that the cams 59 move the pivoted plate 60 backward and forward and prevent any tendency for the coal to bridge up above the pusher bars 40. The hopper 61 may be and normally is used in conjunction with an upper hopper member, the lower end of which is shown at 63 in Fig. 3.

In the embodiment of the invention illustrated, two pusher bars 40 are provided which lie side by side and extend the full distance between the two end walls 32. At their adjacent edges the pusher bars 40 are provided with recesses 64 in their upper surfaces and a strip 65 of metal is located in these recesses. The strip 65 is rigidly secured to one of the pusher bars 40. This strip serves to prevent fine coal from finding its way into the space between the two bars 40. Each pusher bar 40 is preferably in the form of a chambered box provided with two forwardly extending arms 66. Between the two arms 66 the pusher bar 40 is provided with a forwardly extending rod 67, the outer end of which is threaded to receive nuts 68. The arms 66 are formed with opposed grooves 69 for the reception of ends of a bar 70.

The bar 70 is provided with an opening 71 through which the rod 67 extends with a free moving fit. The pusher bars 40 are reciprocated back and forward by means of members 72 which are mounted on an oscillating shaft 73. The members 72 are provided with forked ends 74 which extend upwardly into position between the bar 70 and the front face of the pusher bar 40. As will hereinafter be described, the shaft 73 has a definite degree of oscillation so that the forked ends 74 have also a fixed degree of movement. To adjust the throw of the pusher bar 40, it is merely necessary to move the nuts 68 so as to provide more or less lost motion between the forked ends 74 and the bar 70 and the front wall of the pusher bar 40. It will be understood that if the screws 68 are backed up sufficiently, the pusher bar 40 will be rendered inoperative, the forked ends 74 merely oscillating to their full extent between the front wall of the pusher bar 40 and the bar 70 without forcibly moving either of them. In some cases the bar 70 may move idly with the forked ends 74, but the effect is the same since it does not come into operative engagement with the nuts 68. It will thus be seen that by mere adjustment of the nuts 68 the supply of coal or other fuel to either half of the furnace may be brought to an end or may be adjusted to any desired extent within the capacity of the stoker.

The bearings 36 of the reel shaft 34 are mounted on brackets 75 which are mounted on the limbs of the U-shaped member 16. Set screws 76 are provided so that the bearings 36 may be adjusted accurately before the brackets 75 are bolted in position. The reel 35 comprises collars 77 rigidly mounted on the shaft 34 within the reel housing.

These collars carry between them three longitudinal shafts 78 parallel to the shaft 34 and located equidistantly around that shaft. The shafts 78 serve as pivots for reel blades 79', 79'' and 79''' which are provided with bushings 80 through which the shafts 78 extend with a free working fit. In assembling the reel, the blades 79', 79'' and 79''' are applied thereto by merely slipping their bushings 80 onto the appropriate shafts 78. Thereafter the end collar 77 is rigidly mounted in position. It will be understood that as the shaft 34 is rotated at a rapid rate, for example, at a speed around 300 to 450 revolutions per minute, the blades swing outwardly in the radial direction. In accordance with the present invention the blades are independently mounted and each may swing freely in both directions without interfering with adjacent blades. In the event that a large piece of coal presents difficulty, the blades will yield and will not be broken by impact, as would be the case if the blades were rigidly mounted on the shaft 34. Owing to the independent mounting of the blades the blade which hits a large piece of fuel will be displaced without displacing the adjacent blades. Consequently, the piece of fuel is hit with a force depending upon the inertia of the blade or blades actually contacting it. This independent mounting of the blades constitutes a substantial improvement over the prior art according to which the adjacent blades were in overlapping relation and the inertia of the whole row of blades or a considerable number of blades was applied against a large piece of fuel, incurring frequent breakages and stoppages for repairs. To prevent the shafts 78 from flexing outwardly to an excessive degree owing to the centrifugal load applied thereon, it is preferred to provide collars 81 at intervals along the reel. These collars are similar to the collars 77, but they may have free sliding relation with respect to the shafts 34 and 78 and they may be built into the reel by merely passing these shafts through the four openings provided therein. Certain of the blades are cut away, as shown at 82 in Fig. 10, in order to accommodate the collars 1. Recesses 83 are provided in the bearings of the blades 79', 79'' and 79''' in order to lessen the friction.

The blades 79', 79'' and 79''' may suitably be castings which are reinforced by ribs 79''''. I prefer to provide one row of the three rows included in the embodiment of the invention illustrated which has blades 79' which are substantially parallel to the shaft 34 in their transverse directions. The row of blades in question is the upper row shown in Fig. 3. It will be understood that such blades discharge coal straight out in front of them. Each blade 79' of this row has a front face which is concave in the radial direction of the reel. This concavity causes the discharge fuel to be thrown upwardly to some extent so that it is carried further into the furnace. The other two rows of blades I also prefer to make generally concave, but with an edge which is both generally concave and generally oblique with respect to the axis of the reel. Thus, considering the blades 79'' shown in Figs. 9, 10 and 11, the lower blades in Fig. 3, and the blades in the left-hand half of Fig. 2, it is clear that these blades will have a tendency to throw the fuel more to the left, looking into the furnace. These particular blades I prefer to mount on the left-hand side of the stoker. I provide other blades 79''' which are identical with those shown in Figs. 9 to 11, except that their obliquity with respect to the axis of the reel is in the opposite direction with respect to the shaft 34, with the result that these blades will tend to throw the coal towards the right. I prefer to mount these blades on the right-hand side of the furnace as shown in Fig. 2. As a result of this arrangement, the coal supplied by the left-hand pusher bar 40 will be thrown straight into the furnace and also to the left. Since the fuel feed opening is usually somewhat narrower than the furnace, it will be seen that this arrangement effectively supplies the left-hand side of the furnace uniformly with fuel. Likewise, the fuel supplied by the right-hand pusher bar is thrown straight into the furnace and also somewhat to the right, with the result that the fuel supplied by this pusher bar is uniformly distributed over the right-hand half of the furnace.

As best seen in Fig. 2, I prefer to use blades 79', 79'' and 79''' of different widths. This enables me to arrange the blades of the various rows in overlapping relation so that there is no possibility of any coal accumulating in the reel housing.

The drive of the various elements will now be described. Power is derived from an electric motor 84 which is connected by a belt drive 85 to a shaft 85'. The shaft 85' actuates through a suitable gear reduction 86, the shaft 34 of the reel 35 and a shaft 87, which carries an eccentric 88. The eccentric 88 is suitably located within a housing 89. An eccentric strap 90 is mounted on the eccentric 88 and carries a rod 91. The rod 91 has a free sliding fit in an opening in an arm 92 pivotally mounted on one end of a bell crank lever 93, which is rigidly mounted on one end of the shaft 73. The other arm 94 of the bell crank lever 93 is pivotally connected to a link 95. The link 95 is pivotally connected to a lever 96 which is freely mounted on one end of the shaft 56. The other end of the lever 96 carries a pawl 97 which is in engagement with a ratchet wheel 98 rigidly mounted on the end of the shaft 56. The link 95 is connected by a link 99 to a lever 100 which is freely mounted on one end of the shaft 58. The lever 100 carries a pawl 101 which operatively engages a ratchet wheel 102 rigidly mounted on the end of the shaft 58. A pawl 103 pivotally mounted on the adjacent end wall 32 also engages the ratchet wheel 102 and prevents return movement of the ratchet.

The rod 91 which passes through the arm 92, is provided with two abutments to enable the reciprocating rod 91 to oscillate the arm 92. One of these abutments has the form of a nut 104 located in appropriate position on the rod 91 by means of a lock nut 105. The other abutment is movable and comprises a block 106 which is pivotally mounted on a collar 107 carried by the outer end of the rod 91. As will be readily seen from Fig. 4, the block 106 may be adjusted with respect to the rod 91 with the aid of a set screw 108 mounted in the collar 107. The block 106 is provided with an eye 109 whereby it is engaged by an actuating chain 110. When the block 106 is raised, the rod 91 merely slides to and fro through the opening in the arm 92 without actuating either shaft 56 or 58. When the block 106 is returned to its position as shown in Fig. 4, the shaft 73 is oscillated to actuate the pusher bars 40 and the shafts 56 and 58 are progressively operated by the pawls 97 and 101 cooperating with the ratchet wheels 98 and 102. It will be understood that the block 106 may be actuated by hand when desired.

In the preferred operation of the stoker, the motor 84 is kept running and the hopper is kept full of coal.

The reel may be arranged to rotate at a high speed, for example of the order of 400 revolutions per minute. The continuous operation of the motor 84 causes the shaft 87 to rotate continuously, at a slower speed however than the reel. As a result of the continuous rotation of the eccentric 88, the rod 91 reciprocates continuously. When the block 106 is in its lower position, that is, the position shown in Fig. 4, the shaft 73 is oscillated and the shafts 56 and 58 are rotated step by step. When the block 106 is elevated from the position shown in Fig. 4, the reciprocating rod 91 merely slides back and forth through the arm 92 and the feeding of coal to the furnace is stopped, notwithstanding the continued rotation of the reel.

The oscillation of the shaft 73 causes the reciprocation of the pusher bars 40. As previously indicated, the throw of the pusher bars 40 may be adjusted individually as desired, or may be completely arrested by merely adjusting the nuts 68. The continued rotation of the shaft 56 causes the fingers 57 to stir up the coal within the hopper and causes it to fall in the regular manner so as to be acted upon by the pusher bars 40. The rotation of the shaft 58 causes the cams 59 to move the plate 60 back and forward. This motion prevents any tendency of the coal to bridge across the hopper immediately above the pusher bars 40.

During the operation of the stoker, compressed air is supplied into the box 41. The air is projected through the reel chamber and into the furnace through openings 41' arranged along the front edge of the box 41 and together with the air drawn in through the openings 33 effectively cools the reel. As a result of this cooling and the continuous rotation of the reel, warping or sagging of the reel is prevented, notwithstanding the intense radiant heat to which it may be subjected. At the same time, air is supplied to the interior of the U-shaped member 16 and the conduit member 20, from which the preheated air escapes into the sill of the furnace by means of the openings 23 and into the side walls of the furnace opening through the passageways 25.

Although the invention has been disclosed in connection with the specific details of a preferred embodiment thereof, it must be understood that such details are not intended to be limitative of the invention except in so far as set forth in the accompanying claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A mechanical stoker comprising a rotatable reel having a plurality of longitudinal rows of distributing blades mounted thereon, the blades of one row being adapted to throw the fuel forwardly only and blades of another row being adapted to throw the fuel both forwardly and laterally to one side.

2. A mechanical stoker comprising a rotatable reel having a plurality of longitudinal rows of distributing blades mounted thereon, the blades of one row being adapted to throw the fuel forwardly only, blades of another row being adapted to throw the fuel both forwardly and outwardly to one side, and the blades of still another row being adapted to throw the fuel both forwardly and outwardly to the other side.

3. A mechanical stoker comprising a rotatable reel, means for feeding fuel thereto, a motor for driving said reel continuously at a high speed, a shaft driven by said motor at a lower speed, an eccentric on said shaft, a rod oscillated by said eccentric, an arm through which said rod passes freely, said arm when oscillated actuating said means for supplying fuel to said reel, and an abutment member pivotally mounted on said rod adapted to be moved into position operatively to engage said arm to operate said fuel supply means, and out of said position to discontinue the operation of said fuel supply means.

4. A mechanical stoker comprising a rotatable reel, a housing for said reel, an oscillating pusher bar for supplying fuel thereto, a hollow structure below said bar provided with openings extending into the reel housing, and means for supplying air under pressure to said hollow structure and through said openings into said reel housing.

5. A mechanical stoker comprising a main assembly including a reel housing, a distributing reel rotatably supported in said housing, a pusher bar in said assembly for supplying fuel to said reel, a hopper removably supported upon said assembly, a feed gate pivotally mounted on said hopper and extending into said assembly when the hopper is mounted thereon so as to leave an open path for the fuel from the hopper to the reel housing, means on said assembly to oscillate said gate, and means for adjusting the hopper upon the assembly and thereby the fuel path below said feed gate.

6. A mechanical stoker comprising a main assembly including a reel housing, a distributing reel rotatably supported in said housing, a pusher bar in said assembly for supplying fuel to said reel, a hopper removably supported upon said assembly, a feed gate pivotally mounted on said hopper and extending into said assembly when the hopper is mounted thereon so as to leave an open path for the fuel from the hopper to the reel housing, a shaft rotatably mounted on said assembly, means to rotate said shaft, cams on said shaft adapted to oscillate said feed gate, and screws for supporting the hopper on the assembly whereby the hopper may be elevated and lowered on the assembly to locate the feed gate relatively to the assembly to adjust the path of the fuel from the hopper to the reel housing and thereby adapt the stoker for use with various fuels.

7. A mechanical stoker comprising a rigid framework mounted upon the furnace, said framework defining an upper fuel supply opening into the furnace and a lower door opening into the furnace, said framework comprising perforated ducts adapted to discharge air into the furnace along the bottom and sides of the door opening and through the fuel supply opening, and means for supplying air under pressure to said ducts.

8. A mechanical stoker comprising a rotatable reel having a plurality of longitudinal rows of distributing blades mounted thereon, the blades of one series being adapted to throw the fuel forwardly only and the blades of another row being adapted to throw the fuel forwardly and to both sides.

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