May 9, 1944. P. P. PETERS 2,348,494

STOKER

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FIG. 1.

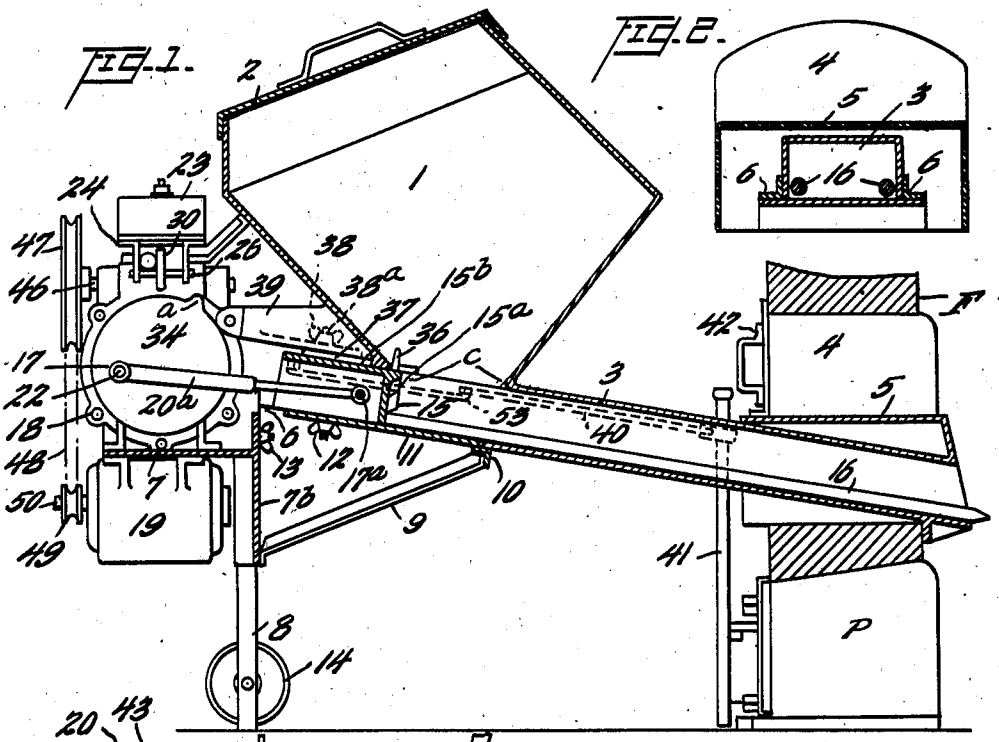


FIG. 2.

FIG. 4.

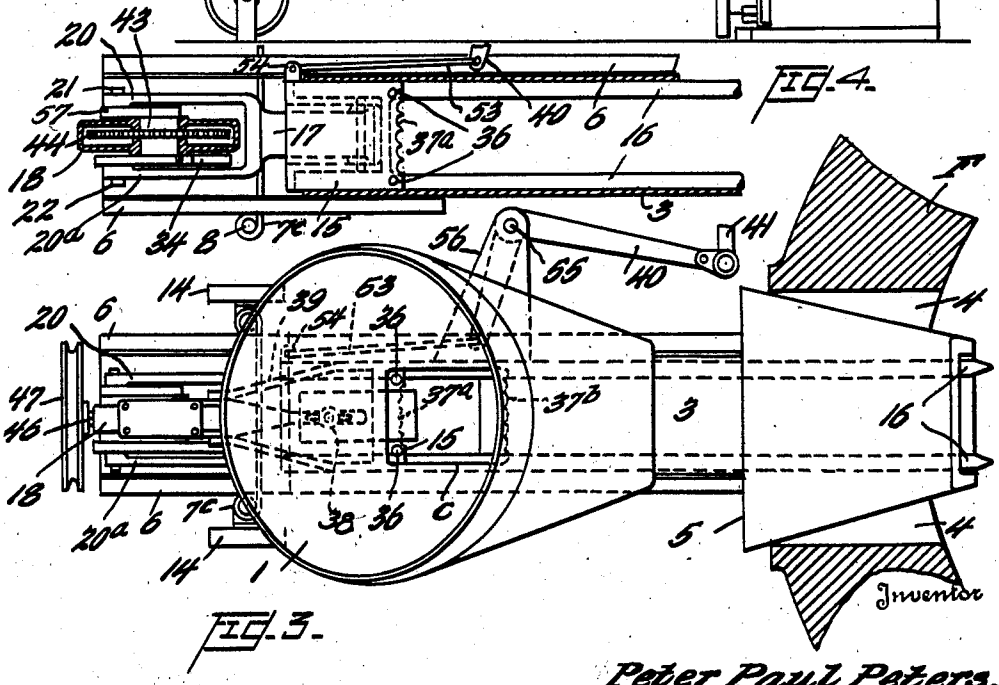


FIG. 3.

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FIG. 5.

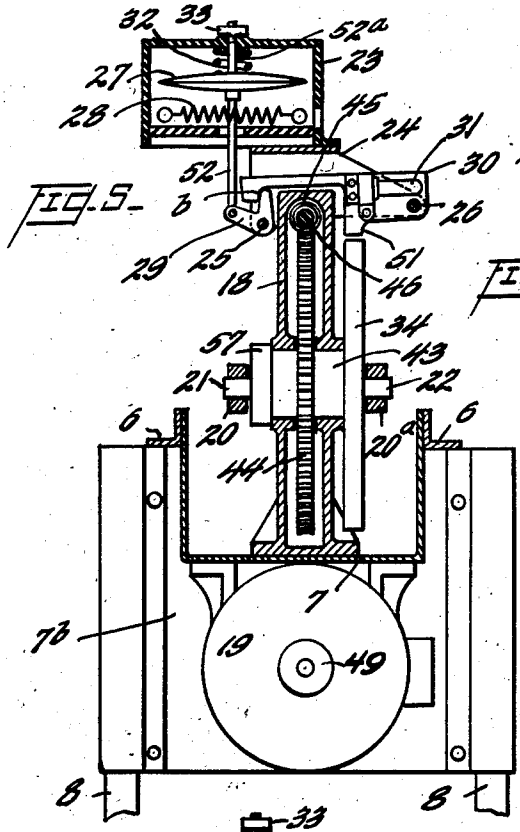


FIG. 7.

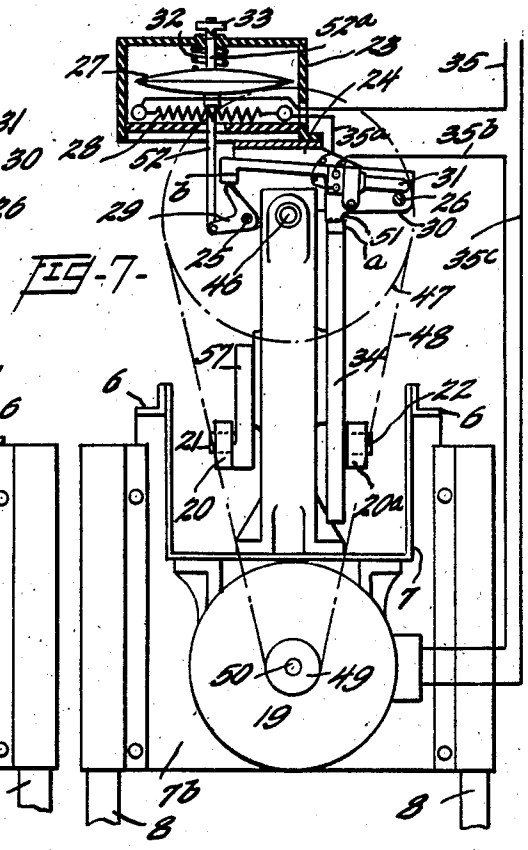
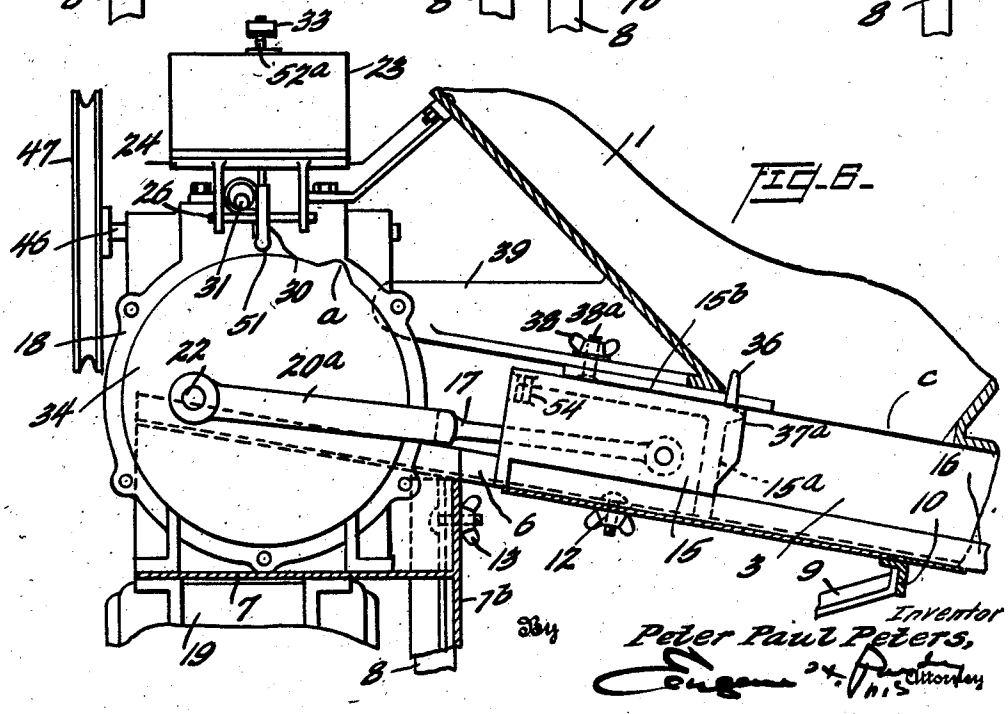


FIG. 6.



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Patented May 9, 1944

2,348,494

UNITED STATES PATENT OFFICE

2,348,494

STOKER

Peter Paul Peters, Waynesburg, Ohio

Application September 23, 1940, Serial No. 357,961

1 Claim. (Cl. 110—109)

This invention relates to stokers and more especially to stokers of the portable over-feed type intended for use in conjunction with the heating furnaces of homes and buildings.

An important object of my invention is to provide a stoker of the above character having a reciprocating slide for feeding fuel into the furnace and poker bars extending longitudinally from the slide into the furnace so as to agitate the bed of coals therein, during the back-and-forth movement of the slide.

Another object of my invention is to provide in a stoker of the above character, control means for automatically starting and stopping the operation of the stoker in response to temperature conditions within the enclosure to be heated, the control means being so constructed and arranged to arrest movement of the slide in or adjacent its fully retracted position with the poker bars partially or fully withdrawn from the fuel bed.

Still another object of my invention is to provide a portable stoker of the above character which is simple in construction and efficient in operation, and especially adapted to maintain the proper condition of the fire bed so as to obtain the most favorable heating results from the furnace.

Other objects and advantages will be apparent from the following detailed description of a preferred embodiment of the invention, reference being had to the annexed drawings in which:

Figure 1 is a view in vertical cross-section through a portable household stoker showing the manner in which it is associated with a furnace;

Figure 2 is a transverse cross-sectional view through the lower end of the feed chute where it enters the furnace;

Figure 3 is a plan view of the stoker of Fig. 1;

Figure 4 is a detail plan view of the frame supporting the upper end of the chute, with parts broken away for greater clearness;

Figure 5 is a transverse cross-sectional view of the upper end of hte chute-supporting frame showing the stoker control means in one position of operation;

Figure 6 is a side view taken at right angles to the view of Fig. 5; and

Figure 7 is an end, and in part, cross-sectional view of the chute supporting frame corresponding to that of Fig. 5, but showing the stoker control means in a different position of operation.

Referring to the drawings, in the cross-sectional view of Fig. 1 is illustrated a stoker of the overfeed type, this stoker being portable and of light construction so as to lend itself to use in connection with the heating furnaces of private dwellings and buildings.

This stoker comprises a vertically disposed hopper 1 having its top closed by a cover 2 and its lower end tapered downwardly and communicating through an outlet *c* with the upper end of a closed chute 3. This hopper is designed to contain a supply of coal. The lower end of the chute projects through the entrance 4 of a furnace F and is enclosed by an air box 5 serving as a shield to close the lower part of the entrance but permitting the circulation of air around the chute to cool the same. The lower edge of a vertically slidable door 42 upon the furnace is adapted to abut the flat horizontal wall of the air box 5.

The chute 3 is of rectangular cross section and to its side walls are secured angle irons 6 which extend lengthwise of the chute and project beyond its upper end and are fastened to the upright side walls of a trough-shaped shelf 7. Closing one end of the shelf is a vertical plate 7*b* which has its opposite side edges rolled into circular shape to form sleeves to slidably receive the upper ends of cylindrical legs 8. The shelf 7 may be raised or lowered to vary the inclination of the chute by releasing wing nuts 13, which serve to contract the sleeves 7*c* about the legs, and adjusting the shelf therealong. Brace members 9, comprising short angle sections, extend between and are attached to the plate 7*b* and a shoulder piece 10 upon the lower face of the chute. The bottom of the chute below the hopper outlet *c* is closed by a plate 11 removably connected to the angle irons 6 by wing bolts 12. By removing the plate 11 coal may be emptied from the hopper. Rollers 14 are mounted adjacent the lower ends of the legs 8, and these rollers may be brought into engagement with the floor, by simply tipping the apparatus, to facilitate the handling of the stoker to and from the furnace.

Adapted to slide back and forth within the upper end of the chute in the vicinity of the hopper outlet *c* is a hollow rectangular slide 15, having a forward pushing face 15*a* disposed perpendicular to the trough and a flat closure face 15*b* adapted to travel crosswise below the outlet *c* and intermittently open and close this passage and allow coal to periodically flow therethrough into the chute in front of the slide. A pair of poker bars 16 having one of their ends fitted into sockets in the pushing face 15*a* project forwardly along the bottom of the chute and extend into the furnace. The operating ends of these poker bars are pointed and serve, upon backward and forward movement of the slide, to

agitate the coal and break up coking therein so as to insure complete combustion of the fuel. Extending upwardly from the closure face 15b are agitator pins 36 adapted by the motion of the slide to rake through the bottom of the body of coal contained in the hopper 1 and tickle it down through the outlet c. These agitator pins are removable from the slide and may be used only when the coal is wet and tends to clog the outlet.

The size of the outlet c may be varied by means of an adjustable feed plate 37. By releasing wing nut 38, which engages a bolt 38a projecting up from the feed plate through a slot suitably formed in a bracket 39 extending laterally from the base of the hopper, the feed plate 37 may be shifted transversely across the outlet c to determine the size of this outlet and hence to regulate the amount of fuel fed from the hopper on each stroke of the slide. The pushing face 15a of the slide 15 is provided with teeth, as indicated at 37a (Fig. 3), as is also the lower edge of the wall of the hopper opposed thereto, as indicated at 37b, these teeth acting to shear off lumps of coal extending part way through the outlet so as to prevent jamming and consequent stalling of the slide in its forward movement. The slide upon its forward stroke does not completely close the outlet but leaves a space between the pushing face 15a and the opposed lower edge of the hopper. This clearance is sufficient to avoid squeezing small lumps of coal together so as to hinder the slide on its forward stroke. The teeth 37a and 37b operate to break through a conglomeration of coal packed between the slide and hopper.

The slide is reciprocated within the chute as follows: Pivotally connected at one end to a cross-rod 17a within the hollow slide 15, is a connecting rod 17 (Fig. 4), the opposite end of the connecting rod being forked to provide branches 20 and 20a. Branch 20 is pivotally connected to a crank pin 21 secured upon the outer end of a crank 57, while branch 20a is pivotally connected to a crank pin 22 arranged upon a generally circular cam disk 34. Both the crank 57 and the cam disk 34 are fastened to a hub 43 upon which is mounted a worm wheel 44 driven by a worm 45 (see Fig. 5), the worm and worm wheel being enclosed within a gear housing 18 to which the end of bracket 39 is pivotally attached. The worm is secured to a rotary worm shaft 46 which extends outwardly through the gear case and has fastened upon its exterior end a pulley 47 (Figs. 6 and 7). A drive belt 48 winds over the pulley 47 and also over another pulley 49 secured to the armature shaft 50 of an electric motor 19. The motor 19 is suspended from the lower face of the shelf 7 and serves as the driving means for the slide 15.

Control means are provided for starting and stopping the operation of the stoker in accordance with the temperature of the enclosure to be heated and to bring the slide to rest in retracted position with the poker bars 16 withdrawn from the fire bed. These control means comprise a timing box 23 supported upon a saddle 24 fastened upon the top of the gear case 18 and disposed crosswise thereof. The ends of the saddle project beyond the sides of the timing box, the end of the saddle upon the same side of the gear case as the cam disk 34 providing a fulcrum pin 26 for one end of a rocker arm 30, this rocker arm supporting in a generally horizontal position a tilt switch, and specifically a mercury contact switch 31. The other end of this saddle disposed upon the opposite side of the gear case from the cam disk 34 provides a fulcrum pin 25 for a bell-crank lever 29, one arm of which lever projects upwardly and is adapted in one of its positions to engage a vertical shoulder b upon the rocker arm 30. The cam disk 34 upon its circumference is formed with a lobe a which during rotation of the cam disk is designed to ride against a bearing block 51 on the rocker arm 30 and tilt the latter, together with the mercury contact switch, upwardly about the fulcrum pin 26.

Pivotally connected to the other arm of the bell-crank trip lever 29 is the lower end of a vertically disposed operating rod 52. This operating rod extends loosely through the bottom of the timing box 23 and connects with a wafer type thermostat 27 above the floor of the timing box. Extending centrally upwardly from the top of the wafer thermostat and through the roof of the timing box is a stem 52a, this stem being threaded to receive an adjusting nut 33 upon its end exterior of the timing box. A coil spring 32 surrounds the stem 52a and is normally under slight compression so as to exert a thrust between the top of the wafer thermostat and the roof of the timing box.

The spring 32 serves as a cushion against which the thermostat is free to expand when the trip lever 29 is locked against rotation by the shoulder b on the rocker arm 30.

Immediately below the wafer thermostat is an electrical resistance element 28, one end of this element being connected to a conductor 35 forming one of the leads of an electric circuit, and the other end of the element being connected, through a short conductor 35a to one of the terminals of the mercury contact switch 31. Connecting the other terminal of the mercury contact switch with a terminal of the motor 19 is a conductor 35b. The other terminal of the motor is connected to a lead 35c constituting the lead of the electric circuit companion to 35, the two leads supplying current from a suitable source, not shown. Thus the mercury contact switch 31 is in series with both the resistance element 28 and the motor 19, so that opening and closing the mercury contact switch cuts out and in the resistance and motor. The timing box 23 is not sealed against the atmosphere but on the contrary is provided with sufficient openings to permit the circulation of air therethrough so that the thermostat 27 may be responsive to temperature conditions within the enclosure to be heated by the stoker, as will later be explained.

Customarily associated with the furnace F is a shaker lever 41 pivoted adjacent its lower end and connected with the grate of the furnace in such a manner that by moving the lever back and forth the fire bed is agitated and the ashes are deposited in the pit P below the grate. In order to automatically actuate the grate from the stoker so that the ashes will not accumulate in the fire box of the furnace, a link 53 (Figs. 1 and 2) is connected at one of its ends to a lug 54 projecting from the slide 15 and at its other end to one arm of a bell-crank 40 pivoted at 55 to a wing 56 projecting laterally from the chute 3 (see Figs. 1 and 3). The other end of the bell-crank is swiveled to the upper end of the shaker lever 41 so that in the forward and backward movement of the slide 15 this shaker lever is rocked in opposite directions.

The stoker described above is adapted to operate as follows: With the mercury contact switch closed, (Fig. 5) the motor 19 will rotate pulley 49 and through belt 48 drive pulley 47 on worm

shaft 46. Worm 45 on worm shaft 46 in turn will impart rotation to worm wheel 44 and the latter will rotate both cam disk 34 and crank 57. Connecting rod 17 having one of its ends connected to the cam disk and crank and its other end connected to slide 15 will impart reciprocating motion to the slide. The agitator pins 36 fastened to the closure face 15b of the slide will rake across the bottom of the mass of coal contained within the hopper 1 and coax it down through the outlet c where it will be impelled by the pushing face 15a of the slide down the chute into the furnace.

During the back and forth movement of the slide the poker bars 16 will alternately penetrate and withdraw from the fuel bed so as to break up coking and maintain the bed in a loose condition so as to promote complete combustion of the fuel. Likewise during reciprocation of the slide the shaker lever 41 of the furnace will be operated through the link 53 and bell crank 40, thus insuring the prompt removal of ashes from the grate and contributing to the maintenance of a bed of hot coals thereon. By adjusting the position of the feed plate 37, the supply of fuel to the furnace may be increased or diminished, and hence the maximum heating capacity of the furnace suitably regulated.

The stoker will operate intermittently under the influence of the thermostat 27. With the control mechanism in the "on" position shown in Fig. 5 with the rocker arm 30 inclined downwardly in a left-hand direction, the mercury contact switch will be closed so that the resistance element 28 and the motor 19 will be in circuit with the conductors 35 and 35c. In this position the motor will be driving the slide 15 so as to feed fuel into the furnace F and the resistance element 28 will be heating up the atmosphere within the timing box 28.

As the temperature within the timing box rises the wafer thermostat 27 will begin to expand. Since at this time an arm of the bell-crank trip lever 29 is latched behind the shoulder b of the rocker arm, the expansion of the thermostat will be in an upward direction against the coil spring 32. However, as soon as the lobe a on cam wheel 34 rides into contact with the bearing block 51 on the rocker arm, the latter will swing upwardly to release the trip lever from the shoulder. Under the urge of coil spring 32, the trip lever will snap anticlockwise into the position shown in Fig. 7 with the latching arm immediately below the end of the rocker arm, and the mercury contact switch will be simultaneously tilted downwardly in a right-hand direction to open the motor circuit, cutting out the resistance element 28, and arresting operation of the stoker. Except for the short drift of the cam disk 34 after power has been cut off, the slide will come to rest in approximately its fully retracted position with the poker bars 16 withdrawn from the fire bed, which is essential in order to prevent damage to these bars by the intense heat of the fire.

Thereupon the heated air within the timing box 23 will slowly escape to the outside atmosphere, and the thermostat 27 will begin to slowly cool and contract. Such contraction draws the operating rod 52 upwardly, swinging the trip lever 29 clockwise so that the trip lever will drop behind the shoulder b, as illustrated in Fig. 5. The rocker arm is thus again tilted downwardly in a left-hand direction so as to close the electric circuit to start motor 19 and heat resistance element 28. The stoker continues to operate as before described until the rocker arm is again released by the cam disk, and this intermittent operation continues indefinitely so as to maintain a substantially even temperature within the enclosure to be heated.

The purpose of the resistance element 28 is to heat the small space within the timing box. While the stoker is in operation the expansion of the thermostat is hastened, but the time required for the heated air to escape from the timing box after the motor has been cut out delays the contraction of the thermostat, so that the periods of rest between successive operations of the stoker are thereby lengthened. By turning the adjusting nut 33 on the stem 52a, the position of trip lever 29 is changed, and hence the setting of the control to respond to different temperature conditions may be varied.

When the stoker is in normal operation with the motor 19 driving the slide 15, the cam 34 will make one or more revolutions, and at each revolution the lobe a will engage the rocker arm to tilt the mercury contact switch 31 to open position. However, the drift of the cam is such as to carry the lobe beyond the rocker arm in a few seconds so that the rocker arm is again lowered to close the switch. That is, unless the rocker arm is maintained raised by the trip lever, the momentary raising of this rocker arm is insufficient to halt the operation of the motor.

From the foregoing description it will be apparent that I have provided a stoker which during its operation pokes the fire bed of the furnace to break up coking which would interfere with the efficient combustion of the fuel and which at the same time shakes the grate to remove ashes from the fire pot, a particular advantage of my apparatus residing in the provision of novel control means adapted to periodically actuate the stoker and to arrest its operation with the poker bars withdrawn from the fire bed. Instead of the mercury contact switch 31, any other suitable form of switch might be employed. Manifestly various other changes in detail and design might be made within the scope of the accompanying claim without departing from the spirit of my invention.

I claim:

An overfeed type of stoker comprising a vertically-disposed coal hopper, an inclined chute located below the hopper and adapted to have its lower end extended through the door of a furnace, an outlet for coal communicating between the bottom of the hopper and the chute, a slide reciprocable within the chute below said outlet, means for reciprocating the slide for pushing coal down the chute, a plurality of elongated, forwardly-projecting poker bars mounted upon the front end of said slide and adapted to rest and slide upon the bottom of said chute, said poker bars having pointed ends and being movable outwardly through the lower end of the chute into and out of the fire bed of the furnace upon reciprocation of the slide for a distance equal to the length of reciprocation of the slide, and means for arresting said slide with the poker bars retracted substantially entirely within the chute when the slide-reciprocating means is rendered inoperative.

PETER PAUL PETERS.