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STOKER CONSTRUCTION

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2 Sheets-Sheet 1

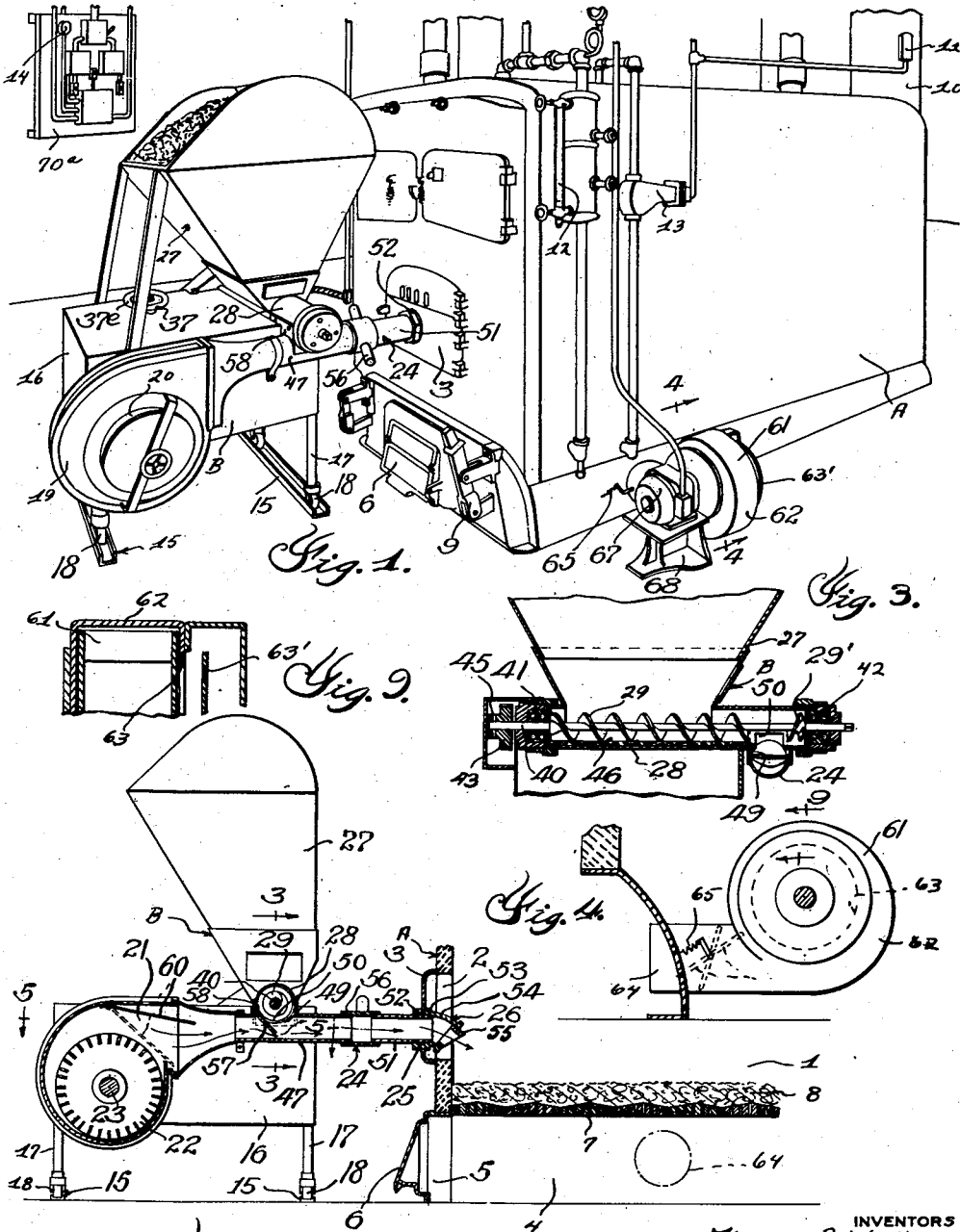


Fig. 2.

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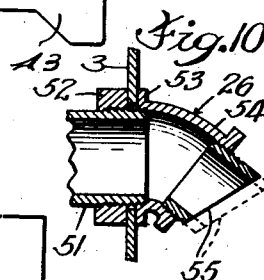
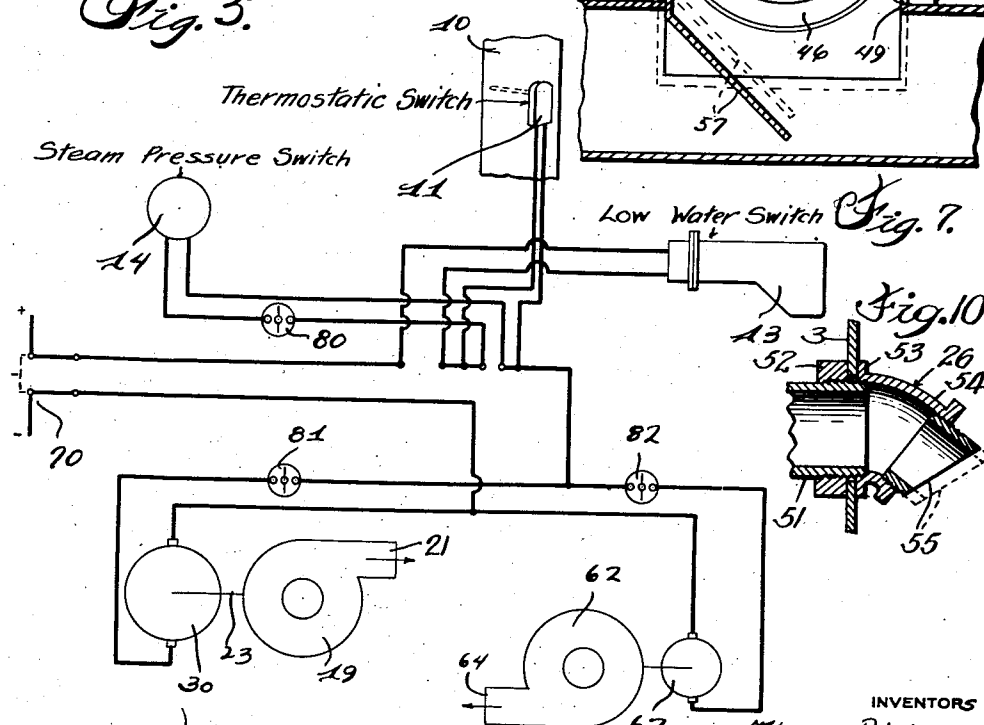
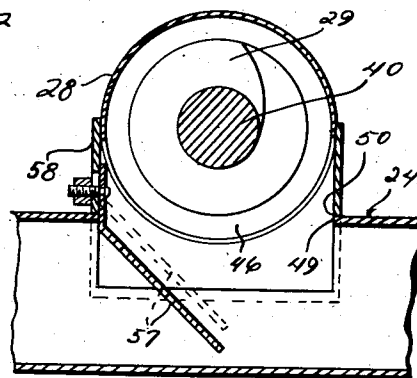
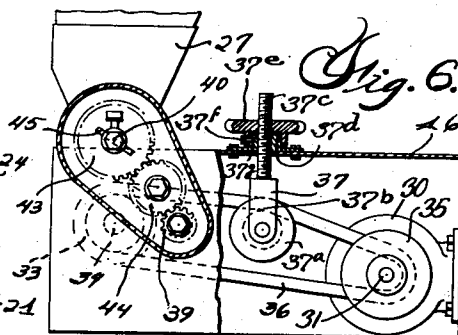
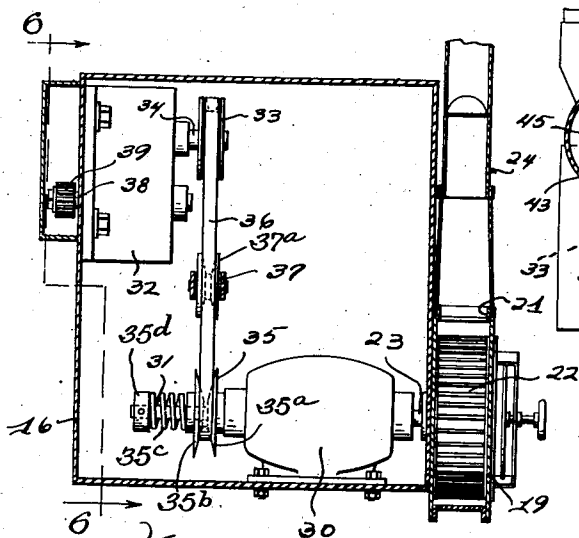
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2 Sheets-Sheet 2



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STOKER CONSTRUCTION

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3 Claims. (Cl. 110—110)

This invention relates generally to stoker constructions and refers more particularly to over-feed stokers for use in connection with furnaces.

One of the essential objects of the invention is to provide a stoker of this type wherein air from a suitable blower is utilized for feeding fuel into the furnace.

Another object is to provide a stoker wherein means preferably in the form of a spiral conveyer is utilized for feeding fuel from a suitable source such as a hopper to the air feeding means.

Another object is to provide a stoker wherein both the blower and conveyer aforesaid are operated by and driven from a single source of power such as a suitable electric motor.

Another object is to provide a stoker wherein the driving connection between the motor and conveyer preferably includes an adjustment for varying the movement of the conveyer so that the quantity of fuel transferred from the hopper to the air feeding means may be varied as desired.

Another object is to provide a stoker wherein adjustable means is provided in the air feeding means for varying the volume of air used to feed the fuel into the furnace.

Another object is to provide a stoker which is a self-contained portable unit and may be conveniently moved to and from one or more furnaces as desired.

Another object is to provide a stoker wherein the conduit for the air used in feeding fuel into the furnace is so constructed that its withdrawal from the furnace upon movement of the stoker as aforesaid will leave the furnace intact so that it may be fired by hand.

Another object is to provide a stoker wherein the air feeding means is provided with an adjustment to compensate for any irregularities in distance between the stoker and furnace when the stoker is moved from one furnace to another along the track.

Another object is to provide a stoker wherein all of the working parts except a nozzle upon the air conduit aforesaid are outside the furnace and are readily accessible.

Another object is to provide a stoker wherein the spiral conveyer and its enclosing conduit are so constructed and arranged that a bed of fuel of sufficient depth is provided on the bottom of the conduit beneath the conveyer to receive and insulate the conduit from the main body of moving fuel and slate or other foreign matter carried by such body which otherwise might have an abrasive action or damaging effect upon the metal of the conduit.

Another object is to provide a construction wherein means in addition to the stoker is provided for feeding air into the furnace beneath the grates thereof while the blower aforesaid is operating or while it is idle to assist in the combustion of the fuel fed into the furnace.

Another object is to provide a construction wherein the supply of air to the furnace is automatically controlled but may at will be manually controlled.

Another object is to provide a construction which is simple, practical, scientific, efficient and economical in operation and which produces practically smokeless combustion.

Other objects, advantages and novel details of construction of this invention will be made more apparent as this description proceeds, especially when considered in connection with the accompanying drawings, wherein:

Figure 1 is a perspective view of a furnace and a stoker embodying our invention applied thereto;

Figure 2 is a fragmentary vertical sectional view taken through the construction illustrated in Figure 1;

Figure 3 is a sectional view taken on the line 3—3 of Figure 2;

Figure 4 is a sectional view taken substantially on the line 4—4 of Figure 1;

Figure 5 is a horizontal sectional view taken on the line 5—5 of Figure 2;

Figure 6 is a sectional view taken on the line 6—6 of Figure 5;

Figure 7 is an enlarged fragmentary vertical sectional view through the juncture of the fuel and air conduits;

Figure 8 is a diagrammatical view of the electrical system;

Figure 9 is a sectional view taken on the line 9—9 of Figure 4.

Figure 10 is a sectional view of a detail on a larger scale.

Referring now to the drawings, A is a furnace of conventional design and B is a stoker embodying our invention for feeding fuel into the furnace. In this connection it is to be understood that the furnace may be any suitable type with which a stoker embodying our invention may be associated.

As shown, the furnace A has a fire box or combustion chamber 1 provided with a suitable fuel feed opening 2 and door 3, an ash pit 4 provided with a suitable opening 5 and door 6, grates 7 for supporting the fuel bed 8, a shaker mechanism 9 for the grates, a stack or smoke pipe

10, a stack control switch 11, a water gauge 12, a low water cut-off switch 13, and a steam pressure switch 14. It will be noted from Figure 8 that the thermostatic switch 11 and steam pressure switch 14 are connected in parallel and that the low water switch 13 is connected in series with the two above switches.

The stoker B is a self-contained portable unit and is preferably movable upon a suitable track 15 in front of the furnace A. If desired, this track 15 may extend in front of more than one furnace so that the stoker B may be moved thereon from one furnace to another, consequently it is possible for the same stoker to be used for firing several furnaces at different times.

Referring now in detail to the stoker B, 16 is a casing having legs 17 provided at their lower ends with casters or rollers 18 for engagement with the rails of the track 15. 19 is a blower or fan housing upon one side of the casing 16 and having a suitable inlet 20 and a suitable outlet 21 for air, 22 is a fan in the housing 19, and 23 is a shaft for the fan extending into the casing 16. 24 is a sectional conduit extending from the air outlet 21 through an opening 25 in the fire box door 3 and provided at its free end within the fire box 1 with a suitable nozzle 26. 27 is a hopper for the fuel, 28 is a conduit for conducting fuel from the hopper to the air conduit 24, and 29 is a spiral or helical conveyor for moving fuel longitudinally of the conduit 28. 30 is an electric motor within the casing 16 connected directly to the fan shaft 23 and having a shaft 31, 32 is a housing for suitable reduction gearing, 23 is a pulley rigid with the drive shaft 34 of the reduction gearing, 35 is a spring pressed pulley on the motor shaft 31, and 36 is an endless belt trained around the pulleys 33 and 35. 37 is a change speed mechanism for the belt drive, 38 is the take-off shaft of the reduction gearing, 39 is a gear on the take-off shaft 38, 40 is a shaft for the spiral conveyor journaled in bearings 41 and 42 respectively at opposite ends of the conduit 28, 43 is a gear rigid with the conveyor shaft 40, and 44 is an idler gear between and meshing with the gears 39 and 43. Thus, it will be apparent that both the conveyor 29 and fan 22 are driven from the motor 30. Preferably the connection between the gear 43 and shaft 40 includes a pin 45 which is shearable when subjected to undue strains or stresses. Likewise, the construction and arrangement of the spiral conveyor 29 relative to the conduit 28 is such that a bed 46 of fuel of sufficient depth is provided on the bottom of the conduit 28 beneath the conveyor 29 to receive and insulate the conduit from the main body of the moving fuel and slate or other foreign matter such as nails, spikes, etc., carried by such body which otherwise might have an abrasive action or damaging effect upon the metal of the conduit 28.

Preferably the section 47 of the conduit 24 and the conduit 28 have registering openings 49 and 50 respectively therein through which the fuel from the hopper passes when actuated by the conveyor 29. The conveyor 29 terminates short of the opening 50, consequently fuel from the hopper will ordinarily not be carried beyond said opening. However, if for any reason the fuel should be carried or moved in the conduit 28 beyond the opening 50, it will be returned to said opening by an auxiliary spiral conveyor 29' which is provided on the shaft 40 between the opening 50 and the bearings 42. As a result, fuel will not clog up or accumulate in the conduit

28 about the shaft 40 beyond the opening. The section 51 carrying the nozzle 26 is detachably connected to the door 3 so that it may be readily withdrawn when it is desired to move the stoker relative to the boiler. Preferably this is accomplished by providing a fixed collar 52 upon the section 51 for engagement with the outer side of the door and by threading a flange 53 of the nozzle 26 upon the free end of the section 51 against the inner side of the door. The nozzle 26 may be of any suitable construction but preferably includes an elbow 54 and an adjustable deflector 55 which are so constructed and arranged that the fuel projected forwardly by the air in the conduit 24 will be distributed in an efficient manner over the fuel bed 8. The intermediate section 56 of the conduit threadedly engages the sections 47 and 51 thereof so as to be adjustable to compensate for any irregularities in distance between the stoker B and furnaces when the stoker is moved from one furnace to another along the track 15. It will also be apparent that this section 56 may be uncoupled from either section 47 or 51 to permit the door 3 carrying the section 51 to be opened for access to the nozzle 26 when the stoker is to be moved relative to the furnace.

Preferably the air outlet 21 converges from the fan housing 19 so that the pressure of air from the housing is built up before it reaches the conduit 24. Moreover, a baffle 57 is provided in the section 47 of the conduit 24 which extends downwardly and forwardly of the fuel opening 49, and is constructed and arranged in such a way that it cooperates with the conduit 24 to form in effect a restricted orifice for the air. As a result, the air from the blower will rush with great velocity past the baffle 57 through the conduit 24 to the nozzle 26 and will serve efficiently to project into the furnace the fuel that is received in the conduit 24 from the conduit 28. Due to the velocity of the air, the major portion of the fuel received in the conduit 24 will be carried in suspension and forcibly projected into the fire box over the fuel bed 8. In this connection it will be noted that the baffle 57 is adjustably mounted on a wall 58 of the conduit 28, hence may be raised or lowered at will relative to the bottom of the conduit 24. As a result, the velocity of the air may be varied as desired. It will also be noted that a damper 60 is provided for closing the air outlet 21 when the fan 22 is not operating. Preferably the construction is such that the damper 60 will be held in open raised position (full lines, Figure 2) by the air when the fan is operating and will fall by gravity to closed position (dotted lines, Figure 2) when the fan 22 stops.

In the present instance air is blown into the ash pit 4 beneath the grates 7 by means of a fan 61 within a suitable housing 62 so that the air will filter upwardly through the fire bed 8 and assist in the combustion of the fuel. As shown, the housing 62 has an air inlet 63 at one side provided with a manually operable damper 63' to control the volume of air admitted, and has a damper controlled outlet 64, a spring 65 being provided to insure proper closing of the damper 66 when the fan 61 is not operating. Preferably a separate motor 67 is used to drive the fan 61 and is mounted on a suitable base 68 beside the housing 62.

In order that the supply of fuel and air to the furnace A will be controlled automatically, we have electrically connected the motors 30 and 75

67 to a switch 70 of a panel board 70^a and to the steam pressure switch 14, low water level cut-off switch 13 and stack control switch 11. Preferably the steam pressure switch 14 is a conventional steam and spring actuated adjustable type which is operable when the steam pressure reaches a predetermined high pressure to open the circuit to both motors 30 and 67 and cause them to stop, and is operable when the steam pressure falls to a predetermined low pressure to close the circuit to both motors and cause them to actuate the fans 22 and 61 and conveyer 29. The stack control switch 11 is a conventional thermostatic type which is operable when the heat in the stack 10 reaches a predetermined high temperature to open the circuit to both motors 30 and 67 and cause them to stop, and is operable when the heat in the stack 10 falls to a predetermined low temperature to close the circuit to both motors 30 and 67 and cause them to actuate the fans 22 and 61. This stack control is primarily a night control and effectively prevents the fire from going out.

The low water line cut-off switch 13 is also a conventional float actuated type which is operable when the water level falls below a predetermined point to open the circuit to both motors 30 and 61 and cause them to stop, and is operable when the water level rises to a predetermined point to close the circuit to the motors 30 and 67 and cause them to actuate the fans 22 and 61. Preferably this switch 13 is located approximately one inch above the bottom of the water gauge 12 on the boiler.

In addition, we have provided three manually operable switches 80, 81 and 82 respectively. Preferably the switch 80 is in the shunt circuit to the steam pressure switch 14. When opened, this switch 80 cuts out the steam pressure switch 14. When closed, the switch 80 permits the steam pressure switch 14 to function. The switch 81 is in the circuit to the motor 30, and the switch 82 is in the circuit to the motor 67. Hence when the switch 81 is opened, the motor 30 will be stopped and the supply of both fuel and air over the fire bed 8 will be stopped. When the switch 82 is opened, the motor 67 will be stopped, consequently the supply of air under the grates 7 will be stopped.

In operation, the hand switches 80, 81 and 82 respectively are normally closed, hence the stoker is normally automatic. As a result, fuel and air are supplied to the furnace over the fire bed 8 and air is supplied to the furnace beneath the fire bed simultaneously. However, at times the fuel bed is too thick for good combustion. We then open the manual switch 81 and allow the fan 61 blowing air beneath the grates to continue operating until the fuel bed is the desired thickness for best combustion. The mechanism 37 and baffle 57 are then adjusted properly to accomplish the desired results. In this connection it will be noted that the mechanism 37 is a change speed mechanism and comprises a pulley 37^a engaging the belt 36 and carried by the forked head 37^b of a supporting screw 37^c extending upwardly through a block 37^d mounted upon the casing 16. An adjusting wheel 37^e threadedly engages the screw 37^c above the block 37^d and carries a pin 37^f which engages an annular groove 37^g in the block. Thus, rotation of the wheel 37^e about the block 37^d will cause the screw 37^c and pulley 37^a to be raised or lowered. The pin 37^f engaging the slot 37^g in the block 37^d will permit such rotation of the wheel 37^e, but

will prevent displacement of the wheel from said block. Referring to Figure 5, it will be observed that the pulley 35 has separate sections 35^a and 35^b. Section 35^a is rigid with shaft 31, while section 35^b is splined upon said shaft and is urged toward section 35^a by a coil spring 35^c located between said section 35^b and a block 35^d anchored on said shaft 31. Preferably the arrangement is such that the section 35^b may be moved away from section 35^a by the belt 36 when the pulley 37^a is raised by adjustment of the wheel 37^e. Likewise when the pulley 37^a is lowered, the section 35^b will be moved by the spring 35^c toward the section 35^a of the pulley 35. Therefore, it will be obvious that rotation of the wheel 37^e causes indirectly the effective radius of the pulley 35 to be increased or decreased, thereby causing an increase or decrease in the speed of rotation of shaft 34. Following this, the switch 81 is closed so that the operation will be fully automatic. At times the fuel bed is too thin for good combustion, producing an excess amount of air in the furnace through holes in the fuel bed. We then open the switch 82 controlling the motor 67 to cut off the supply of air beneath the grates, at the same time allowing the motor 30 operating the conveyer 29 and fan 22 to continue operating so that the supply of coal and air over the grates will continue until the desired thickness of fuel bed is obtained. The mechanism 37 and baffle 57 are then adjusted properly for efficient results and following this, the switch 82 is closed so that the operation will again be fully automatic.

Normally, switch 80 is closed during operation of the stoker so that the steam pressure switch 14 will operate. However, when normal conditions are not required, for example, during the night, this switch 80 is opened so that the steam pressure switch 14 will be cut out. The stack control switch 11 functions to maintain a certain stack temperature and in doing so controls the circuits to the motors so that sufficient combustion takes place to prevent the fire from going out. When the water gets too low in the boiler, then the low water cut-off switch will function to open the circuits to the motors and cause the fans and conveyer to stop operating. In the event of failure of the electric service, or damage to the stoker, the latter may be moved away from the furnace so that the furnace may be fired by hand. This is an important factor in greenhouse work, power plants, schools, apartments, etc. Moreover, it is a big advantage to be able to move the stoker from one furnace to another for any reason such as failure of any one furnace. In this way only one stoker is required for several furnaces. For example, where two furnaces are necessary to carry the load and a third is used as a standby, then only two stokers of the type herein described are required. When the third furnace is wanted in service, one of the two stokers mentioned can be moved and attached to such third furnace.

When the circuit to the motor 30 is closed, air at sufficient velocity, volume and pressure from the fan 22 passes through the conduit 24 beneath the baffle 57, picks up the fuel dropped from the conduit 28 and carries it to the nozzle 26 where it is projected in spray form into all parts of the fire box upon the fuel bed. The fine particles of the fuel are to a large extent burned in suspension. The larger particles fall onto the fuel bed. Inasmuch as the mechanism 37 controls indirectly the speed of rotation of

the conveyer 27, it is apparent that the supply of fuel by the conveyer 29 to the conduit 24 may be effectively metered upon adjustment of the mechanism 37. Likewise, adjustment of the baffle 57 varies the velocity, volume, etc. of the air utilized in the conduit 24 for projecting the fuel into the fire box and for assisting the combustion thereof. In this connection it should be noted that the nozzle and/or deflector 55 can be turned relative to the section 51 to throw fuel down one side or the other of the fire box, as desired. Actually the nozzle is so shaped that it functions to throw the fuel and air to all parts of the fire box. The high velocity of the air produces the necessary turbulence within the fire box to cause thorough commingling of the air and fuel for the most efficient combustion. Thus, it is possible with our stoker to feed simultaneously the correct amount of fuel and air at the correct volume and pressure above the grates and at the same time to feed the correct amount of air at the correct volume and pressure beneath the grates.

What we claim as our invention is:

1. The combination with a furnace having a heating chamber, of apparatus for feeding fuel into the heating chamber comprising a blower located exteriorly of the chamber, means establishing communication between the blower and heating chamber including a conduit, a fuel hopper located between the blower and said chamber and communicating with said conduit to discharge fuel into the air stream passing through the conduit, means located between the blower and point of communication of the hopper with said conduit for varying the rate of flow of air through said conduit, said last named means including a damper having a portion extending into the conduit and inclined from one side wall of the conduit in a direction toward said chamber, and means supporting the damper for sliding movement relative to the conduit to vary the clearance between one edge of the damper and the side wall of the conduit opposite the wall aforesaid and effective to maintain the angle of inclination of said portion of the damper with the air stream substantially constant in several of the adjusted positions of the damper.

2. The combination with a furnace having a heating chamber, of apparatus for feeding fuel into the heating chamber comprising, a blower

located exteriorly of the chamber, means establishing communication between the blower and heating chamber including a conduit, a fuel hopper having a discharge opening communicating with the conduit at a point between the blower and heating chamber for discharging fuel into the air stream passing through the conduit, means located within the conduit adjacent the discharge opening of the fuel hopper for varying the rate of flow of air through the conduit and for directing the fuel into the air stream, said last named means including a damper having a portion inclined from one side wall of the conduit in a direction toward the heating chamber and positioned with respect to the discharge opening of the hopper to direct fuel into the air stream flowing past said damper, and means for adjusting the damper relative to the conduit to vary the clearance between the side wall of the conduit opposite the side wall aforesaid and effective to maintain the angle of inclination of said portion with the axis of the hopper discharge opening substantially constant in several of the adjusted positions of the damper.

3. The combination with a furnace having a heating chamber, of apparatus for feeding the fuel into the chamber comprising, a blower located exteriorly of the chamber, means establishing communication between the blower and heating chamber including a conduit, a fuel hopper having a discharge opening communicating with said conduit at a point between the blower and heating chamber, means located between the blower and hopper discharge opening for varying the rate of flow of air through said conduit, said last named means including a damper having a portion inclined downwardly from the upper side of the conduit in the direction of flow of air through said conduit and located in said conduit adjacent the hopper discharge opening to provide a chute for directing fuel into the conduit in the air stream flowing past the damper, and means supporting said damper for sliding movement in a direction parallel to the axis of the discharge opening for varying the clearance between the lower edge of the damper and adjacent wall of the conduit without changing the angle of inclination of the portion aforesaid of said damper.

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