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AUTOMATIC STOKER

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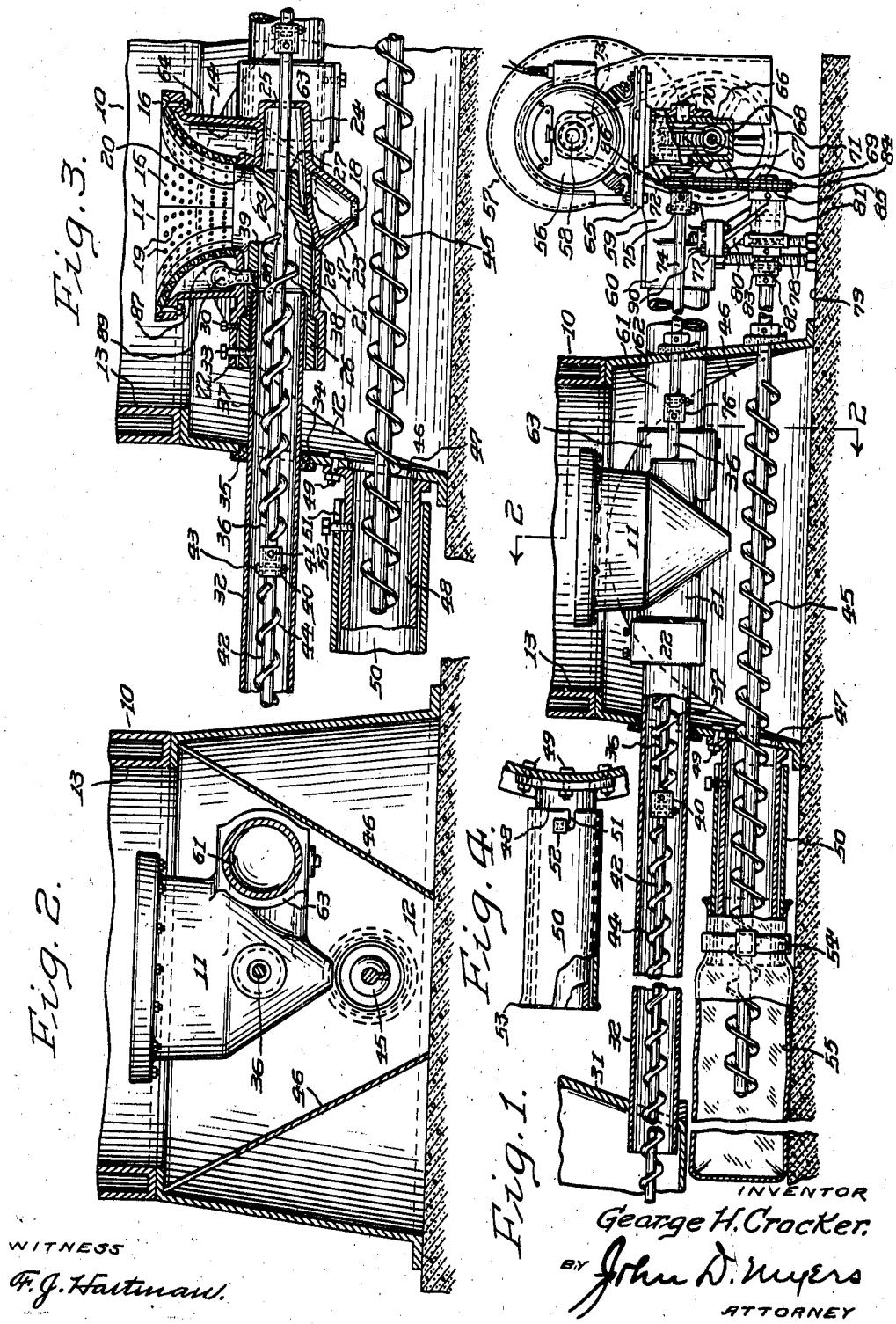


Fig. 3.

Fig. 4.

Fig. 2.

Fig. 1.

WITNESS

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AUTOMATIC STOKER

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9 Claims. (Cl. 110—45)

The invention relates to automatic stokers and involves various improvements in the burner, the fuel feeding device, the ash removal device, the power apparatus, and certain combinations and arrangements of these parts of an automatic stoker with respect to each other.

Automatic stokers designed for domestic use are usually provided with a conveyor for delivering fuel to the burner, a conveyor for removing the ashes discharged from the burner, a blower for producing a forced draft in the burner, and motor mechanism for driving the conveyors and the blower. It is usual in such apparatus to combine the motor and the blower as a unit for assembly with the other elements of the stoker. The present invention has for its primary object a decrease in the cost of stokers of this general type. This object is accomplished by simplifying the structure of the different parts referred to above, by the elimination of various features of construction, and by certain novel arrangements of the fuel feeding device and the ash removal device with respect to the burner and the power unit.

The invention also has for an important object the provision of a fuel feed screw which is directly connected to the power unit so as to be driven thereby with a minimum reduction in speed, and consequently with a minimum number of parts in the speed reducing mechanism which is essential with power apparatus of the electric motor type. This object is attained by so designing the fuel feed screw that it may be driven at a speed many times that which has been necessary heretofore for the satisfactory operation of a fuel conveyor of this general type.

Another important object of the invention is the provision of an ash removal device which is so designed that ashes are discharged from the ash pit of the furnace into a receptacle in the form of a bag made of paper or other suitable material. With such a structure the ashes from the stoker are automatically delivered to the receptacle, and the employment of paper bags makes possible the use of what would otherwise be a waste household product, and avoids the necessity of transferring the ashes from the receptacle to a collecting wagon or truck with the consequent annoyance caused by spilled ashes.

Another object of the invention is the provision on the conveyor for transferring the ashes from the ash pit to the bag of a bag holder so designed that the ashes will not be spilled when the filled bag is removed from the holder. This object is attained by means of an ash discharge tube secured to and extending outwardly from the ash pit of the furnace and having a sleeve slidably arranged thereon and adapted to be removed therefrom with a filled bag and thereafter removed from the filled bag and restored to the discharge tube.

A further object of the invention is the provision of means for preventing combustion gases from backing up through the fuel feed pipe from the burner and escaping into the furnace room. This object is accomplished by providing an air passage between the air chamber surrounding the grate and the outlet end of the fuel feed pipe, and by providing a funnel or pick-up device at the inlet of this passageway in the air chamber to insure the flow of air from the air chamber to the fuel feed pipe.

Still other objects and advantages of the invention will be apparent from the following description, taken with the accompanying drawing wherein:

Fig. 1 is a vertical setcional view showing my improvements in assembled relation with respect to a furnace, the burner being shown in elevation;

Fig. 2 is a transverse sectional view taken on the line 2—2 of Fig. 1, slightly enlarged;

Fig. 3 is a vertical sectional view similar to Fig. 1, but slightly enlarged and showing the burner in section; and

Fig. 4 is a plan view, partly broken away, of the bag holder employed with the ash removal device.

My improved stoker has been designed particularly for assembly with a furnace 10 theretofore installed as part of a heating system, although it will be understood that it is also adapted to be incorporated with the furnace upon its installation in the system if desired. The stoker is of the type in which an upright burner 11 is mounted in the ash pit 12 of the furnace 10 so that the upper end thereof projects into the combustion chamber 13 and ashes and other solid products of combustion are discharged over the upper edge of the burner and drop downwardly into the ash pit.

The body of the burner 11 comprises a casing 14 which is generally circular in cross section and open at its upper end. The upper end of the casing 14 is closed by means of a grate in the form of a fire pot composed of a plurality of downwardly curved, tapering sections 15, the upper ends of which are supported upon the upper edge of the wall of the casing 14 and are secured thereto by bolts 16. As shown at 17, the

lower end of the side wall of the casing 14 tapers inwardly to a small central opening 18 which serves as a discharge opening for fine ashes and powdered coal which fall through the perforations 19 in the grate.

The lower end of the fire pot communicates with an opening 20 in a fuel conduit 21 which extends transversely through the wall of the casing 14 and terminates at its outer end in a faucet 22. The fuel conduit 21 is continuous with a bearing chamber 23 in the opposite side of the casing 14 and projecting outwardly thereof as a hollow boss 24 closed at its outer end except for a central shaft opening 25 in alinement with the fuel conduit.

Inasmuch as the burner casing 14 disclosed herein has been designed for use with stokers of various types, the form shown in the drawing is one in which an adapter 26 is employed for the purpose of permitting a distinct type of fuel feeding device to be used therewith. This adapter is in the form of a hollow casting with the inner end thereof provided with a shaft opening 27 in alinement with the opening 25 in the outer end of the hollow boss and with the axis of the fuel conduit 21. As indicated at 28, the inner end of the bore through the adapter 26 curves upwardly to an opening 29 in alinement with the opening 20 from the fuel conduit into the lower end of the fire pot. The adapter may be retained in position in the fuel conduit by means of a set screw 30 threaded through the wall of the faucet 22 into engagement with the adapter.

The fuel conduit 21 is connected to a source of fuel supply, such as a coal hopper or bin 31, by means of a fuel feed pipe 32. The outer end of the fuel pipe 32 is supported by the bin 31 and the inner end projects into the adapter 26 and is secured therein by a set screw 33 extending through an opening in the faucet 22 and threaded through the adapter into engagement with the pipe. In order to prevent the transmission of vibrations from the stoker to the furnace, the opening 34 in the furnace wall through which the fuel pipe 32 extends may be packed with asbestos rope or the like and suitably cemented as indicated at 35.

The fuel feeding device which I employ has been so designed as to operate at a speed much greater than the speed which has been necessary with stokers heretofore manufactured and used, the improvements in the feeding device being necessitated by reason of certain other improvements which I have made in the power unit for the purpose of eliminating parts thereof as hereinafter described. This feeding device comprises a conveyor shaft extending throughout the length of the fuel pipe 32 and having the flight thereof formed of a round wire or rod wound spirally on the shaft and welded or otherwise secured thereto at suitable intervals. As I have disclosed the same herein, and as a convenience in manufacture and installation, the fuel feed screw, as well as the extended driving shaft therefor, is made in sections of limited length. In the form which I now prefer to use, a shaft section 36 extends through the fuel conduit 21, the shaft opening 27 in the inner end of the adapter, the bearing chamber 23, and outwardly through the opening 25 in the boss 24, with the opposite end extending outwardly into the fuel pipe 32. The latter end of the shaft section 36 is provided with a flight of wire 37 the inner end of which terminates within the fuel conduit 21 and merges with a flight 38 comprising a single turn in the form of a spiral blade which serves as a propeller to feed the fuel upwardly into the fire pot at a rate slightly greater than that at which it is delivered by the wire spiral 37. The diameter of the spiral blade 38 is preferably slightly greater than the diameter of the wire spiral portion 37, and the inner end of the propeller 38 preferably terminates a slight distance inwardly of the edge 39 of the opening from the adapter into the fire pot.

The outer end of the shaft section 36 is provided with a collar 40 secured thereon by means of a pin 41 and serving as a connecting member with the adjacent shaft section 42. The end of shaft section 42 may be removably secured in the collar by any suitable means such as a bolt 43. The fuel feeding means on shaft section 42 comprises a flight 44 made of round wire wound spirally about the shaft and suitably secured thereto as heretofore described in connection with the flight 37 on shaft section 36. In this case, however, the flight 44 may be formed of round wire having a diameter slightly less than the diameter of the wire forming the flight 37. With two conveyor sections of this character, it will be apparent that the feed of the fuel through that portion of the fuel pipe 32 adjacent the burner will be greater than the feed through the portion of the pipe adjacent the source of fuel supply 31, and that such a construction facilitates the feeding of the fuel from the source of supply to the burner and eliminates any tendency of the fuel to jam in the feed pipe. It will be understood that additional conveyor sections may be used if necessary to extend the conveyor to the source of fuel supply.

The fuel feed pipe which I now utilize for feeding a fine grade of coal has an inner diameter of two inches. While a structure having other dimensions may be devised, I have found from experience that the coal screw disclosed herein operates with entire satisfaction with a shaft having a diameter of one-half inch. The preferred diameter of the wire forming the flight 37 on the conveyor section 36 is five-sixteenths of an inch, with a pitch of two inches, and the preferred diameter of the wire used for the flight 44 of the shaft section 42 is one-fourth of an inch, with a two-inch pitch. The preferred over-all diameter of the propeller 38 is one and three-fourths inches. It will be understood, however, that these dimensions are merely suggestive and are not intended to limit the scope of my invention in any manner.

The improvement which I have devised in ash removal mechanism includes a screw conveyor 45 extending transversely through the ash pit 12 below the burner 11. Ash directing plates 46 may be inserted in the ash pit, if desired, to deflect the ashes toward the ash screw 45. The ash screw extends outwardly from the ash pit through an opening 47 near the bottom of the furnace wall, and through an ash discharge tube 48 projecting outwardly from the opening 47 and secured to the furnace wall by bolts 49. A sleeve 50 is slidably mounted on the ash discharge tube 48 so that it may be bodily removed over the outer end of the discharge tube. The sleeve 50 may be retained in its innermost position by means of a bayonet slot 51 formed on its inner end for co-operation with a pin 52 secured in the discharge tube. The outer end of the sleeve 50 may be turned outwardly to provide a tapered flange 53 which co-operates with a strap 54 or the like for retaining the open end of a bag 55 made

of paper or other suitable material upon the sleeve to serve as a receptacle for discharged ashes.

The outer end of the ash screw 45 preferably extends to some distance beyond the outer end of the ash discharge tube 48 so as to properly feed ashes to the bottom of the bag. When the bag has been completely filled with ashes, the bayonet slot 51 in the end of the sleeve is disconnected from the pin 52, and the bag, with the sleeve secured in the open end thereof, is removed from the ash discharge tube 48. The bag may then be placed in upright position and the sleeve may be removed therefrom after unfastening the strap 54. With such a structure, the bag may be removed from the ash discharge device without danger of spilling ashes due to the withdrawal of the ash screw 45 from the bag. As will also be apparent, when paper bags are used as ash receptacles, the open ends of the bags may be closed and secured by strings, so that such receptacles may be collected without transferring the ashes therefrom and the usual spilling of the ashes due to such transference.

The power mechanism which I have devised for use with my invention is of the type wherein an electric motor 56 is directly associated with a blower 57, the fan of the blower being mounted on an extension of the motor shaft 58. Such a unit is well understood in the art and a detailed description thereof is unnecessary to a complete understanding of the present invention. As disclosed herein, the blower casing terminates at its lower end in an air outlet 59 provided with a faucet 60 within which one end of the air pipe 61 is secured. The opposite end of the air pipe 61 extends through an opening 62 in the furnace wall, into a faucet structure 63 forming an air inlet on the wall of the burner casing for admitting air into the air chamber 64 between the grate 15 and the side wall of the burner casing 14. Preferably the air supply pipe 61 is insulated from the furnace wall in the manner heretofore described with respect to the fuel pipe 32.

A plate 65 extending horizontally from the blower casing serves as a support for the motor 56 which is suitably secured to the top thereof. A gear case 66 secured to the underside of the plate 65 extends downwardly therefrom. The gear case 66 contains two shafts arranged at right angles to each other. Shaft 67 extends through the case parallel to the motor shaft 58 and has a worm 68 secured thereon within the case. This worm meshes with the worm wheel 69 secured on a stub shaft 70 arranged at right angles to motor shaft 58. The worm shaft 67 is driven by a large pulley 71 secured on the outer end thereof and carrying a belt 72 which passes around a small driving pulley 73 on the motor shaft. With this arrangement of power mechanism and transmission mechanism, the stub driving shaft 70 is positioned in alinement with the fuel feed screw and is connected directly to one end of a shaft section 74 by means of a coupling 75 pinned to the stub shaft and removably bolted to shaft section 74. The opposite end of shaft section 74 is similarly connected to shaft section 36, within the ash pit 12, by a coupling 76.

The air outlet 59 from the blower casing is provided on each side with a horizontal lug 77 having a hole therein threaded to receive threaded adjusting legs 78 by means of which the power unit is supported on the floor 79. A bracket 80 secured to and extending downwardly from one of the lugs 77 is provided at its lower end with a bearing 81 for a stub shaft 82 arranged in alinement with the ash screw 45 and secured to the shaft thereof by the coupling and pin connection 83. The opposite end of the stub shaft 82 has a sprocket wheel 84 secured thereon and driven by a sprocket chain 85 passing around a driving sprocket 86 secured on the stub driving shaft 70 in the gear case.

As will be apparent from this arrangement of power mechanism, the fuel feed screw is connected directly to the stub driving shaft 70, and the ash screw 45 is driven directly from the sprocket wheel 86 on the stub driving shaft. The arrangement makes it possible to eliminate additional reduction gearing which has been necessary for the satisfactory operation of automatic stokers heretofore manufactured. This elimination of parts from the speed reducing mechanism ordinarily employed with automatic stokers results in an operating speed for the fuel feed screw which is much greater than has heretofore been practical. Such an increase in the speed of rotation of the fuel feed screw is possible with the stoker herein disclosed by reason of the unusual structure of the feed screw which I have devised.

As will be apparent from the drawing, the burner mechanism is supported in the furnace solely by the fuel pipe 32 and the air pipe 61, the fuel pipe having its outer end secured in the bin or other source of fuel supply 31, and its inner end supported in the opening 34 in the furnace wall. The air delivery pipe is supported at its outer end by the motor-blower unit, and is supported at its inner end in the opening 62 in the furnace wall.

With the above-described arrangement of the various parts of my improved stoker, it will be apparent that the power mechanism, the burner, and the source of fuel supply are arranged in alinement, and that the fuel conveyor shaft extends in a direct line with the stub driving shaft 70 of the transmission mechanism, through the lower part of the burner, and through the fuel supply pipe to the source of fuel supply. It will also be apparent that the ash screw is parallel with the fuel feed screw, is driven directly from the stub driving shaft of the transmission by a sprocket chain, and operates to discharge the ashes from the ash pit in the direction of the source of fuel supply.

It will also be apparent that both conveyor shafts have, in effect, a floating construction. The coupling 75 by which the feed screw is connected to the stub driving shaft fits somewhat loosely upon the adjacent ends of the connected shaft sections so as to permit a considerable degree of lateral movement in the feed screw. In like manner the other coupling members between the different sections of the fuel feed shaft are loosely fitted thereon. As will be apparent, therefore, the only positive support for the fuel feed screw is that which is provided by its connection with the stub driving shaft. When the stoker is in operation, the feed screw is supported in the fuel feed pipe by the fuel which is being delivered therethrough, also by the self-forming bearing which is produced in the bearing chamber 23 by means of the powdered fuel which works its way into this chamber and is compressed therein by the rotation of shaft section 36. I have found from experience that a bearing of this character operates with entire satisfac-

tion and makes possible the elimination of the metal bearing which has heretofore been regarded as essential.

In the operation of the stoker a suitable fuel, such as a fine grade of coal, is delivered to the burner 11 by the fuel feed screw through the fuel pipe 32 and forced upwardly through the fire pot 15 by the propeller 38. Upon combustion of the fuel in the fire pot, assisted by a forced draft of air from the blower through the air pipe 61, the air chamber 64 and the perforations 19 in the grate, the ashes and other solid products of combustion are discharged from the upper edge of the burner and drop downwardly into the ash pit 12. The ash plates 46 are preferably employed to direct the ashes into the region of the ash screw 45, whereupon they are discharged through the ash tube 48, into the bag 55 supported on the floor 79, in the manner heretofore described. It will be understood, however, that the ash directing plates 46 are not essential to the operation of the ash removal device inasmuch as the ashes may be permitted to accumulate in the ash pit to a sufficient extent to bring them within the zone of action of the ash screw. The tapered end 17 of the burner casing facilitates the movement of the ashes to the ash screw.

In order to avoid the difficulty which is sometimes encountered through combustion gases backing up in and escaping from the fuel pipe, I have provided a passageway between the air chamber 64 and the inner end of the fuel conduit 21, this passageway being provided in the present instance by alined openings 87 and 88 in the fuel conduit and the adapter 26. To insure the flow of air from the air chamber through this passageway, a pick-up device in the form of a funnel 89 is positioned with its outlet end in the passageway and its inlet end in the air chamber, preferably projecting in a direction opposite that in which the current of air in the air chamber is circulating as it is supplied thereto by the air delivery pipe 61.

As will be apparent from the structure and arrangement of the apparatus illustrated in the drawing, the ash removal device may be omitted where this is desired for reasons of economy. This may be easily done by reason of the fact that the sole connection between the ash removal device and the other parts of the mechanism is through the bracket 80 which is detachably secured to one of the lateral lugs 77 by means of bolts 90. In case the ash removal device is omitted, it is, of course, necessary that ashes be removed from the ash pit 12 from time to time in order to prevent too great an accumulation therein.

While certain structural forms of the important features of the stoker have been disclosed herein, together with a preferred arrangement of the various parts with respect to one another, it is to be understood that the invention is not intended to be limited to the precise structure and arrangement of parts as shown and described. The above description and the accompanying drawing is therefore to be regarded as illustrative only of the form and arrangement of the various elements of the apparatus, and it is to be understood that the invention is susceptible of other forms and arrangements so long as they come within the scope of the appended claims.

What I desire to claim is:

1. In an automatic stoker provided with a burner casing having a fuel inlet opening in one side near the lower end thereof, and a conveyor shaft opening in alinement therewith in the opposite side, a grate supported in said casing and having an opening at its lower end communicating with said inlet opening, and a fuel conveyor pipe connecting said inlet opening with a source of fuel supply, the combination of a conveyor shaft extending through said pipe and projecting outwardly through said shaft opening, a wire wound spirally around said shaft within said pipe to form a conveyor for feeding fuel through said pipe to said grate upon rotation of said shaft, the overall diameter of said conveyor being substantially less than the inside diameter of said conveyor pipe, and power means connected to said shaft for rotating the same.

2. In an automatic stoker provided with a burner having a fuel inlet opening in one side near the lower end thereof, a hollow boss on said burner opposite said inlet opening and having a conveyor shaft opening in its outer end, and a fuel conveyor pipe connecting said inlet opening with a source of fuel supply, the combination of a conveyor shaft extending through said pipe and said boss and projecting loosely through said shaft opening, a wire spiral wound around and secured to said shaft within said pipe to form a conveyor for feeding fuel through said pipe to said burner, the overall diameter of said conveyor being substantially less than the inside diameter of said conveyor pipe, and means connected to said shaft for rotating the same.

3. In an automatic stoker provided with a burner having a fuel inlet opening in one side near the lower end thereof to deliver fuel upwardly therethrough, and a conveyor pipe connecting said opening with a source of fuel supply, the combination of a conveyor shaft extending through said pipe and said opening, a wire spiral wound around and secured to said shaft to form a conveyor for feeding fuel through said pipe upon rotation of said shaft, the overall diameter of said conveyor being substantially less than the inside diameter of said conveyor pipe, and means for rotating said shaft.

4. In an automatic stoker provided with a burner having a fuel inlet opening in one side near the lower end thereof to deliver fuel upwardly therethrough, and a conveyor pipe connecting said opening with a source of fuel supply, the combination of a conveyor shaft extending through said pipe and said opening, a wire spiral wound around and secured to said shaft to form a conveyor for feeding fuel through said pipe upon rotation of said shaft, the overall diameter of said conveyor being substantially less than the inside diameter of said conveyor pipe, propeller means secured on said shaft at said inlet opening to feed the fuel upwardly into said burner, and means for rotating said shaft.

5. In an automatic stoker provided with a burner having a fuel inlet opening in one side near the lower end thereof to deliver fuel upwardly therethrough, and a conveyor pipe connecting said opening with a source of fuel supply, the combination of a conveyor shaft extending through said pipe and said opening, a wire spiral wound around and secured to said shaft to form a conveyor for feeding fuel through said pipe upon rotation of said shaft, the overall diameter of said conveyor being substantially less than the inside diameter of said conveyor pipe, a flat spiral flight secured on said shaft at said inlet opening to feed upwardly into said burner

and fuel delivered to said opening by said wire spiral, and means for rotating said shaft.

6. In an automatic stoker provided with a burner and a coal conveyor pipe extending between said burner and a source of coal supply, the combination of a shaft extending through said pipe, a spiral of wire closely wound around and secured to said shaft to form a conveyor to feed coal through said pipe to said burner upon rotation of said shaft, the overall diameter of said conveyor being substantially less than the inside diameter of said conveyor pipe, and power mechanism for rotating said shaft.

7. In an automatic stoker provided with a burner and a coal conveyor pipe extending between said burner and a source of coal supply, the combination of a floating shaft extending through said pipe, a spiral of round wire closely wound around and secured to said shaft and forming a conveyor to feed coal through said pipe to said burner upon rotation of said shaft, the overall diameter of said conveyor being substantially less than the inside diameter of said conveyor pipe, and power transmitting mechanism in alinement with said pipe for supporting one end of said shaft and rotating said shaft.

8. In an automatic stoker provided with a burner and a coal conveyor pipe extending between said burner and a source of coal supply, the combination of a shaft extending through said pipe, a spiral of wire of a given diameter closely wound around a section of said shaft adjacent said burner, a spiral of wire of smaller diameter closely wound around the portion of said shaft between said section and said source of supply, said spirals forming a conveyor having an overall diameter substantially less than the inside diameter of said conveyor pipe, and means for rotating said shaft.

9. In an automatic stoker provided with a burner and a coal conveyor pipe extending between said burner and a source of coal supply, the combination of a shaft extending through said pipe, a wire spiral of a given diameter closely wound around a section of said shaft adjacent said source of supply, a wire spiral of larger diameter closely wound around the portion of said shaft between the first wire spiral and said burner, said spirals forming a conveyor having an overall diameter substantially less than the inside diameter of said conveyor pipe, a flat spiral flight secured on said shaft at the delivery end of the second wire spiral, and means for rotating said shaft.

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