March 24, 1936. J. WYNN, JR 2,034,890

MECHANICAL STOKER FOR FURNACES

Filed Jan. 7, 1931 6 Sheets-Sheet 1

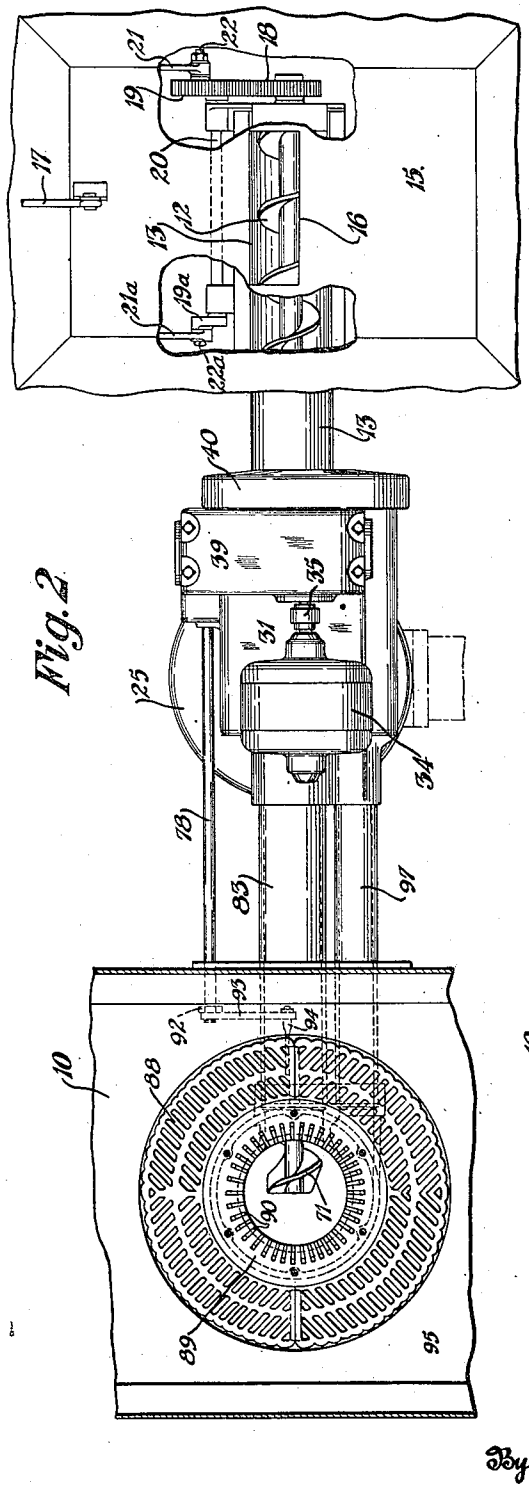


Fig. 2

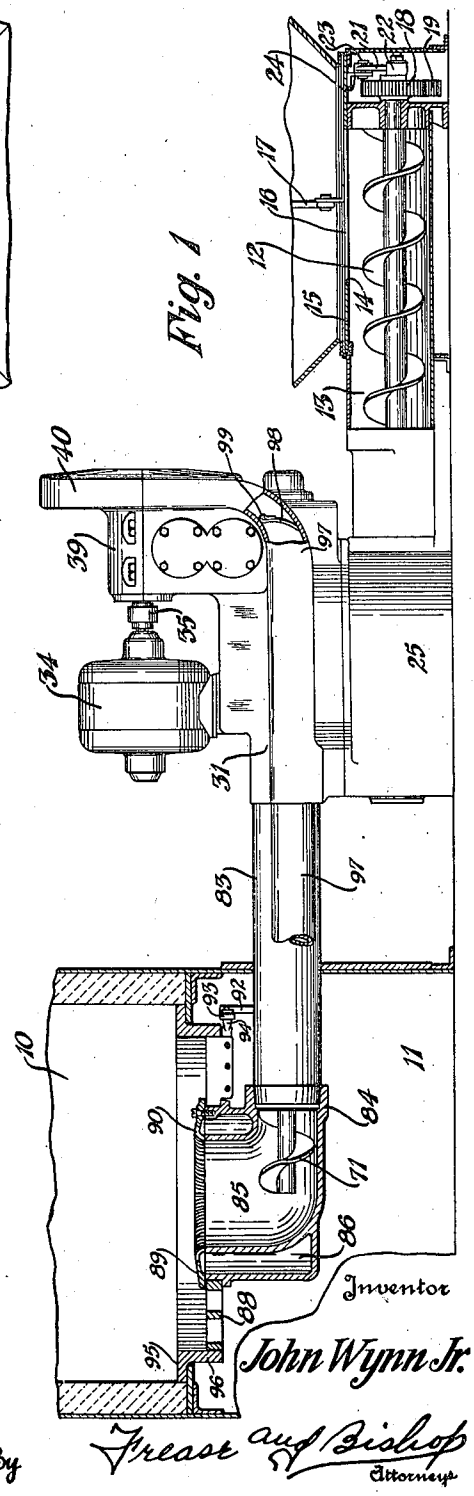


Fig. 1

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MECHANICAL STOKER FOR FURNACES

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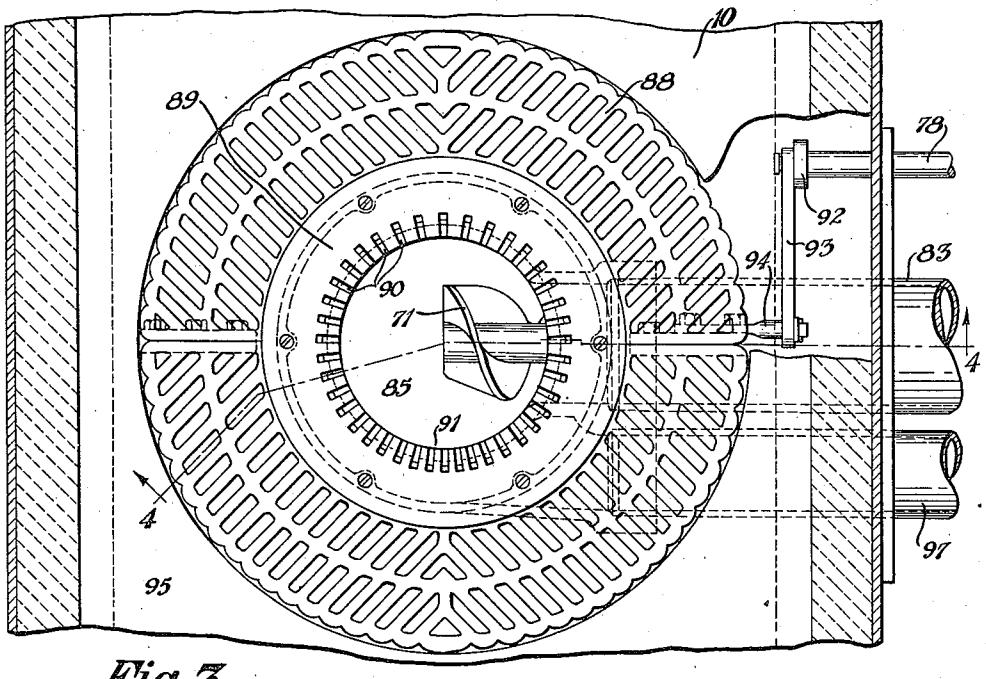


Fig. 3

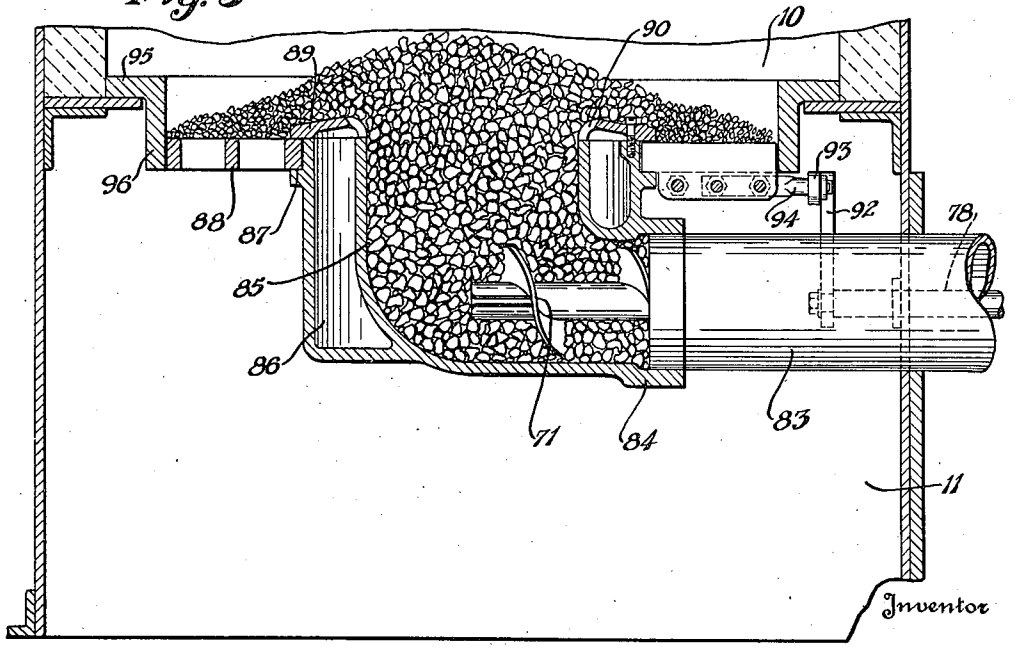


Fig. 4

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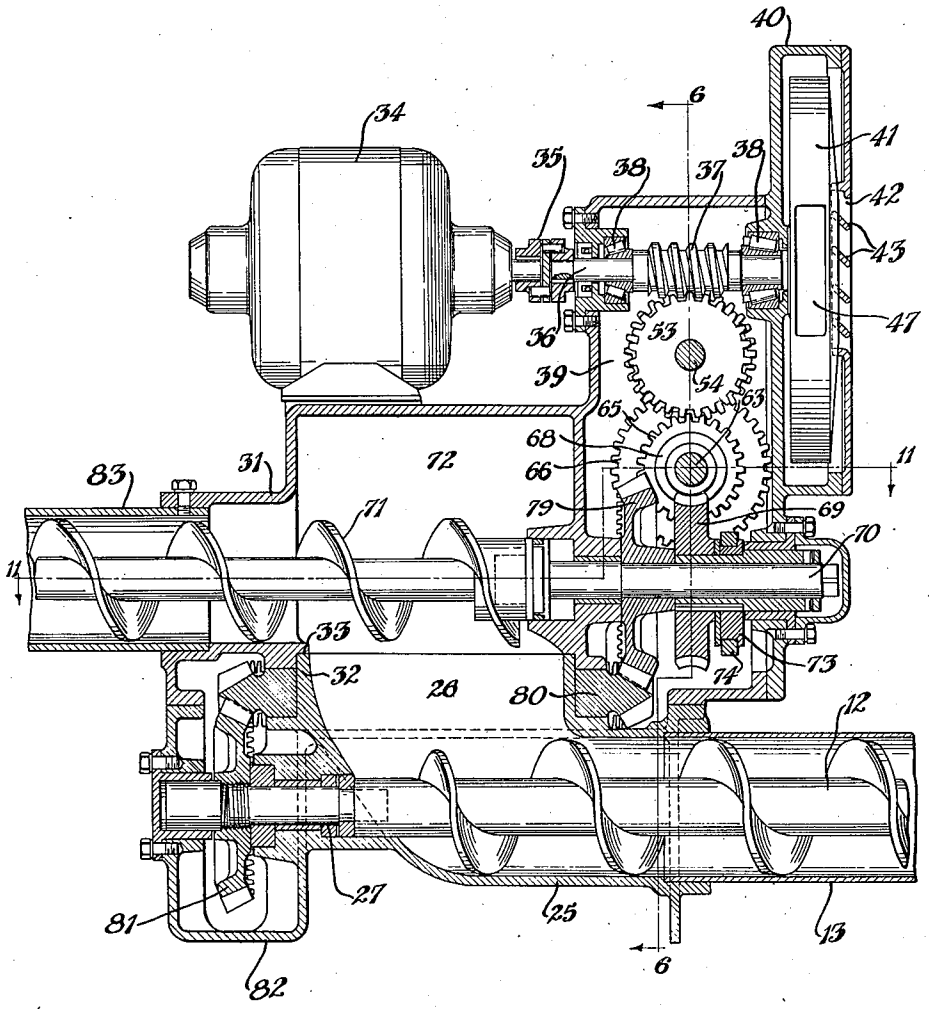
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MECHANICAL STOKER FOR FURNACES

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Fig. 5



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MECHANICAL STOKER FOR FURNACES

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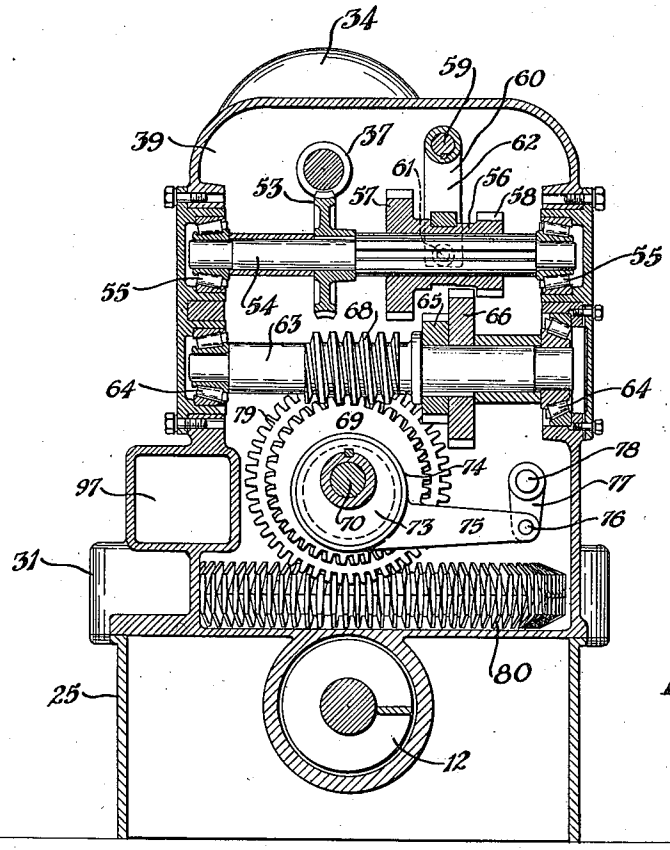


Fig. 6

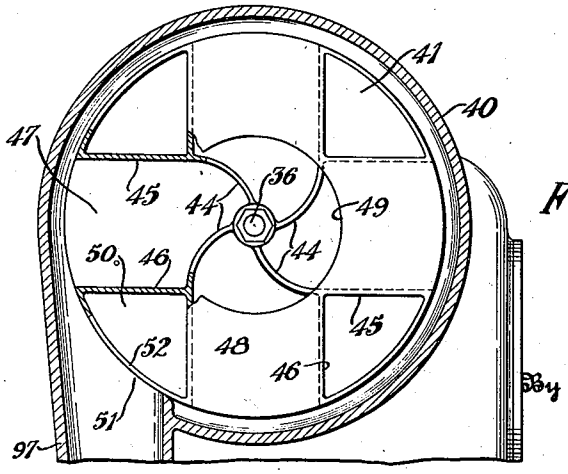


Fig. 7

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MECHANICAL STOKER FOR FURNACES

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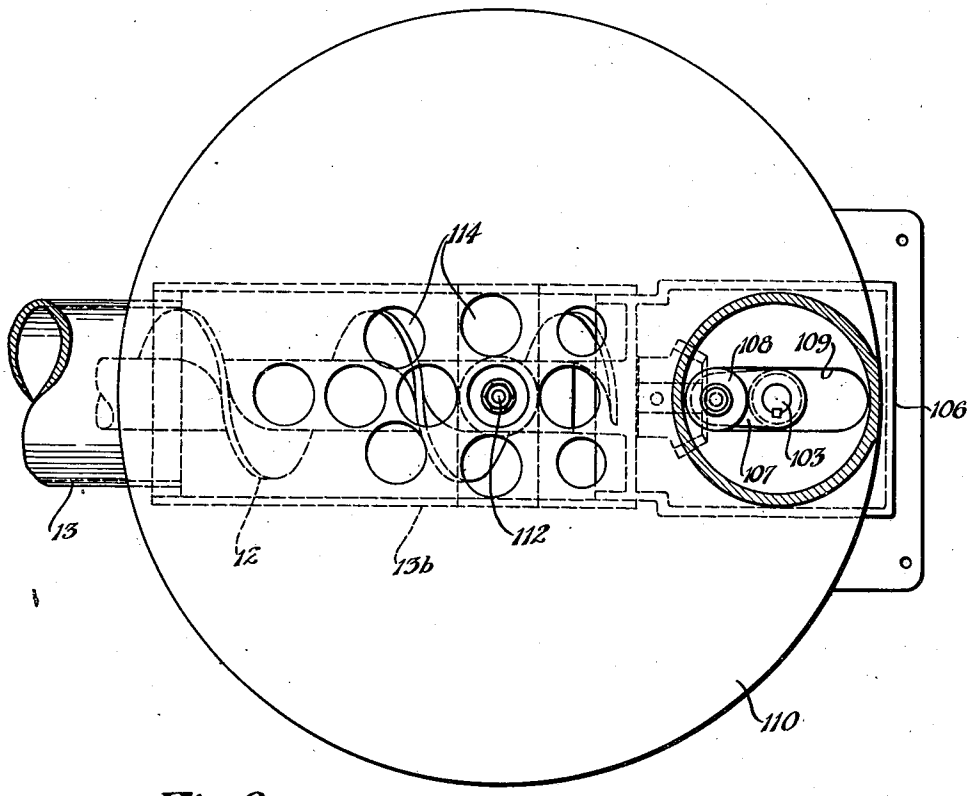


Fig. 8

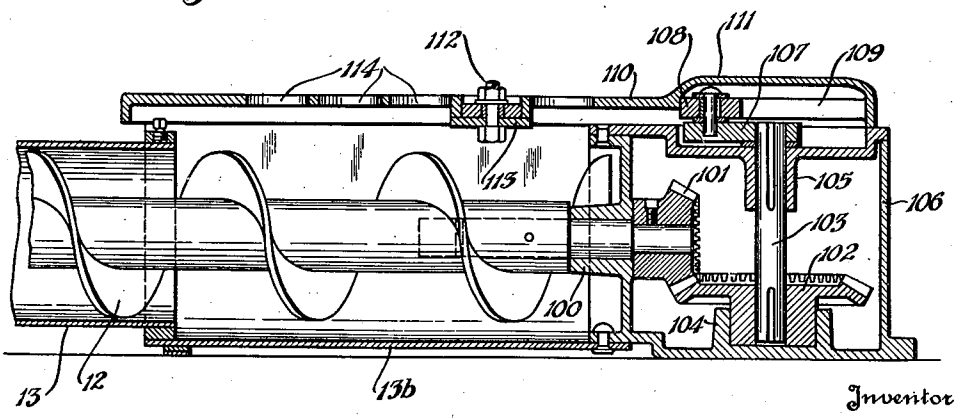


Fig. 9

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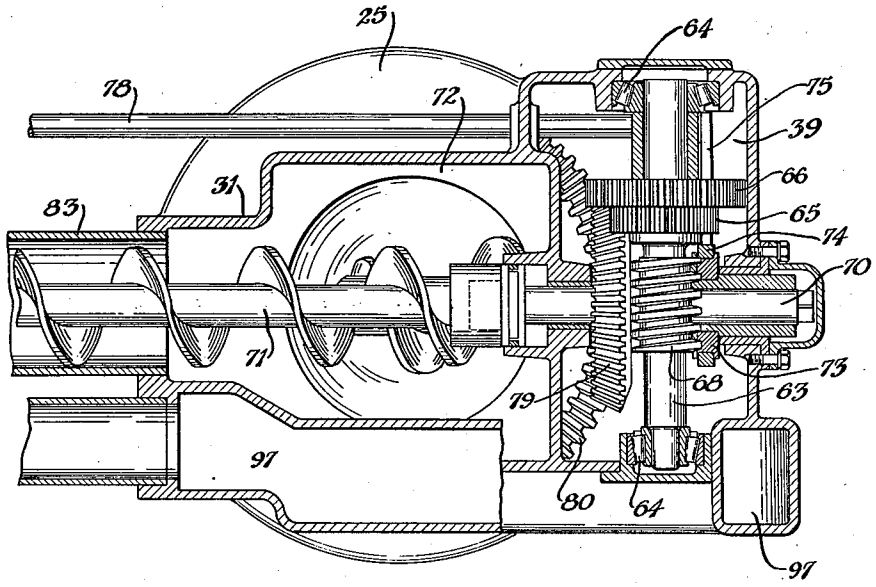
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March 24, 1936. J. WYNN, JR 2,034,890

MECHANICAL STOKER FOR FURNACES

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Fig. 11



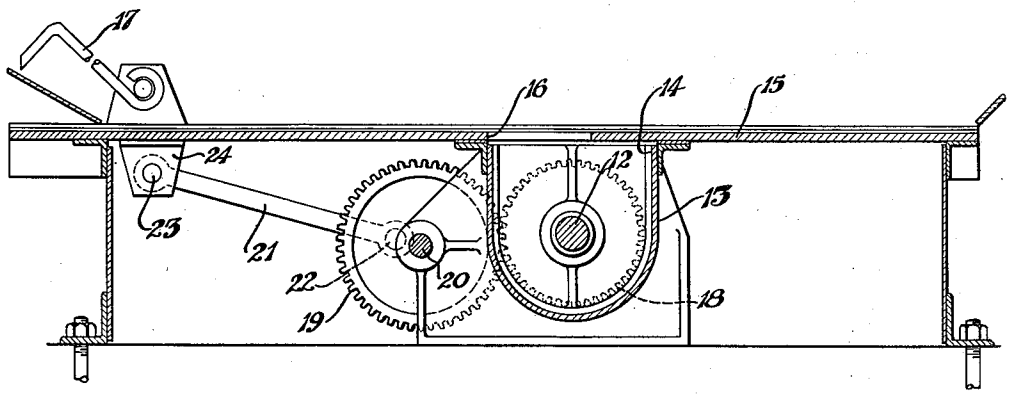


Fig. 10

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UNITED STATES PATENT OFFICE

2,034,890

MECHANICAL STOKER FOR FURNACES

John Wynn, Jr., Canton, Ohio

Application January 7, 1931, Serial No. 507,095

5 Claims. (Cl. 110—45)

The invention relates to stokers and more particularly to an underfeed stoker arranged to automatically carry fuel from a coal bin or the like and deliver the same to the fuel chamber of a furnace at the proper rate of speed to produce the desired temperature within a building in which the furnace is installed.

An object of the improvement is to provide a stoker of this character including a mechanically driven conveyer screw which may be fed by an agitating feeder leading from the bottom of a coal bin or the like to a point intermediate the bin and furnace, a second screw located above the same being arranged to carry the fuel from this point through a fuel chamber having air for combustion discharging thereinto and thence to the grate of the furnace, whereby a block of fuel is always maintained between the first and second screw conveyers, preventing gases or products of combustion from passing backward through the conveyers and into the coal bin.

Another object is to provide a greater area in the air duct openings of the tuyère on the side towards the stack flue, so as to maintain a more intense heat on this side of the combustion chamber in order to burn the smoke and unburned gases of combustion before they pass to the stack flue.

A further object is to maintain a relation between the height of the tuyère above the grate and the width of the air duct surrounding the fuel chamber to prevent excessive clinkering of the fuel upon the grate.

Another object is to provide means for mounting the motor which drives the mechanism on top of the housing surrounding the inner fuel chamber at the charging end of the second or upper screw conveyer.

Another and very important object is the provision of a ring gear journaled around the fuel passage between the two screw conveyers whereby both conveyers may be driven from the same source of power and the lower conveyer may be swung around the axis of the ring gear to be located at any necessary or desired angle to the upper conveyer, and permitting the feeding of the fuel through the center of the ring gear from the lower conveyer to the upper conveyer.

A further object is to provide a normally closed check draft or damper in the air duct arranged to prevent a natural air draft through the air duct from burning out the fire around the tuyère but adapted to be automatically opened by the pressure of air when the fan is operated.

Another object is the provision of a chamber above the charging end of the upper screw to accommodate a surplus storage of fuel.

A still further object is the provision of a feeding, agitating and sizing mechanism in the coal bin adapted to deliver fuel of proper size to the conveyer mechanism.

A still further object of the improvement is to provide a construction of blower fan which will operate with a minimum amount of noise.

The above and other objects which will appear from the following detail description of the invention and an inspection of the accompanying drawings may be attained by constructing the stoker in the manner illustrated in the drawings, in which

Figure 1 is a sectional view through the lower portion of a furnace provided with the improved stoker, showing the location of the feed mechanism within the coal bin;

Fig. 2, a plan view of the same partly in section;

Fig. 3, an enlarged plan view of the tuyère and grate showing the connection of the conveyer and air duct thereto;

Fig. 4, a vertical section on the line 4—4, Fig. 3;

Fig. 5, a vertical sectional view through the cooperating end portions of the two conveyer screws, illustrating the ring gear surrounding the fuel passage between the screws and showing the motor and blower fan;

Fig. 6, a transverse vertical section on the line 6—6, Fig. 5;

Fig. 7, a section through the blower housing showing the blower fan with parts broken away;

Fig. 8, a plan view of the fuel feeding, agitating and sizing mechanism in the coal bin;

Fig. 9, a vertical sectional view of the same;

Fig. 10, a vertical sectional view of a modified form of feeding, agitating and sizing mechanism; and

Fig. 11, a plan sectional view taken on the line 11—11, Fig. 5.

Similar numerals refer to similar parts throughout the drawings.

A portion of the combustion chamber of the furnace is shown generally at 10, the usual ash pit being located beneath the same as indicated at 11. The furnace may be of any usual and well known construction and for this reason only the lower portion of the same is illustrated in order to show the application of the improved stoker thereto.

The invention contemplates the feeding of the fuel, which may be slack, finely divided coal or the like, directly from the coal bin to the furnace, and for this purpose a conveyer screw 12

extends into the bottom of the coal bin, being located within a housing 13 having an opening 14 in its upper portion at the end located within the coal bin.

In order to feed the fuel from the coal bin into the housing 13, a reciprocating plate 15 is mounted above the opening 14 of the housing and provided with a slot or aperture 16 through which coal may pass from the bin downward into the housing 13. If desired, one or more pivoted hooks 17 may be carried by the reciprocating plate 15 for raking the fuel onto the plate as the same is moved back and forth within the coal bin.

For the purpose of reciprocating the plate 15 as the conveyor screw 12 is operated, a gear 18 may be fixed upon the shaft of the conveyer 12 and arranged to mesh with a gear 19 pivoted upon a countershaft 20 and having a connecting rod 21 eccentrically mounted thereon as by the wrist pin 22, said connecting rod being pivotally connected to a pin 23 upon the depending ear 24 fixed to the under side of the reciprocating plate 15.

The other end of the countershaft 20 may have a crank arm 19*a* fixed thereto, a connecting rod 21*a* being connected at one end to the crank as by a wrist pin 22*a*, the other end of the connecting rod being connected to the sliding plate 15 in the same manner as above described regarding the connecting rod 21.

The other end of the tubular housing 13 is connected to a cast housing 25, terminating in the enlarged, angular passage 26, extending upward therefrom and constituting means for directing upwardly fuel being fed through the housing. The conveyer screw 12 is journaled in this housing, as at 27, and is arranged to feed the fuel upward into the passage 26 in order to form a block or slug of fuel therein for preventing gases and smoke from the furnace from passing backward through the conveyer housing and into the coal bin.

A cast housing 31 is journaled upon the cylindric neck 32 of and communicates with the housing 25, having an annular shoulder 33 resting upon the upper edge of said cylindric neck.

The motor 34 is mounted upon the top of the casting 31, being thus spaced considerably above the cellar floor where it is away from the dirt and dust which may accumulate upon the floor and can be easily inspected. By thus mounting the motor above this casting the same will not be harmed in the event water gets into the cellar.

The motor shaft may be connected, as through a coupling 35, with the shaft 36 of a worm 37 journaled as in the roller bearings 38 mounted within a gear housing compartment 39 which may form a part of the casting 31.

The outer end of the worm shaft 36 extends into the fan casing 40 which may be connected to the casting 31, the fan indicated generally at 41 being mounted upon said shaft. The fan casing has a central inlet opening 42 which may be provided with louvers 43.

A plurality of arcuate ribs 44, preferably four in number, are formed upon the disk body portion 41 of the fan, extending from the center thereof and terminating in the tangential ribs 45.

A rib 46 is spaced from and located parallel to each of the tangential portions 45, thus forming a radially disposed air passage 47 extending from the center of the fan to the periphery thereof. These radial air passages may be covered by a web or plate 48 provided with a central opening 49 registering with the inlet opening 42 of the fan casing and exposing the curved ribs 44 of the fan.

For the purpose of preventing a back lash of air into the segmental pockets 50 as they pass the outlet port 51 of the fan casing, an arcuate rim 52 may be formed around the periphery of the disk body portion of the fan covering each of these segmental pockets.

The worm 37 meshes with a worm gear 53 fixed upon the shaft 54 located within the gear housing 39 below and at right angles to the worm shaft 36.

The shaft 54 may be journaled in roller bearings 55 located in the end walls of the gear housing 39 and has splined thereon the longitudinally slidable sleeve 56 provided with the gear 57 and pinion 58 fixed to opposite ends thereof.

For the purpose of slidably moving this sleeve upon the shaft, a rocker shaft 59 may be located through the gear housing 39 and provided with arms 60 which engage studs 61 upon a yoke 62 carried by the sleeve.

A worm shaft 63 is located below and parallel with the shaft 54 and may be journaled in roller bearings 64 carried in the end walls of the gear housing. A pinion 65 and a gear 66 are fixed upon the worm shaft and adapted to be engaged by the gear 57 and pinion 58 respectively, depending upon the position to which the sleeve 56 is moved.

The worm 68 upon the shaft 63 meshes with the worm gear 69 upon the shaft 70 of the upper conveyer screw 71, one end portion of which extends into the casting 31, above the vertical passage 26 of the lower conveyer screw housing. The casting 31 may be enlarged above this end of the upper screw conveyer 71 to provide a surplus fuel storage chamber 72 above the charging end of the upper screw.

An eccentric disk or wheel 73 may be mounted upon the shaft 70 and the eccentric ring 74 surrounding the same is provided with an arm 75 pivotally connected at its outer end, as at 76, to a rocker arm 77 fixed upon the rocker shaft 78 which is journaled through the casting 31 and extends into the furnace for operating the grate, as will be later described.

A bevel gear 79 is fixed upon the shaft 70 and meshes with a double beveled ring gear 80 journaled upon the annular neck 32 of the lower conveyer screw housing. A bevel gear 81, similar to the gear 79, is fixed upon the shaft of the lower conveyer screw 12, being located in a gear housing 82 formed upon the lower casting 25, said bevel gear also meshing with the ring gear 80. With this construction the upper and lower conveyer screws 71 and 12 respectively are both driven at the same speed and in the same direction.

A cylindric housing 83 surrounds the upper conveyer screw 71 and leads from the casting 31 to the furnace, extending through the side wall thereof and communicating with the angular neck 84 upon the vertically disposed cylindric chamber 85 which is surrounded by the air chamber 86, the outer wall of which may be provided with a peripheral shoulder 87 spaced from its upper end upon which the annular grate 88 is mounted for oscillatory movement.

By providing the lower conveyer 12 for feeding fuel collected from the floor of the fuel bin, and the upper conveyer 71 for feeding fuel from the lower conveyer to the tuyère, horizontally dis-

posed conveying means is provided for feeding fuel directly from the ordinary bin, which is normally located at the floor level of the building in which the stoker is to be installed, and delivering the fuel to the tuyère which is normally located at a materially higher level.

The annular tuyère 89 is highest at its inner portion, sloping downward toward its periphery and is mounted in fixed position upon the upper ends of the walls of the fuel chamber 85 and air chamber 86.

The height of the tuyère above these walls should not exceed the width of the air passage 86, this being for the purpose of preventing sufficient ash from accumulating on the grate to produce any considerable amount of clinker thereon.

The inner portion of the tuyère is provided with openings 90 communicating with the air passage 86 for discharging air for combustion into fuel passing through the chamber 85 beneath the top surface of the fuel, these openings being located closer together upon the flue side of the furnace, as indicated at 91, than upon the opposite side in order to provide an increased air area on the flue side of the furnace for the purpose of consuming smoke and gases of combustion before they pass to the chimney flue.

The rocker shaft 78 extends into the furnace as best shown in Figs. 2, 3, and 4 and has fixed thereon a rocker arm 92 connected as by a link 93 with a radial finger 94 upon the grate whereby the rocking of the shaft 78 will oscillate the grate to shake the ashes therefrom into the ash pit 11.

A plate 95 may be mounted in the furnace above the ash pit and provided with a depending annular flange 96 surrounding the grate, substantially cutting off the ash pit from the combustion chamber of the furnace excepting through the openings in the grate.

A conduit 97 leads from the exhaust port 51 of the fan housing to the air chamber 86 and for the purpose of preventing a natural draft from passing through this conduit and burning out the fire too rapidly around the tuyère, when the fan is not in operation, a check draft or damper 98 is located within the conduit 97, being preferably pivoted at its upper portion, as indicated at 99, and adapted to normally hang in closed position, as shown in Fig. 1.

When the fan is operated, the air blast will automatically swing this check draft into open position to permit the air blast to pass through the conduit 97 but it will be seen that when the fan is shut off the check draft 98 will return to closed position by gravity, preventing passage of a natural draft of air through the conduit.

The feeding, agitating and sizing mechanism in the coal bin may, if desired, be of the construction shown in Figs. 8 and 9 of the drawings in which the lower conveyer screw housing 13 communicates at its charging end with a trough 13b located within the coal bin, the conveyer screw 12 being located within said trough and journaled through a bearing 100 at the end portion of the trough.

A bevel pinion 101 is fixed upon the shaft of the conveyer screw 12 and meshes with a bevel gear 102 mounted upon the vertical shaft 103 journaled at its lower end in a bearing 104 and at its upper end in a bearing 105 carried in the cast housing 106 located beyond the trough 13b.

An arm 107 is fixed upon the upper end of the shaft 103 and may be provided with a roller 108 located within a radial slot 109 formed in the oscillating feeding, agitating and sizing disk 110, a cover portion 111 being preferably formed in said disk for covering the arm 107 and roller 108.

The disk 110 is centrally journaled as at 112 upon a spider 113 located above the trough 13b, and is provided in its central portion with a plurality of openings 114 so arranged and located that they will remain over the trough 13b in all positions to which the disk 110 is oscillated. These apertures 114 are of such size that particles of fuel of excessive size are not allowed to enter the trough 13.

By providing the upper casting 31 journaled upon the lower casting 25 with the ring gear 80 journaled therebetween for engagement with the bevel pinions 81 and 79 of the lower and upper conveyer screws respectively, it will be seen that the two vertically spaced conveyer screws and their housings may be adjusted to any desired angle with reference to each other without in any way interfering with the operation of the mechanism, thus permitting the apparatus to be installed regardless of the relative locations of the furnace and coal bin.

It will also be seen that with this construction the fuel is fed upward from the lower conveyer screw to the upper conveyer screw through the inside of the ring gear, thus permitting any desired adjustment as well as the operation of the ring gear at all times without interference.

The apparatus does not necessarily operate continuously but is preferably controlled by a thermostatic device of any usual and well known construction adapted to start the operation of the motor when the house temperature falls below a certain predetermined point and to stop the operation of the motor when the house temperature rises to the desired point. This thermostatic device, however, forms no part of the invention and is merely connected to the stoker in usual and well known manner for the purpose of convenience.

In the operation of the apparatus, when the motor is started, the feeding, agitating and sizing mechanism within the coal bin will operate to feed coal from the floor of the coal bin to the lower conveyer screw 12 which will feed the same forward through the conduit 13 and then upward through the vertical chamber 26 to the upper conveyer screw 71. It will be seen that the chamber 26 must necessarily be filled with fuel before the conveyer screw 71 can carry fuel forward to the furnace, thus providing a solid block or plug of fuel in the chamber 26, between the two conveyer screws, at a point removed from the furnace, preventing smoke and gases of combustion from the furnace from passing backward through the lower conveyer screw conduit 13 into the coal bin.

It will also be seen that the chamber 72 provides room for surplus storage of fuel above the conveyer screw 71 as well as providing a gas and smoke pocket for any smoke or gases of combustion which may pass through the upper conduit 83 from the furnace.

As the fuel is fed forward through the upper conduit 83, by means of the upper conveyer screw 71, it will be delivered to the chamber 85 at a point spaced considerably above the floor of the fuel bin, and since the chamber 85 communicates with the tuyère, the fuel will be fed upward through the chamber 85 and over the tuyère from which it will spread down over the grate in the manner illustrated in Fig. 4.

When the motor is operated, the blower fan will also operate, automatically opening the check

draft 98 and discharging an air blast into the air chamber 86, from which it will discharge through the openings 90 in the tuyère into the upwardly moving fuel column beneath the top surface thereof, furnishing sufficient air for combustion of the fuel.

The rocker shaft 78 will also be operated during the operation of the motor to oscillate the grate 88, shaking the ash therefrom into the ash pit 11.

When the operation of the motor is stopped, all of the moving parts will stop movement and the check draft 98 will automatically return to closed position, preventing a natural draft of air through the conduit 97.

It will of course be understood that in order to provide a practical apparatus for the purpose for which this invention is intended, all of the housings between the furnace and the coal bin should be entirely gas tight in order that no gases or smoke may leak therethrough into the basement or other room in which the stoker is located.

I claim:

1. An underfeed furnace structure including an upwardly opening fuel chamber surrounded by an annular air chamber having means for discharging air therefrom into the fuel contained in the fuel chamber beneath the top surface thereof, means for supplying air under pressure to said air chamber, and means for feeding fuel upwardly through and over the top of said fuel chamber, said fuel feeding means including vertically spaced substantially horizontal conveyers, the upper conveyer communicating at one end with said fuel chamber, the lower conveyer communicating at one end with a fuel bin, and the other ends of the conveyers being adjacent, and a housing into which the said adjacent ends extend whereby the fuel delivered from the lower conveyer passes upwardly through said housing and forms an air seal between said conveyers.

2. An underfeed furnace structure including an upwardly opening fuel chamber surrounded by an annular air chamber having means for discharging air therefrom into the fuel contained in the fuel chamber beneath the top surface thereof, means for supplying air under pressure to said air chamber, and means for feeding fuel upwardly through and over the top of said fuel chamber, said fuel feeding means including vertically spaced substantially horizontal screw conveyers, the upper conveyer communicating at one end with said fuel chamber, the lower conveyer communicating at one end with a fuel bin, the other ends of the conveyers being adjacent, a housing into which the said adjacent ends extend whereby the fuel delivered from said lower conveyer passes upwardly through said housing and forms an air seal between said conveyers, a ring gear journalled around the housing, and a pinion on each screw conveyer meshing with said ring gear.

3. An underfeed furnace structure including an upwardly opening fuel chamber, walls forming an air chamber surrounding the fuel chamber and communicating therewith below the top surface thereof, means for supplying air under pressure to said air chamber, and conveyer mechanism including a housing located at a point between the furnace and a source of fuel supply, a substantially horizontal conveyer leading from the source of fuel supply to said housing, a second housing journalled upon the upper end of the first housing and communicating therewith, and a second substantially horizontal conveyer leading from said second housing to the fuel chamber, whereby fuel from the lower conveyer is fed upwardly through said housings to form an air seal between the conveyers.

4. An underfeed furnace structure including an upwardly opening fuel chamber, walls forming an air chamber surrounding the fuel chamber and communicating therewith below the top surface thereof, means for supplying air under pressure to said air chamber, and conveyer mechanism including a housing located at a point between the furnace and a source of fuel supply, a substantially horizontal conveyer screw leading from the source of fuel supply to said housing, a second housing journaled upon the upper end of the first housing and communicating therewith, a second substantially horizontal conveyer screw leading from said second housing to the fuel chamber, whereby fuel from the lower conveyer is fed upwardly through said housings to form an air seal between the conveyers, a ring gear journalled around one of said housings, and a pinion upon each of said conveyer screws meshing with the ring gear.

5. An underfeed furnace structure including an upwardly opening fuel chamber, walls forming an air chamber surrounding the fuel chamber and communicating therewith below the top surface thereof, means for supplying air under pressure to said air chamber, and conveyer mechanism including a housing located at a point between the furnace and a source of fuel supply, a substantially horizontal conveyer leading from the source of fuel supply to said housing, a second housing journalled upon the upper end of the first housing and communicating therewith, a second substantially horizontal conveyer leading from the second housing to the fuel chamber, whereby fuel from the lower conveyer is fed upwardly through said housings to form an air seal between the conveyers, and said second housing forming a fuel storage chamber above said second horizontal conveyer screw.

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