

Aug. 8, 1944.

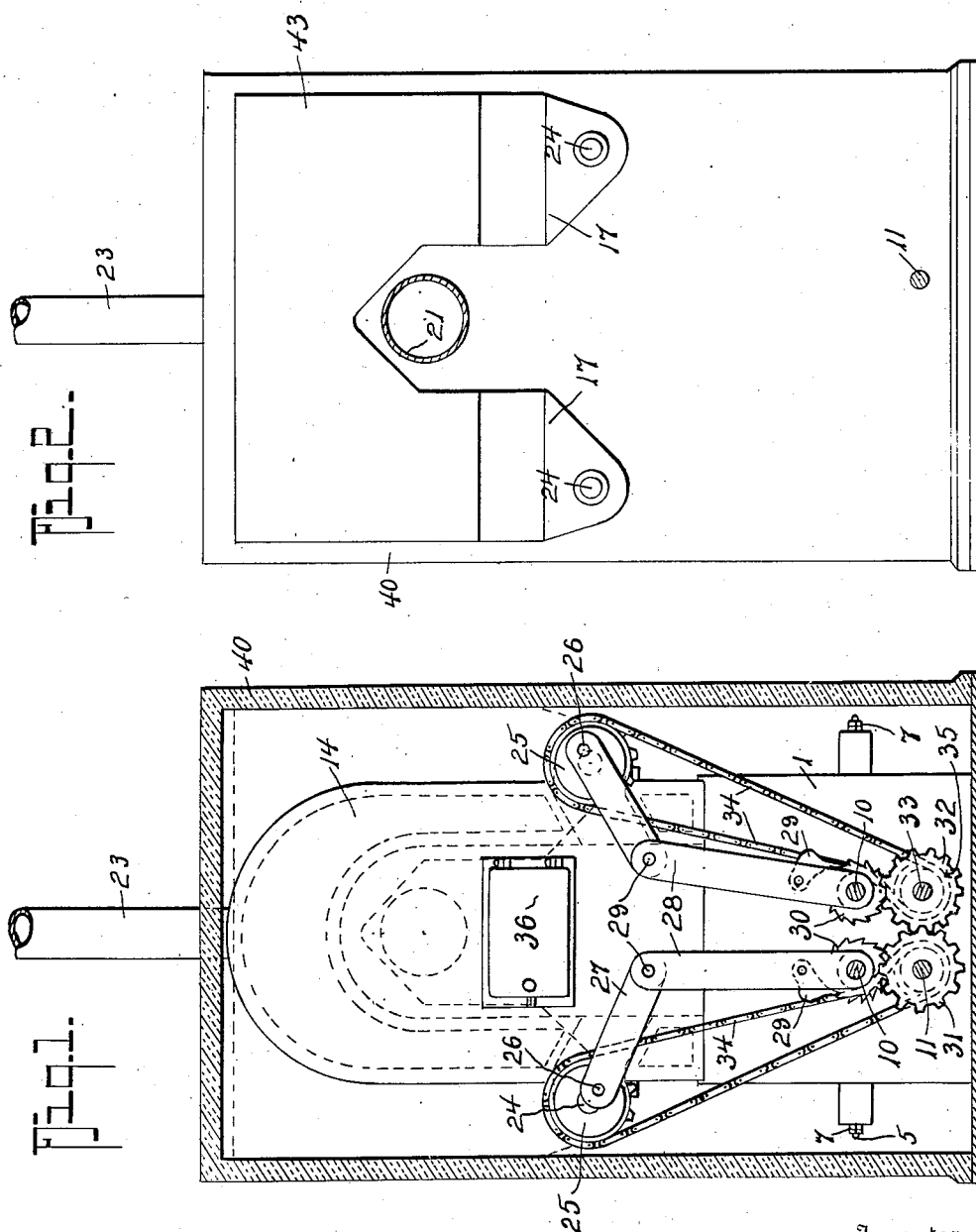
J. T. NORMAN

2,355,101

AUTOMATIC STOKER

Filed Aug. 12, 1940

4 Sheets-Sheet 1



Inventor
Joseph T. Norman
By *Albert E. Dieterich*
Attorney

Aug. 8, 1944.

J. T. NORMAN

2,355,101

AUTOMATIC STOKER

Filed Aug. 12, 1940

4 Sheets-Sheet 2

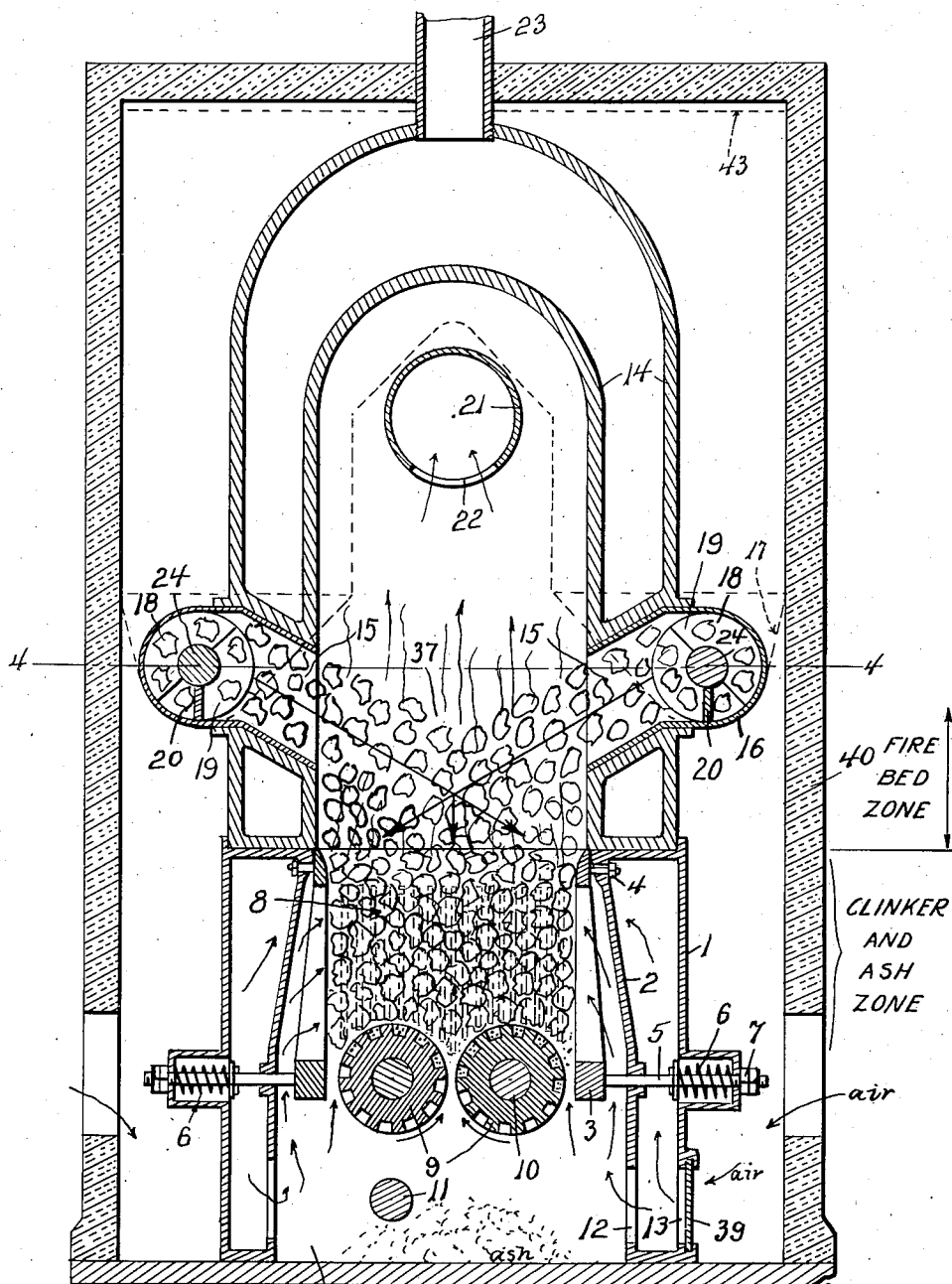


Fig. 3

Joseph T. Norman

By Albert E. Dieterich

Attorney

Aug. 8, 1944.

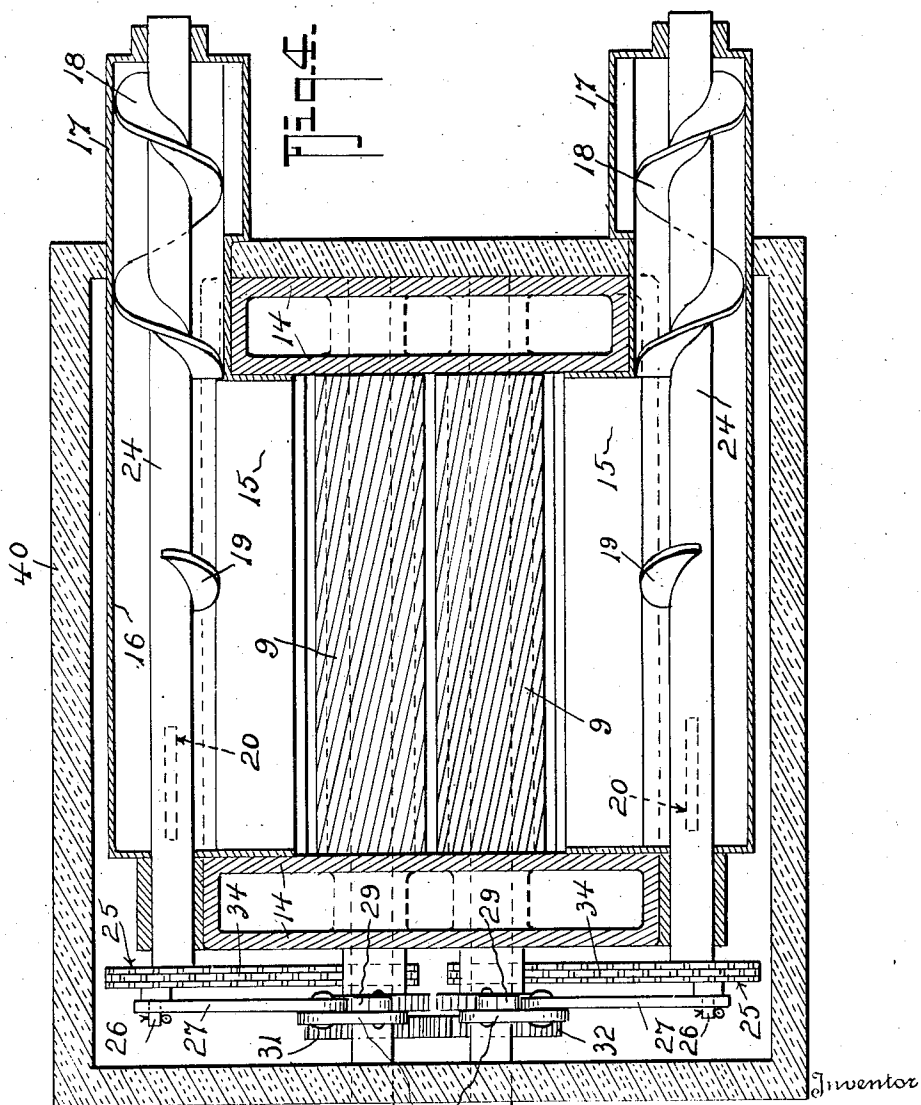
J. T. NORMAN

2,355,101

AUTOMATIC STOKER

Filed Aug. 12, 1940

4 Sheets-Sheet 3



10 28 33

Joseph T. Norman

Albert E. Dieterich
Attorney

Aug. 8, 1944.

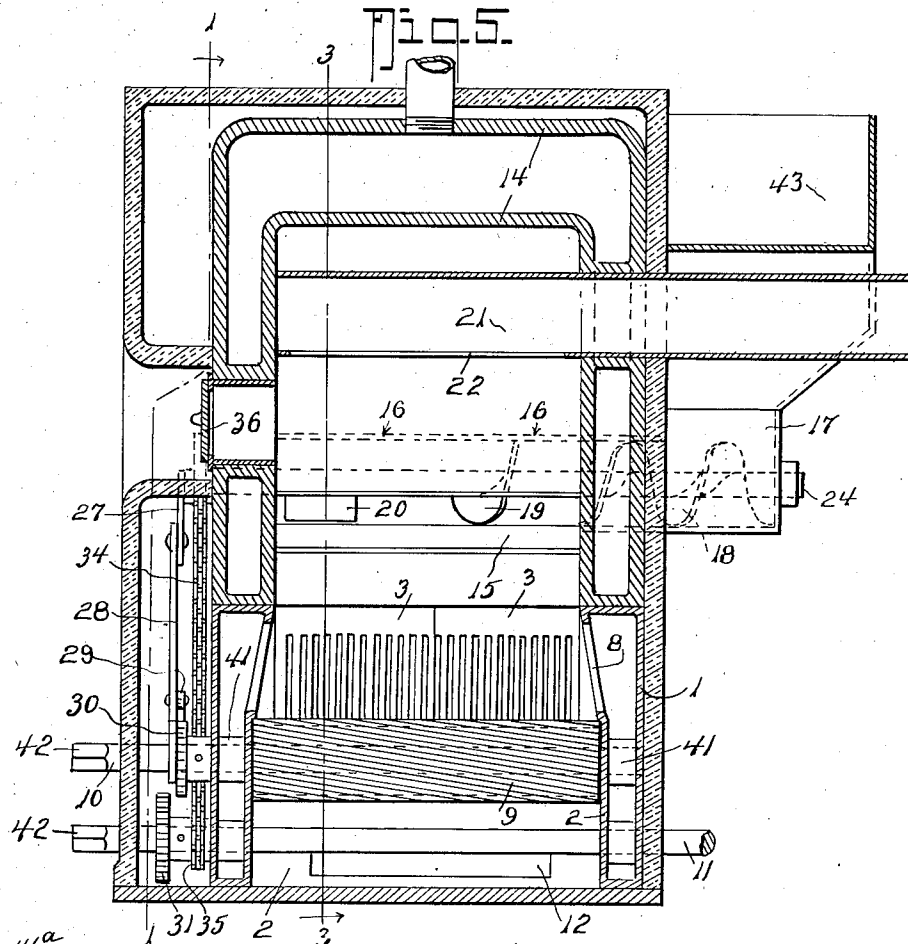
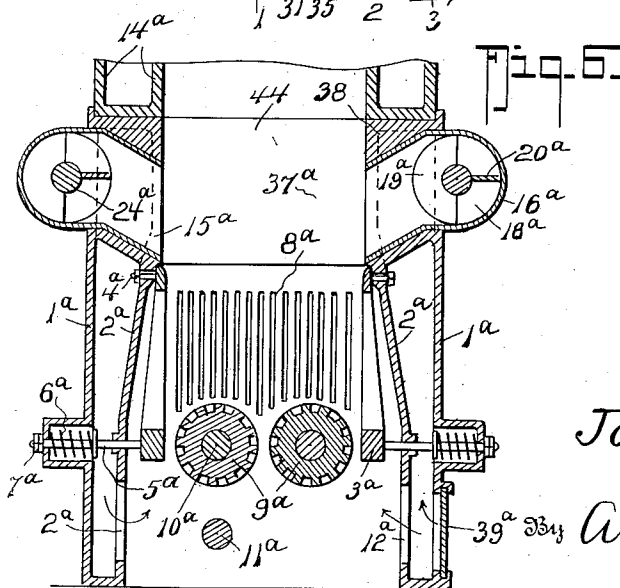
J. T. NORMAN

2,355,101

AUTOMATIC STOKER

Filed Aug. 12, 1940

4 Sheets-Sheet 4



Inventor
Joseph T. Norman

Albert E. Dieterich

Attorney

UNITED STATES PATENT OFFICE

2,355,101

AUTOMATIC STOKER

Joseph T. Norman, Huntington Mills, Pa., assignor
to Edith J. Norman, Huntington Mills, Pa.

Application August 12, 1940, Serial No. 352,330

16 Claims. (Cl. 110—35)

My invention relates to coal burning furnaces and particularly to automatic stokers therefor.

Heretofore automatic stokers have been provided, but all those which have come to my attention are adapted for burning only the smaller sizes of coal such as buckwheat and rice. My invention, however, has for one of its principal objects to provide a stoker which will enable the furnace to burn coal of the larger sizes, either anthracite or bituminous coal, at will and without change of apparatus.

Further, it is an object to provide a stoker which possesses the following advantages over other stokers now on the market, namely:

It will burn either the larger sizes or the smaller sizes of coal and by burning the larger sizes will reduce the demand for smaller sizes of coal and increase the demand for the larger sizes; the larger sizes can be burned with natural draft; the feeder worms can be replaced without disturbing the fire; in case of power break-down or shut-offs, one can operate the stoker by hand to hand fire the furnace or boiler and thus ensure heat at all times; it will eliminate fly ash; and it will be less expensive to manufacture and can be sold cheaper than other types now on the market.

Other objects will in part be obvious and in part be pointed out hereinafter.

To the attainment of the aforesaid objects and ends the invention still further resides in the novel details of construction, combination and arrangement of parts, all of which will be first fully described in the following detailed description, and then be particularly pointed out in the appended claims, reference being had to the accompanying drawings, in which—

Fig. 1 is a vertical section on approximately the line 1—1 of Fig. 5.

Fig. 2 is a rear elevation of a boiler or furnace embodying the invention.

Fig. 3 is a vertical section on the line 3—3 of Fig. 5.

Fig. 4 is a horizontal section on the line 4—4 of Fig. 3.

Fig. 5 is a vertical section on the central vertical longitudinal plane of the boiler or furnace.

Fig. 6 is a detail vertical cross section of a modification of the invention.

In the drawings, in which like numbers of reference indicate like parts in all the figures, the base casting may be a solid one or, as shown, it may be hollow and composed of the outer side and end walls 1 and the inner side and end walls 2 and 8 respectively. These walls are spaced to form an air chamber and are provided with air

openings 12 in the inner walls 2 and 13 in the outer wall 1, the latter opening being provided, preferably, with a regulating damper 39.

Side grates 3 are supported at their upper edges by bolts 4, loose enough to permit the lower ends of the grates to move toward and from the rotary bottom grates 9.

Rods 5 are connected to the lower ends of the grates 3 and project through the side walls 2 and 1 of the base, and have springs 6 and adjusting stop nuts 7 so constructed as to continuously tend to force the lower ends of the grates 3 toward the grates 9 but be capable of yielding under excessive force to permit the grates 3 to be swung away from the grates 9, for a purpose which will later more fully appear.

The inner end walls of the base may also be formed as grates 8 above the level of the grates 9 if desired.

The grates 9 comprise spirally grooved cylinders secured on shafts 10 which are journaled in suitable bearings 41 in the base casting and project through the front wall of the base to the outside where their ends are squared as at 42 to receive a crank for purposes later explained.

Power is applied by a suitable motor-driven shaft 11 (hereinafter called the first motion shaft) which carries a gear 31 that meshes with a gear 32 on a stub shaft 33, the two shafts 11 and 33 also carrying sprockets 35 around which pass chains 34 that also pass around sprockets 25 on worm shafts 24 to drive the coal feed worms.

In the embodiment of the invention shown in Figs. 1 and 5 inclusive the coal is fed through side openings 15 in the top section 14 of the boiler or furnace which sits on the base section and has the fire box 37 directly above the fire pot or combustion space that lies between the grates 3 and 8 above the grates 9.

The openings 15 are located in the long side walls of the furnace section 14 and receive the coal from the coal ducts 16 arranged at each side of the furnace and in which ducts 16 the coal feed worm shafts 24 are located. The ducts 16 are longer than the furnace section 14 (see Fig. 5) and merge with branches 17 of the common hopper 43. From the openings 15 to the back end of the branches 17 each duct 16 is tubular and in this portion of the duct the shaft 24 has a continuous worm 18 to convey the coal from the hopper and along 16. The worms 18 terminate where the feed openings 15 begin. Further along the shafts 24 are worm segments 19 and at the front ends—i. e., where the ducts 16 terminate, or adjacent thereto—the shafts have throw-off

paddles or vanes 20 which push the coal laterally into the downwardly inclined openings 15 and into the fire pot of the base section.

The smoke pipe 21, preferably, extends within the combustion chamber of the upper section 14 the full length thereof and has a slot 22 along its under side for the smoke and burnt gases to enter and pass to the outlet end of the smoke pipe and to the chimney. The pipe 21 is, preferably, located below the crown of the combustion chamber and serves somewhat as a baffle for the gases.

The heated fluid from within the jacket space of the section 14 is passed out to radiators (not shown) through a suitable pipe or pipes 23.

The sprockets 25 have eccentrics or crank pins 26 to which links 27 are connected, the links also being connected to rocking levers 28 which carry gravity actuated (preferably) pawls 29 that engage with ratchets 30 on the shafts 9.

In the modified form shown in Fig. 6 the entire stoker and grate mechanism is constructed as a unit with the base. This form is for use with old furnaces where the ordinary grate carrying base is removed and the new base unit replaces it.

Coal of any size desired is placed in the hopper 43 and gravitates to the branches 17. From the branches 17 the coal is fed with the short worms 18 into the ducts 16 which, together with worm segments 19, convey the coal the entire length of the fire box, thus effecting an even distribution of the coal on the fire. By this method of feeding the coal into the fire box the ashes are forced downward to the grates 9. This eliminates bridging and hollow spots in the fire bed. The feeders 15 are preferably placed on a downward incline so that all bridging and hollow spots in the fire are eliminated. The ashes are forced to the grates and removed from the fire box in a practical manner without the use of bars or pokers to break bridging.

The spiral grates 9 are cylinders having spiral grooves about one-half inch deep and three-quarters inch wide. This allows the ashes to fall in the grooves and be discharged into the ash-pit, or container, without gouging the fire or upsetting the fire bed. As the surfaces of the grates 9 revolve smoothly step by step under the ash bed, thus keeping the fine dust from choking the fire, this allows the fire to burn freely and evenly. When coal is burned under natural draft the ashes are finer and softer than when a blower is used. Should a clinker form, it is forced down on the spiral grates and into the grooves and is broken and discharged into the ash-pit. Should a piece of iron or other foreign matter happen to get into the fire and be too large to pass through the grates and the spiral grooves, the side grates 3 are so arranged in sections and held yielding by the coil springs that they can be forced open to allow the iron or foreign matter to pass; this eliminates the breaking of any part of the machine.

I have found that with my apparatus very satisfactory results are obtained; breakage is eliminated, no fine coal or dust is permitted to collect around the worm feed, but is distributed on the fire and is burned quickly, thus eliminating wear on the worm feed. If either feeder should need repairing or replacing, it can be done without disturbing the fire or shutting off the heat of the furnace and the furnace can be fired by hand by using a crank on the shaft ends 42 until repairs are complete. The furnace has a door 36 to the combustion chamber.

In the form shown in Fig. 6 the base has a filler 38 to give a horizontal seat for the top section 14^a.

In Fig. 6 those parts having like functions and similar constructions to those corresponding parts of Figs. 1 to 5 have been given the same reference number plus the index letter "a," so a detailed description of the same is thought to be unnecessary. The walls of the extension filler 38 may be lined with fire brick (not shown), if desired.

Operation

In general, the shaft 11 is driven at a predetermined speed to impart proper rotation to the shafts 24 to feed the required amount of coal constantly to the fire box, while shaft 11 is running. The rotation of shafts 24 also imparts a step by step movement to shafts 10 via the cranks 26 connecting links 27, rocking levers 28, and pawl and ratchet devices 29, 30. This step by step movement is timed in cooperation with the feed of coal so as to remove sufficient ashes so as to keep the fire bed always at a constant level and hence obtain a uniform firing.

It will be obvious to anyone having practical skill and experience in the art that when starting a fire in the furnace, if the fuel level is first brought up to the top of the passages 15, and the worms 18 and the rotary grates 9 are timed to cooperate with each other, the fuel being forced from opposite sides of the furnace through the passages 15 will cause a downward pressure to be applied to the coal in the furnace chamber; this downward pressure will in turn force the ashes toward the grate, where any clinkers will be sheared and broken up, thus keeping the fire bed always at a constant level and obtaining thereby a uniform firing and an efficient operation.

In the normal operation of applicant's stoker the ducts or passages 16 and 15 are kept full of fuel and the fuel level in the chamber of the furnace is approximately that of the line 4-4 of Fig. 3.

The outside ends of the various shafts 11, 24 and 10 are provided with crank-receiving portions so that they may be turned by hand should power failure occur or should it be found desirable to hand-operate the same for any purpose.

The entire furnace is preferably enclosed in a heat insulating jacket or box 40.

From the foregoing description, taken in connection with the accompanying drawings, it is thought that the construction and advantages of the invention will be clear to those skilled in the art to which it relates.

What I claim is:

1. In apparatus of the class described, a body enclosing a fire chamber having end and side walls, approximately upright grates extending along said side walls, spirally grooved rotary grates extending between said end walls and located between the lower portions of said upright grates, coal ducts located at the outer sides of said body above said grates with their axes extending in the same general direction as the rotary grates, said coal ducts having side coal-feed openings extending the length of the fire chamber for delivering coal into the fire chamber, coal conveyor shafts having coal feeding and pushing means located in said ducts for conveying the coal along said ducts and forcing it into the side coal feed openings and into the fire and forcing the ashes down into the grates, and means to impart rotation to said coal conveyor

shafts and to said rotary grates in timed relation to each other for purposes described.

2. In apparatus of the class described, a body enclosing a fire chamber having end and side walls, approximately upright grates extending along said side walls, spirally grooved rotary grates extending between said end walls and located between the lower portions of said upright grates, coal ducts located at the outer sides of said body above said grates with their axes extending in the same general direction as the rotary grates, said coal ducts having side coal-feed openings extending the length of the fire chamber for delivering coal into the fire chamber, coal conveyor shafts having coal feeding and pushing means located in said ducts for conveying the coal along said ducts and forcing it into the side coal feed openings and into the fire and forcing the ashes down into the grates, and means to impart continuous rotation to said coal conveyor shafts and intermittent rotation to said rotary grates in timed relation to each other for purposes described.

3. In apparatus of the class described, a base section and a top section set on the base section, said top section having a combustion chamber and said base section having a fire chamber which is provided with side and end walls, upwardly extending side grates in said fire chamber, rotary grates forming the bottom of said fire chamber and arranged to rotate on axes extending from adjacent one end wall to adjacent the other end wall of said fire chamber, and coal-feeding means located above and at the sides of the fire for forcing coal in downwardly-inwardly inclined directions into the fire chamber to force the fuel in said chamber downwardly, in virtue of all of which the ashes are forced to the grates and removed by the same.

4. In apparatus of the class described, a base section and a top section set on the base section, said top section having a combustion chamber and said base section having a fire chamber which is provided with side and end walls, the end walls of said fire chamber being slotted to constitute end grates, upwardly extending side grates in said fire chamber, rotary grates forming the bottom of said fire chamber and arranged to rotate on axes extending from adjacent one end wall to adjacent the other end wall of said fire chamber, and coal-feeding means located above and at the sides of the fire chamber for feeding coal into the fire chamber in downwardly-inwardly inclined directions from opposite sides of the fire chamber and consequently applying downward pressure to the fuel in said chambers, in virtue of all of which the ashes are forced downward to the grates and removed by the same.

5. In apparatus of the class described, a base section and a top section set on the base section, said top section having a combustion chamber and said base section having a fire chamber which is provided with side and end walls, upwardly extending side grates in said fire chamber, rotary grates forming the bottom of said fire chamber and arranged to rotate on axes extending from adjacent one end wall to adjacent the other end wall of said fire chamber, coal-feeding means located above and at the sides of the fire chamber for forcing coal into the fire chamber from opposite sides thereof in downwardly-inwardly inclined directions and consequently applying a downward pressure to the coal within said chambers, in virtue of all of which the ashes are forced downward to the grates in down-

wardly-inwardly-inclined directions, and means to effect continuous operation of said coal-delivering means while effecting intermittent rotation of said rotary grates.

6. In apparatus of the class described, a base section and a top section set on the base section, said top section having a combustion chamber and said base section having a fire chamber which is provided with side and end walls, upwardly extending side grates in said fire chamber, rotary grates forming the bottom of said fire chamber and arranged to rotate on axes extending from adjacent one end wall to adjacent the other end wall of said fire chamber, and coal-feeding means located above and at the sides of the fire chamber for forcing coal into the fire chamber from opposite sides thereof in downwardly-inwardly inclined directions and consequently applying a downward pressure to the coal within said chambers, in virtue of all of which the ashes are forced downward to the grates, said side grates being laterally yieldably supported in place with their lower portions spaced from said rotary grates a predetermined distance and adapted to yield should foreign matter tend to jam between the side grates and the rotary grates.

7. In a structure of the character described, a base section and an upper section, the latter enclosing a combustion chamber and the former enclosing a fire chamber, side grates loosely mounted at their tops to said base and yieldably connected at their lower portions to said base so as to be capable of lateral movement, rotary grates located adjacent the lower extremities of said side grates and spaced apart with their axes paralleling said side grates, side-feeding coal conveyors for simultaneously feeding coal over the full length of the fire in the fire chamber from both sides in inwardly-downwardly-inclined directions, and means to operate said coal conveyors and said rotary grates in harmony.

8. In a structure of the character described, a base section and an upper section, the latter enclosing a combustion chamber and the former enclosing a fire chamber, side grates loosely mounted at their tops to said base and yieldably connected at their lower portions to said base so as to be capable of lateral movement, rotary grates located adjacent the lower extremities of said side grates and spaced apart with their axes paralleling said side grates, side-feeding coal conveyors for simultaneously depositing coal over the full length of the fire in the fire chamber from both sides, and means to operate said coal conveyors and said rotary grates in harmony, said coal-feeding means comprising two longitudinal coal ducts one on each outer side of the base section and two coal conveyors and shafts co-operating with the respective longitudinal coal ducts, individual hopper elements one for supplying each coal duct, and inwardly-downwardly-inclined coal ducts through which the coal is forced from the longitudinal coal ducts to the combustion chamber.

9. In a structure of the class described, a base section and a top section, said base section enclosing a fuel and ash containing space, said top section enclosing a combustion chamber which communicates with said fuel and ash containing space, coal ducts on the outer sides of said top section, said top section having longitudinally disposed laterally discharging coal-feeding openings communicating with said combustion chamber, rotary bottom grates and flat side grates in said fuel and ash containing space below said

coal feed openings, coal-feeding means in said coal ducts, and means to operate said coal-feeding means and said rotary grates in harmony, said rotary grates comprising spirally grooved rollers.

10. In a structure of the class described, a base section and a top section, said base section enclosing a fuel and ash containing space, said top section enclosing a combustion chamber which communicates with said fuel and ash containing space, coal ducts on the outer sides of said top section, said top section having longitudinally disposed laterally discharging coal-feeding openings communicating with said combustion chamber, spirally grooved rotary bottom grates and flat side grates in said fuel and ash containing space below said coal feed openings, coal-feeding means in said coal ducts, means to operate said coal-feeding means and said rotary grates in harmony, said means to operate comprising a first motion shaft, power transmitting connections between said first motion shaft and said coal-feeding means for imparting continuous motion to said coal-feeding means, and ratchet and pawl devices operatively connected with said coal-feeding means and with said rotary grates for imparting intermittent rotation to said rotary grates during the continuous operation of said coal-feeding means.

11. In a structure of the class described, a base section and a top section, said base section enclosing a fuel and ash containing space, said top section enclosing a combustion chamber which communicates with said fuel and ash containing space, coal ducts on the outer sides of said top section, said top section having longitudinally disposed laterally discharging inwardly-downwardly-inclined coal-feeding openings communicating with said combustion chamber, rotary bottom grates and flat side grates in said fuel and ash containing space, coal-feeding means in said coal ducts, and means to operate said coal-feeding means and said rotary grates in harmony.

12. In apparatus of the class described, a base casting enclosing a chamber divided horizontally by longitudinally disposed rotary grates into an upper fuel and ash containing chamber and a lower ash receiver, swingably mounted plate grates located in the fuel and ash containing chamber at the sides of said rotary grates and cooperating with the same to hold the fuel and ash, means yieldably supporting said plate grates with their lower portions spaced laterally from said rotary grates, said rotary grates being similarly spaced apart, said base casting including elongated longitudinally extending downwardly inclined coal-feeding openings above the grates, coal ducts located outside the base and having elongated openings registering with said coal-feeding openings, rotating shafts having coal feeding worms and throw-off paddles located in said ducts for conveying the coal along the ducts and delivering it uniformly to said coal-feeding openings and forcing the coal through said openings into the first mentioned chamber, said base casting having a flat top to receive the heat exchange section of a furnace or boiler, and means to operate said coal-feeding shafts and said rotary grates in harmony.

13. In apparatus of the class described, a base casting enclosing a chamber divided horizontally by longitudinally disposed rotary grates into an upper fuel and ash containing chamber and a lower ash receiver, swingably mounted plate

grates located in the fuel and ash containing chamber at the sides of said rotary grates and cooperating with the same to hold the fuel and ash, means yieldably supporting said plate grates with their lower portions spaced laterally from said rotary grates, said rotary grates being similarly spaced apart, said base casting including elongated longitudinally extending coal-feeding openings above the grates, coal ducts located outside the base and having elongated openings registering with said coal-feeding openings, and rotating shafts having coal feeding worms and throw-off paddles located in said ducts for conveying the coal along the ducts and delivering it uniformly to said coal-feeding openings and forcing the coal through said openings into the first mentioned chamber, said base casting having a flat top to receive the heat exchange section of a furnace or boiler, said rotary coal-feeding shafts and said rotary grates having extended shaft portions to receive a hand crank.

14. In apparatus of the class described, a base casting enclosing a chamber having an upper fire box, a lower ash receiver and an intermediate chamber, said intermediate chamber being bounded at the ends by perforated walls, and at the sides by imperforate walls, a rotary grate constituting the bottom of said intermediate chamber, side grates adjacent but spaced from said imperforate walls, said side grates being yieldably supported in place with their lower portions spaced from said rotary grates a predetermined distance and adapted to yield should foreign matter tend to jam between the side grates and the rotary grates, means for turning said rotary grates, and means for passing air to said grates.

15. In apparatus of the class described, a base casting enclosing a chamber having an upper fire box, a lower ash receiver and an intermediate chamber, said intermediate chamber being bounded at the ends by perforated walls, and at the sides by imperforate walls, a rotary grate constituting the bottom of said intermediate chamber, side grates adjacent but spaced from said imperforate walls, said side grates being yieldably supported in place with their lower portions spaced from said rotary grates a predetermined distance and adapted to yield should foreign matter tend to jam between the side grates and the rotary grates, means for turning said rotary grates, means for passing air to said grates, and means for forcing fuel into said upper fire box from opposite sides in an inwardly-downwardly-inclined direction, by virtue of all of which bridging of the fire and formation of hollow spots in the fire is avoided.

16. In apparatus of the class described, a structure enclosing a chamber, a clinker shearing grate located in the bottom of said chamber, coal conveyors located along each side of said chamber a predetermined distance above the grate, passages extending approximately the full length of said chamber and inclined downwardly-inwardly from said coal conveyors to said chamber, means for operating said conveyors to push the coal through said inclined passages into said chamber and force the solid contents of said chamber downwardly, and means for operating said conveyors and said grate in timed relation, in virtue of all of which the ashes are forced to the grate, bridging is prevented, and clinkers are broken up.

JOSEPH T. NORMAN.