July 19, 1927. 1,636,375

E. LUNDGREN

AUTOMATIC STOKER

Filed July 27, 1922 3 Sheets-Sheet 1

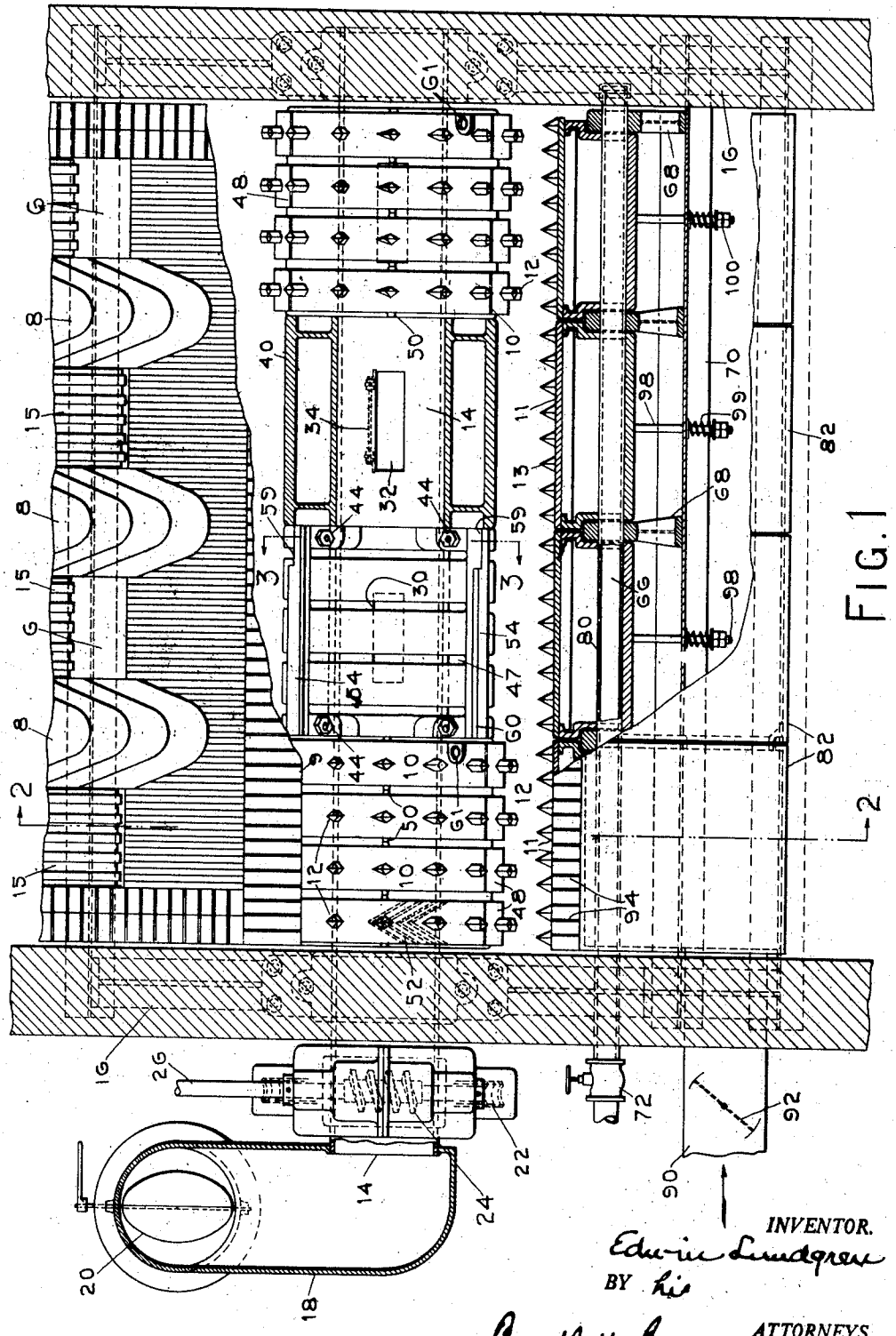


FIG. 1

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FIG. 3

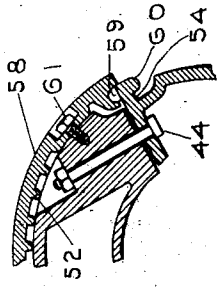


FIG. 2

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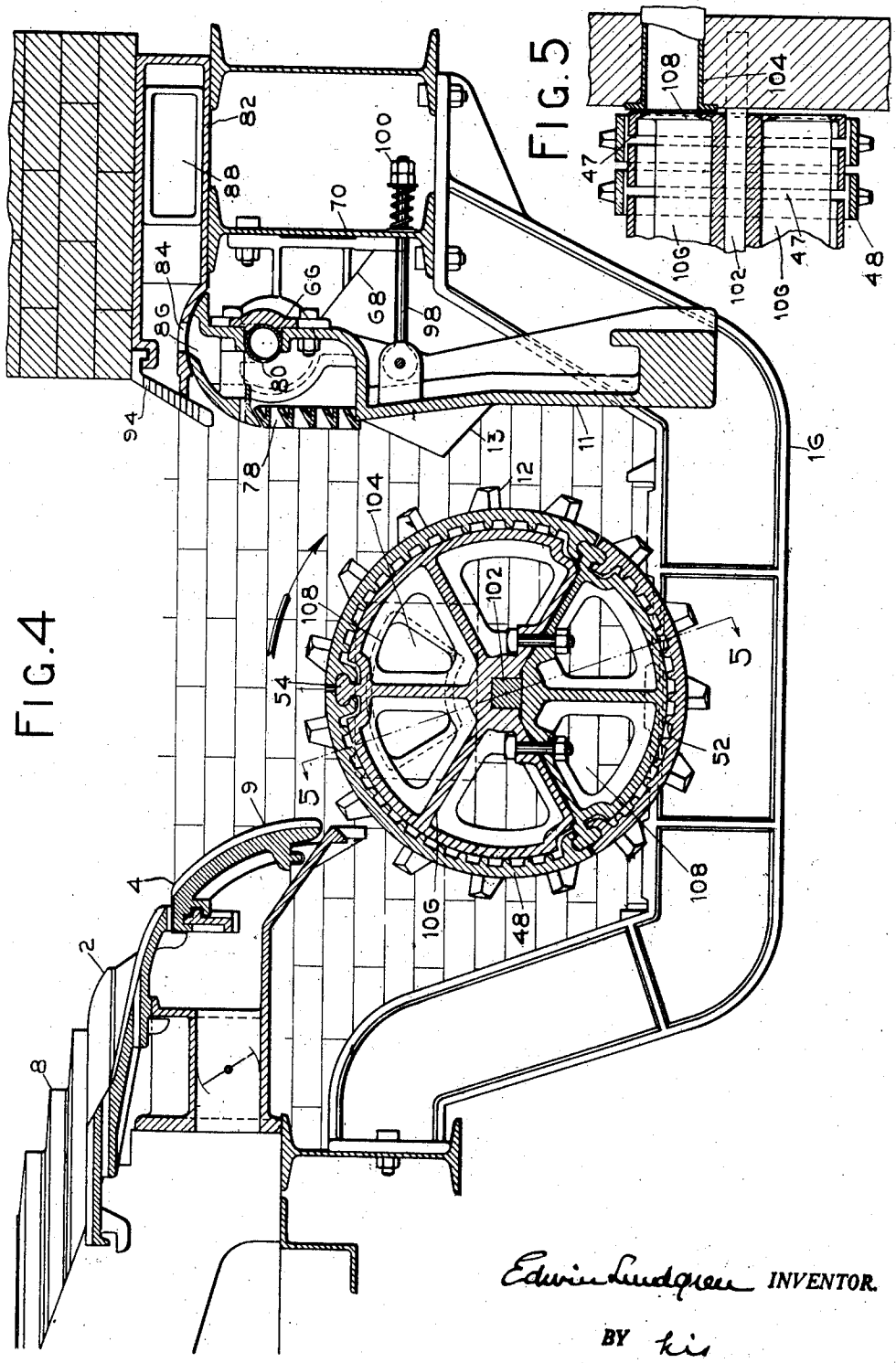
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UNITED STATES PATENT OFFICE.

EDWIN LUNDGREN, OF FREDERICK, MARYLAND, ASSIGNOR TO COMBUSTION ENGINEERING CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

AUTOMATIC STOKER.

Application filed July 27, 1922. Serial No. 577,823.

The present invention relates to furnaces or stokers of the type in which the fuel while in the course of combustion is fed progressively toward a discharge outlet through which the refuse of the fuel is automatically discharged.

An object of the invention is to provide a novel and improved furnace of this character.

Another object of the invention is to provide novel and improved means in a furnace of this character for insuring the complete combustion of the fuel before being discharged.

Another object of the invention is to provide novel and improved refuse crushing and expelling means for a furnace of this character.

With these and other objects in view, the features of the invention consist in certain constructions, arrangements and combinations of parts hereinafter described and claimed, the advantages of which will be obvious to those skilled in the art.

The several features of the invention will be clearly understood from the following description and accompanying drawings, in which,—

Figure 1 is a plan view, partly in section and with some of the said metal plates constituting component parts of the refuse discharging means hereinafter described removed, of a portion of a furnace of the underfeed type embodying the features of the invention in their preferred form;

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

Fig. 3 is a detail sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 is a similar view showing a modified construction of clinker crushing and expelling means; and

Fig. 5 is a sectional view, taken on the line 5—5 of Fig. 4.

The furnace illustrated in the drawings is provided with an underfeed section 2, and an overfeed section 4 at the rear of the underfeed section. The underfeed section comprises a series of downwardly and rearwardly inclined retorts 6 arranged side by side and spaced apart and the outer walls of the outer retorts are spaced from the side walls of the furnace, with inclined rows of tuyère blocks 8 spanning the spaces between the margins of adjacent walls of the retorts, and the margins of the outer walls of the outer retorts and the side walls of the furnace. Reciprocating plungers 15 are mounted in the retorts, or other suitable means may be provided for progressively feeding the fuel from the retorts while in the course of combustion and discharging the refuse of the fuel from the grate sections. The overfeed grate section 4 comprises a plurality of grate bars 9 arranged side by side and curved downwardly and rearwardly.

The illustrated construction is also provided with a novel and improved refuse crushing and expelling roll 10, and an apron 11 which constitutes a portion of the rear wall of the ash pit of the furnace, the roll and apron having cooperating clinker crushing teeth 12 and 13, respectively. The clinker crushing roll is mounted on a hollow shaft 14 having its ends journaled in bearings on beams or hangers 16 arranged adjacent the side walls of the furnace. One end of the hollow shaft 14 is closed and its other end is open and is connected by a swivel joint with a conduit 18 to which air is supplied under pressure by suitable means, the supply of air to the hollow shaft 14 being controlled by a damper 20 in the conduit 18. The shaft 14 is driven in a clockwise direction by any suitable means as by a worm wheel 22 secured thereon which is operatively engaged by a worm 24 carried by a driving shaft 26.

The clinker crushing roll 10 which is of relatively large diameter is of hollow construction and made up of sections that are arranged end to end as shown in Fig. 1. Each section of the roll 10 is divided into three segmental compartments 28 that together completely surround the hollow shaft 14. The inner peripheral wall of each compartment is provided with a rectangular aperture 30 which registers with a similar aperture 32 in the hollow shaft 14 so as to provide communication between the several chambers and the shaft. Gravity actuated clapper valve members 34 are pivotally mounted at one end on the interior of the hollow shaft 14 and are associated with the apertures 32, respectively, so that as a compartment 28 approaches its lower position during the rotation of the roll 10 the clapper valve member 34 will close communication between the compartment and the hollow

shaft 14 and as the compartment approaches its uppermost position the clapper valve member will swing down by gravity and thus open communication between the compartment and the hollow shaft 14. For convenience in assembling, each section of the roll 10 is divided into two longitudinally extending segmental parts 38 and 40, the part 38 containing one of the compartments 28 and the part 40 containing the other two compartments 28, this part 40 being provided with a radially extending partition 42 separating the compartments. These two parts 38 and 40 are detachably secured together by clamping bolts 44 which extend through apertures in adjacent radially extending walls 46 of said parts, thus enabling the parts of each section to be easily assembled and taken apart.

The outer peripheral wall of each of the compartments 28 is provided with a series of circumferentially extending spaced apertures 47, the apertures of the several compartments being in circumferential alinement, respectively. Each of the apertures 47 in the outer peripheral wall of the compartments 28 is covered by a segmental plate 48. The plates 48 associated with corresponding apertures of the several compartments are arranged end to end so as to embrace the drum, the series of plates associated with the apertures of each compartment being held spaced apart by spacing bosses 50 on the edges thereof. The under sides of the segmental plates 48 are provided with radially projecting herring-bone or V-shaped ribs 52 which are spaced apart. The plates 48 prevent the peripheral apertures 47 from becoming clogged by the refuse of the fuel and prevent the refuse from sifting through the apertures, a free passage for the air from the several compartments 28 being provided through the apertures 47 and the spaces between the ribs 52, the herring-bone shape of the ribs 52 obviating any danger of the spaces between them becoming clogged.

The segmental plates 48 are adapted to be easily applied to and removed from the drum 10 without removing the drum or drum sections from the shaft 14 and without removing the shaft from its bearings. To provide for this each section of the drum is provided with a plurality of T-shaped rails 54 extending longitudinally thereof and the ends of the segmental plates 48 are provided with transverse grooves 56 which are adapted to fit over opposed laterally projecting ribs 60 on the rails and thus securely lock the plates on the drum, the plates being applied by successively sliding them over the rails from one end of the drum section and the correct spacing of the plates being determined by the spacing bosses 50 on the edges of the plates. The right hand end portion, viewing Fig. 1, of corresponding locking ribs 60 of the rails is cut away as indicated at 59 so as to enable the segmental plates to be slid into position from this end of the drum sections without disturbing the position of the sections, each plate being applied by engaging one of its grooved ends with its locking rib 60, then swinging the plate downwardly to bring its opposite end in said cut away portion of the opposed locking rib and then sliding the plate longitudinally of the rails into its final position. The right hand series of segmental plates 48 of each drum section are held in place by bolts 61 which extend through apertures in the plates and are screw-threaded into the drum section. The clinker crushing teeth 12 of the drum are formed on the segmental plates 48. From the foregoing it will be apparent that each section of the clinker crushing roll or drum may be easily taken apart and assembled without disturbing the other sections or removing the shaft of the roll from its bearings.

The clinker crushing drum or roll 10 is arranged with the top portion of its surface substantially on the level of the lower end of the overfeed grate section, and is of sufficiently large diameter to enable its forward portion to extend closely adjacent to and slightly forwardly of the lower end of the supporting surface of the overfeed section, and its rear portion to extend sufficiently close to the apron 11 to enable its crushing teeth to effectively cooperate with the crushing teeth of the apron.

Heretofore it has been considered necessary in furnaces employing a clinker crushing roll to provide a deep ash pocket and to mount the roll near the bottom of the ash pocket so that the ashes in the pocket will protect the roll from injury from the heat of the fuel bed. It will be apparent, however, that although my improved clinker crushing roll is located close to the burning fuel, it is so constructed that the cool air admitted to its interior and discharge through apertures in the upper portion of its peripheral wall at all times during its operation, effectively prevents the roll from becoming overheated. It will also be apparent that the large refuse supporting area of the clinker crushing roll and the discharge of air therefrom not only insures the proper cooling of the refuse but also ensures the complete combustion of any unconsumed fuel passing the grate sections 2 and 4, the roll thus serving as an additional grate section.

The apron 11 above referred to is made up of a plurality of sections corresponding in number and arranged opposite to the sections of the clinker crushing roll or drum 10. Each section of the apron 11 is pivotally mounted on a hollow fixed shaft or pipe 66 which is supported by brackets 68 projecting from an I-beam 70. One end of the pipe 66

is closed and its other end is in communication with a suitable source of water or steam supply through a valve 72. The upper portion of each section of the apron 11 is of box-like construction and its forward wall is provided with apertures 78 through which water or steam is adapted to be directed from the pipe 66 which is provided with perforations 80. The said box-like portion of each section of the apron is in communication with an air supply chamber 82 through an opening 84 in the bottom wall of the chamber which registers with an opening 86 in the upper end wall of the section, the air being directed into the furnace through the apertures 78. The air chamber 82 is made in sections corresponding in number and arrangement to the sections of the apron. The several sections of the chamber are in communication with each other through registering apertures 88, and the chamber is adapted to receive air under pressure through a pipe 90 at one end, the supply of air to the chamber being controlled by a damper 92 mounted in the pipe. The forward wall of the several sections of the air chamber 82 is provided with tuyère openings 94 for directing air into the furnace.

Each section of the apron 11 extends a considerable distance below its pivot and its lower end is so weighted that under normal conditions of operation the apron will offer sufficient resistance to being swung back from the clinker crushing roll to enable its clinker crushing teeth to effectively cooperate with the teeth of the roll, but in case a clinker should be acted upon that cannot be broken by the teeth of the roll and apron, the section of the apron engaged by the clinker will yield or swing back sufficiently to permit the clinker to drop down into the ash pit, this construction preventing injury to the parts of the clinker crushing devices. To obviate any danger of the teeth of the apron being brought into the path of the teeth of the roll, spring buffers are provided for limiting the forward swinging movement of the sections of the apron. Each of these spring buffers comprises a rod 98 having one end pivotally connected with a section of the apron and its other end extending through an aperture in the I-beam 70, and a spring 99 coiled about the rod and interposed between the I-beam and a washer and nuts 100 on the end of the rod. As shown in Fig. 1, each of the sections of the clinker crushing roll 10, apron 11 and air chamber 82 corresponds in length to the distance between the axes of adjacent rows of tuyère blocks 8, which construction is desirable as it enables the stoker to be easily increased and decreased in width by increasing or decreasing the number of said sections, retorts 6, rows of tuyère blocks 8 and overfeed grate bars 9.

The clinker crushing roll illustrated in Figs. 4 and 5, instead of being mounted on a hollow shaft through which air is supplied to the roll is mounted on a solid shaft 102 and the air is supplied to the roll through a conduit 104 extending through a side wall of the furnace and having its end flush with the side wall. The interior of the roll is divided by radially extending partitions 106 into six compartments and the end wall of the roll is arranged closely adjacent to said side wall and is provided with openings 108 leading into said compartments, respectively. The air supply conduit 104 is arranged above the axis of the roll and the openings 108 are so arranged as to be successively brought into registry with the air supply conduit during the rotation of the roll so as to cause air from the air supply conduit to be directed through the air passages in the peripheral wall of the roll as they approach their uppermost position and to be shut off from the air passages as they approach their lowermost position.

As will be evident to those skilled in the art my invention permits of various modifications without departing from the spirit thereof or the scope of the appended claims.

What I claim is:

1. A furnace having, in combination, means for supporting and feeding fuel while in the course of combustion and for delivering the refuse of the fuel therefrom, and refuse expelling means comprising a rotatable drum of hollow construction, having a substantially cylindrical refuse supporting surface having clinker crushing teeth thereon, arranged to act on the refuse as it leaves said supporting means and having air ducts leading out through its peripheral wall, and means acting automatically during each rotation of the drum to direct air through those of said air ducts approaching the top of the drum and shutting it off from those of said air ducts approaching the bottom of the drum.

2. A furnace having, in combination, means for supporting and feeding fuel while in the course of combustion and for delivering the refuse of the fuel therefrom, and refuse expelling means comprising a rotatable drum of hollow construction, having a substantially cylindrical refuse supporting surface having clinker crushing teeth thereon, arranged to act on the refuse as it leaves said supporting means, having air ducts leading out through its peripheral surface and having its interior divided radially into a plurality of air chambers, and means comprising an air supply conduit for automatically supplying air to and shutting it off from said chambers successively during the rotation of the drum to cause air to be directed through the air ducts at the top of the drum while being shut off from the air ducts at the bottom of the drum.

3. A furnace having, in combination, means for supporting and feeding fuel while in the course of combustion and for delivering the refuse of the fuel therefrom, and refuse expelling means comprising a rotatable drum of hollow construction arranged to act on the refuse as it leaves said supporting means, having air ducts leading out through its peripheral surface and having radially extending partitions dividing the interior of the drum into a plurality of air chambers, a hollow shaft on which the drum is mounted having openings registering with openings in the walls of said chambers, respectively, air supplying means in communication with the interior of said shaft, and valve members for said openings in said shaft pivotally mounted on the wall of said shaft and constructed to be opened by gravity as they approach the top of the drum and to close by gravity as they approach the bottom of the drum.

4. A furnace having, in combination, means for supporting and feeding fuel while in the course of combustion and for delivering the refuse of the fuel therefrom, and refuse expelling means comprising a rotatable drum of hollow construction arranged to act on the refuse as it leaves said supporting means, and having openings in its peripheral wall, and members covering said openings and provided with laterally extending ribs spaced apart and engaging the periphery of the drum to enable air after passing through said openings to pass out through the spaces between said ribs, and means for supplying air to the drum and for rotating the drum.

5. A furnace having, in combination, means for supporting and feeding fuel while in the course of combustion and for delivering the refuse of the fuel therefrom, and refuse expelling means comprising a rotatable drum of hollow construction arranged to act on the refuse as it leaves said supporting means, having openings in its outer wall arranged in circumferential alinement, and segmental members arranged end to end so as to surround the drum and covering said openings with their inner surfaces provided with laterally extending ribs to enable air after passing through said openings to pass out through the spaces between said ribs, means for detachably securing said members to the drum, and means for supplying air to and for rotating the drum.

6. An underfeed furnace having, in combination, an underfeed grate section, an overfeed grate section inclined downwardly and reawardly from the underfeed section, an ash pit at the rear of the overfeed section having its rear wall provided with clinker crushing teeth, a rotatable refuse crushing and expelling drum of relatively large diameter having its top surface portion arranged substantially on the level of the lower end of the overfeed section, its forward portion arranged closely adjacent the lower end of the overfeed section and its rear portion sufficiently close to the rear wall of the ash pit to enable its teeth to co-operate with the teeth of said wall of the ash pit, said drum being of hollow construction and having apertures leading out through its peripheral wall, and means for rotating the drum and for supplying air to the interior thereof.

7. A furnace having, in combination, means for supporting and feeding fuel while in the course of combustion and for delivering the refuse of the fuel therefrom, refuse expelling means comprising a roll having clinker crushing teeth arranged to act on the refuse as it leaves said fuel supporting means, and a pivotally mounted apron spaced from and at the opposite side of the roll from said fuel supporting means and provided with clinker crushing teeth arranged to co-operate with the teeth on the roll, the upper portion of said apron being of hollow construction and having apertures leading out through its exposed wall, and means for supplying air to the interior of said hollow portion of the apron.

8. A furnace having, in combination, means for supporting and feeding fuel while in the course of combustion and for delivering the refuse of the fuel therefrom, refuse expelling means comprising a roll having clinker crushing teeth arranged to act on the refuse as it leaves said fuel supporting means, an apron spaced from and arranged at the opposite side of the roll from said fuel supporting means and having a portion thereof of hollow construction having its exposed wall provided with apertures, and a fluid conducting pipe on which the apron is pivotally mounted having apertures opening into the interior of said hollow portion of the apron.

9. A furnace having, in combination, an underfeed grate section comprising a plurality of retorts and rows of tuyère blocks alternately arranged, an ash pit arranged at the rear of said grate section for receiving the residue of the fuel, a clinker crushing roll mounted in the ash pit, a pivotally mounted apron of hollow construction constituting a portion of the rear wall of the ash pit, and an air chamber in communication with the interior of the apron, said clinker crushing roll, apron and air chamber being each made in sections, each section corresponding in length to the distance between the axes of adjacent rows of tuyère blocks so as to permit the width of the furnace to be easily increased and decreased.

10. A furnace having, in combination, means for supporting and feeding fuel while in the course of combustion and for delivering the refuse of the fuel therefrom, and refuse expelling means comprising a ro-

tatable drum of hollow construction arranged to act on the refuse as it leaves said supporting means, and having air ducts leading out through its peripheral surface, a hollow shaft on which the drum is mounted, means for directing air into the interior of said shaft, and means acting automatically during each rotation of the drum to open communication between the interior of the drum and those of said air ducts approaching the top of the drum, and to close communication between the interior of said shaft and those of said air ducts approaching the bottom of the drum.

11. A furnace having, in combination, means for supporting and feeding fuel while in the course of combustion and for delivering the refuse of the fuel therefrom, and refuse expelling means comprising a rotatable drum of hollow construction arranged to act on the refuse as it leaves said supporting means, having air ducts leading out through its peripheral surface and having radially extending partitions dividing the interior of the drum into a plurality of air chambers, a hollow shaft on which the drum is mounted, means for supplying air to the interior of the shaft and means acting automatically during each rotation of the drum to open communication between the interior of the shaft and one of said air chambers as it approaches the top of the drum and to close communication with said air chamber as it approaches the bottom of the drum.

12. An underfeed furnace having, in combination, an underfeed grate section, an overfeed grate section at the rear of the underfeed section, an ash pit at the rear of the overfeed section, and refuse expelling and crushing means comprising a rotatable drum of hollow construction mounted in the ash pit and arranged to act on the refuse as it leaves said overfeed grate section, and having air ducts leading out through its peripheral wall, and means acting automatically during each rotation of the drum to direct air through those of said air ducts approaching the top of the drum and to shut it off from those of said air ducts approaching the bottom of the drum.

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