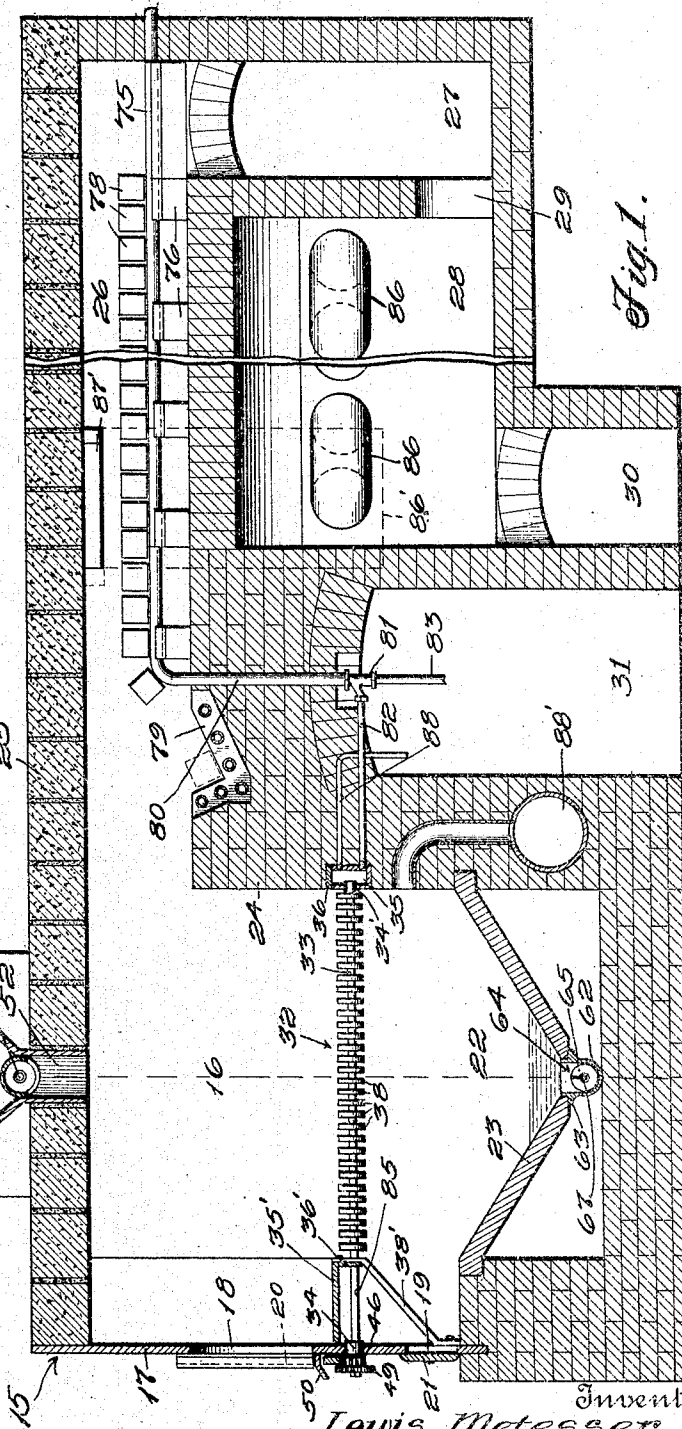
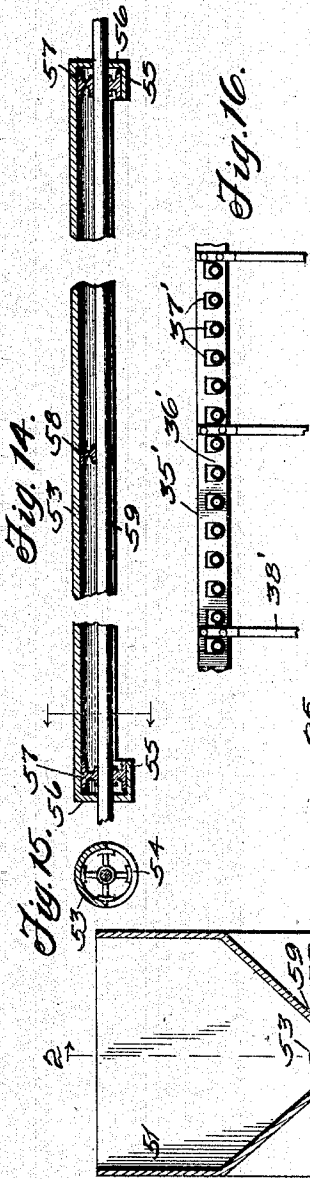


1,177,429



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METALLURGICAL FURNACE.
APPLICATION FILED MAR. 17, 1915.

1,177,429.

Patented Mar. 28, 1916.

4 SHEETS—SHEET 2.

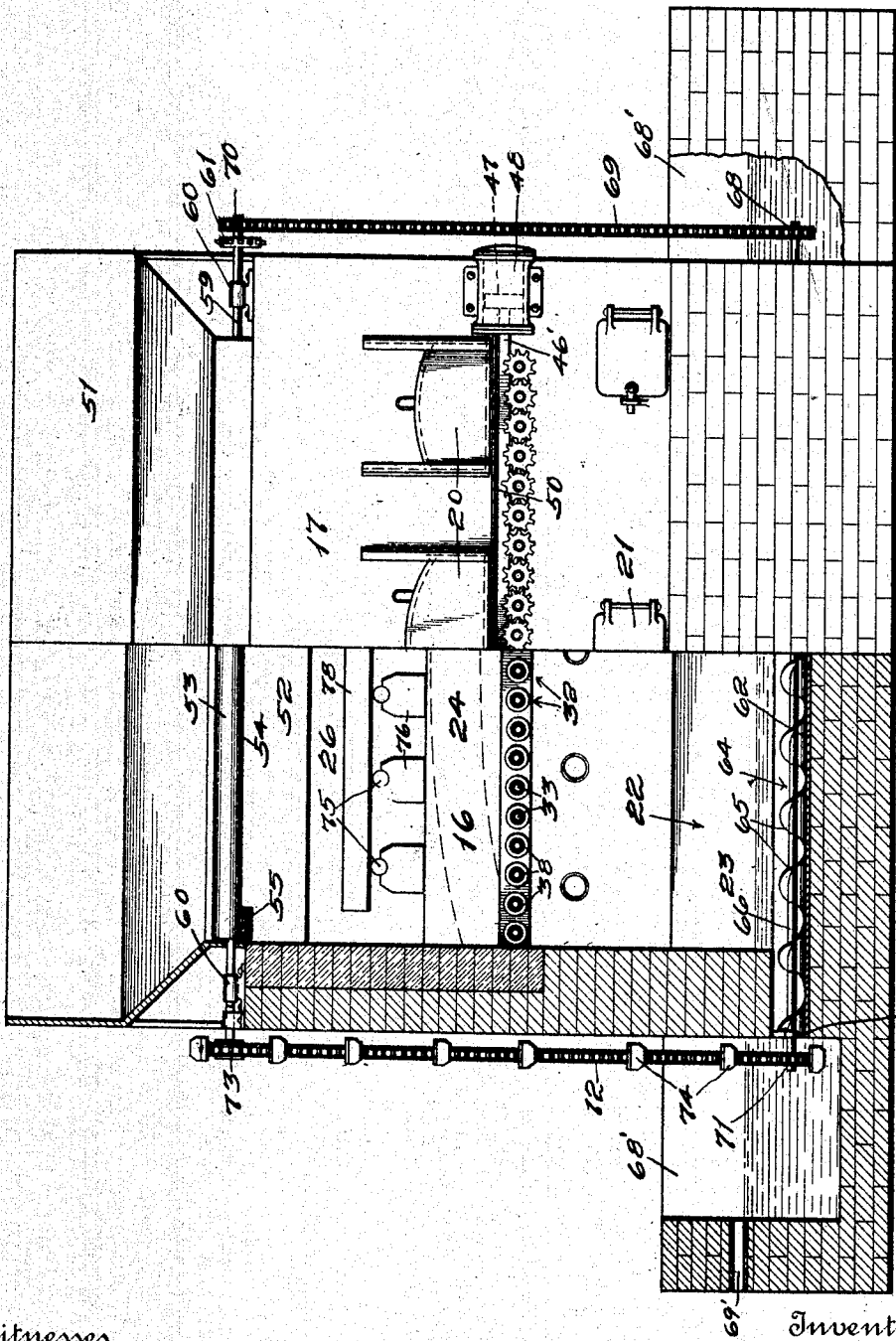


Fig. 2.

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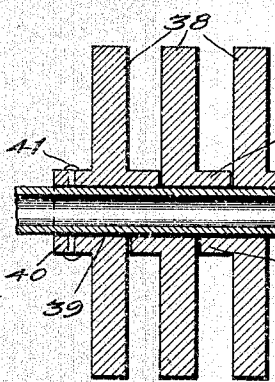
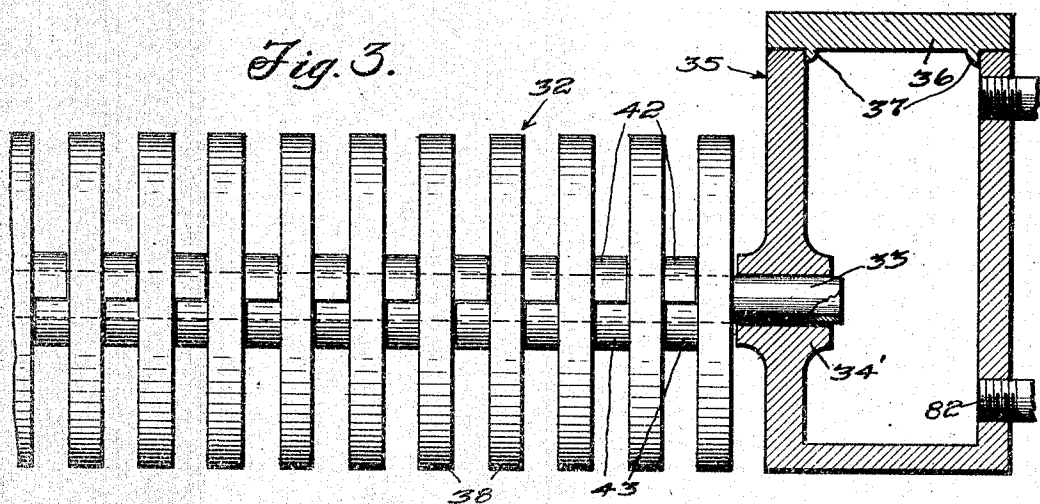


Fig. 4.

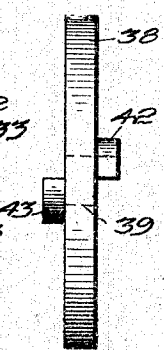


Fig. 6.

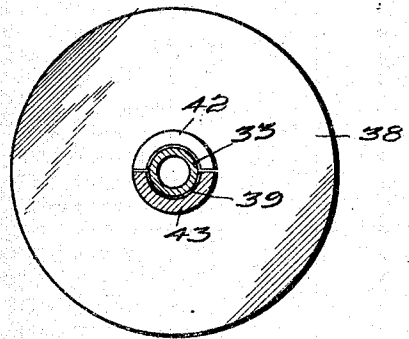


Fig. 5.

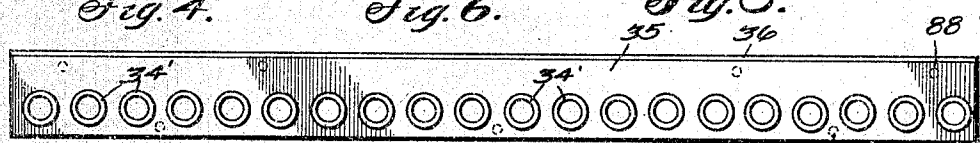


Fig. 8.

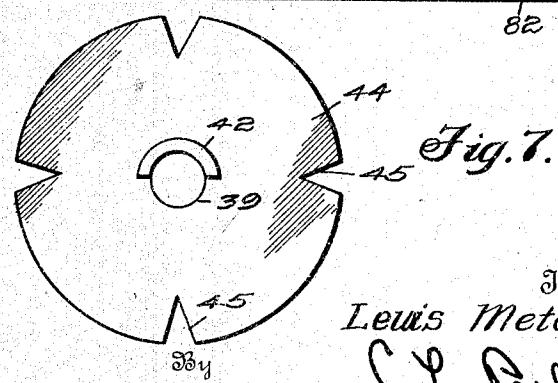


Fig. 7.

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Patented Mar. 28, 1916.
 4 SHEETS—SHEET 4.

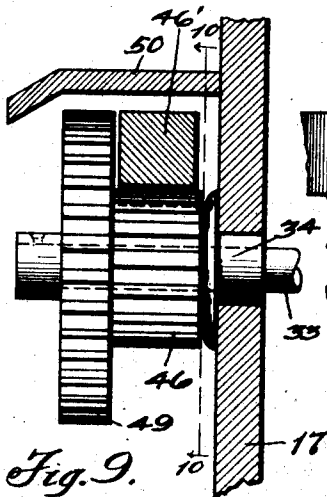


Fig. 9.

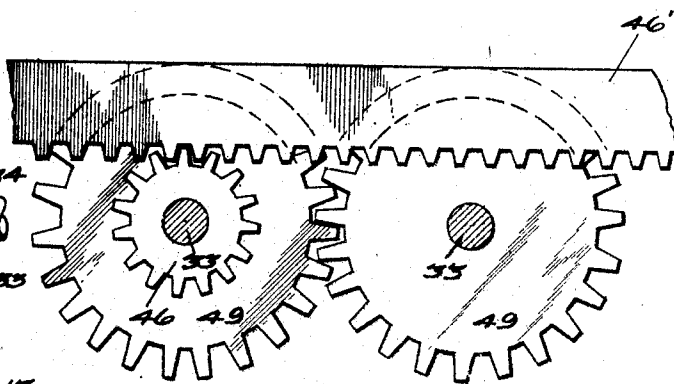


Fig. 10.

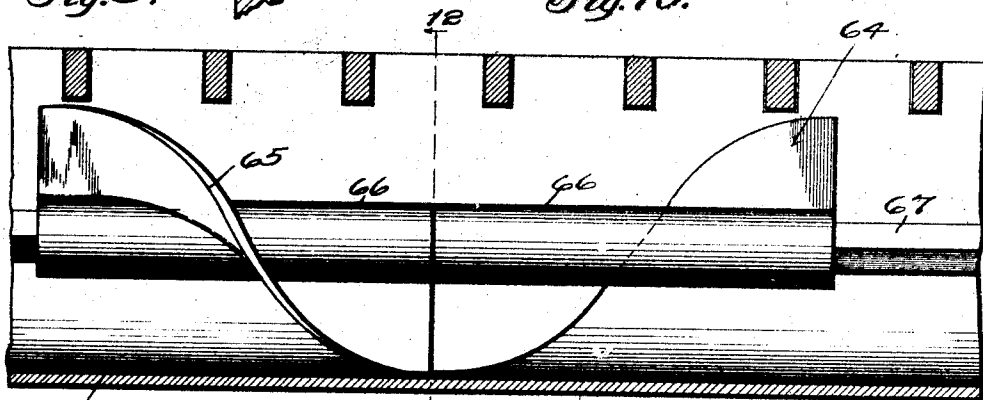


Fig. 11.

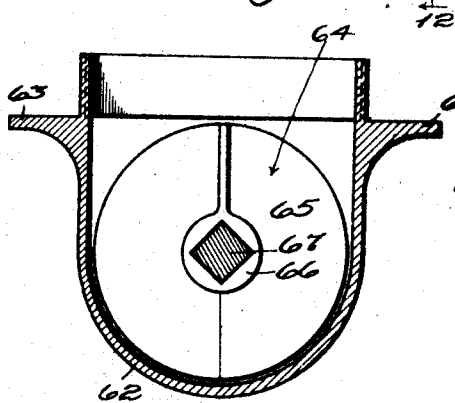


Fig. 12.

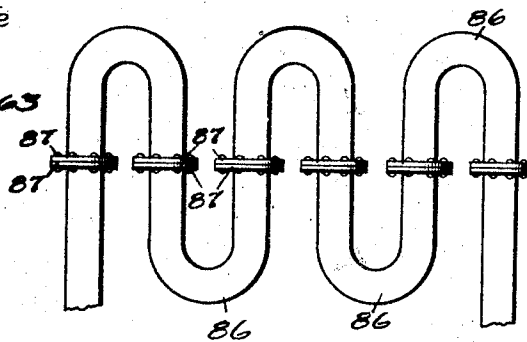


Fig. 13.

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UNITED STATES PATENT OFFICE.

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1,177,429.

Specification of Letters Patent.

Patented Mar. 28, 1916.

Application filed March 17, 1915. Serial No. 15,013.

To all whom it may concern:

Be it known that I, LEWIS METESSER, a citizen of the United States, residing at New Orleans, in the parish of Orleans and State of Louisiana, have invented certain new and useful Improvements in Metallurgical Furnaces, of which the following is a specification.

My invention relates to improvements in metallurgical furnaces, wherein metals or their alloys, may be heated, melted, puddled, annealed, or otherwise treated and to kilns for nodulizing and vitrifying.

An important object of the invention is to provide improved apparatus for preferably intermittently feeding a predetermined amount of fuel upon the grate throughout its entire width, at desired intervals.

A further object of the invention is to provide an improved grate which is water-cooled, and which is so constructed that the disks included therein may be replaced when broken in a highly convenient manner and in the minimum time.

A further object of the invention is to provide an improved water-back adapted to serve as a bearing for the rotatable tubular shafts of the grate and as means for supplying the water to the shafts.

A further object of the invention is to provide improved mechanism for operating or rotating the grate members, which is strong, durable, and convenient to operate.

A further object of the invention is to improve the construction of means for withdrawing ashes from the water ash pit and delivering the ashes to a desired point remote from the water ash pit.

A further object of the invention is to provide a system of adjustable metal pipes or refractory conduits for receiving air, and arranged in the path of travel of the heated spent gases in the furnace, whereby the heat which is ordinarily wasted may be utilized.

A further object of the invention is to provide a furnace of the above mentioned character, which is designed and constructed to admit of its operation whereby various combinations of gases, air, steam and other vapors, may be readily had for producing

desired degrees of combustion, heat, and chemical mixtures, within the furnace, to perform the required work, such as heating, melting, puddling, converting, annealing, roasting, or carbonizing the metal or its alloy, in furnaces and nodulizing and vitrifying in kilns.

A further object of this invention is to provide a furnace of the above mentioned character, which is designed and constructed to admit of its operation whereby the metals or materials being treated therein will receive the graduated or maximum amount of heat and chemical treatment from the products of combustion or hot gases, and the roof and walls or masonry of the furnace subjected to a uniform or even distribution of heat, whereby the expansion of the same is equalized, preventing the roof of such walls or masonry from undue cracking, falling apart or the like.

A further object of the invention is to provide a furnace of the above mentioned character, which is of simplified design and construction to enable its operation by unskilled labor and which will last a long time.

A further object of the invention is to improve in general the construction of furnaces of this character, with a view of increasing their efficiency of operation.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this specification and in which like numerals are employed to designate like parts throughout the same, Figure 1 is a central vertical longitudinal sectional view through apparatus embodying my invention, Fig. 2 is an end elevation, half thereof being shown in transverse section, taken on line 2-2 of Fig. 1, and looking in the direction of the arrow, Fig. 3 is a fragmentary side elevation of one of the rotatable grate members, with the water-back in transverse section, Fig. 4 is a central longitudinal sectional view through a plurality of the grate disks and the tubular shaft carrying them, Fig. 5 is a side elevation of one of the grate disks, Fig. 6 is an edge elevation of the same,

Fig. 7 is a side elevation of a slightly different form of disk, Fig. 8 is a forward side elevation of the water-back, Fig. 9 is a side elevation of a pair of pinions for rotating one of the grate members and transmitting rotation to another grate member, associated elements being shown in section, Fig. 10 is a longitudinal sectional view taken on line 10—10 of Fig. 9, showing the operating pinions in elevation, Fig. 11 is a fragmentary side elevation of a portion of the screw of a conveyer, embodied in the ash removing apparatus, the trough being shown in section, Fig. 12 is a transverse sectional view taken on line 12—12 of Fig. 11, Fig. 13 is a side elevation of air heating pipes or conduits embodied in the invention, Fig. 14 is a central longitudinal sectional view through a feed valve, Fig. 15 is a transverse sectional view taken on line 15—15 of Fig. 14, Fig. 16 is a rear elevation of an auxiliary bearing for the grate shafts.

In the drawings, wherein for the purpose of illustration is shown a preferred embodiment of my invention, the numeral 15 designates the casing or body portion of my furnace, having a combustion chamber 16 arranged in the forward end thereof. The forward end of this combustion chamber is preferably covered or protected by a metal sheet or plate 17, having openings 18 and 19, covered by movable doors 20 and 21 respectively. Below the combustion chamber 16 is a water ash pit 22, preferably having a V-shaped bottom 23, tapering downwardly, as shown.

The numeral 24 designates a bridge wall, the upper end of which is spaced from the tiled top or roof 25 of the casing 15, whereby a heating chamber or passage 26 has free communication with the top of the combustion chamber, as shown. The heating chamber or passage 26 communicates at its rear end with down-comers 27, having communication with a lower or spent gas chamber 28, through an opening 29. The chamber 28 discharges into a passage 30, discharging into a chimney or stack (not shown). It is thus apparent that the heat or products of combustion pass from the combustion chamber 16 through the heating chamber or passage 26, downwardly through down-comers 27, opening 29, and through passage 30 to the chimney or stack. When the heated gases or products of combustion pass through the heating chamber 26, the principal portion of them circulate below the blooms or metal, in a manner to be more fully described.

The combustion chamber 16 and water ash pit 22 are separated by a horizontal grate designated as a whole by the numeral 32. This grate, as more clearly shown in Figs. 1, 3, 4, 5, 6 and 7, embodies a plurality of spaced tubular horizontal shafts 33. The

forward ends of the shafts 33 are journaled in bearings 34 secured in openings in the plate 17 and project forwardly beyond these bearings, as shown.

The numeral 35' designates a cast iron surface plate, the width of the masonry of the front, and arranged adjacent the forward ends of the grate members for preventing the fuel falling into the water ash pit. At its rear edge the plate 35' is provided with a depending plate 36', see Fig. 16, having openings 37', formed therein for rotatably receiving the shafts 33. The plate 35' is supported by diagonal braces 38' preferably attached to the depending plate 36'. The rear ends of the tubular shafts 33, are journaled in bearings 34', formed in the forward wall of a transverse horizontal water-back 35, which is preferably formed of cast iron and preferably rectangular in cross-section. The top of the water-back 35 is preferably covered by a top or lid 36, having ribs 37 extending into the same, preventing displacement thereof. It is thus apparent that the water-back serves as a bearing for the tubular grate shafts and as means for supplying the water thereto.

Each rotatable shaft 33 is included in a rotatable grate member. Each of these grate members comprises spaced preferably circular disks 38 having central apertures 39 for receiving the tubular shaft. The two end disks are provided with outwardly extending tubular hubs 40, which are rigidly secured to the shaft by bolts 41 or the like. These end disks are provided upon their inner sides with preferably semi-circular hub-sections 42, adapted to engage and interlock with co-acting hub-sections 43 carried by the intermediate disks. The intermediate disks are also provided with the interlocking hub-sections 42 and 43, as shown. The end disks 38 being locked to the tubular shaft and the intermediate disk 38 being locked to the end disks, it is obvious that these intermediate disks are also locked to the shaft.

In Fig. 7, I have a slightly different form of disk, designated by the numeral 44. This disk is identical in all substantial respects with the disks 38 except that the same is provided upon its periphery with openings or notches 45, which may be of any desired shape. The particular function of the peculiar construction of the disks 38 and 44 whereby they have detachable interlocked engagement with each other, is that if one of these disks should become broken, as for instance the disk in the central portion of the combustion chamber, where it would be particularly hard to repair or remove it, the broken disk may be completely broken from the tubular shaft, the end disk removed, the other disks shoved up in place, a new disk arranged upon the end of the

shaft and the end disk again returned upon the shaft and locked thereto.

As above stated, the forward ends of the shafts 33 extend outwardly beyond the plate 17, and alternate tubular shafts have small inner pinions 46 rigidly mounted thereon, which are engaged by the teeth of a rack-bar 46', mounted to horizontally reciprocate, and connected at one end with a piston 47, reciprocating in a cylinder 48. Any suitable means may be employed for introducing steam or other fluid pressure into the opposite ends of the cylinder to reciprocate the piston and rack-bar.

I wish it understood that the invention is in no sense restricted to the use of the cylinder and piston to reciprocate the rack-bar, as it may be accomplished by any other suitable means. Rigidly mounted upon each of the tubular shafts 33 outwardly of the small pinions 46 are large pinions 49, in engagement with each other and constituting a train of gears. It is obvious that the rotation imparted to the alternate tubular shafts is transmitted to the large pinions 49, whereby all of the tubular shafts are made to simultaneously rotate. The stroke of the rack-bar is preferably such in either direction to turn the tubular shafts, for a complete revolution. Particular attention is called to the fact that the grate members in alternate pairs or couples rotate in opposite directions to each other. The alternate pairs also rotate in opposite directions, to wit, when the grate members in one pair are rotating downwardly producing a crushing action, the grate members in the adjacent alternate pair are rotating upwardly, producing an agitating action. The pinions 46 and 49 are covered by a guard 50, rigidly attached to the plate 17, as shown.

Arranged above the top of the combustion chamber 16 and extending transversely thereof for its entire width is a hopper 51, having an outlet chute 52 extending across the combustion chamber for substantially its entire width. The coal or like material is fed into the hopper and is intermittently fed upon the grate in the combustion chamber, by a rotary hollow feed valve 53. This feed valve, as more clearly shown in Figs. 14 and 15, is formed of a section of pipe or tube, having one side thereof cut away at 54, such cut away portion terminating at points near and spaced from the ends of the valve providing rings 55, the ends of which are closed by heads 56. Wheels 57 are rigidly mounted within the rings 55 and a wheel 58 having a portion thereof cut away is rigidly mounted in the valve 53 between the ends thereof. The wheels 57 and 58 are rigidly mounted upon a horizontal rotatable shaft 59, extending outwardly beyond the ends of the rotatable valve. The rotatable

shaft 59 is journaled through bearings 60, rigidly secured upon the top of the casing 15. It is thus apparent that during a complete revolution of the tubular valve from the closed position shown in Fig. 1, the open side thereof will be moved into the hopper and filled with coal or other material, and upon the further rotation of the tubular valve this material will be dumped upon the grate. The means for rotating the shaft 59 preferably consists of a sprocket wheel 61, rigidly secured thereto and driven by a sprocket chain (not shown) in turn receiving its rotation from any suitable source of power.

The ash removing apparatus comprises a trough 62 more clearly shown in Figs. 1, 2, 11 and 12, which is arranged beneath the inclined bottom 23 and having its top flush therewith. This trough is provided with laterally extending flanges 63, engaging the lower side of the bottom 23, as shown in Fig. 1. Rotatably mounted within the trough 62 is a screw conveyer 64, preferably formed of cast iron and preferably made in sections 65, having hubs 66, provided with openings which are square in cross-section for receiving a driving shaft 67, also square in cross section. The ends of the shaft 67 are cylindrical, to be journaled in hanger bearings 67', and this shaft may be supported in bearings between its ends, if desired. The water ash pit 22 has communication with water seal pits 68', arranged exteriorly of the sides of the casing 15, through the ends of the trough 62, as shown. The screw conveyer is submerged in the water ash pit 22. Rigidly mounted upon one end of the driving shaft 67 is a sprocket wheel 68, engaged by a sprocket chain 69 engaging a sprocket wheel 70, rigidly mounted upon the corresponding end of the shaft 59. Rigidly mounted upon the opposite end of the shaft 67 is a sprocket wheel 71, engaged by an endless conveyer sprocket chain 72, engaging a sprocket wheel 73, having any desired location, depending upon the direction in which it is desired to extend the conveyer to discharge the ashes. Buckets 74 are carried by the sprocket chain 72, and operate in one of the seal pits 68' in proximity to the discharge end of the screw conveyer, for taking up the ashes and conducting them to any desired point. These seal pits 68' are provided with over-flow pipes 69'.

Extending longitudinally within the heating chamber 26 are horizontal skid pipes 75, which are laterally spaced and spaced from the top and bottom of the chamber 26, the same being held elevated by tiles 76. These pipes extend preferably through the rear end wall of the casing 15 and have connection with a source of water (not shown). These pipes serve to slidably support blooms

or metal 78, which are forced along these skid pipes by any suitable means to be discharged upon a cast iron chill 79, which is cooled by water and supported by the bridge wall 24. Connected with the down turned ends 80 of the pipes 75 are Y-couplings 81, having connection with pipes 82 preferably of a smaller diameter than the pipes 75, as shown. The pipes 82 discharge into the lower end of the water-back 35, for feeding water thereto, while the water may be fed to the water-back by any other suitable means. Connected with the Y-couplings 81 are depending pipes 83, of smaller diameter. Connected with the top of the water-back 35 are waste pipes 88, discharging into the chamber 31. The tubular rods 33 are provided near their forward ends with apertures 85, discharging the water downwardly into the water ash pit. This water ash pit is preferably permanently partly filled with water, which completely submerges the spiral conveyer and also constitutes a water seal.

In order to utilize the heat contained within the spent gases or products of combustion before they discharge to the stack or atmosphere, I arrange air heating pipes 86 in the chamber 28, such pipes being of a peculiar construction whereby they have a wide range of adjustability. As clearly shown in Fig. 13, each of these pipes 86 is U-shaped, and provided at its ends with flanges 87, bolted or otherwise rigidly attached to the flanges of the adjacent U-shaped pipes 86. By this construction the U-shaped pipes may all be arranged horizontally, or vertically, or some horizontally and others vertically, and they may be coupled in any desired number of layers. The free end of one of the U-shaped pipes 86 communicates with an air supply while the outlet end of the discharge U-shaped pipe communicates with a vertical passage 86'. This vertical passage is provided at its top with a horizontal inwardly discharging outlet 87', communicating with the heating chamber 26, as shown. The ends of the horizontal outlet 87' are transversely inclined rearwardly, to deflect the preheated incoming air rearwardly. There are two of these outlets 87', one upon each side of the heating chamber 26, and they serve to deflect the air in two streams, rearwardly in the heating chamber. A portion or all of the preheated air may also be suitably conducted into a combustion conduit 88', having discharge pipe arm or arms leading into the water ash pit 22, below the grate.

The operation of the apparatus is as follows: The shaft 59 is continuously rotated, which rotation is imparted to the feed valve 53. This feed valve by rotating in the lower end of the hopper or chute 52, becomes intermittently filled with coal or fuel and

drops it upon the grate 32, throughout the entire width of the grate. The rotation of the shaft 59 is imparted to the shaft 67, which effects a continuous rotation of the spiral or screw conveyer, feeding the ashes into the end of the seal pit 68', adjacent the conveyer 72, whereby it is carried from proximity to the screw conveyer, by the buckets 74. The water is continuously supplied into the water-back 35 and circulates forwardly through the tubular shafts 33, discharging through the apertures 85 and passing into the water ash pit 22, after cooling the grate members. When it is desired to rotate the grate members for shaking the ashes in the combustion chamber, steam is introduced into the opposite ends of the cylinder 43, causing a reciprocation of the rack bar 46', which through the medium of the associated pinions, turns the tubular shafts 33 and disks carried thereby.

It is to be understood that the form of my invention herewith shown and described is to be taken as a preferred example of the same, and that various changes in the shape, size, and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

Having thus described the invention, I claim:—

1. In a furnace of the character described, a casing, a plurality of substantially horizontal rotatable tubular grate shafts arranged within the casing and provided near their forward ends with water outlet openings, a hollow water-back arranged within the casing adjacent the rear ends of the tubular grate shafts and apertured to receive them for supplying water thereto, means for supplying water to the hollow water-back, disks carried by the tubular grate shafts, apparatus arranged upon the upper portion of the casing to feed fuel upon the disks, means to turn the grate shafts, an ash-pit arranged within the casing beneath the disks and having its walls extending downwardly toward the center thereof and adapted to receive ashes from the disks and water discharging from the apertures in the grate shafts, and a conveyer disposed beneath the upper surface of the ash-pit to remove ashes therefrom.

2. In a furnace of the character described, a casing, a plurality of substantially horizontal rotatable tubular grate shafts arranged within the casing and provided with water outlet openings, a hollow water-back arranged within the casing adjacent corresponding ends of the tubular grate shafts and apertured to receive them for supplying water thereto, means to supply water to the hollow water-back, disks carried by the tubular grate shafts, means to turn the grate shafts, apparatus arranged above the disks

to feed fuel thereto, an ash-pit arranged within the casing beneath the disks and adapted to receive ashes from the disks and water from the outlet apertures of the grate shafts, and a submerged conveyer operating within the ash-pit to remove ashes therefrom.

In testimony whereof I affix my signature in presence of two witnesses.

LEWIS METESSER.

Witnesses:

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