

A. R. EARL.

FURNACE.

APPLICATION FILED MAR. 14, 1910.

1,032,661.

Patented July 16, 1912.

2 SHEETS—SHEET 1.

Fig 1.

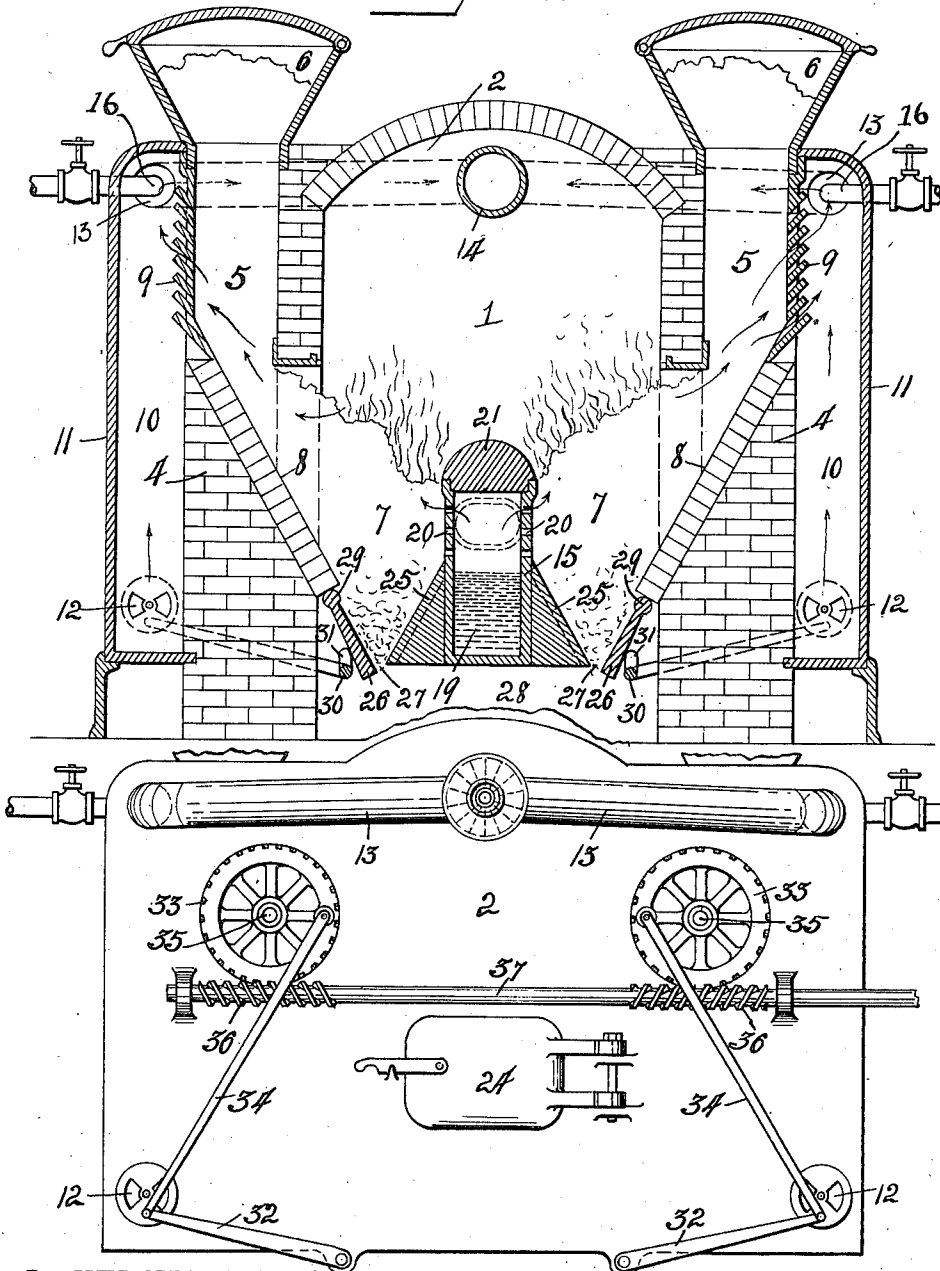


Fig 2.

WITNESSES:

C. H. Bills.
E. C. Thomas.

INVENTOR.

Alfred R. Earl,
By Owen & Owen,
His attys.

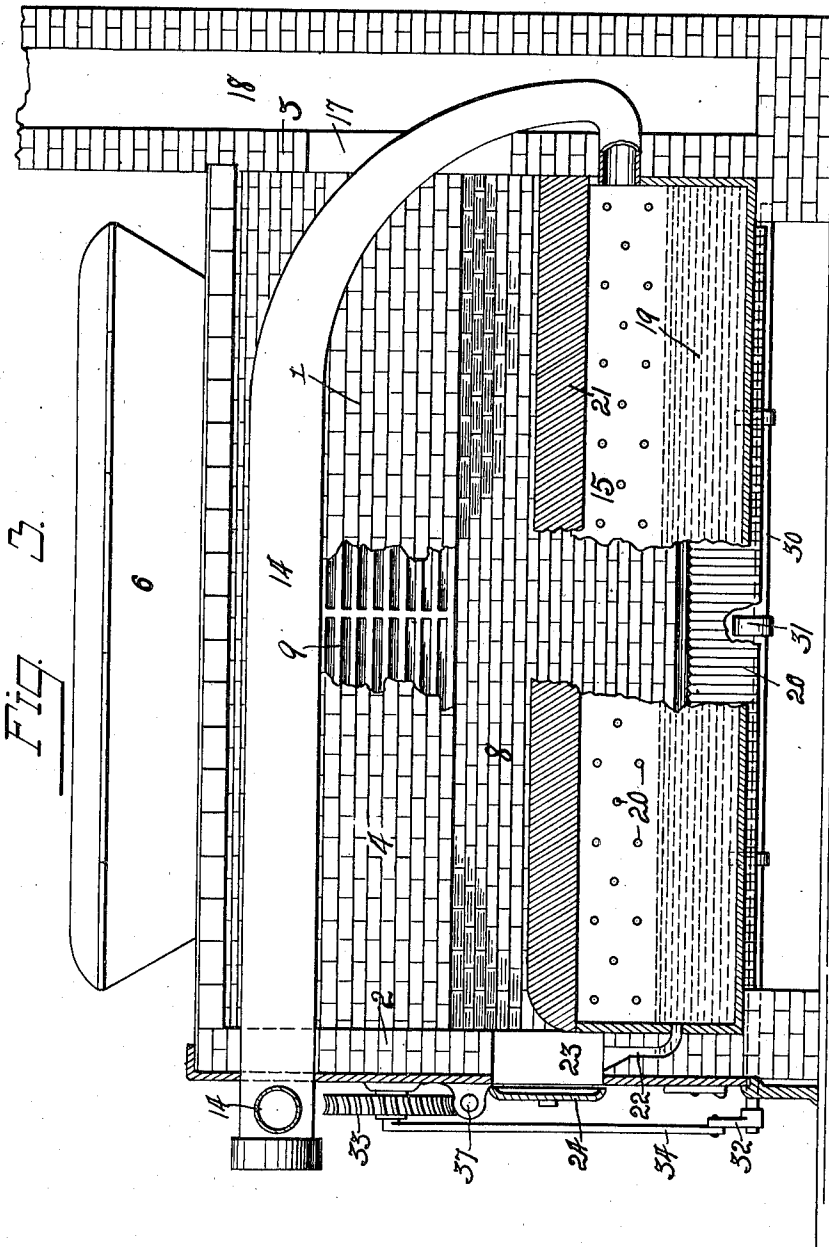
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UNITED STATES PATENT OFFICE.

ALFRED R. EARL, OF TOLEDO, OHIO.

FURNACE.

1,032,661.

Specification of Letters Patent.

Patented July 16, 1912.

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To all whom it may concern:

Be it known that I, ALFRED R. EARL, a citizen of the United States, and a resident of Toledo, in the county of Lucas and State of Ohio, have invented a certain new and useful Furnace; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

My invention relates to self-feeding furnaces, and particularly to furnaces of the type in which the coal is coked and the hydrocarbon gases distilled therefrom prior to the burning of the fuel, and the distilled gases mixed with air in proper proportion and subsequently utilized to support and facilitate combustion within the furnace.

The object of my invention is the provision of an improved and highly efficient furnace of the class described, which is simple in its construction and economical of operation, and in which the fuel as it feeds to the fire bed is coked and the hydrocarbon gases distilled therefrom, and such gases mixed with air in proper proportions and subsequently discharged in a heated state to the fuel bed whereby to create both a forced draft within the furnace and to support combustion in a highly efficient manner.

A further object of my invention is the provision of means in lieu of the usual grate bars, which is automatically operative to crush any clinkers which may accumulate in the fire bed or ash, and also to facilitate a gradual downward feed of the ash and fuel, thus obviating the very objectionable accumulation of clinkers on the usual grate surface and the consequent lessening of the air space through the grates, which decreases the efficiency of the furnace and causes the grates to warp and burn out. This means also prevents the necessity of opening the furnace doors to permit the removal of clinkers from the grates, and the consequent cooling of the furnace interior, which is very objectionable and which it is the principal purpose of automatic stokers to overcome.

A further object of my invention is the provision of an improved, simple and highly efficient furnace of the automatic stoker or

self-feeding type, which is adapted for the feeding and burning of either small or large chunk coal, whereby to particularly adapt it to the needs of smelting or melting furnaces.

The invention is fully described in the following specification, and a preferred embodiment thereof illustrated in the accompanying drawings, in which,—

Figure 1 is a vertical cross-sectional view of a furnace embodying the features of my invention.— Fig. 2 is a front end view thereof with portions of the hoppers broken away, and Fig. 3 is a central longitudinal section thereof with portions broken away.

Referring to the drawings, 1 designates the combustion-chamber having the front and rear walls 2 and 3, respectively, and the side walls 4, 4. Each side wall 4 is provided substantially throughout its length, or preferably so, with a passage 5 for the gravity feed of fuel from the hoppers 6, located at the top of the furnace, to the fuel or fire beds 7 within the chamber 1. The passages 5 at their lower end portions are provided with the inclined walls 8, which direct the fuel into the lower portion of the chamber 1, as indicated. The outer walls of the upper portions of the passages 5 are provided with grate-bars, as indicated at 9, which provide communication between such passages and the air chambers 10 at the adjacent sides of the furnace, which chambers are formed by the casings or walls 11.

The heat radiated into the passages 5 from the inner walls thereof, which walls become highly heated by the heat within the combustion chamber, augmented by the heat circulating up through the fuel body, effects a coking of the coal within such passages, and a distilling of the hydrocarbon gases therefrom which pass through the gratings 9 and into the chambers 10, where such gases are mixed with air in proper proportion to make a highly combustible gas.

Air is admitted to the chambers 10 through damper-controlled openings 12, and the mixed gas and air pass from such chambers through the pipes 13, located in the present instance at the front of the furnace, and then through a common pipe 14 to a blower-box 15 located within the lower portion of the combustion-chamber. A draft is created through the pipes 13, 14 by jet-blowers 16, or in any other suitable manner.

The pipe 14 passes rearwardly through the upper portion of the chamber 1, thence through the exit passage 17 to the smoke flue 18, and communicates with the blower-box 15 at the rear end thereof as shown in Fig. 3. It is thus evident that the pipe 14 becomes highly heated and effects a very high heating of the gases passing there-through before discharging the same into the blower-box.

The blower-box 15 is of narrow elongated form and extends longitudinally through the lower central portion of the chamber 1 in the path of discharge of the fuel from the passage 5. The lower portion of the blower-box is imperforate and contains water 19 to prevent a too highly heating of the walls thereof, while the upper portions of the side walls thereof are provided with openings or perforations 20 for the lateral discharge of the combustible gases contained in the box into the fuel beds on both sides of the blower-box, as indicated. The box 15 is provided with a removable top 21 of fire-brick or the like. Water is admitted to the box through a filling passage 22 in the front of the furnace, the mouth of which is shown as opening within the front wall opening 23, which is closed by a door 24.

The blower-box 15 beneath the openings 20 therein is provided with the inclined outer walls or crusher surfaces 25, which combine with the opposed oppositely inclined clinker-crushing bars 26 to provide gradually restricted ash discharge openings 27 to a subjacent ash chamber 28 from which the ashes may be removed in any suitable manner. The bars 26 are pivoted at their upper edges adjacent to the lower edges of the inclined walls 8 of the fuel passages 5, as at 29, to adapt such bars to form continuations of said walls and to have their lower edges oscillated toward and away from the cooperating clinker-crushing walls 25.

Mounted at the rear of the lower edge of each bar 26 is a rock-shaft 30 having cam-ports 31 disposed at intervals thereon for acting on the bar to impart oscillatory movements thereto when the shaft is rocked. Each shaft 30 has an arm 32 projecting from an end thereof and connected at its free end to a crank-pin on a worm-wheel 33 by a rod 34, whereby rocking movements are imparted to the shaft from a rotation of the worm-wheel. The wheels 33 are mounted on studs 35 at an end of the furnace, the front, in the present case, and mesh with worm-sections 36 on a shaft 37 journaled transversely of the furnace front.

In the operation of my furnace the oscillatory action of the bars 26 effects a gradual discharge of the ashes from the bottom of the fuel beds on opposite sides of the blower-box 15 and also crushes any clinkers which

would otherwise lodge in and clog the openings 27. As the ash is discharged from the bottom of the fuel beds, the fuel works down by gravity through the passages 5 from the hoppers 6 and continually keeps the fuel beds supplied with fresh fuel, as is apparent. The coal in its passage through the passages 5 becomes thoroughly coked by radiant heat from the combustion chamber 1, and the hydrocarbon gases distilled therefrom pass through the grates 9 into the mixing chambers 10. The dampers in the air inlet openings 12 to such chambers are regulated to admit air thereto in proper proportion to mix with the distilled gases to provide a highly combustible mixture. This mixture is forced through the pipes 13 and 14 and into the blower-box 15 by suitable draft creating means, and in its passage through the pipe 14 is highly heated due to the extension of such pipe through the combustion-chamber. These hydrocarbon gases are discharged through the perforated side walls of the blower-box 15 into and pass up through the incandescent coke disposed at the sides of such box where it is ignited and also supplies the necessary draft to consume the coke, thus making a forced-draft automatic stoker without the provision of the usual expensive fan system or tall stack and is independent of any weather conditions. It is apparent with this construction that the feed of the fuel is by gravity and self-regulating, and that all shaking grates or pushing bars on which clinkers can form are eliminated. It is also evident that as foreign clinker forming matter in the fuel can only be fused by intense heat clinkers will not form until the fuel reaches the portions of the fuel bed in the paths of the escaping gases from the blower-box where such clinkers will be within reach of the crushers and carried through the same by their own weight. As the draft is mechanical, to stop the furnace the only thing necessary is to shut off or stop the blowers; and to start the furnace the only thing necessary is to kindle the fire in contact with the blower-box and start the forced draft means.

For the perfect combustion of coal the gases distilled therefrom must be mixed with the proper amount of oxygen (approximately 12 pounds of oxygen to 1 pound of coal) and be heated to a temperature at which it will readily ignite (approximately 750 degrees). This is impossible with the ordinary type of grates as the necessary amount of air cannot pass through the fuel as fast as the gases are liberated, thus preventing the formation of a mixture that is combustible, and if the proper amount of air does not pass through the fuel, it is found that it invariably cools the temperature of the furnace so low that the mixture will pass off unconsumed. As all

of the gases generated in the furnace are not combustible, any attempt to draw the unconsumed gases from the smoke-box of the furnace will draw the non-combustible with the combustible gases and represent so much dead loss. Another objection incident to the ordinary form of grates, which objection is obviated by my invention, consists in the gathering of foreign matter, such as clinkers, upon the grate surface, which decreases the efficiency of the same and causes them to warp and burn out. When these clinkers gather on the grates, they must be removed by hand which means open doors and a consequent cooling of the furnace interior.

It is evident with the construction of furnace herein described that the features referred to which are objectionable in other forms of furnaces are entirely overcome and an intense fire provided by a discharging of the highly combustible gaseous mixture into the fuel bed.

I wish it understood that my invention is not limited to any specific construction or arrangement of the parts except in so far as such limitations are specified in the claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is,—

1. A furnace having a combustion-chamber, the side walls of which are provided with fuel passages for delivering fuel from an elevated point to the lower portion of said chamber, casings forming air chambers at the outer sides of said furnace wall and having communication with the fuel passages through the outer walls thereof, a blower-box within the combustion-chamber with its interior in communication therewith, and means for gathering the air and distilled gases within said casings, passing the same through the upper portion of the furnace, and discharging them into the combustion-chamber through the blower-box.

2. A furnace having a combustion-chamber, the side walls of which are provided with vertically disposed passages for the delivering of fuel from an elevated point to the lower portion of the combustion-chamber, said passages forming coking chambers and having grated outer wall openings for the passage of distilled gases, casings without said walls forming mixing chambers and having openings for the admission of air, a blower-box in the lower portion of the combustion-chamber with its interior in communication therewith, and means for gathering, forcing and directing the mixed gases into the combustion-chamber through the blower-box.

3. A furnace having a combustion-chamber, a side wall of which is provided with a

vertically disposed passage for the delivery of fuel from an elevated point to the lower portion of the combustion chamber, said passage forming a coking chamber, a casing without said wall forming a mixing chamber, said mixing chamber being in communication with said passage and having an opening for the admission of air, and means for gathering the mixed gases within said mixing chamber and forcing the same through the upper portion of the combustion-chamber and thence discharging them into the lower portion thereof.

4. In a furnace, a blower box extending through the central portion of the furnace longitudinally thereof, said blower box forming a water receptacle with its side walls provided adjacent the tops thereof with laterally projecting discharge openings and having a removable top, passages provided vertically in the side walls of the furnace for the delivery of fuel from an elevated point to the lower portion of the furnace at the sides of said blower box, said passages forming coking chambers, mixing chambers disposed without said coking chambers and having communication therewith and with the atmosphere, and means for gathering, forcing and directing the mixed gases to said blower box.

5. A furnace having walls forming a combustion-chamber, mixing chambers and vertically disposed passages at the sides of the combustion-chamber for the feed of fuel from an elevated point to the lower side portions of the combustion-chamber, said passages forming coking chambers and having grated openings into said mixing-chambers and said mixing-chambers having openings for the admission of air, a blower-box extending longitudinally of the combustion-chamber within the lower central portion thereof and having its side walls perforated for the lateral discharge of gases therefrom, communication between said mixing-chambers and said box, means for forcing gases into said box from said mixing-chambers, sets of relatively movable oppositely inclined parts disposed on opposite sides of said blower-box beneath the outlet of said passages to form ash discharge openings which are gradually restricted toward the bottom of the combustion-chamber, and mechanism for relatively moving the parts of each set to facilitate such discharge and to crush clinkers within such openings.

In testimony whereof, I have hereunto signed my name to this specification in the presence of two subscribing witnesses.

ALFRED R. EARL.

Witnesses:

C. W. OWEN,
E. E. THOMAS.