

July 5, 1932.

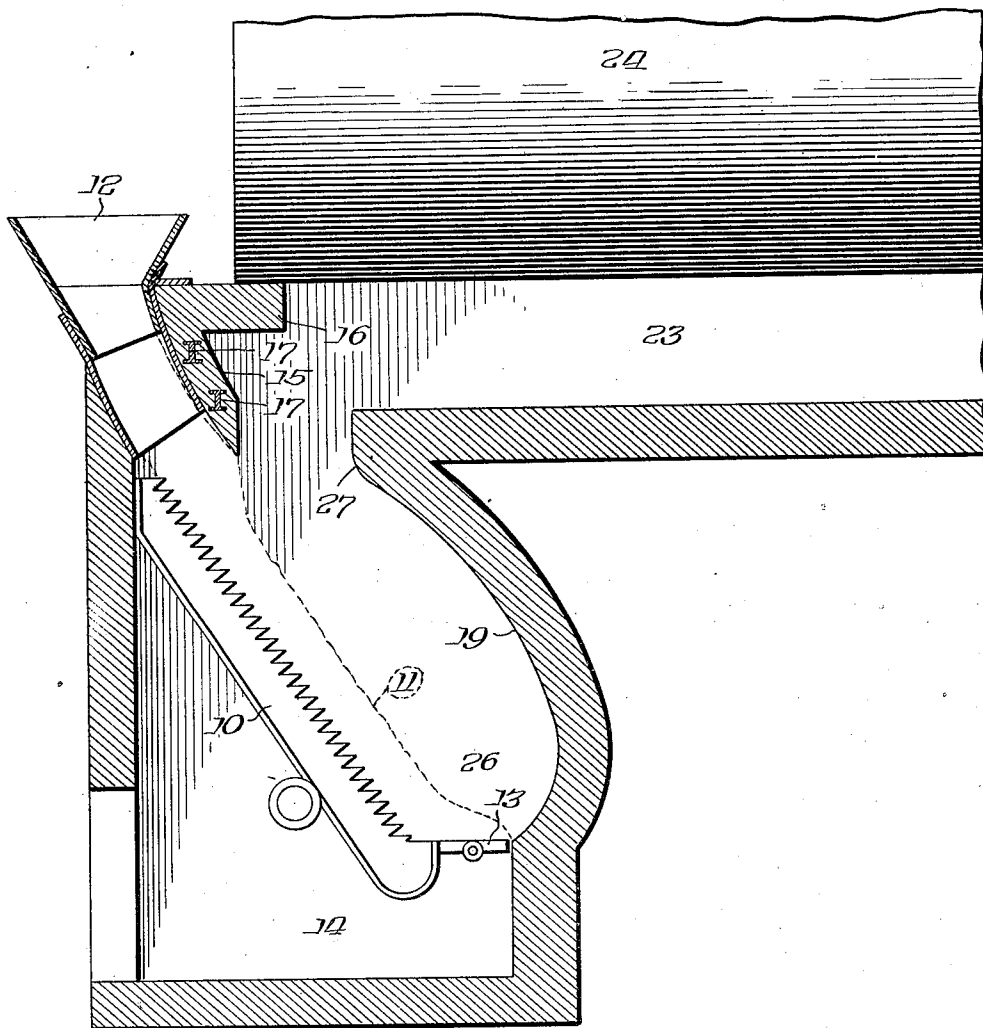
W. A. GILCHRIST

1,865,753

FURNACE

Original Filed April 14, 1921 2 Sheets-Sheet 1

Fig. 1.



Witness:

Ed. C. Jensen

Inventor:

William A. Gilchrist,
By Ira Wilson

Atty

July 5, 1932.

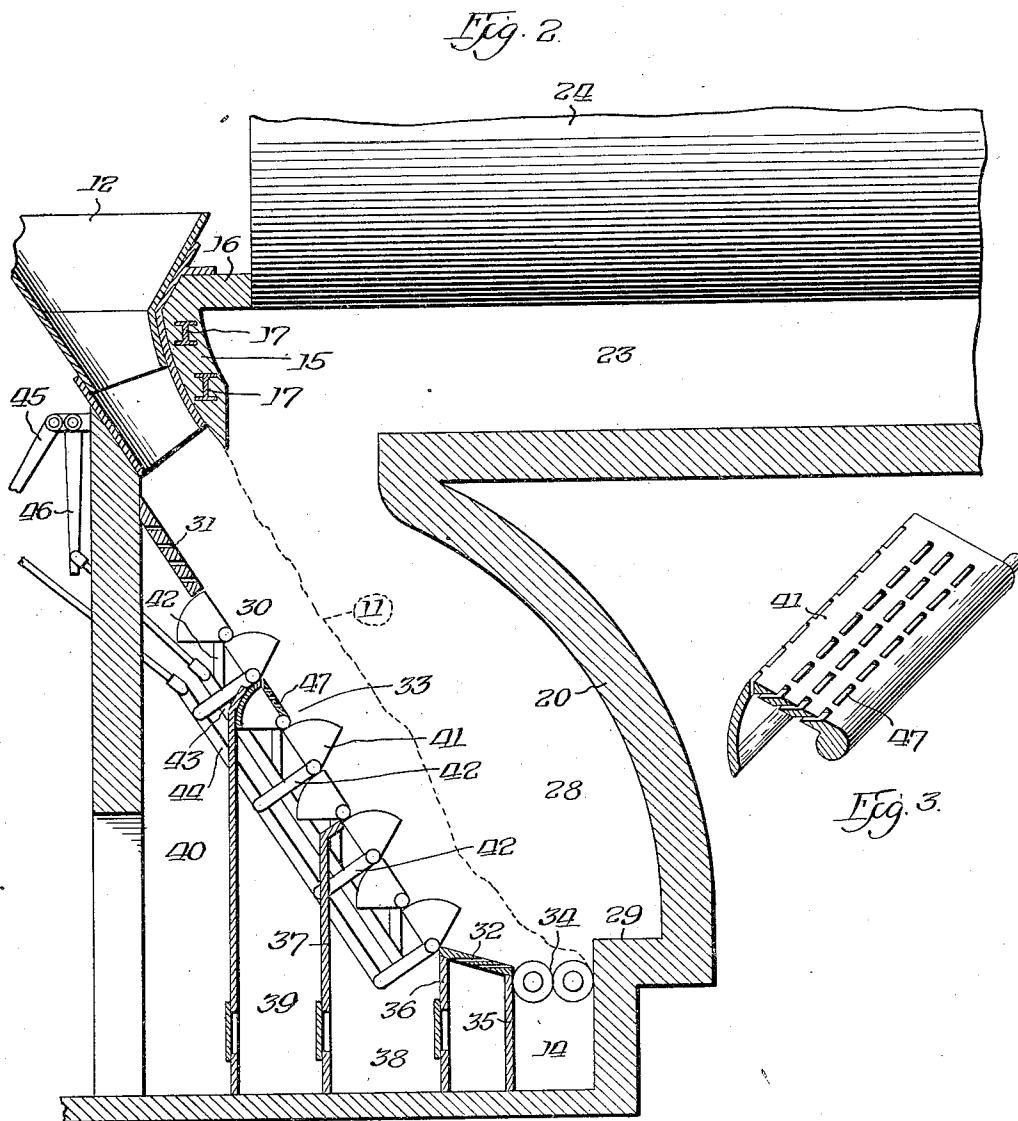
W. A. GILCHRIST

1,865,753

FURNACE

Original Filed April 14, 1921

2 Sheets-Sheet 2



Witness:

Ed. C. Duran

Inventor:

William A. Gilchrist

By Ira Wilson

Atty

UNITED STATES PATENT OFFICE

WILLIAM A. GILCHRIST, OF CHICAGO, ILLINOIS

FURNACE

Original application filed April 14, 1921, Serial No. 461,364. Divided and this application filed October 20, 1927. Serial No. 227,601.

This application is a division of my application for a patent on "Furnaces" filed April 14, 1921, bearing Serial No. 461,364.

This invention relates to furnaces having the ability to burn low grade fuels such as lignite, bagasse and other fuels having a large moisture content. In order that the solid particles of these fuels may be burned it is necessary to drive therefrom the large quantities of moisture which they contain. Some of these fuels do not burn entirely in the solid state but have a considerable amount of combustible volatiles. It is desirable therefore to drive off the moisture as quickly as possible, as the fuel enters the furnace, and thereafter to subject the dried fuel to intense reflected and radiated heat to complete the process of combustion without hindrance by the moisture which formerly was present in the fuel. The next step is to drive off the combustible volatiles after which the remaining combustible solids may be burned in the solid state and these volatiles burned in their gaseous state.

One of the objects of this invention is to provide a furnace having means for drying fuel as it enters a furnace, concentrating upon the dried fuel the heat produced by the fuel, and having means for sweeping the products of combustion over the surface of the moist fuel to drive the moisture therefrom.

Another object of this invention is to provide a furnace adapted to retain a bed of fuel in an inclined position, to pocket the burning gases near the lower portion of the fuel and to sweep the burned gases over the upper portion of the fuel to carry off the moisture therefrom.

Other objects, advantages, and capabilities will later more fully appear and are inherently possessed by this invention.

Referring now to the drawings, Fig. 1 is a central vertical longitudinal section of one embodiment of the invention;

Fig. 2 is a central vertical longitudinal view of another embodiment of the invention, and

Fig. 3 is a detail perspective view partly

in section, showing a form of rocking grate bar which may be used.

Referring now in greater detail to the drawings, a simple grate 10, is shown in Fig. 1 capable of retaining a relatively thin bed of fuel 11 upon the grate. The fuel is fed to this grate through the hopper 12, and as the fuel burns and is reduced to ash the ashes may be removed through the tilting plate 13 into the ash pit 14.

As the fuel is fed downwardly through the spout 12, it is guided into the combustion chamber by a depending curtain 15 which is united with the refractory roof 16 to form a refractory surface for radiating heat through the burning gases as they pass from the combustion chamber into the heating flue. When desired this curtain 15 may be supported by reinforcement beams 17. The rear wall of the combustion chamber in Fig. 1 is designated with the numeral 19 and forms an enlarged pocket in which the volatile combustibles issuing from the fuel may be temporarily detained while their combustion is being completed. This wall radiates and reflects heat emanating from the burning gases back upon the burning gases and through them onto the fuel. In Fig. 2 the rear wall 20 is shaped somewhat differently, being spaced further rearwardly at its bottom end to provide more space for the burning gases.

The products of combustion pass from the combustion chamber into the heating flue 23 which is disposed underneath a boiler 24. Instead of a boiler some other heat absorbing device may be used.

The combustion chamber 26 and the chamber 28 in Figs. 1 and 2 respectively are much wider in their lower portions than near their exits. The walls being curved inwardly toward the fuel at 27 in the wall 19 of Fig. 1.

In Fig. 2 the lower portion of the combustion chamber is shown as having a floor 29 extending backwardly from the grate to thereby provide for increased combustion space.

In Fig. 2 there is disclosed a rocking grate which is especially useful in the operation of this device as it permits the agitation of a heavy moist bed of fuel and permits thereby

the easy passage of air through this fuel. The rocking grate 30 is disposed between the stationary grate bars 31 and 32. The outermost surface 33 of each grate bar not only supports and pushes the fuel downwardly but it also is provided with holes for the admission of air.

When desired a clinker grinder 34 may be used below the grate to discharge the clinkers or ashes into the ash pit 14. A partition 35 is then used to close the ash pit, while partitions 36 and 37 are placed between various sections underneath the grate and through these partitions air is regulatably admitted. According to the requirements of the fuel the shutters may be used to vary considerably the admission of air through each of the chambers 38, 39 and 40 which are formed by the partitions.

The operation of a grate is explained as follows. A tilting grate bar, such as the bar 41, shown in its outwardly extended position, has connected with it a crank arm 42. Alternate crank arms are connected to alternate grate bars and the separate links 43 and 44 extend back through the furnace to the operating levers 45 and 46. The rocking of the grate bars not only serves to manipulate the fuel bed to advance the fuel and to break up clinkers but as each grate bar has a series of holes 47 along its face, as shown particularly in Fig. 3, the grate bars are adapted to admit air through several depths of fuel depending on the position of each grate.

The shape of each of these combustion chambers is such that the combustible volatiles are retained until their combustion is practically completed, then these gases, heated to their maximum temperatures are caused to sweep upwardly over the fuel surface to impinge upon it and drive from the fuel the moisture which it contains. The water vapor is then carried immediately out of the combustion chamber without chilling the lower portion of the chamber where the heat is being generated. The dried fuel then passes downwardly over the grate to the lower portion of the chamber where it is burned partly in the solid state and where its combustible volatiles are driven off by the reflected and radiated heat which the rear wall concentrates upon the fuel in the lower portion of the fuel bed. The volume of the combustion chamber in each furnace is amply large enough to retain the combustible volatiles until their combustion is substantially completed.

By using only a thin bed of fuel which is fed into the furnace rapidly the volume of combustible volatiles emanating from the fuel per unit of time will be much less than if a large quantity of fuel, such as the usual large heap, were being subjected to the heat of the furnace. Accordingly the combustion chambers can be and are made smaller than

the chambers such as are employed in furnaces covered by my United States Letters Patent No. 1,664,029, issued March 27, 1928. The rear refractory walls concentrate upon the fuel near the bottom of the grate the heat radiated from the burning volatile combustibles. The restricted exhaust flue aids in pocketing these gases in the lower part of the chamber, while the inwardly inclined nose of the rear wall causes the escaping gases to impinge with force upon the moist fuel higher up in the fuel bed.

Furnaces made in accordance with this invention are also well adapted to burn fuels having a large moisture content but having a smaller proportion of combustible volatiles than are present in some bagasses. When such fuel is being burned it is found that these combustion chambers are large enough to properly handle the combustible volatiles.

Having shown and described my invention, I claim:

1. In a furnace, steeply inclined fuel supporting means adapted for supporting a relatively thin steeply inclined bed of fuel to permit the fuel to have a steeply inclined rearwardly facing exposed surface, and a combustion chamber having refractory walls one of which is opposite said surface and rises from adjacent the lower edge of the fuel bed curving first outwardly away from thence inwardly toward the fuel bed forming with the other said walls a restricted flue at the top of the chamber of less cross sectional area than that of said chamber and an enlarged lower combustion space extending rearwardly from the lower portion of said surface and a more restricted upper combustion space extending rearwardly from the upper portion of said surface, said chamber being shaped to retain the combustible volatiles in the enlarged space until they are substantially burned and to concentrate upon said lower portion of the fuel surface the heat reflected and radiated by said refractory walls.

2. In a furnace, in combination, an inclined grate for supporting a thin inclined fuel bed sloping downwardly and rearwardly, and a forwardly inclined heat radiating and reflecting and flame confining refractory wall rising from adjacent the lower edge of the fuel bed and directly facing the same through its entire extent and spaced therefrom to form a combustion chamber of sufficient volume to permit combustion of the volatile constituents in immediate proximity to the fuel on said grate and shaped for the intimate sweeping of the flames over the upper portion of the fuel bed and for the maximum radiation and reflection of heat upon the lower portion of the bed, the upper edge of the said wall constituting the rear margin of an upwardly directed flue opening which is

adjacent to and reaches to the upper edge of the fuel bed.

3. In a furnace, in combination, an inclined grate for supporting a thin inclined fuel bed sloping downwardly and rearwardly, and a forwardly inclined heat radiating and reflecting and flame confining refractory wall directly facing the fuel bed throughout its entire extent, said wall being spaced therefrom to form a combustion chamber of sufficient volume to permit combustion of the volatile constituents in immediate proximity to the fuel on said grate and rising from adjacent the lower edge of the grate and extending to the level of the upper edge of the grate, the upper edge of the wall constituting the rear margin of a substantially vertical upwardly directed flue passage which reaches to the upper edge of the fuel bed, the lower portion of said refractory wall being shaped to concentrate principally upon the lower portion of the fuel bed the heat which it reflects and radiates.

4. In a furnace, in combination, an inclined grate for supporting a thin inclined fuel bed sloping downwardly and rearwardly and a transverse heat radiating and reflecting and flame confining refractory wall rising in the rear of the grate from substantially the level of the lower edge of the grate, and spaced therefrom to form a combustion chamber of sufficient volume to permit combustion of the volatile constituents in immediate proximity to the fuel on said grate extending to substantially the level of the upper edge of the grate, the upper edge of said wall constituting the rear margin of an upwardly directed exit flue opening which reaches vertically to the upper edge of the said fuel bed, the lower portion of said refractory wall being shaped to concentrate principally upon the lower portion of the fuel bed the heat which it reflects and radiates.

5. In a furnace, in combination, an inclined grate for supporting a thin inclined fuel bed sloping downwardly and rearwardly, and a transverse heat radiating and reflecting and flame confining refractory wall rising in the rear of the grate from substantially the level of the lower edge of the grate, extending upwardly and forwardly to substantially the level of the upper edge of the grate, and spaced therefrom to form a combustion chamber of sufficient volume to permit combustion of the volatile constituents in immediate proximity to the fuel on said grate, the upper edge of said wall constituting the rear margin of an upwardly directed exit flue opening which reaches to the upper edge of the said fuel bed, the lower portion of said refractory wall being shaped to concentrate principally upon the lower portion of the fuel bed the heat which it reflects and radiates.

6. In a furnace for burning moist fuels, steeply inclined fuel supporting means adapt-

ed for supporting a relatively thin steeply inclined bed of fuel to permit the fuel to have a steeply inclined rearwardly facing exposed surface, an upwardly extending forwardly inclined refractory wall facing said surface, a combustion chamber formed in part by said wall having an enlarged lower portion adapted to retain in its lower rear portion in proximity to the fuel a substantial volume of the combustible gases arising from the fuel until they are substantially burned, said wall being shaped to concentrate the reflected and radiated heat from the burning gases principally onto the lower portion of the fuel surface, the upper portion of said wall being curved forwardly more closely to said fuel bed to cause the gases after being burned in said lower portion of the chamber to sweep forwardly and upwardly against and in intimate contact with the uppermost portion of the fuel surface as they pass out of the chamber.

In witness of the foregoing I affix my signature.

WILLIAM A. GILCHRIST.