

Sept. 9, 1930.

T. T. McENTEE

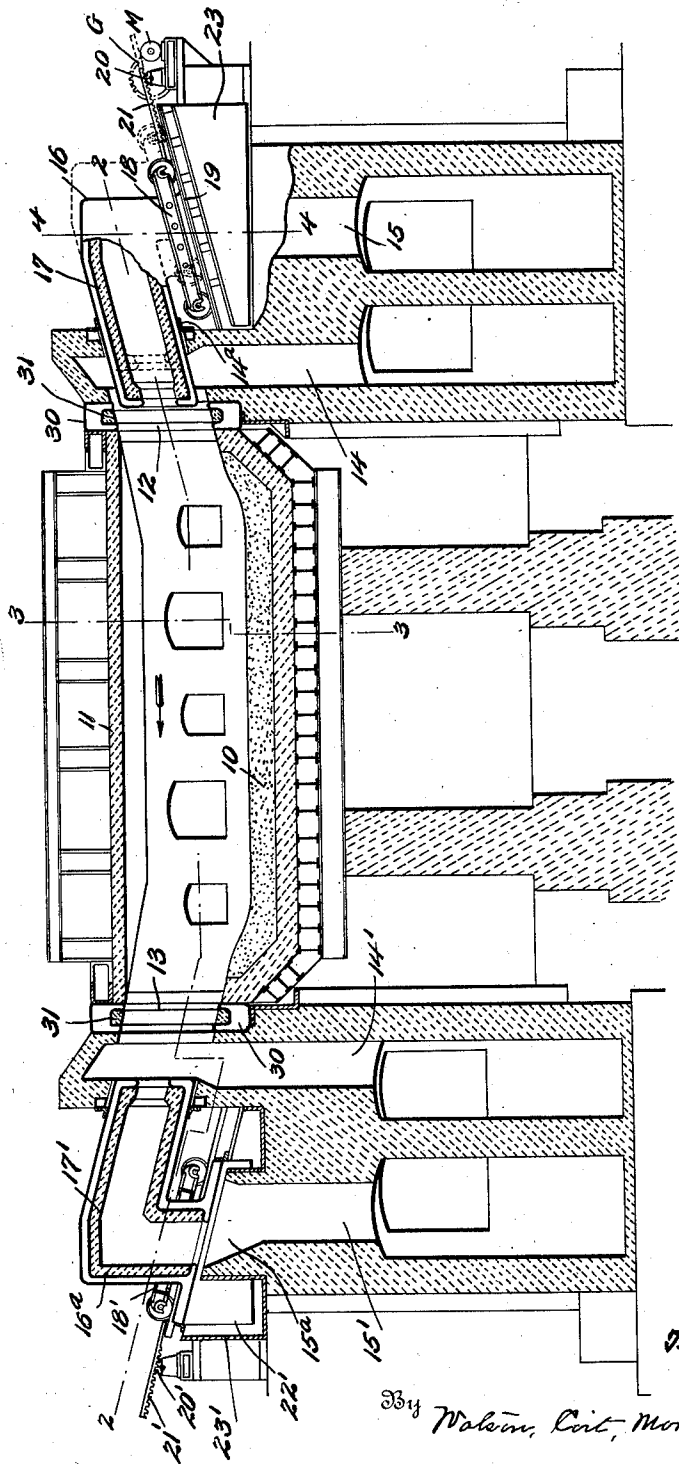
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OPEN HEARTH FURNACE

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2 Sheets-Sheet 1

Fig. 1.



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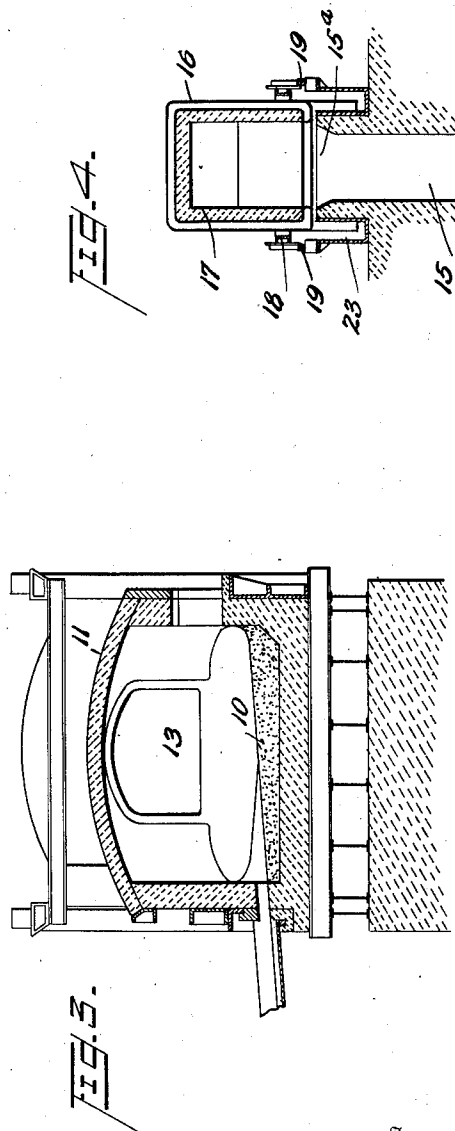
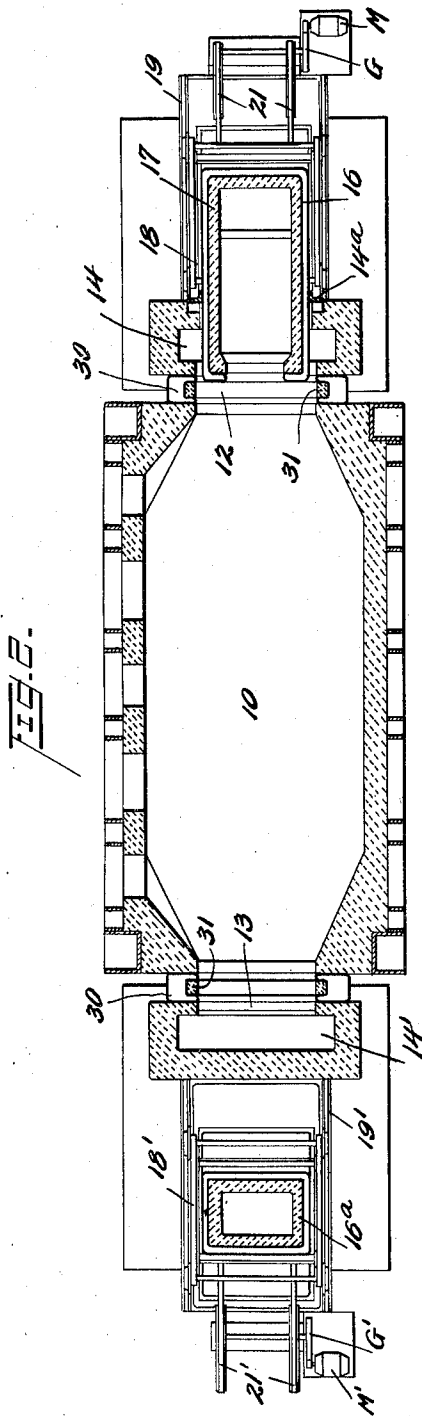
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2 Sheets-Sheet 2



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OPEN-HEARTH FURNACE

Application filed December 13, 1921. Serial No. 522,089.

The present invention relates to regenerative furnaces and particularly to regenerative furnaces of the type utilized in the manufacture of steel by the open hearth process.

5 The object of the invention is to provide a furnace of this class which is designed and constructed to permit, if desired, the use therein of relatively high velocity gases, thereby increasing the amount of gas burned
10 in the combustion chamber in a stated interval of time, increasing the rate of melting of the charge and hence increasing the productive rate of the furnace, and without at the same time decreasing the length of the effective life of the furnace.

The invention may be embodied in different types of furnaces, one of which is illustrated in the accompanying drawings, in which:

20 Fig. 1 is a longitudinal, vertical section through a reverberatory regenerative open hearth furnace, having the improved end construction;

Fig. 2 is a section on line 2—2 of Figure 1;

25 Fig. 3 is a section on line 3—3 of Figure 1; and

Fig. 4 is a section on line 4—4 of Figure 1.

30 The furnace is preferably symmetrically formed, as is standard practice in modern open hearth furnace construction, that is, the two end portions are similar, and one end only will therefore be described.

40 The hearth is indicated at 10, the reverberatory roof at 11, and the throat openings at the ends of the hearth each of which is adapted to serve alternately as an inlet passage for fuel and an outlet passage for products of combustion, at 12 and 13 respectively. An uptake is indicated at 14, which uptake is rectangular in horizontal cross section as shown in Figure 2, and communicates with throat 12. A second uptake is indicated at 15 and this uptake communicates with throat 12 through a nozzle 16. These uptakes are
45 for air and gas respectively and preferably

the air passes through uptake 14 and the gas through uptake 15.

Nozzle 16 comprises essentially a hollow L-shaped casing 17 one portion of which extends forwardly through an aperture of similar cross section in the rear of uptake flue 14.

A sealing ring 14^a slidably supports the nozzle 16 in the aperture in the wall and has a sufficiently close fit against the outer wall of the nozzle to substantially prevent leakage around the same. The outer vertical portion of the nozzle is supported upon a wheeled carriage 18 which is movable along the inclined trackway 19 by means of an electric motor M which is operatively connected to the carriage through suitable reducing gearing G, pinion 20 mounted to rotate about a fixed axis, and rack 21 secured to the carriage 18 and meshing with the pinion. The motor is reversible and may be operated to move the nozzle from the position in which it is illustrated at the right hand end of the furnace (Figure 1) to that which it occupies at the left hand end of the furnace (Figure 1) or to any desired intermediate portion.

The nozzle 16 has a depending apron 22, the lower edge of which is at all times beneath the level of water contained in a tank 23. The provision of the water seal prevents the escape of gases through the joint between the nozzle and the stationary portion of the uptake, for all adjustments of the nozzle. The upper end 15^a of the stationary portion of the uptake 15 is flared outwardly so that for all adjustments of elbow 16 there is an unobstructed channel for the gases passing to or from the nozzle.

It will be seen that the throat opening 12, while having substantially the same shape as the end of nozzle 16, is somewhat larger, so that even when the nozzle is in its innermost position, as shown at the right hand end of the furnace, (Figure 1) there is an opening around the nozzle through which air may pass from uptake 14 into the com-

bustion chamber. Retracting nozzle 16 and withdrawing it from the throat 12 increases the effective area of the throat, and when it has been completely withdrawn, as shown at the left (Figure 1) the throat has free communication with uptake 14.

In Figure 1 the nozzles at the ends of the furnace are positioned for a flow of fuel into the furnace at the right hand end and a flow of products of combustion from the left hand end, that is, the flow through the furnace is in the direction of the arrow. Air, which is preferably under pressure, passes into throat 12 through the continuous opening between the wall of the throat and the outer wall of the end of the nozzle, this sheet of air enveloping the gas which issues from the port in the end of the nozzle, and accelerating the inflowing gas in a sort of blow pipe action.

The combustible mixture flows downwardly toward the hearth due to the downward inclination of the walls of throat 12 and the nozzle, and across the hearth at a relatively high rate of speed, the products of combustion passing outwardly through throat 13 and thence downwardly through uptakes 14' and 15', the nozzle 16^a having been retracted at the outlet end to provide an unobstructed throat, that is, an opening for the outgoing gases which has unrestricted communication with the two uptakes 14' and 15'. At suitable intervals the direction of flow of the gases is reversed.

In order to preserve the shape of the throat openings, which would tend to become enlarged due to the destructive action of the hot gases of combustion, and seriously affect the feeding in of the fuel at the inlet end, a member 30 is provided at each end, which comprises a hollow metal casing extending around the throat and arranged to have cooling water circulated therethrough. Each of these casings is interiorly grooved and the groove filled with refractory material 31.

It is believed that the construction and mode of operation of the furnace will be apparent to one skilled in the art from the foregoing explanation. By furnishing the air, or gas, or both, under pressure more heat may be imparted to the work within a given time, than where no pressure or only slight pressure is employed, and by means of the novel end construction disclosed this high speed melting may be realized without destroying the furnace in a short time. The outlet opening for products of combustion is of sufficient size to easily conduct away the burned gases without checking the draft, being considerably larger than the inlet opening.

The position of the nozzle at the fuel inlet end of the furnace may be varied to secure the best intermixture of gas and air. It may be desired to have the forward end of the nozzle within the rear end of the throat,

as shown in full lines in Figure 1, (at the right hand end of the furnace) or the nozzle may be retracted to an intermediate position, as shown in dotted lines. In such intermediate position gas will be discharged into the upper end of uptake 14 and this portion of the uptake will function as a mixing chamber, securing a more complete mixture of the gas and air. The nozzle 16 functions in reality as a damper movable axially of the throat for varying the effective area of the throat. It constitutes a means positioned between the air uptake and the hearth for varying the amount and velocity of the air supplied for combustion. The nozzle at the outlet end of the furnace in like manner serves as a damper which may be retracted to provide a maximum throat opening for the products of combustion. Preferably the air is furnished under considerable pressure and the gas at slightly above atmospheric pressure, but the mode of operation of the furnace may be varied as desired.

It will be understood that by the word "hearth" used in the appended claims to indicate the chamber into which the throat opens is meant "combustion chamber". The combustion chamber is the chamber between the throats 12 and 13 and enclosed by the hearth proper 10, the roof 11, and the side walls.

Having thus described the invention what is claimed as new and desired to be secured by Letters Patent is:

1. An end construction for regenerative open hearth furnaces having a throat opening into a hearth, an uptake communicating with said throat, a nozzle extending through the wall of the uptake and toward the throat, and a motor driven carriage supporting the nozzle whereby it may be moved relatively to the throat.

2. An end construction for regenerative open hearth furnaces having a throat opening into a hearth, an uptake communicating with said throat, a nozzle extending through the wall of the uptake and toward the throat, a stationary uptake communicating with the nozzle, a carriage supporting the nozzle for movement relatively to the throat, and water sealing means between the nozzle and the stationary uptake flue for preventing gas leakage for all positions of the nozzle.

3. An end construction for open hearth furnaces, comprising an end wall having an opening therein, an uptake outside the end wall and having a flared upper open end, a port having a vertical portion movable through a range of movement in registration with the flared end and a portion adapted to extend through the opening in the port wall, and means carried by the port for covering the flared end of the uptake.

4. An end construction for open hearth furnaces, comprising an end wall having an

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port having a vertical portion movable
through a range of movement in registration
5 with the flared end and a portion adapted to
extend through the opening in the port wall,
means carried by the port for covering the
flared end of the uptake, a sloping trackway
adjacent the flared uptake end and a car-
riage for the port running on said trackway.
10 In testimony whereof I hereunto affix my
signature.

THOMAS T. McENTEE.

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