

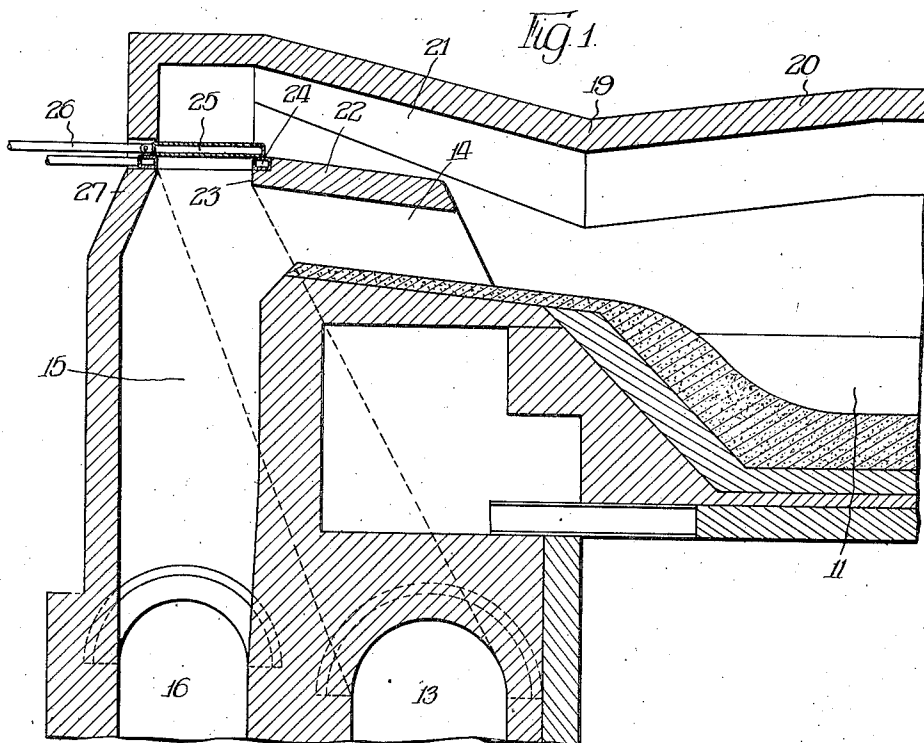
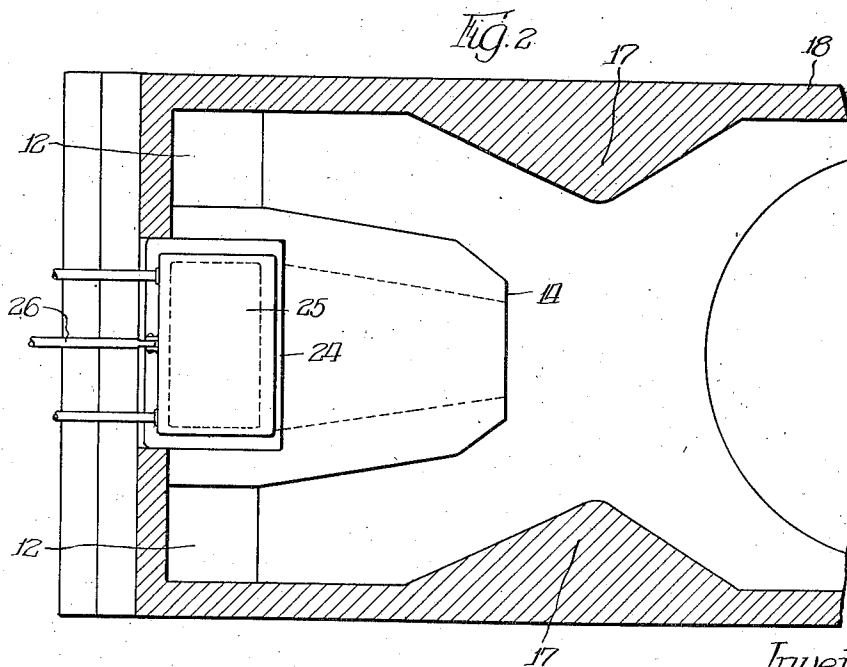
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OPEN HEARTH FURNACE

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UNITED STATES PATENT OFFICE

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OPEN HEARTH FURNACE

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This invention relates to a new and improved open hearth furnace and more particularly to a construction for such furnaces whereby provision may be made for increasing the effective passage area between the furnace chamber and gas regenerators.

Open hearth furnaces are now generally operated in this country with producer gas which is passed to the furnace at comparatively high temperature, the producers usually being located in proximity to the furnace. When using producer gas, gas regenerators are usually provided as well as regenerators for preheating the air to be used in the furnace. In the usual furnace construction the gas port is comparatively small in area and is maintained constant in size on the incoming and outgoing ends of the furnace. The air port is larger than the gas port and a number of constructions have been developed whereby the effective area of the air ports may be increased on the outgoing end of the furnace so as to effectively carry off the increased volume of the products of combustion. In view of the large air port area and small gas port area, the greater portion of the products of combustion passes off through the air regenerators. This results in a decreased effectiveness of the gas regenerators and the gas is not preheated to the same extent as the air. This is not particularly detrimental to furnace operation where producer gas is used, as the gas is already hot and it is not of great importance whether the heat units are returned to the furnace in the air or in the gas.

It has been found that the transfer of heat from a furnace flame to the charge in the furnace is greatly furthered by luminous condition of the flame. This luminosity is inherent in a producer gas flame, but ordinarily does not exist in any marked degree in a flame which results from the burning of a gas containing a large percentage of coke oven gas or of blast furnace gas, or of a mixture of these gases. Coke oven gas is light and tends to rise to the furnace roof where it burns without luminosity so that its combustion is not apparent. The heat is largely lost to the bath and further results in burn-

ing out the furnace roof. It has been found, however, that by heating coke oven gas or a mixture of coke oven and blast furnace gases to a temperature of approximately 2150° F., the higher hydrocarbons and also the methane in the coke oven gas may be broken down. The methane may reduce to carbon and hydrogen. The higher hydrocarbons also liberate some free carbon when broken down. The flame from a gas of this character, which has been heated to break down the hydrocarbons and provide the free carbon, is highly luminous and the results obtained from the use of these fuels is very considerably more economical of heat than the results ordinarily obtained from producer gas.

In order to provide a temperature sufficiently high to break down the coke oven and other gases, it is necessary to increase the heat input to the gas regenerator from the products of combustion. The ordinary type of furnace does not provide sufficient heat input into the gas regenerators and this is even more true of the damper types of furnace. In furnaces of the damper type the products of combustion very largely go through the gas regenerators as the effective passage area to the air regenerators is increased by withdrawing dampers on the outgoing end of the furnace. The gas port is made small in order to give the desirable blow torch flame on the incoming end of the furnace.

It is an object of the present invention to provide a new and improved furnace structure having a large passage area to the gas regenerators.

It is an additional object to provide a construction of this type in which the effective passage area between the furnace chamber and gas regenerator may be increased on the outgoing end of the furnace.

It is also an object to provide a construction in which the increased effective area may be controlled by movable dampers or the like.

It is an additional object to provide a construction which is simple in design and operation and which may be adapted to existing furnaces without material alteration therein.

Other and further objects will appear as the description proceeds.

I have illustrated one preferred embodiment of my invention in the accompanying drawing, in which—

Figure 1 is a fragmentary vertical section of an end of an open hearth furnace; and

Figure 2 is a horizontal section of the furnace structure shown in Figure 1.

The furnace includes the furnace chamber 11, the air uptakes 12, and the air slag pocket 13 which communicates with any usual type of air regenerators. The gas port 14 communicates with the gas uptake 15 which leads from the gas slag pocket 16, this slag pocket being connected with any usual type of gas regenerator.

The furnace is shown as provided with the monkey walls 17 extending inwardly from the side walls 18 of the furnace. These walls, with the low portion 19 of the roof 20, serve to define the combined air and fuel port of the furnace. The air port 21 extends on both sides and across the top of the gas port 14. The upper wall 22 of the gas port 14 is provided with the opening 23 which carries a water-cooled valve seat 24. A water cooled valve 25 is provided with a connection 26 for moving it into and out of the furnace on the valve seat 24 through the end wall 27 of the furnace.

It will be noted that the gas port 14 is reduced in area as it approaches the furnace chamber, this being shown in the plan view in Figure 2. The gas uptake 15 has been shown as larger than either air uptake 12, and its effective area may be substantially that of the two air uptakes combined, or the relation between the areas of the gas and air uptakes may be determined by the percentage of products of combustion which it is desired to pass through the gas regenerators.

In the operation of the furnace on the incoming end, the damper or valve 25 will be in the position shown in Figure 1, and will serve to direct the gas through the gas port 14, this damper being located in alignment with the top of the gas port. The air will come up the air uptakes 12 and the air stream will enclose the gas stream on its sides and upper surface. The monkey walls 17 will direct the air stream into the gas stream and cause an effective mixture and the desired blow torch type of flame on the bath.

On the outgoing end, the damper 25 will be partially or entirely withdrawn through the end wall 27 so that the products of combustion may enter the gas uptake 15 not only through the gas port 14 but also through the opening or passage 23 formed in the upper wall of the gas port. The products of combustion will also go down through the air uptakes 12 to the air regenerators.

By this construction the desired type of flame and flame control may be maintained on the incoming end of the furnace and the effective passage area for the gases may be

increased on the outgoing end. This will be apparent from the fact that the gas uptake 15 is greater in area than the discharge opening of the gas port 14, and the entire effective area of the uptake is made readily available for the products of combustion by withdrawing the damper 25. This increased effective area for the products of combustion will not only assist in the furnace operation by more easily withdrawing the increased volume of products of combustion, but will also increase the proportion of such products passing through the gas regenerators so that these regenerators may be raised to a temperature suitable for the regeneration of coke oven gas or mixed gases, including coke oven and blast furnace gas. This regeneration of these gases can be raised to such a temperature as to effectively break down the higher hydrocarbons and methane and give a gaseous fuel which will product a highly luminous and effective flame in the furnace.

It will be understood that the form of construction shown is only one way in which my invention may be carried out. It is essential to increase the effective passage area between the furnace chamber and the gas regenerators and this may be accomplished by other forms of construction involving other types of by-passes or supplementary connections between the furnace chamber and regenerators. I contemplate such changes and modifications as come within the spirit and scope of the appended claims.

I claim:

1. In an open hearth furnace, a furnace chamber, separate air and gas slag pockets and uptakes, a central gas port connected to the gas uptake, the air uptakes terminating in the floors of the furnace ends on either side of the gas port, a single air port joining the air uptakes and extending above the gas port, a passage through the gas port wall communicating with the air port, and means for closing said opening.

2. In an open hearth furnace, a furnace chamber, separate air and gas slag pockets and uptakes, a central gas port connected to the gas uptake, the air uptakes terminating in the floors of the furnace ends on either side of the gas port, a single air port joining the air uptakes and extending above the gas port, a passage through the upper gas port wall above the gas uptake communicating with the air port, and a damper for closing said passage.

Signed at Chicago, Illinois, this 27th day of December, 1929.

ARTHUR J. BOYNTON.