Dec. 1, 1942. W. T. DEAN 2,303,620

METHOD OF FIRING REGENERATIVE FURNACES OR THE LIKE

Original Filed July 31, 1940

FIG. 1.

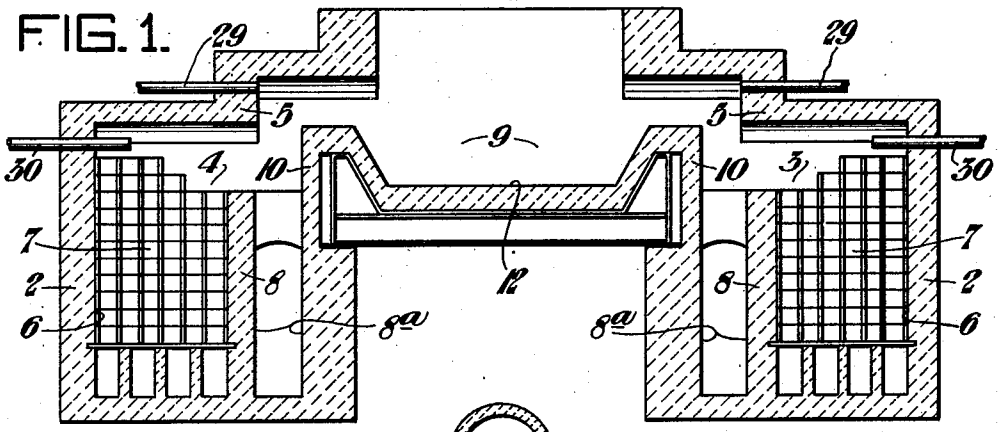
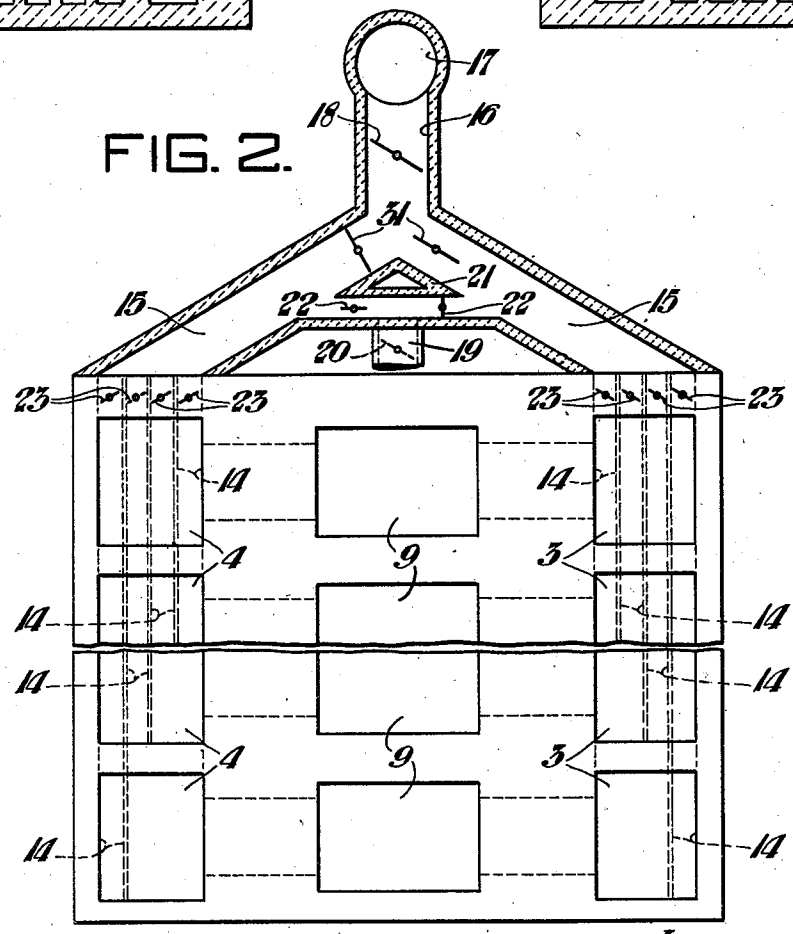


FIG. 2.



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METHOD OF FIRING REGENERATIVE FURNACES OR THE LIKE

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Original application July 31, 1940, Serial No. 348,871. Divided and this application November 23, 1940, Serial No. 366,929

2 Claims. (Cl. 263—52)

This invention relates to improvements in the method of firing soaking pit furnaces and the like, this application being a division of my pending application, Serial No. 348,871, filed July 31, 1940.

My invention contemplates the use of rich and lean fuels by an improved method of firing, whereby to produce a highly luminous flame and thereby eliminate the injurious effects of direct localized flame impingement of high temperature flames upon the ingots or steel being heated.

I further have in view the use of blast furnace gas as a source of lean fuel, and combine the source with a rich fuel such as coke oven gas, in such a manner that the blast furnace gas may be utilized without costly cleaning treatment.

More particularly, it is an object of my invention to utilize a lean gas to modify and control a rich gas so as to obtain a luminous flame for heating, which flame characteristic and control is obtained without the necessity of initial admixture of the two fuels prior to combustion.

A still further object is to provide for combined rich and lean fuel combustion so related as to provide for the improved combustion and flame characteristics as above stated.

Additional objects and advantages will become apparent from the following description taken in connection with the accompanying drawing, wherein:

Figure 1 is a sectional elevation of the furnace constructed under the present invention; and

Figure 2 is a diagrammatic plan of the showing of Figure 1.

In the drawing, the furnace 2 includes firing zones 3 and 4 each comprising a lean and a rich fuel firing zone, with the wall of said furnace so constructed and arranged as to provide a deflecting wall 5. Located at opposite sides of the furnace are regenerator chambers 6 lined with checker-brick or tile indicated at 7. Separated from said regenerator chambers 6 by walls 8 are hot slag chambers or pockets 8a.

Positioned centrally of said furnace and between the regenerator chambers 6 are soaking pits 9 within which the steel to be treated is positioned. The bridge walls 10, forming the ends of said soaking pits, extend upwardly beyond the hearth or base 12 of said pits to a point in substantial alignment with and laterally spaced from the deflecting walls 5 at each side of said furnace, and assist in precipitating the solids from the outflowing gases, said walls 5 and 10 thus providing deflecting passages between the rich and lean fuel firing zones.

Extending from each regenerator chamber, as shown in dotted lines in Figure 2, is a flue 14 connecting with a branch 15 of the main flue 16 leading to a stack 17. Positioned within the main flue 16 is a main damper 18 controlled, in any desired manner, from the operation station (not shown) to regulate the amount of draft desired for said furnace. A source of air supply is connected to the pipe 19, said air being supplied by low pressure blowers (not shown) or, if desired, such air may be induced by stack action. A damper 20 is positioned within the air inlet pipe 19 to control, as desired, the amount of air supplied. Positioned adjacent the air outlet pipe 19 is a deflector 21 for directing the air to either regenerator chamber, as desired, while reversing dampers 22 are arranged adjacent the air outlet to admit the directed air supply to that side of the regenerators not connected to the stack 17. Dampers 31 are regulated to connect either regenerator to the stack 17 when the dampers connecting the opposite regenerator to the stack are closed. Individual dampers 23 are positioned within the flues leading to each regenerator chamber to regulate the amount of air supplied to the respective pits 9 or to limit the amount of draft thereto.

The hazard of directly impinging flames upon the surface of certain steels has led to the adoption of automatic means for reversing such furnaces on a time or temperature basis and to the use of automatically controlled combustion, or at least visual means for knowing combustion conditions with quick and accurate hand controls.

In designing new pits or furnaces, space limitations may not prevent ample allowance for regenerative chambers but, in order to convert existing furnaces to the use of lean gases requiring approximately double the flue area with increased heating surface, space is not always available for the larger regenerators required by present designs for regenerator checkers.

Therefore, the present invention contemplates the burning of combinations of rich and lean gases by giving to each fuel the combustion space and time elements needed for the best results. Separate fuel supply pipes are provided for the rich and lean fuel firing zones, 29 diagrammatically indicating the pipes for rich fuels and 30 the pipes for lean fuels. In each case, suitable nozzles are used to impart a wide angle diffusing shape to the rich mixture and a narrower whirling mixing cone to the lean mixture with said bridge wall 10 to insure complete mixing. Upon reversing the flow, the products of combustion

leave the pit horizontally and are deflected downwardly by said deflecting wall through the passages between the rich and lean gas firing zones, thence again horizontally to one of the regenerators. This change in direction with the change in velocity tends to throw down practically all of the entrained solids into a hot slag pocket or chamber 8a beneath the deflecting passage. The hot gases then enter the regenerator flues substantially free from solids or slag, greatly increasing the life of the upper courses of checkers, at present so susceptible to slag damage.

In practicing the present method, a lean fuel, such as blast furnace gas is supplied to the gas pipes 30 at the side of the furnace being fired, said gas mixing with the incoming air from the preheated regenerator chamber 6 therebelow to effect substantially complete combustion of said gas. The impingement of the burning gases upon the bridge wall 10 aids combustion through aiding the mixture of gas and air, and effects a separation of the entrained solids from the gas, which solids lose their velocity and fall into the slag pocket 8a below said wall.

The burning blast furnace or lean gas is also deflected upwardly by the wall 10, between said wall and the deflection wall 5, and engages the stream of rich gas from the burner 29 spaced thereabove. At the zone of engagement of the said gases, the temperature of the combusted mixture of air and lean gas is high in relation to that of the rich gases, whereupon the following action takes place.

Due to the utilization of the incoming air for burning the lean gas, there exists a shortage of air for the combustion of the rich gas which readily permits a partial decomposition of the incompletely combusted rich gas.

The high temperature of the lean gas and air combustion cracks the incompletely combusted rich coke oven or other high hydrocarbon gas, liberating free carbon from the latter, whereupon the heating flame reaching the hearth and the ingots is rendered highly luminous and soft, and has an increased area of spread or dispersion over the hearth.

The resulting flame will not injure the steel of the ingots as the same does not have the high oxidizing property nor the high temperature heretofore attendant upon the use of such gases in firing soaking pit furnaces. Further, the diffusion of the flame under my method prevents localized direct impingement upon the ingots.

I have found that by firing the lean and rich gases in the manner herewith set forth, I am enabled to successfully utilize blast furnace gas without the necessity of prolonged and expensive cleaning operations as heretofore deemed necessary before attempting to burn the gas.

While I have shown and described one specific embodiment of the invention, it will be understood that I do not wish to be limited exactly thereto, since various modifications may be made without departing from the scope of the invention, as defined in the appended claims.

I claim:

1. The herein described method of firing a regenerative furnace or the like having a soaking pit, which consists in initially burning a lean gas to substantially complete combustion with substantially all of the air supply from a hot regenerator of said furnace, burning a rich gas in incomplete combustion in spaced relation to the initial combustion of the lean gas, mixing the products of the lean gas combustion with the burning rich gas adjacent the soaking pit, thereby increasing the temperature of the resulting mixture in sufficient amount to crack the incompletely combusted rich gas to produce a luminous heating flame in said pit.

2. The herein described method of firing a regenerative furnace or the like having a soaking pit, which consists in initially burning a blast furnace gas to substantially complete combustion with substantially all of the air supply from a hot regenerator of said furnace, burning a rich gas in incomplete combustion in spaced relation to the initial combustion of the blast furnace gas, mixing the products of the blast furnace gas combustion with the burning rich gas adjacent the soaking pit, thereby increasing the temperature of the resulting mixture in sufficient amount to crack the incompletely combusted rich gas to produce a luminous heating flame in said pit.

WILLIAM T. DEAN.