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METHOD AND APPARATUS FOR MAKING COKE

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FIG. 1.

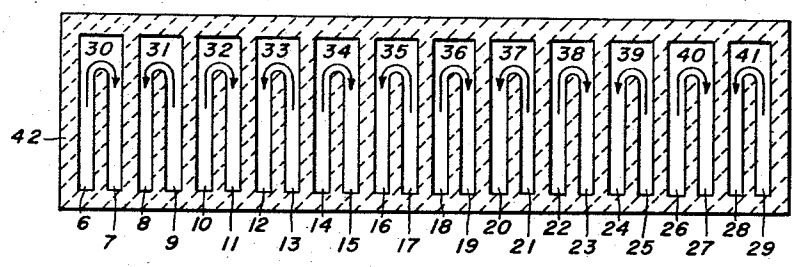
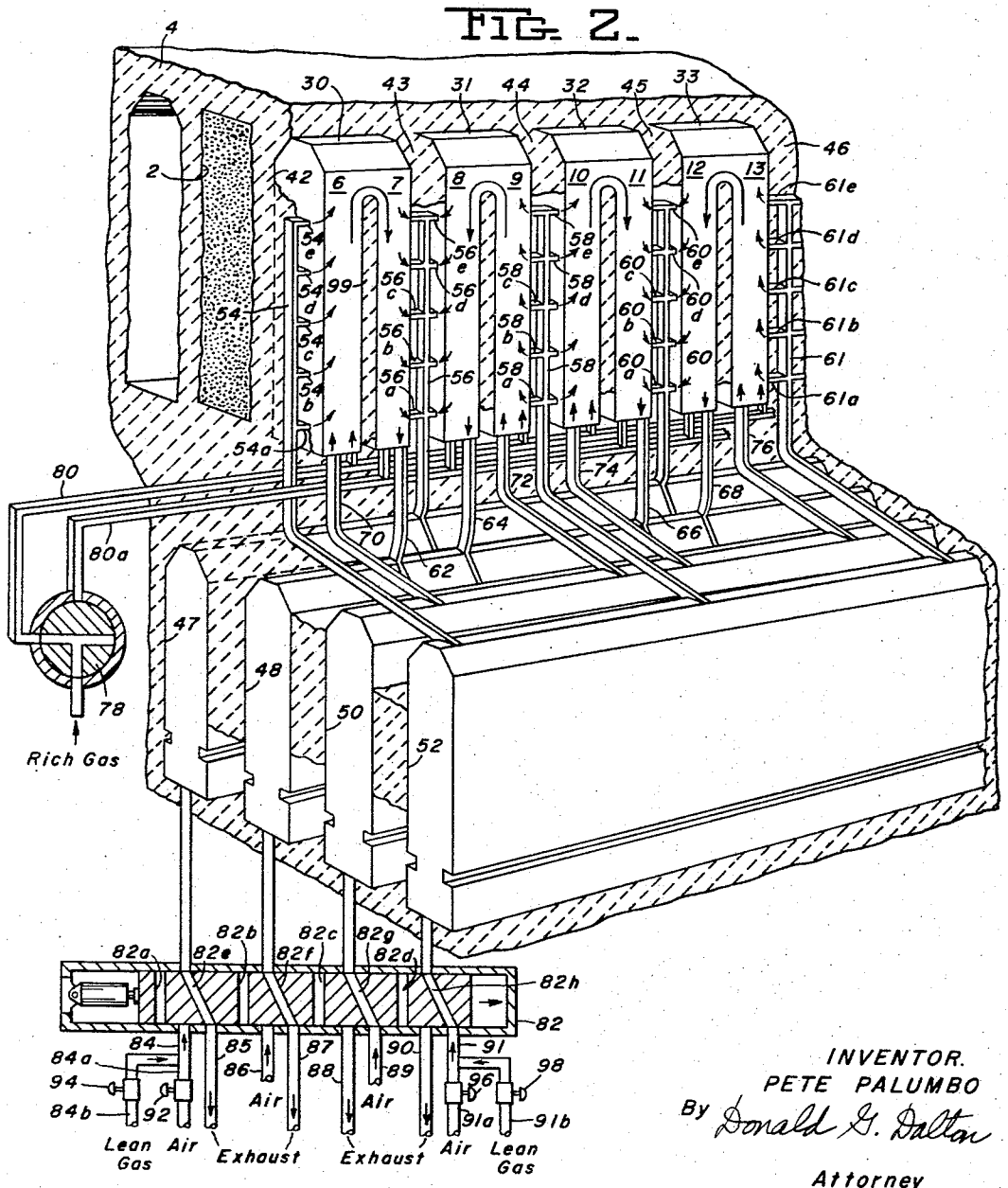


FIG. 2.



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METHOD AND APPARATUS FOR MAKING COKE

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ABSTRACT OF THE DISCLOSURE

A coke oven having spaced apart coking chambers with vertical flues arranged in pairs connected at their top. Two sets of two regenerators each are provided for supplying heated air and, in some instances, also lean gas to one flue of each pair. Suitable connections are provided between the regenerators and flues to enable production of coke by delivering heated air from one regenerator of a set to the bottom of the flues and heated air from the second regenerator of the set to the flue at a plurality of elevations or, in the alternative, delivering heated lean fuel from the second regenerator. Each flue receiving air and fuel is adjacent another flue receiving air and fuel and each flue receiving burnt gases is adjacent another flue receiving burnt gases.

This invention relates to a method and apparatus for making coke and more particularly to the making of coke in a gas fired regenerative coke oven. Such coke ovens include a plurality of elongated vertical coking chambers arranged side by side in spaced apart relationship with a wall between adjacent coking chambers. Each of the walls has vertical flues therein with the regenerators being located beneath the coking chambers and flues. The fuel used is usually rich gas, lean gas or a combination thereof. For best operation, it is necessary that the heat be delivered uniformly over the entire area of the coking chambers. It is also desired that the pressure exerted on the walls between the flues be as uniform as possible to prevent leakage between the flues and damage to the walls. To accomplish this, many arrangements of flues have been used with the manner of firing also being varied. However, none of those of which I have knowledge have proved entirely satisfactory for various reasons, especially when the coking chambers are high.

It is therefore an object of my invention to provide a coke oven in which the differential pressure is minimized and in which the area of exposure to the differential pressure is mininized.

Another object is to provide such a coke oven having uniform heating.

Still another object is to provide a method of making coke in which the firing is such that uniformity of heating results.

These and other objects will be more apparent after referring to the following specification and attached drawings, in which:

FIGURE 1 is a schematic elevation showing the flue arrangement of my invention; and

FIGURE 2 is a schematic isometric view of a portion of the flues, regenerators and associated equipment.

Referring more particularly to the drawings, reference numeral 2 indicates spaced apart coking chambers having walls 4 therebetween. A plurality of vertical flues 6 to 29, inclusive, are arranged in each of the walls 4. It will be noted that the flues are arranged in pairs with the flues in each pair being connected at their top by horizontal flues 30 to 41, inclusive. The direction of firing during one cycle is indicated by the arrows in FIGURE 1. It will be understood that either a greater or lesser

number of flues may be provided and that the direction of firing will be reversed for the second cycle as is common. In FIGURE 2 I have shown further details relating to the construction and firing of flues 6 to 13, inclusive, it being understood that the same construction will be utilized for the remaining flues. A refractory end wall 42 is provided for flue 6 and a refractory division wall 43 is provided between flues 7 and 8. A division wall 44 is provided between flues 9 and 10, a similar wall 45 between walls 11 and 12, and a similar wall 46 between flues 13 and 14. Four regenerators 47, 48, 50 and 52 supply heated air and, in some instances, lean gas for use in the flues. Regenerators 47 and 48 form one set and regenerators 50 and 52 form another set. A main passageway 54 is provided in wall 42 and has branch passageways 54*a*, 54*b*, 54*c*, 54*d* and 54*e* connected to flue 6 at different elevations. A main passageway 56 extends upwardly in division wall 43 and has branch passageways 56*a*, 56*b*, 56*c*, 56*d* and 56*e* at different elevations for connecting the passageway 56 to flues 7 and 8. In like manner, vertical passageways 58, 60 and 61 are provided in walls 44, 45 and 46, respectively, with branch passageways leading to flues 9, 10, 11, 12, 13 and 14. The branch passageways are at the same elevation as the corresponding branch passageways from the other vertical passageways. Regenerator 47 is connected to passageways 56 and 60. Regenerator 48 is connected to passageways 62, 64, 66 and 68 which are connected to the bottom of flues 7, 8, 11 and 12, respectively. Regenerator 50 is connected by means of flues 70, 72, 74 and 76 to the bottom of flues 6, 9, 10 and 13, respectively. Regenerator 52 is connected to main vertical passageways 54, 58 and 61. It will be understood that this arrangement will continue for flues 14 to 29.

The coke ovens may be operated on rich gas and/or lean gas. For the purpose of this application rich gas has a B.t.u. content per cu. ft. of over 140 and lean gas has a B.t.u. content per cu. ft. below 140.

A three way valve 78 controls flow of rich gas through conduits 80 and 80*a* to the bottom of the flues. A valve 82 controls flow of gases to and from the regenerators. Valve 82 is provided with passageways 82*a*, 82*b*, 82*c*, 82*d*, 82*e*, 82*f*, 82*g* and 82*h* which are selectively connected to the regenerators 47, 48, 50 and 52. Conduits 84 to 91 are also connected to valve 82. Branch conduits 84*a* and 84*b*, having valves 92 and 94 therein, are connected to conduit 84. Branch conduits 91*a* and 91*b*, having valves 96 and 98 therein, are connected to conduit 91.

When using rich gas as the sole fuel, one set of regenerators will be heated with waste gas while the other set is providing heated air to the flues. In this case, valves 94 and 98 will be closed and valves 92 and 96 open. The regenerators 47, 48, 50 and 52 have the same capacity and during the cycle of operation shown in the drawings, air will be delivered through regenerator 50 into the bottom of flues 6, 9, 10 and 13. Rich gas is delivered into the bottom of these same flues through fuel line 80. The passageways are so constructed that half the air necessary for combustion will be delivered into the bottom of the flues from regenerator 50 with the remaining air being delivered from regenerator 52. It is preferred that half the air from the generator 52 be delivered through the bottom branch conduit, 25% of the air through the second branch conduit, 12½% through the third branch conduit, 7.5% through the fourth branch conduit, and 5% through the top branch conduit. In this manner heat is supplied uniformly at all elevations in the coking chambers. The burnt gases from flues 7, 8, 11 and 12 will pass through regenerators 47 and 48 to heat them during this time. The burnt gases then pass through valve 82 and conduits 85 and 87 to exhaust. After a period of time,

the operation is reversed by moving valve 78 so that rich gas passes through conduit 80*a* and by moving valve 82 to the right. Thus, heated air will pass through regenerators 47 and 48 to flues 7, 8, 11 and 12 and the burnt gases from flues 6, 9, 10 and 13 will pass through regenerators 50 and 52. Also, rich gas passes through conduit 80*a* to the bottom of flues 7, 8, 11 and 12. The distribution of hot air to these flues will be the same as during the other part of the cycle. After a period of time, the flow of air and gas is again reversed to return the regenerators and flues to their original condition. This cycle of operations is repeated in the usual manner until the coking is completed.

It will be seen that the wall between each pair of connected vertical flues has the same pressure on each side which enables the air distributing passageways to be arranged therein. This would not otherwise be possible. Thus, the only walls having differential pressure is wall 99 between the flues in each pair, but since these walls are solid and since the pressure differential is low, this has little effect on the life of the wall.

When lean gas is used, either alone or with rich gas, the operation is as follows:

Valves 92 and 96 are closed, valves 94 and 98 opened, and the valves 78 and 82 positioned as shown. Combustion will take place in flues 6, 9, 10 and 13 and burnt gases will pass out through regenerators 47 and 48 in the same manner as when using rich gas alone. However, air will pass through regenerator 50 only and will be delivered to the bottom of flues 6, 9, 10 and 13. The lean gas will be heated in regenerator 52 and will be delivered into the respective flues at five elevations with the proportion of fuel at the five elevations being the same as that for air in the operation with rich gas alone. When rich gas is also used it is delivered into the bottom of the chambers through fuel supply line 80. When rich gas is not used, valve 78 will be closed. The flow of gases in this operation will be reversed in the same manner as in the first embodiment described above, and burnt gases will pass through regenerators 50 and 52, air through regenerator 48 and lean gas through regenerator 47.

While several embodiments of my invention have been shown and described, it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claims.

I claim:

1. A coke oven comprising a plurality of elongated vertical coking chambers arranged side by side in spaced apart relationship, a main wall between adjacent coking chambers, a plurality of paired vertical flues arranged in each of said main walls, a horizontal flue connecting the tops of the flues in each pair, a division wall between each pair of vertical flues, a main passageway extending upwardly in each division wall, a plurality of branch passageways at different elevations connecting said main passageway to the adjacent vertical flues, two sets of regenerators associated with the flues in each main wall, connections between one set of regenerators, alternate main passageways and the bottom of the vertical flues associated with the alternate passageways, connections between the other set of regenerators, the remaining main passageways and the bottom of the vertical flues associated with the remaining main passageways, means for delivering air to one set of regenerators and fuel to the flues associated therewith while the other set of regenerators receives waste gases from the burning of the fuel and air, and means for reversing the flow of air and fuel so that air is delivered to the other set of regenerators and fuel to the flues associated therewith while the said one set of regenerators receives waste gases from the burning of the fuel and air.

2. A coke oven according to claim 1 in which each set of regenerators includes two regenerators, and the fuel is rich fuel delivered to the bottom of the vertical fuels.

3. A coke oven according to claim 1 in which each set of regenerators includes two regenerators, a lean fuel connection to one regenerator in each set, an air connection to the other regenerator in each set, a connection between said one regenerator in each set and the associated main passageways, a connection between the said other regenerator in each set and the bottom of the associated vertical flues, and means for delivering rich fuel to the bottom of the vertical flues.

4. The method of making coke in a plurality of elongated vertical coking chambers arranged side by side in spaced apart relationship with a main wall between adjacent coking chambers and a plurality of paired vertical flues arranged in each of said main walls and connected at their tops, which comprises delivering heated air from one generator of a set of regenerators to the bottom of one flue of each pair of flues, delivering heated air from another regenerator of said set to the said one flue of each pair of flues at a plurality of elevations, delivering rich fuel to the bottom of the flues receiving air and burning said fuel and air in said one flue of each pair of flues, and taking the burnt gases from the other flue of each pair of flues to a second set of regenerators, each flue receiving the air and fuel being adjacent another flue receiving the air and fuel and each flue receiving burnt gases being adjacent another flue receiving burnt gases.

5. The method of making coke in a plurality of elongated vertical coking chambers arranged side by side en spaced apart relationship with a main wall between adjacent coking chambers and a plurality of paired vertical flues arranged in each of said main walls and connected at their tops, which comprises delivering heated air from one generator of a set of regenerators to the bottom of one flue of each pair of flues, delivering heated lean fuel from another regenerator of said set to said one flue of each pair of flues at a plurality of elevations, burning said fuel and air in said one flue of each pair of flues, and taking the burnt gases from the other flue of each pair of flues to a second set of regenerators, each flue receiving the air and fuel being adjacent another flue receiving the air and fuel and each flue receiving burnt gases being adjacent another flue receiving burnt gases.

References Cited

UNITED STATES PATENTS

1,961,265 6/1934 Van Ackeren ..... 202—144

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