March 12, 1968 J. VAN ACKEREN 3,373,087

COKE OVEN STRUCTURE

Filed Aug. 31, 1964 4 Sheets-Sheet 1

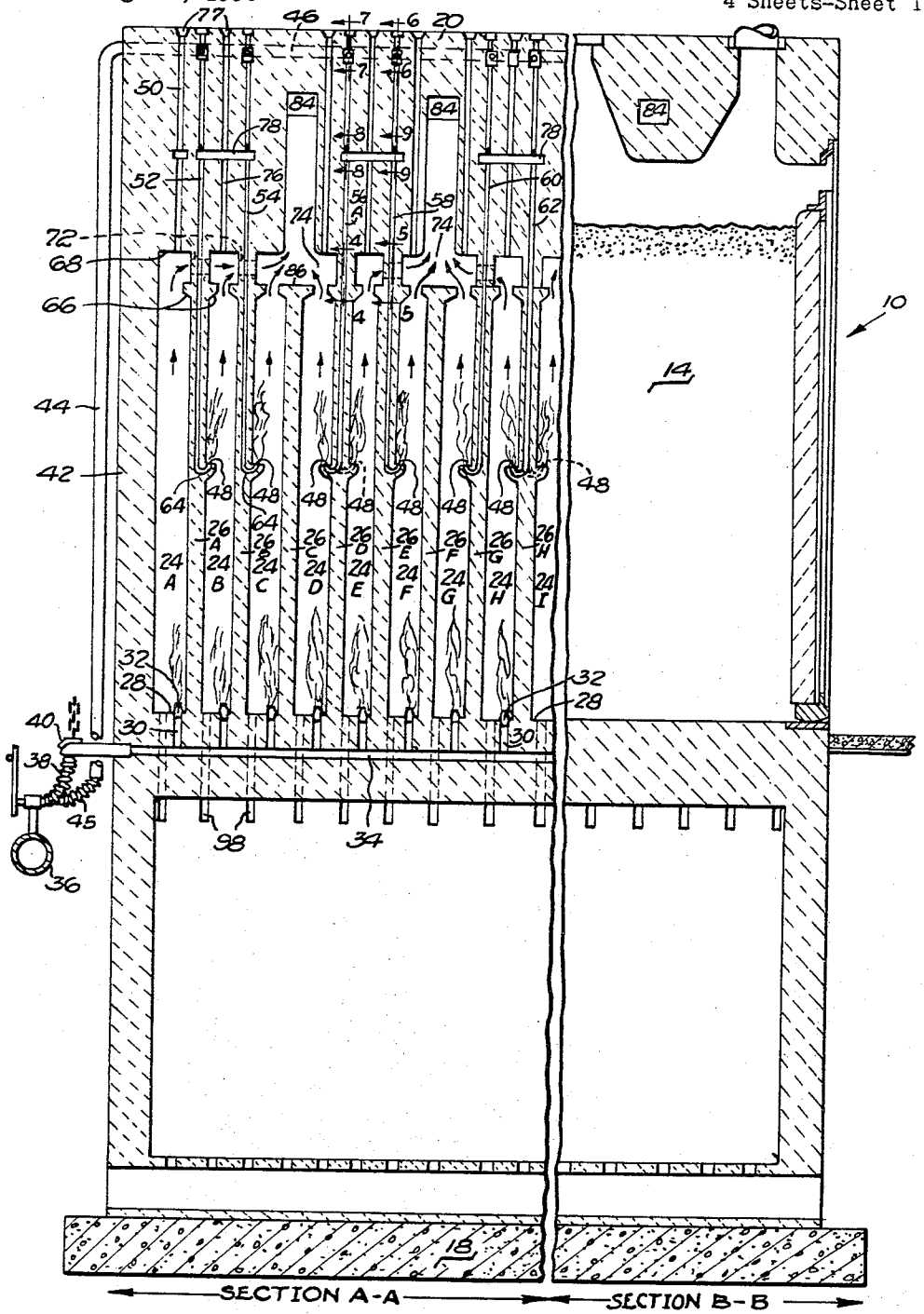


Fig. 1.

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COKE OVEN STRUCTURE

Filed Aug. 31, 1964 4 Sheets-Sheet 2

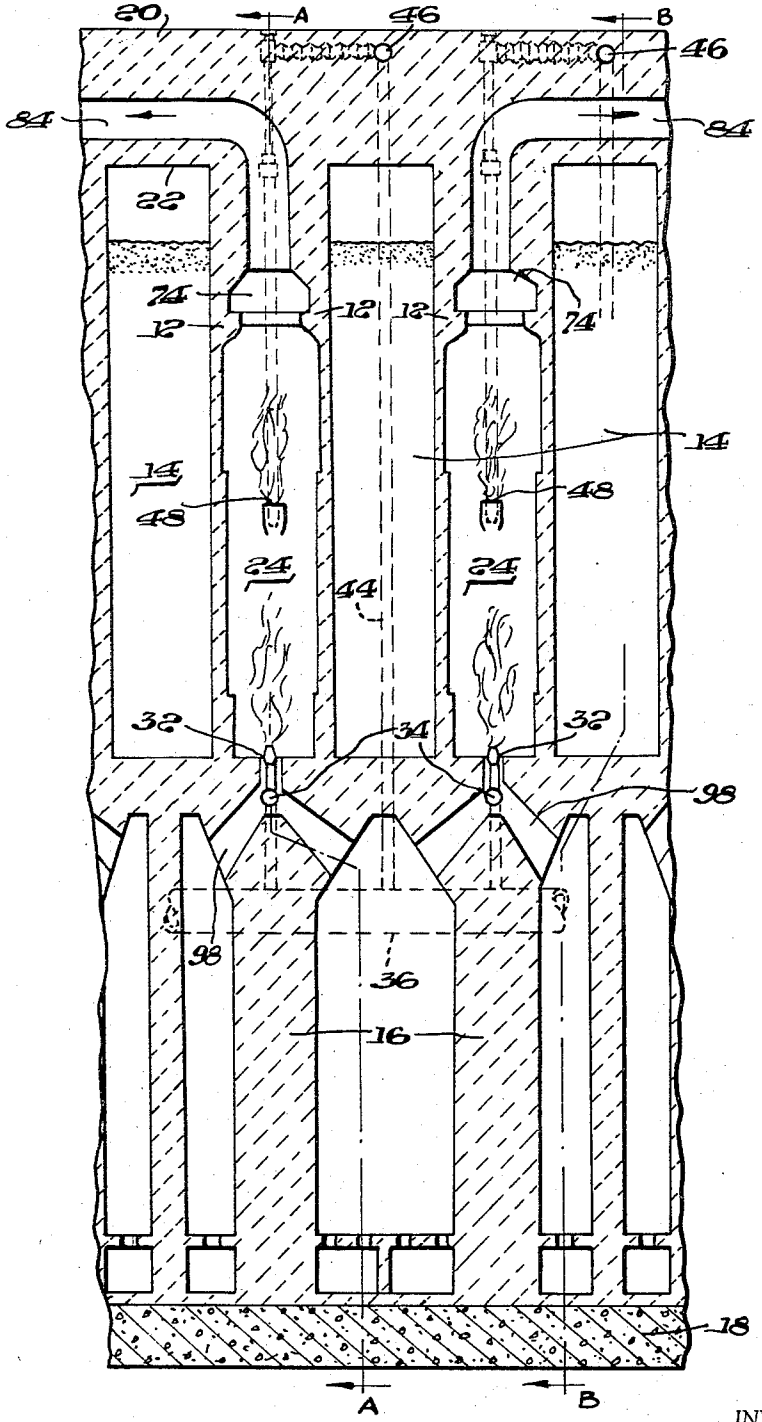


Fig. 2.

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COKE OVEN STRUCTURE

Filed Aug. 31, 1964 4 Sheets-Sheet 3

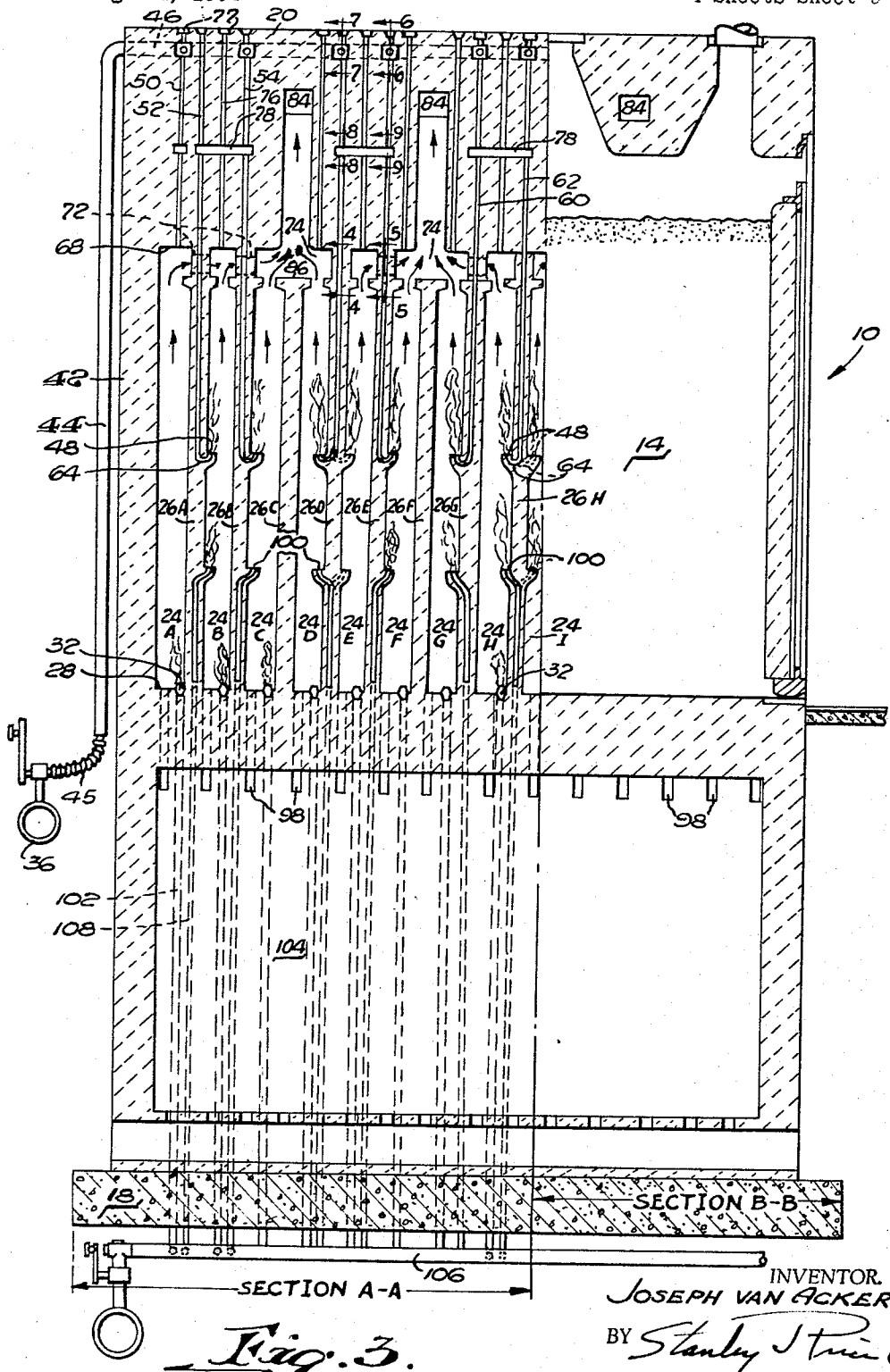


Fig. 3.

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March 12, 1968 J. VAN ACKEREN 3,373,087

COKE OVEN STRUCTURE

Filed Aug. 31, 1964 4 Sheets-Sheet 4

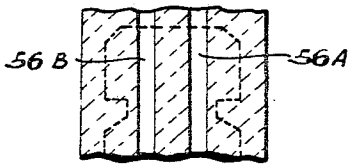


Fig. 4.

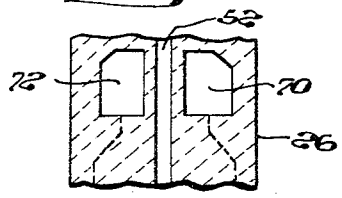


Fig. 5.

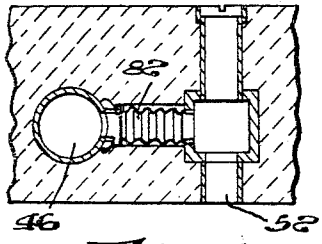


Fig. 6

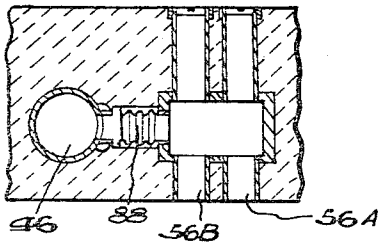


Fig. 7.

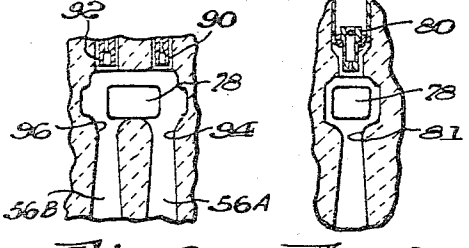


Fig. 8.

Fig. 9.

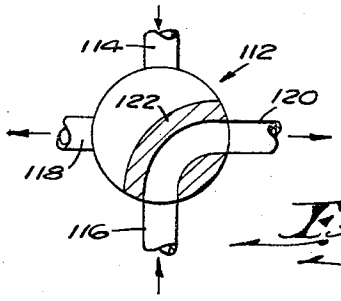


Fig. 10.

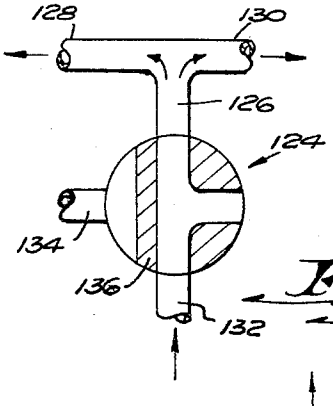


Fig. 11.

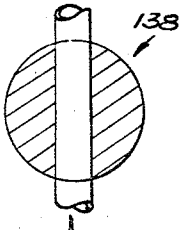


Fig. 12.

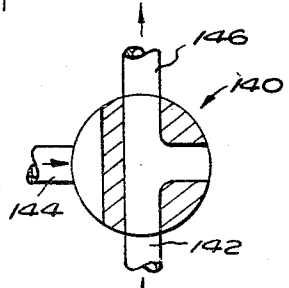


Fig. 13.

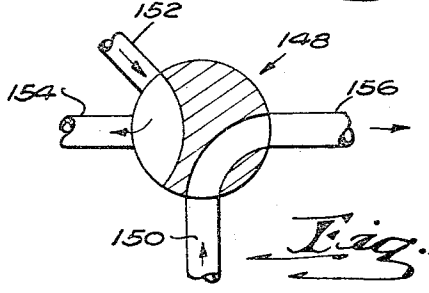


Fig. 14.

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Patented Mar. 12, 1968

3,373,087

COKE OVEN STRUCTURE

Joseph Van Ackeren, Pittsburgh, Pa., assignor to Koppers Company, Inc., a corporation of Delaware

Filed Aug. 31, 1964, Ser. No. 393,124
10 Claims. (Cl. 202—135)

This invention relates to improvements in a high chambered horizontal regenerative coke oven that has a high and low burner and more particularly to a high chambered coke oven having high and low burners and an improved means for supplying fuel gas to the high level burners, and for admixing waste combustion gas with the fuel gas supplied to the high level burners.

In the design and construction of horizontal retort ovens one of the primary objectives in recent years has been to increase oven capacity without adversely affecting the quality of the coke produced therein. To attain this objective the height of the coking chamber has been increased and burners spaced from the base of the flues have been included to supply heat to the adjacent coking chambers. For a coke product of high quality, it is desirable that the heat supplied by the burners be distributed uniformly through the heating walls to the coal in the coking chambers.

One of the problems encountered in providing additional burners in the combustion flues is the manner in which the fuel gas is supplied to the burners spaced from the base of the flue. Passageways have been provided in the partition walls and the pillar walls therebeneath to provide conduit means for the fuel gas. It has also been found advantageous to supply a portion of the products of combustion to the fuel supply passageways for admixture with the fuel gas to minimize the thermal decomposition of the fuel gas as it is conveyed upwardly through the passageways in the partition walls. Since the partition walls, pillar walls and other portions of the coke oven battery through which the ducts or passageways are formed serve as structural members for the coke oven battery there are limitations in the number of ducts or passageways that can be formed in the partition walls for the flow of either fuel gas or waste combustion gas therethrough.

In certain installations it has been found desirable to use a rich fuel gas as the heating gas for at least a portion of the coke oven battery. It has been found when rich fuel gas is subjected to high temperatures, thermal decomposition takes place and a carbonaceous residuum is deposited in the ducts or passageways. This carbonaceous residuum accumulates and eventually clogs the riser passageways. Where the rich fuel gas is diluted with an inert diluent gas, the deposition of the carbonaceous residuum is eliminated and the passageways remain open for the flow of the fuel gas therethrough. A readily available source of inert diluent gas is the gaseous products of combustion present in the flues. The gaseous products of combustion, called waste combustion gas, when admixed with the rich fuel gas eliminates the deposition of the carbonaceous residuum in the ducts or passageways. A portion of the waste combustion gas may be withdrawn from the combustion flue by providing an opening in the combustion flue and a passageway between the opening and the fuel supply passageways. It is preferred that the waste combustion gas passageway be connected to the fuel supply passageways at the venturi sections of the fuel supply passageways so that there is sufficient differential in pressure between the two gases to aspirate a sufficient amount of the waste combustion gas for admixture with the rich fuel gas.

For certain high chambered coke oven batteries it is desirable to have more than a high level and a low level burner so that the radiant heat can be provided to the flues in a more uniform manner, thereby providing a uniform temperature from the bottom to the top of the flues and uniformly heating the coal in the adjacent coking chambers. Further, with a greater number of burners and separate fuel supply systems thereto, it is possible to more closely regulate the temperature of the heating walls and the coal in the adjacent coking chambers. The limitation in the number of passageways that can be included in the partition walls and pillar walls presents a difficult problem for supplying the plurality of burners with fuel gas and for withdrawing a portion of the waste combustion gas from the flues and conveying the waste combustion gas to the rich fuel gas passageways for admixture with the rich fuel gas.

Briefly, the invention herein disclosed provides an improved means for supplying fuel gas to the high burner and an improved means for admixing a portion of the waste combustion gas with the fuel gas supplied to the high burner. The coke oven battery of the herein described invention includes fuel gas headers that are located below the top surface of the battery. Connected to the horizontal headers are the vertical fuel supply conduits that extend downwardly through the upper portion of the battery and through the partition wall to the high level burner. The high level burners are supplied with fuel gas that is conveyed vertically downwardly from horizontal headers located below the oven battery roof through a flue partition wall to the high level burner. There is also provided a horizontal duct that connects a pair of the vertical fuel supply conduits with a conduit that is connected to an adjacent combustion flue. With this arrangement a portion of the gaseous products of combustion are withdrawn from the combustion flue and admixed with the fuel gas before the admixture is conveyed downwardly through the vertical supply passageways to the high burners.

In another embodiment of this invention there is disclosed a coke oven battery wherein each flue is provided with a low level burner, an intermediate level burner and a high level burner. The low level burner and the intermediate level burner are supplied with fuel gas through passageways formed in the pillar walls and the base of the coke oven battery. The fuel gas for the low and intermediate burners flows upwardly through respective passageways to the gas ports of these burners. The fuel gas for the high level burners is supplied through vertical passageways connected to horizontal headers located adjacent the oven battery roof. With this arrangement it is now possible to provide a greater number of burners in each flue and to more accurately control the temperatures throughout the entire length of the flue.

Accordingly, the principal feature of this invention is to provide an improved high chambered coke oven structure that includes high and low level burners and an improved means for supplying fuel gas to the high burners.

Another feature of this invention is to provide an improved high chambered coke oven structure that includes a plurality of burners in the flues and means for supplying fuel gas to certain of the burners from horizontal headers positioned adjacent the roof of the coke oven battery.

Another feature of this invention is to provide an improved high chambered coke oven structure that includes a means for supplying fuel gas to the high burners from a horizontal header positioned adjacent the roof of the coke oven battery and a means for admixing waste combustion gas with the fuel gas as it is conveyed from the horizontal header to the high burner.

Another feature of this invention is to provide an improved high chambered coke oven structure that includes means to supply fuel gas to a pair of adjacent flues

through vertical conduits connected to a horizontal header positioned adjacent the roof of the coke oven battery.

In the accompanying drawings forming a part of this specification, there is shown for purposes of illustration a regenerative coke oven wherein the fuel gas supplied to the high level burners flows downwardly through passageways in the upper portion of the coke oven batteries and is diluted with waste combustion gas withdrawn from the combustion flue located therebelow. It is not intended that the invention herein disclosed be limited in its application to the specific type of coke oven illustrated in the drawings. The invention is applicable to other high chambered regenerative coke ovens that employ a plurality of burners in each flue.

In the drawings:

FIGURE 1 is a crosswise vertical section through a coke oven battery embodying features of the present invention. The battery comprises coke ovens wherein the low level burners are supplied with fuel gas by so-called gas guns. The section A—A of FIGURE 1 is taken longitudinally through a heating wall and along the line A—A of FIGURE 2; the section B—B is taken through a coking chamber and a regenerator and along the line B—B of FIGURE 2.

FIGURE 2 is a vertical section in elevation taken longitudinally of the coke oven battery.

FIGURE 3 is a view similar to FIGURE 1 illustrating another embodiment of this invention wherein there are low level burners, intermediate level burners and high level burners in substantially all of the flues. The low level burners and intermediate burners are supplied with fuel gas by the so-called underjet principle.

FIGURE 4 is a view in section taken along the lines **4—4** of FIGURES 1 and 3 illustrating a pair of vertical passageways extending through one of the partition walls.

FIGURE 5 is a view in section taken along the lines **5—5** of FIGURES 1 and 3 illustrating a vertical fuel supply passageway through a partition wall and a pair of horizontal passageways for the flow of waste combustion gas therethrough.

FIGURE 6 is a view in section taken along lines **6—6** of FIGURES 1 and 3 illustrating the connection between a horizontal header positioned adjacent the roof of the coke oven battery and a vertical fuel supply passageway.

FIGURE 7 is a view in section taken along the lines **7—7** in FIGURES 1 and 3 illustrating the connection between a horizontal header positioned adjacent the roof of the coke oven battery and a pair of vertical fuel supply passageways.

FIGURE 8 is a view in section taken along the lines **8—8** of FIGURES 1 and 3 illustrating the manner in which waste combustion gas is admixed with the fuel gas supplied to the pair of vertical fuel supply passageways.

FIGURE 9 is a view in section taken along the lines **9—9** of FIGURES 1 and 3 illustrating the manner in which the waste combustion gas is admixed with the fuel gas supply to a single vertical passageway.

FIGURES 10 through 14 are schematic gas flow arrangements for supplying fuel gas and air to the various burners.

Referring to the drawings and particularly FIGURES 1 and 2, there is illustrated a coke oven battery generally designated by the numeral **10** that has a plurality of heating walls **12** and a plurality of intermediate coking chambers **14**. The heating walls **12** form side walls of the respective coking chambers **14** and are supported by pillar walls **16** positioned therebeneath that extend crosswise of the coke oven battery **10** and lengthwise of the coking chambers **14**. The coke oven battery **10** has a base portion **18** that supports the pillar walls **16** and an upper roof or top portion **20**. The coking chambers **14** have a top horizontal wall **22** that is spaced below the oven battery roof **20**.

The heating walls **12** have an elongated chamber extending parallel to the adjacent coking chambers **14** that is divided into individual vertically disposed heating flues by means of transversely extending partition walls **26**, as is illustrated in FIGURE 1. Beginning from the left of FIGURE 1, the heating flues for convenience are designated by the numerals **24A**, **24B**, **24C**, **24D**, **24E**, **24F**, **24G**, **24H** and **24I**, with the partition walls therebetween being designated **26A**, **26B**, **26C**, **26D**, **26E**, **26F**, **26G**, and **26H**. The letter designation of the various flues and walls is included to clearly indicate the manner in which the waste combustion gases are conveyed through the respective passageways in certain of the partition walls and through the crossover ducts.

The flue **24A** is an end flue adjacent a longitudinal side of the coke oven battery and is provided with a single low level burner. The flues **24B**, **24C**, **24D**, **24E**, **24F**, **24G**, **24H**, and **24I** inclusive, however, are provided in FIGURE 1 with low level burners and high level burners. All of the flues **24** have a base portion **28** with a vertical passageway **30** extending downwardly therefrom. The opening in the flue base portion **28** forms a gas port for the low level burner **32**. The passageways **30** extending downwardly from flues **24** are all connected to a horizontal supply conduit **34** that extends crosswise of the coke oven battery **10** beneath the flue base portion **28**. The supply conduit **34** is connected through suitable valving to supply a supply main **36** positioned externally of the coke oven battery **10** and extending lengthwise thereof by a flexible conduit **38**. Suitable valve means **40** are provided for controlling the supply of fuel gas through the supply conduit **34** to thereby regulate the flow of fuel gas or, where desired, decarbonized air to the low level burners **32** connected thereto. In this manner, a horizontal supply conduit **34** is arranged to supply fuel gas to all of the low level burners **32** in a bank of combustion flues **24** and a horizontal supply conduit **34** is provided for each bank of flues **24**. Valve means control the flow of the fuel gas through the conduits **34** so that certain banks of the flues are burning while the waste combustion gas flows downwardly through the adjacent bank of flues to supply heat to the coking chamber therebetween.

Extending vertically adjacent the coke oven battery side wall **42** is another supply conduit **44** that is connected to the same supply main **36** through a flexible connection **45**. The vertical conduit **44** is connected to a horizontal header **46** that is positioned slightly below the coke oven battery roof or top surface **20**. The vertical conduit **44** and the horizontal header **46** are arranged to supply fuel gas to high level burners designated by the numeral **48** in the combustion flues **24B**, **24C**, **24D**, **24E**, **24F**, **24G**, **24H** and **24I** inclusive.

The masonry between the top of the coking chambers **22** and the coke oven battery roof **20** has a plurality of vertical passageways extending downwardly therethrough and into the respective flues **24A**, **24B**, **24C**, **24D**, **24E**, **24F**, **24G**, **24H**, and **24I**. The vertical passageways designated by the numeral **50** are inspection openings through which visual inspection of the flues can be made and the temperature of the flues measured during the combustion cycle. There is also provided in the masonry between the top of the coking chambers and the battery roof other vertical passageways **52**, **54**, **56A**, **56B**, **58**, **60**, **62A**, and **62B**, that are arranged to supply fuel gas to the high level burners from the horizontal header **46**. The passageways **52** and **54** extend downwardly through the masonry beneath the coke oven battery roof and through the partition walls **26A** and **26B** respectively to a location spaced above the flue base portion **28**. The parition walls **26A** and **26B** have protuberances extending into the flues **24B** and **24C**. Both of the passageways **52** and **54** have curved end portions **64** that terminate in a gas port for the high level burners **48** in both of the flues **24B** and **24C**.

The partition wall **26A** has outwardly flared portions **66** adjacent its top portion that are spaced below the roof

68 of the flues 24. The flared portions 66 are arranged to deflect the flow of the gases flowing upwardly through respective flues 24A and 24B. The partition wall 26A has a pair of horizontal passageways 70 and 72, as is illustrated in FIGURE 5, for the flow of waste combustion gas horizontally therethrough from the vertical flue 24A into the upper portion of the flue 24B. The flue 24B has a roof portion 68, and the partition wall 26B has a similar pair of horizontal passageways 70 and 72 for the flow of waste combustion gas from the upper portion of flue 24B. There is a horizontal bus duct 74 located above the combustion flues 24C and 24D into which the waste combustion gas from the flues 24A and 24B flows by means of the horizontal passageways 70 and 72 in the partition walls 26A and 26B.

Extending upwardly through the roof 68 of the flue 24B is a vertical passageway 76 that terminates at the coke oven battery roof 20 and is utilized as an inspection opening. Cap members 77 are positioned in the openings of inspection passageways 50 and passageway 76 to seal these passageways when they are not being utilized for inspection purposes. There is formed in the masonry between the flue roof portion 68 and the coke oven battery roof 20 a horizontal mixing duct 78 that connects the vertical passageway 76 opening into flue 24B with the vertical fuel supply passageways 52 and 54. Thus, a portion of the hot combustion gas that flows upwardly from combustion flue 24B instead of being diverted horizontally through the passageways 70 and 72 in the partition wall 26B is conveyed upwardly through passageway 76 into horizontal mixing duct 78 where the waste combustion gas is admixed with the fuel gas flowing downwardly through the respective passageways 52 and 54.

As is illustrated in FIGURE 9, each of the vertical fuel supply passageways 52 and 54 has an adjustable nozzle 80 positioned adjacent the horizontal mixing duct 78 to regulate the flow of fuel gas downwardly through the fuel supply passageway. The vertical fuel supply passageways 52 and 54 also have a venturi section 81 positioned beneath the horizontal mixing duct 78 to assist in aspirating a portion of the hot combustion gas from the horizontal mixing duct 78 into the vertical passageways 52 and 54. With this arrangement the high level burners 48 in flues 24B and 24C are supplied with a diluted fuel gas through vertical passageways extending downwardly from the coke oven battery roof portion 20. The vertical passageways 52 and 54 are connected to the horizontal header 46 by means of a flexible coupling 82, as illustrated in FIGURE 6.

The heating walls 12 are provided with a plurality of crossover ducts 84 (FIGURES 1, 2 and 3) that are each associated with a horizontal bus duct 74. The hot combustion gas from a group of flues is directed into the horizontal bus ducts 74 and upwardly through the crossover ducts 84. The hot combustion gas is then conveyed downwardly from the crossover ducts 84 through similar ducts and flues on the opposite side of the coke oven chamber, as is illustrated in FIGURE 2. In FIGURE 1 the waste combustion gas from flues 24A, 24B, 24C, and 24D is conveyed upwardly through crossover duct 84 to a similar group of flues on the other side of coking chamber 14. The waste combustion gas from flues 24E, 24F, 24G and 24H is conveyed through another crossover duct 84 to a similar group of flues on the opposite side of the adjacent coking chamber.

In the group of flues 24A, 24B, 24C, and 24D the pillar wall 26C terminates at an upper horizontal surface 86 that forms a portion of the lower wall for the bus duct 74. The partition wall 26C does not have any fuel supply passageways extending vertically therethrough. The adjacent partition wall 26D has a pair of passageways 56A and 56B extending downwardly therethrough, as is illustrated in FIGURE 4, and does not have horizontal passageways therethrough similar to passageways or openings 70 and 72 as in partition walls 26A and 26B. The partition wall 26D serves as a dividing wall between the group of flues 24A, 24B, 24C and 24D and the adjacent group of flues 24E, 24F, 24G and 24H. The vertical passageways 56A and 56B extend downwardly from the oven battery roof 20 in parallel spaced relation to each other and are connected to the horizontal header 46 by means of a horizontal flexible conduit 88, as is illustrated in FIGURE 7. The vertical conduits or passageways 56A and 56B extend downwardly through the partition wall 26D in spaced parallel relation to each other, as is illustrated in FIGURE 4. The vertical fuel supply passageways 56A and 56B have upwardly curved end portions that extend in opposite directions and open into the flues 24D and 24E forming gas ports for the high level burners 48 in the respective flues. With this arrangement, fuel gas from the horizontal header 46 is conveyed downwardly through the pair of passageways 56A and 56B to the high level burners 48 in the pair of flues 24D and 24E for combustion therein.

The vertical passageway 58 that supplies fuel gas to the high level burner 48 in the flue 24F extends downwardly through the masonry beneath the coke oven battery roof 20 and through the partition wall 26E in substantially the same manner as passageway 54 that supplies fuel gas to the high level burner 48 in flue 24C. There is a horizontal mixing duct 78 between the passageways 56A, 56B and 58 which has a vertical passageway 76 that supplies waste combustion gas from flue 24E to the horizontal mixing duct 78 and to the vertical fuel supply passageways 56A, 56B and 58. FIGURE 8 illustrates the manner in which the horizontal mixing duct 78 supplies the waste combustion gas to passageways 56A and 56B. The passageways 56A and 56B have nozzles 90 and 92 that control the rate of fuel gas to the respective passageways from the horizontal header 46 and venturi sections 94 and 96 positioned adjacent to the horizontal mixing duct 78. With this arrangement, waste combustion gas is admixed with the rich fuel gas flowing downwardly through the fuel supply passageways 56A, 56B and 58.

The partition wall 26E has a pair of passageways 70 and 72 therethrough similar to the passageways illustrated in FIGURE 5 to provide a means for conveying the waste combustion gas from flue 24E to the horizontal bus duct 74. The partition wall 26F is similar to the partition wall 26C and partition wall 26G is similar to the partition wall 26A and has a similar fuel supply passageway 60 extending downwardly therethrough. The fuel supply passageway 60 has a curved end portion that terminates in a gas port for high level burner 48 in flue 24G. The partition wall 26H is similar in construction to the partition wall 26D and has a pair of vertical fuel supply passageways 62A and 62B that supply fuel gas to the high level burners 48 in flues 24H and 24I respectively. The partition wall 26H forms a dividing wall between the group of flues 24E, 24F, 24G and 24H and a similar group of flues beginning with flue 24I. This group of flues, therefore, has transverse division walls 26D, 26H, a pair of adjacent partition walls 26E, 26G connected to the heating chamber top portion and an intermediate partition wall 26F terminating below the heating chamber top portion.

The flues 24, arranged in groups as is illustrated in FIGURE 1, continue sequentially in similar groups throughout the length of the heating wall 12. A similar arrangement is provided in each group of flues for the admixing of the waste combustion gas with the fuel gas supplied through the respective passageways as was previously described. Vertical passageways 98 connect the respective flues 24 to the regenerators positioned therebelow for supplying combustion air to the flues 24.

With the above described arrangement for supplying fuel gas to a bank of combustion flues, the low level burner 32 in the bank of flues is supplied with fuel gas through a gas gun type horizontal conduit 34 positioned beneath the base of the flues through vertical conduits or

pasageways 30 connected to the horizontal supply conduit 34. The high level burners 48 are supplied with fuel gas through a horizontal header or supply conduit 46 positioned adjacent to and beneath the coke oven battery roof 20 by means of vertical passageways previously described that extend through the masonry between the coke oven battery roof 20 and the upper portion of roof 68 of flues 24. The vertical passageways extend downwardly through the partition walls 26 in the manner previously described and there is also provided a means for withdrawing a portion of the waste combustion gas from the flues and admixing this waste combustion gas with the fuel gas supplied to the high level burners.

In FIGURE 3 there is illustrated another embodiment of the invention wherein similar numerals will be used to indicate similar parts. There are in the embodiment illustrated in FIGURE 3, high level burners 48 and intermediate burners 100 arranged between the low level burners 32 and the high level burners 48. The manner in which the high level burners 48 are supplied with an admixture of fuel gas and waste combustion gas is similar to that illustrated in FIGURE 1. The embodiment in FIGURE 3, however, includes an underjet type supply system for the low level burners 32 and the intermediate burners 100. There is provided in the masonry beneath the base or floor of the flues 24 vertical passageways 102 that extend downwardly through a pillar wall 104 and through the coke oven battery base portion 18. The passageways 102 are connected to a horizontal header or supply conduit 106 that extends crosswise of the coke oven battery 10. With this arrangement each of the low level burners 32 in the flues 24A, 24B, 24C, 24D, 24E, 24F, 24G and 24H are supplied with fuel gas from the horizontal header 106 through the vertical passageways 102. Adjacent to and substantially parallel with the passageways 102 are other fuel supply passageways 108 that are connected at their lower portion to the horizontal header 106 and extend upwardly through the pillar wall 104 and through the partition walls 26B, 26C, 26D, 26E, 26F, 26G and 26H and terminate in a gas port for the intermediate burners 100. There are a pair of vertical passageways extending through the partition wall 26D that are connected to the horizontal header 106 for supplying fuel gas to both of the flues 24D and 24E. Similarly, there are a pair of vertical passageways 108 that are connected to the horizontal header 106 and supply fuel gas to the intermediate burners 100 in the flues 24H and 24I. FIGURE 3 also illustrates vertical passageways 98 in the masonry beneath the flues 24 that connect the respective flues to the regenerators positioned therebelow. The passageways 98 supply combustion air to the respective flues 24.

With this arrangement, as illustrated in FIGURE 3, there are provided low level burners 32, intermediate burners 100, and high level burners 48. The low level burners 32 and intermediate burners 100 are supplied with fuel gas from an underjet type supply system and the high level burners 48 are supplied with fuel gas from a horizontal header 46 positioned below the coke oven battery roof 20. Suitable valving may be provided to control the burning of the low level burners 32, the intermediate level burners 100 and the high level burners 48 for either alternate burning or simultaneous burning of the respective burners.

In FIGURES 10 through 14 there are illustrated various combinations of gas flow arrangements. In FIGURE 10 a valve generally designated by the numeral 112 has a decarbonizing air inlet 114, a fuel gas inlet 116 and an outlet 118 to the low level burners, and an outlet 120 to the high level burners. The valve body 122 is arranged for alternate burning so that when the valve core 122 is positioned as illustrated in FIGURE 10, the fuel gas flows from conduit 116 to the conduit 120 and thence to the high level burners 48. At the same time, decarbonizing air is supplied through conduit 114 to conduit 118 and the low level burners 32. When the valve core 122 is rotated to supply fuel gas to the low level burners 32 through conduit 118, decarbonizing air is supplied to the high level burners 48.

In FIGURE 11 there is illustrated valving for simultaneous burning of both the high and low level burners 48 and 32 respectively. The valve 124 has an outlet 126 that is connected to a conduit that supplies either fuel gas or decarbonizing air to the low level burner 32 through outlets 128 and to the high level burner through outlet 130, as indicated by the arrows in FIGURE 11. The valve 124 has a fuel gas inlet 132 and a decarbonizing air inlet 134. The valve core 136 has internal passageways so that both the high level burner 48 and low level burner 32 are supplied with either fuel gas from inlet 132, as is illustrated in FIGURE 11, or with decarbonizing air when the valve core 136 is rotated to connect decarbonizing air inlet 134 with the valve outlet 126.

FIGURES 12 and 13 illustrate a valving arrangement for simultaneous burning of the high level burners 48 and low level burners 32 by means of separate valves 138 and 140. The valve 138 connects the low level burners 32 with a source of fuel gas and is conventional. The valve 140 has a fuel gas inlet 142, a decarbonizing air inlet 144 and an outlet 146 to the high level burners 48. When the valve is positioned as illustrated in FIGURE 13, fuel gas is supplied to the high level burners 48 through conduit 146. When the valve core is rotated to connect the internal passageway of valve 140 with decarbonizing air inlet 144 and outlet 146, the high level burners 48 are supplied with decarbonizing air. The valving illustrated in FIGURES 10 and 11 is preferably utilized with the gas gun type of fuel supply for the low level burners, as is illustrated in FIGURE 1. The valving in FIGURES 10 and 11 may be utilized, however, with the underjet type of fuel system.

In FIGURE 14 there is illustrated suitable valving for alternate burning of the high level and low level burners when the underjet type fuel supply is utilized. In FIGURE 4 the valve generally designated by the numeral 148 has a fuel gas inlet 150 and a decarbonizing air inlet 152. There is an inlet 154 for the high level burners 48 and an outlet 156 for the low level burners 32. This arrangement provides for alternate burning of the high and low level burners. For example, as is illustrated in FIGURE 14, the low level burners 32 are supplied with fuel gas through the valve 148 and the high level burners are supplied with decarbonizing air. Rotation of the valve core connects the low level burners to a source of decarbonizing air when the high level burners are supplied with fuel gas. The above combinations of gas flow arrangements are described for illustrative purposes only, and it should be understood that other gas flow arrangements may be provided for either the embodiment illustrated in FIGURE 1, or the embodiment illustrated in FIGURE 3. Where a rich fuel gas is utilized in the intermediate burners 100 (FIGURE 3) provisions can be made for admixing a portion of the waste combustion gas with the fuel gas and the admixture supplied to the intermediate burner.

According to the provisions of the patent statutes, I have explained the principle, preferred construction, and mode of operation of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. In a high chambered horizontal coking retort oven the combination of heating elements therefor to provide uniform heat for the coking chambers comprising,

elongated heating walls on opposite sides of said coking chambers,

said heating walls each having transverse division walls

and a plurality of intermediate partition walls therebetween forming groups of vertical combustion flues connected to a common crossover duct,

said combustion flues each having a base portion with an opening therein forming a gas port for a low burner,

a source of pressurized fuel gas for each of said low level burners located below said combustion flue base portion,

conduit means connecting said source of pressurized fuel gas to each of said low level burners,

said division walls having vertical passageways extending downwardly therethrough and each said pasageway terminating in a gas port for a high level burner in a flue adjacent to said respective division wall,

said high level burner positioned above said low level burner in said respective flues,

a source of pressurized fuel gas for each of said high level burners located above the upper portion of said combustion flues, and

means connecting said vertical passageways with said source of pressurized fuel gas.

2. In a high chambered coking retort oven the combination of heating elements therefor to provide uniform heat for the coking chambers comprising,

elongated heating walls on opposite sides of said coking chambers,

said heating walls each having an elongated heating chamber with a top portion and a bottom portion, said heating chamber top portion spaced below the roof portion of said retort oven,

said heating walls having groups of vertical combustion flues connected to a common crossover duct, said groups of flues having transverse division walls connected to said heating chamber top portion, a pair of partition walls adjacent to said respective division walls connected to said heating chamber top portion and an intermediate partition wall between said pair of partition walls terminating below said heating chamber top portion,

said partition walls connected to said heating chamber top portion and said division walls having openings therein forming gas ports for high level burners in a flue adjacent to said respective walls,

vertical fuel supply passageways in said partition walls connected to said heating chamber top portion and in said division walls, said vertical fuel supply passageways connected at one end to said openings and extending upwardly through said partition walls connected to said heating chamber top portion and through said division walls and the masonry between said heating chamber top portion and said retort oven roof portion, said fuel supply passageways terminating below said retort over roof portion.

horizontal headers extending across said retort oven below the top surface of said retort oven roof portion,

said vertical fuel supply passageways connected to said horizontal headers at a location below the top surface of said retort oven roof portion, and

said horizontal headers arranged to supply fuel gas under pressure through said vertical fuel supply passageways to said high level gas ports for combustion at said high level gas ports.

3. In a high chambered horizontal coking retort oven as set forth in claim 2 which includes other passageways opening into said flues between said division walls and said partition walls connected to said heating chamber top portion adjacent said chamber top portions,

said other passageways connected to said fuel supply passageways and operable to convey a portion of the gaseous products of combustion from said flue positioned therebelow to said adjacent fuel supply passageway for admixture with said fuel gas flowing downwardly through said fuel supply passageway.

4. In a high chambered horizontal coking retort oven the combination of heating elements therefor to provide uniform heating for the coking chambers comprising,

elongated heating walls on opposite sides of said coking chambers,

said heating walls each having an elongated heating chamber with a top portion and a bottom portion, said heating chamber top portion spaced below the roof portion of said retort oven,

said heating walls having groups of vertical combustion flues connected to a common crossover duct, said groups of flues having transverse division walls connected to said heating chamber top portion, a pair of partition walls adjacent to said respective division walls connected to said heating chamber top portion and an intermediate partition wall between said pair of partition walls terminating below said heating chamber top portion,

said partition walls connected to said heating chamber top portion and said division walls having openings therein forming gas ports for high level burners in flues adjacent to said respective walls,

vertical fuel supply passageways in said partition walls connected to said heating chamber top portion and in said division walls, said vertical fuel supply passageways connected at one end to said openings and extending upwardly through said respective partition walls connected to said heating chamber top portion and through said division walls and the masonry between said heating chamber top portion and said oven roof portion, said fuel supply passageways terminating below said oven roof portion,

horizontal mixing ducts in said masonry between said retort oven roof portion and said heating chamber top portion, said mixing ducts communicating with said vertical fuel supply passageways extending downwardly through said respective partition walls connected to said heating chamber top portion and said division walls,

vertical waste gas passageways opening into said flues adjacent between said division walls and partition walls connected to said heating chamber top portion and extending into each said horizontal mixing duct, said vertical waste gas passageways arranged to convey a portion of the gaseous products of combustion from said flue to said horizontal mixing duct positioned thereabove,

horizontal headers extending across said retort oven below the top surface of said retort oven roof portion,

said vertical fuel supply passageways connected to said horizontal headers at a location below the top surface of said retort oven roof portion,

said horizontal mixing ducts arranged to convey said gaseous products of combustion supplied by said vertical waste gas passageways to all of said vertical fuel supply passageways communicating therewith, and

said horizontal headers arranged to supply fuel gas under pressure through said vertical fuel supply passageways for admixture with said gaseous products of combustion adjacent said horizontal mixing duct and to supply said admixture of fuel gas and said gaseous products of combustion to said high level gas ports for combustion at said high level gas ports.

5. A high chambered horizontal coking retort oven as set forth in claim 4 in which said partition walls connected to said heating chamber top portion have lateral passageways therethrough adjacent said heating chamber top portion for the flow of the gaseous products of combustion from said flues to a crossover duct associated therewith.

6. A high chambered horizontal coking retort oven as

set forth in claim 4 in which said division walls include a pair of openings on opposite sides thereof forming gas ports for high level burners in combustion flues on opposite sides thereof,

pairs of vertical fuel supply passageways in said division walls, said pairs of fuel supply passageways connected at one end to said pair of gas ports and extending upwardly through said division walls and through the masonry between said heating chamber top portion and said retort oven roof portion, said pair of fuel supply passageways terminating below said retort oven roof portion, and

said pair of vertical fuel supply passageways connected to the same horizontal header extending across said retort oven.

7. A high chambered horizontal coking retort oven as set forth in claim 4 in which said partition walls connected to said heating chamber top portion each have a vertical fuel supply passageway extending downwardly therethrough,

said partition walls connected to said heating chamber top portion having a pair of horizontal passageways therethrough adjacent the heating chamber top portion for the flow of the gaseous products of combustion from the flues in said respective groups to said crossover duct connecting the respective groups of flues on both sides of said coking chamber.

8. In a high chambered horizontal coking retort oven the combination of heating elements therefor to provide uniform heat for the coking chambers comprising,

elongated heating walls on opposite sides of said coking chambers,

said heating walls each having transverse division walls and a plurality of intermediate partition walls therebetween forming groups of vertical combustion flues connected to a common crossover duct,

said combustion flues each having a base portion with an opening therein forming a gas port for a low level burner,

said division walls having vertical passageways extending downwardly therethrough and each said passageway terminating in a gas port for a high level burner in a flue adjacent to said respective division wall,

said high level burner positioned above said low level burner in said respective flues,

a source of pressurized fuel gas for each of said high level burners located above the upper portion of said combustion flues,

means connecting said vertical passageways with said source of pressurized fuel gas,

said division walls having other vertical passageways extending upwardly therethrough and terminating in a gas port for an intermediate level burner,

said intermediate level burner positioned between said high level burner and said low level burner in said respective flues,

a source of pressurized fuel gas for each of said low level burners and said intermediate level burners located below said combustion flue base portion, and

conduit means connecting said last named source of pressurized fuel gas to each of said low level burners and said intermediate level burners.

9. In a high chambered horizontal coking retort oven the combination of heating elements therefor to provide uniform heat for the coking chambers comprising,

elongated heating walls on opposite sides of said coking chambers,

said heating walls each having an elongated heating chamber with a top portion and a bottom portion, said heating chamber top portion spaced below the roof portion of said retort oven,

regenerator chambers positioned below said coking chambers and said heating walls,

said heating walls having groups of vertical combustion flues connected to a common crossover duct, said groups of flues having transverse division walls connected to said heating chamber top portion, a pair of partition walls adjacent to said respective division walls connected to said heating chamber top portion and an intermediate partition wall between said pair of partition walls terminating below said heating chamber top portion,

vertical fuel supply passageways in said partition walls connected to said heating chamber top portion and said division walls, said vertical fuel supply passageways connected at one end to said openings for said high level burner gas ports and extending upwardly through said respective partition walls connected to said heating chamber top portion and said division walls and the masonry between said heating chamber top portion and said retort oven roof portion, said fuel supply passageways terminating below said retort oven roof portion,

horizontal headers extending across said retort oven below the top surface of said retort oven roof portion,

horizontal mixing ducts in said masonry between said retort oven portion and said heating chamber top portion, said mixing ducts communicating with said vertical fuel supply passageways extending downwardly through adjacent partition walls,

vertical waste gas passageways opening into said flues between said division walls and said partition walls connected to said heating chamber top portion and extending into said horizontal mixing duct,

said vertical waste gas passageways arranged to convey a portion of the gaseous products of combustion from said flue therebeneath to said horizontal mixing duct,

said horizontal mixing duct arranged to convey said gaseous products of combustion supplied by said vertical waste gas passageway to all of said vertical fuel supply passageways communicating therewith,

said vertical fuel supply passageways connected to said horizontal headers at a location between the top surface of said retort oven roof portion, and said heating chambers top portion,

said horizontal headers arranged to supply fuel gas under pressure through said vertical fuel supply passageways for admixture with said gaseous products of combustion supplied from said horizontal mixing duct and to convey said admixture to said high level gas ports for combustion at said high level gas ports,

said partition walls connected to said heating chamber top portion and said division walls having openings therein below said high level burners and forming gas ports for intermediate level burners, said intermediate level burners spaced above said heating chamber bottom portion,

other vertical fuel supply passageways in said partition walls connected to said heating chamber top portion and said division walls, said other vertical fuel supply passageways connected at one end to said gas ports for said intermediate level burners and extending downwardly through said partition walls and the masonry between said heating chamber bottom portion and said regenerator chambers,

said heating chamber bottom portion having a plurality of openings therein forming gas ports for low level burners in each of said flues,

low level burner vertical fuel supply passageways extending downwardly from said low level burner gas ports through the masonry between said heating chamber bottom portion and said regenerator chambers. and

other horizontal headers positioned beneath said regenerators, said last named horizontal headers connected to said vertical fuel supply passageways for said low level burners and said other vertical fuel

supply passageways for said intermediate level burners,

said other horizontal headers arranged to supply fuel gas to said low level and said intermediate level burners for combustion at said respective burners.

10. In a high chambered horizontal coking retort oven the combination of heating elements to provide uniform heating for the coking chambers comprising,

elongated heating walls on opposite sides of said coking chambers,

said heating walls each having an elongated heating chamber with a top portion and a bottom portion, said heating chamber top portion spaced below the roof portion of said retort oven,

regenerator chambers positioned below said coking chambers and said heating walls,

said heating walls having groups of vertical combustion flues connected to a common crossover duct, said groups of flues having transverse division walls connected to said heating chamber top portion, a pair of partition walls adjacent to said respective division walls connected to said heating chamber top portion and an intermediate partition wall between said pair of partition walls terminating below said heating chamber top portion,

pillar walls between said regenerator chambers positioned below said heating chambers,

a plurality of crossover ducts connecting each group of flues on one side of a coking chamber with a similar group of flues on the other side of said coking chamber so that the gaseous products of combustion from a group of flues on one side of said coking chamber flow upwardly through said crossover duct connected thereto and downwardly through said flues on the opposite sides of said coking chamber,

said partition walls connected to said heating chamber top portion and said division walls having openings therein forming gas ports for high level burners,

vertical fuel supply passageways in said partition walls connected to said heating chamber top portion and said division walls, said fuel supply passageways connected at one end to said openings and extending upwardly through said respective partition walls connected to said heating chamber top portion and said division walls and the masonry between said heating chamber top portion and said retort oven roof portion, said fuel supply passageways terminating below said retort oven roof portion,

horizontal headers extending across said retort oven below the top surface of said retort oven roof portion,

horizontal mixing ducts in said masonry between said retort oven portion and said heating chamber top portion, said mixing ducts communicating with said vertical fuel supply passageways extending downwardly through said partition walls connected to said heating chamber top portion and said division walls,

vertical waste gas passageways opening into said flues between said division walls and partition walls connected to said heating chamber top portion and extending into said horizontal mixing duct,

said vertical waste gas passageways arranged to convey a portion of the gaseous products of combustion from said flue therebeneath to said horizontal mixing duct,

said horizontal mixing duct arranged to convey said gaseous products of combustion supplied by said vertical waste gas passageway to all of said vertical fuel supply passageways communicating therewith,

said vertical fuel supply passageways connected to said horizontal headers at a location between the top surface of said retort oven roof portion and said heating chamber top portion,

said horizontal headers arranged to supply fuel gas under pressure through said vertical fuel supply passageways for admixture with said gaseous products of combustion supplied from said horizontal mixing duct and to convey said admixture to said high level gas ports for combustion at said high level gas ports,

said partition walls connected to said heating chamber top portion having horizontal passageways therethrough adjacent the heating chamber top portion for the flow of gaseous products of combustion from the flues in said respective groups to said crossover duct connecting said respective groups of flues on both sides of said heating chamber,

said partition walls connected to said heating chamber top portion and said division walls having openings therein below said high level burners and forming gas ports for intermediate level burners, said intermediate level burners spaced above said heating chamber bottom portion,

other vertical fuel supply passageways in said partition walls connected to said heating chamber top portion and said division walls, said other vertical fuel supply passageways connected at one end to said gas ports for said intermediate level burners and extending downwardly through said partition walls connected to said heating chamber top portion and said division walls, the masonary between said heating chamber bottom portion and said regenerator chambers, and through said pillar walls,

said heating chamber bottom portion having a plurality of openings therein forming gas ports for low level burners in each of said flues,

low level burner vertical fuel supply passageways extending downwardly from said low level gas ports through the masonry between said heating chamber bottom portion and said regenerator chambers and through said pillar walls positioned therebeneath, and

other horizontal headers positioned beneath said regenerators, said last named horizontal headers connected to said vertical fuel supply passageways for said low level burners and said other vertical fuel supply passageways for said intermediate level burners,

said other horizontal headers arranged to supply fuel gas to said low level and said intermediate level burners for combustion at said respective burners.

No references cited.

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