

May 13, 1930.

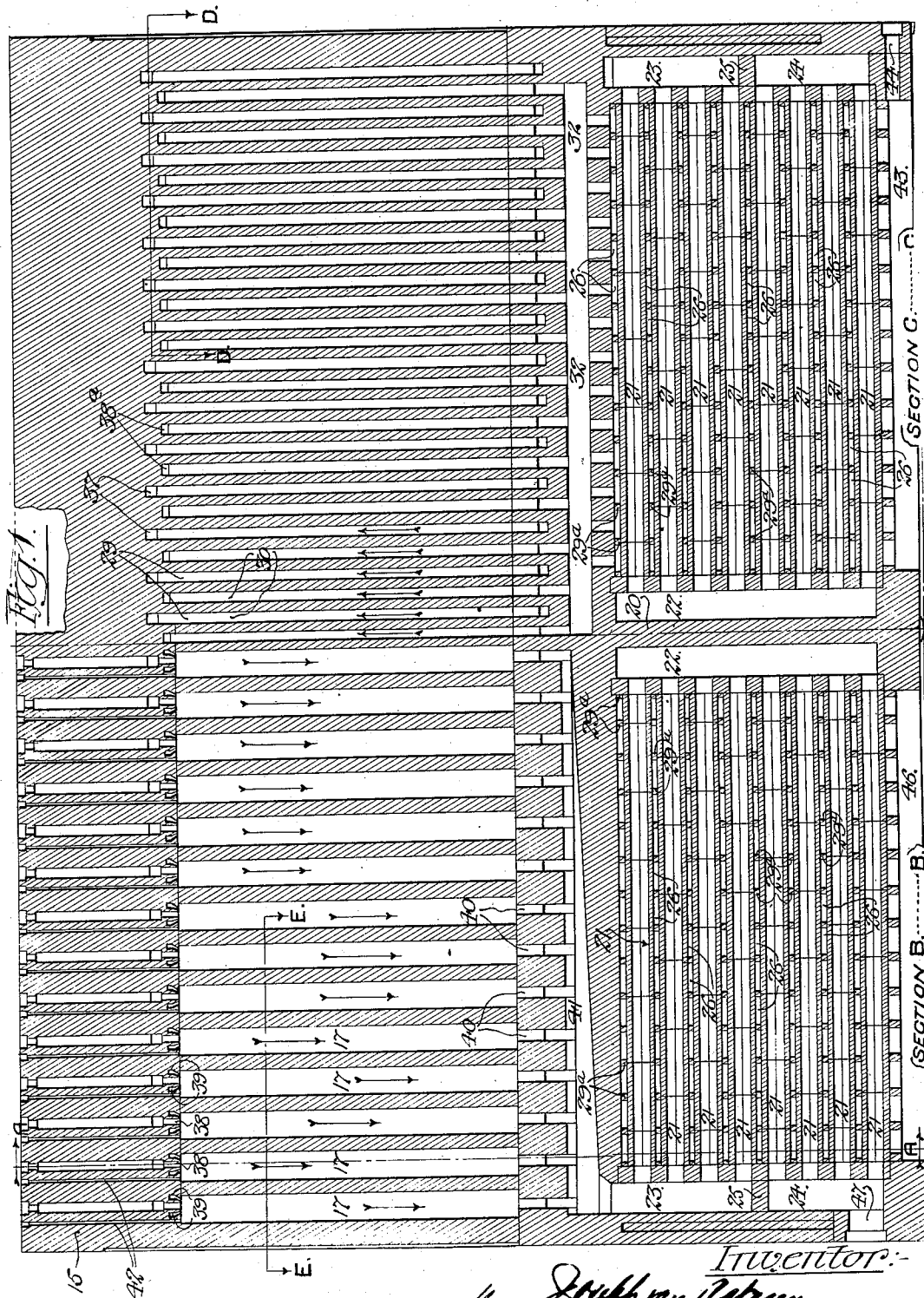
J. VAN ACKEREN

1,758,544

RECUPERATIVE COKING RETORT OVEN

Filed Sept. 29, 1921

3 Sheets-Sheet 1



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By: Messrs. Charles T. Carpenter & Co. Attorneys

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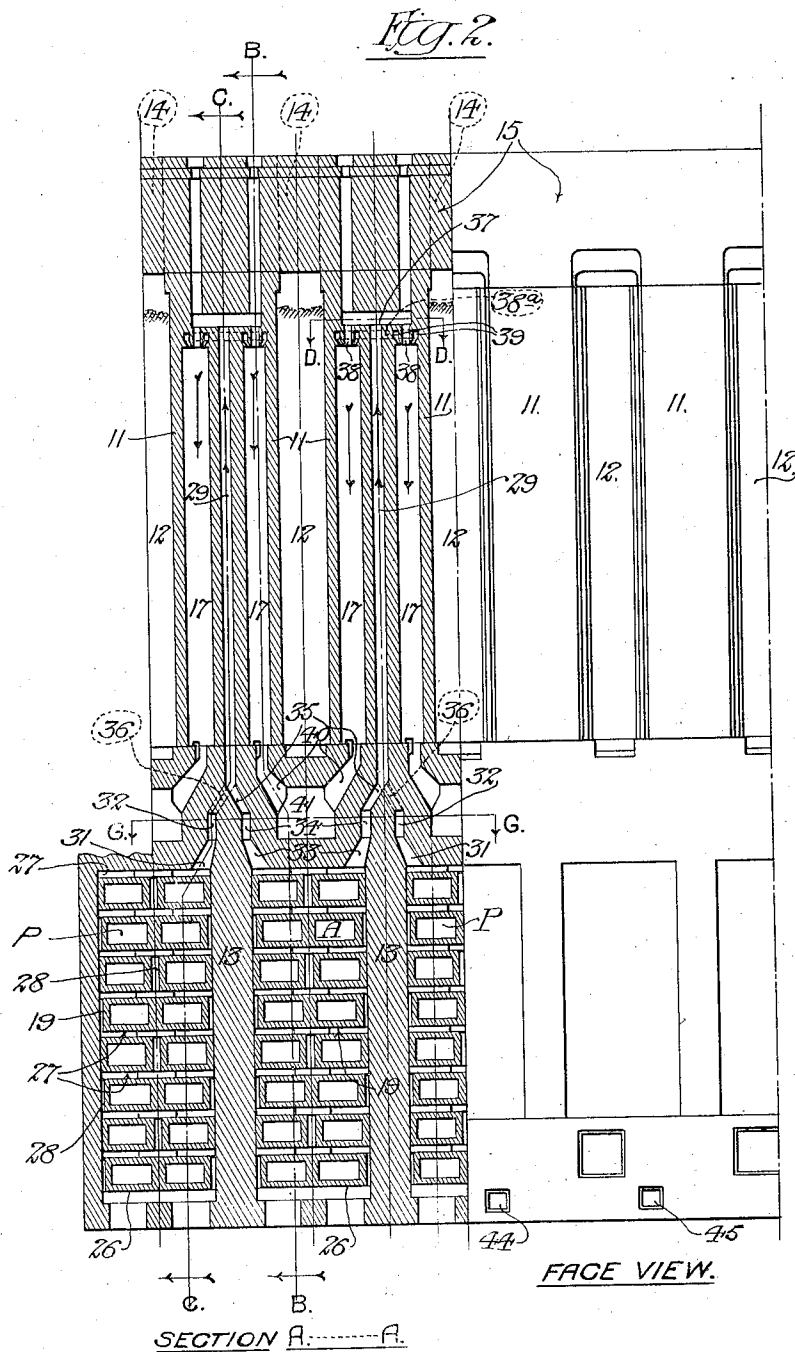
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3 Sheets-Sheet 2



Inventor:

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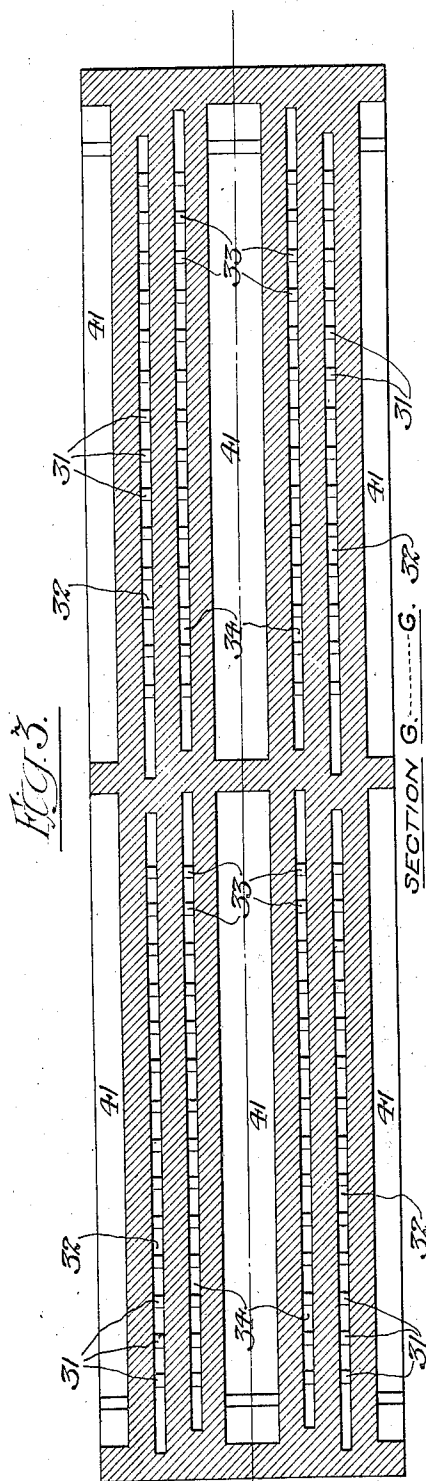
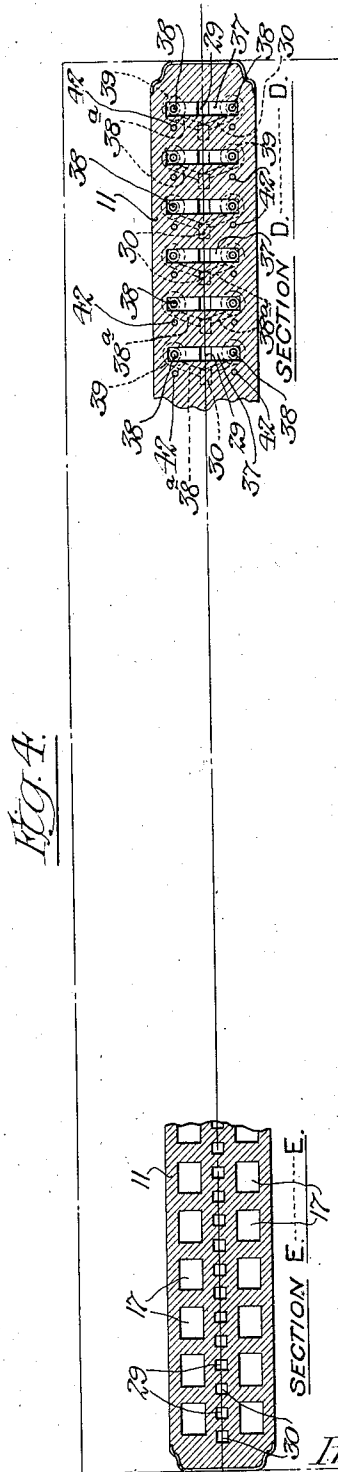
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RECUPERATIVE COKING RETORT OVEN

Filed Sept. 29, 1921

3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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RECUPERATIVE COKING RETORT OVEN

Application filed September 29, 1921. Serial No. 504,143.

This invention comprehends improvements of especial utility in the coking retort oven art. The invention has for an object to employ the gas oven principle in a coking retort oven having recuperators communicably connected with the heating walls, thereby providing a recuperative coking retort oven, in which the heat for coking the charges of coal in the retorts or coking chambers may be developed from the combustion of a preheated extraneously derived special generator gas, such as producer gas or blast furnace gas, with a resultant conservation of the entire product of the relatively richer coke oven gas derived from the carbonization of the coal charged into the retorts of the oven.

Another important characteristic of the invention is to permit the employment of the before mentioned gas oven principle in a recuperative coking retort oven having the combination oven features, whereby the oven may be optionally operated with the employment of the extraneously derived special generator gas as the fuel, or alternatively with the employment of coke oven gas burned in an atmosphere of ordinary preheated air or in an atmosphere containing both air and a neutral gaseous diluent, the latter having the function of lengthening the flames in the heating walls, so as to check flame concentration in the region of the fuel gas inlets.

In addition to the general objects recited above, the invention has for further objects such other improvements and advantages in construction or operation as may be found to obtain in the structures and devices hereinafter described or claimed.

In the accompanying drawings, forming a part of this specification and showing, for purposes of exemplification, a preferred form and manner in which the invention may be embodied and practiced, but without limiting the claimed invention to such illustrative instance or instances:

Figure 1 is a crosswise vertical sectional elevation through a coke oven battery embodying features above specified and equipped with the improvements of the present invention, the view being taken longitudinally through a heating wall and the com-

municably connected recuperators, in planes indicated by the lines B—B and C—C of Fig. 2;

Fig. 2 is a composite vertical sectional elevation and face view taken longitudinally of the coke oven battery, the sectional portion of the figure being on the plane indicated by the line A—A of Fig. 1;

Fig. 3 is a horizontal section taken in a plane indicated by the line G—G of Fig. 2; and,

Fig. 4 is a composite horizontal section of a heating wall taken in the planes indicated by the lines D—D and E—E of Figs. 1 and 2.

The same characters of reference designate the same parts in each of the several views of the drawings.

In the embodiment illustrated in the drawings, the invention is incorporated in a combination coke oven battery, i. e.—a battery having provision for being operated either with an extraneously derived special generator gas, such as producer gas or blast furnace gas, or with the coke oven gas derived from the distillation of the coal in the coking chambers of the battery. For convenience, the present description will be confined to the present illustrated embodiment of the invention in such a combination coke oven battery; novel features and improvements made by the invention are susceptible of other applications, such, for example, the coke oven principle may be employed in ordinary so-called "gas ovens" employing producer gas or blast furnace gas as the fuel; hence, the scope of the invention is not confined to the specific use and specific embodiment herein described as an illustrative example.

Referring to the drawings: there are illustrated views of a coke oven battery or plant of the by-product type, having features above specified; said oven battery embodies in its construction a plurality of crosswise elongated heating walls 11, 11, and a plurality of intermediate crosswise elongated coking chambers 12, 12. The heating walls 11 form the side walls of the respective coking chambers 12, as shown more particularly in Fig. 2, and together with the coking chambers are supported by the heavy supporting walls

13, 13, which extend crosswise of the battery and are located, as shown, below the heating walls. The supporting walls 13 collectively form the main support for the entire superstructure of the oven battery and are themselves supported upon a flat mat or platform which constitutes the sub-foundation on which the entire battery rests.

The coal to be coked is charged into the several coking members or ovens through charging holes 14 located in the top 15 of the oven battery and positioned, as shown by dotted lines in Fig. 2, directly above the retorts or ovens 12. These charging holes 14 are equipped with the usual removable covers, which are removed during charging of the individual ovens or retorts and are placed in position to close the tops of such retorts during the entire coking or distilling operation. The gases of distillation pass from the tops of the retorts 12 through the usual gas outlets (not shown), and thence through ascension pipes (not shown) into the usual gas collecting main, which carries the distillation products to the by-product recovery apparatus.

Heat for coking the charges of coal in the several ovens or retorts 12 is derived from the heating walls 11, which, as above mentioned, extend crosswise of the battery at the sides of the retorts. As shown, each heating wall 11 is, in accordance with the present embodiment of the invention, constituted of a plurality of vertical combustion flues 17 which extend in two series parallel with the longitudinal axis of the heating wall. Both series of flame flues of each heating wall, in accordance with the present embodiment of the invention, operate concurrently as burning flues and combustion is maintained concurrently in all the flues of the heating walls of the battery, the flames burning downwardly from top to bottom of the several flues, as will be hereinafter more fully explained.

The recuperators 19 of the retort oven or battery preferably extend crosswise of the battery from the opposite sides thereof inwardly to the central dividing partition 20, and are located at a lower level than the afore-said heating walls 11 and coking chambers or retorts 12. Each recuperator unit 19 is constituted of a plurality of superposed horizontal exhaust passages 21, for the outflow of the products of combustion and waste gases from the heating walls above mentioned. The exhaust passages 21 of each recuperator preferably extend parallel with the crosswise axis of the battery and said exhaust passages of each individual recuperator unit are communicably connected together at their inner ends by means of a vertical channel 22. At their outer ends, the upper exhaust passages 21 of each recuperator unit are communicably connected together by an upper vertical channel 23, and the lower exhaust

passages by a lower vertical channel 24, the said upper vertical channel 23 being separated from the lower vertical channel 24 by means of a baffle 25, in order to force the waste gases which enter the upper vertical channel 23 to pass inwardly through the upper exhaust passages 21 to the inner vertical channel 22 and thence outwardly through the lower exhaust passages 21 to the lower exhaust channel 24. This construction insures complete circulation of the hot waste gases through the exhaust passages of each recuperator unit. The inflow passages 26 of each recuperator unit 19 extend along three sides of the above mentioned exhaust passages 21, said inflow passages 26 being constituted of horizontal passageways 27 communicably connected with vertical passageways 28, to produce the tortuous inflow passages shown more particularly in Fig. 2. As shown in Fig. 1, the several inflow passages 26 of each recuperator unit 19 are individually separated from each other by means of baffles 29^a which divide the inflow through the recuperator into streams individual to the individual inflow passages.

The inflow through each recuperator unit is preheated by effecting a heat exchange between the waste gases from the heating walls, which waste gases flow through the exhaust passages of each recuperator unit. In accordance with the invention, the recuperator units 19 are disposed, taken seriatim longitudinally of the battery, in two groups P and A of recuperator units, the recuperator units of the group P alternating with the recuperator units of the group A, as shown in Fig. 2.

Located between the two parallel series of combustion flues 17 of each heating wall are two series 29 and 30 of vertical feed channels, the feed channels of the series 29 of each heating wall alternating with the feed channels of the series 30 of the same heating wall. Referring more particularly to Figs. 1, 2 and 3, the inflow passages 26 of each recuperator unit of the alternate series P are communicably connected by means of two series of ducts 31 with two horizontal feed channels 32, said feed channels being respectively located at the opposite sides of their communicably connected recuperator unit and extending parallel therewith. Similarly, the inflow passages 26 of the recuperator units of the intermediate series A are each communicably connected by two series of ducts 33 with similarly located horizontal feed channels 34.

The series of vertical feed channels 29 of each two adjacent heating walls 11 are respectively communicably connected by ducts 35 with the horizontal feed channels 34 of the adjacent recuperator unit 19 of the group A. The series of vertical feed channels 30 of each two adjacent heating walls are also communicably connected by ducts 36 with the horizontal feed channels 32 of the adjacent recuperator of the group P. With this con-

struction each heating wall 11 is communicably connected by a series of feed channels with a pair of recuperator units, one of the group P and the other of the group A.

5 At their tops, the feed channels of the series 29 respectively open up into short horizontal channels 37, which respectively communicate by ports 38 with two flame flues 17, one of each of the two series. The vertical
10 feed channels of the series 30 also respectively open up into short horizontal channels 38^a the latter each communicating by annular ports 39 with one flame flue of each parallel series of a heating wall.

15 The two adjacent series of flame flues 17 of each pair of adjacent heating walls respectively communicate at their lower ends by outflow ducts 40 with a common outflow passageway 41, the bottom of the latter preferably
20 inclining downwardly from the inner longitudinal median plane of the battery toward the outer side thereon, as shown in Fig. 1. Each said outflow passageway 41 is communicably connected at its discharge end
25 with the upper outer vertical channel 23 of the adjacent recuperator unit. With the above construction, the lower ends of the two series of flame flues of the heating walls are communicably connected by outflow passage-
30 way and duct means with the outflow passages of the adjacent recuperator units, as shown in Fig. 2.

Extending through the top 15 of the battery into the tops of the several flame flues
35 17 of each heating wall 11 are vertical gas supply ducts 42. These gas supply ducts are for the purpose of supplying coke oven gas to the several flame flues of each heating wall, when the battery is operating with coke oven
40 gas as the fuel. The supply of coke oven gas to the respective ducts 42 is derived from coke oven gas mains of the usual type located on the top of the battery. Suitable means is provided for admitting or cutting off the supply of coke oven gas with respect to the ducts
45 42, it being understood that the coke oven gas supply may be cut off when the battery is operating with the extraneously derived gas, such as producer gas, as the fuel.

50 For operating the battery alternatively with the use of a special generator gas, such as producer gas or blast furnace gas as the fuel, the feed channels 43 below the several recuperator units of the group P may be connected with a gas main for feeding such gas
55 through the ports 44, so that the extraneously derived gas may be directed into the inflow passages 26 of the alternate recuperator units and conveyed through these recuperator units ultimately into the tops of the burning
60 flame flues 17. The operation of the retort oven or battery when employing a special generator gas for fuel is as follows: The supply of coke oven gas to all of the coke oven gas ducts 42 is cut off. A supply of producer

gas is permitted to flow into the feed channels 43 of the gas recuperators P and passing through the tortuous inflow passages 26 of such recuperators is preheated by the hot waste gases flowing out through the exhaust
70 passages 21 before being delivered into the horizontal feed channels 32 and vertical feed channels 30. From the tops of the vertical feed channels 30 the preheated fuel gas passes through the short channels 38^a and ports 39
75 into the flame flues of both series of each heating wall. During the inflow of fuel gas through such recuperators P, inflow of air is maintained through the air ports 45 and feed channels 46 of the recuperators of the
80 group A. Passing upwardly through the inflow passages 26 of the recuperators A the air is preheated by the outflowing waste gases in the exhaust passages 21 and the preheated air enters the feed channels 34 and rising in the vertical feed channels 29 passes through the short channels 37 and enters the tops of the several flame flues 17 through the ports
85 38. The flames burn downwardly in the flues 17 and the exhaust gases pass out of said flues from their bottoms through the ducts 40 and into the passages 41 which convey the waste products into the outer vertical chan-
90 nels 23 of the several recuperators. From said channels 23 the waste products pass through the upper exhaust passages 21 inwardly to the inner vertical channels 22 and then circulate through the lower passages 21 to the lower outer vertical channels 24 of the recuperators, from which channels 24 the
95 waste gases discharge through ports 47 to a suitable waste gas tunnel.

In operating the battery with coke oven gas, the supply of extraneously derived gas to the recuperators of the group P is shut off
105 and air is permitted to flow into such recuperators in place of the fuel gas. During coke oven gas operation a supply of coke oven gas is maintained in the ducts 42 which feed the burning flues.

Alternatively, during such coke oven gas operation, some of the recuperators, such as the recuperator P, may be employed for conveying to the flues a neutral gaseous diluent, such as return waste gas, to lengthen the
115 flames in the flues, for the purpose of preventing flame concentration in the upper regions of the battery. The recuperators P may be employed entirely for the preheating of return waste gas or return waste gas may be mixed with air and fed through the recuperators to the flues.

The invention as hereinabove set forth is embodied in a particular form of construction but may be variously embodied within
125 the scope of the claims hereinafter made.

I claim:

1. In a coking retort oven, in combination: a plurality of coking chambers; heating walls contiguous to such coking chambers and re- 130

spectively comprising two series of vertical combustion flues of which the flues of each series are contiguous to each other; recuperator units, having inflow and outflow passages, disposed at a lower level than the aforesaid coking chambers and heating walls, said recuperator units being disposed into two series, the recuperator units of one series alternating with the recuperator units of the other; duct means communicably connecting the inflow passages of recuperator units of both series with the tops of both series of combustion flues of each heating wall; duct means communicably connecting the bottoms of both series of combustion flues with the outflow passages of such recuperator units; and separate fuel gas connections also communicably connected with the tops of both series of such combustion flues; substantially as specified.

2. In a coking retort oven, in combination: a plurality of coking chambers; heating walls contiguous to such coking chambers and respectively comprising two series of vertical combustion flues of which the flues of each series are contiguous to each other; recuperator units, having inflow and outflow passages, disposed at a lower level than the aforesaid coking chambers and heating walls, said recuperator units being disposed into two groups; duct means communicably connecting the inflow passages of recuperator units of both groups with the tops of both series of combustion flues of each heating wall; duct means communicably connecting the bottoms of both series of combustion flues with the outflow passages of such recuperator units; and separate fuel gas connections also communicably connected with the tops of both series of such combustion flues; substantially as specified.

3. In a coking retort oven, in combination: a plurality of coking chambers; heating walls contiguous to such coking chambers and respectively comprising two series of combustion flues of which the flues of each series are contiguous to each other; recuperator units, having inflow and outflow passages, disposed at a lower level than the aforesaid coking chambers and heating walls, said recuperator units being disposed into two groups; duct means communicably connecting the inflow passages of recuperator units of both groups with both series of combustion flues of each heating wall; duct means communicably connecting both series of combustion flues with the outflow passages of such recuperator units; and separate fuel gas connections also communicably connected with both series of such combustion flues; substantially as specified.

4. In a recuperative coking retort oven having a plurality of coking chambers and heating walls contiguous to such coking chambers, said walls respectively comprising contiguous concurrently operable flame flues, combined

with the improvements characterized by recuperators disposed into two groups, one recuperator of each group being communicably connected with one end of the flues of a single heating wall, whereby air and an extraneously derived fuel gas may be conveyed to the flues of each heating wall; duct means communicably connecting the other end of the aforesaid flues of said single heating wall with the recuperators; and separate fuel gas connections also leading to said one end of the flues of said heating walls, for conveying thereto an alternative fuel gas; substantially as specified.

5. In a recuperative coking retort oven having a plurality of coking chambers and heating walls contiguous to such coking chambers, said walls respectively comprising contiguous concurrently operable flame flues, combined with the improvements characterized by recuperators disposed into two groups, one recuperator of each group being communicably connected with one end of the flues of a single heating wall, whereby air and an extraneously derived fuel gas may be conveyed to the flues of each heating wall; and duct means communicably connecting the other end of the aforesaid flues of said single heating wall with the recuperators; substantially as specified.

6. In a recuperative coking retort oven having a plurality of coking chambers, and heating walls contiguous to such coking chambers, said walls respectively comprising contiguous concurrently operable flame flues, combined with the improvements characterized by recuperator units disposed in two groups with one recuperator unit of each group communicably connected with the flues of a single heating wall, whereby said recuperator units may be jointly employed for conveying to said flues air or separately employed for conveying thereto air and another gas, and outflow duct means also communicably connecting the flues of each heating wall with said recuperators; substantially as specified.

7. In a coking retort battery having a plurality of coking chambers, and heating walls contiguous to such coking chambers, said walls respectively comprising contiguous concurrently operable flame flues, combined with the improvement characterized by two individual recuperator units communicably connected with the flues of each heating wall, whereby air and another gas may be individually fed by such recuperator units to said heating walls; substantially as specified.

8. A recuperative coke oven provided with coking chambers, heating walls contiguous to such coking chambers and respectively comprising contiguous concurrently-operable downburning combustion flues, and fuel gas and air recuperators arranged below and having their inflow passages communicating with

the flues of each heating wall; substantially as specified.

9. A recuperative coking oven provided with coking chambers, heating walls contiguous to such coking chambers, said walls respectively comprising contiguous concurrently operable flame flues, and fuel gas and air recuperators arranged below and both communicably connected with the flues of each heating wall for supplying thereto the gas and air required for combustion in said heating wall; substantially as specified.

10. In a recuperative coking retort oven, in combination: a plurality of coking chambers, heating walls contiguous to such coking chambers, said walls respectively comprising contiguous concurrently operable flame flues, combined with individual recuperator units which are respectively communicably connected in pairs with the flues of the heating walls, the recuperator units of such pairs being separately operable for conveying to the said heating walls air and another gas; substantially as specified.

11. In a coking retort oven having a plurality of coking chambers and heating walls contiguous to such coking chambers, said walls respectively comprising contiguous concurrently operable flame flues, combined with the improvement characterized by recuperator units which are respectively communicably connected in pairs with the flues of said heating walls, the recuperator units of each pair being jointly operable for conveying air to the heating walls or separately operable for conveying to the said heating walls air or an extraneously derived gas, and means for supplying, at will, to said heating walls an alternative fuel gas, such as coke oven gas; substantially as specified.

12. In a coking retort oven having a plurality of coking chambers and heating walls contiguous to such coking chambers, said walls respectively comprising contiguous concurrently operable flame flues, combined with the improvement characterized by recuperator units which are respectively communicably connected in pairs with the flues of said heating walls, the recuperator units of each pair being jointly operable for conveying air to the heating walls or separately operable for conveying to the said heating walls air or an extraneously derived gas; substantially as specified.

13. In a coking retort oven, in combination: a coking chamber; a heating wall contiguous to said coking chamber and comprising contiguous concurrently operable flame flues; preheaters for preheating air and other gas by a heat exchange between waste gas from said flame flues and said air and said other gas while said waste gas is flowing countercurrent to the flow of said air and said other gas; duct means communicably connecting said preheaters with one end

of the flues of the heating wall; and means for removing the products of combustion from the other end of said flues; substantially as specified.

14. In a coking retort oven, in combination: parallel coking chambers; heating walls between said coking chambers and respectively having their interiors flued for passage of combustion gases in a generally vertical direction from their upper portions to their lower portions; recuperator units, having inflow passages and outflow passages, below the coking chambers and heating walls; said recuperator units being respectively communicably connected in groups with the flue spaces for passage of combustion gases in said heating walls by duct means connecting the inflow passages of said groups with the said flue spaces at the upper portions of said heating walls and by duct means connecting the outflow passages of said groups with said flue spaces at the lower portions of said heating walls; the recuperator units of each of said groups being jointly operable for conveying air to the said flue spaces in said heating walls or separately operable for conveying to the said flue spaces in the heating walls air or another gas; and means for supplying, at will, to said flue spaces in said heating walls, at the upper portions of said heating walls, an unpreheated combustible gas; substantially as specified.

15. In a coking retort oven, in combination: parallel coking chambers; heating walls between said coking chambers and respectively having their interiors flued for passage of combustion gases in a generally vertical direction from their upper portions to their lower portions; recuperator units, having inflow passages and outflow passages, below the coking chambers and heating walls; said recuperator units being respectively communicably connected in groups with the flue spaces for passage of combustion gases in said heating walls by duct means connecting the inflow passages of said groups with the said flue spaces at the upper portions of said heating walls and by duct means connecting the outflow passages of said groups with said flue spaces at the lower portions of said heating walls; the recuperator units of each of said groups being separately operable for conveying to the said flue spaces in the heating walls air and another gas; and means for supplying to said flue spaces in said heating walls, at the upper portions of said heating walls, an unpreheated combustible gas; substantially as specified.

16. In a coking retort oven, in combination: parallel coking chambers; heating walls between said coking chambers and respectively having their interiors flued for passage of combustion gases in a generally vertical direction from their upper portions to their lower portions; recuperator units, having in-

flow passages and outflow passages, below the coking chambers and heating walls; said recuperator units being respectively communicably connected in groups with the flue spaces for passage of combustion gases in said heating walls by duct means connecting the inflow passages of said groups with the said flue spaces at the upper portions of said heating walls and by duct means connecting the outflow passages of said groups with said flue spaces at the lower portions of said heating walls; the recuperator units of each of said groups being separately operable for simultaneously preheating both air and fuel gas for the said flue spaces in the heating walls; and means for supplying to said flue spaces in said heating walls, at the upper portions of said walls; an unpreheated combustible gas; substantially as specified.

17. In a coking retort oven, in combination: a coking chamber; a heating wall contiguous to said coking chamber and having combustion chamber means therein adapted for heating said coking chamber by flow of combustion gases in a generally vertical direction from one to the other of two opposite upper and lower portions thereof; recuperators, having inflow passages for inflow of combustion media from said recuperators to said combustion chamber means and outflow passages for outflow of waste gas from said combustion chamber means to said recuperators, for separately and simultaneously preheating air and another gas and each communicably connected with the combustion chamber means by duct means remote from said coking chamber relative to the combustion chamber means; the duct means which leads from said inflow passages of each of said recuperators porting into the said combustion chamber means at one of said portions of the heating wall, and the duct means which leads from the combustion chamber means to said outflow passages of each of said recuperators porting out of the combustion chamber means at the other portion of the heating wall; and the duct means which communicates with the combustion chamber means at the upper portion of the heating wall being arranged within the heating wall; substantially as specified.

18. In a coking retort oven, in combination: parallel coking chambers; heating walls between said coking chambers and respectively having therein combustion chamber means adapted for heating said coking chambers by flow of combustion gases in a generally vertical direction from their upper portions to their lower portions; recuperator units, having inflow passages for inflow of combustion media from said recuperators to said combustion chamber means and outflow passages for outflow of waste gas from said combustion chamber means to said recuperators, below the coking chambers and heating walls; said recuperator units being respectively commu-

nicably connected in groups with the combustion chamber means by duct means remote from said coking chambers relative to the combustion chamber means; the duct means which leads from said inflow passages of said groups being arranged within the heating walls and porting into the said combustion chamber means at the upper portions of said heating walls, and the duct means which leads from the combustion chamber means to said outflow passages of said groups porting out of said combustion chamber means at the lower portions of said heating walls; and the recuperator units of each of said groups being separately operable for separately and simultaneously preheating air and another gas.

In testimony whereof I have hereunto set my hand.

JOSEPH VAN ACKEREN.