Aug. 16, 1932. J. VAN ACKEREN 1,872,532

COKING RETORT OVEN

Filed June 22, 1928 4 Sheets-Sheet 1

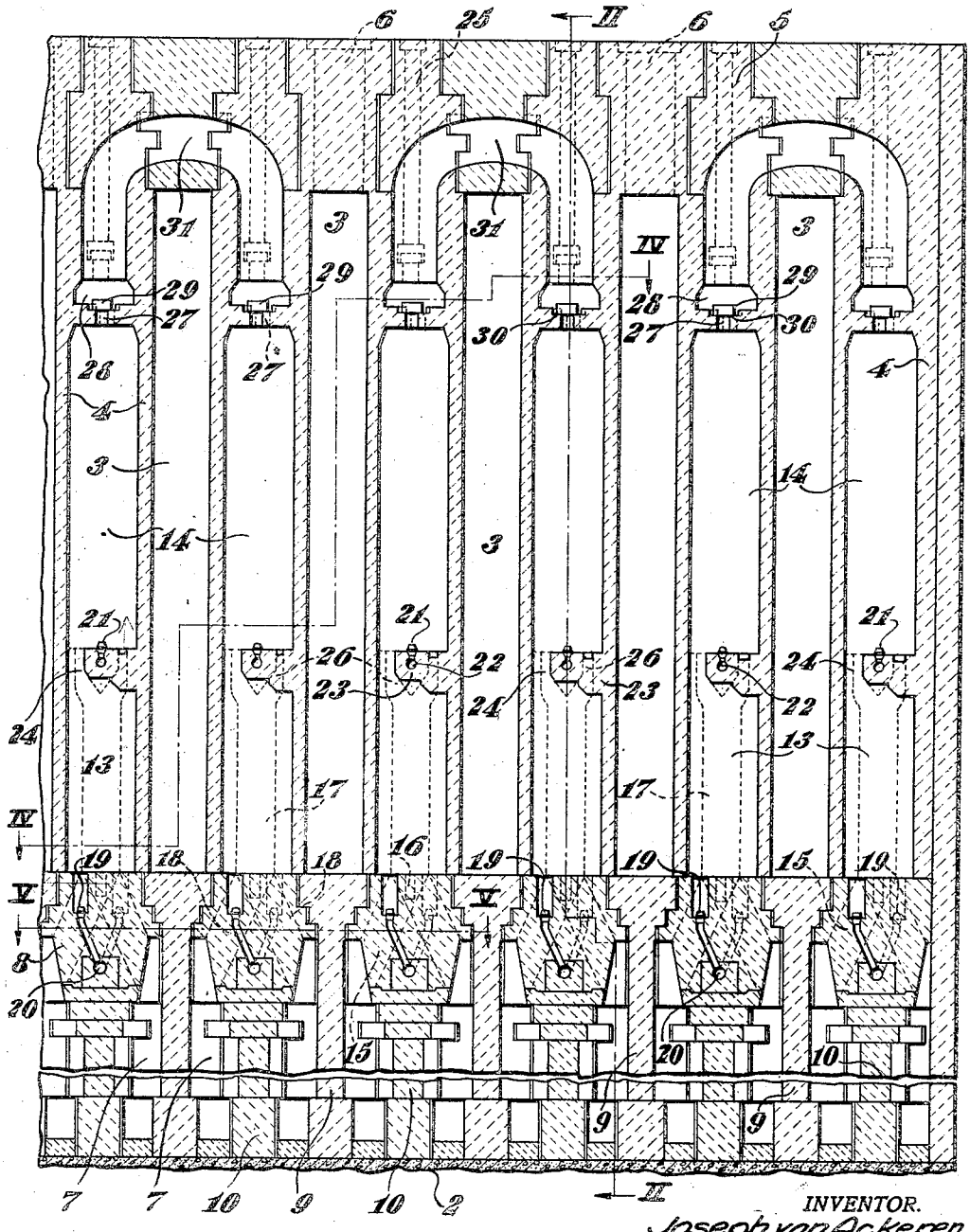


Fig. 1

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COKING RETORT OVEN

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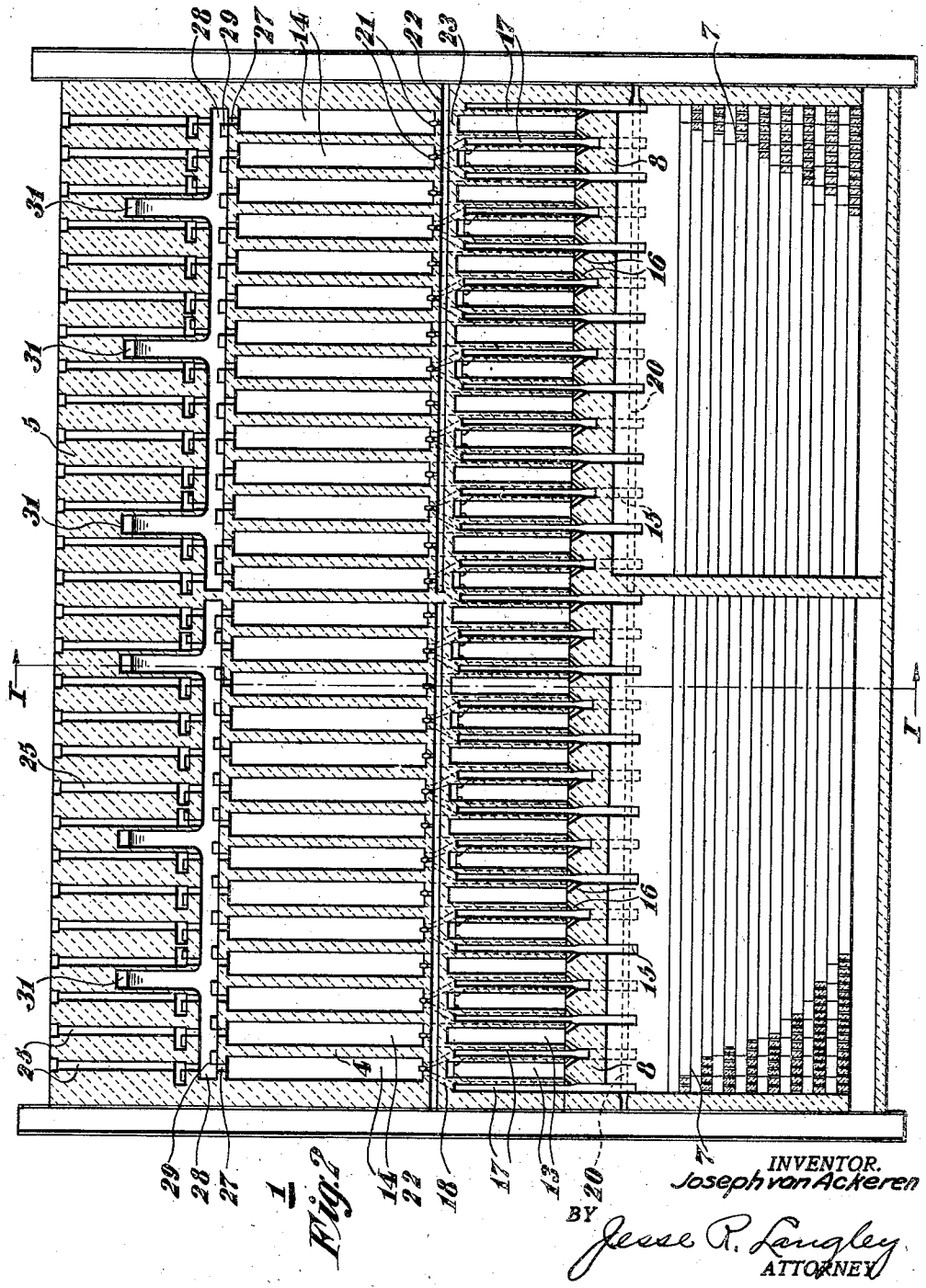


Fig. 2

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COKING RETORT OVEN

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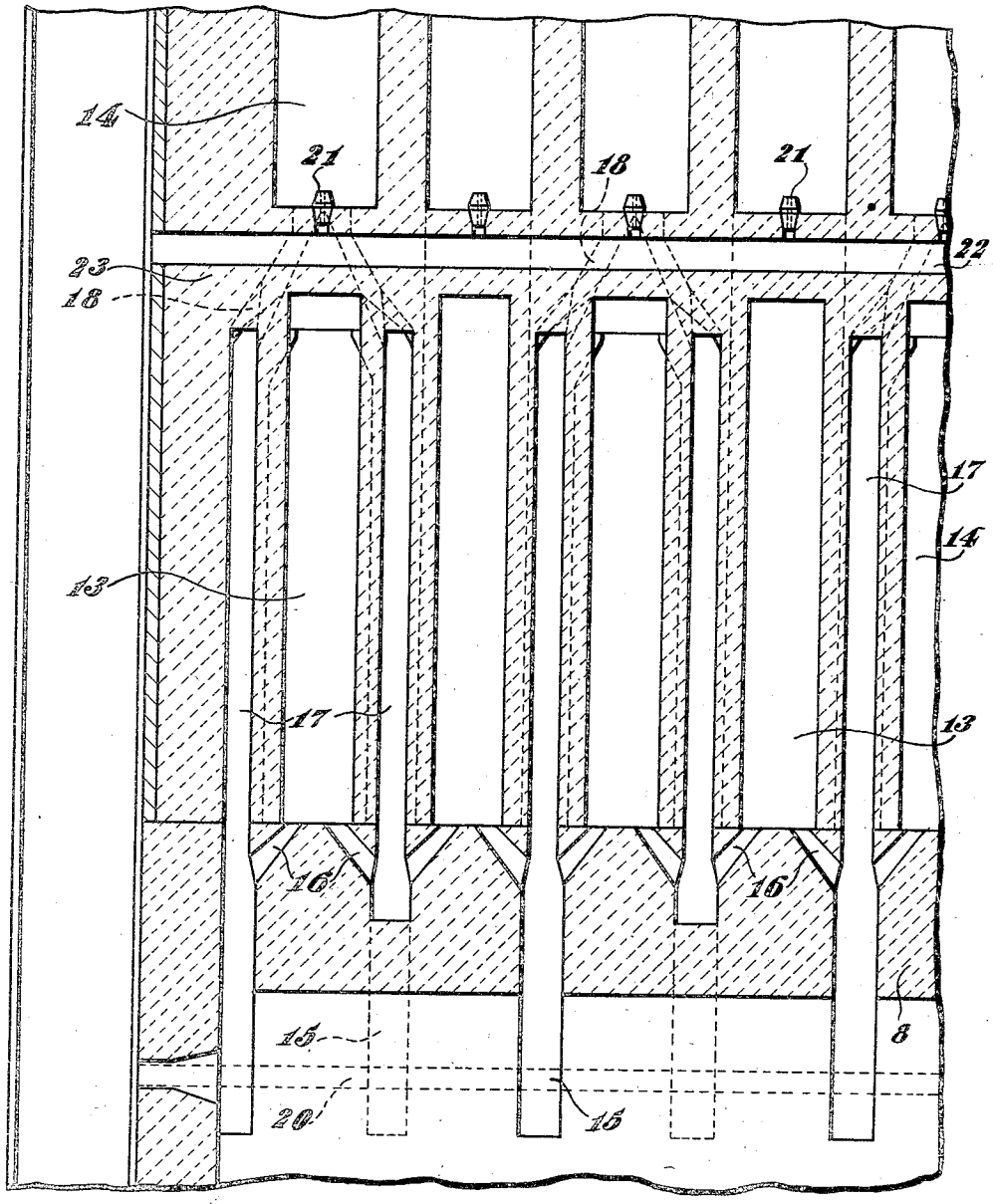


Fig. 3

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COKING RETORT OVEN

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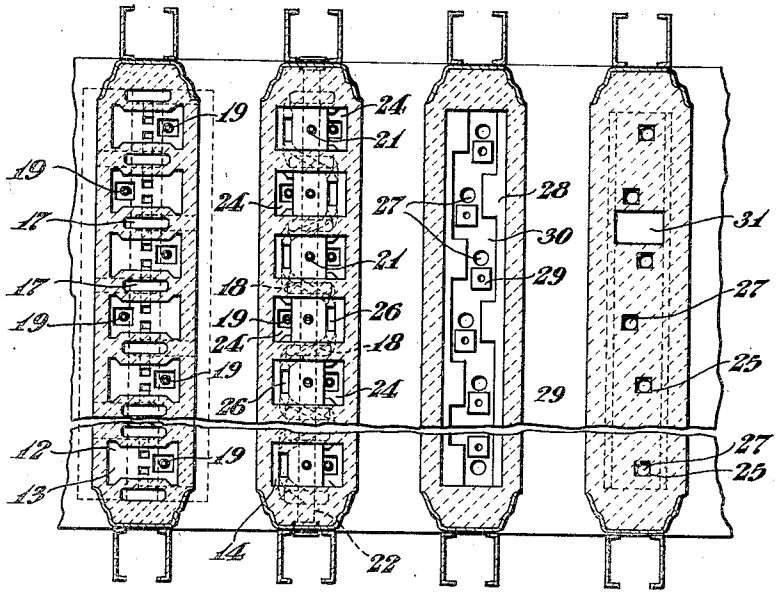


Fig. 4

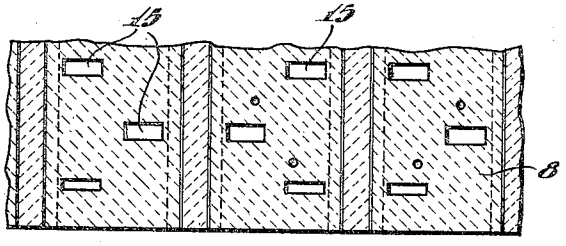


Fig. 5

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UNITED STATES PATENT OFFICE

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COKING RETORT OVEN

Application filed June 22, 1928. Serial No. 287,408.

My invention relates to coking retort ovens and particularly to heating systems for high-chambered ovens of the horizontal type.

It is an object of the present invention to provide improved means for heating the coking chambers of horizontal coking retort ovens whereby the coking chambers may be of relatively great height.

A further object of my invention is to provide a battery of coking retort ovens of greatly increased height that may be adequately heated by means that are accessible for inspection and adjustment.

A further object of my invention is to provide a structure for producing combustion in a plurality of zones in the flame flues of coke ovens, the component parts of which structure are accessible for inspection and adjustment and that operate to heat equally the opposite sides of the heating walls containing the flame flues.

It is a still further object of my invention to provide a heating system for high-chambered ovens of the horizontal type in which primary and secondary combustion is employed and the respective zones of combustion may be supplied with either rich gas or lean gas for fuel.

Horizontal coking retort ovens as at present constructed comprise coking chambers having a maximum height of approximately 13 to 14 feet. It is not practicable to extend the height of the coking chambers of coke-oven batteries as at present constructed to any great extent because the means for heating the same would be entirely inadequate. It is not possible to supply sufficient gas and air and to maintain combustion throughout the height of the flame flues to such uniform degree as would be necessary to effect the uniform coking of the coal in a vertical plane.

It is highly desirable that the capacity of the coking chambers be increased in order that the output of the ovens may be correspondingly increased without a proportional increase in the cost of construction and operation. In other words, within limits, the efficiency of the battery is increased by increasing the capacity of the ovens.

In accordance with the present invention, I provide coking chambers that are approximately 18 feet in height and that are adequately heated by a system that constitutes a number of improvements over the prior art. The heating walls are provided with flame flues in which combustion occurs in two zones. Either rich gas or lean gas is supplied to one end of each of the sections comprising the flame flues and the gases of combustion of one of the sections passes into the second section and dilutes the combustion occurring in the latter.

Rich gas is supplied through gas guns and nozzles in the respective sections of the flame flues that are so located that both nozzles of a flue are visible from an inspection opening with which each of the flues is provided. Lean gas is supplied to each of the sections through ducts that are substantially centrally located in each of the lower sections of the flame flues and are staggered horizontally in the upper sections, alternate ducts being adjacent opposite sides of the heating wall. The communicating openings between the sections of each flue are staggered oppositely to the lean gas ducts. The nozzles for rich gas in the lower sections are staggered similarly to the communicating openings in such manner that they are always visible through the latter.

Accordingly, both of the nozzles for rich gas are always visible from the inspection opening which are also staggered in order that they may be in alinement with the communicating openings and the nozzles of the lower section. The alternate arrangement of the several nozzles for rich gas, ducts for lean gas and the communicating openings insure that opposite sides of the heating walls are substantially equally heated.

The details of my invention will be described in connection with the accompanying drawings, in which

Figure 1 is a view in longitudinal section of a portion of a coke-oven battery taken on line I—I of Fig. 2;

Fig. 2 is a transverse sectional view of the battery taken on line II—II of Fig. 1;

Fig. 3 is an enlarged view of a portion of the structure of Fig. 2;

Fig. 4 is a broken sectional view, taken on line IV—IV of Fig. 1; and

Fig. 5 is a fragmentary sectional view, taken on line V—V of Fig. 1.

A coke-oven battery 1, constructed in accordance with my invention, comprises a foundation 2, upon which are located a series of coke ovens comprising coking chambers 3 that alternate with heating walls 4. The number of ovens and their corresponding heating walls may be of any desired or convenient number, only a few of which are shown in the drawings by way of example. The battery is provided with a roof 5, through which suitable charging openings 6 are provided for each of the coking chambers 3.

Beneath the coking chambers and heating walls are two series of regenerators 7, the regenerators of each series extending transversely half the width of the battery. The regenerators 7 are of the usual checkerwork type and are located between the foundation 2 and brickwork 8 constituting the bottom or floor of the several ovens. The regenerators 7 are separated from each other by means of pillar walls 9 and 10 for respectively supporting the coking chambers 3 with their contents and the heating walls 4.

Each heating wall 4 is provided with a series of vertical flame flues 12 that are divided into lower sections 13 and upper sections 14 in which primary and secondary combustion occur, respectively. The number of flame flues in each heating wall may be any desired number, twenty-eight being shown by way of example in Fig. 2.

Each of the flame flues 12 is connected at the bottom portion thereof through inclined ducts 15 and branch ducts 16 to the regenerators 7 that are beneath the respective heating walls and adjacent to each other. The upper section of each flame flue is also connected to the same regenerators by means of the inclined ducts 15 and vertical ducts 17 that extend between the flame flues 12 and are each connected by branch ducts 18 to two adjacent flame flues. The connections just described are those employed for supplying the upper and the lower sections of the flame flues with producer gas or for conveying products of combustion in accordance with the direction of the gases through the heating system.

Each of the flame flues is provided at its lower end with a nozzle 19 that is connected to a gas gun 20 for supplying rich gas. The upper sections 14 of the flame flues are each provided with a centrally located nozzle 21 that is connected to a gas gun 22 for supplying rich gas. The gas guns 22 of the battery extend through intermediate brickwork 23 which divides the flues 12 into its sections 13 and 14 and which also supports the nozzles 21. The brickwork 23 is provided with communicating openings 24 between the lower and upper sections 13 and 14.

By reference to Figs. 1 and 4, it will be noted that the nozzles 19 in a series of flues are alternately located adjacent opposite sides of the heating wall—that is, the nozzles 19 are staggered horizontally. The openings 24 are similarly staggered, as are inspection openings 25 with which each of the flame flues is provided. Accordingly, the inspection openings 25, communicating openings 24 and nozzles 19 are in alinement whereby the latter may be viewed through the inspection openings, as may also the nozzles 21.

The port 26 for the introduction of lean gas and air through the inclined ducts 18 into each of the upper sections 14 is staggered oppositely to the communicating openings 24. Each of the vertical flame flues 12 is connected through a duct 27 to a horizontal flue 28. The ducts 27 are staggered and are in alinement with inspection openings 25. As best shown in Fig. 2, each horizontal flue 28 extends half the width of the battery, two horizontal flues being in alinement and each being connected to fourteen of the vertical flame flues. The regulation of the amount of gases passing through the ducts 27 is accomplished by sliding bricks 29 that are located in a groove 30 in the bottoms of the horizontal flues 28.

The horizontal flues 28 of adjacent heating walls are connected in pairs by means of cross-over flues 31, six being employed for each pair of heating walls. This arrangement provides that each pair of heating walls is a unit of the heating system of the battery, combustion occurring in one of the heating walls and the gases of combustion passing upwardly over the intervening coking chamber and downwardly through the other heating wall. The direction of flow is reversed periodically.

In the operation of the battery, for example, by lean gas, such as producer gas, gas and air are supplied by adjacent regenerators 7 to one member of each pair of heating walls that are connected by cross-over flues in the manner previously described. For example, it may be assumed that producer gas is supplied through an inclined duct 15 and that air is supplied through an adjacent inclined duct 15 to the lower section 13 of each of the flame flues of one half of the heating walls of the battery.

Combustion occurs at the entrance of the gases to the flame flues and the gases of combustion pass upwardly and through the communicating openings 24. Gas and air are also supplied through the vertical ducts 17 from the same regenerators to the upper sections of the flues through the ports 26.

The secondary combustion occurring in the upper sections 14 is diluted by the gases of combustion from the primary zone and the resulting gases of combustion pass upwardly through the ducts 27 and along the horizontal

flues 28 into the cross-over flues 31 and then are distributed by the horizontal flue 28 in the connected wall and pass downwardly through the flame flues and the various ducts connected thereto in directions reverse to those described in connection with the heating wall in which combustion occurs.

The gases of combustion pass downwardly through the several regenerators connected to the heating walls in which downward flow occurs and are conveyed to the stack where they escape to the atmosphere. The regenerators and the heating walls are connected in such maner that air and gas are passing upwardly through one-half of the regenerators while hot gases of combustion are passing downwardly through the remaining half. The regenerators are connected in such manner that those conveying air are always interposed between regenerators carrying producer gas and those carrying gases of combustion.

In case rich gas, such as coke-oven gas, is employed, the fuel gas is transmitted through the several gas guns 20 and 22 and their connected nozzels 19 and 21 to the several sections of one-half of the heating walls in the manner described above in connection with producer gas. The regenerators and ducts which conveyed producer gas are now employed to convey air in addition to those previously employed for this purpose. The same ducts and regenerators convey waste gases as in the previous arrangement.

By means of the arrangement described above, I am enabled to provide means for adequately heating horizontal coking retort ovens of materially greater height than has been possible heretofore with the means previously employed. Material economies are secured by the operation of high-chambered coking retort ovens because the capacity of the battery is increased without a corresponding outlay for construction and operating equipment. There is very small additional cost, also, for labor in the operation of my improved ovens.

The construction of the superposed sections of the flame flues is such that operating conditions may be observed in each of them from the inspection openings and the nozzles may be removed or inserted therethrough for inspection and replacement.

By means of the alternate or staggered arrangement of the nozzles for rich gas, the communicating openings through the horizontal brickwork and the ports for the introduction of producer gas in the upper sections, both sides of each heating wall are substantially equally heated. The distances between alternate heating flues being relatively small, the temperatures of the various portions of the walls are substantially equalized.

The foregoing and other advantages will be apparent to those skilled in the art of operation of coking retort ovens. My invention is not to be limited except as expressed in the claims.

I claim as my invention:

1. In a coking retort oven, a coking chamber and a heating wall therefor, flame flues in said heating wall each comprising two communicating sections and means comprising inlet openings for supplying rich gas and lean gas respectively to each of said sections, the inlets for rich gas in similarly disposed sections being substantially on the longitudinal axes of said flues, respectively, the inlets for lean gas in the other sections being similarly disposed and the other inlets in each section being spaced from said axes adjacent a side of the heating wall.

2. In a coking retort oven, a coking chamber and a heating wall therefor, flame flues in said heating wall each comprising two communicating sections and means comprising inlet openings for supplying rich gas and lean gas respectively to each of said sections, the inlets for rich gas in similarly disposed sections being substantially on the longitudinal axes of said flues, respectively, the inlets for lean gas in the other sections being similarly disposed and the other inlets in each section being spaced from said axes alternately adjacent opposite sides of the heating wall, the inlets in each flue being staggered in opposite directions.

3. In a coking retort oven, a coking chamber, heating walls therefor, vertical flame flues in said heating walls, each of said flame flues comprising two superposed sections, and means comprising inlets spaced from the sides of said flame flues for supplying fuel gases to each of said sections, each of said flame flues having an inspection opening and an opening between said sections in alinement with said inspection opening and one of said inlets.

4. In a coking retort oven, a coking chamber, heating walls therefor, vertical flame flues in said heating walls, each of said flame flues comprising two superposed sections with a communicating opening therebetween, and means comprising inlets for supplying fuel gases to each of said sections at the lower ends thereof for combustion therein, one of said inlets and the communicating opening of each of said flues being staggered with respect to those of adjacent flues whereby they are alternately adjacent to opposite sides of the heating wall.

5. In a coking retort oven, a coking chamber, heating walls therefor, two adjacent flame flues in one of said walls, each of said flame flues being in two sections having a communicating opening therebetween, and means comprising inlets for supplying fuel gases to each of said sections at one end thereof for combustion therein, the communicat-

ing opening and an inlet of one of said sections of one of said flues being adjacent one side of the heating wall and the communicating opening and the corresponding inlet of the other of said flues being adjacent the opposite side of said heating wall.

6. In a coking retort oven, a coking chamber, heating walls therefor, two adjacent flame flues in one of said walls, each of said flame flues being in two sections having a communicating opening therebetween, and means comprising inlets for supplying fuel gases to each of said sections at one end thereof for combustion therein, the communicating opening and an inlet of one of said sections of one of said flues being adjacent opposite sides of the heating wall and the relative positions of the communicating opening and the corresponding inlet of the other of said flues being reversed.

7. In a coking retort oven, a coking chamber, heating walls therefor, a plurality of flame flues in each of said walls, each of said flues being in two sections having a communicating opening therebetween, and means comprising inlets for supplying fuel gases to said sections at one end thereof for combustion therein, certain inlets of said flues being alternately adjacent opposite sides of the heating wall and the communicating openings of each flue being disposed similarly to said certain inlets.

8. In a battery of high-chambered horizontal coking retort ovens having coking chambers and heating walls alternating therewith, a plurality of vertical flame flues in each of said walls, each of said flues comprising two superposed sections with a horizontal wall therebetween, said wall having an opening for connecting said sections, and means comprising inlets for supplying fuel gases to each of said sections at the lower ends thereof, the connecting openings and an inlet for each of the lower sections of said flues being staggered with respect to those of adjacent flues whereby they are alternately disposed adjacent opposite sides of the heating wall.

9. In a battery of high-chambered horizontal coking retort ovens having coking chambers and heating walls alternating therewith, a plurality of vertical flame flues in each of said walls, each of said flues comprising two superposed sections with a horizontal wall therebetween, said wall having an opening for connecting said sections, and means comprising inlets for supplying fuel gases to each of said sections at the lower ends thereof, the connecting openings and an inlet for each of the upper sections of said flues being staggered with respect to those of adjacent flues whereby they are alternately disposed adjacent opposite sides of the heating wall.

10. In a battery of high-chambered horizontal coking retort ovens having coking chambers and heating walls alternating therewith, a plurality of vertical flame flues in each of said walls, each of said flues comprising two superposed sections with a horizontal wall therebetween, said wall having an opening for connecting said sections, and means comprising inlets for supplying fuel gases to each of said sections at the lower ends thereof, an inlet for the upper section of each flue being located in said wall substantially axially of the flue, the connecting openings and certain inlets for the lower flue sections being offset with respect to the axes of the flues and being staggered with respect to those of jacent flues whereby they are alternately disposed adjacent opposite sides of the heating wall and the sides of said wall are similarly heated.

11. In a coking retort oven, a coking chamber, heating walls therefor, vertical flame flues in said heating walls, each of said flame flues comprising two superposed sections, and means comprising inlets for supplying rich gas or lean gas respectively to each of said sections for combustion therein, said sections having a communicating opening therebetween, the inlets for one kind of gas in the upper sections and the inlets for the other kind of gas in the lower sections of the several flues being staggered with respect to the sides of the heating wall and with respect to the similar inlets of adjacent flues.

12. In a coking retort oven, a coking chamber, heating walls therefor, vertical flame flues in said heating walls, each of said flame flues comprising two superposed sections, and means comprising inlets for supplying rich gas or lean gas respectively to each of said sections for combustion therein, said sections having a communicating opening therebetween, the inlets for one kind of gas in the upper sections and the communicating openings being disposed adjacent opposite sides of the heating wall in each flue and their relative positions reversed in alternate flues.

13. In a battery of high-chambered horizontal coking retort ovens having coking chambers and heating walls alternating therewith, a plurality of vertical flame flues in each of said walls, each of said flues comprising two superposed sections with a horizontal wall therebetween, said wall having an opening for connecting said sections, and means comprising inlets for supplying rich gas or lean gas respectively to each of said sections at the lower ends thereof, each of said flues having an inspection opening at the top thereof, said inspection openings of adjacent flues being staggered with respect to the central vertical longitudinal plane of the heating wall, the rich gas inlets for the upper sections being substantially axially thereof, said connecting openings and the

rich gas inlets for the lower flue sections of adjacent flues being spaced from the vertical axes of said flues in staggered relation and in alinement with said inspection openings whereby both rich gas inlets of each flue are visible through the inspection opening for that flue.

14. In a coking retort oven, a heating wall having flame flues therein and having also inspection openings for said flame flues, a partition wall having an opening therethrough in each of said flame flues at an intermediate portion thereof for dividing the latter into communicating sections, and means comprising inlets for supplying fuel gases to each of said sections, one of said inlets being in one end of each of said flues and being in alinement with the opening in the partition wall in the flue and one of said inspection openings.

15. In a coking retort oven, a heating wall having flame flues therein and having also inspection openings for said flame flues, a partition wall having an opening therethrough in each of said flame flues at an intermediate portion thereof for dividing the latter into communicating sections, and means comprising inlets for supplying fuel gases to each of said sections, one of said inlets being in one end of each of said flues and being in alinement with the opening in the partition wall and one of said inspection openings, the alined openings and inlet of each of said flues constituting a group, the axis of alinement of the groups of adjacent flues being disposed adjacent opposite sides of the heating wall.

16. In a coking retort oven, a coking chamber, a heating wall therefor, vertical flame flues in said heating wall and means comprising inlets for admitting rich gas and lean gas respectively to each of said flame flues for combustion at a plurality of zones therein, the inlets for respective kinds of gas in each of the flues being out of vertical alinement in opposite directions toward the respective sides of the heating wall.

17. In a coking retort oven, a coking chamber, a heating wall therefor, vertical flame flues in said heating wall and means comprising inlets for admitting rich gas and lean gas respectively to each of said flame flues for combustion at a plurality of zones therein, the combustion zones of each of said flues being similarly disposed with respect to the other flues, respectively, the inlets for respective kinds of gas in each of the flues being out of vertical alinement in opposite directions toward the respective sides of said heating wall and the inlets for each kind of gas for similarly disposed zones of adjacent flues being staggered horizontally with respect to the sides of said heating wall.

In testimony whereof I have hereunto subscribed my name this 20th day of June, 1928.

JOSEPH VAN ACKEREN.