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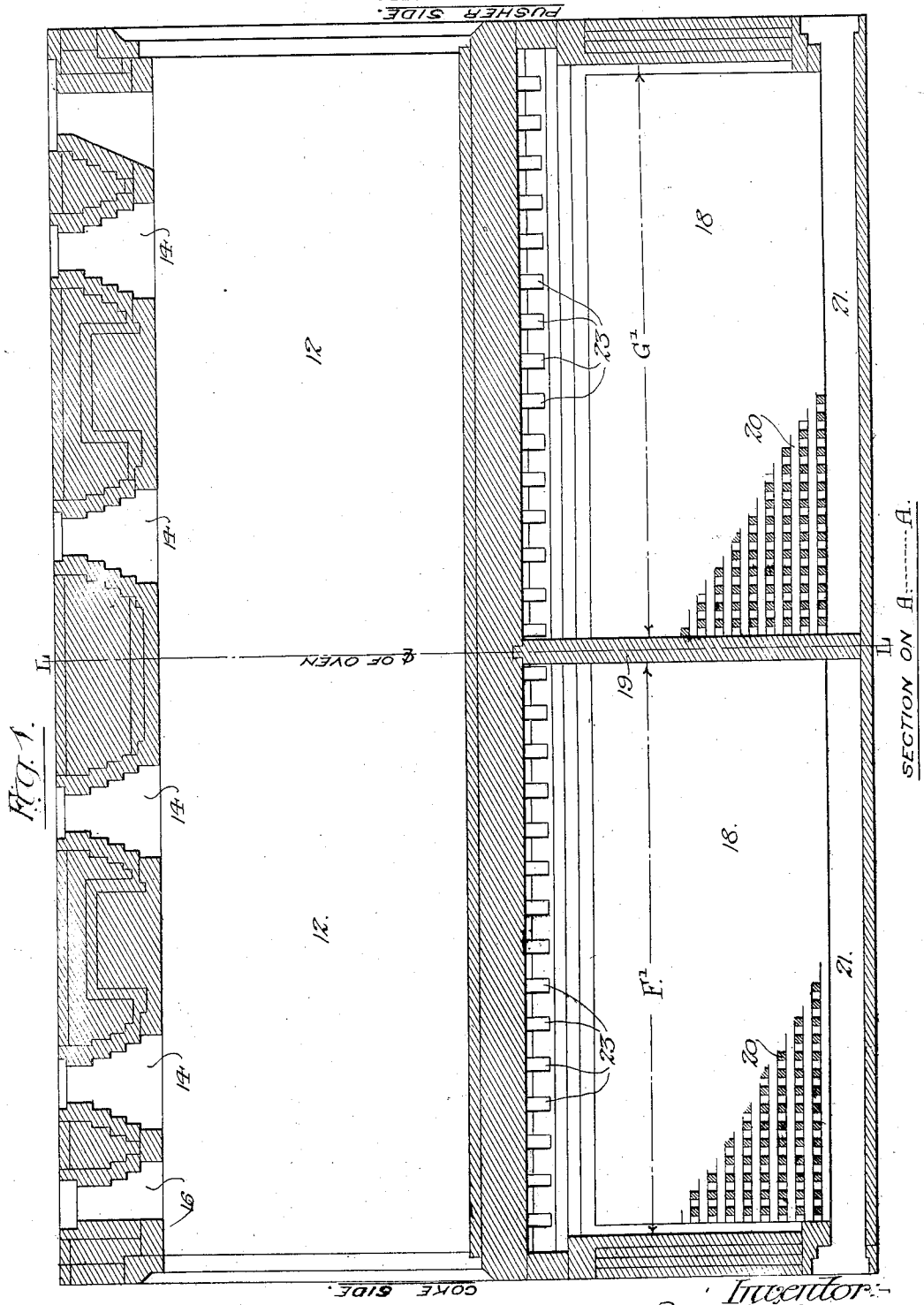
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J. VAN ACKEREN

COKING RETORT OVEN

Filed Jan. 18, 1921

3 Sheets-Sheet 1



Inventor:
Joseph van Ackeren,
By: Munson, Clarke & Campbell, Attys.

June 28, 1927.

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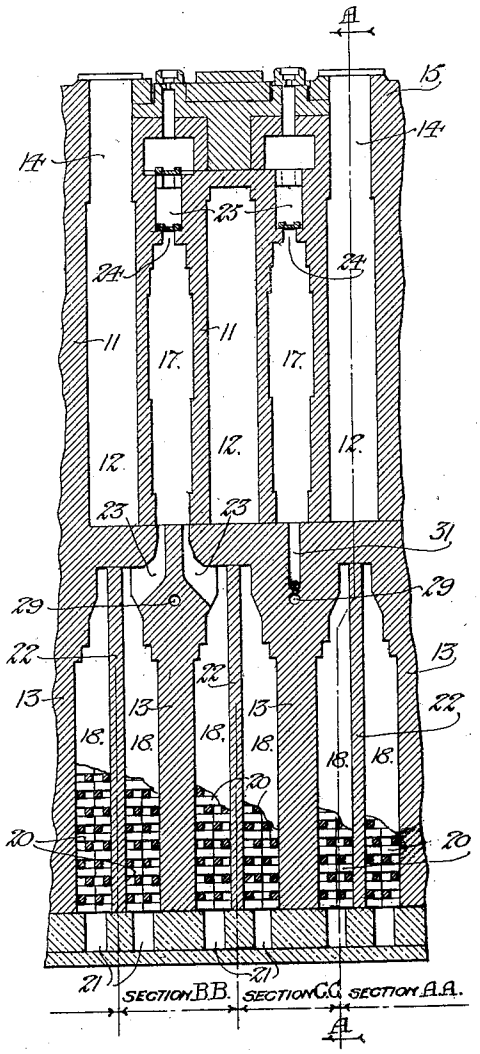
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Fig. 2.



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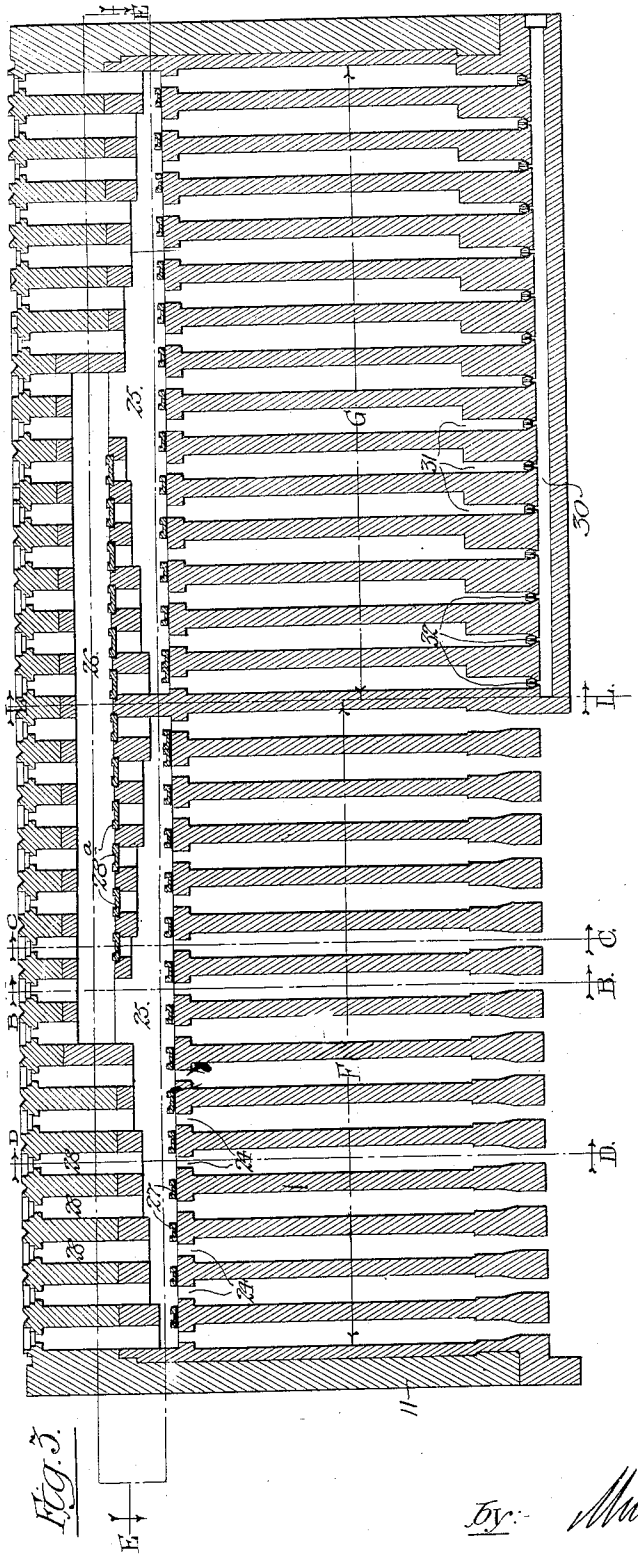


Fig. 3.

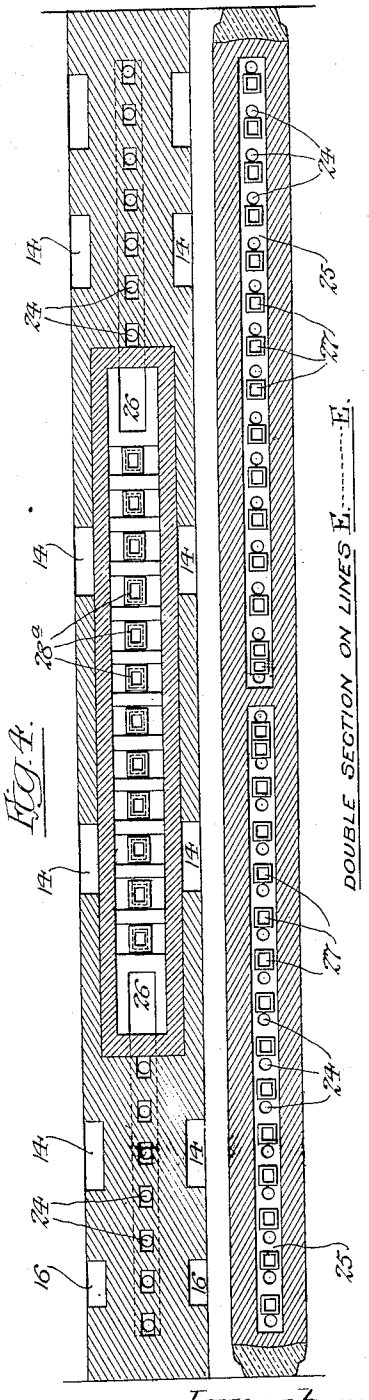


Fig. 4.

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UNITED STATES PATENT OFFICE.

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COKING RETORT OVEN.

Application filed January 18, 1921. Serial No. 438,222.

This invention comprehends improvements of general utility in the coking retort oven art; and also comprehends certain improvements especially applicable to coking retort ovens of the well-known cross-regenerative type exemplified in the patent to H. Koppers No. 818,033 dated April 17, 1906.

The invention has for objects the provision of a coking retort oven having, as an important characteristic, a novel system in control of the flow through the flame flues of the heating walls, which permits a considerable reduction not only in the length but also in the cross sectional dimensions of the horizontal or bus flues located at the top of the vertical flame flues and connecting a plurality of the latter with each other, while permitting the employment of the usual system of the flow through the flues, wherein upflow in the flues on one side of the oven takes place concurrently with downflow in the flues on the opposite side. The present invention permits, for example, the substitution of a pair of horizontal flues in each heating wall for the usual single horizontal flue. With a plurality of separate horizontal flues in each heating wall, each individual flue need communicate with only part of the total number of flues of the heating wall and consequently the dimensions of each flue may be considerably reduced, because of the reduction in the volume of flow which must be maintained through the flue. The above stated reduction in size of the horizontal flues is an important advantage for the reason that it enables a considerable thickening and strengthening of the walls of the oven structure in the region of the horizontal flues.

In addition to the objects recited above, the invention contemplates a novel regenerator construction and system of flow therethrough and through the flues, promoting uniformity of distribution, and has for other objects such other improvements or advantages in construction and operation as are 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 section 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 coking chamber and a pair of regenerators, in planes indicated by the line A, A of Fig. 2;

Fig. 2 is a composite vertical sectional elevation taken longitudinally of a coke oven battery, in planes indicated by the lines B, B, C, C and D, D of Fig. 3;

Fig. 3 is a composite vertical sectional elevation taken transversely of a coke oven battery, in planes indicated by the lines E, E and F, F of Fig. 2, and

Fig. 4 is a composite horizontal sectional elevation taken in planes indicated by the lines G, G and I, I, of Fig. 2.

The same characters of reference indicate the same parts throughout 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 producer gas for fuel or with coke oven gas burned in an atmosphere of ordinary preheated air, such as is utilized in ordinary coke ovens or with coke oven gas burned in an atmosphere containing both air and a neutral gaseous diluent which is introduced into the flame flues separately from the air. A combination coke oven battery having these features is described and claimed in the application of Joseph Becker for Letters Patent for a coking retort oven filed April 23, 1920, Serial No. 376,126. For convenience, the present description will be confined to the present illustrative embodiment of the invention in such a combination oven battery; the novel features and improvements made by the invention are susceptible of other applications, such, for example, as ordinary so-called "coke ovens" employing coke oven gas as a fuel, or ordinary so-called "gas oven" employing producer gas as a 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 vertical 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, in the present instance, are supported by the heavy supporting or pillar walls 13, 13 which extend crosswise of the battery and are located, as shown in Fig. 2, beneath the respective heating walls 11, 11. These pillar walls collectively form the main support for the entire super-structure 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 chambers or ovens through charging holes 14 located in the top 15 of the oven battery and positioned directly above the oven or chambers 12, as shown in Figs. 1 and 2. These charging holes 14 are equipped with the usual removable covers, which are removed during charging of the individual ovens or coking chambers and are placed in position to close the tops of such coking chambers during the entire coking or distilling operation. The gases of distillation pass from the tops of the several coking chambers 12 through gas outlets 16 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 chambers 12 is derived from the heating walls 11, which, as above mentioned, extend crosswise of the battery at the sides of the coking chambers. Referring now more particularly to Figs. 2 and 3, each heating wall 11 is constituted of a plurality of flame or combustion flues 17. The flame flues of each heating wall are, in accordance with the present embodiment of the invention, operatively disposed into two groups, a pusher side group F and a coke side group G. When the flame flues on one side of the battery, for example the pusher side are burning, that is to say, operating for upflow, the flame flues of the coke side group of the same heating wall are operating for downflow to permit exhaust of the waste bases. Reversal of the battery is effected to cause the coke side group of heating flues to operate as upflow or burning flues and the pusher side group as downflow flues.

The crosswise regenerators 18 of the regenerator oven or battery are located in planes beneath the planes of the aforesaid heating walls 11 and coking chambers 12, and, in the present instance, extend in parallelism beneath the coking chambers and between the pillar walls 13. Located in the middle lengthwise vertical plane of the coke oven battery, is a vertical partition 19, as shown in Fig. 1, which partition extends all the way up from the mat of the battery to the bottom of the overlying coking chamber and from one to the other of the pillar walls 13. The regenerators, which are respectively located on opposite sides of the battery extend inwardly to said partition 19 and are separated thereby as clearly shown in Fig. 1. This arrangement provides pairs of regenerators extending crosswise of the battery, each pair being constituted of a pusher side regenerator, indicated by the reference character F′ and a coke side regenerator indicated by the reference character G′. The pusher side regenerators F′ correspond to the pusher side groups of flues F and the coke side regenerators G′ correspond to the coke side groups of flues G.

Each regenerator 18 is a chamber containing open brick work, commonly called checkerwork, and indicated at 20, with distributing sole channels 21 underneath such checkerwork, the channels forming the soles of such chambers and opening up into the checkerwork. If desired, each regenerator 18 may be divided, as shown in the present embodiment of the invention, by a vertical partition 22 which extends longitudinally of the regenerator and serves to separate the regenerator into two flow compartments located respectively on the opposite sides of such partition 22.

The several regenerators are heated, in alternation by the hot combustion products that are exhausted from the flame or combustion flues hereinbefore mentioned and then impart such heat to the medium that they feed into these flame flues. Each regenerator 18 communicates with the corresponding groups of flues 17 of the two heating walls adjacent to and respectively located on the opposite sides of the regenerator, by means of ducts 23, each duct leading upwardly from a regenerator into a flue, as shown in Fig. 2. Thus, each regenerator of the group F′ is connected with all of the flues of the two adjacently disposed groups F; and similarly each regenerator of the group G′ is connected with all of the flues of the two adjacently disposed groups G. With this construction and arrangement, every group of flues F or G is connected by ducts 23 with two adjacently disposed regenerators of the corresponding group, and, consequently, each group of flues may be fed with gaseous medium from two separate regenerators. The advantage of this arrangement will be clear in the hereinafter described operation of the battery.

In the present embodiment of the invention, the groups of flues on one side of the battery are operating for flow in one direction, while concurrently the groups of flues on the other side of the battery are operating

for flow in the opposite direction, and consequently there is maintained flow in reverse directions through the regenerators that are respectively positioned on opposite sides of the central longitudinal partition 19. The reversal inflow through the flame flues 17 and their communicably connected regenerators may thus be said to take place crosswise of the battery, in accordance with the common practice in this art. The reversal of the battery is effected at the end of an operating period determined by practice, and by means of any preferred type of reversing mechanism. The function of such reversal is as follows: The regenerators that prior to the reversal operated as inflow regenerators become outflow regenerators, and the outflow operating regenerators become inflow operating regenerators; the upburning series of flues switches functions with the downburning series of flues on the opposite side of the battery, and the supply of gas is turned off from the previously upburning flues and turned on into the mains of the previously downburning flues.

Each flame flue 17 of each heating wall has at its top a port or opening 24 for draft and the passage of combustion products or waste gas from the flame within the flue. These ports 24 open up into horizontal or bus flues 25 formed in the heating walls and connecting all of the vertical flues that communicate with such horizontal flues 25 by means of the ports 24. According to the invention there are in each heating wall a plurality of, in the present instance, two of such horizontal flues 25 positioned end to end with respect to each other and respectively located on opposite sides of the central dividing line L. By reason of the fact that there is a plurality of such horizontal flues 25 in each heating wall, these flues 25 are not required to be of so great capacity as that necessary in present practice and consequently the cross sectional area of each horizontal flue 25 may be materially reduced proportionately with the length of such flue, with the result that the thickness and strength of the heating walls are substantially increased in the region of the horizontal flues. Moreover, because of the fact that each horizontal flue 25 communicates with a substantially reduced number of vertical flues, in the present instance, half of the flues of the heating wall, uniformity and distribution of the flow through the vertical flues and the communicating regenerators is greatly promoted.

As shown in Fig. 3, each such horizontal flue 25 tapers from its middle toward its opposite ends in such manner that the smallest cross-sectional area of each flue are located at its opposite extremities. The tapering channel thus formed serves to distribute the flow equally through the several vertical flues 17 with which such channel communicates. As shown, the two horizontal flues 25 of each heating wall are communicably connected with each other by means of passageways 26 which extend crosswise of the battery or preferably open up into substantially the middle portions of their respective connected flues 25. Thus the flow from a pusher side group F of flues may pass into the communicating channel 25 and thence through the channel 26 to the coke side group G of the same heating wall. On reversal the flow from the coke side group G of each heating wall passes over through the horizontal flue 25 and the channel 26 into the pusher side group F of the same heating wall.

The draft through the ports 24 may be regulated by means of the usual movable dampers or sliding bricks 27, positioned in the ordinary way in the bottom of the horizontal flues 25 and adapted to be reached by access flues 28 which extend from the top of the horizontal flues 25 in each heating wall to the top 15 of the battery, there being an access flue positioned over each flame or combustion flue of each heating wall. As shown in Fig. 3, the lower portions of the access flues 28 which intersect the horizontal channel 26 may be closed by covers 28^a adapted to seat over said lower portions of the access flues. Extending crosswise of the battery in each pillar wall 13 and located beneath the heating wall 11 thereabove, is a pair of gas supply channels 29 and 30. These channels 29 and 30 are for the purpose of supplying coke oven gas to the several flame flues on each side of the central line L and, for this purpose, the channel 29 communicates with the individual flues of the pusher side group F by means of ducts 31 that lead from such channel 29 individually into the bottoms of individual flues; and the channel 30 which supplies the several flues of the coke side group G communicates therewith by means of similar connecting ducts. Within the several ducts are disposed the usual nozzles 32. The supply of coke oven gas to the respective channels 29 and 30 is derived from coke oven gas mains of the usual type and respectively located on the opposite sides of the battery and extending longitudinally therealong. Suitable means is provided for admiting or shutting off the supply of gas with respect to each pair of channels 29 and 30, it being understood that the supply of gas is maintained in one of the channels of each pair while shut off from the other.

For operating the battery alternatively with the use of a special generator gas, such as producer gas as a fuel, alternately disposed inflow operating regenerators may be optionally connected with a producer gas main, by mechanism such as is disclosed in the before mentioned application, Serial No.

376,126, whereas the regenerators that are intermediate such alternately disposed regenerators are supplied with air, so that producer gas and air may be conveyed into the upburning flame flues.

The operation of the battery, when using a special generator gas, such as ordinary producer gas as a fuel, is as follows: the supply of coke oven gas to the coke oven gas main and to all of the coke oven gas channels 29, 30 is cut off. A supply of producer gas is permitted to flow into the alternate regenerators, such as are operating for inflow, and a supply of air enters the intermediately disposed regenerators. As each flame flue is communicably connected with two regenerators, and each regenerator with the flame flues of two adjacently disposed heating walls, gas and air preheated in the respective gas and air regenerators enters and burns upwardly in each inflow operating vertical flue. The waste gases from the upburning flues passes into the horizontal flues 25 and thence through the channel 26 to the horizontal flues on the opposite side of the battery. From the last mentioned horizontal flues, the exhaust gases pass downwardly through their communicably connected flame flues and finally through all of the regenerators on the downflow side of the battery to the waste gas tunnel, through which the waste gases are conveyed to the stack. On reversal of the flow, the inflow operating regenerators and their communicably connected flame or combustion flues become outflow regenerators and flues, and concurrently the outflow operating regenerators and flues become inflow operating regenerators and flues.

In operating the oven with coke oven gas in the ordinary manner, the supply of producer gas to alternate regenerators is shut off and air is permitted to flow into all of the inflow operating regenerators. During coke oven gas operation, the supply of coke oven gas in the channels 29 or 30 is fed into the upburning flues. The reversing mechanism is operated at each reversal to place all of the inflow operating regenerators in communication with the outer air and concurrently all of the outflow operating regenerators in communication with the exhaust.

A further mode of operation is with coke oven gas as a fuel, combined with a supply of neutral gaseous diluent to the upburning flues. In so operating the batteries the supply of producer gas is turned off and the supply of coke oven gas is turned on. Instead however of permitting air to flow into alternate regenerators that are intermediate such alternate regenerators, waste gas is permitted to flow into alternate inflow operating regenerators and are delivered thereby to the upburning flame flues. The admission into each of the upburning flues of a supply of neutral gaseous diluent, such as waste gas, along with the air, is effective to lengthen greatly the flames within such flues and to prevent the localization of the hottest flame temperature in the extreme lower portions of the flues.

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

I claim:

1. In a coking retort oven, in combination: coking-chambers; heating-walls contiguous thereto and each constituted of vertical combustion flues disposed in groups operating alternately for upflow combustion and downflow of combustion-products, such vertical flues extending upward substantially to the top of the coal-charge space in the adjacent coking-chambers; horizontal flues immediately above and each directly communicating with vertical flues within one of said groups; a connection-flue above said horizontal flues of each heating-wall and disposed higher than the coking-chambers, said connection-flue connecting the aforesaid horizontal flue of one group with the horizontal flue of a reversely flowing group of vertical flues of the same heating-wall, each of said horizontal flues porting intermediate its ends into said connection-flue whereby each part of said horizontal flue is required to accommodate the volume of combustion products collecting from or distributing to only part of the vertical flues served by such horizontal flue; and cross-regenerators respectively serving the mutually connected burning and off-flow groups of vertical flues of each such heating-wall; substantially as specified.

2. In a coking retort oven, in combination: coking-chambers; heating-walls contiguous thereto and each constituted of vertical combustion flues disposed in groups operating alternately for upflow combustion and downflow of combustion-products, such vertical flues extending upward substantially to the top of the coal-charge space in the adjacent coking-chambers; horizontal flues immediately above and each directly communicating with vertical flues within one of said groups; a connection-flue above said horizontal flues of each heating-wall, and disposed higher than the coking-chambers, said connection flue connecting the aforesaid horizontal flue of one group with the horizontal flue of a reversely flowing group of vertical flues of the same heating-wall, each of said horizontal flues porting intermediate its ends, into said connection-flue whereby each part of said horizontal flue is required to accommodate the volume of combustion products collecting from or distributing to only part of the vertical flues served by such horizontal flue; and regenerators serving the mutually connected burning and off-flow

groups of vertical flues of each such heating-wall; substantially as specified.

3. In a coking retort oven, in combination: coking-chambers; heating-walls contiguous thereto and each constituted of individual vertical flame flues disposed in groups operating alternately for upflow combustion and downflow of combustion-products; horizontal flues immediately above and each directly communicating with vertical flues within one of said groups; a connection-flue above said horizontal flues of each heating-wall, said connection-flue connecting the aforesaid horizontal flue of one group with the horizontal flue of a reversely flowing group of vertical flues of the same heating-wall, each of said horizontal flues porting intermediate its ends into said connection-flue, whereby each part of said horizontal flue is required to accommodate the volume of combustion products from only part of the individual vertical flame flues served by such horizontal flue; and cross-regenerators respectively serving the mutually connected burning and off-flow groups of vertical flues of each such heating-wall; substantially as specified.

4. In a coking retort oven, in combination: coking-chambers; heating-walls contiguous thereto and each constituted of individual vertical flame flues disposed in groups operating alternately for upflow combustion and downflow of combustion-products; horizontal flues immediately above and each directly communicating with vertical flues within one of said groups; a connection-flue above said horizontal flues of each heating-wall, said connection-flue connecting the aforesaid horizontal flue of one group with the horizontal flue of a reversely flowing group of vertical flues of the same heating-wall, each of said horizontal flues porting intermediate its ends, into said connection-flue, whereby each part of said horizontal flue is required to accommodate the volume of combustion products from only part of the individual vertical flame flues served by such horizontal flue; and regenerators serving the mutually connected burning and off-flow groups of vertical flues of each such heating-wall; substantially as specified.

5. In a coking retort oven, in combination; a plurality of coking chambers; heating walls contiguous to such coking chambers and respectively constituted of vertical combustion flues; tapered horizontal flues in each heating wall and respectively connecting a plurality of the combustion flues of their respective heating walls; the horizontal flues being also communicably connected with other horizontal flues of the same heating wall; and regenerators communicating with said combustion flues; substantially as specified.

6. In a coking retort oven, in combination: a plurality of coking chambers; heating walls contiguous to such coking chambers and respectively constituted of vertical combustion flues; tapered horizontal flues in each heating wall and respectively connecting a plurality of the combustion flues of their respective heating walls, the cross-section of each of said tapered flues being greatest at the region at which the greatest volume of gas flows; the horizontal flues being also communicably connected with other horizontal flues of the same heating wall; and regenerators communicating with said combustion flues, substantially as specified.

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