April 3, 1928. 1,664,649

J. VAN ACKEREN

COKING RETORT OVEN

Original Filed Sept. 6, 1921 4 Sheets-Sheet 1

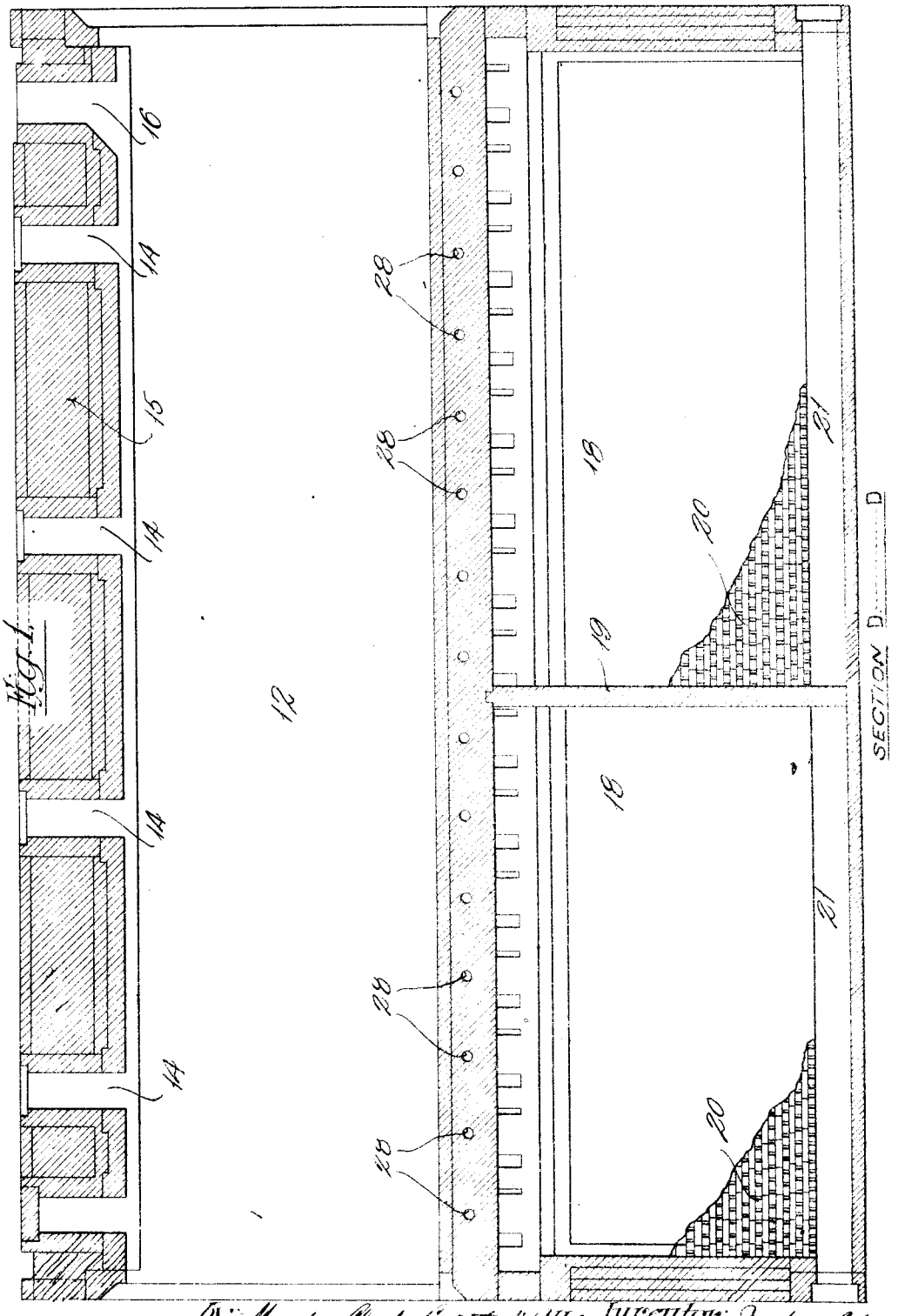



Fig. 1.

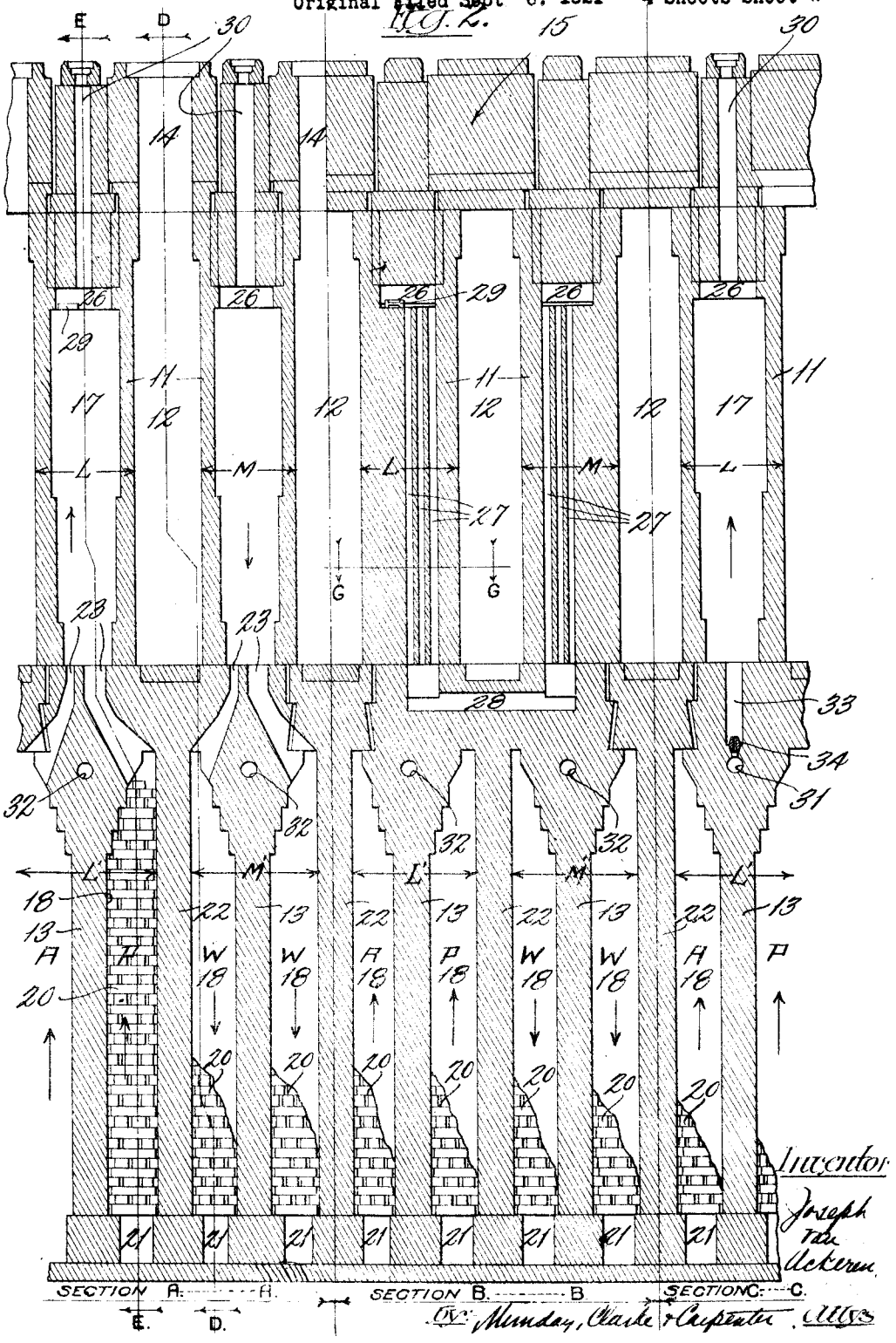
By: Munson, Clarke & Esperutia, his Attys. Inventor: Joseph van Ackeren

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Original Filed Sept 6, 1921 4 Sheets-Sheet 2




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COKING RETORT OVEN

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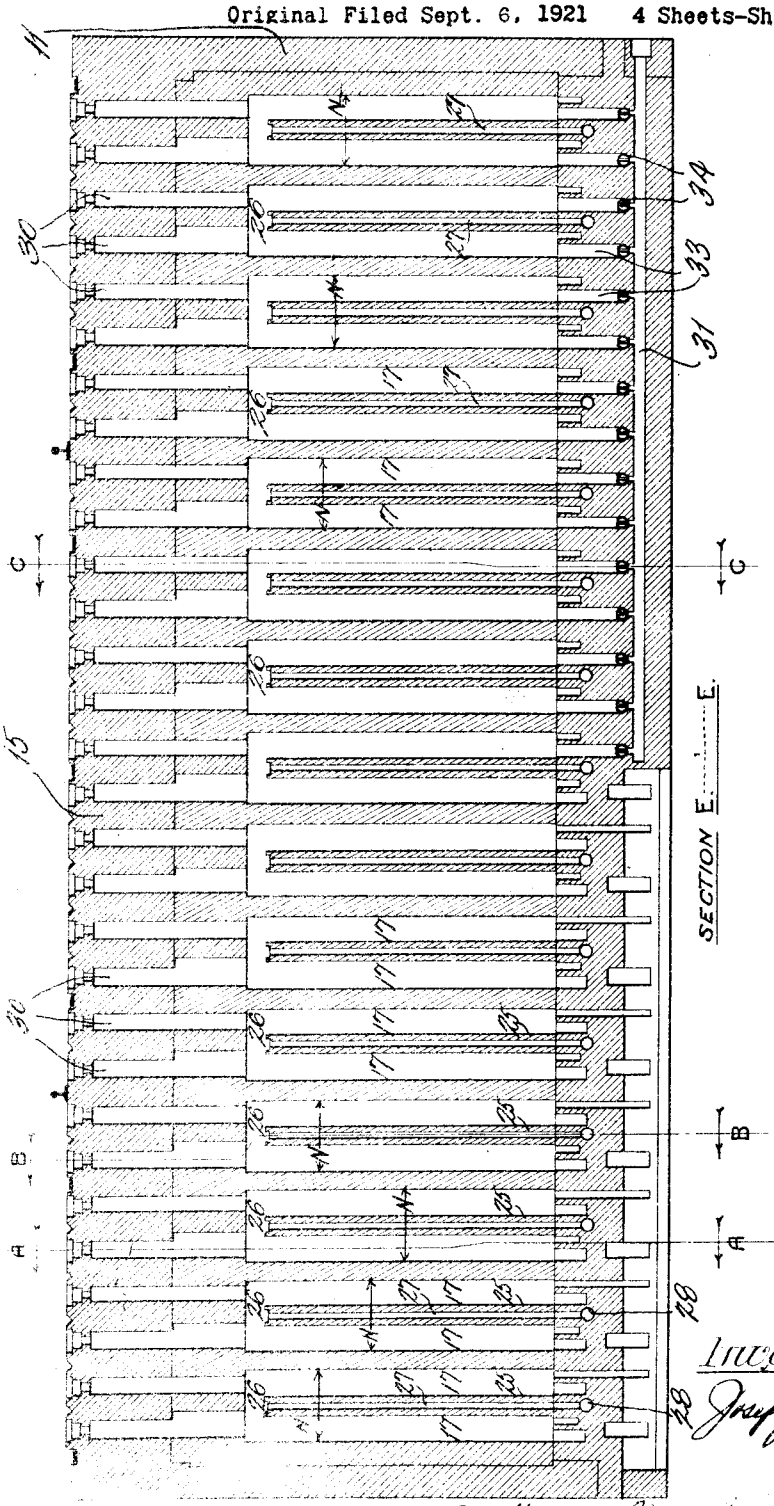



Fig 3.

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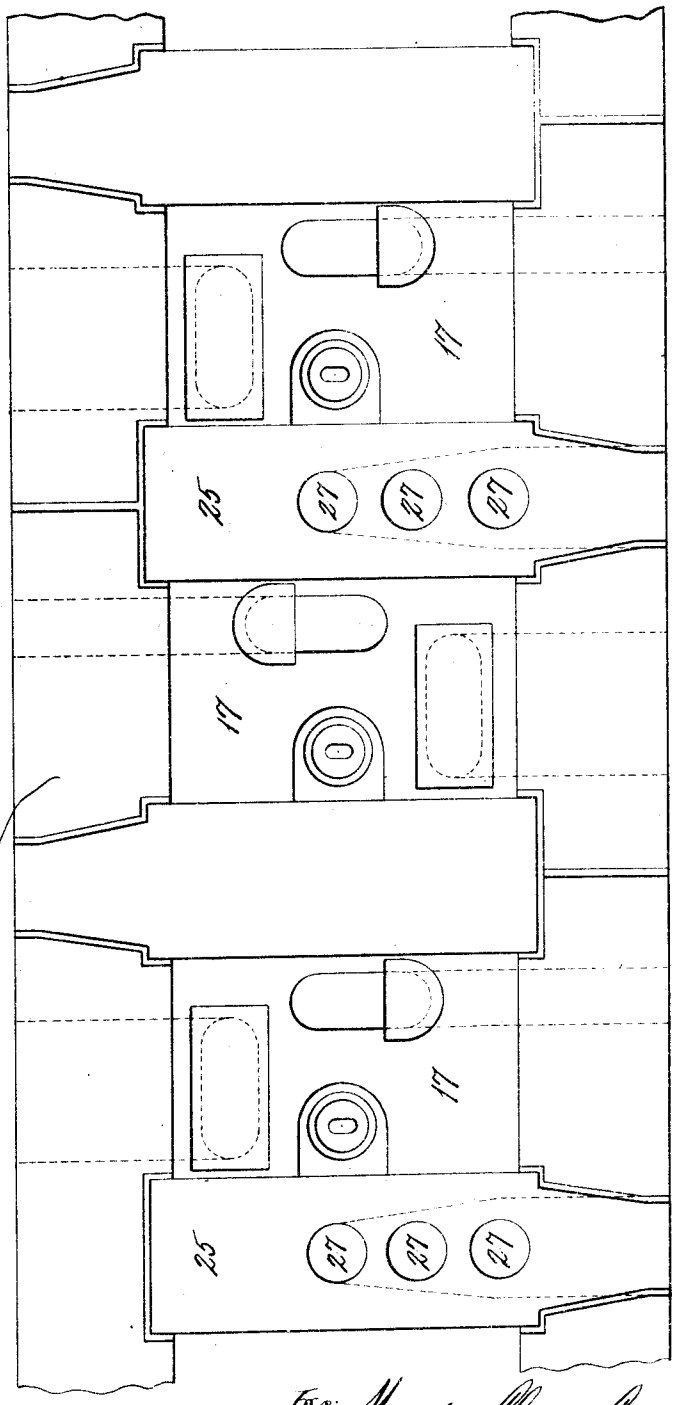



Fig. 4.

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# UNITED STATES PATENT OFFICE.

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## COKING RETORT OVEN.

Application filed September 6, 1921, Serial No. 498,796. Renewed January 29, 1926.

This invention comprehends improvements of general utility in the coke 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, 818,033, dated April 17, 1906, and in the patent to Joseph Becker, 1,374,546, dated April 12, 1921.

The invention has for objects the provision of a coking retort oven having, as important characteristics: a flue construction that contemplates the entire elimination of the usual horizontal or bus flues that are located at the top of the vertical flame flues and connect a plurality of said vertical flues with each other; and, as a feature that may be secured by the above structural improvements, a novel system of control of the flow through the flame flues of the heating walls, permitting flow in the same direction through all of the flame flues of alternate heating walls, with the result that all the flame flues of alternate heating walls are either simultaneously burning, or simultaneously operating as outflow flues, while the flues of the intermediate heating walls are operating concurrently for flow in the opposite direction to that of the alternate heating walls.

The above stated elimination 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 located at the upper extremity of the vertical flame flues. Moreover, the improved construction of the invention permits an increase of the height of the flame flues, with a corresponding increase in the height of the coking chambers, so that the latter may be made narrower in width, a development greatly facilitating the coking of high volatile coals, and yet having adequate provision for taking care of the increased volume of combustion products, without making it necessary to provide flue spaces of sizes inconsistent with adequate strength of the wall construction. The flue construction of the invention is furthermore of great importance in oven batteries fired with extraneously derived gas, such as producer gas, since the employment of such gas results in an increased volume of combustion products and adequate flue spaces must be provided to collect and feed to the down-flow operating flues this increased volume of combustion products. By the invention, the flue construction may be adequately accommodated to such increased volume of combustion products, without introducing elements of weakness into the wall structure.

In addition to the general objects recited above, the invention has for further objects such other improvements and 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 invention, the view being taken longitudinally through a coking chamber and a pair of regenerators in a plane indicated by the line D—D of Fig. 2.

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

Fig. 3 is a vertical section taken crosswise of the battery and longitudinally of a heating wall in a plane indicated by the line E—E of Fig. 2; and

Fig. 4 is an enlarged, horizontal section of a heating wall taken in a plane indicated by the line G—G of Fig. 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 producer gas as the 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 such features is described and claimed in the co-pending application of Joseph Becker for Letters Patent of the United States for 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 of the invention are, however, capable of other applications, such for example, to ordinary so-called "coke ovens" employing coke oven gas as the fuel, or to ordinary so-called "gas ovens" employing an extraneously derived gas, such as producer 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 vertical coking chambers 12, 12, the heating walls 11 forming the side walls of the respective coking chambers 12, as shown in Fig. 2. The heating walls 11 are directly 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, together with other walls hereinafter described, 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 subfoundation 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 battery and positioned directly above the ovens 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 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 several 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. 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 invention, operatively disposed into a single series, that is to say, all of the flues of each heating wall operate concurrently as up-flow or down-flow flues, as will be hereinafter more fully explained. With regard to the flow through the flues, the heating walls are disposed into two groups L and M, the heating walls of the group L alternating with those of the group M. When the flame flues of the group of alternate heating walls L are burning, that is to say operating for up-flow, the flame flues of the intermediate heating walls of the group M are operating for down-flow, to permit exhaust of the waste gases. With this system of flow, when the flame flues on one side of a coking chamber are burning, the flame flues on the opposite side of the same coking chamber are operating for down-flow, the same system of flow taking place uniformly throughout the battery. Consequently, heating is maintained continuously from end to end on one side of a charge of coal in each coking chamber, the heat being applied to the full length of one side of such charge during an entire operating period, and then, after reversal being applied to the full length of the opposite side of the charge until a subsequent reversal is effected.

The crosswise regenerators 18 of the battery are located at a lower level than the aforesaid heating walls 11 and coking chambers 12 and, in the present instance extend in parallelism between the pillar walls 13, and the other heavy supporting walls hereinafter described. Located in the middle, lengthwise, vertical plane of the 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 and the other walls which are between the pillar walls. 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 permits control from opposite sides of the battery of the flow through the regenerators, thereby assisting the novel flue arrangement in promoting uniformity of distribution.

Each regenerator 18 is a chamber containing open brick work, commonly called checker work, and indicated at 20 with a distributing sole channel 21 underneath such checker work, the channels forming the soles of such chambers and opening up into the checker work. As shown, a heavy vertical gas-tight supporting wall 22 extends directly beneath each coking chamber in parallelism between each two adjacent pillar walls 13,

and such supporting walls 22 provide two regenerators located respectively on the opposite sides of such walls 22 and between adjacent pillar walls 13. The several walls 22 also have the function, with the pillar walls 13, of supporting the weight of the battery superstructure.

This supporting wall construction provides two series of crosswise extending true gas-tight, load-carrying walls, located below the coking chambers and intermediate heating walls. The supporting walls of one series 13 being directly beneath the heating walls and the supporting walls of the other series 22 being directly beneath the coking chambers, are constructed and function not as mere partitions commonly employed, but as true load-carrying, gas-tight walls, permitting relatively different pressures to be maintained in the checker work chambers on the opposite sides of such walls, or the flow of different media in the checker work chambers separated by these walls without leakages from one checker work chamber into another and without danger of mixing gases in the checker work chambers which must be kept separate in this region of the battery.

In accordance with the invention, the series of regenerators on the opposite sides of the aforesaid central partition 19 are respectively grouped into pairs L′ of alternate regenerators, said pairs corresponding individually to the individual heating walls of the group L and into pairs M′ of the intermediate regenerators respectively corresponding to the individual heating walls of the intermediate group M. Each regenerator of a pair L′ or M′ is provided with a series of ducts 23, the ducts of both regenerators of a pair leading respectively to individual flame flues 17 of the same corresponding heating wall. With this construction, each flame flue 17 communicates by a pair of ducts 23 with adjacent separate regenerators, through which however flow is maintained concurrently in the same direction, that is to say, both said regenerators are either operating for in-flow or out-flow.

In the present embodiment of the invention, the entire series of flame flues 17 of each heating wall 11 is either burning or operating for down-flow to convey waste products to the regenerators beneath and consequently the regenerators aligned on opposite sides of the central longitudinal partition 19 operate concurrently for flow in the same direction and in the same manner. The reversal in flow through the flues 17 on opposite sides of the coking chamber and into communicably connected regenerators may thus be said to take place longitudinally of the battery instead of transversely thereof, as has heretofore been a 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 out-flow regenerators, and the out-flow operating regenerators become in-flow operating regenerators. The up-burning series of flues switches function with the down-burning series of flues and the supply of gas is turned off from the previously up-burning flues and turned on into the mains of the previously down-burning flues.

As shown in Figs. 3 and 4, the series of flues of each heating wall are respectively grouped into pairs N of adjacent flues, and the separating walls 25 which are between the two members of the respective pairs of such flues terminate below the top of the flues, thereby providing out-flow passage-ways 26 for the exhaust of the products of combustion from the flames within the flues. The alternate separating walls 25, which are constituted of the usual bottle bricks, are provided with a plurality of, in the present instance three, vertical out-flow channels 37, communicably connected at their tops with the respective passage-ways 26 and leading downwardly and respectively opening into cross ducts 28. These cross ducts 28 extend beneath the coking chambers 12 and function to connect the several passage-ways or channels 27 of each heating wall respectively with the corresponding vertical channels or passage-ways 27 of the next adjacent heating wall. Thus the entire flow from the heating wall within the flues of which combustion is being maintained, pass through the passage-ways 26 of the pairs of flues N thence downwardly through the vertical channels 27 of the bottle bricks, thence under an adjoining coking chamber through ducts 28 to the vertical channels 27 of an adjacent heating wall, thence up through said channels 27 to the passage-ways 26, and thence downwardly through the out-flow operating flues 17 to the out-flow operating regenerators with which said flues are connected.

The draft through the flues 17 may be regulated by means of the usual removable dampers or sliding bricks 29 located in the passage-ways 26 of the respective flues. These sliding bricks may be reached by access flues 30 which extend through passage-ways 26 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.

Extending crosswise of the battery and located beneath the heating wall 11 thereabove, is a pair of gas supply channels 31 and 32. These channels 31 and 32 are for a purpose of supplying coke oven gas to the

several flame flues on the opposite sides of the central partition 19. For this purpose the channel 31 communicates with the individual flues 17 on one side of the said partition 19 by means of ducts 33 that lead from such channel 31 individually into the bottoms of individual flues; the channel 32 which supplies the several flues which are located on the other side of the before-mentioned partition 19 communicates with said flues by means of similarly connecting ducts 13. Within the several ducts are disposed the usual nozzles 34.

The supply of coke oven gas to the respective channels 31 and 32 is derived from the coke oven gas mains of the usual type and respectively located in the opposite sides of the battery and extending longitudinally therealong. Suitable means is provided for admitting or cutting off the supply of gas with respect to each pair of channels 31 and 32, it being understood that the gas supply is either concurrently maintained in or concurrently shut off from both channels of a pair. For operating the battery alternatively with the use of a special generator gas, such as producer gas, as the fuel, one regenerator of each in-flow operating pair, such as the regenerators P of the pairs L′ may be optionally connected with a producer gas main by mechanism such as is disclosed in the before-mentioned application of Joseph Becker, Serial No. 376,126, so that producer gas may be directed into such of the regenerators P as are operating for in-flow, conveyed through these regenerators into burning flame flues 17.

The operation of the battery when employing a special generator gas, such as producer gas, as the 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 31, 32, is cut off. A supply of producer gas is permitted to flow into one regenerator P of each of the in-flow operating pairs, such as the pairs L′. Passing through said regenerators, the producer gas is preheated before being delivered into the burning flame flues. During the in-flow of producer gas into such regenerators P, air flows into the other regenerators A of said in-flow operating pairs L′ and passing through said regenerators is preheated prior to its delivery into the burning flame flues, such as the flame flues L of alternate heating walls. In the flame flues of the intermediate heating walls M and in the intermediate pairs of regenerators M′, down-flow is maintained, said regenerators M′ operating as waste gas regenerators W. The flame flues of the walls M receive the waste gases from the before-mentioned channels 27 and cross ducts 28. On reversal of the flow, the in-flow operating regenerators and flues become out-flow operating regenerators and flues and concurrently the out-flow operating regenerators and flues become in-flow operating regenerators and flues.

In operating the battery with coke oven gas in the ordinary manner, the supply of producer gas to alternate regenerators P is cut off and air is permitted to flow into such regenerators in place of the producer gas. During coke oven gas operation a supply of coke oven gas is maintained in the channels 31 and 32 which feed the up-burning flues. The reversing mechanism is operated at each reversal to place each of the in-flow operating regenerators in communication with the outer air and concurrently all of the out-flow operating regenerators W in communication with the exhaust.

A further mode of operation is with coke oven gas as the fuel combined with a supply of a neutral gaseous diluent to the up-burning flues. In so operating the battery, the supply of producer gas is cut off and the supply of coke oven gas is turned on. Instead, however, of permitting air to flow into the regenerators of the series P, waste gas is permitted to flow into such regenerators and be delivered thereby to the up-burning flame flues. The admission into each of the up-burning flues of a supply of neutral gaseous diluent, such as waste gas, is effective to lengthen greatly the flames within such flues and to prevent the localization of the hottest flame temperature in the extreme lower portion 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: a plurality of coking chambers; heating walls contiguous to such coking chambers and respectively comprising vertical combustion flues; vertical out-flow channels communicably connected with a pair of combustion flues; duct means extended beneath the coking chambers, said duct means communicably connecting transversely of the intervening coking chambers the vertical out-flow channels of alternate heating walls respectively with the corresponding vertical out-flow channels of intermediate heating walls; and crosswise regenerators parallel with the coking chambers and the heating walls, such regenerators being disposed into in-flow and out-flow operating pairs, both regenerators of each pair corresponding to and being communicably connected with combustion flues of only a single heating wall; 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 vertical combustion flues; vertical out-flow channels

communicably connected with said combustion flues; duct means extended beneath the coking chambers, said duct means communicably connecting transversely of the intervening coking chamber the vertical out-flow channels of one heating wall respectively with the corresponding vertical out-flow channels of an adjacent heating wall; and crosswise regenerators parallel with the coking chambers and the heating walls, such regenerators being disposed into in-flow and out-flow operating pairs, both regenerators of each pair corresponding to and being communicably connected with combustion flues of only a single heating wall; substantially as specified.

3. In a coking retort oven, in combination: a plurality of coking chambers, flued heating walls contiguous to such coking chambers; duct means extended beneath the coking chambers and communicably connecting transversely of the intervening coking chambers the flues of the alternate heating walls respectively with the flues of the intermediate heating walls; and crosswise regenerators parallel with the coking chambers and the heating walls, such regenerators being disposed into in-flow and out-flow operating pairs, both regenerators of each pair corresponding to and being communicably connected with the flues of only a single heating wall; substantially as specified.

In testimony whereof I hereunto affix my signature this 27th day of August, 1921.

JOSEPH VAN ACKEREN.