April 2, 1929. J. VAN ACKEREN 1,707,419

COKING RETORT OVEN

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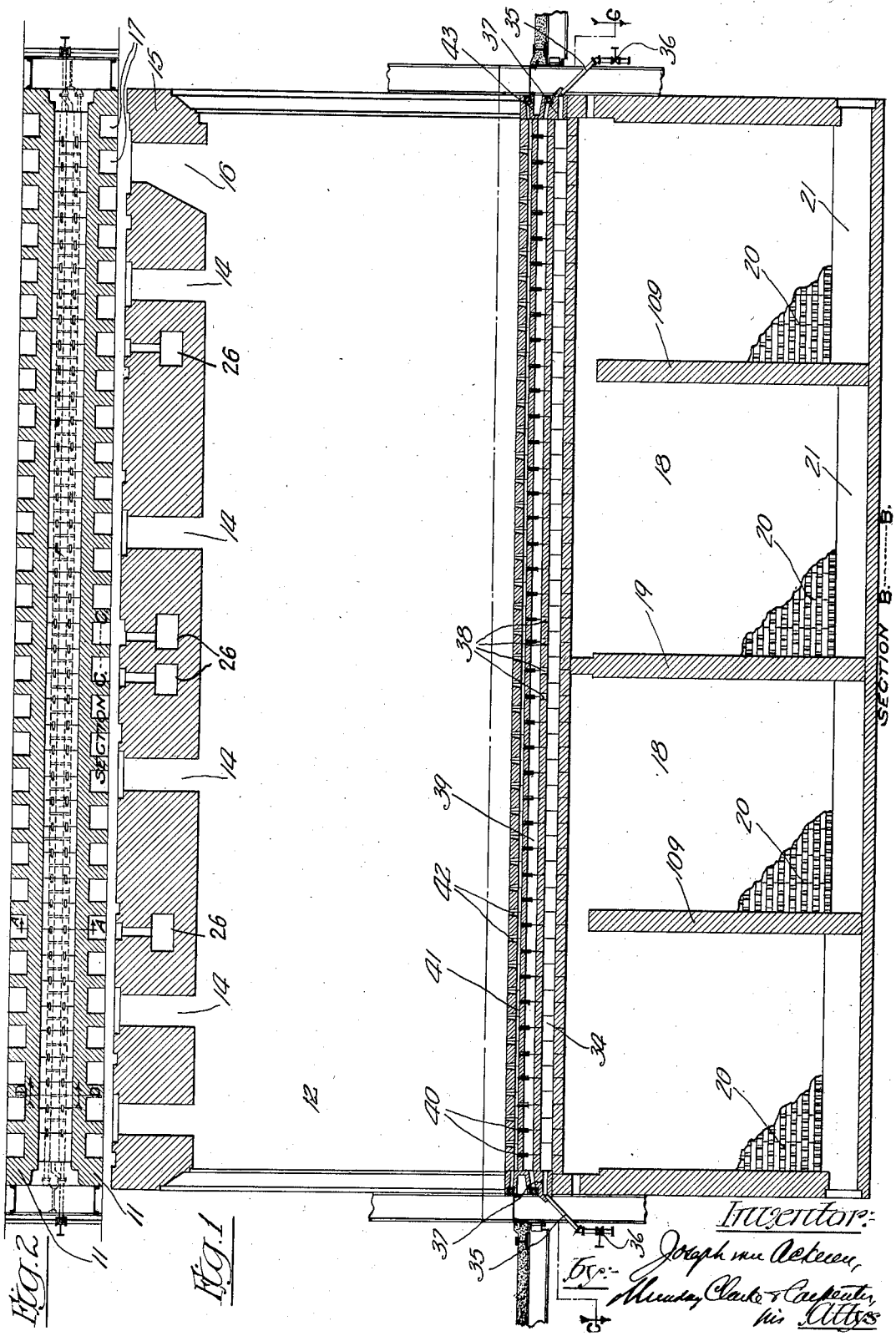


Fig. 2

Fig. 1

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Fig. 3

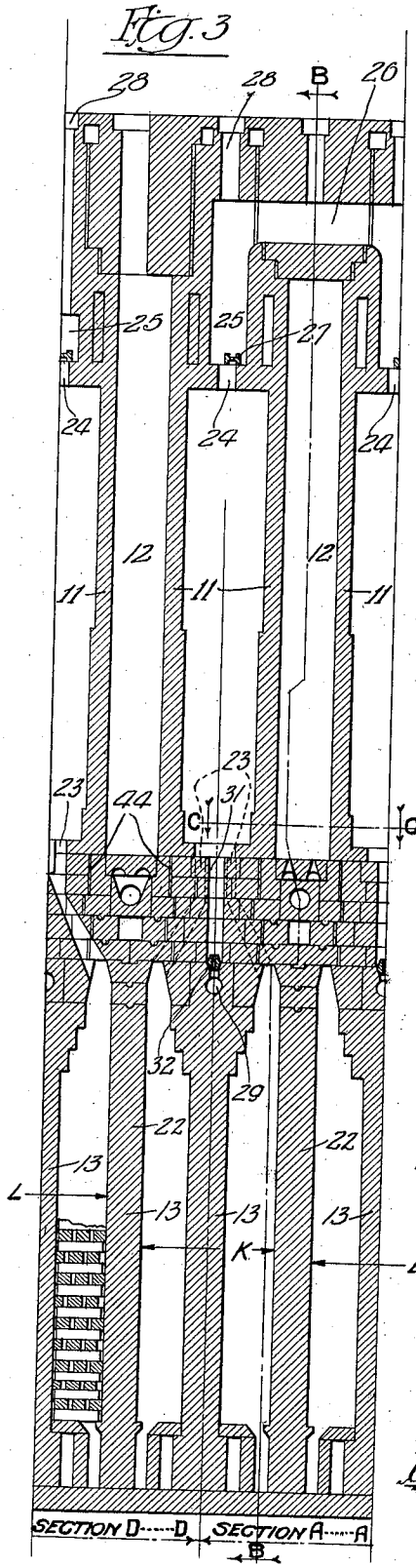
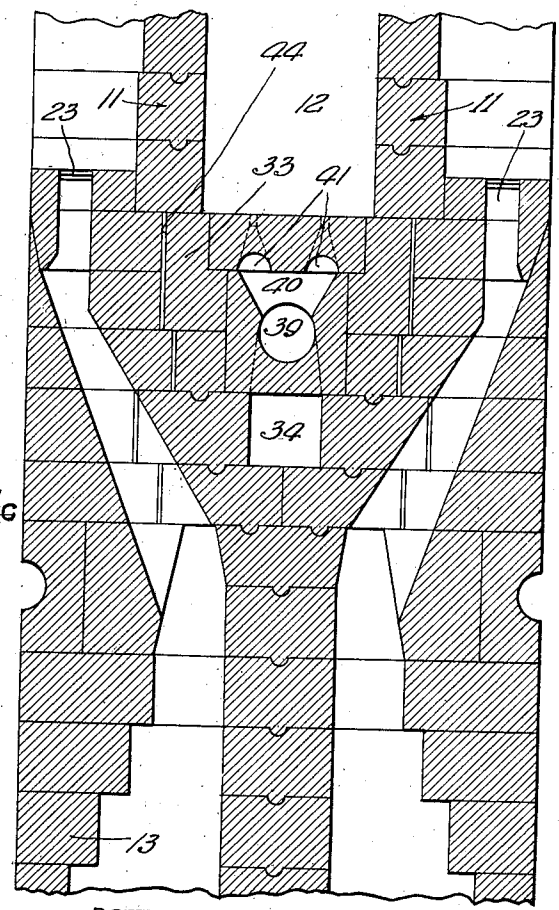


Fig. 4



PARTIAL SECTION D-------D
ENLARGED.

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his Attys

Patented Apr. 2, 1929. 1,707,419

UNITED STATES PATENT OFFICE.

JOSEPH VAN ACKEREN, OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR TO THE KOPPERS COMPANY, OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

COKING RETORT OVEN.

Application filed April 22, 1922. Serial No. 555,942.

This invention comprehends improvements of especial utility in the coking retort oven art; and also comprehends certain improvements applicable to coking retort ovens of the wellknown Koppers regenerative type exemplified in the patent to H. Koppers No. 818,033 dated April 17, 1906, and in the patent to Joseph Becker No. 1,374,546 dated April 12, 1921.

The invention has for objects to incorporate in a coke oven structure a novel and improved means for introducing steam into the coking chambers or retorts of such ovens, the improvements contemplated by the invention having provision for superheating the steam prior to its introduction into the coking chamber or retort, and for effecting thorough distribution and diffusion of the steam throughout the mass of the material within the retort. By the invention the steam flow areas are substantially protected from deposits of coke or ashes from the retort chambers with which such steam flow areas communicate, and a thorough distribution of the steam into the retorts is effected with a resultant reduction in the velocity of steam required for steaming the charge, and yet without any necessity for employing nozzles for introducing the steam into the retort.

In addition to the general objects recited above, the invention has for further 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 vertical section taken transversely through a coking retort oven of the type such as that above specified and equipped with the improvements of the present invention, the view being taken longitudinally through a coking chamber and the regenerators therebeneath on planes indicated by the line B—B of Fig. 3;

Fig. 2 is a horizontal section through one of the coking chambers or restorts and the contiguous heating walls, taken in a plane indicated by the line C—C of Fig. 3;

Fig. 3 is a composite vertical sectional elevation taken longitudinally of the oven battery on the different planes indicated by the lines A—A and D—D of Fig. 2; and

Fig. 4 is an enlarged sectional elevation through the steam flow passages taken in the plane indicated by the line D—D of Fig. 2.

The same characters of reference designate the same parts throughout the several views.

In its present embodiment, the invention is incorporated in a coking retort oven or battery having features of the wellknown Koppers cross regenerative type exemplified in the patents to H. Koppers and Joseph Becker hereinabove mentioned.

A retort oven or battery of this type includes in its construction crosswise extending parallel heating walls constituted of series of vertical flame or combustion flues, elongated coking chambers or retorts intermediate the heating walls and parallel therewith, and crosswise extending regenerators located at a lower level than the coking chambers and the heating walls and parallel therewith. For convenience, the present description will be confined to this embodiment of the invention; features of construction are, however, capable of other applications; consequently, the invention is not confined in its scope to the specific use and specific embodiment herein described as an illustrative example.

Referring to the drawings: there are illustrated sectional views of a coke oven battery of the by-product type, such as has been hereinbefore mentioned, which battery embodies in its construction a plurality of crosswise elongated heating walls 11 and a plurality of intermediate crosswise elongated coking chambers or retorts 12. The heating walls 11 form the side walls of the respective coking chambers 12, as shown more particularly in Fig. 3, and in the present instance, are directly supported by the heavy supporting or pillar walls 13 which extend crosswise of the battery and are located beneath the respective heating walls 11. These pillar walls, together with other walls, 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 other walls 22 extend directly beneath the respective coking chambers 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. As stated before, the several walls 22 also have the function with the pillar walls 13 of supporting the weight of the battery superstructure.

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 retorts of chambers 12, as shown in Fig. 1. These charging holes 14 are equipped with the usual removable covers (not shown) which are removed during charging of the individual chambers 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 several retorts 12 through gas outlets 16 and thence through ascension pipes (not shown) to 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 coking chambers. Referring now more particularly to Figs. 2 and 3, each heating wall 11 is constituted of a plurality of vertical 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 a single group, that is to say—all of the flues of each heating wall operate concurrently as upflow or downflow flues, and, when flame flues on one side of the coking chamber are burning, or operating for upflow, the flame flues on the opposite side of the same coking chamber are operating for downflow to permit exhaust of the waste gases.

The crosswise generators 18 of the retort oven or battery are located at a lower level than the aforesaid heating walls 11 and coking chambers 12 and extend in parallelism between the pillar walls 13 and the other supporting walls 22. 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 walls 13 and 22. 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. Preferably each regenerator is divided into an inner and outer compartment by a vertical partition 109 located between the aforesaid partition 19 and the side of the battery. The partitions 109 however do not extend clear up to the bottom of the coking chamber overlying the regenerator.

Each regenerator 18 is a chamber containing open brickwork, commonly called checkerwork, and indicated at 20, with a distributing sole channel 21 underneath and opening up into such checkerwork. The regenerators are heated, in alternation, by the hot combustion products that are exhausted from the flame or combustion flues and then impart such heat to the medium that they feed into these flame flues. The regenerators are grouped into pairs K and L, as shown in Fig. 3, the regenerators of the pairs K alternating with the regenerators of the pairs L. Each pair of such regenerators is provided with a series of ducts 23 all of which lead respectively to individual flame flues 17 of the same heating wall. With this construction each flame flue 17 communicates by a pair of ducts 23 with adjacent separate regenerators through which flow is maintained concurrently in the same direction. When the regenerators of the pairs K and their communicably connected flame flues are operating for inflow the regenerators of the alternate pairs L and their communicably connected alternate flame flues are operating for outflow to permit exhaust of the waste gases.

Each flame flue 17 of each heating wall has at its top a port or opening 24 for draft and the passing 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 present embodiment of the invention, the horizontal flues 25 of each heating wall are communicably connected by means of passageways 26 respectively with the corresponding horizontal flues of one of the next adjacent heating walls. Thus the entire flow from the heating wall, within the flues of which combustion is being maintained passes downwardly through all of the flues of the next adjacent heating wall and each reversal operation is accompanied by a reversal in direction in flow of all the flues of each heating wall.

The draft through the ports 24 may be regulated by means of the usual dampers or sliding bricks 27, positioned in the ordinary way in the bottoms 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.

Extending crosswise of the battery in the pillar walls 13 and located beneath the heating walls 11 thereabove are gas supply channels 29 for the purpose of supplying coke oven gas to the several flame flues. The channels 29 respectively communicate with the individual flues 17 by means of ducts 31 that lead from such channels 29 individually into the bottoms of individual flues. Within the several ducts are disposed the usual nozzles 32. It will be understood that the battery may be operated alternatively with the use of a special regenerator gas such as producer gas, as the fuel, during such producer gas operation. One regenerator of each pair of inflow regenerators may be optionally connected with a producer gas main by a mechanism such as is disclosed in the co-pending application of Joseph Becker for Letters Patent in the United States filed April 23, 1920, Serial No. 376,126, now Patent No. 1,416,322, granted May 16, 1922.

In accordance with the present invention the soles or bottoms 33 of the several coking chambers or retorts 12 are respectively provided with a channel 34. The several channels 34 extend longitudinally of the coking chamber and from side to side of the battery and constitute steam flow passages located directly above the supporting walls 22 and contiguous to the tops of the regenerators 18. Steam may be introduced simultaneously into both ends of said channels 34 through steam supply pipes 35 located on the opposite sides of the oven battery and individually provided with controlling valves 36. The discharge ends of the respective steam supply pipes 35 are let into removable channelled plugs 37 which may be inserted into the opposite ends of the channels or passageways 34. The channels 34 receive the steam directly from the supply pipes 35 and because of their proximity to the hot gases flowing through the regenerator ducts 23 and the tops of the regenerators 18 function as superheating passages in which the steam introduced through the pipes 35 may be superheated to a high temperature, for example to 1,200° Fahrenheit. By providing steam supply pipes at both ends of the channels 34, these channels may be rapidly supplied with steam, although the latter moves at a very low velocity.

The steam supplied to both ends of the channels 34 travels toward the central portion of said channels and from such center portion passes through a plurality of discharge ports 38 into the intermediate distributing channels 39. The intermediate distributing channels 39 are located respectively above the superheating channels 34. It is preferable to provide the discharge ports 38 only at the central portions of the channels 34, in order to force the steam to travel through the channels 34 a distance great enough to effect the desired superheating of the steam. From each distributing channel 39 the steam passes through a great number of distributing ports 40 dispersed at frequent intervals from end to end of each channel 39 and leading into a pair of horizontal distributing ducts 41 located above each channel 39. The ducts 41 also extend from side to side of the battery structure and are located above the respective channels 39 on opposite sides of the longitudinal center of the retort. Each horizontal duct 41 communicates with the interior of its corresponding coking chamber or retort by means of a series of discharge ports 42 also dispersed in great numbers at intervals along each duct 41 from end to end thereof. As shown in Fig. 1, the ports 42 that lead from the ducts 41 into the coking chambers are preferably staggered relatively to the ducts 40 that connect the distributing channels 39 with the horizontal ducts 41. This arrangement avoids the deposit of ashes or other solid matter in the distributing channels 39 and also provides an extremely diffuse distribution of the steam flow into the corresponding coking chamber, with a relatively low velocity. The opposite ends of the horizontal ducts 41 and channels 39 may be closed by plugs 43 let into the sides of the battery structure. The plugs 43, as well as the plugs 37 are removable at will, when it is desired to clean out any of the steam flow spaces. By providing the great number of ports 42 and 40, the employment of steam nozzles for introducing the steam into the coking chambers or retorts is entirely eliminated, while, at the same time, the area through which steam is diffused into the charge is greatly increased.

In the carbonization process, the coking of the coal proceeds inwardly from the opposite sides of the charge of coal in each coking chamber, with the result that the center or core of the charge remains in a more or less gumlike or sticky consistency until the charge is completely coked. By the special steam flow passage and distributing means of the invention, the steam is diffused into the sides of the coking mass of coal, so that the steam may pass, highly superheated and with a relatively low velocity, freely through the coke already formed on the opposite sides of the coal charge. By superheating the steam, undue cooling of the charge is avoided and the water gas reaction is promoted. Moreover, the charge is prevented from being cooled to the point of sticking to the bottom or side

walls of the retort, so that any difficulty in pushing the charge is entirely eliminated.

The battery is especially constructed, so as to permit the necessary horizontal expansion caused by the high temperatures, without opening up any of the steam ducts or passages in such manner as to cause short circuiting or leakages of the steam flow. As shown in Figs. 3 and 4, the vertical expansion joints 44, for permitting the horizontal expansion are located on opposite sides of the steam flow area and remotely from any of the steam passageways. With this construction the necessary expansion may take place freely, without affecting the steam flow area.

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 coke oven battery, in combination: coking chambers; heating walls forming the sides of said coking chambers and respectively adapted to impart coking heat to the masses of carbonaceous material within such coking chambers; regenerators communicably connected with said heating walls; steam-superheating channels located below the respective coking chambers and extending from side to side of the battery; intermediate steam distributing channels located above said superheating channels and communicably connected therewith by ports disposed only at the central portions of said superheating channels; upper pairs of steam distributing channels corresponding to the aforesaid intermediate distributing channels and communicably connected therewith by ports dispersed at intervals from end to end of such intermediate distributing channels, the aforesaid upper distributing channels of said pairs being disposed respectively on opposite sides of the longitudinal center of the coking chambers and being communicably connected with the aforesaid coking chambers by discharge ports dispersed at intervals from end to end of said channels and staggered relatively to the ports connecting the intermediate distributing channels with the aforesaid upper pairs of distributing channels; and means for introducing steam into the opposite ends of the aforesaid steam superheating channels; substantially as specified.

2. In a coke oven battery, in combination: coking chambers; heating walls forming the sides of said coking chambers and respectively adapted to impart coking heat to the masses of carbonaceous material within such coking chambers; regenerators communicably connected with said heating walls; steam-superheating channels located below the respective coking chambers and extending from side to side of the battery; intermediate steam distributing channels located above said superheating channels and communicably connected therewith; upper pairs of steam distributing channels corresponding to the aforesaid intermediate distributing channels and communicably connected therewith by ports dispersed at intervals from end to end of such intermediate distributing channels, the aforesaid upper distributing channels of said pairs being disposed respectively on opposite sides of the longitudinal center of the coking chambers and being communicably connected with the aforesaid coking chambers by discharge ports dispersed at intervals from end to end of said channels and staggered relatively to the ports connecting the intermediate distributing channels with the aforesaid upper pairs of distributing channels; and means for introducing steam into the opposite ends of the aforesaid steam-superheating channels; substantially as specified.

3. In a coke oven battery, in combination: coking chambers; heating walls forming the sides of said coking chambers and respectively adapted to impart coking heat to the masses of carbonaceous material within such coking chambers; regenerators communicably connected with said heating walls; steam-superheating channels located below the respective coking chambers and extending from side to side of the battery; intermediate steam distributing channels located above said superheating channels and communicably connected therewith; upper pairs of steam distributing channels corresponding to the aforesaid intermediate distributing channels and communicably connected therewith by ports dispersed at intervals from end to end of such intermediate distributing channels, the aforesaid upper distributing channels of said pairs being communicably connected with the aforesaid coking chambers by discharge ports dispersed at intervals from end to end of said channels and staggered relatively to the ports connecting the intermediate distributing channels with the aforesaid upper pairs of distributing channels; and means for introducing steam into the opposite ends of the aforesaid steam superheating channels; substantially as specified.

4. In a coke oven battery, in combination: coking chambers; heating walls forming the sides of said coking chambers and respectively adapted to impart coking heat to the masses of carbonaceous material within such coking chambers; regenerators communicably connected with said heating walls; steam-superheating channels located below the respective coking chambers and extending from side to side of the battery; intermediate steam distributing channels located above said superheating channels and communicably connected therewith; upper pairs of steam distributing channels correspond-

ing to the aforesaid intermediate distributing channels and communicably connected therewith by ports dispersed at intervals from end to end of such intermediate distributing channels, the aforesaid upper distributing channels of said pairs being communicably connected with the aforesaid coking chambers by discharge ports dispersed at intervals from end to end of said channels; and means for introducing steam into the opposite ends of the aforesaid steam-superheating channels; substantially as specified.

5. In a coke oven battery, in combination: coking chambers; heating walls forming the sides of said coking chambers and respectively adapted to impart coking heat to the masses of carbonaceous material within such coking chambers; regenerators communicably connected with said heating walls; steam-superheating channels located below the respective coking chambers and extending from side to side of the battery; intermediate steam distributing channels located above said superheating channels and communicably connected therewith by ports disposed only at the central portions of said superheating channels; upper pairs of steam distributing channels corresponding to the aforesaid intermediate distributing channels and communicably connected therewith by ports dispersed at intervals from end to end of such intermediate distributing channels, the aforesaid upper distributing channels of said pairs being communicably connected with the aforesaid coking chambers by discharge ports dispersed at intervals from end to end of said channels and staggered relatively to the ports connecting the intermediate distributing channels with the aforesaid upper pairs of distributing channels; and means for introducing steam into the opposite ends of the aforesaid steam superheating channels; substantially as specified.

6. In a coke oven battery, in combination: coking chambers; heating walls forming the sides of said coking chambers and respectively adapted to impart coking heat to the masses of carbonaceous material within such coking chambers; regenerators communicably connected with said heating walls; steam-superheating channels located below the respective coking chambers and extending from side to side of the battery; intermediate steam distributing channels located above said superheating channels and communicably connected therewith by ports disposed only at the central portions of said superheating channels; upper pairs of steam distributing channels corresponding to the aforesaid intermediate distributing channels and communicably connected therewith by ports dispersed at intervals from end to end of such intermediate distributing channels, the aforesaid upper distributing channels of said pairs being disposed respectively on opposite sides of the longitudinal center of the coking chambers and being communicably connected with the aforesaid coking chambers by discharge ports dispersed at intervals from end to end of said channels; and means for introducing steam into the opposite ends of the aforesaid steam superheating channels; substantially as specified.

7. In a coke oven battery, coking chambers, heating walls, regenerators communicably connected with said heating walls, steam superheating passageways located below the respective coking chambers and extending from side to side of the battery, combined with multi-ported means extending from side to side of the battery for distributing the steam from said passageways into said coking chambers, said distributing means being communicably connected with said passageways only at the central portions thereof; substantially as specified.

8. In a coke oven battery, coking chambers, heating walls, regenerators communicably connected with said heating walls, steam superheating passageways located below the respective coking chambers and extending from side to side of the battery, combined with channel means provided with steam outlets and connected with the super-heating passageways and extending from side to side of the battery for distributing the steam from said passageways into said coking chambers; substantially as specified.

9. A coking retort oven comprising a coking chamber, and heating means therefor, the oven structure being provided with a steam-superheating flow passage exposed to extraneous heat derived from said heating means, combined with a channel means provided with steam outlets and connected with the super-heating passage for diffusely distributing into said coking chamber the steam superheated in said passage; substantially as specified.

10. In a coke oven battery, or the like, in combination: a heat treating chamber and heating means therefor; the structure being provided with a steam superheating flow passage exposed to extraneous heat derived from said heating means combined with a plurality of channel means provided with steam outlets and connected with the super-heating passage for diffusely distributing into said chamber the steam super-heated in said passage; substantially as specified.

11. In a coke oven battery, or the like, in combination: a heat treating chamber and heating means therefor, the structure being provided with a steam superheating passage combined with multiported means for distributing the steam from said passage into said chamber, said distributing means be-

ing communicably connected with said passage only at the central portions thereof; substantially as specified.

12. In a coke open battery, or the like, in combination: a heat treating chamber and heating means therefor, the structure being provided with a main steam distributing channel and an auxiliary steam distributing channel connected by ports with said main distributing channel, the auxiliary distributing channel being communicably connected with said heat treating chamber by discharge ports staggered relatively to the ports connecting the main and auxiliary channels; substantially as specified.

13. The combination as defined by claim 12 in which the main and auxiliary distributing channels extend from said to side of the battery and are provided with plugs in their ends to permit cleaning of the same; substantially as specified.

14. The process of operating a coke oven battery, or the like, comprising a heat treating chamber, heating means therefor, and a steam super-heating flow passage open at both ends and connected intermediate its ends to the heat treating chamber: which process consists in introducing steam simultaneously into both ends of said passage whereby the resultant velocity of the steam is decreased over that which would obtain from introducing steam into one end only; substantially as specified.

15. In a coke over battery, or the like, in combination: a heat treating chamber; heating means therefor; means for preheating the fuel supplied to said heating means; and a steam super-heating flow passage for introducing steam into said chamber, said battery structure comprising brickwork provided with expansion joints between portions of said brickwork intermediate the several parts, and said steam super-heating flow passage being located in unit of said brickwork lying entirely within expansion joints; substantially as specified.

16. In a coke oven battery, or the like, in combination: a heat treating chamber; heating means therefor and a steam super-heating flow passage for introducing steam into said chamber, said battery structure comprising brickwork provided with expansion joints between portions of said brickwork intermediate the several parts and said steam super-heating flow passage being located in unit of said brickwork lying entirely within expansion joints; substantially as specified.

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