A. GOHMANN.

REGENERATIVE COKE OVEN.

APPLICATION FILED NOV. 15, 1910.

1,041,457. Patented Oct. 15, 1912.

3 SHEETS—SHEET 1.

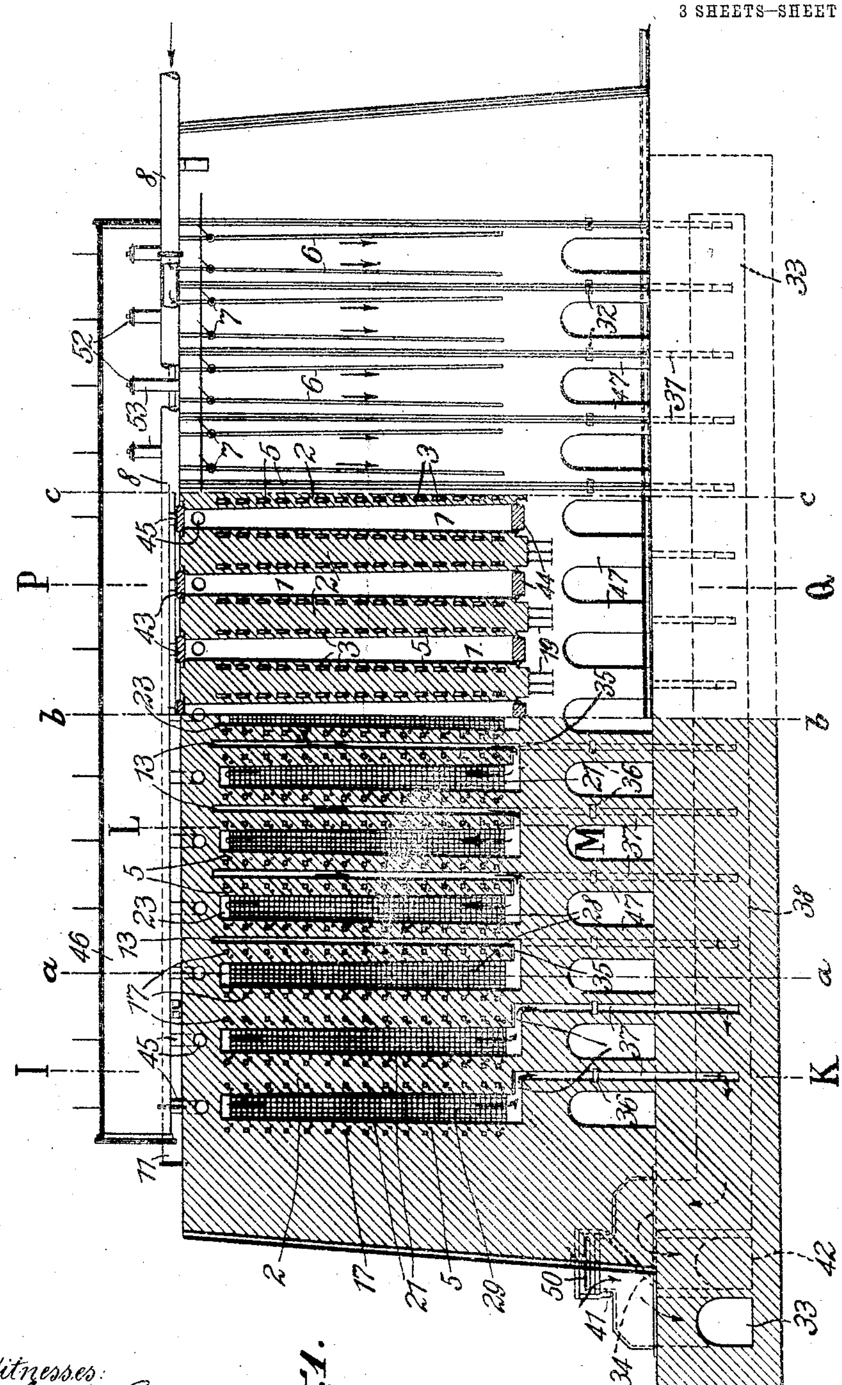

Fig. 1.

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3 SHEETS—SHEET 2.

Fig. 2.

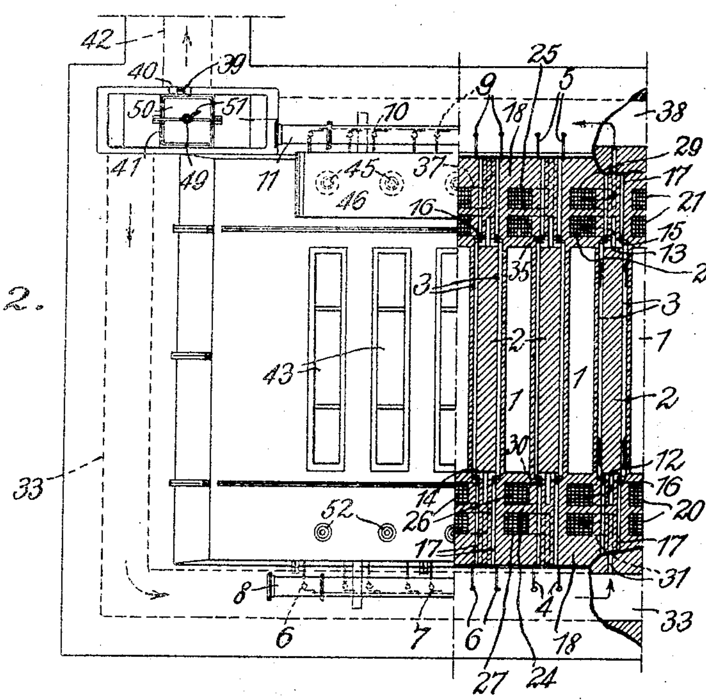
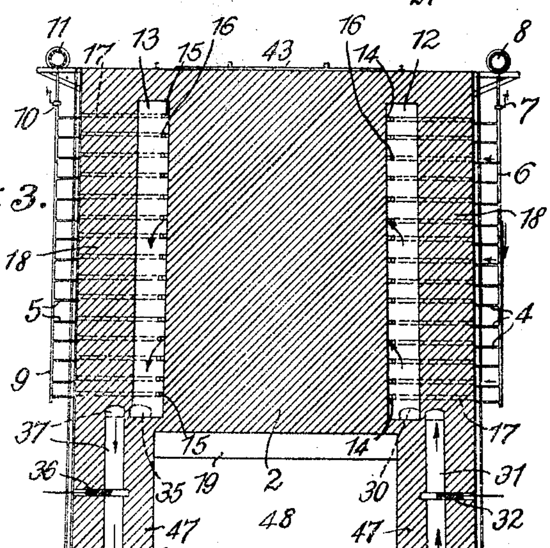


Fig. 3.



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3 SHEETS—SHEET 3.

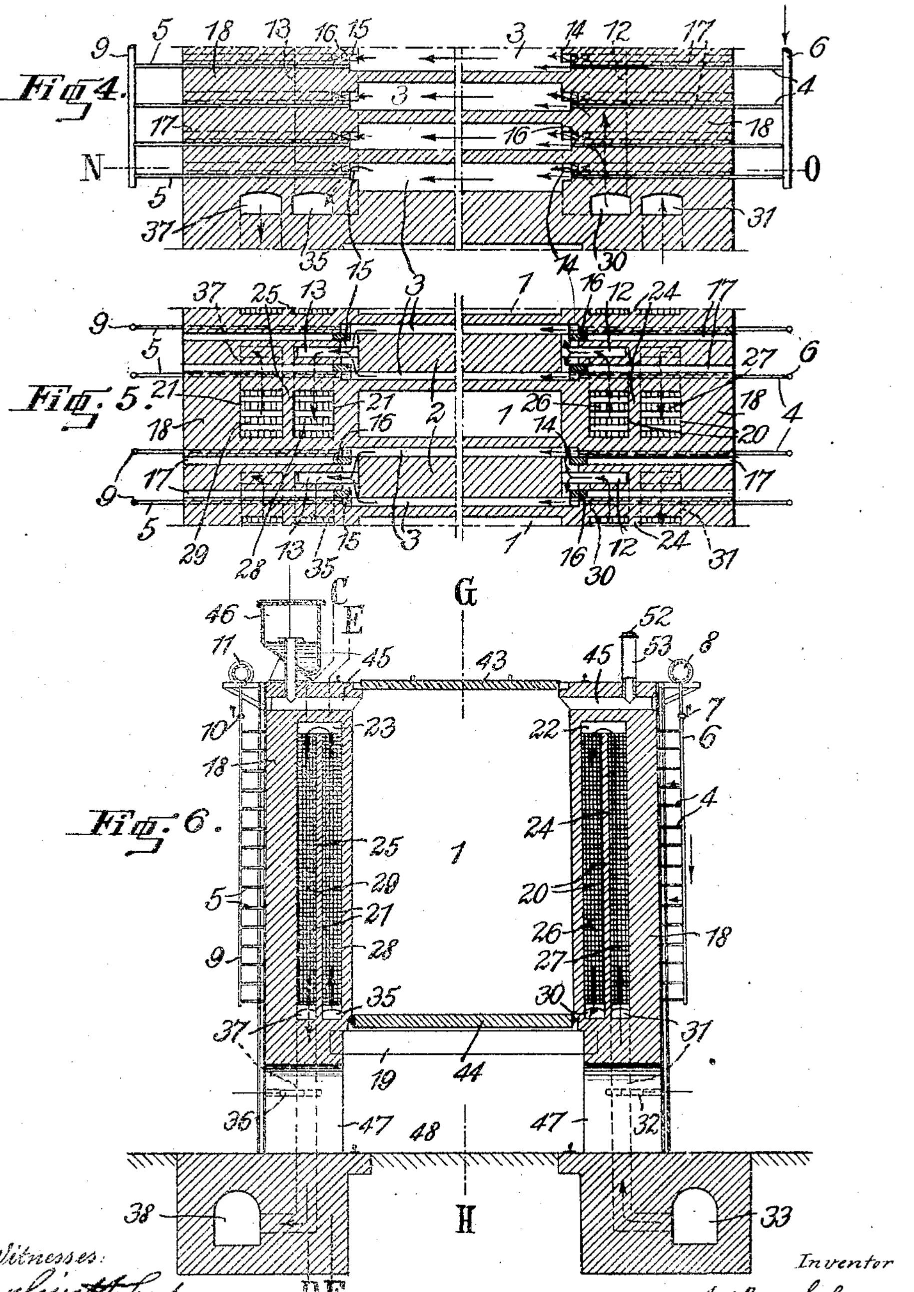

Fig. 4. Fig. 5. Fig. 6.

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UNITED STATES PATENT OFFICE.

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REGENERATIVE COKE-OVEN.

1,041,457. Specification of Letters Patent. Patented Oct. 15, 1912.

Application filed November 15, 1910. Serial No. 592,476.

To all whom it may concern:

Be it known that I, ARTHUR GOHMANN, a subject of the German Emperor, and a resident of Stettin, Germany, have invented certain new and useful Improvements in Regenerative Coke-Ovens, of which the following is a specification.

My invention relates to regenerative coke ovens having upright coking chambers, and consists in arranging upright regenerators adjacent to the coking chambers within the outer walls of the bench of coke ovens, thus simplifying the construction of the oven and reducing the cost of the installation. The new arrangement also secures an easy accessibility of the oven channels and an economical operation of the oven, owing to the avoidance of long channels which are required in the usual constructions to connect the heating flues with the regenerators and which cause considerable loss of heat.

A coke oven embodying my present invention is illustrated in the accompanying drawings, in which—

Figure 1 is a composite view, the left-hand portion, to the line *a*—*a*, showing the oven in longitudinal section on the line C—D of Fig. 6, while the portion between the lines *a*—*a* and *b*—*b* is a longitudinal section on line E—F of Fig. 6, the portion between the lines *b*—*b* and *c*—*c* is a longitudinal section on line G—H of Fig. 6, and the end to the right of the line *c*—*c*, is a side elevation; Fig. 2 is partly a top view and partly a horizontal section of the oven; Fig. 3 is a cross section on line I—K of Fig. 1; Fig. 4 is a partial cross section on line L—M of Fig. 1; drawn upon an enlarged scale; Fig. 5 is a horizontal section on line N—O of Fig. 4; and Fig. 6 is a vertical section on line P—Q of Fig. 1.

The coke oven shown in the drawings comprises a series of upright coking chambers 1 arranged side by side, said chambers being of rectangular cross section and separated from each other at the long sides of the rectangles by partitions 2. Superposed horizontal heating flues 3 (see Figs. 4 and 5) are disposed within these partitions in two vertical sets, each set being adjacent to one of the long sides of adjoining coking chambers 1. The gas to be burned and the air to support combustion are introduced alternately from opposite sides of the oven, after intervals of say one half hour each, so as to always secure a uniform heating of the coking chambers 1.

The gas for heating is admitted to the heating flues 3 alternately at the right and at the left, through burners 4 and 5 respectively (see Fig. 5). The burners 4 are branched off from vertical gas conduits 6 located exteriorly of the oven at the right thereof and provided with cutoff valves 7 (Fig. 1) controlling their connection with the gas main 8. The burners 5 are connected in a similar manner with conduits 9 located outside the oven on its left hand side and having connections, controlled by valves 10, with a gas main 11. All the valves 7 may be connected for simultaneous operation, as shown, and the same kind of connection may be adopted for the valves 10.

The supply of air and the carrying away of the waste gases are accomplished alternately at opposite ends of the oven, by means of vertical collecting channels 12 and 13 respectively (Figs. 3 and 5). Short horizontal channels 14 and 15 connect both sets of heating flues, 3, of a partition 2 at the ends with the collecting channels 12 and 13 respectively (Figs. 4 and 5). The effective cross section of these channels 14, 15 may be altered by means of regulating slide valves 16 accessible from the outside through channels 17.

Immediately adjacent to the coking chambers 1, at the short sides of the rectangles, upright regenerators 20, 21 are built into the outside walls 18 of the bench of ovens (Figs. 5 and 6), said regenerators being filled with checker-work, in the well-known manner. Each of these regenerators 20, 21 is sub-divided by a partition 24 or 25 respectively into two chambers 26, 27 or 28, 29 respectively, connected at the top by transverse channels 22, 23 respectively located in said partitions. The regenerator chambers 26 and 28 are contiguous to the short sides of adjacent coking chambers 1, and next to said chambers are the other regenerator chambers 27 and 29.

The chamber 26 of each regenerator 20 located at the right hand of the oven is connected at the bottom by a channel 30 with one of the above mentioned upright collect-

ing channels 12 (Figs. 3 and 5). The other chamber 27 of each regenerator 20 is connected at the bottom by means of a channel 31 (Fig. 6) containing a cut-off valve 32, with a flue 33 leading to a reversing valve 34 (Fig. 1) located at the left hand side of the oven adjacent to one of its ends.

In an analogous manner the chamber 28 of each left hand regenerator 21 is connected at the bottom by a channel 35 with one of the vertical collecting channels 13, while the other regenerator chamber 29 communicates at its lower end by means of a channel 37 controlled by a valve 36, with a flue 38 likewise leading to the reversing valve 34. This reversing valve is secured to a shaft 39 which by means of a lever 40 (Fig. 2) can be turned from the position indicated in Fig. 1 to the reversing position, in the well-known manner. According as the valve 34 occupies one or the other position, it either connects the flue 33 with an air inlet 41 and the flue 38 with a smoke flue 42 leading to the stack, or the flue 33 with the smoke flue 42 and the flue 38 with the air inlet 41. To regulate the total amount of air required by the bench of ovens, I provide a valve 50 secured to a screw spindle 49 and located above the air inlet 41, said valve being adjustable vertically by means of a hand lever 51 secured to the spindle, to vary the effective cross section of the air inlet 41.

The coking chambers are filled with coal through top opening normally closed by covers or plugs 43, while the coke is removed through openings at the bottom, normally closed by plates 44. The gas produced in the coking chambers 1 passes through the conduits 45 (Fig. 6) at the left of the ovens to the condenser 46. At the right hand of the ovens there are conduits 53, which may be closed by means of removable covers 52 and which serve for the escape of the gases at the termination of the coking operation and at the time of filling the oven chambers 1. The ovens rest upon pillars 47 (Fig. 1) between which is left a space 48 (Fig. 6) for the passage of the cars used to carry away the coke. The partitions 2 are supported by beams 19 resting on the foundation.

The operation of the oven is as follows: When the coking chambers 1 are heated from the right-hand side of the oven, as indicated in the drawings by arrows, the gas valves 7 (Fig. 6) are open and the gas valves 10 closed, the reversing valve 34 being in the position indicated in Fig. 1. In this case gas enters each of the heating flues 3 through the corresponding burner 4 (Fig. 4) while the air for supporting combustion is conveyed to both sets of heating flues 3 of each partition 2 from the common collecting channel 12 through the branch channels 14. The combustion gases travel through the heating flues 3 but once, from right to left, and in so doing give off most of their heat to the coking chambers 1. The still considerable heat then remaining in the combustion gases is then carried away with them through the branch channels 15 to the respective collecting channels 13 and thence through the short channels 35 into the corresponding upright regenerators 21 arranged immediately adjacent to the individual coking chambers 1. It will be seen that the heating gases do not have to pass through any long connecting channels on their way from the heating flues to the regenerators, so that I avoid losses of heat which would result from the employment of such long channels. Thus that portion of the heat contained in the heating gases which has not been absorbed by the coking chambers will be delivered almost in full to the regenerators and by them transferred again to the incoming air intended to support combustion, after the direction of the gas and air currents has been reversed.

In each regenerator the combustion gases travel upward in the inner chamber 28 and downward in the outer chamber 29. By subdividing each regenerator into two chambers I provide for the combustion gases a long path of comparatively small cross-section. In passing through the regenerator chambers 28, 29, the combustion gases give off the heat contained in them to the checkerwork of the regenerators, with the exception of a remnant such as is required to insure a proper draft in the stack. The waste gases traveling through the regenerators 21 do not heat the coking chambers 1, but simply maintain the temperature prevailing within the oven. In order not to interfere with a uniform operation of the oven, the hot waste gases enter at the bottom of each of the inner regenerator chambers 28, that is the chambers nearest to the coking chambers, so that during their upward travel in said chambers, they will lose heat, corresponding to the upward decrease of heat within the oven. The waste gases, after passing through the outer regenerator chamber 29 from top to bottom, reach the flue 38 through the channel 37 and finally travel through the smoke flue 42 leading to the stack.

At the same time, the air for supporting combustion enters through the inlet 41 into the flue 33 and then passes through the channels 31 into the regenerators 20. Through each of these regenerators the air passes in a direction opposite to that of the passage of the waste gases through said regenerator during the operation period immediately preceding. During its travel through the regenerators, the air absorbs the heat stored therein. The highly heated air then passes from each regenerator 20 to the corresponding collecting channel 12 through the channel 30.

Reversal of the operation is effected by throwing the valve 34 into its other position and by closing the gas valves 7 and opening the gas valves 10. This will cause the heating gases to travel through the flues 3 in the direction opposite to that indicated by the arrows in Fig. 4, while the regenerators 21 serve to preheat the air intended to support combustion and the regenerators 20 are heated by the waste gases.

Very important advantages are secured by certain features in the relative arrangement of the coking chambers, the heating flues, and the regenerators. Thus, the regenerators are located at the end of the oven (adjacent to the short sides of the rectangular coking chambers) while the (horizontal) heating flues are disposed between the coking chambers (adjacent to the long sides of said chambers). I am thus enabled to place the coking chambers very close together, since the partitions between them contain only the heating flues. Another advantage results from the fact that regenerators and heating flues are not adjacent to each other, but located in different walls; thus the walls of the heating flues are not likely to crack, but even if they should, the combustion gases escaping through such cracks would have to travel a comparatively long distance in order to reach the regenerators. The heating walls or partitions are not affected by the periodical heating and cooling of the regenerators, and thus the heating of the coking chambers is very uniform. In my improved oven, each of the heating walls has its own set of regenerators, and it is therefore a very simple matter to regulate the heating action of each wall individually, or even to stop the heating action entirely for any one of the heating walls, which is a great convenience in making repairs. In order that individual regenerators may be provided for each heating wall, the upright arrangement has been adopted for such regenerators.

The regenerators 20, 21 may be modified by omitting the partitions 24, 25, so that in this case each regenerator will have a single chamber. The collecting channels 12, 13 would then be connected with the upper ends of the regenerators 20, 21, while the channels 31, 37 would be connected with the lower ends of the regenerators, as described. With this construction, the air for supporting combustion would pass through the regenerators but once, from the bottom to the top, and after reversal the water gases would pass through the regenerators but once, from top to bottom. This modification and others may be made without departing from the nature of my invention as defined in the appended claims.

I claim:

1. A coke oven provided with coking chambers arranged side by side, heating flues in the side walls of said chambers, and a plurality of upright regenerators connected with said flues and arranged in the end walls of the coking chambers.

2. A coke oven provided with upright coking chambers of rectangular cross section, regenerators located adjacent to the short sides of said chambers, two sets of superposed heating flues located in the partitions between the coking chambers, adjacent to the long sides of said chambers, upright collecting channels whose lower ends are connected with said regenerators, and branch channels connecting said upright channels with the heating flues.

3. A coke oven provided with upright coking chambers, upright regenerators adjacent to said chambers, each regenerator being provided with a partition extending from its bottom to a point at a distance from its top, so as to leave at the top a channel connecting the two compartments of the regenerator, one of said compartments being located between the coking chamber and the other compartment, superposed heating flues in the partitions separating adjacent coking chambers, and upright collecting channels connected with said heating flues and also connected with the lower ends of the regenerator compartments nearest to the coking chambers.

4. A coke oven provided with coking chambers arranged side by side, heating flues in the side walls of said chambers, a plurality of upright regenerators each connected with the flues of one side wall only, and arranged in the end walls of the coking chambers, and means for controlling the connection of the individual regenerators with the respective heating flues.

5. A coke oven provided with upright coking chambers of rectangular cross section and partitions intervening between the long sides of adjacent chambers, two sets of superposed heating flues located in said partitions adjacent to the respective coking chambers, individual regenerators adjacent to the short sides of the coking chambers, and connections between the heating flues and the regenerators, the heating flues of different partitions being connected with different regenerators.

6. A coke oven provided with coking chambers arranged side by side, heating flues in the side walls of said chambers, two sets of regenerators, each set arranged in one of the opposite end walls of the coking chambers, and each set comprising a plurality of regenerators each corresponding to one of said side walls and connected with the flues thereof, and individual means for controlling the connection of the several regenerators with the respective heating flues.

7. A coke oven provided with coking

chambers, regenerators adjacent to said chambers, each regenerator being provided with a partition extending from one of its ends to within a distance from its other end so as to leave a channel connecting the two compartments of the regenerator, one of such compartments being located between the coking chamber and the other compartment, and heating flues connected with those ends of the first-named compartments from which said partition extends.

In testimony whereof, I have signed this specification in the presence of two subscribing witnesses.

ARTHUR GOHMANN.

Witnesses:
G. LILIEQUIST,
EMIL SCHMIDT.