

March 24, 1925.

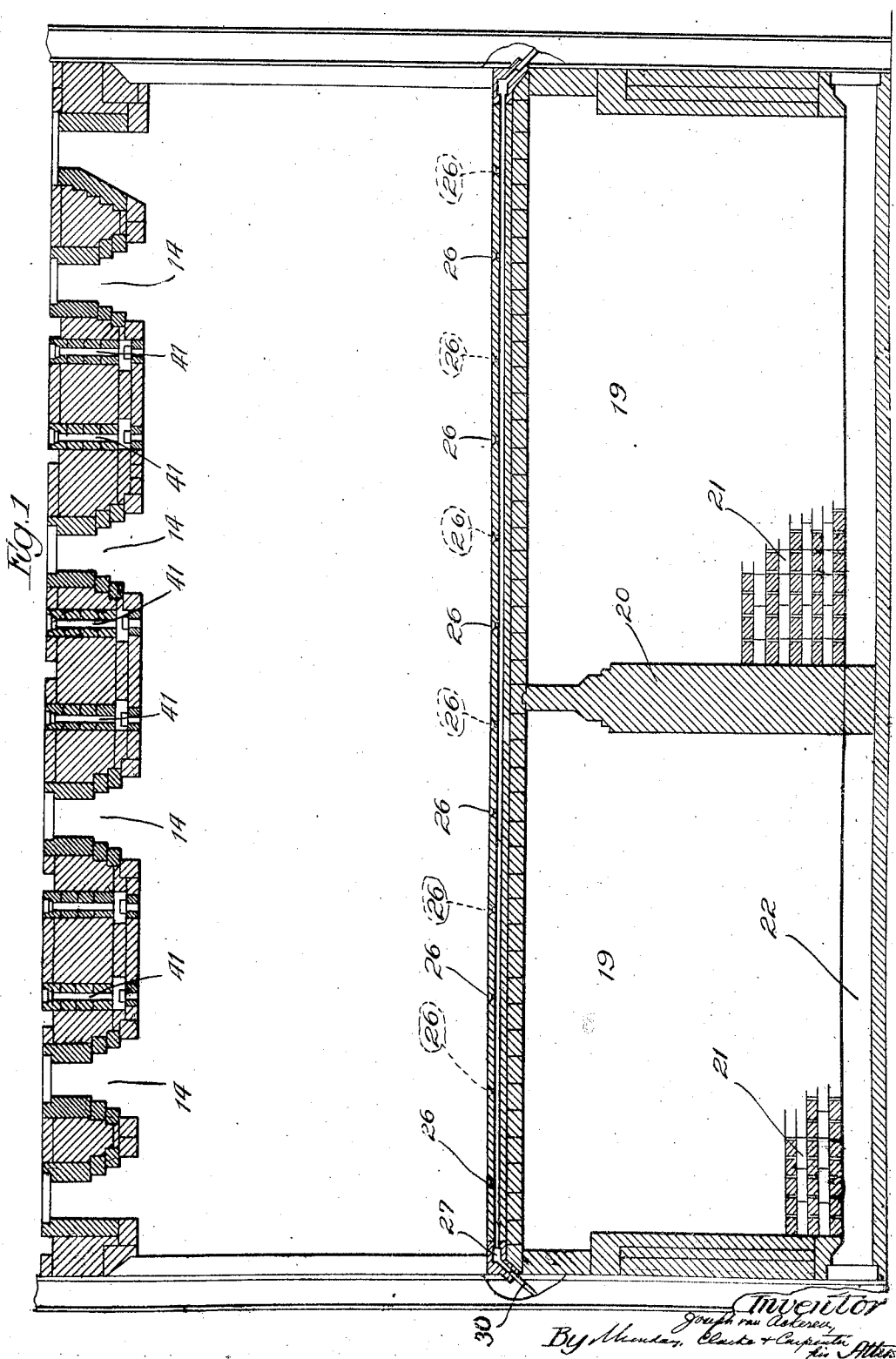
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J. VAN ACKEREN

COKING RETORT OVEN

Filed April 8, 1920

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Fig. 2

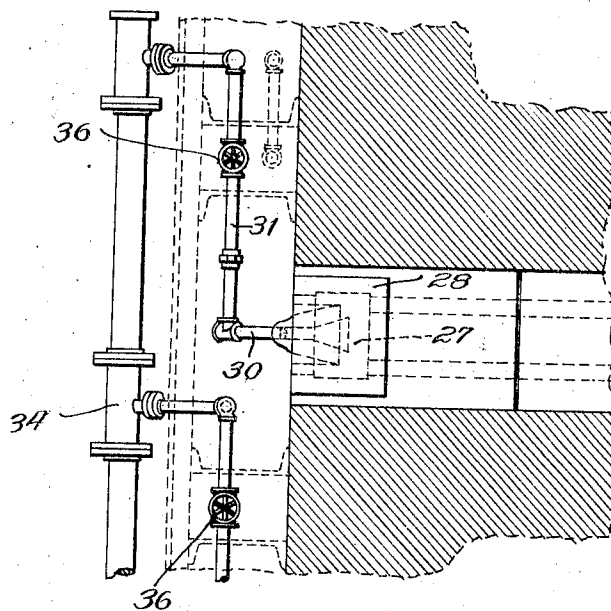
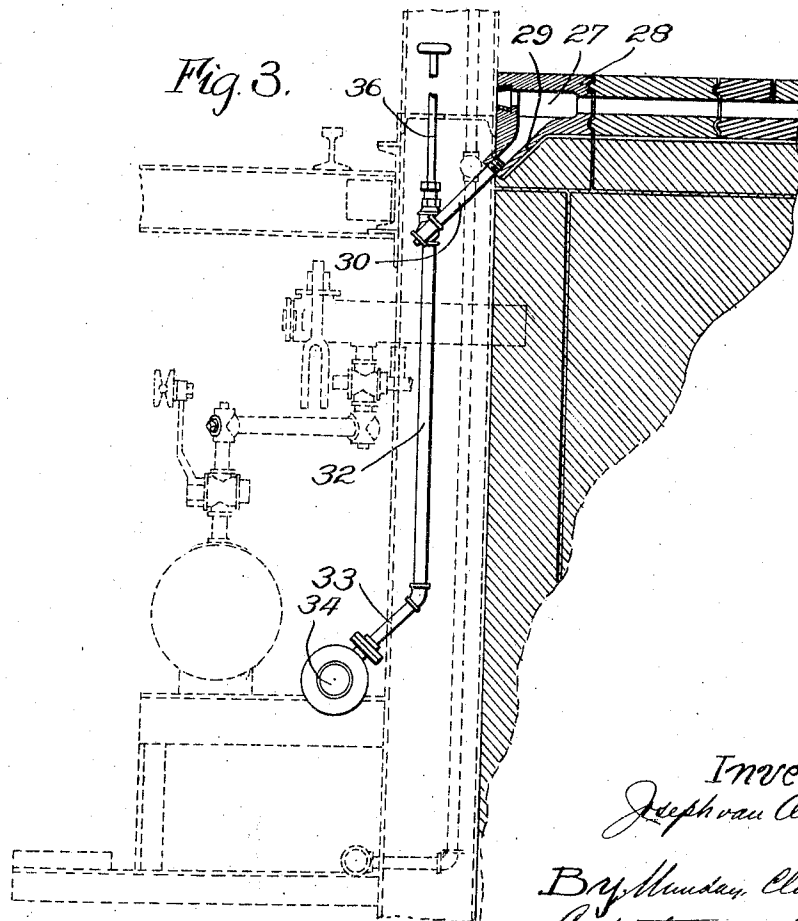


Fig. 3.



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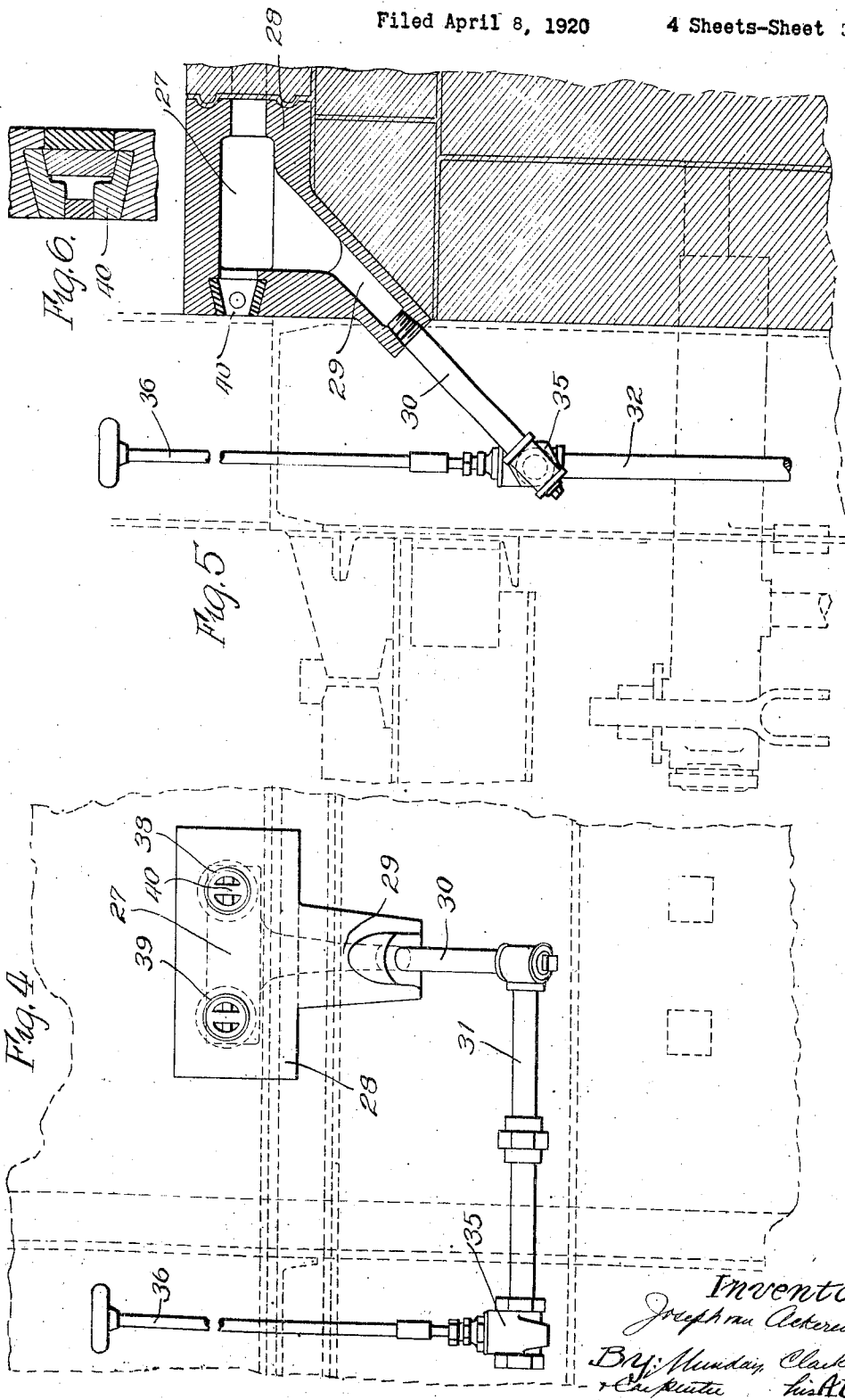
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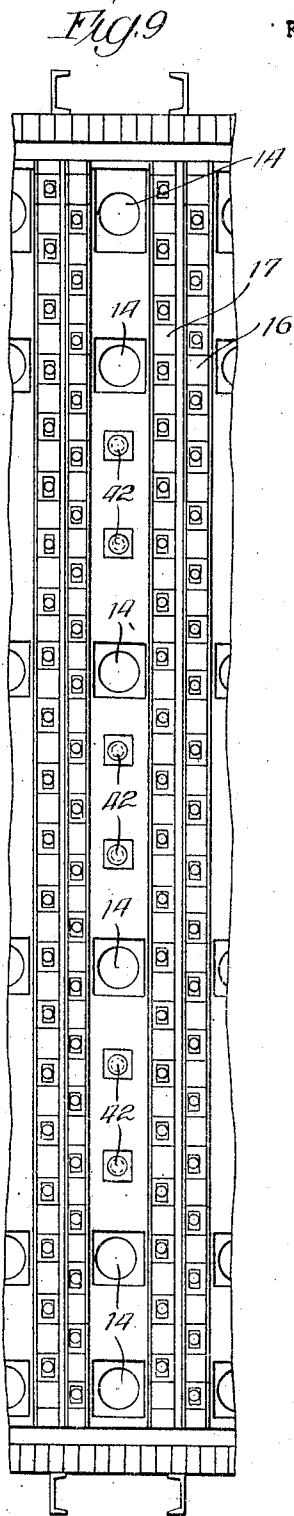
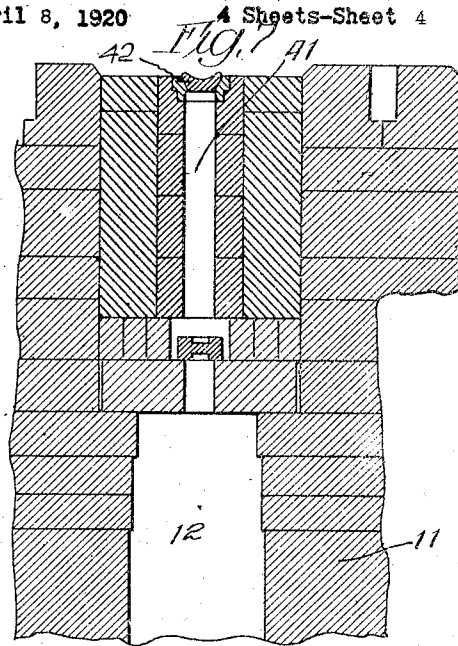
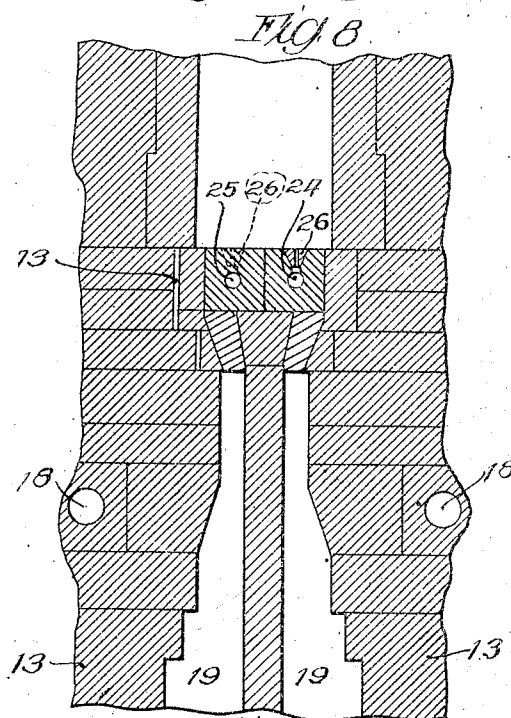
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COKING RETORT OVEN

Filed April 8, 1920

4 Sheets-Sheet 4



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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 8, 1920. Serial No. 372,151.

To all whom it may concern:

Be it known that I, JOSEPH VAN ACKEREN, a citizen of the United States, residing in Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Coking Retort Ovens, of which the following is a specification.

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 well known Koppers cross-regenerative type exemplified in the patent to H. Koppers No. 818,033 date April 17, 1906.

The invention has for one of its objects to incorporate in a coke oven a novel and highly efficient means for increasing the production of combustible fuel gas derived from the carbonization of coal in the coking chambers of such ovens, and particularly for augmenting the volume of the gas derived from the coal toward the end of its coking period. With this end in view, the invention embodies means for introducing steam into the several coking charges in a peculiarly efficient manner so as to effect reactions of the steam with the hot coking charges, which will produce an augmented output of gas without substantially decreasing its fuel value.

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 specifically to such illustrative instance or instances:

Figure 1 is a vertical section taken transversely through a coking retort oven of a type such as above specified and equipped with the improvements of the present invention, the transverse plane on which the view is taken being longitudinally through a coking chamber and the pair of regenerators therebeneath;

Fig. 2 is a detailed horizontal section through one side of the coking retort oven illustrated in Fig. 1 and showing in plan the

means for feeding steam into a coking chamber of said oven;

Fig. 3 is a detailed vertical section taken transversely through the same portion of the oven indicated in Fig. 2 and showing the steam feeding or injecting means in elevation;

Fig. 4 is an enlarged front elevation of the steam injecting means;

Fig. 5 is an enlarged vertical sectional elevation similar to Fig. 3;

Fig. 6 is a detailed sectional view illustrating a preferred form of plug hereinafter explained;

Fig. 7 is a detailed vertical section taken longitudinally through the top of the coking retort oven and transversely through its coking chamber;

Fig. 8 is a view on substantially the same plane as Fig. 7 but of a lower portion of the oven; and,

Fig. 9 is a fragmentary top plan view of the coking retort oven.

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

In its present embodiment, the invention is incorporated in a coking retort oven or coke oven battery having features of the well known Koppers cross-regenerative type exemplified in the patent to H. Koppers hereinabove mentioned, which retort oven or battery includes in its construction crosswise extending parallel heating walls constituted of series of vertical flame or combustion flues, elongated coking chambers or ovens intermediate the heating walls and parallel therewith, and crosswise extending regenerators located in planes beneath the planes of the coking chambers and the heating walls and parallel therewith. For convenience, the present description will be confined to this use of the invention; features of construction are, however, readily susceptible of other applications, and consequently, it is manifest that the scope of the invention is by no means confined 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 embodies in its construction a plurality of crosswise elongated heating walls 11 and a plurality of in-

intermediate crosswise elongated vertical coking chambers or ovens 12. The heating walls 11 form the side walls of the respective coking chambers 12 as shown more particularly in Fig. 7, and in the present instance are supported by the heavy supporting or pillar walls 13 extending crosswise of the battery and located, as shown, beneath the heating walls 11. These pillar walls collectively form the main support for the entire superstructure of the oven battery and are themselves firmly 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 12 through charging holes 14 located in the top 15 of the oven battery and positioned directly above the ovens or chambers 12, as shown in Fig. 1. These charging holes 14 are equipped with the usual removable covers, not shown, which are removed when charging any of the several ovens and placed in position to close the tops of the ovens during the entire coking operation. Heat for coking the charges of coal in the several ovens or chambers 12 is derived from the heating walls 11, which as before mentioned, extend crosswise of the battery at the sides of the coking chambers. To accomplish this purpose, the heating walls are respectively constituted of two series 16 and 17 of substantially triangular combustion or flame flues alternately facing oppositely toward the coking chambers contiguous to either side of each such heating wall. These combustion flues 16 and 17 may be of the general nature disclosed in my prior Patent No. 1,312,372 dated August 5, 1919, and in the prior patent to Joseph Becker No. 1,312,301 dated August 5, 1919, and may communicate by a duct system with the several regenerators, said duct system being in its general characteristics similar to that disclosed in the two prior patents just mentioned.

The said two series of flues in each heating wall are operatively disposed in two groups, each of about half the length of the heating wall and respectively on opposite sides of the center line of such wall, this disposition of the flues being for the purpose of reversing the direction of flow therein at each periodic reversal of the oven. While one group of flues is operating as upburning flues and is receiving a supply of fuel gas from the gas channel 18 located in the pillar wall beneath the heating wall; the other group of flues in the same heating wall is concurrently operating to direct the downflow from the first mentioned group of flues into the regenerators located below the downflow operating flues.

The crosswise regenerators 19 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 beneath the coking chambers 12 between the pillar walls 13. Below the middle lengthwise line of the heating wall aforesaid, there is a partition 20, as shown in Fig. 1, which 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, such partition 20 corresponding in position with the line between the hereinbefore mentioned two groups of combustion flues. With this construction, there are thus formed below each coking chamber and crosswise of the battery, two end to end regenerators 19, the meeting ends of which are the partition 20 above mentioned. Each regenerator 19 is a chamber containing open brickwork commonly called checkerwork and indicated at 21, with a distributing sole channel 22 underneath the checkerwork of each regenerator, the channels forming the soles of such chambers and opening up into the checkerwork of their respective regenerators. These regenerators in alternation are heated by the hot combustion products that are exhausted from the flame or combustion flues hereinabove mentioned and then impart such heat to the air that they feed into these flames flues.

The reversal in direction of flow through the several regenerators of the battery, and also through the flame or combustion flues of the heating walls with which the regenerator communicate, takes place crosswise of the battery in accordance with the mode of operation designated in the patent to Koppers above mentioned. For example, all of the regenerators 19 on one side of the partition 20 operate concurrently as inflow regenerators, while all of the regenerators on the opposite side of the partition 20 operate concurrently as outflow regenerators. On reversal by means of the usual reversing connection all of the regenerators which previously operated as inflow regenerators become outflow regenerators and concurrently all of the regenerators which previously operated as outflow regenerators become inflow regenerators. It will be understood that the inflow operating generators deliver preheated air to the upburning flues and that the outflow operating regenerators receive the products of combustion from the down-draft flues and convey such products of combustion to the waste gas tunnel leading to the stack.

In accordance with the present invention, the soles or bottoms 23 of the several coking chambers or ovens 12 are provided with two channels 24 and 25 extending longitudinally of the coking chamber and respectively located on opposite sides of its longitudinal center and toward the sides of such coking chamber. Each channel communicates with

the interior of its adjoining coking chamber 12 by means of a series of nozzles 26 and in the present instance, as shown in Fig. 8, the nozzles 26 of one channel are staggered relatively to the nozzles of the other channel in the sole of the same coking chamber. Each pair of channels 24 and 25 constitutes a pair of steam channels for injecting superheated steam through their respective ducts or nozzles 26 into the coking mass thereabove, the steam being injected on opposite sides of the central portion or core of such coking mass. 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 disposition of the steam channels on opposite sides of the longitudinal center of the adjoining coking chamber, the steam is injected into the sides of the coking mass of coal, so that the steam may pass freely and directly through, and react upon, the coke already formed towards the sides of the coal-charge, and also to avoid pressures which might develop from injecting steam into the uncoked core of such charge. The steam reacts with the glowing coking mass to augment the combustible fuel production. In practice the steam will be introduced into the mass of coal toward the end of its coking period but while the center or core still remains in a gum-like or sticky condition, to augment the volume of gas given off from the charge that is nearly coked.

The pair of channels 24 and 25 communicate at their opposite ends with steam chambers 27, there being a steam chamber communicating with each pair of channels and adapted to supply steam to each channel, as shown. The steam chamber 27 is formed in a casting 28 the top of which is a continuation of the bottom of the coking chamber. This casting 28 is furthermore formed with a downwardly-inclined nozzle 29 the discharge end of which opens up into the chamber 27 as shown in Figs. 2 to 5 inclusive. At its lower end, the aforesaid nozzle 29 projects beyond the side wall of the oven or battery and screwed into the lower end of the nozzle 29 is a steam injector pipe 30, the lower receiving end of which is connected with a horizontal steam pipe 31 that leads to a vertical steam pipe 32, the latter being connected by means of an inclined steam pipe 33 with a steam main 34 extending longitudinally along the side of the battery. The aforesaid pipe connections leading from the steam main 34 are provided for each steam chamber 27 at each end of each coking chamber, there being a series of such pipe connections on each side of the battery. Within each horizontal steam pipe

31 is a valve 35 of any approved construction and adapted to be operated by a valve operating rod 36 which extends upwardly beyond the level of the bench 37, so as to be in convenient reach of an operator standing on said bench.

By operating any one of the series of valve operating rods 36 on either side of the battery, the steam may be supplied to or cut off from the pair of channels 24, 25 which such valve operating rod controls. There is thus provided an individual control for the steam injecting or feeding means contiguous to each coke oven or chamber, the control being operable from either side of the battery.

Within each casting 27 is a pair of inspection holes 38 and 39 respectively registering with the pair of channels 24 and 25 and adapted to be closed by suitable plugs 40 shown in detail in Fig. 6. As shown in Figs. 1 and 9 a number of the nozzles 26 in the channels 24 and 25 may be reached through the charging holes 14. Those nozzles which are intermediate the aforesaid charging holes 14 may be reached through access channels 41 formed in the top 15 of the coking chamber and adapted to be opened or closed by removable covers 42.

The expansion joints 43 accommodate any expansion or contraction resulting from the employment of the steam in the ducts 24, 25.

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.

What I claim is:

1. In a coke oven of the by-product type, in combination: a plurality of long, high, narrow, horizontal coking chambers; heating walls forming the sides of said coking chambers and respectively adapted to impart coking heat laterally to the vertical sides of a mass of carbonaceous material within each of such coking chambers; a pair of ducts located in the refractory structure of the bottom of and extending longitudinally with respect to each coking chamber, the ducts of each pair being respectively located on opposite sides of the longitudinal center of the adjoining coking chamber and slightly displaced inward of the sides of the latter and each duct communicating by a series of ports with the interior of the coking chamber whereby steam may be injected into the coked portion of the carbonaceous material; a source of steam supply; and individually-controlled connections for feeding steam from said source to each pair of ducts; substantially as specified.

2. In a coke oven of the by-product type in combination: a coking chamber; a heating wall for said coking chamber adapted to impart high coking heat to the contiguous surface of a mass of carbonaceous material

within said coking chamber; a duct so located in the coking chamber with respect to said heating surface as to deliver steam substantially to the outer coked portions only of said carbonaceous material; and a source of steam supply; substantially as specified.

3. In a coke oven of the by-product type, in combination: a coking chamber; a heating wall for said chamber adapted to impart high coking heat to carbonaceous material within said chamber, and means for feeding steam into the coked side of the carbonaceous material without substantially penetrating the uncoked core thereof.

4. In a coking retort oven of the by-product type, in combination: a long, high, narrow, horizontal coking chamber, two vertical substantially parallel heating walls respectively forming the sides of such coking chamber and respectively adapted to impart coking heat laterally to the vertical sides of a mass of carbonaceous material contained within such coking chamber; and means, located in the refractory structure of the bottom of such coking chamber, for introducing steam in series of jets respectively located on opposite sides of the longitudinal center of such coking chamber and so directed as to inject steam into the coked portion only of the carbonaceous material, substantially as specified.

5. The improvement in the art of coking carbonaceous material, such as coal, which consists in applying a high coking heat to the side of a mass of such material, and injecting steam through the coked side of the carbonaceous material without substantially penetrating the uncoked core thereof; substantially as specified.

6. The improvement in the art of coking carbonaceous material, such as coal, which consists in applying a coking heat laterally to the opposite vertical sides of a long, high, narrow mass of such material, and, during the latter portion of the coking period, injecting steam through the bottom of the mass of such material on each side of its longitudinal center in a manner to cause it substantially to penetrate the outer or coked sides only of the carbonaceous material; substantially as specified.

7. In the coking of coal, or other carbonaceous material in horizontal chamber ovens in which the heating is applied from the opposite side walls thereof so that the heating and coking of the material progresses inwardly from the opposite sides of the mass, the improvement characterized by injecting steam into the substantially or nearly coked mass toward the end of the coking simultaneously from the opposite sides of the central vertical plane of the mass, to induce water gas reaction in the relatively porous, substantially coked portions of the mass, but to avoid the contact of the steam with fused material in the center of the mass.

8. In the coking of coal, or other carbonaceous material in horizontal chamber ovens in which the heating is applied from the opposite side walls thereof so that the heating and coking of the material progresses inwardly from the opposite sides of the mass, the improvement characterized by injecting steam toward the end of the coking into the substantially or nearly coked mass simultaneously from the bottom of and vertically into the opposite sides of the central vertical plane of the mass, to induce water gas reaction in the relatively porous, substantially coked portions of the mass, but to avoid contact of the steam with fused material in the center of the mass.

9. A steam cap for coke oven floors comprising a casting adapted to form a continuation of the oven floor, provided with steam passage-ways therethrough.

10. A steam cap for coke oven floors comprising a casting adapted to form a continuation of the oven floor, provided with a steam chamber and passage-ways leading to and from the same.

11. A steam cap for coke oven floors comprising a casting adapted to form a continuation of the oven floor, provided with steam passage-ways therethrough and means permitting inspection of one of the steam passage-ways.

In testimony whereof, I have hereunto set my hand to the foregoing specification and claims.

JOSEPH VAN ACKEREN.