

C. SCHROETER.
COKE OVEN.

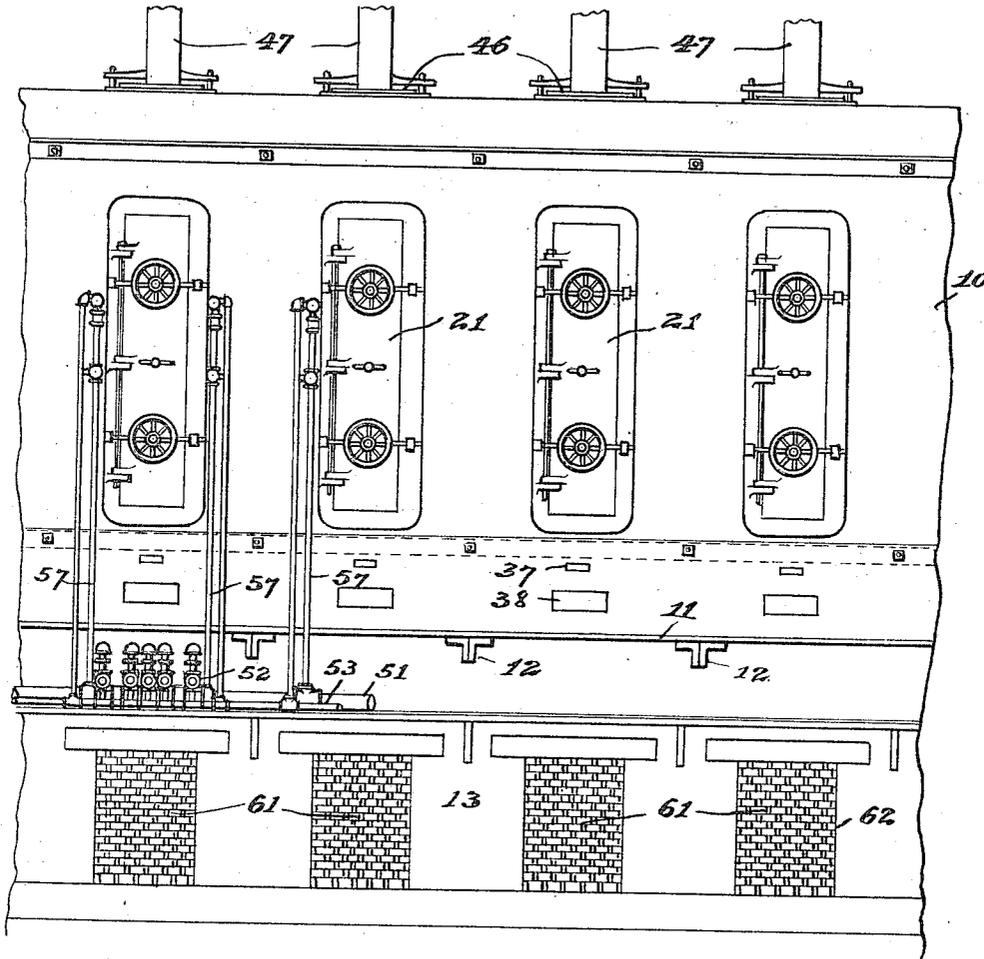
APPLICATION FILED JUNE 24, 1910.

Patented July 25, 1911.

4 SHEETS—SHEET 1.

998,805.

Fig. 1.



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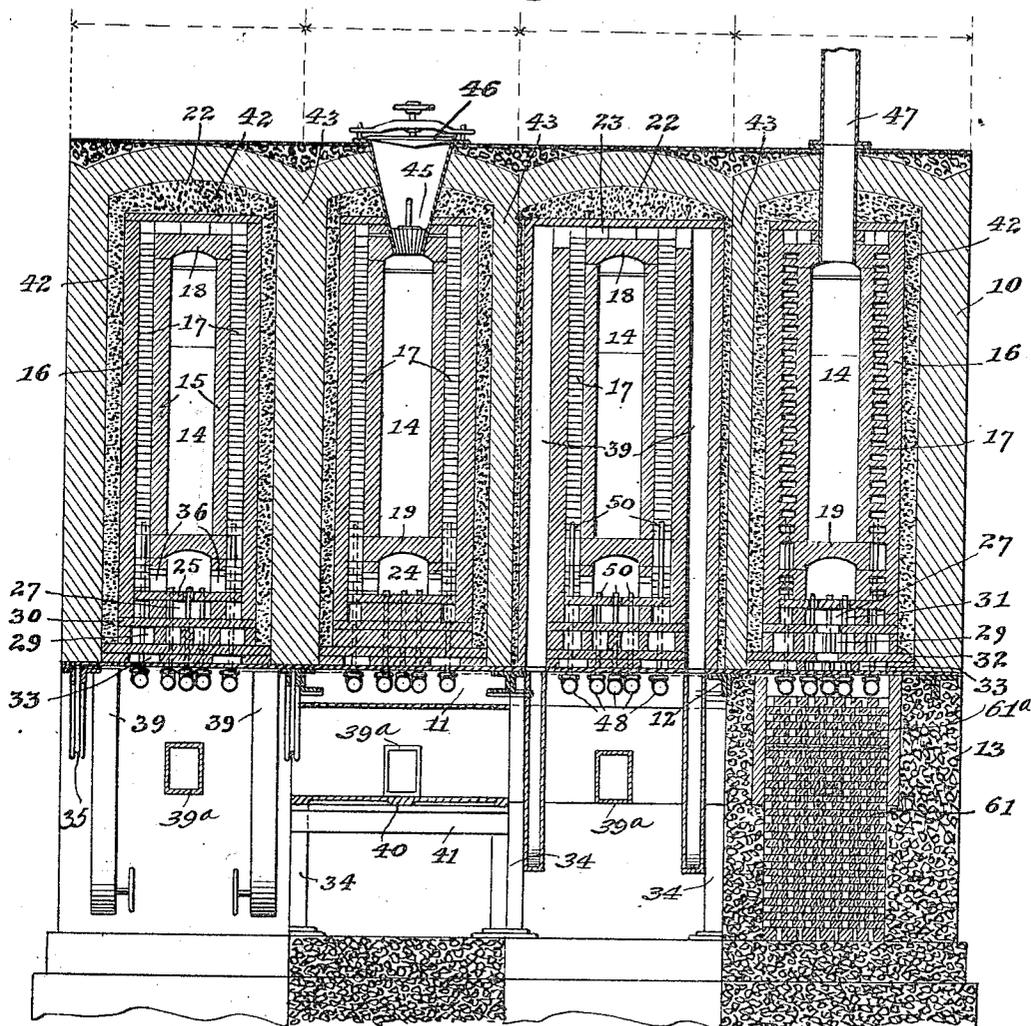
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4 SHEETS—SHEET 2.

Fig. 2.



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4 SHEETS—SHEET 3.

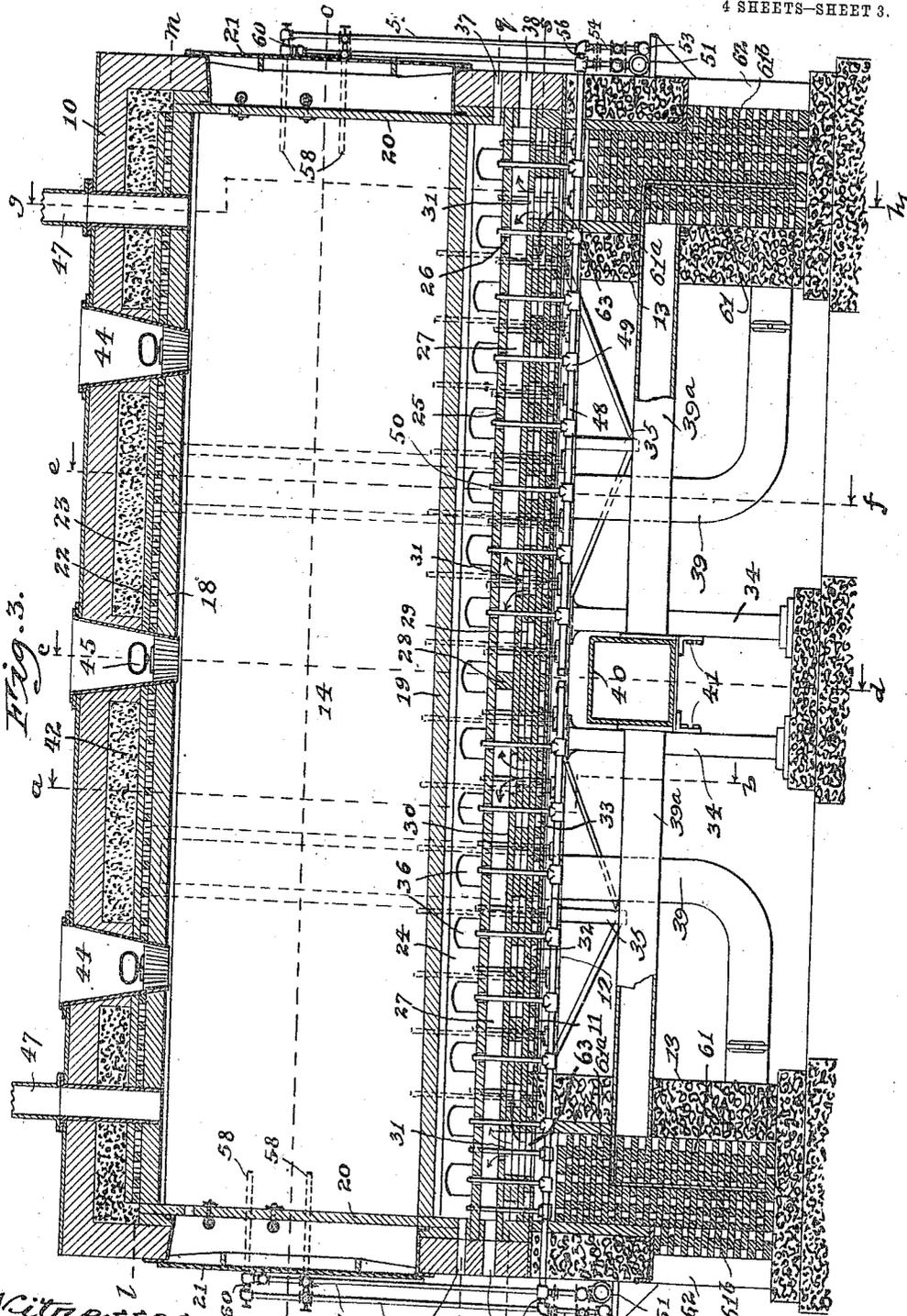


Fig. 3.

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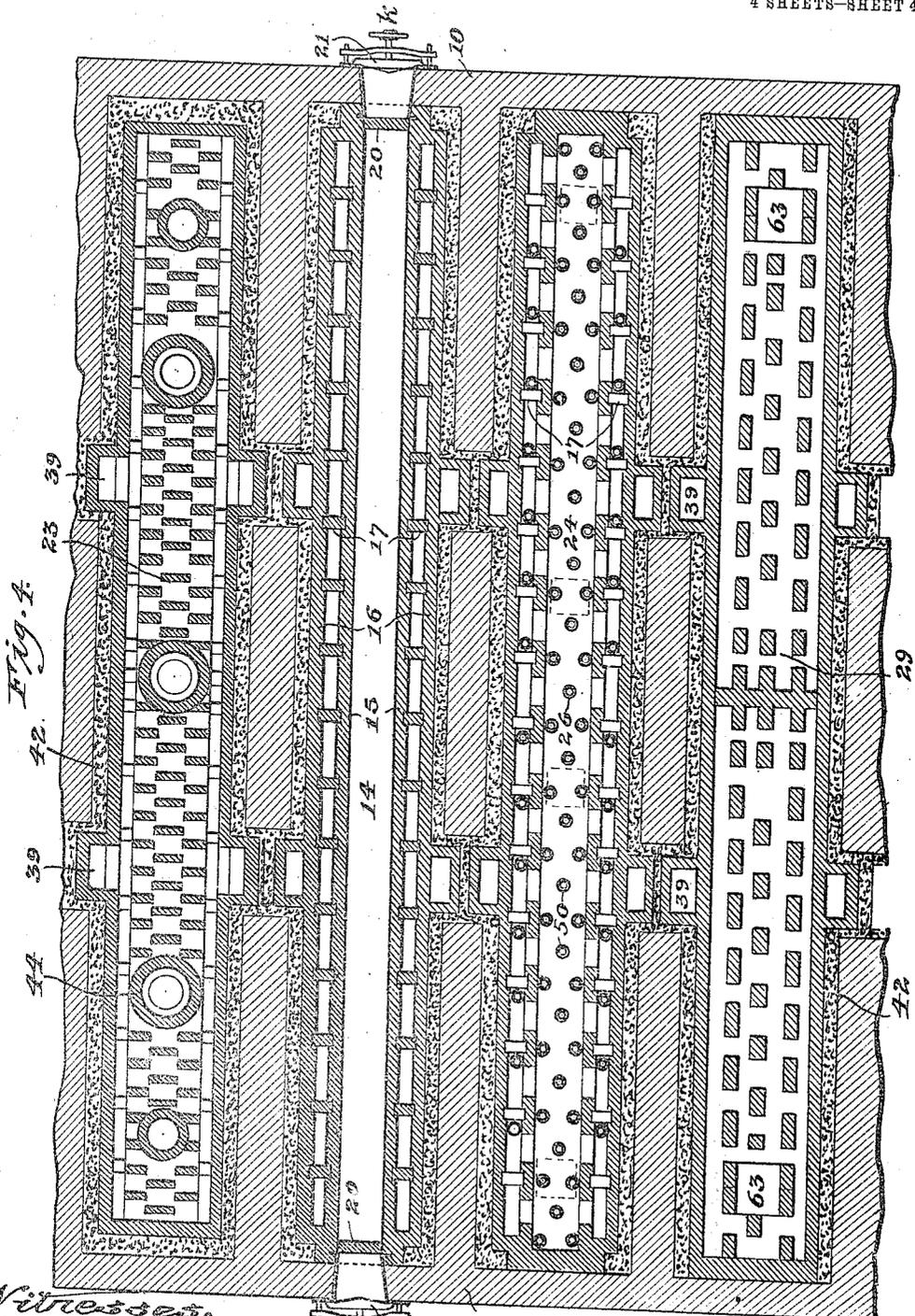
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4 SHEETS—SHEET 4.



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UNITED STATES PATENT OFFICE.

CARL SCHROETER, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE SCHROETER BY-PRODUCT COKE-OVEN CONSTRUCTION COMPANY, OF PHOENIX, ARIZONA TERRITORY, A CORPORATION OF ARIZONA TERRITORY.

COKE-OVEN.

998,805.

Specification of Letters Patent. Patented July 25, 1911.

Application filed June 24, 1910. Serial No. 568,660.

To all whom it may concern:

Be it known that I, CARL SCHROETER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Coke-Ovens, of which the following is a specification.

My invention relates to improvements in coke-ovens of that general type wherein the oven comprises within a single external housing or casing a bank or group of similarly arranged and equipped retorts adapted to treat independent quantities of coal supplied thereto, the several retorts being adapted to effect the coking action solely through the application of external heat applied to the several retorts.

The coke-oven embodying the present invention is of the same general type as, and in many respects is constructionally similar to, the coke-oven shown in and forming the subject matter of Letters Patent No. 922,201, granted to me May 18, 1909.

Among the principal objects of the present invention are to improve the arrangement of burners and burner supply-pipes with a view to better protecting the latter from injury by the high heat, and with a further view to facilitating repair work, when necessary; to provide an improved means for supplying air to support combustion; to provide an improved arrangement of regenerators for preliminarily heating the air; to provide an improved and simplified support for the several retorts and the casing or housing which contains them, said support having the regenerators in part contained therein; to provide suitable insulation for the metal base-plate of the retorts; and in general to provide improvements in the details of construction and arrangement of the apparatus as will hereinafter more fully appear.

To these ends the invention consists in the matters hereinafter described and more particularly pointed out in the appended claims.

In the accompanying drawings I have illustrated a coke-oven embodying my present improvements wherein—

Figure 1 is a front elevational view broken away at the sides of the oven, illustrating a group of four retorts arranged side by side, it being understood that the rear end of the bank of retorts is a duplicate

of the front end, the retorts extending entirely through the oven and being provided with like closures at both ends; Fig. 2 is a vertical sectional view taken transversely of the retorts, the several retorts from left to right being shown on the section lines *a-b*, *c-d*, *e-f*, and *g-h*, respectively, of Fig. 3; Fig. 3 is a longitudinal vertical section through one of the retorts and its underlying supports taken on the line *i-k*, of Fig. 4; and Fig. 4 is a horizontal sectional view through four adjacent retorts, the upper retort being shown as cut on the line *l-m*, the second retort being shown as cut on the line *n-o*, the third retort being shown as cut on the line *p-q*, and the lowermost retort as cut on the line *r-s*, of Fig. 3.

Referring to the drawings, 10 designates an external brick-work or other fireproof housing or casing resting upon a broad flat steel base-plate 11, which latter, in turn rests upon a series of steel-beams 12 extending from front to rear of the oven and themselves supported at their ends upon masonry walls 13 extending across the front and rear of the entire structure. The housing or casing 10 incloses a group of relatively long, narrow retort-chambers 14. These several retort-chambers are duplicates of each other in construction, and a description of one will suffice for all.

The side walls of the retorts are made with interior open-work or checker formation, each wall consisting of an inner lining 15, an outer shell 16, and an intermediate checker-work 17; this construction being best shown in Figs. 2 and 4; the top lining of the wall of the retort is formed by one or more transversely extending fire-clay arch pieces 18, while the bottom wall or sole is formed by one or more removable fire-clay slabs or arch pieces 19. Refractory plates 20 (Fig. 3), which may be made in sections, are set in the retorts near the ends thereof to serve as inner end walls and to prevent excessive heating of the outer iron doors 21. The top of the retort comprises an outer plate or cover 22 between which and the refractory top lining 18 is an intersticed or checker-work 23, of the character clearly shown in Fig. 4. Beneath the floor walls of the retorts the checker-work sides 17 are continued downwardly, constituting the side walls of combustion-chambers 24, the bottom

walls of which combustion-chambers are formed by horizontal plates 25 having burner apertures 26 formed therein at frequent intervals.

5 Below the plates 25 forming the bottom of the combustion-chamber is formed an air-chamber 27 preferably divided centrally by a partition 28 (Fig. 3); and below the air-chamber 27 is formed a checker-work
10 space 29 (Fig. 4) which forms in effect a recuperator-duct or flue for conducting a portion of the air that supports combustion into the superposed air-chamber 27 as more particularly hereinafter described; the top
15 wall 30 of said recuperator flue (which also forms the bottom wall of the air-chamber 27) being apertured at intervals, as shown at 31 (Fig. 3) to permit the upward flow of heated air from the recuperator-flue into
20 the air-chamber. Between the bottom wall 32 of the recuperator-flue 29 and the steel base-plate 11, and to protect the latter from the intense heat, I interpose suitable insulation which may consist of a dead air-space
25 33 containing sufficient bricks or fire-clay blocks to adequately support the bottom wall 32 of the superposed recuperator-flue. In the case of long ovens, I preferably employ an intermediate support in the form of
30 columns 34 disposed substantially midway between the end-supporting walls 13 (Fig. 3), said columns supporting the beams 12, and the latter, in turn, being preferably additionally strengthened by truss-work 35.

35 The inner linings of the side walls of the combustion-chamber are formed with lateral openings 36 which communicate with the checker-work spaces 17 in the side walls and in the ends of the combustion and air-chambers 24 and 27 are preferably formed observation-openings 37 and 38, respectively.
40 The checker-work spaces in the sides of the retort are in communication with each other at their upper ends through the checker-work space 23, and at both sides said space 23 communicates with downtake flues 39, serving in part to conduct the burned
45 gases to a single central transverse flue 40 (Fig. 3) conveniently supported by brackets 41 on the columns 34 and leading to a suitable chimney (not shown). A non-conducting jacket or packing 42 of ashes or other heat insulating material completely surrounds the top and sides of the walls or heating
50 jackets of the retorts, this layer of non-conducting material being confined between the outer side walls 43 of the several retort-containing receptacles of the super-structure of the oven.

60 Through the roof of each retort and its surrounding shell or casing are formed conical-charging openings 44, which can be made air-tight by fire-clay plugs 45 seated in the lower ends of said openings and cast-iron covers 46 applied to the entrance ends
65

of the openings. Chimneys or flues 47 also tap the roof of each retort and serve as outlets for volatile products driven off by the coking operation, which products may, if desired, be led to, and passed through suitable
70 converters to extract therefrom the by-products, while the combustible gas therefrom is in part returned to the oven to supply, when mixed with air and burned, the necessary heat which is applied to and through
75 the combustion chamber and checker-work jackets of the retorts as now to be described.

Beneath the steel base-plate 11 and extending longitudinally of the several retorts are fuel supply pipes 48, there being, as
80 herein shown, five of such pipes located beneath each retort (Fig. 2). In these pipes are interposed T-shaped couplings 49 into which are screwed or otherwise secured vertical branch burner pipes 50, which latter
85 extend upwardly through the base-plate 11, insulating-chamber 33, recuperator-flue 29, air-chamber 27, and the apertures 26 in the bottom wall of the combustion-chamber 24. Certain of these burner pipes 50 are extended
90 further up into the checker-work spaces 17 in the side walls of the retort, as clearly shown in Fig. 2. Extending along the front and rear sides of the oven are gas pipes 51, with which are connected the outer
95 ends of the several fuel-supply pipes 48, the fuel-supply to each pipe being controlled by suitable valves indicated at 52. Along the side of the gas pipes 51 are disposed air pipes 53 which are in communication with a
100 blower, air-pump or other suitable source of compressed air. Opposite the ends of each of the several pipes 48, the air-pipes 53 are provided with lateral branches 54 controlled by valves 55 and having nozzles 56 which
105 extend within the ends of the fuel-supply pipes 48 whereby the jets of air entrain a flow of gas mixed with said air to and through the branch burner pipes 50. The gas-pipes 51 are provided with branch risers
110 57 which rise adjacent to the end walls of the furnace opposite the lateral checker-spaces of the several retorts; said riser-pipes 57 being each provided with a plurality of inturned extensions or burner-tubes 58 (Fig. 3) which project through the end walls of the furnace and discharge into the checker-spaces 17. The air-pipes 53 are likewise provided with riser-pipes 59 which extend
115 alongside the riser-pipes 57 and are similarly provided with inturned nozzles 60, which enter the burner-tubes 58 and serve to entrain the gas through the latter.

In each of the front and rear masonry walls 13 and directly beneath the end of
125 each retort is located a checker-work regeneration-chamber 61 that is open to the atmosphere throughout its lower portion through an opening 62 formed in the front portions of the walls 13, and, at its upper
130

end, communicates freely with the air-chamber 27, and with the recuperator flue 29 through registering openings in the base-plate 11 and bottom wall 32 of the recuperator flue, as clearly shown at 63 in Fig. 3; a part of the air passing directly across the recuperator flue and through the end openings 31 into the air-chamber 27, and another part flowing along the recuperator flue and thence upwardly into the air-chamber through the intermediate openings 31.

A portion of the regeneration chamber 61 at each end is partitioned off, as by solid walls shown at 61^a and 61^b thereby forming an inclosed heating chamber extending the full length of the inner or back-side of each regenerator, into which the downtake flues 39 lead; and from these heating chambers, between each pair of flues 39, is led across another discharge flue 39^a leading into delivery flue 40, whereby the regenerators 61 are heated.

With the oven constructed as described, the coking operation is carried on substantially as follows: The retorts having been charged with coal through the several charging openings 44, and the latter closed, gas and compressed air are turned on through the gas and air-supply pipes, it being understood that the air supply is under pressure while the gas is drawn into the furnace chiefly by the suction or entraining action of the air-jets. The air and gas entering and mixing in the longitudinally disposed pipes 48 pass upwardly through the burner-tubes and discharge within the combustion-chambers, in which latter the combustion begins. The burning gases flow from the combustion-chambers laterally outward through the openings 36 to the checker-spaces 17, rising through the latter to the top of the furnace and filling the checker-space 23 over the tops of the retorts, passing thence to the downtake flues 39. From the latter the gases pass through the heating chambers of the regenerators and the flues 39^a to the main transverse discharge flue 40 and thence to the chimney. Inasmuch as the several soles 19 of the retorts form the tops of the combustion chambers, it will be seen that the retorts are completely enveloped by the burning gases, and by reason of the distribution of the burners and the eduction flues the gases are thoroughly dispersed and the circulation maintained substantially uniform around each of the several retorts; this uniformity of distribution being promoted by the outer burner tubes of the vertical series and the horizontal burner tubes 58 which directly penetrate the lateral checker-work spaces 17. The jet-like action of the gas burning at the tips of the burner tubes 50 has the effect of entraining the air through the regenerators 61 and recuperator flues 29, such air becom-

ing quite highly heated during its passage through the regenerators and recuperator flues, which latter are in a heated state by reason of their proximity to the burners. This entrained air, although considerably heated by the regenerators, is comparatively cool relatively to the temperature obtaining within the combustion-chamber and hence preserves the burner-tubes from melting. It also furnishes an auxiliary supply of oxygen to support combustion in addition to that introduced by the internal air-blast.

The insulation provided between the recuperator flues and the metal base-plate prevents the transmission by conduction of sufficient heat to injuriously effect said metal base-plate; and the location of the longitudinal gas-pipes 48 beneath the base-plate of the furnace not only affords a better protection to said pipes against the heat, but also makes the work of repairing or renewing the burner-tubes 50 much simpler, since not requiring the tearing out of any of the structure to withdraw and replace said tubes.

It will be understood that the details of construction may be somewhat modified without departing from the spirit of the invention or sacrificing any of its advantages; and accordingly I do not limit myself to the exact details shown and described except to the extent that they are made the subject of specific claims.

I claim:

1. In a coking oven, a coking retort comprising a closed coking chamber the side walls whereof are formed with checker-work for the passage of products of combustion, a combustion-chamber beneath said coking chamber provided with apertures in its bottom wall for the entraining of air and with lateral openings communicating with said checker-work, an air-chamber beneath said combustion chamber, and a recuperator space beneath and communicating with said air-chamber, in combination with a fuel-pipe extending beneath the bottom of said retort and provided with branch burner-tubes extending therefrom upwardly through said recuperator space and air-chamber and the entraining apertures in the bottom wall of said combustion-chamber, substantially as described.

2. In a coking oven, a coking retort comprising a closed coking chamber the side walls whereof are formed with checker-work for the passage of products of combustion, a combustion-chamber beneath said coking chamber provided with apertures in its bottom wall for the entraining of air, and with lateral openings communicating with said checker-work, an air-chamber beneath said combustion chamber, a recuperator space beneath and communicating with said

air-chamber, a metal base-plate forming the bottom of the retort, and suitable heat-insulation between said base-plate and the bottom of said recuperator space, in combination with a fuel-pipe extending beneath said base-plate and provided with branch burner-tubes extending therefrom upwardly through said base-plate, insulation, recuperator space, air-chamber and the entraining apertures in the bottom wall of said combustion chamber, substantially as described.

3. In a coking oven, a coking retort comprising a closed coking chamber the side walls whereof are formed with checker-work for the passage of products of combustion, a combustion-chamber beneath said coking chamber provided with apertures in its bottom wall for the entraining of air and with lateral openings communicating with said checker-work, an air-chamber beneath said combustion chamber, burner-tubes extending from beneath the retort upwardly into said combustion-chamber, other burner-tubes extending from beneath said retort upwardly into the checker-work spaces of the side walls, means for supplying fuel to said burner-tubes, and means for admitting air to said air-chamber, substantially as described.

4. In a coking oven, a coking retort comprising a closed coking chamber the side walls whereof are formed with checker-work for the passage of products of combustion, a combustion-chamber beneath said coking chamber having lateral openings communicating with said checker-work, an air-chamber beneath and communicating with said combustion-chamber, a fuel-pipe provided with branch burner-tubes extending into said combustion chamber, foundation walls supporting the ends of said retort, and regenerators in said foundation walls and communicating with said air-chamber through which the air to the latter is preliminarily heated, substantially as described.

5. In a coking-oven, a coking retort comprising a closed coking chamber the side walls whereof are formed with checker-work for the passage of products of combustion, a combustion-chamber beneath said coking chamber having lateral openings communicating with said checker-work, an air-chamber beneath and communicating at a plurality of points with said combustion-chamber, a recuperator space beneath and communicating at a plurality of points with

said air-chamber, a fuel-pipe provided with branch burner-tubes extending into said combustion-chamber, foundation walls supporting the ends of said retort, and checker-work regenerators in said foundation walls communicating at their lower ends with the atmosphere and at their upper ends with said recuperator space and air-chamber, substantially as described.

6. In a coking oven of the general character described, the combination with a bank of coking retorts arranged side by side, and a masonry foundation therefor comprising a pair of walls extending beneath and supporting the opposite ends of said bank of retorts, of intercommunicating combustion spaces beneath, at each side of, and above each retort, means for supplying fuel and air to support combustion to said combustion spaces, down-take flues communicating with the upper combustion spaces of the several retorts and extending downwardly alongside of the latter, and a main discharge flue disposed beneath and transversely of said bank of retorts and between said foundation walls with which said down-take flues communicate, substantially as described.

7. In a coking oven of the general character described, the combination with a bank of coking retorts arranged side by side, and a masonry foundation therefor comprising a pair of walls extending beneath and supporting the opposite ends of said bank of retorts, of intercommunicating combustion spaces beneath, at each side of, and above each retort, air spaces beneath and communicating with the lower combustion spaces of the several retorts, checker-work regenerators built in said foundation walls and communicating at their upper ends with said air spaces, fuel pipes extending through said walls and beneath said bank of retorts and provided with branch burner-tubes extending upwardly into the combustion spaces of the latter, down-take flues communicating with the upper combustion spaces of the several retorts and extending downwardly alongside of the latter, and a main discharge flue disposed beneath and transversely of said bank of retorts and between said foundation walls with which said down-take flues communicate, substantially as described.

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