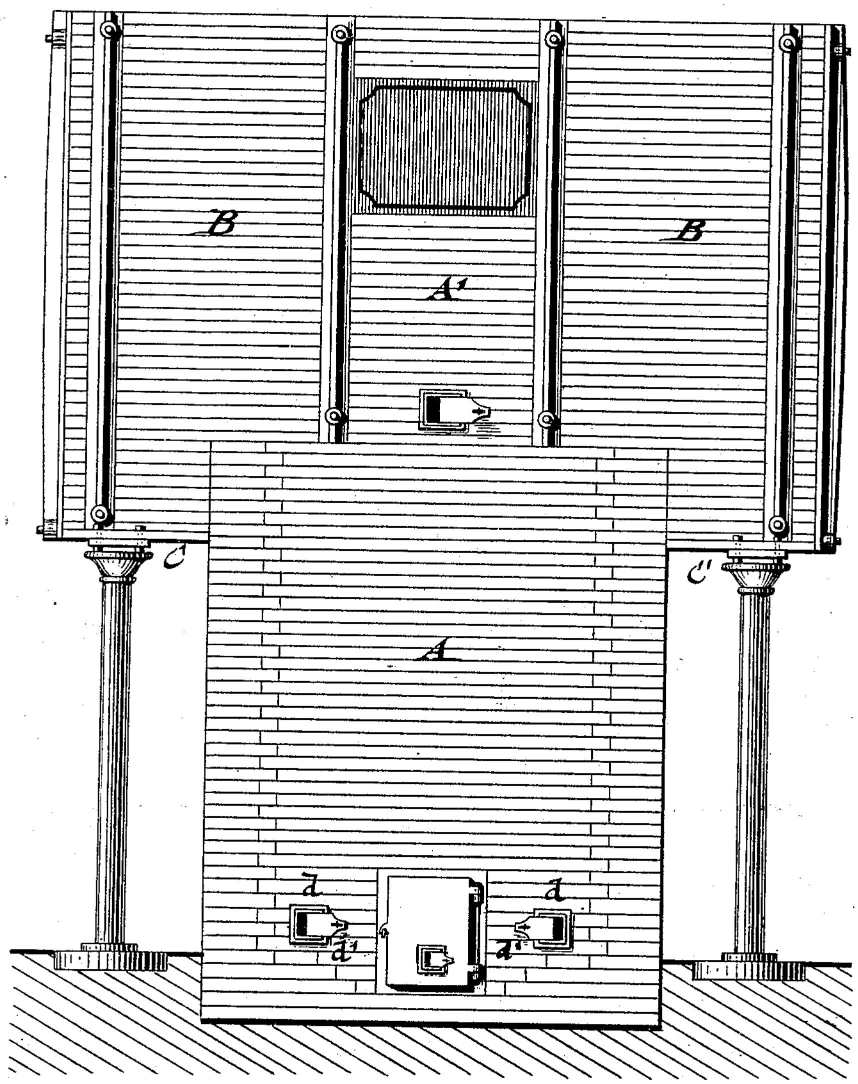
(No Model.) 5 Sheets—Sheet 1.

A. WEBER.

FURNACE FOR BURNING AND REVIVIFYING BONE BLACK.

No. 265,723. Patented Oct. 10, 1882.

Fig. 1.



WITNESSES

Jos. H. Rosenbaum.

Otto Risch

INVENTOR

Adam Weber

BY Paul Goepel

ATTORNEY

N. PETERS. Photo-Lithographer, Washington, D. C.

(No Model.) 5 Sheets—Sheet 2.

A. WEBER.

FURNACE FOR BURNING AND REVIVIFYING BONE BLACK.

No. 265,723. Patented Oct. 10, 1882.

Fig. 2.

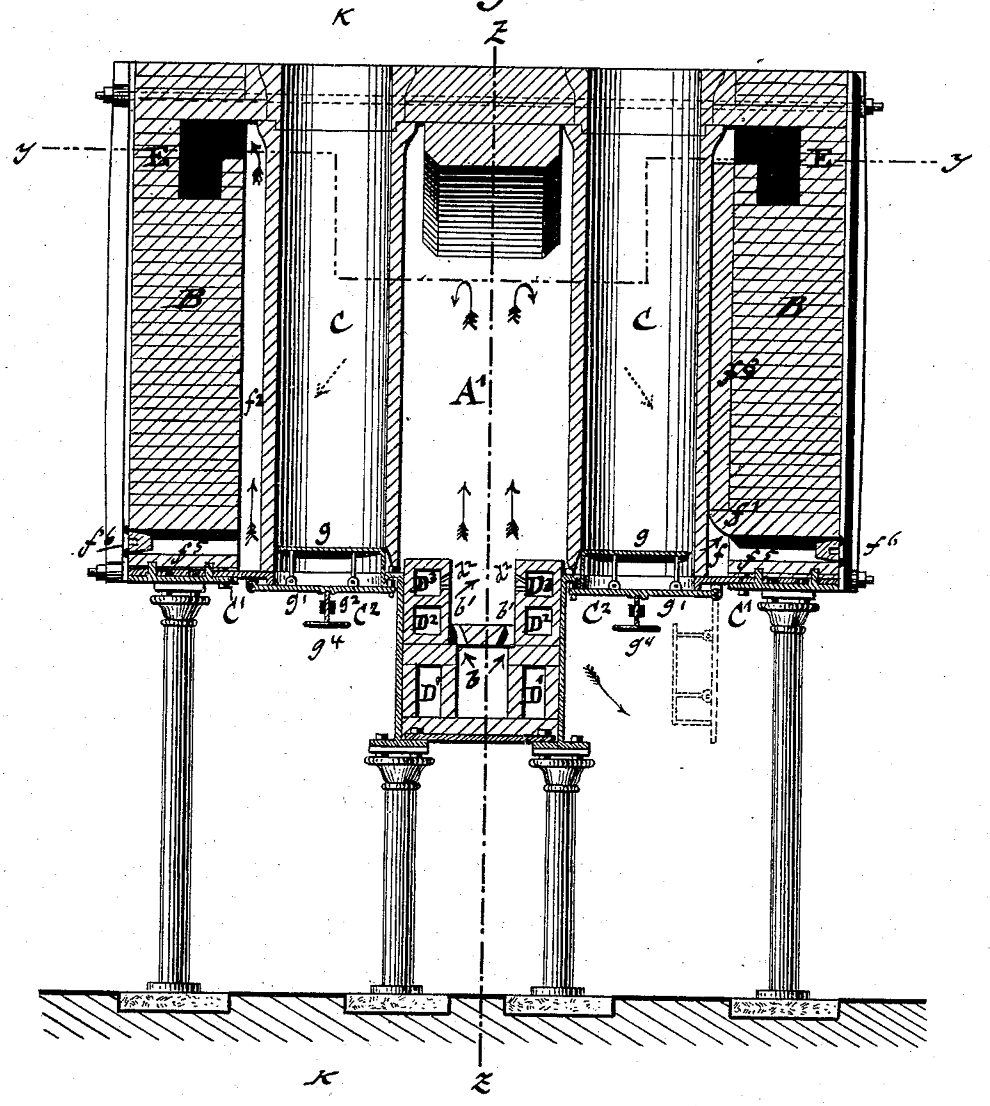
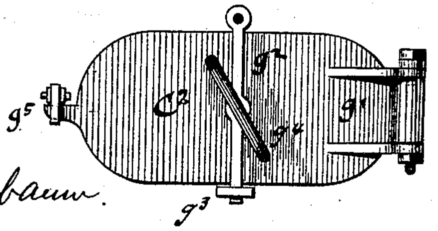


Fig. 3.



WITNESSES:

Jol. U. Rosenbaum.

Otto Risch

INVENTOR

Adam Weber

BY Paul Goepel

ATTORNEY

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.)

5 Sheets—Sheet 3.

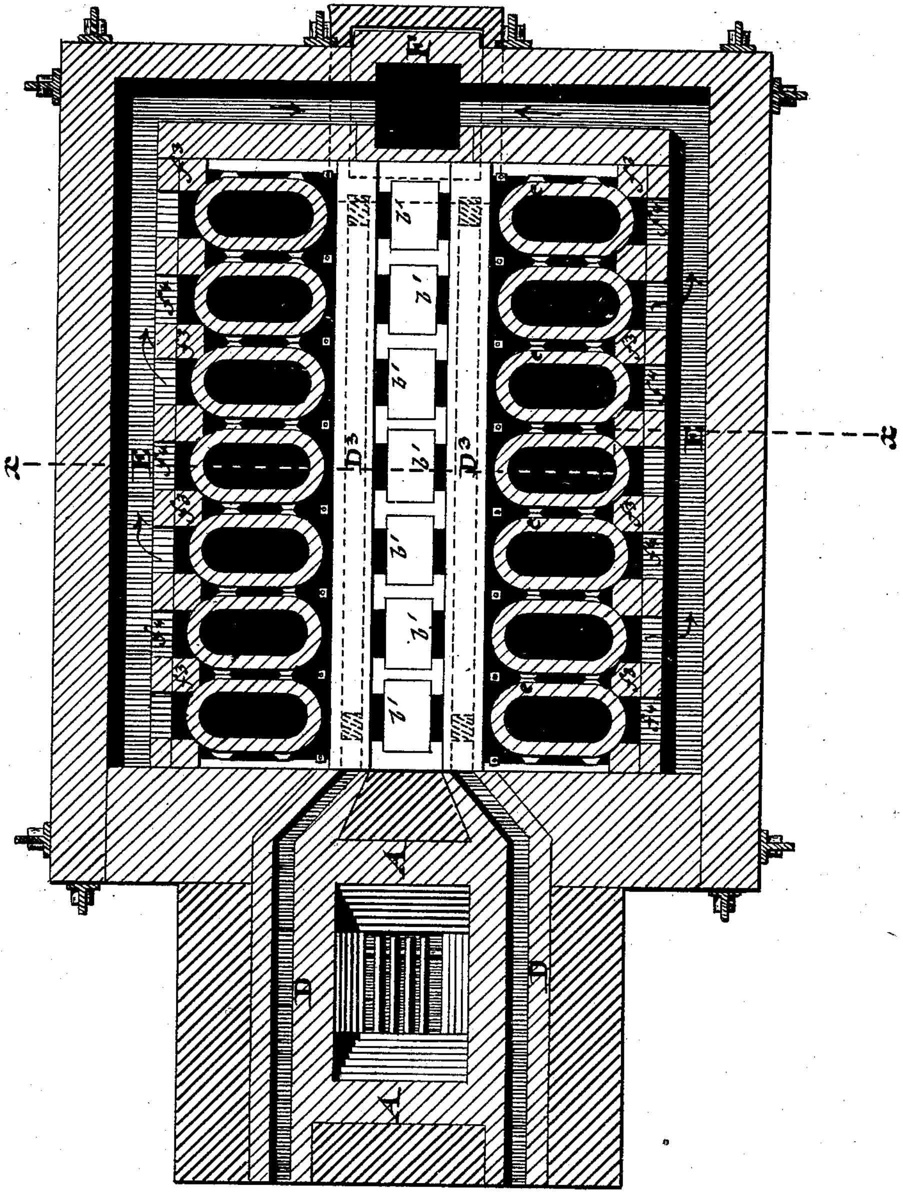
A. WEBER.

FURNACE FOR BURNING AND REVIVIFYING BONE BLACK.

No. 265,723.

Patented Oct. 10, 1882.

Fig. 4.



WITNESSES:

Jos. U. Rosenbaum.

Otto Risch.

INVENTOR

Adam Weber

BY Paul Goepel

ATTORNEY

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 5 Sheets—Sheet 4.

A. WEBER.

FURNACE FOR BURNING AND REVIVIFYING BONE BLACK.

No. 265,723. Patented Oct. 10, 1882.

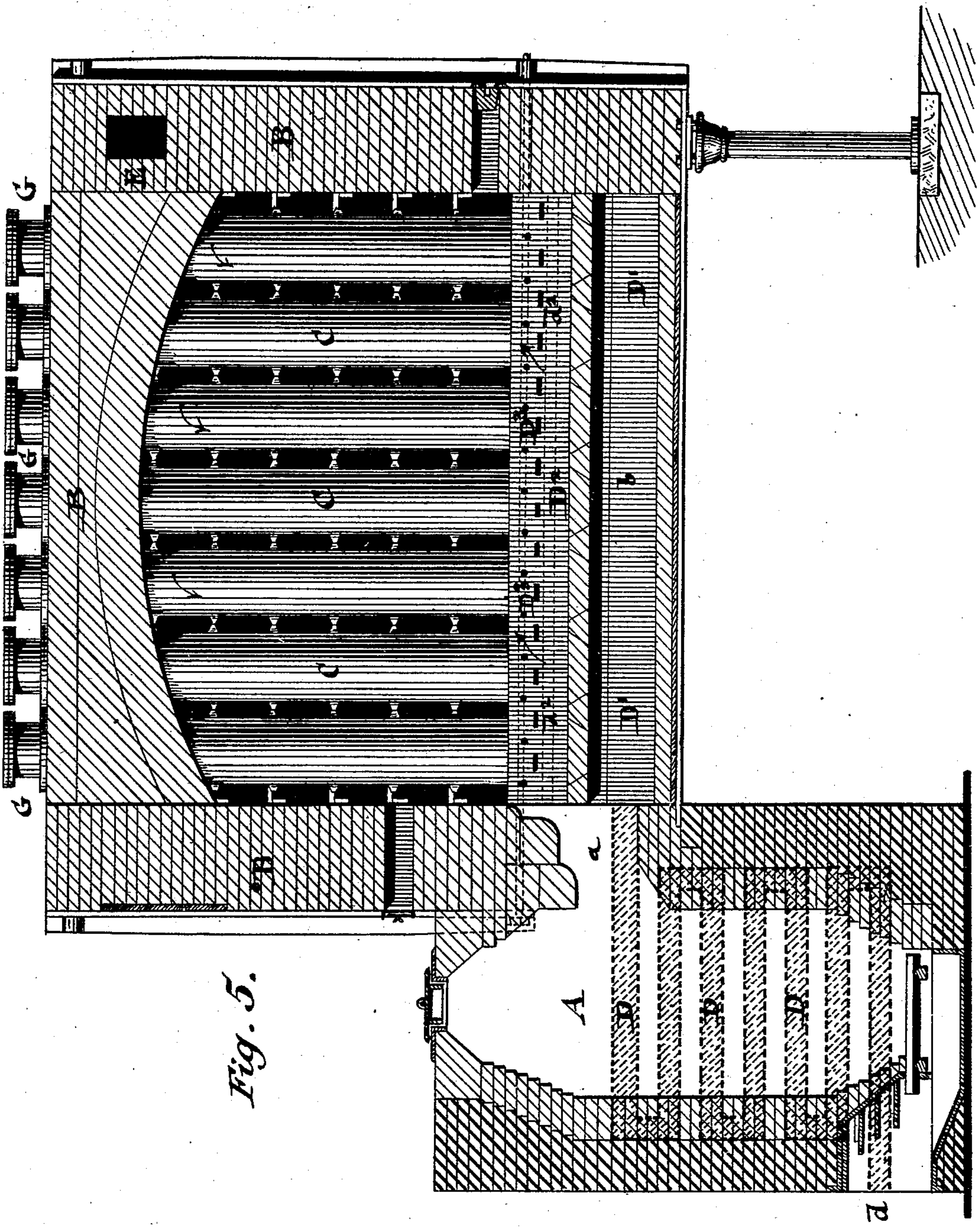


Fig. 5.

WITNESSES:

Jos. H. Rosenbaum.

Otto Risch.

INVENTOR

Adam Weber

BY Paul Goepel

ATTORNEY

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 5 Sheets—Sheet 5.

A. WEBER.

FURNACE FOR BURNING AND REVIVIFYING BONE BLACK.

No. 265,723. Patented Oct. 10, 1882.

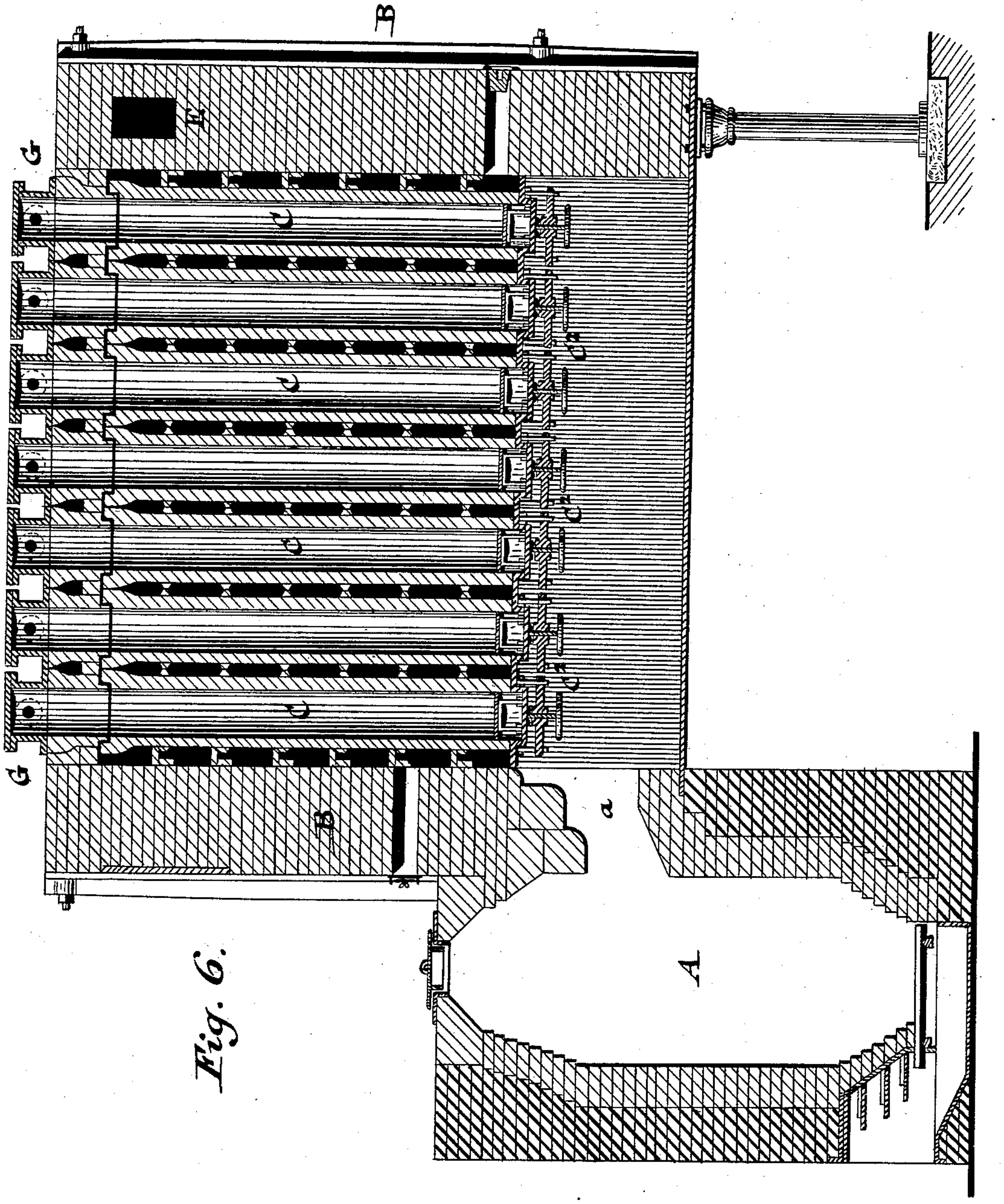


Fig. 6.

WITNESSES:

Jos. U. Rosenbaum.

Otto Risch

INVENTOR

Adam Weber

BY Paul Goepel

ATTORNEY

N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

ADAM WEBER, OF NEW YORK, N. Y.

FURNACE FOR BURNING AND REVIVIFYING BONE-BLACK.

SPECIFICATION forming part of Letters Patent No. 265,723, dated October 10, 1882.

Application filed July 15, 1882. (No model.)

To all whom it may concern:

Be it known that I, ADAM WEBER, of the city, county, and State of New York, have invented certain new and useful Improvements in Furnaces for Burning and Revivifying Bone-Black, of which the following is a specification.

The object of this invention is to construct an improved furnace or kiln for burning and revivifying bone-black on the so-called "regenerative" system, in which the retorts are heated by means of gas generated in a separate furnace, which gas is then mixed and burned with highly-heated air, whereby not only a more durable structure is obtained, and the running expenses of the furnace or kiln are considerably reduced, but also by the more uniform and higher heat produced by the burning gas and air-mixture the more effective heating of all retorts throughout their entire height, and consequently a superior and more uniform product is obtained than in cases of furnaces in which the retorts are heated by direct fires.

The invention consists of two or more series or rows of retorts, which are arranged at both sides of a central arched combustion-chamber, in which the carbonic-oxide gas obtained from the separate gas-generating furnace arranged at the front part of the kiln is burned in the presence of highly-heated air, which is drawn in through two sets of primary air-channels arranged in the side walls of the gas-generating furnace, thence through two sets of secondary air-channels at both sides of the central gas-channel, through which the gas generated in the gas-furnace is conducted to the combustion-chamber and there mingled and burned with the air that is emitted into the combustion-chamber through air-outlet openings of the uppermost air-channels. The flame is drawn from the combustion-chamber laterally and downward between the retorts to a longitudinal bottom channel, thence through vertical channels formed between inwardly-projecting abutments that support the retorts along the rear walls of the retorts into horizontal flues in the upper part of the walls of the kiln, and thence to the chimney. The retorts are composed of a longer main section or body and of a top section, which is closed by a cast-iron cap or head, from which the ammoniacal vapors generated in the retorts are drawn off for further utilization. The retorts are closed at the bottom by hinged double trap-doors, having intermediate air-spaces. The trap-doors are locked to the retorts by transverse bars and hand-screws and by gravity-latches, so as to be quickly opened for discharging the contents of the retorts when the operation of burning the bones has been completed.

In the accompanying drawings, Figure 1 represents a front elevation of my improved furnace for burning and revivifying bone-black. Fig. 2 is a vertical transverse section on line *x x*, Fig. 4. Fig. 3 is a detail bottom view of one of the trap-doors of the lamp-black retorts. Fig. 4 is a horizontal section on line *y y*, Fig. 2; and Figs. 5 and 6 are vertical longitudinal sections on lines *z z* and *k k*, Fig. 2.

Similar letters of reference indicate corresponding parts.

My improved furnace consists of two main parts—a gas-generating furnace, A, which is arranged in front of and with its greater part below the level of the bottom of the main part or kiln B, which latter is arranged with one or more rows or series of fire-clay retorts, C C, at each side of a central arched combustion-chamber, A′, that extends longitudinally through the kiln B. The gas-generating furnace A may be of any approved construction, it being provided at the bottom with a grate and a step-shaped fire-pot and at the top with a covered opening, through which the fuel is supplied at regular intervals. The upper part of the gas-generating furnace A communicates by an opening, *a*, in its rear wall with a central gas-channel, *b*, that extends longitudinally throughout the lower part of the kiln B, and serves to conduct the carbonic-oxide gas that is produced by the limited supply of oxygen to the fuel in the gas-generating furnace A through top openings, *b′*, into the combustion-chamber A′. The gas generated in the furnace A is mingled in the combustion-chamber with highly-heated air and burned therewith, the required high temperature being imparted to the air by being drawn on its way to the combustion-chamber through a system of primary air-flues, D, and a system of secondary air-flues, $D' D^2 D^3$. The primary series of air-flues D are arranged in the side walls of the gas-generating furnace, A, as shown in dotted lines in Fig. 5, the air entering through openings d, having adjustable slides d', (shown in Fig. 1,) and passing then forward and backward in the primary series of channels D, so as to be heated up by the heat radiated by the furnace A. The air-channels D are arranged vertically above each other, the upper channels communicating with the lower channels, D′, of the secondary series of channels, which are located at both sides of the central gas-channel b. The lower channels, D′, extend back to the rear wall of the kiln B, communicate there by short vertical portions with the intermediate channels, D^2, that extend forward again, then at the front wall of the kiln by short vertical portions with the upper channels, D^2, which run backward again, and which are provided at their inner walls above the gas-openings b' b' with two rows of alternating air-openings d^2 d^2, as shown clearly in Figs. 2 and 5. The air is heated up to a high degree of temperature in its passage through the secondary channels D′ D^2 D^3, so as to be emitted and mingle with the carbonic-oxide gas at nearly the same temperature, whereby the more effective combustion of the same in the kiln is promoted. The gas and air supplied through the openings b' of the central gas-channel, b, and the air-openings d^2 of the air-channels D^3 is burned in the combustion-chamber A′, the flame ascending to the full height of the retorts, and being then drawn through the narrow lateral passages formed between the short abutting side ribs, e e, of the same first sidewise and then downward to the lower parts of the retorts into bottom flues f, which extend longitudinally along the lower part of the kiln between the side walls of the same and the retorts. The products of combustion are then drawn around inwardly-projecting bracket-tiles f' into vertical flues f^2, arranged between vertical abutments f^3 of the side walls of the kiln, and then through short lateral channels f^4 in the upper part of the side walls of the kiln into the horizontal flues E, and thence to the chimney F, as indicated by arrows in Fig. 2. The projecting bracket-tiles f' are rounded off at their under side, so as to offer as little resistance as possible to the passage of the flames from the longitudinal bottom flues f to the vertical flues f^2. As the flame passes first in upward direction in the combustion-chamber, then through between the retorts and down to the bottom of the kiln, then up again along the rear walls of the retorts, the latter are thus entirely enveloped by the flame and exposed to a uniform degree of heat throughout their entire height, so that the bones in the retorts are quickly and uniformly burned.

The retorts C C are made of the usual oval cross-section, of the best fire-clay, and are supported upon iron bottom plates, C′, having openings for the retorts, said plates being supported on iron columns, as shown in Fig. 5. The central gas-channel, b, and the secondary air-channels D′ D^2 D^3 are also incased by iron plates and supported by iron columns of less height, whereby an open space is obtained below the retorts for the purpose of admitting the discharge of the bone-black from the retorts into suitable receivers, and also the convenient opening and closing of the hinged trap-doors C^2 at the lower part of the retorts. When the furnace is used for reburning or revivifying bone-black the usual coolers are arranged below the retorts from which the bone-black is drawn off, while a new quantity is continually supplied to the top of the retorts, whose cast-iron caps are then removed. The short side ribs, e e, of the retorts abut against each other, so as to form thereby supports by which the retorts are strengthened and prevented from cracking. The rear walls of the retorts rest against the intermediate vertical abutments, f^3, which are supported on the bracket-tiles f'. The flues f, below the bracket-tiles f', are cleaned by lateral flues f^5, which extend through the walls of the kiln B, and are closed by stoppers f^6, as shown clearly in Fig. 5. Each retort is composed of two parts, a longer main part and a shorter top part, which latter is securely luted to the former, so as to prevent the cracking off of the top parts by the unequal expansion and contraction to which the lower part is exposed when the retorts are made out of one piece. The upper parts of the retorts are closed by cast-iron caps or heads G, to which suitable pipes are connected for conducting off the ammoniacal vapors generated at the interior of the retorts, which vapors are then condensed and utilized in the manner well known in the manufacture of bone-black.

The flues E, which conduct off the gases or products of combustion, are provided in the customary manner with dampers, so as to regulate the draft through the entire furnace, the air-supply being regulated by the slides d' of the entrance-openings d at the front part of the gas-generating furnace A, as shown in Fig. 1.

The entire furnace is built in a substantial manner of fire-brick, stiffened by vertical iron stays, which are bolted to ribs or flanges of the bottom plates in any suitable manner.

The double trap-doors C^2 of the retorts are hinged at one side to the bottom plate, C′, and constructed of two bottoms—an interior smaller and an outer larger bottom. The interior bottom, g, is supported at some distance from the outer bottom, g', so that a non-conducting air-space between the bone-black in the lowermost part of the retorts and the exterior air is obtained. The trap-doors are rigidly secured in closed position by means of transverse bars g^2, having screws g^4, operated by hand-levers. The transverse bars g^2 are pivoted at one end to the bottom plate, C′, and retained at the other end by fixed hooks g^3, the bar g^2 and its screw g^4 being swung on the pivot sidewise of the door when the same is to be opened. The hinged trap-door C^2 is furthermore locked at a point opposite its hinge-connection with the bottom plate, C′, by a gravity-latch, g^5, so that as soon as the fastening-screws g^4 are released and the bars thrown sidewise but a small pressure exerted upon the latch device g^5 by means of a hooked rod or other implement is sufficient to release the latch and to cause the instant dropping of the trap-door C^2 and the discharge of the entire body of bone-black from the retort into the receiver. By means of the double trap-doors, which extend to some distance into the lower part of the retorts, the bones in the retorts are uniformly burned, as they are all exposed to a uniform degree of heat above the trap-door, so that no part of the bones can only be partly burned, which feature has formed one of the main disadvantages of the bone-black retorts heretofore in use, in which the partly-burned bones had to be separated for reburning with the next charge.

In revivifying bone-black the caps G are removed and coolers applied to the lower parts of the retorts, which are well-known and not shown in the drawings.

By applying the regenerative system of heating to the retorts of bone-black furnaces the thorough and uniform heating and burning or revivifying of the contents are secured, whereby not only a more economical and effective working of the furnace, but also a more uniform and superior product, is obtained.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. A bone-black furnace having two or more rows of retorts which are arranged at both sides of the central arched combustion-chamber, a separate gas-generating furnace arranged at the front part of the kiln, two sets of primary air-channels arranged in the side walls of the gas-generating furnace, two sets of secondary air-channels at both sides of the central gas-channel, and air-openings of the uppermost air-channels, through which openings air is admitted to the combustion-chamber and burned with the gas from the gas-generating furnace, substantiully as described.

2. The combination of a gas-generating furnace, A, having a series of primary air-channels in each side wall thereof, a combustion-chamber, A′, having a central gas-channel, *b*, and openings *b′ b′*, and three secondary series of air-channels, D′ D^2 D^3, at the bottom part thereof, the upper air-channels, D, having lateral discharge-openings d^2 d^2, one or more rows of retorts, C, at each side of the combustion-chamber, passages between the retorts, bottom flues *f*, vertical flues f^2 back of the retorts, and horizontal main flues E, leading to the chimney, all substantially as and for the purpose set forth.

3. In a bone-black furnace or kiln, the combination of a central combustion-chamber, A′, having a series or row of retorts, C, at each side thereof, said retorts having short abutting side ribs, *e e*, and intermediate draft passages, longitudinal bottom flues *f′*, vertical abutments f^3, supported on projecting bracket-tiles *f*, intermediate vertical flues, f^2, extending along the rear walls of the retorts from the bottom flues *f′*, and horizontal main flues E, leading to the chimney, substantially as specified.

4. In a bone-black furnace, the combination of a bone-black retort with a hinged double bottom or trap-door secured by a pivoted transverse center bar, retaining-hook, and fastening-screw, and by a latch device at a point opposite to the hinge, substantially as described.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

ADAM WEBER.

Witnesses:
PAUL GOEPEL,
SIDNEY MANN.