(No Model.)

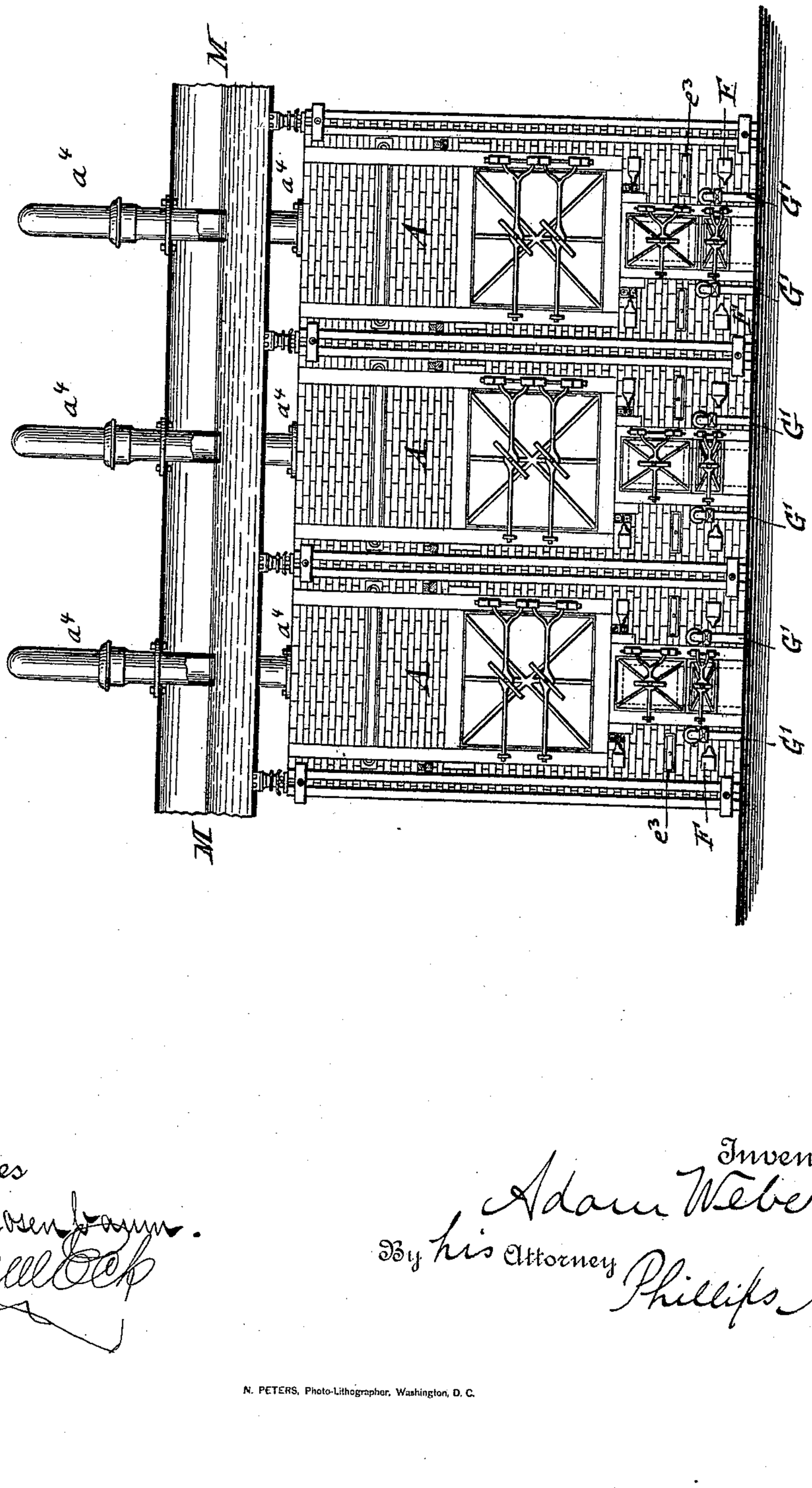
6 Sheets—Sheet 1.

A. WEBER.

COKE OVEN.

No. 407,879. Patented July 30, 1889.

Fig. 1.



Witnesses
H. N. Rosenbaum.
Wellington Cook

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Adam Weber
By his Attorney Phillips Abbott

(No Model.)

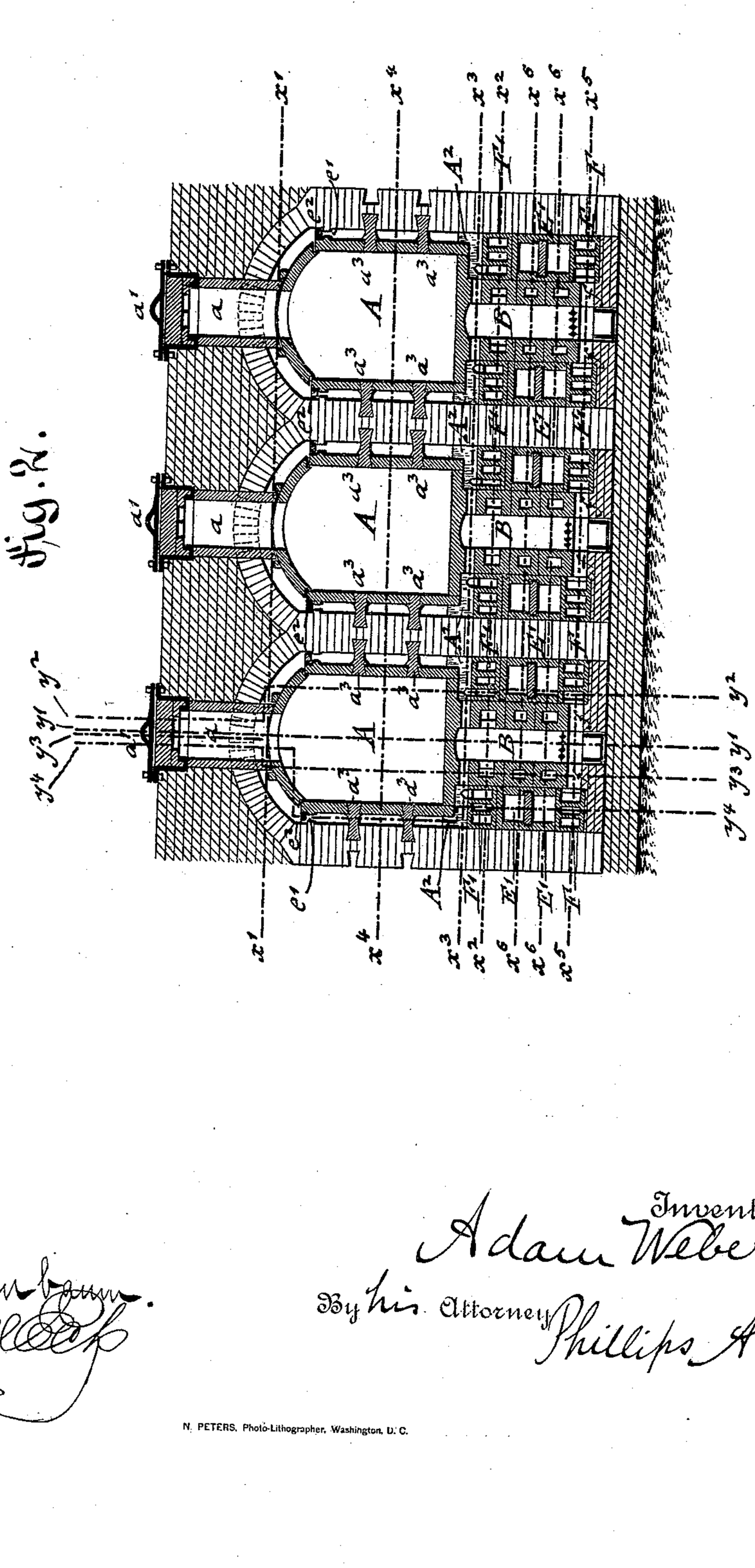
6 Sheets—Sheet 2.

A. WEBER.

COKE OVEN.

No. 407,879. Patented July 30, 1889.

Fig. 2.



Witnesses

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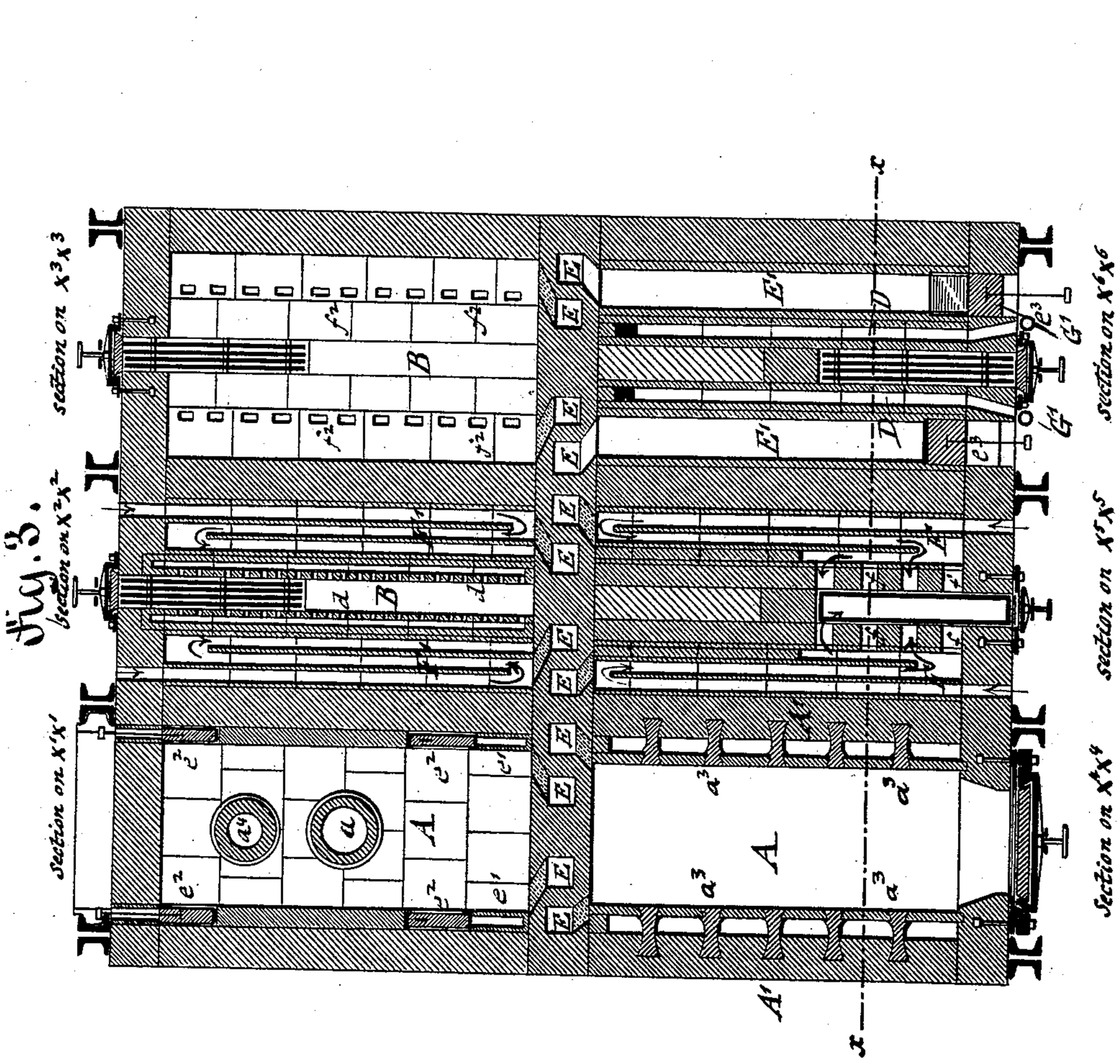
Phillips Abbott

(No Model.) 6 Sheets—Sheet 3.

A. WEBER.

COKE OVEN.

No. 407,879. Patented July 30, 1889.



Witnesses
F. N. Rosenbaum.
[illegible]

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(No Model.) 6 Sheets—Sheet 4.

A. WEBER.

COKE OVEN.

No. 407,879. Patented July 30, 1889.

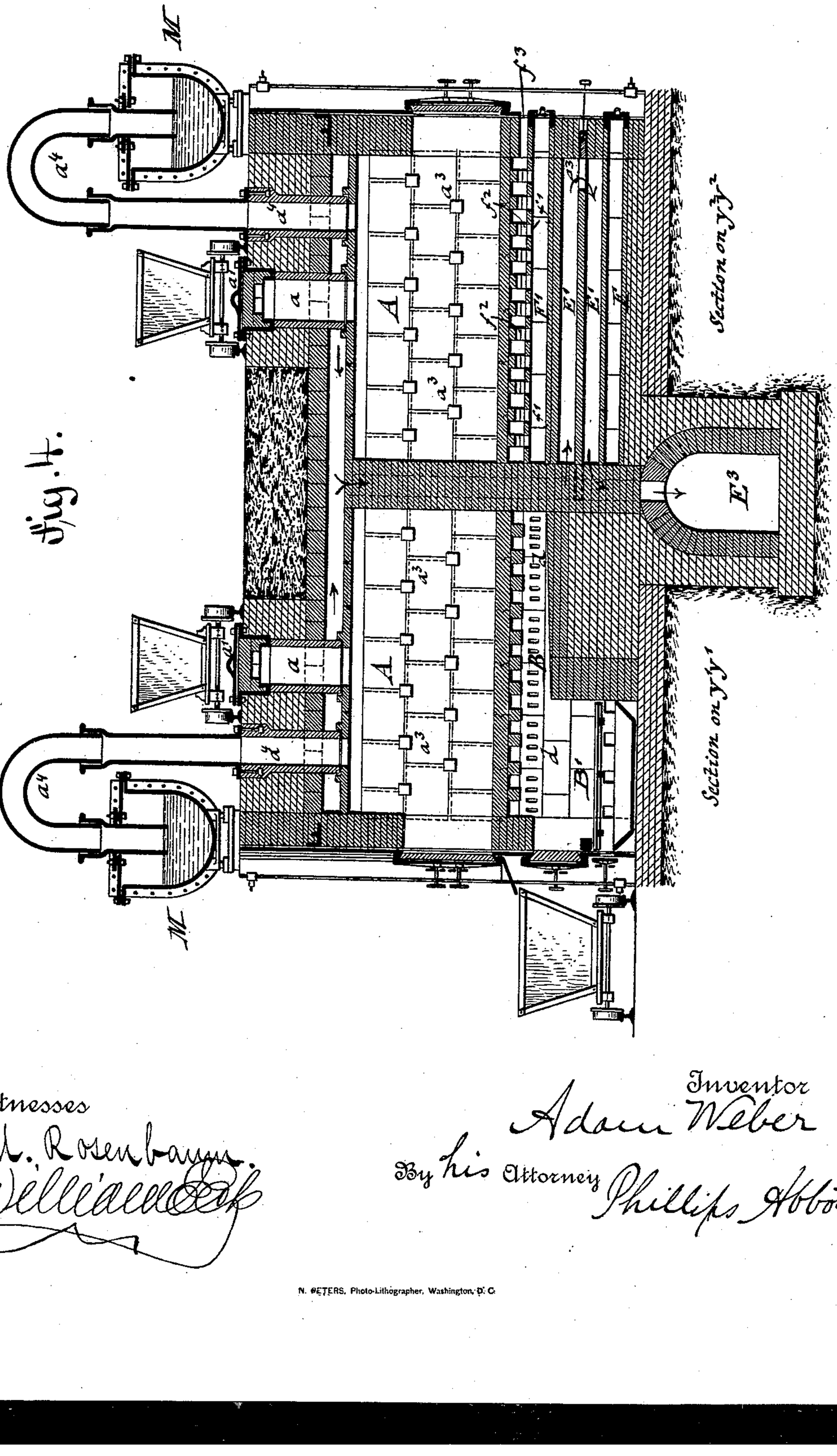

Fig. 4.

Witnesses
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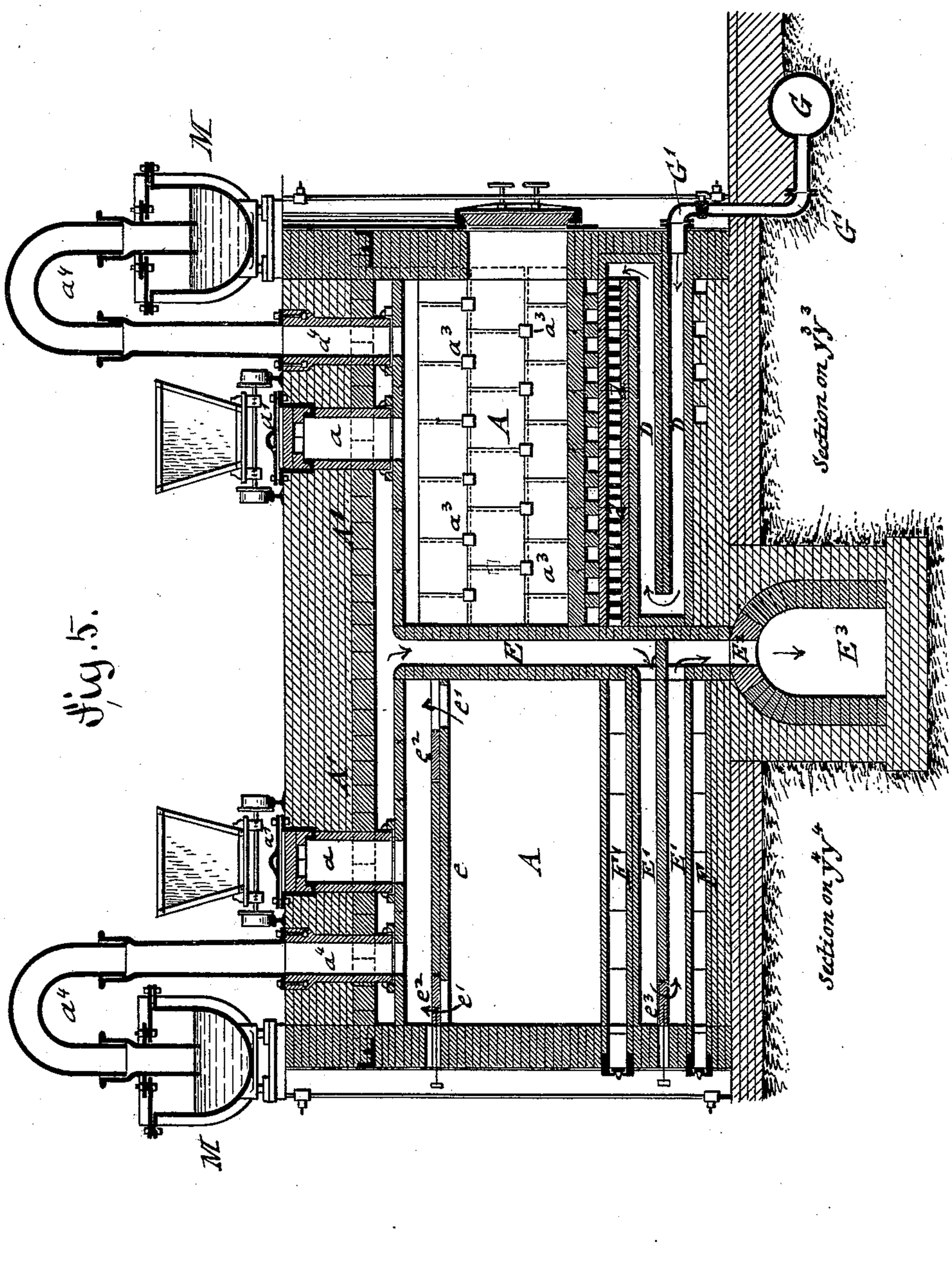
(No Model.) 6 Sheets—Sheet 5.

A. WEBER.

COKE OVEN.

No. 407,879. Patented July 30, 1889.



Witnesses
F. H. Rosenbaum.
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(No Model.) 6 Sheets—Sheet 6.

A. WEBER.

COKE OVEN.

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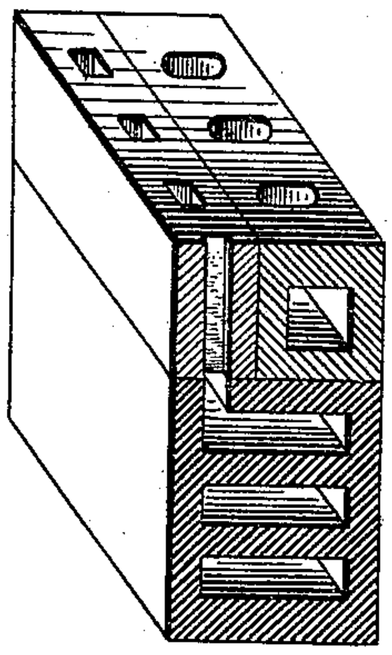

Fig. 12.

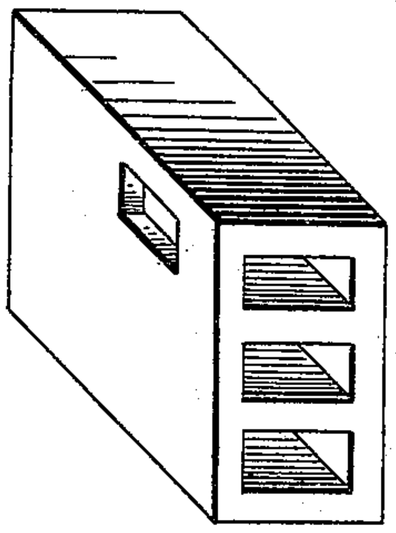

Fig. 8.

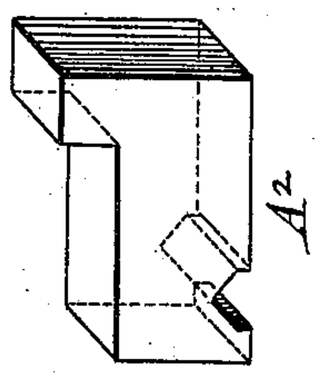

Fig. 11.

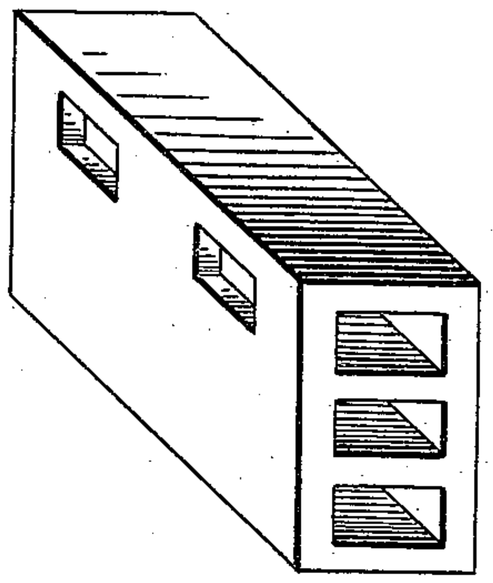

Fig. 7.

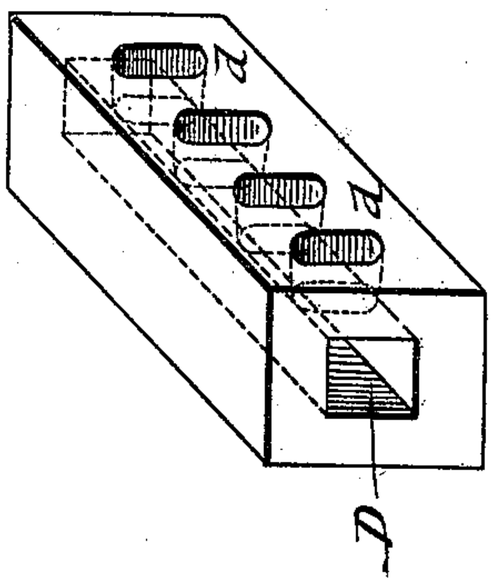

Fig. 10

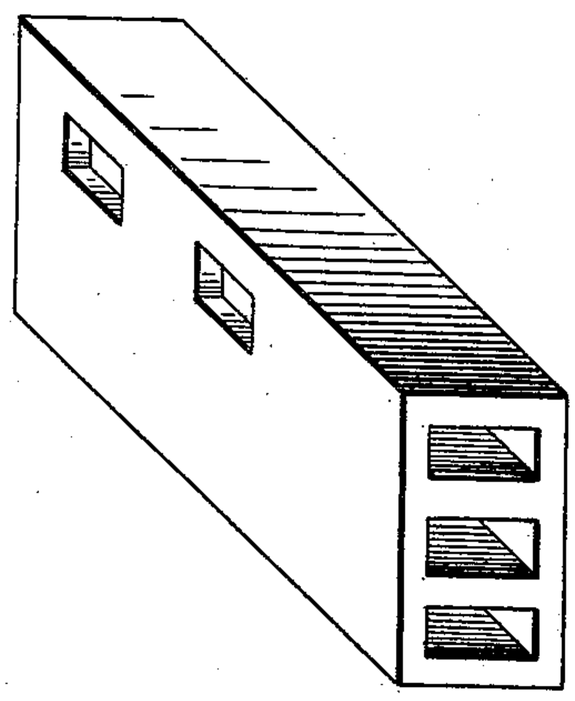

Fig. 6.

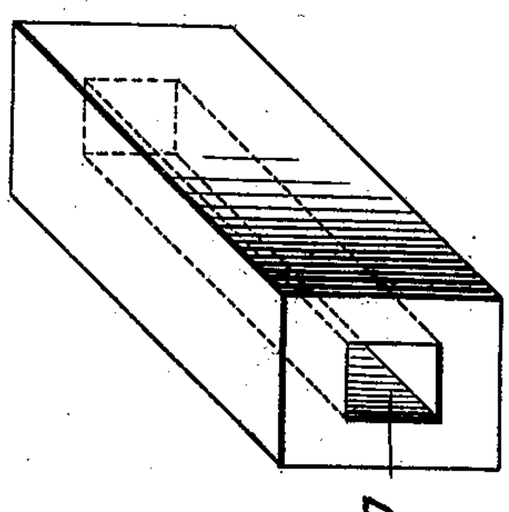

Fig. 9.

Witnesses

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Inventor

Adam Weber

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UNITED STATES PATENT OFFICE.

ADAM WEBER, OF NEW YORK, N. Y.

COKE-OVEN.

SPECIFICATION forming part of Letters Patent No. 407,879, dated July 30, 1889.

Application filed September 25, 1888. Serial No. 286,332. (No model.)

To all whom it may concern.

Be it known that I, ADAM WEBER, a citizen of the United States, and a resident of New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Coke-Ovens, of which the following is a specification.

This invention has reference to certain improvements in the construction of coke-ovens in which the system known as the "regenerative" system or principle is carried out for heating the coking-chamber and coking the coal therein.

In this invention the combustible gases generated during the coking process are utilized by conducting them through heating-flues to the combustion-chamber and burning them mingled with heated air, so as to produce a high temperature for carrying on the coking operation, thus effecting a considerable saving in the consumption of fuel by the more perfect utilization of the combustible gases given off by the coal. By my invention I also collect all the by-products of the coking process.

The invention consists of a coke-oven the coking-chamber of which is heated in the first instance by fire in a furnace under the oven. The heating thereafter is continued by the combustion of the combustible gases distilled from the coal being coked, mixed with heated air, in a combustion-chamber below the coking-chamber, said gases and air being conducted to the combustion-chamber through flues located in the side walls of the furnace and through a primary and second series of air-flues, of which the former is located below the grate of the fire-place, while the latter is located sidewise of the uppermost gas-heating flues. The air-heating flues are heated by means of smoke-flues located between the two series of air-heating flues and connected by vertical flues in the rear wall of the oven with the mantel-flue formed by a space between the coking-chamber and the mantel surrounding the same. The side walls of the coking-chamber and mantel are connected by dove-tailed brace-blocks and by lateral plates connecting the skew-backs of the coking-chamber and mantel, said plates having openings and dampers at the front and rear ends for regulating the flow of the gases at the sides and top of the mantel-flue.

In the accompanying drawings, Figure 1 represents a front elevation of my improved regenerative coke-oven, showing a range or group of ovens arranged side by side, partly in section, which is taken through the hydraulic main at the top of the ovens. Fig. 2 is a vertical transverse section of a range or group of ovens on line $x\ x$, Fig. 3. Fig. 3 represents horizontal sections of a group or battery of six ovens, each section being taken on a different plane, respectively, on lines $x'\ x'$, $x^2\ x^2$, $x^3\ x^3$, $x^4\ x^4$, $x^5\ x^5$, and $x^6\ x^6$ of Fig. 2. Figs. 4 and 5 show four vertical longitudinal sections of the ovens on four different vertical planes, respectively, on the lines $y'\ y'$, $y^2\ y^2$, $y^3\ y^3$, and $y^4\ y^4$, Fig. 2; and Figs. 6 to 12 are detail perspective views of different shapes of flue-blocks employed in the construction of my coke-oven.

The same letters of reference indicate corresponding parts in all figures.

Referring to the drawings, A represents the coking-chamber, which forms the central part of my improved coke-oven and which is made in the nature of a retort of blocks or tiles of fire-brick, and provided with an arched dome also formed of fire-brick blocks or tiles. It is not essential that the dome should be arched, however. It may be flat. The coking-chamber A is preferably charged from the top of the oven by a supply-channel a, formed of a fire-brick tube, which is hermetically closed by a cover a', which is formed of a ring-shaped iron frame lined with fire-brick, and it may be tightly closed by a bar and fastening-screws. The material to be coked is conveyed to the supply-channel a in cars which move on tracks located on the top of the ovens, as shown in Figs. 4 and 5. When the coking-chamber A is charged, the channel a is closed by the cover a', and the same is then securely fastened.

The coking-chamber A is surrounded at the sides and top by the mantel A', the top of which is arched like the top of the coking-chamber. The corners of the coking-chamber A are supported by angle-blocks A^2, which are placed at some distance from each other,

so as to form channels that connect the combustion-chamber B, which is located centrally below the coking-chamber, with the mantel-flue formed between the walls of the coking-chamber A and mantel A′. The side walls of the coking-chamber A are connected with the side walls of the mantel A′ by dovetailed brace-blocks a^3 a^3, as shown clearly in Fig. 2 and in side view in Figs. 3 and 4. The combustible gases which are generated by the coking operation are conducted from the coking-chamber through a goose-neck pipe a^4 to a hydraulic main M, which is supported on the top of the oven and connected to a suitable gas-holder. (Not shown in the drawings.) In the hydraulic main the tar, ammoniacal, and other products of distillation are collected and conducted from the same to a suitable reservoir, from which they are removed for further treatment in the usual manner.

The combustion-chamber B extends to the entire depth of the oven, while the fire-place B′ of the same extends to about half its length. For starting the coking operation the oven is heated with coal or coke burned in the fire-places B′ until a sufficient quantity of the combustible gases have been collected from the coking-chambers of the different ovens in the gas-holder so as to permit the continuation of the coking operation by the direct supply of said gases. These gases are conducted from the gas-holder by a gas-main G, and from the same by branch pipes G′ to the lowermost flue of a series of horizontal flues D, which are arranged in the side walls of the combustion-chamber B.

The flues D are connected alternately at the rear and front, the uppermost flue D being formed of flue-blocks D′ D′, (shown in Fig. 10,) which are provided with lateral channels d d, that open into the upper part of the combustion-chamber and supply the combustible gases to the same. The gases are heated up in their passage through the flues D and are mingled in the combustion-chamber with highly-heated air that is supplied through a series of air-heating flues located sidewise of the uppermost gas-heating flue D at each side of the combustion-chamber. The products of combustion pass between the blocks A^2 and through the mantel-flue around the side walls of the coking-chamber and are drawn by means of flue-openings e' in the lateral plates e, which connect the skew-backs of the coking-chamber and mantel-arch, and which are opened more or less by sliding dampers e^2 toward the front and rear wall of the oven and conducted over the arched top of the coking-chamber A to descending flues E, located in the partition-wall of the battery of ovens, as shown in Fig. 5. The innermost damper can be operated by the introduction of a rod having a right-angle bend at its end, which engages with recesses in the damper or a projection therefrom, as preferred. When once adjusted or regulated, it is not necessary to again move these dampers. The vertical flues E are connected with horizontal flues E′, which are arranged sidewise of the gas-heating flues D and provided at their connected front ends with sliding dampers e^3. The lower flues E′ communicate at their rear ends with vertical flues E^2 in line with the descending flues E, which terminate in an arched channel or take-off flue E^3, connected with the chimney, of sufficient height to produce the required degree of draft for the proper working of the oven. The flues E′ E′ are located between the side walls of the combustion-chamber and the main partition-walls of the ovens, and serve for the purpose of heating up the air that is drawn in for the purpose of combustion through two series of air-heating flues, the lower or primary series of flues, which is located below the level of the grate of the fire-place B′, while the second series of air-flues is located above the smoke-flues E′ E′. The lower or primary air-heating flues F take in the air at the front of the oven and emit it through lateral channels f to the space below the grate, so as to supply heated air to the fuel on the grate for producing the more perfect combustion of the same.

The upper or second series of flues F′ communicates by top channels f' in that flue nearest to the combustion-chamber with a transverse channel f^2 in the angle-blocks A^2, that support the corner-blocks of the coking-chamber. The flue-blocks with the channels f' are shown in Figs. 6, 7, and 8. The transverse bottom channels f^2 of the angle-blocks A^2 are made with inclined sides for the purpose of facilitating the cleaning of the same by means of a scraper, which is introduced through an opening f^3 in the front wall of the oven. (Indicated at the right-hand side of Fig. 4.) The heated air passes from the channels f^2 into the channels which lead from the combustion-chamber B to the mantel-flue surrounding the coking-chamber, and mingles with the gases of combustion supplied by the eduction-channels d d of the flues D D, so as to produce the perfect combustion of all the gases and keep the outer surface of the coking-chamber enveloped by a sheet of flame, so as to subject the coal in the coking-chamber to a high temperature and convert it quickly into coke.

In place of arranging the eduction-channels for the heated air at the top of the innermost air-flue F′ and in the angle-blocks A^2, they can be arranged in lateral flue-blocks F^2, located above the uppermost gas-heating flue D, as shown in Fig. 12. By using the flue-blocks F^2 the combustion of the gases takes place in the combustion-chamber directly below the central part of the retort. With either arrangement of the eduction-channels the material in the coking-chamber is subjected to a high temperature by the combustion of the heated gases and the heated air supplied to and mingled with

the same. The former arrangement is to be preferred when the highest temperature is desired to be supplied to the side walls of the coking-chamber, while the latter is preferred when the highest temperature is to be applied to the bottom of the coking-chamber.

When the combustible gases are supplied, the fire in the fire-place may be discontinued and the lower series of air-flues closed. When the coking operation is completed, the coke is removed from the coking-chamber through an opening in the front wall of the oven, which opening is closed like the front openings of the fire-place and ash-pit by tightly-closing iron doors lined with fire-bricks, which doors are closed by means of bars and clamping-screws, as customary in coke-ovens and gas-benches.

The operation of the furnace is as follows: The retorts are charged with the required quantity of coal, coal-dust, or other material to be coked and the fire then started in the fire-place, so as to start the coking process. The gases generated in the coking-chamber are conducted through the hydraulic main to the gas-holder, and, after the separation of the by-product from the same, to the gas main, connecting-pipes, and gas-heating flues located in the side walls of the combustion-chamber into the latter. They are mingled in the combustion-chamber with the heated air supplied by the eduction-channels of the upper series of air-heating flues. As soon as the ovens can be supplied with the gases obtained from the distillation of the coal in the coking-chamber the fire in the fire-place may be discontinued. The products of combustion are conducted through the mantel-flues and descending rear smoke-flues to the horizontal smoke-flues between the lower and upper series of air-heating flues and from the same through shorter descending flues to the take-off flue and the chimney. The smoke-flues serve for heating the rear walls of the coking-chamber, as well as for heating the air-flues and the gas-flues located in the side walls of the combustion-chamber, so that the regenerative principle on which my improved coke-oven is based is well carried out.

The coke-oven can be run at a considerable saving of fuel, owing to the more perfect combustion of the heated combustible gases with the heated air. Besides economy in fuel, the tar and ammonical and other products are obtained as valuable by-products.

Owing to the more complete, uniform, speedy, and economical coking operation of my coking-furnace as compared to others known to me, and also because of the avoiding of loss incident to other apparatus, but prevented by me, I am enabled not only to get better and more results of the distillation in by-products, but also the coke produced by my improved furnace is better than that of other apparatus per equal grade of coal.

Certain features of my invention hereinabove described are not claimed in this case. I do not abandon the same, however, because under a ruling of the Commissioner of Patents made herein. I have described and claimed the same in another application for Letters Patent filed by me on the 26th day of February, 1889, Serial No. 301,196.

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

1. The combination of a coking-chamber, a combustion-chamber provided with a grate, each side wall of the combustion-chamber having separate series of horizontal gas-heating flues, gas-supply pipes connecting with the front end of the lowermost gas-heating flue, and lateral channels connecting the uppermost gas-heating flues with the combustion-chamber, and means for supplying air to the combustion-chamber, substantially as set forth.

2. The combination of a coking-chamber, a combustion-chamber provided with a grate, each side wall of the combustion-chamber having separate series of gas-heating flues connected with a source of gas-supply and smoke-flues arranged side by side, a mantel having a flue therein extending around the coking-chamber, a rear wall for the oven provided with descending flues, and a chimney connecting with the smoke-flues, substantially as set forth.

3. The combination of a coking-chamber, a combustion-chamber provided with a grate the side walls whereof are provided with gas-heating flues and air-heating flues located side by side, and gas-supply pipes connecting with the lowermost gas-heating flues, the uppermost ones being provided with lateral eduction-channels connecting with the combustion-chamber, said air-heating flues having also eduction-channels communicating with the combustion-chamber, substantially as set forth.

4. The combination, with a coking-chamber, of a combustion-chamber located below the coking-chamber, each side wall whereof is provided with a series of gas-heating flues and a series of air-heating flues located side by side therein, gas-supply pipes connecting with the lowermost gas-heating flues, the uppermost gas-heating flues having lateral eduction-channels connecting with the combustion-chamber, said air-heating flues being also provided with eduction-channels communicating with the combustion-chamber, a mantel surrounding the bottom, sides, and top walls of the retort, having a flue therein, substantially as set forth, a rear wall for the oven having a descending flue therein, partition-walls between the several ovens having horizontal smoke-flues for the products of combustion and air-heating flues above them, and a chimney connecting with the smoke-flues, substantially as set forth.

5. The combination, with a coking-chamber, of a combustion-chamber located below the coking-chamber, each side wall whereof is provided with a series of gas-heating flues,

the lowermost ones whereof connect with gas-supply pipes and the uppermost ones whereof are provided with lateral eduction-channels connecting with the combustion-chamber, the walls of the combustion-chamber being also provided with a primary series of air-heating flues located sidewise of and below the gas-heating flues, and provided with lateral eduction-channels communicating with the space below the grate of the fire, said walls being also provided with a second series of air-heating flues located sidewise of the uppermost gas-heating flues and provided with eduction-channels connecting with the combustion-chamber, said walls also having smoke-flues located between the primary and second series of air-flues, a mantel having a flue surrounding the coking-chamber, a rear wall to the oven having descending smoke-flues, and a chimney connected with the smoke-flues, substantially as set forth.

Signed at New York, in the county of New York and State of New York, this 17th day of September, A. D. 1888.

ADAM WEBER.

Witnesses:

PHILLIPS ABBOTT,

WILLIAM ECK.