

(No Model.)

4 Sheets—Sheet 1.

F. L. SLOCUM.
COKE OVEN.

No. 568,075.

Patented Sept. 22, 1896.

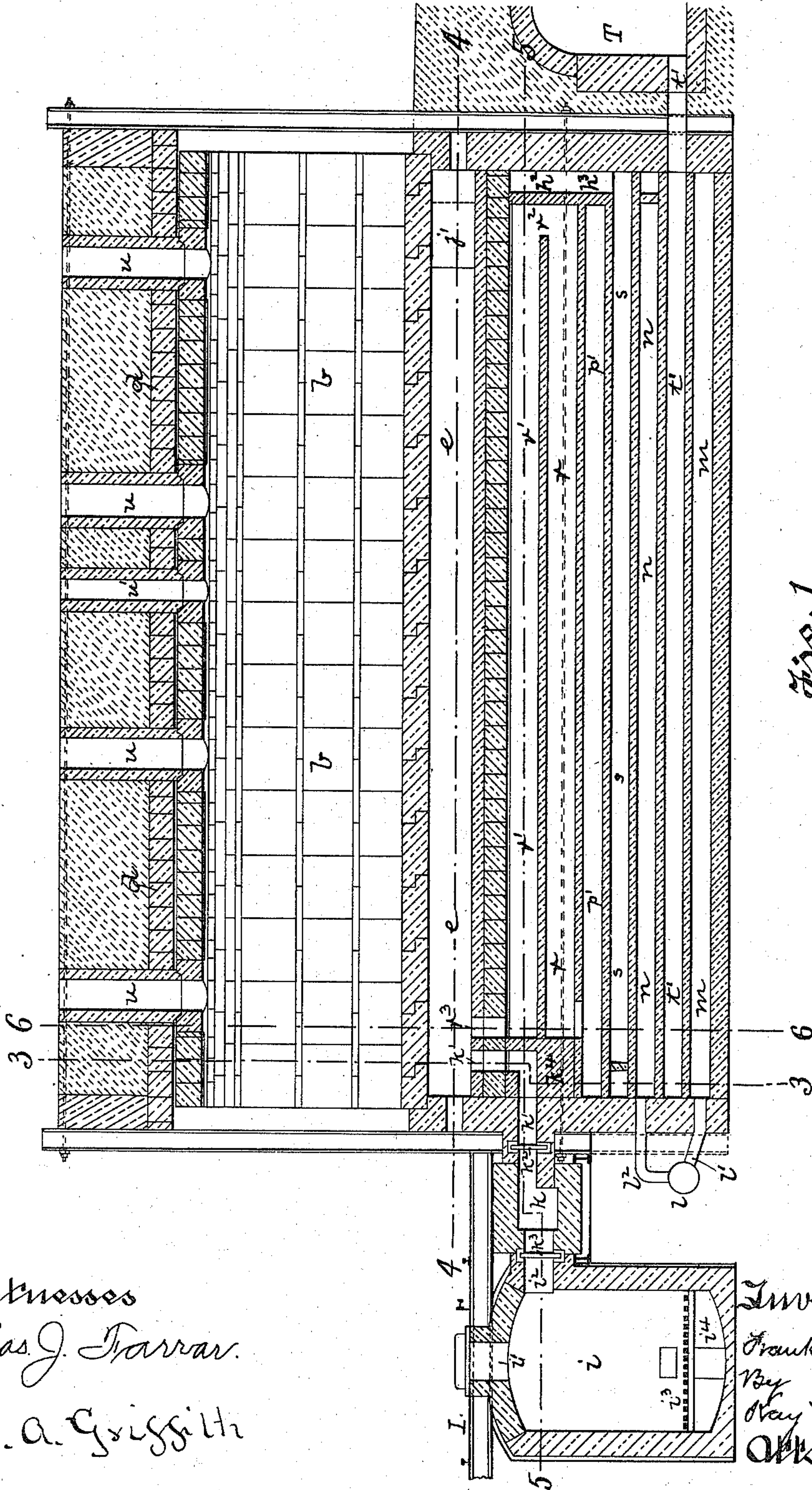


Fig. 1.

Witnesses

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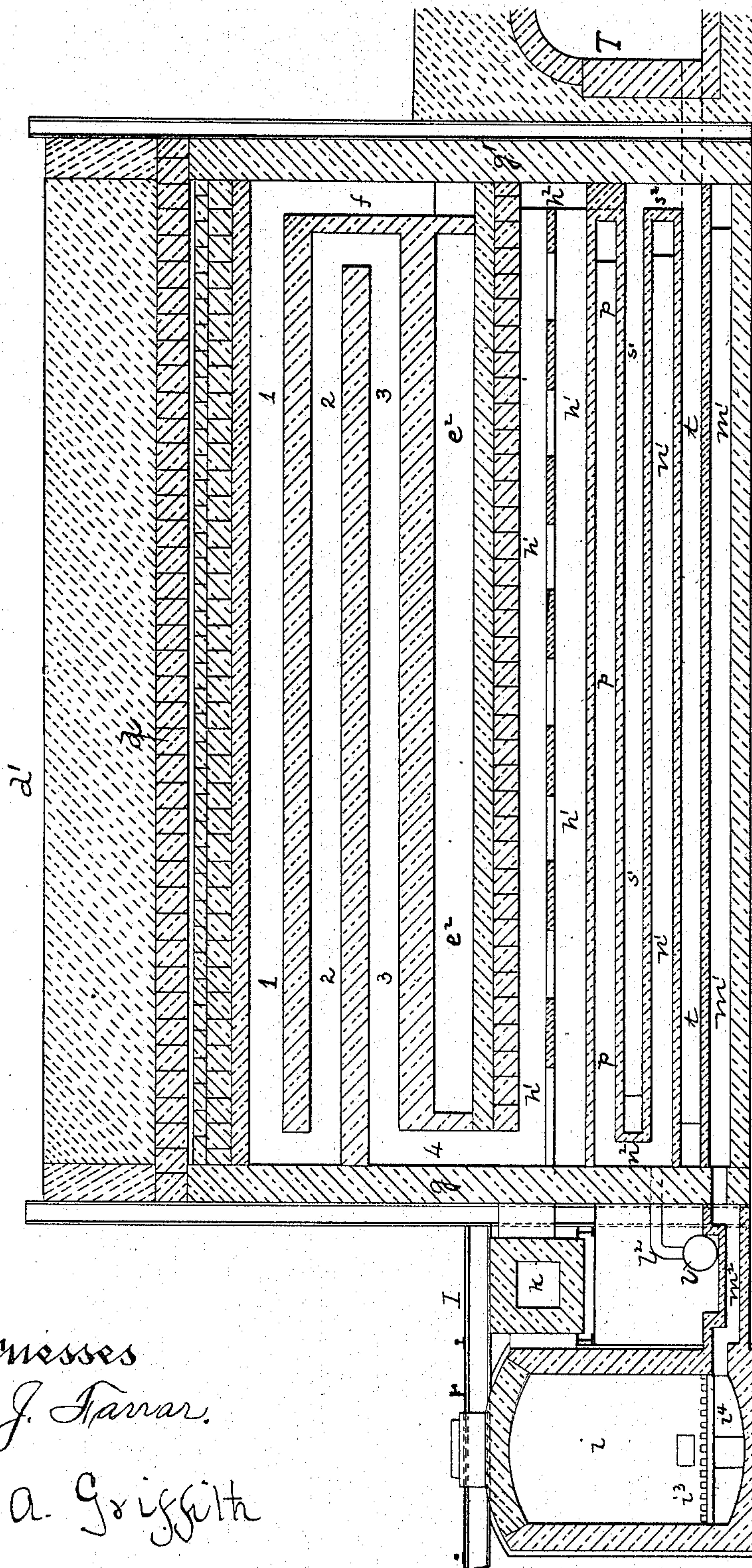
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2 Witnesses
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(No Model.)

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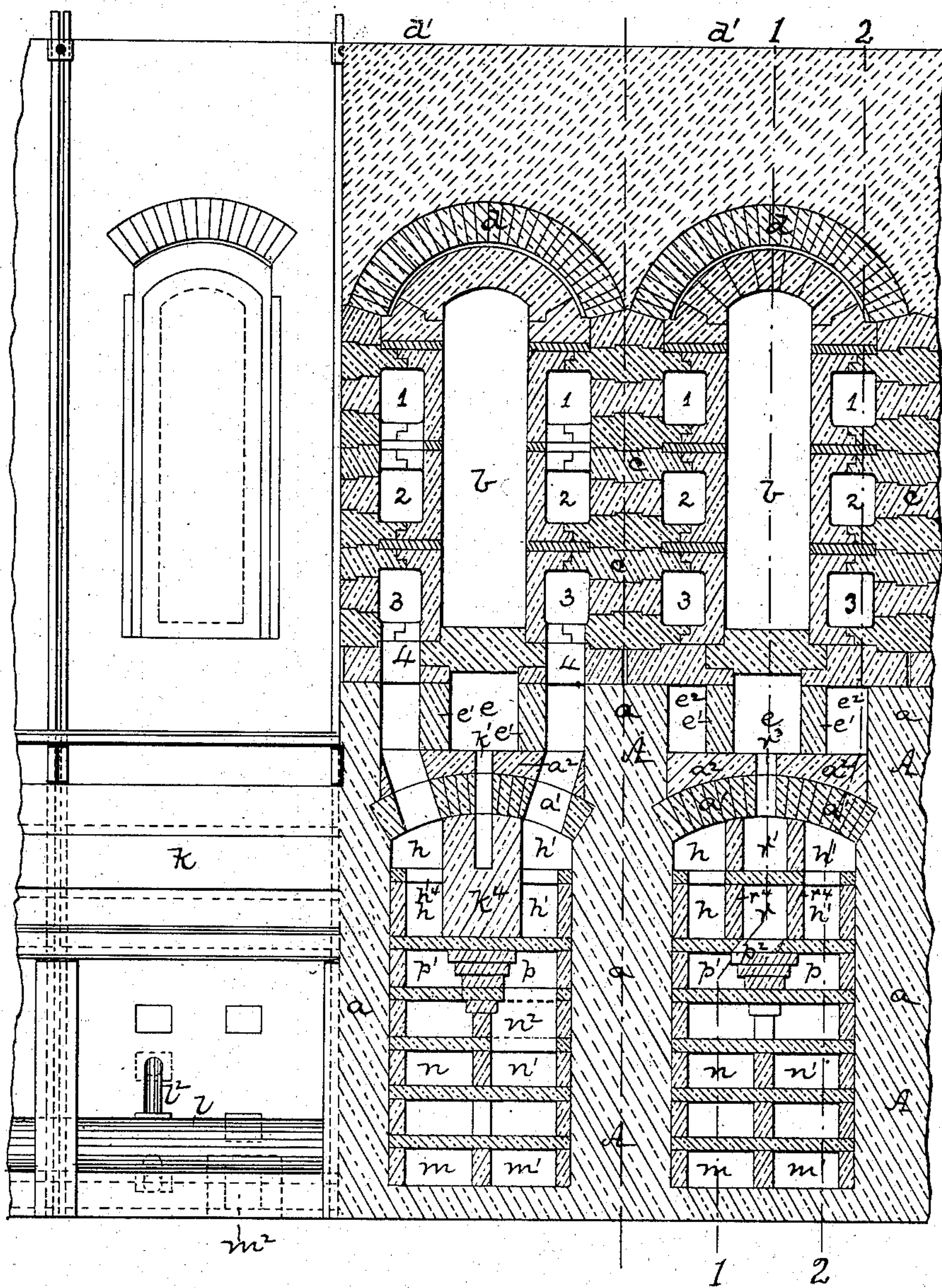


Fig. 3

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4 Sheets—Sheet 4.

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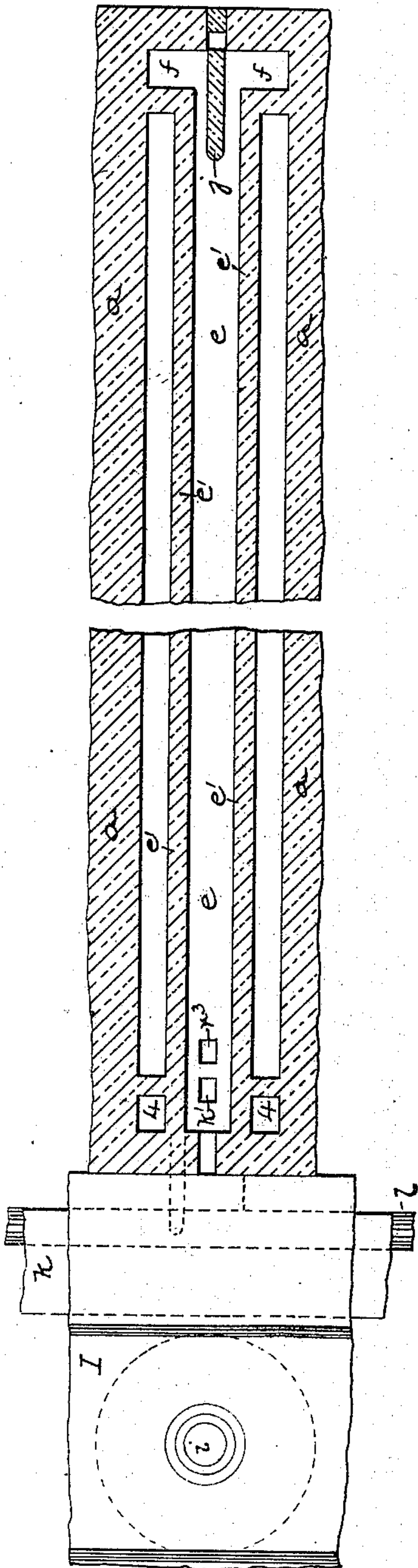


Fig. 4

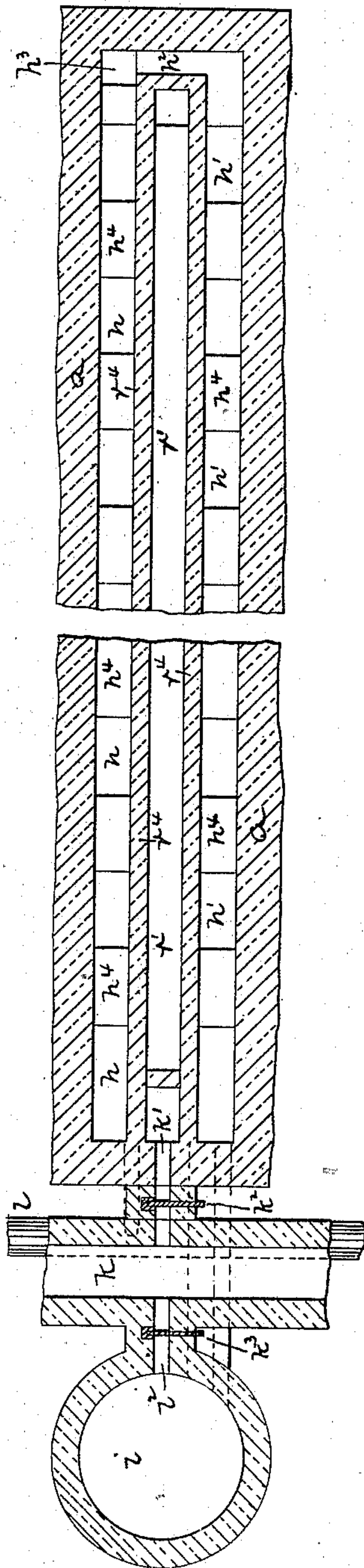


Fig. 5

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UNITED STATES PATENT OFFICE.

FRANK L. SLOCUM, OF PITTSBURG, PENNSYLVANIA.

COKE-OVEN.

SPECIFICATION forming part of Letters Patent No. 568,075, dated September 22, 1896.

Application filed May 23, 1895. Serial No. 550,337. (No model.)

To all whom it may concern:

Be it known that I, FRANK L. SLOCUM, a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Coke-Ovens; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to ovens for coking coal, and more especially to that class of coking-ovens having long horizontal coking or distilling chambers with heating-flues in the side walls, the object of the present invention being to provide suitable ovens of this class so arranged that they may be heated by gas formed in separate generators, and all the gas obtained from the distilling of the coal in forming coke may be stored for illuminating or heating purposes, and, further, to provide for the high heating of the air employed to support combustion both in the separate gas generator or producer and within the coke-ovens themselves.

In my improved coke-oven the entire space extending under the long horizontal coking-chamber, and under the side walls containing the heating-flues around the same, is utilized for the heating of the incoming air by means of horizontal return-flues, the construction of which will be hereinafter described. The gas generator or producer is located outside of the bank of ovens and communicates with a transverse gas-flue, from which ports or flues lead to the combustion-chambers of two or more of the coking-ovens, so that a single gas-producer may be utilized for supplying gas for heating several ovens, and in the case of a long continuous bank of ovens requiring two or more gas-producers for heating the same, by means of this transverse gas-flue, gas may be supplied continuously to all of the ovens, so that the heat may be maintained in the same, even if it is necessary to cut off one of the producers for cleaning or for other reasons. The invention also comprises certain other improvements, all of which will be hereinafter described and claimed.

To enable others skilled in the art to make and use my invention, I will describe the same more fully, referring to the accompanying drawings, in which—

Figure 1 is a longitudinal section on the line 1 1, Fig. 3. Fig. 2 is a like section on the line 2 2, Fig. 3. Fig. 3 is a front view of one oven and a vertical cross-section of another oven on the line 3 3, Fig. 1, and a vertical cross-section of another oven on the line 6 6, Fig. 1, the latter cross-section to the right of the figure. Fig. 4 is a horizontal section on the line 4 4, Fig. 1; and Fig. 5 is a horizontal section on line 5 5, Fig. 1.

Like letters and figures of reference indicate like parts in each of the figures.

The several coke-ovens forming the bank of ovens are divided by the walls A A, which in the lower parts of the ovens are formed of ordinary brickwork, as at *a*, but in the upper part of the ovens, where the coking-chambers *b* are located, are formed of the pier-walls *c*, on which rest the arches *d*, which support the brickwork between the same and the floor *d'*.

In the lower part of the structure between the walls *a* are the waste-gas flues and the air-heating flues, which will be hereinafter described, extending over which, between the walls *a*, are the arches *a'*, and supported on the brickwork *a''* resting on said arches are the walls *e'*, which form the central bottom combustion-flue *e*, leaving the spaces *e''* on each side thereof, which are not utilized for any special purpose. Resting on these walls *e'* and the walls *a* is the structure forming the coking-chambers *b* and the side heating-flues 1 2 3, special forms of fire-brick blocks for forming the same being employed, such as described in an application for patent filed by me on May 23, 1895, Serial No. 550,336, the construction of which does not require special description herein further than the description of the arrangement of the flues and connections with each other. The main combustion-flue *e* extends to the rear of the oven and has the side flues *f*, which lead back of the spaces *e''* and to the same vertical plane as the flues 1 2 3, and thence rise past the flues 2 and 3 and communicate with the rear ends of flues 1. Each of these flues extends to the front of the oven, as shown in Fig. 2, and thence by a downtake communicates with the flue 3, which extends to the front of the oven and communicates with the downtake 4, the two downtakes 4 extending

in front of the spaces e^2 close to the front end wall g and lead down to the horizontal flues $h h'$, hereinafter described in connection with the air-heating and waste-product flues.

5 Located in front of the bank of ovens is the gas-flue k , which extends transversely of the bank of ovens and from which project the flues k' on the same vertical planes as the combustion-flue e , which lead first horizon-
10 tally into the bank of ovens and then upwardly through the base of each combustion-flue e , near the forward end thereof, so providing the supply of gas to such flues, the flues k being controlled by suitable valves k^2 ,
15 which provide for the opening and closing of the same and which are preferably slide-valves. Communicating with this transverse flue k is the gas-producer i , which producer is located under the working floor I, so that
20 if coke is to be used for fuel it may be introduced directly into the same through the feeding-port i' , or coal may be fed thereto for like purposes. These producers are preferably made large enough to supply several of
25 the coking-ovens with the necessary heating-gas, and they communicate with the gas-flue k by the side ports i^2 , so that the gas is first introduced into that flue and distributed from the producer to the several combustion-flues
30 of the several ovens, such construction having also the further advantage that in a bank requiring two or more producers the flow of gas may be so controlled that one of the producers can be cut out at any time by its valve
35 k^3 , such as for clinkering or repairing, and the gas from the other producers carried to the different ovens, so that they also may be operated continuously.

40 While the construction of the waste-product and heating flues hereinafter described can of course be employed where a separate gas-producer is employed with each oven, I find the above construction much preferable and more economical. The gas-producers
45 have the grates i^3 and ash-pits i^4 .

I will now proceed to describe the system of air-heating and waste-product flues, so as to show how the waste gases are utilized for the heating of both the primary air for main-
50 taining combustion in the producer and the secondary air for maintaining combustion around the coking-chamber. The air-heating and waste-product flues are built, as above stated, between the walls a , and the space
55 utilized is practically the full width and length of the oven, so that they might be termed "full-width" and "full-depth" ovens. To feed air to the flues, the transversely-extending air-pipe l is employed, which extends
60 along the bottom of the bank, and to which air is fed under pressure, branch pipes l' leading from the same into the primary air-heating flue m , which extends at the bottom of the air-heating system to the rear end of
65 the same and to the rear end wall g' and communicates therewith and with a like flue m' , which extends parallel with the flue m to

the front wall g , the flues m and m' being separated by a division-wall, and these flues occupying the full space between the walls 70
 a . Leading from the flue m through the front wall g is the flue m^2 , which communicates with the producer below the grate-bars, and so feeds the heated air to the producer. Above the waste-product flues $t t'$, hereinafter 75
referred to, are the air-heating flues $n n'$, the branch pipe l^2 leading from the air-pipe l into the flue n' , which extends to the rear of the oven and then communicates with the flue n' , which extends parallel therewith to 80
the front wall g and communicates with the uptake-flue n^2 , which leads up to the air-heating flue p , said flue leading to the rear of the oven and communicating with the flue p' , which is on the same horizontal plane and 85
extends forward parallel therewith, though not for the full length, the flue p' terminating in front of the brickwork k^4 , inclosing the gas-entrance flue k' , and there communicating with the inclined uptake p^2 , which 90
leads into the central air-heating flue r . Said central flue leads longitudinally toward the rear of the oven and communicates by an uptake-passage r^2 with the central air-heating flue r' , which extends forward directly 95
above the flue r to the brickwork k^4 , inclosing the gas-entrance k' , and thence communicates with the air-entrance port r^3 , which opens into the combustion-flue e below the coking-chamber b . 100

The waste-product flues are arranged to heat the said several air-heating flues as they carry the waste products to the stack or sewer, and I will now describe them. The down-
105 take-flues 4 lead from the lower combustion-flues 3 in the side walls of the coking-chamber on each side of and past the combustion-flue e and through the arches e' until brought into line with the central air-heating flues r
110 r' , that is, on each side of the brickwork k^4 , inclosing the gas-entrance k' . They then communicate with the flues $h h'$, one on each side of the central air-heating flues $r r'$, which flues $h h'$ extend back to the rear wall
115 g on each side of the air-heating flues $r r'$, where these flues are united by a cross-flue h^2 , extending between the flues $r r'$ and the rear wall g' , the waste products being carried to one side and entering the downtake-flue h^3 , which leads past the rear end of the air-heating flue p' and into the waste-product flue
120 s , which extends longitudinally to a point near the forward end of the oven and thence communicates with the flue s' , parallel with and on the same horizontal plane as the flue s 125
and extends to the rear wall g , where it communicates with the downtake-flue s^2 , the waste-product flues $s s'$ thus extending between the air-heating flues $n n'$ and $p p'$, and the forward ends terminating back of the uptake n^2 . 130
The downtake-flue s^2 communicates with the flue t , which extends longitudinally forward to the front wall g and there communicates with the flue t' on the same horizontal plane,

which leads back through the rear wall *g* and communicates with the sewer *T*, back of the bank of ovens which leads to the stack, (not shown,) the flues *t t'* extending between the primary air-heating flues *m m'* and the air-heating flues *n n'*, the lowest of the secondary air-heating flues. In this way practically all the space between the two division-walls *a a'* is utilized for heating the incoming air by the outgoing waste products, and this without the necessity of carrying any of the flues into the side walls, while the necessary locations for the combustion-flues below and in the side walls of the coke-oven are maintained, and the air is introduced upwardly into the combustion-flue. The two bodies of waste products leading from the two sets of heating-flues are carried in proper course for heating the air in the central air-heating flues *r r'* and are finally united and carried in proper course for heating the air in the flues below the same. To properly brace the walls of the central air-heating flues *r r'*, it will be noticed that on each side of the air-heating flues brace-blocks *h⁴* extend at intervals across the flues *h h'* and between the division-walls *r⁴* and the walls *a*, such brace-blocks, however, interfering in no way with the flow of the waste products through said flues *h h'*.

To regulate the direction of the gases from the combustion-flue *e* into the flues *f*, on one or the other side of the ovens, I place in the combustion-flue *e*, at the rear end thereof and extending somewhat in front of the flues *f*, the movable deflecting-tile *j*, which can be swung to one side or the other so as to properly divide the flow of the heated products and direct them into the side flues, a port *j'* giving access to the combustion-flue for such purpose, the port *j'* being closed by a suitable plug. The oven has the usual feeding-ports *u*, which may be closed and sealed after the coal is fed to the coking-chamber, and has also the gas-eduction port *u*, through which the gas passes to the water seal and thence to the washing apparatus and storage-tank, and it has any suitable form of doors for closing the ends of the coking-chamber.

When the coking-oven is in use, the coal is fed through the feeding-ports *u*, which are then properly sealed, and the gas generated from the coal or coke in the producer *i* passes into the transverse gas-flue *k* and is then fed to the different ovens, the gas entering through the gas-port *k'* into the combustion-chamber *e*. Air under blast is fed from the air-pipe *l* through the primary air-heating flues *m m'* to the producer *i* under the grate-bars, and air is fed through the branch pipe *l²* into the secondary air-heating system, passing through the flues *n n'*, and thence by the uptake *n²* to the flues *p p'*, and thence by the inclined uptake *p²* to the flues *r r'*, and to the entrance-port *r³*, communicating with the combustion-chamber. The flame and heated products from the combustion of the gas pass along the combustion-chamber *e*, below the coking-

chamber *b*, and thence are directed into the two uptake-flues *f* and into the upper flues *l* of the side heating-flues, and thence passing through the flues 2 and 3 into the downtake-flues 4, the high heat so generated passing through the walls surrounding the coking-chamber and acting upon the coal within the same to distil off the gases therefrom, which gases pass through the outlet-port *u'* to the water seal, and thence to the washing apparatus and storage-tank. If it is found desirable, by means of suitable branch gas flues or pipes gas and heated air may be introduced into the side combustion-flues to maintain the necessary high heat therein; but this is not generally considered necessary. The waste products pass through the two downtake-flues 4 into the flues *h h'*, and thence travel back through said flues and on each side of the central air-heating flues *r r'*, the heated products in the flue *h'* passing through the rear cross-flue *h²* and uniting with the heated products in the flue *h*, passing down into the flue *s*, forward along the same, and thence back in the flue *s'*, between the air-heating flues *n'* and *p p'*, thence passing down into the flue *t* to the forward end of the oven, and thence back along the flue *t'*, between the air-heating flues *m m'* and *n n'*, and thence to the sewer. The heat from the waste products is radiated through the walls dividing these flues from the air-heating flues, and the larger portion of the heat of the same is thus absorbed therefrom, so that a large portion of the heat is carried by the incoming air either into the producer to assist in forming the producer or generator gas therein or into the main combustion-flue *e* to assist in the combustion of the gases.

It is found that by such construction, and by utilizing the space directly under each oven for heating the incoming air for supporting combustion therein, great economy of space and compactness of structure are obtained, as well as economy of fuel in the coking of the coal. I am also enabled to utilize common producer-gas for coking the coal, instead of requiring the use of gas distilled from the coal, and I can therefore store all the gases obtained for fuel or illuminating purposes.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A bank of coke-ovens having longitudinally-extending coking-chambers, combustion and heating flues in the bottom and side walls thereof, and a series of longitudinally-extending waste-product flues and air-heating flues alternating with each other and filling the space under the coke-oven, a gas-producer communicating with the combustion-flue of the coke-oven, the bottom air-heating flues of said series leading to the gas-producer, and the other air-heating flues passing between the waste-product flues and opening into the combustion-flue under the coking-chamber, substantially as set forth.

2. A coke-oven having a longitudinally-extending coking-chamber, longitudinally-extending combustion and heating flues in the bottom and side walls thereof, and a
 5 series of longitudinally-extending waste-product flues and air-heating flues filling the space under the coke-oven, the waste-product flues having return-flues on the same horizontal plane, and downtake-flues at one
 10 end of the oven passing the air-heating flues in their downward course to the stack, and the air-heating flues between the waste-product flues having return-flues on the same horizontal plane and uptake-flues passing
 15 the waste-product flues at the other end of the oven, substantially as set forth.

3. A coke-oven having a longitudinally-extending coking-chamber, longitudinally-extending combustion and heating flues in
 20 the bottom and side walls thereof, and having a system of waste-product flues and air-heating flues in the space below the coke-ovens, said air-heating flues being formed as return-flues side by side in the lower part of the sys-
 25 tem, and thence communicating with a longitudinal air-heating flue centrally of the space, and having waste-product flues extending longitudinally on each side thereof, substantially as set forth.

30 4. A coke-oven having a longitudinally-

extending coking-chamber and combustion and heating flues in the bottom and side walls thereof, and having the return air-heating flues n, n' on one horizontal plane, the
 35 return air-heating flues p, p' on another horizontal plane, the central air-heating flues r, r' on the same vertical plane above the flues p, p' and having waste-product flues h, h' at the sides of the air-heating flues r, r' , the return waste-product flues s, s' between the
 40 flues n, n' and p, p' and the return waste-product flues t, t' below the flues n, n' , all said flues extending longitudinally of the oven, substantially as set forth.

5. A coke-oven having a longitudinally-
 45 extending coking-chamber, a single combustion-flue under the same, heating-flues in both side walls with which said bottom combustion-flue communicates, and a movable deflecting-tile at the rear end of the bottom
 50 flue extending beyond the ports leading to the heating-flues in the side walls, substantially as set forth.

In testimony whereof I, the said FRANK L. SLOCUM, have hereunto set my hand.

FRANK L. SLOCUM.

Witnesses:

JAMES I. KAY,

ROBERT C. TOTTEN.