

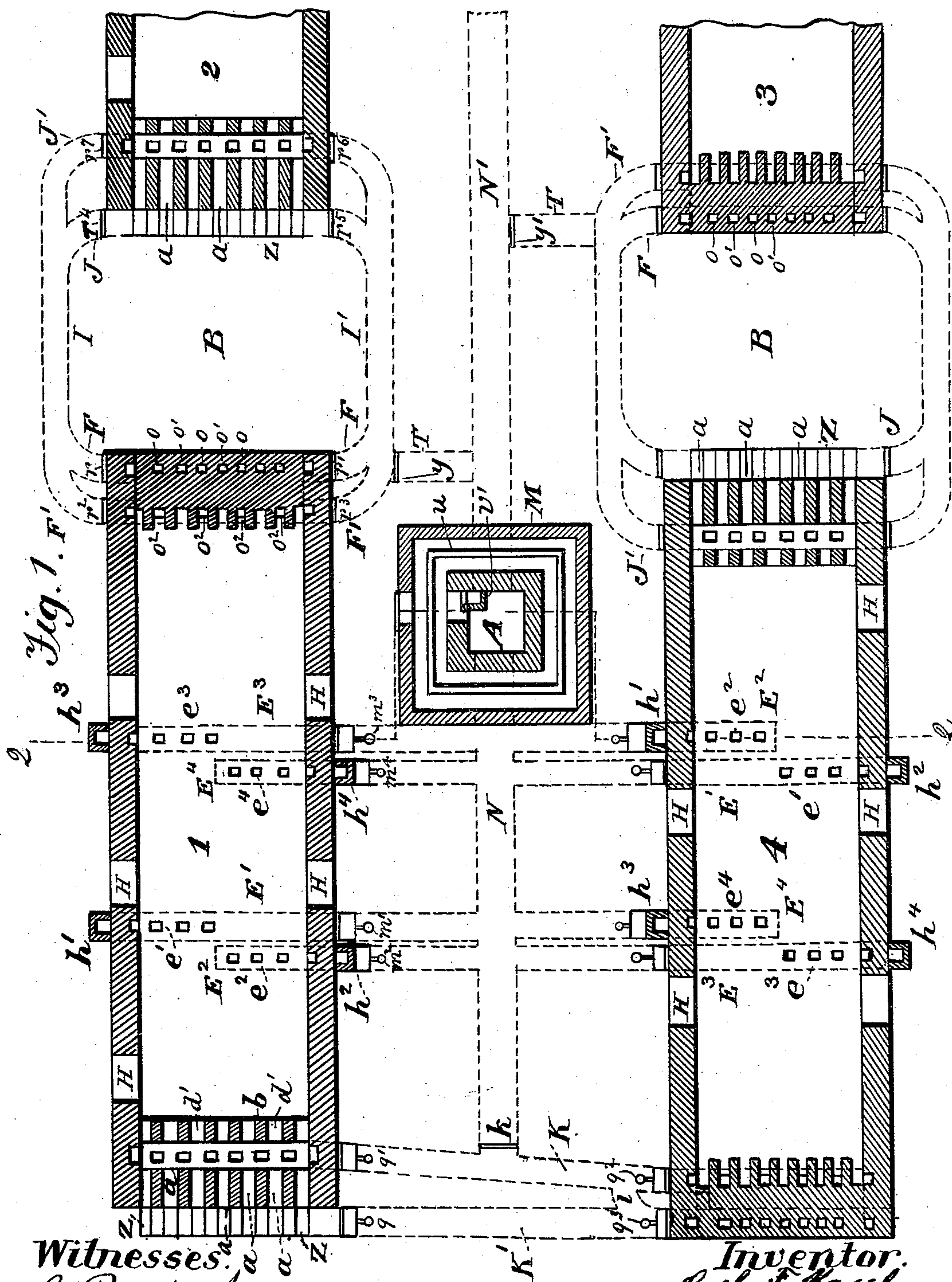
(No Model.)

3 Sheets—Sheet 1.

C. F. KAUL.  
CONTINUOUS BRICK KILN.

No. 507,274.

Patented Oct. 24, 1893.



(No Model.)

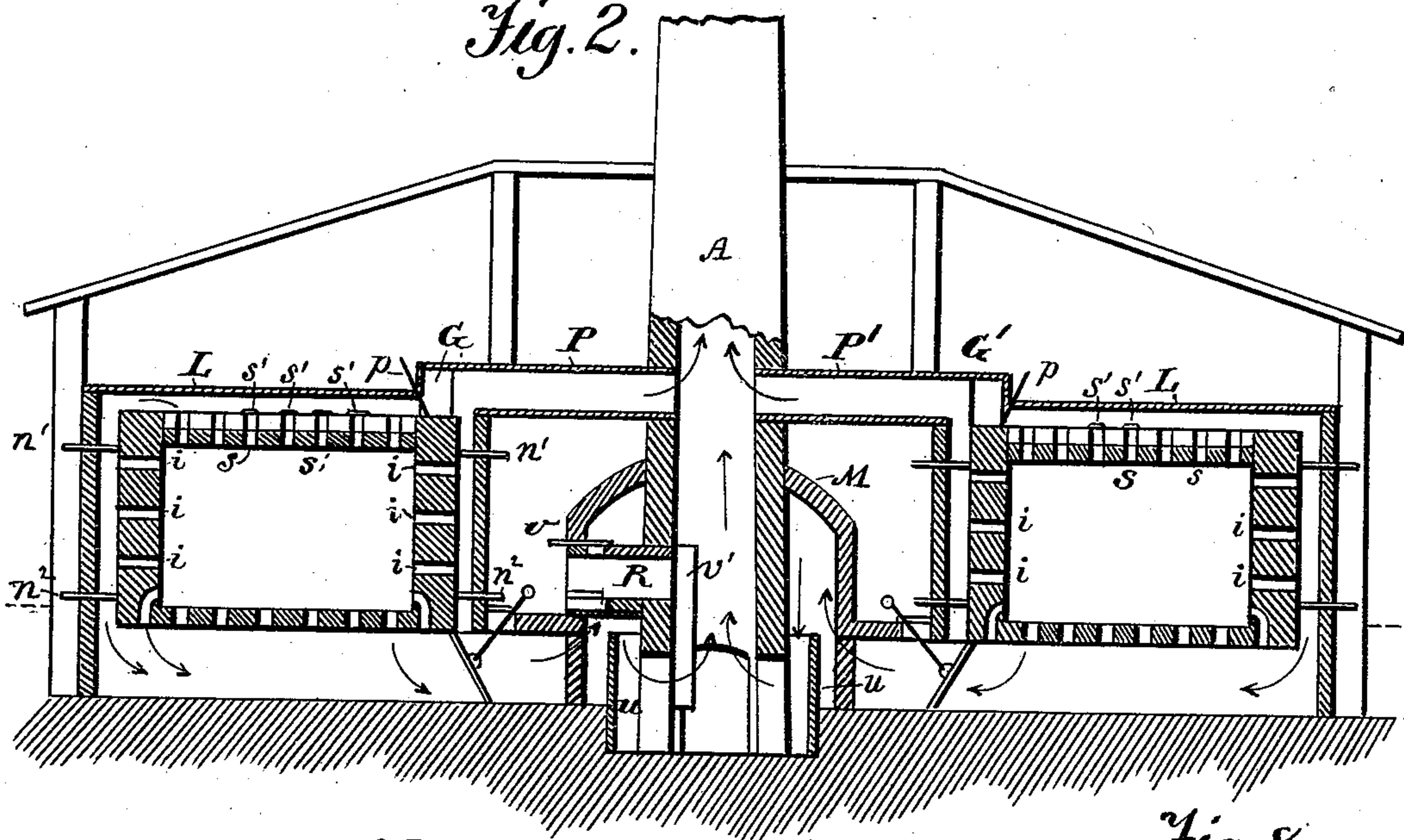
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C. F. KAUL.  
CONTINUOUS BRICK KILN.

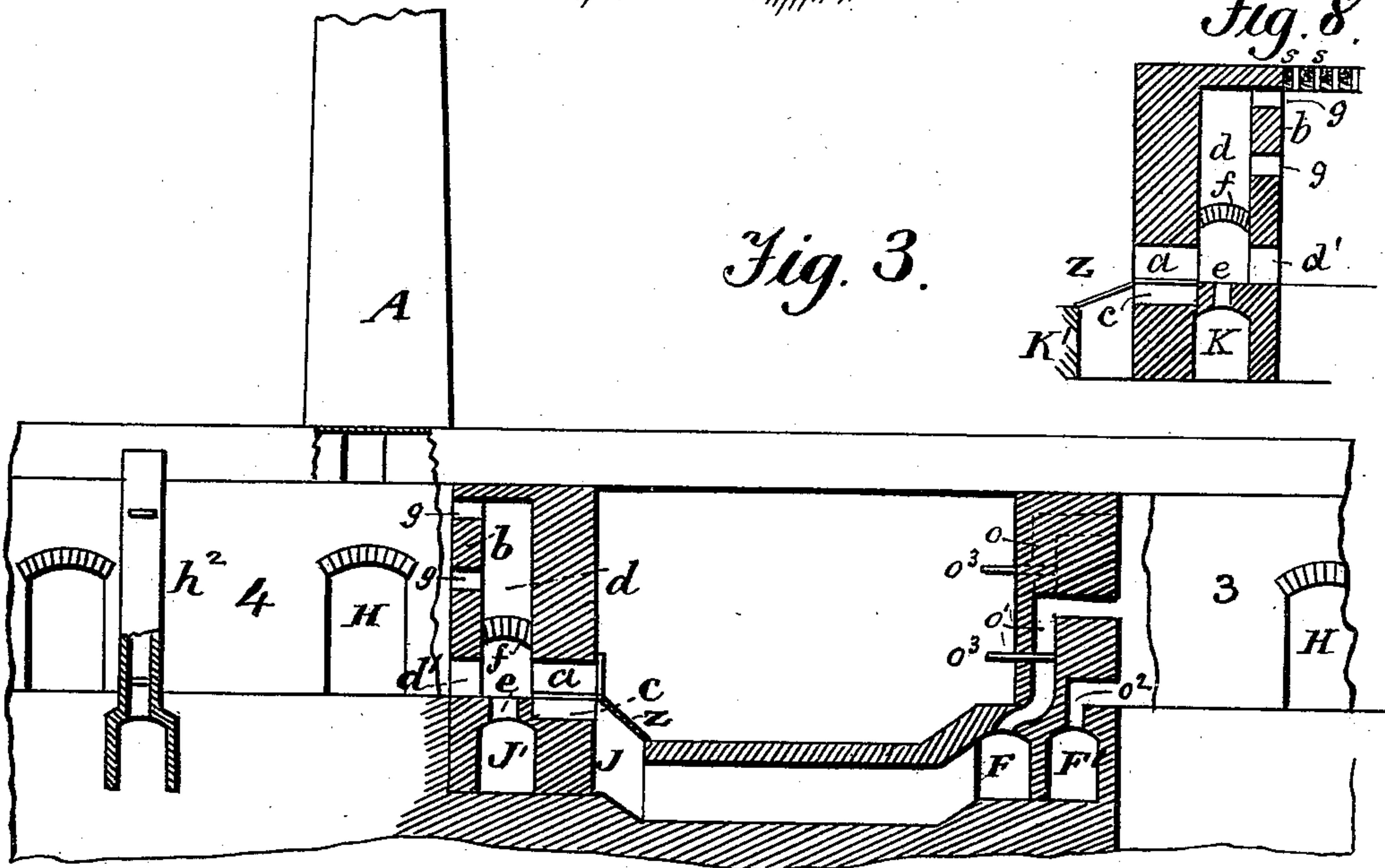
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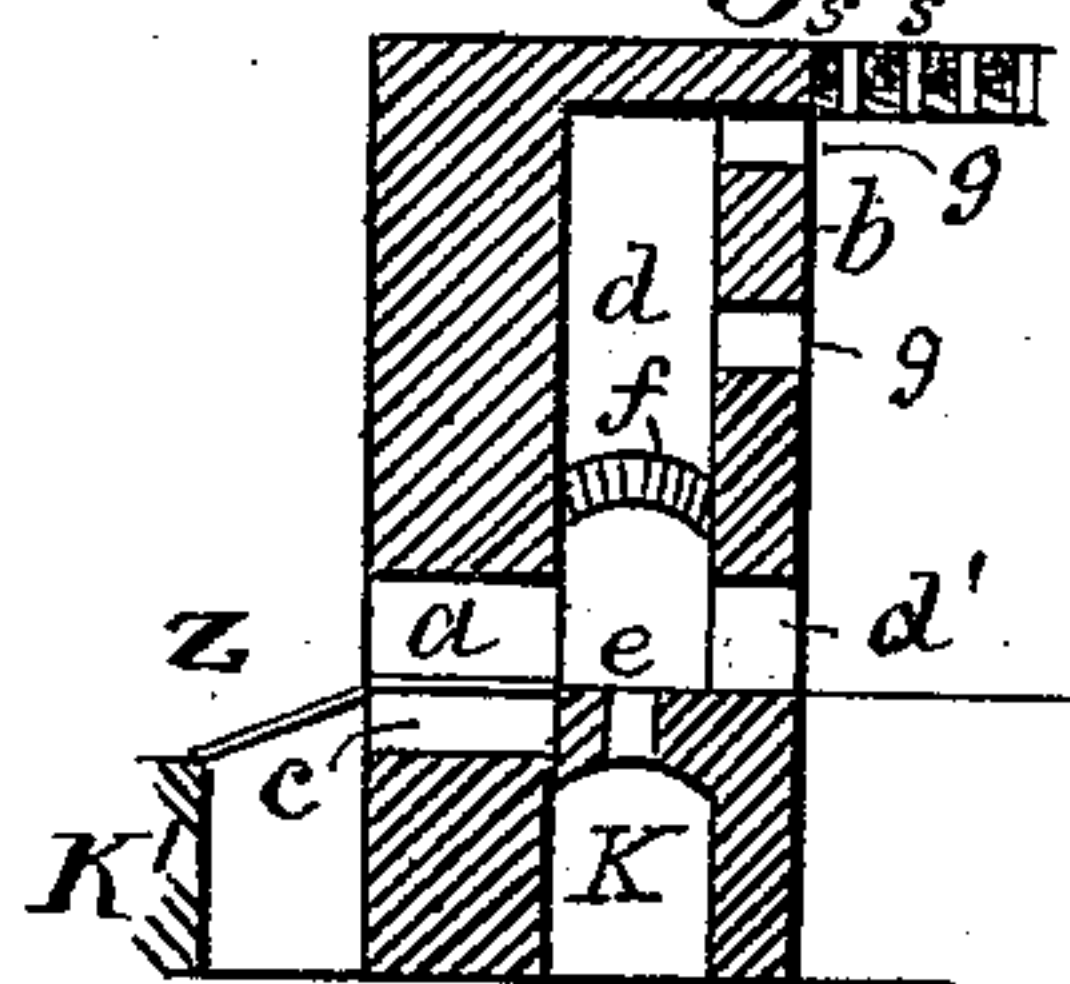
*Fig. 2.*



*Fig. 3.*



*Fig. 8.*



*Witnesses.*  
*A. Ruppert.*  
*H. A. Daniels*

*Inventor.*  
*Carl F. Kaul*



(No Model.)

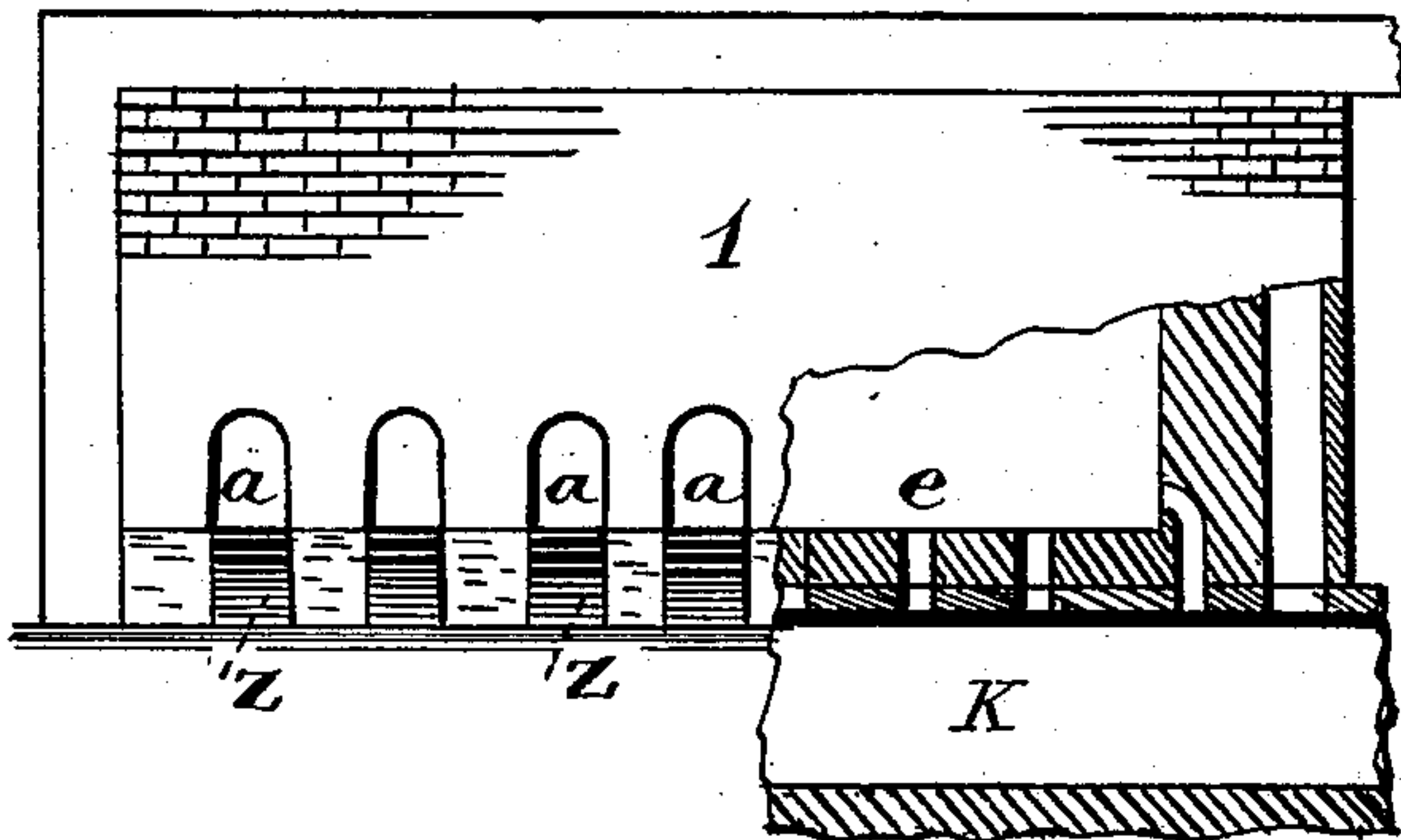
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C. F. KAUL.  
CONTINUOUS BRICK KILN.

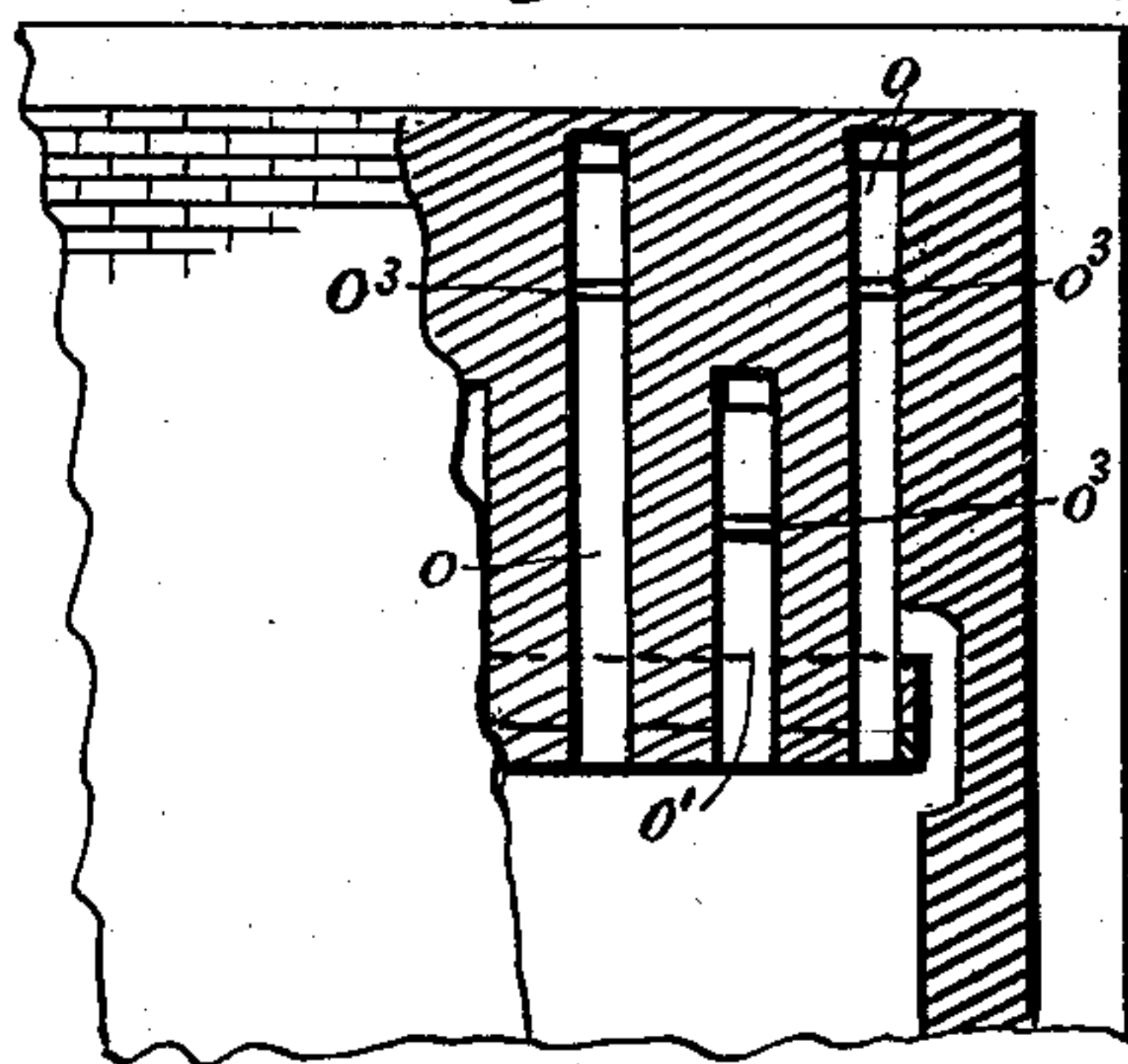
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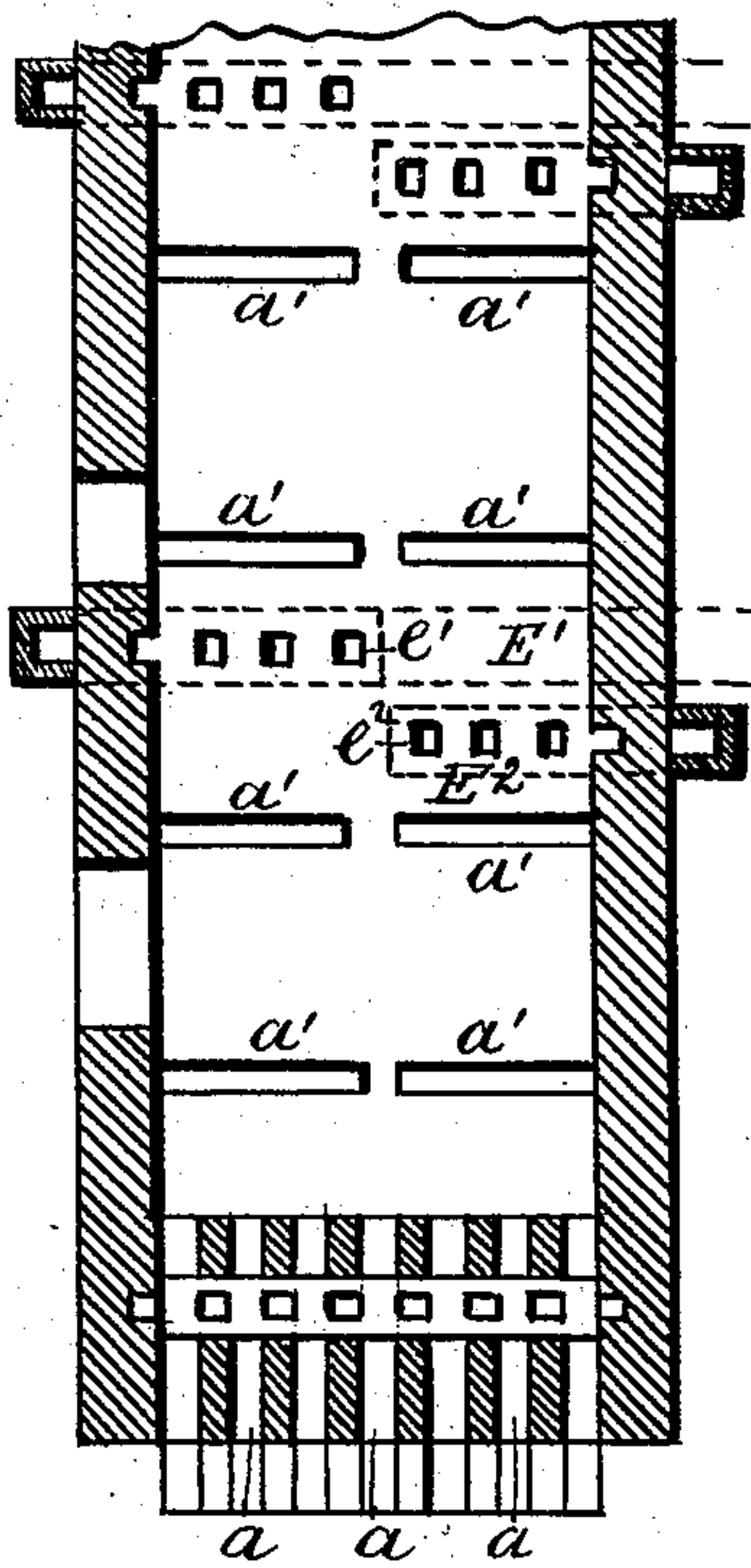
*Fig. 4.*



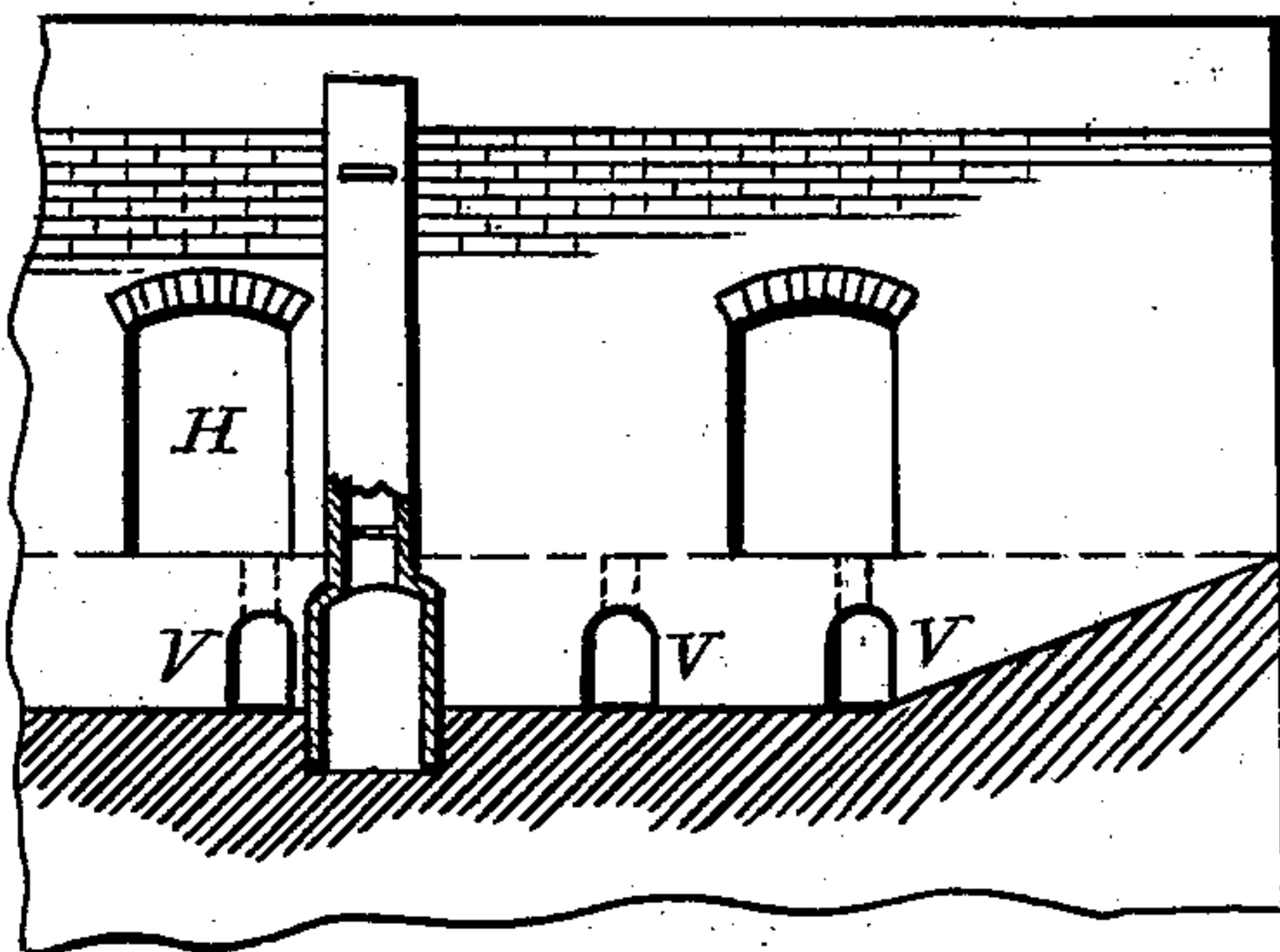
*Fig. 5.*



*Fig. 6.*



*Fig. 7.*



*Witnesses.*  
*A. Ruppert.*  
*H. A. Daniels*

*Inventor.*  
*Carl F. Kaul*



# UNITED STATES PATENT OFFICE.

CARL F. KAUL, OF MADISON, NEBRASKA.

## CONTINUOUS BRICK-KILN.

SPECIFICATION forming part of Letters Patent No. 507,274, dated October 24, 1893.

Application filed January 23, 1893. Serial No. 459,463. (No model.)

*To all whom it may concern:*

Be it known that I, CARL F. KAUL, a citizen of the United States, residing at Madison, in the county of Madison and State of Nebraska, have invented certain new and useful Improvements in Brick-Kilns; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

This invention relates to brick-kilns and consists in certain improvements on a kiln for which Letters Patent No. 486,972 were issued to me on the 29th day of November, 1892.

In the accompanying drawings—Figure 1 represents a sectional plan view of my improved brick-kiln, certain portions being broken away. Fig. 2 is a vertical section of the kiln, taken on line 2—2 of Fig. 1. Fig. 3 illustrates certain parts of the kiln in sectional, side view. Fig. 4 is a sectional, front view of a section of the kiln. Fig. 5 is a sectional rear view of one section of the kiln. Fig. 6 is a plan view and Fig. 7 is a side view showing a modification in the construction of the kiln. Fig. 8 represents a vertical section of the fore part of section 1 of the kiln.

A brick-kiln having my improvements is preferably constructed in two main divisions which are built on parallel lines, the smoke-stack A being located between said divisions, as shown in Fig. 1. In each division are usually several sections, each of which has a compartment for brick, two sections designated 1 and 2 being shown in one division and two sections, 3 and 4, being shown in the opposite division. The spaces B between sections are for convenience for access with teams to the compartments at their inward sides and to the smoke stack A. The several sections are similar in construction and communication one with another is formed by underground flues, the operation being continuous from section 1, and continued through sections 2, 3, and 4 successively, the last having communication with section 1. As will be seen, the sections in one division are in position reverse to that of the sections in the opposite division; that is,—the sections 3 and

4 extend from front to rear in a direction opposite to that of sections 1 and 2, and each section has a series of furnaces at its front.

In the front of the section 1 are the furnaces *a*, under each of which is an ash-box *c*. An inner wall *b* is located a suitable distance in rear of the front wall, leaving space *d* between said front wall and wall *b*, which space is crossed by brick work on the same plane with the floor of the kiln, said brick-work having apertures *e*, which connect with an underground flue K hereinafter referred to. A series of arches *f* cross the space *d* for the purpose of strengthening the structure. Openings *d'* are made in the wall *b* in rear of the furnaces *a*, and apertures *g*, being passages for heat and smoke, are made in said wall.

Lines of apertures, *e'*, *e''*, *e'''* and *e''''*, are made in the floor of section 1 at intervals, said apertures connecting the interior of the compartment with under-ground flues *E'*, *E''*, *E'''*, and *E''''*, respectively, said flues being connected indirectly with the stack A. Opposite the said lines of apertures, *e'*, *e''*, &c., in the side walls of the kiln or outside of the same, are arranged the vertical flues *h'*, *h''*, *h'''* and *h''''*, which connect with said flues *E'*, *E''*, *E'''* and *E''''*, respectively. Apertures *i* are made in the side walls, connecting said vertical flues *h'*, *h''*, &c., with the interior of section 1. The vertical flues *h'*, *h''*, &c., extend to the top of the compartment, in position to connect with removable flues L placed across the top as hereinafter set forth. Dampers *m'*, *m''*, *m'''*, and *m''''* are placed in flues *E'*, *E''*, *E'''* and *E''''* respectively, for closing or opening them, and dampers *n'*, *n''*, are intended for opening or closing the said vertical flues in the side walls, either above or below the apertures *i*. The purpose of extending the lines of apertures *e'*, *e''*, *e'''*, *e''''*, only about one half the distance across the floor of the compartment is to regulate the draft of hot air through the contained mass of brick, making it stronger in one part of the mass than in another part, this being sometimes necessary to equalize the drying or burning of the brick in all parts of the compartment.

The rear wall of section 1 is provided with a series of vertical flues *o*, *o'*, which connect at their lower ends with an underground flue F, the said flues *o*, *o'*, being turned inward



at their upper extremities to connect with the interior of said section Fig. 3. As shown in Fig. 5, the flues  $o$  extend nearly to the top of the compartment before turning to connect with the interior, but the flues  $o'$  extend only about half way to the top before turning to the interior. Dampers  $o^3$  are placed in the flues  $o$   $o'$ . A row of apertures  $o^2$ , a short distance rearward from the flues  $o$ ,  $o'$ , form passages from the interior of section 1 to the underground flue  $F'$ . Dampers  $r$ ,  $r'$ ,  $r^2$ ,  $r^3$ , two being at each side of section 1, serve to open or close the flues  $F$ ,  $F'$ .

The section 1 is closed at the top, after being charged with green brick, in the following manner: A layer of brick is first placed on the mass of green brick which is piled in such a manner as to have vertical openings in the mass extending from top to bottom. Thimbles  $s$  are set in the layer of brick in rows across the top and said thimbles are surrounded by a layer of earth, on the layer of bricks, and form passages from the interior through the top covering, and caps  $s'$  are placed on said thimbles. The removable flues  $L$  are adapted to cover a line of the thimbles  $s$  and form passages from them to a flue  $G$  which extends along on the top of the inward side-walls of sections 1 and 2. These removable flues are, for convenience, usually made in sections and when one of said flues is placed in position over any desired line of thimbles  $s$ , the caps of said thimbles are first removed and said flue is placed with its inward extremity in connection with said flue  $G$ , at an opening in the latter, where a damper  $p$  is placed, openings in flue  $G$  being made at intervals for such purpose. The removable flue  $L$  may be placed so as to cover a line of thimbles  $s$  and also connect, at its outward end, with one of the vertical flues  $h'$ ,  $h^2$ , &c., and when said flue  $L$  is removed, the vertical flue with which it was connected may be closed by a damper in the upper part of said vertical flue. When flue  $L$  is located so that it does not connect with a vertical flue in a side wall, said flue  $L$  may be temporarily closed at its outward end by any suitable means.

Doors  $H$  are made at intervals in the side walls of the kiln for access to the interior of the several sections.

The other sections 2, 3 and 4, of the kiln, and their various details, are similar in construction to section 1. The rear wall of section 1 faces the front wall of section 2, and the rear wall of section 3 faces the front wall of section 4, a series of furnaces being at the front of each section.

Communication between sections 1 and 2 is formed by the underground flues  $F$ ,  $F'$ , under the rear of section 1, flues  $I$ ,  $I'$ , with which flues  $F$ ,  $F'$ , after joining at opposite ends connect, and flues  $J$ , and  $J'$ , under the front of section 2, said last named flues, after joining, connecting with said flues  $I$ ,  $I'$ , as shown. Communication between sections 3

and 4 is formed by a series of underground flues similar to those by which sections 1 and 2 are connected. Communication is formed between the rear end of section 4, and the front end of section 1, by two underground flues  $K$ ,  $K'$ , connected by a short flue at  $l$ ; and in like manner, the rear end of section 2 is connected with the front end of section 3, by underground flues similar in construction to flues  $K$ ,  $K'$ ,  $l$ .

The smoke-stack  $A$  stands within a sunken inclosure having a wall  $u$  surrounding the stack at its base. A compartment  $M$  is built around the stack and in said compartment, at one side of the stack, is placed a furnace  $R$ , the fire box of which communicates rearward with the interior of the stack  $A$ . An aperture, in the top of the furnace  $R$ , which may be closed by a damper  $v$ , allows heat to pass from the furnace to the upper part of the compartment  $M$  and circulate about the smoke-stack. A deflecting plate  $v'$  is fixed in position to deflect the heat passing from the furnace to the interior of the stack, turning the course of such heat downward to the bottom.

$N$ ,  $N'$  indicate two underground flues extending from the stack  $A$  at opposite points in its base, said flues connecting with flues  $K$  at opposite ends of the kiln. Dampers  $k$  are located in flues  $N$ ,  $N'$ , where said flues connect with flues  $K$ . The underground flues  $E'$ ,  $E^2$ ,  $E^3$ ,  $E^4$ , which have communication with the interior of section 1, connect with the underground flue  $N$ , as do also the similar flues communicating with the interior of section 4; and the similar underground flues, communicating with the interiors of sections 2 and 3, connect in like manner with flue  $N'$ . Short, underground flues  $T$  and  $y'$ , connect joining flues  $F$ ,  $F'$  in rear of section 1 and  $F$ ,  $F'$ , in rear of section 3 respectively with flue  $N'$ . The flues  $G$ ,  $G'$ , which extend along on the tops of the inward walls of the kiln, are respectively connected with the stack  $A$  by flues  $P$ ,  $P'$ . Openings are made at intervals in flues  $G$ ,  $G'$  and provided with dampers  $p$ , for the connection of removable flues  $L$ .

In operation, the section 1 is charged with green brick, vertical openings, equally spaced, being left in the mass of brick, extending from top to bottom. The compartment of section 1 is then closed at the top by layers of brick and earth and thimbles set as before described, the side doors  $H$  being closed. The caps are then removed from a line of thimbles  $s$  which is about in or near a vertical plane with the line of apertures  $e'$  in the floor of section 1 and a removable flue  $L$  is placed over said line of thimbles  $s$ , and put in connection with a flue  $G$  which is connected by a flue  $P$  with the smoke-stack. The dampers  $m'$  and  $m^2$ , in underground flues  $E'$ ,  $E^2$  of section 1, are then opened, as are also the lower dampers  $n^2$ ,  $n^2$ , in vertical flues  $h'$ ,  $h^2$ , of the side walls of said section. Fire is then started



in the furnaces *a* of section 1 and the heat and smoke are drawn into the mass of brick and downward through apertures *e'*, *e*<sup>2</sup> in the floor of said section to the underground flues *E'*, *E*<sup>2</sup>, and also upward through the thimbles *s* which have been covered by a removable flue *L*, into the latter and to a flue *G*, the damper *p* between said flues *L* and *G* being open, and from flue *G* through a flue *P* to the smoke stack; a portion of the smoke is also carried by the draft through passages *i* into vertical flues *h*, *h'*, and down to flues *E*, *E'*. By this operation, about one third of the green brick, in the forward part of section 1, becomes dry, and while this drying is going on, the next rearward dampers *m*<sup>3</sup>, *m*<sup>4</sup>, in flues *E*<sup>3</sup>, *E*<sup>4</sup>, are opened and the lower dampers *n*<sup>3</sup>, *n*<sup>4</sup>, in vertical flues *h*<sup>3</sup>, *h*<sup>4</sup>, of the side walls are also opened; another flue *L* is then placed over a line of thimbles *s* in the top of section 1 as before, the caps *s'* having been removed from said thimbles, which latter are about on or near a vertical plane with the line of floor apertures *e*<sup>3</sup>; the last mentioned flue *L* is put in connection with said flue *G* and the opposite damper *p* is opened. The draft is thus made to pass rearward in section 1 as far as the line of floor apertures *e*<sup>3</sup>, and passes through said apertures downward to the flues *E*<sup>3</sup>, *E*<sup>4</sup>, below, and also upward through the thimbles *s* in line above and into the last mentioned flue *L* and to flue *G* as before. Meanwhile the next section 2 has been charged with green brick and closed at the top, with thimbles set, as before in section 1. The brick in section 1 being dry about as far rearward as the line of floor-apertures *e*<sup>3</sup>, the dampers *r'* and *r*<sup>3</sup> in the flues *F*, *F'*, under the rear of section 1, are opened; the damper *y* in flue *T* is also opened; also the dampers *o*<sup>3</sup> in flues *o*, *o'* in the rear wall of section 1 are also opened. The brick in the fore part of section 1 are now quite hot and the brick in the rear part of said section are nearly dry. Now firing is commenced through the top of section 1, beginning at the fore part, the fuel being fed through the thimbles *s* gradually toward the rear of said section. Meanwhile the dampers *m'*, *m*<sup>2</sup>, in flues *E'*, *E*<sup>2</sup>, and also the lower dampers in side flues *h'*, *h*<sup>2</sup>, of section 1 and dampers *n*<sup>2</sup> are closed; the flue *L* first placed on the top of section 1 is removed, the line of thimbles from which said flue *L* is removed are closed, and said flue *L* is placed over a row of thimbles in the top of section 2, located over the line of floor apertures *e'* of section 2, said flue *L* being put in connection with flue *G* as before. The dampers *m'*, *m*<sup>2</sup>, in underground flues *E'*, *E*<sup>2</sup>, leading under section 2 are then opened, as are also the lower dampers in the vertical side flues *h'*, *h*<sup>2</sup>, of section 2. The dampers *r*<sup>6</sup> and *r*<sup>7</sup> in underground flue *J'* are now opened; and the dampers *r*, *r*<sup>2</sup>, of flues *F*, *F'*, at the rear of section 1 are also opened; the damper *y* in flue *T* is then closed, connection being thus formed, between sections 1 and 2, through flues *F*, *F'*,

and *I*, *I'*, and apertures *e* and openings *d'* and *g* of section 2. Then the dampers *m*<sup>3</sup>, *m*<sup>4</sup> of flues *E*<sup>3</sup>, *E*<sup>4</sup> under section 1, and also the lower dampers in side flues *h*<sup>3</sup>, *h*<sup>4</sup> of section 1 are closed; the flue *L* last placed on the top of section 1 is removed and caps placed on the thimbles which were covered by said flue *L*; and the damper *p* between said flue *L* and flue *G* is closed; the said flue *L*, last removed from section 1, is placed over another line of thimbles in section 2, as was before done with section 1, and put in connection with flue *G*, and the dampers in underground flues *E*<sup>3</sup>, *E*<sup>4</sup> under section 2 are opened; the damper *p* to flue *G* is also opened. While the firing is continued rearward in section 1, the section 3 is being charged with green brick and closed at the top, with thimbles set, as before. Now the dampers *m*<sup>3</sup> and *m*<sup>4</sup> of underground flues *E*<sup>3</sup>, *E*<sup>4</sup> of section 2, are opened; caps are removed from the line of thimbles, in the top of section 2, which is over the line of floor apertures *e*<sup>3</sup> in said section 2 and a flue *L* is placed over said thimbles; the lower dampers in side flues *h*<sup>3</sup>, *h*<sup>4</sup>, of section 2 are opened; the damper *p*, opposite said flue *L* is opened. Now the firing through the top of section 1 has proceeded to the rear of said section, and the fire in the furnaces in the front of said section 1 has been allowed to go out slowly. The brick has been getting dry in section 2 as far as the underground flues *E*<sup>3</sup>, *E*<sup>4</sup> of said section. Communication is now opened between sections 2 and 3, from the rear of section 2 to the front of section 3 by opening dampers *q'* and *q*<sup>2</sup> in underground flue *K*, and damper *q*<sup>3</sup> in flue *K'*, and the dampers *o*<sup>3</sup> to the flues *o* in the rear of section 2 are also opened. Now the brick in section 1 being burned and the brick in section 2 being quite hot, fire is started in the furnaces in section 2. Now open dampers *r*<sup>4</sup>, *r*<sup>5</sup> in flue *J* to draw hot air from the interior of section 1, for the necessary draft to the furnaces in section 2. Now the brick in section 1 are cooling and section 4 is charged with green brick and the top is closed as before in sections 1 and 2; now remove the first flue *L* placed on section 2 and place the said flue over a row of thimbles on the fore part of section 3 as was formerly done with sections 1 and 2. The brick in section 1 is now taken out the top covering being removed, and said section is again charged with green brick, and the operation is continued through sections 3 and 4, and through flues *K* *K'* to section 1 as before.

The doors to furnaces *a* of section 1 are kept open for draft and the door to the furnaces in the following sections are kept closed until communication is opened between section 4 and section 1, after which the furnace doors of section 1 are kept closed. During the operation the draft is drawn from the compartments of sections from which I am removing the burned brick.

The covers *z* serve to close the ash boxes



of the furnaces and also cover underground flues where they extend in front of said furnaces.

As will be seen, the smoke is carried by the draft to the smoke-stack through the flues P, P', which are about on the level of the top of the kiln, and also through underground flues N, N', entering the compartment M at the bottom. The smoke then passes upward in said compartment to the top and circulates around the stack and is drawn downward on all sides of the stack and passes within the inclosure of the wall *u*; through openings in the stack at its base and from thence upward through the stack.

It is frequently necessary to have a certain degree of heat around the stack A at its base to make the draft through the stack sufficiently strong. In hot or cloudy weather, the flues leading to the stack will get filled with acid and acid gases so as to choke up the flues and render the draft too slight for operation, and I have occasionally found it necessary to make a fire within the stack at its base to expel or consume the gases, and this being done, the draft becomes increased at once and the flues become entirely cleared of such gases.

When the clay contains too much lime and alkali, it is necessary to use salt, in brick-making, to consume the lime and alkali. The

salt, with other mineral substances put in the brick, generates the acid and acid gas, which, as they accumulate, are effectually expelled or consumed by the use of my improvement, and the heat is retained to some extent in the compartment M surrounding the lower part of the stack, so that the latter is effectually heated.

In Figs. 6 and 7 is shown a modification in the construction of the kiln, the floor of a section having openings *a'* extending from opposite walls to points near the center line of said floor. Furnaces V are arranged below the floor, said furnaces extending from the side walls of the kiln, along, under said openings, and having doors in said side walls, so that the furnaces may be charged with fuel from the outside. This construction is for the use of cord wood instead of coal.

I claim—

The smokestack A, surrounding compartment M, dampered furnace R and deflector *v'* in combination with the flues as and for the purpose set forth.

In testimony whereof I have affixed my signature in presence of two witnesses.

CARL F. KAUL.

Witnesses:

A. RUPPERT,  
H. A. DANIELS.