

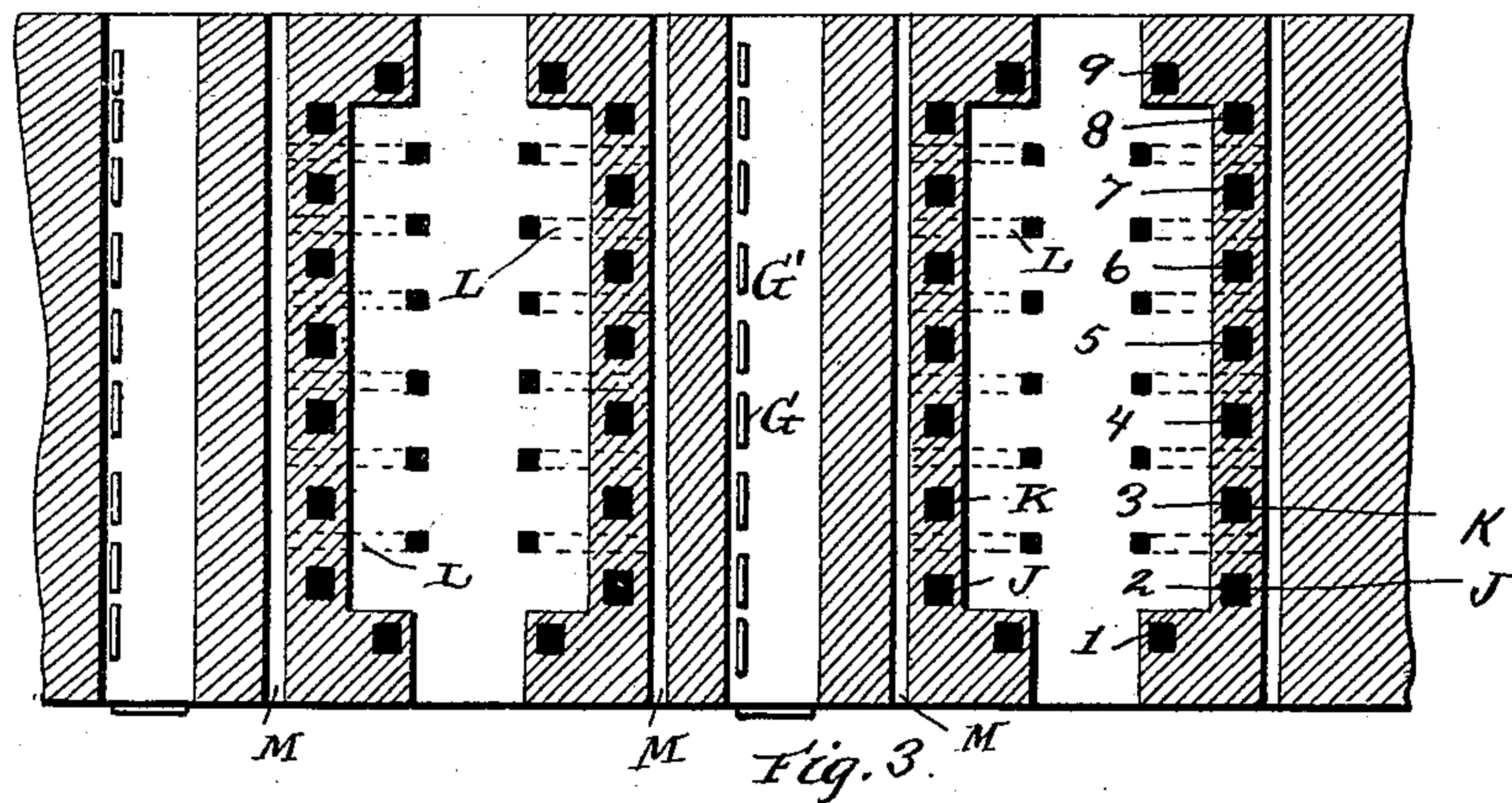
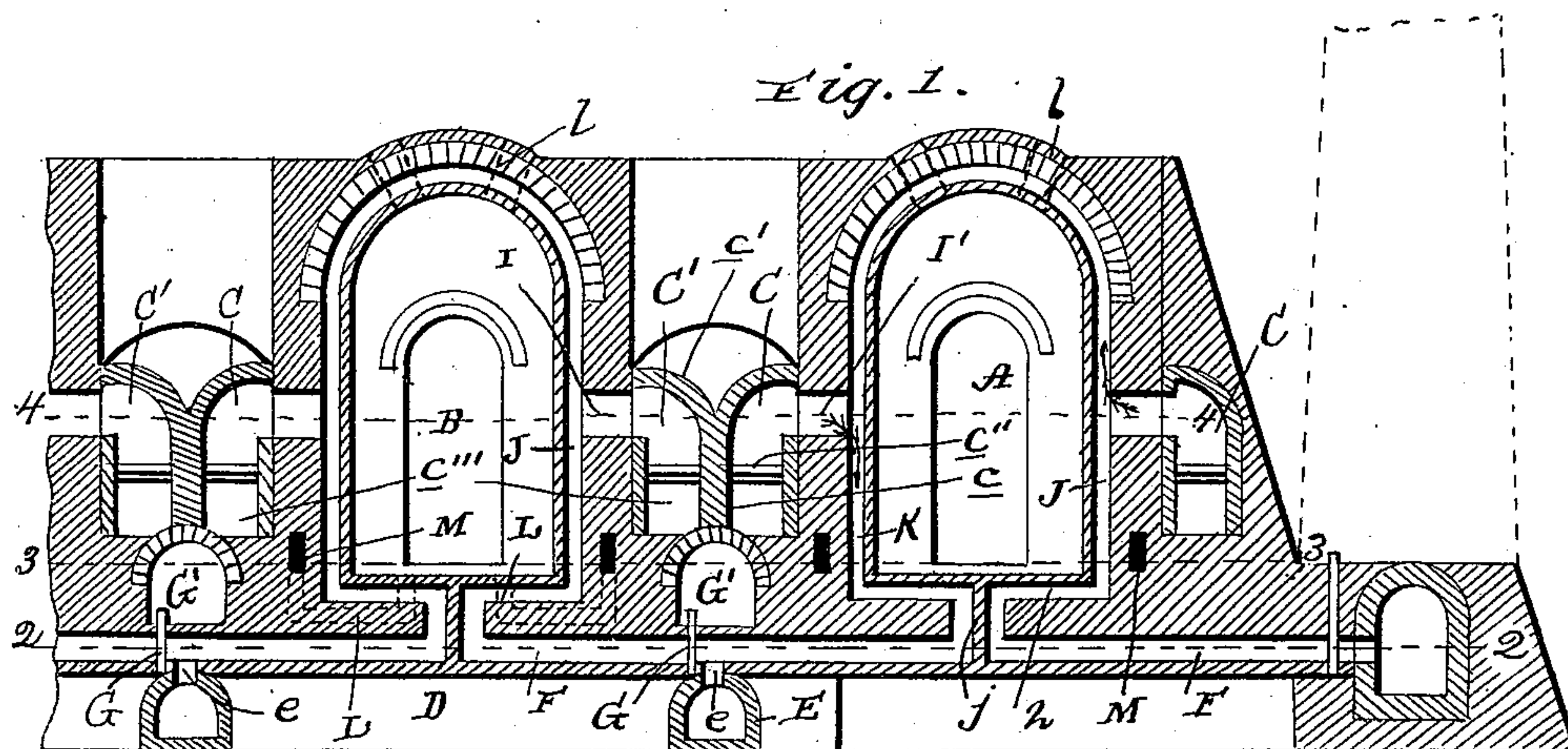
(No Model.)

3 Sheets—Sheet 1.

F. MACARTHY.  
KILN FOR BAKING AND BURNING BRICKS.

No. 518,153.

Patented Apr. 10, 1894.



Witnesses:

*E. Paeder*  
*James Sheehy*

Inventor

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Attorney



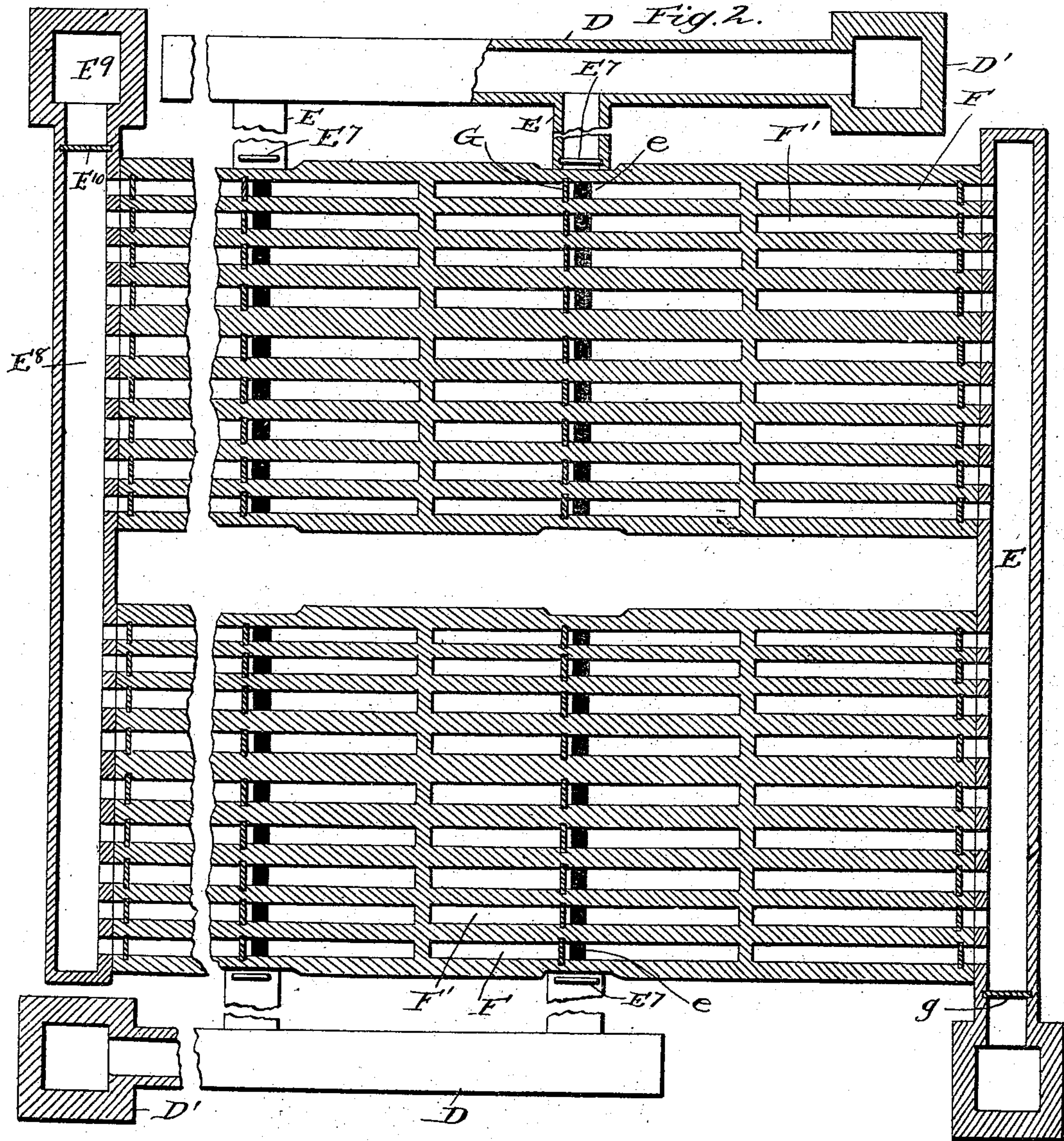
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3 Sheets—Sheet 2.

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KILN FOR BAKING AND BURNING BRICKS.

No. 518,153.

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(No Model.)

3 Sheets—Sheet 3.

F. MACARTHY.

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Fig. 4.

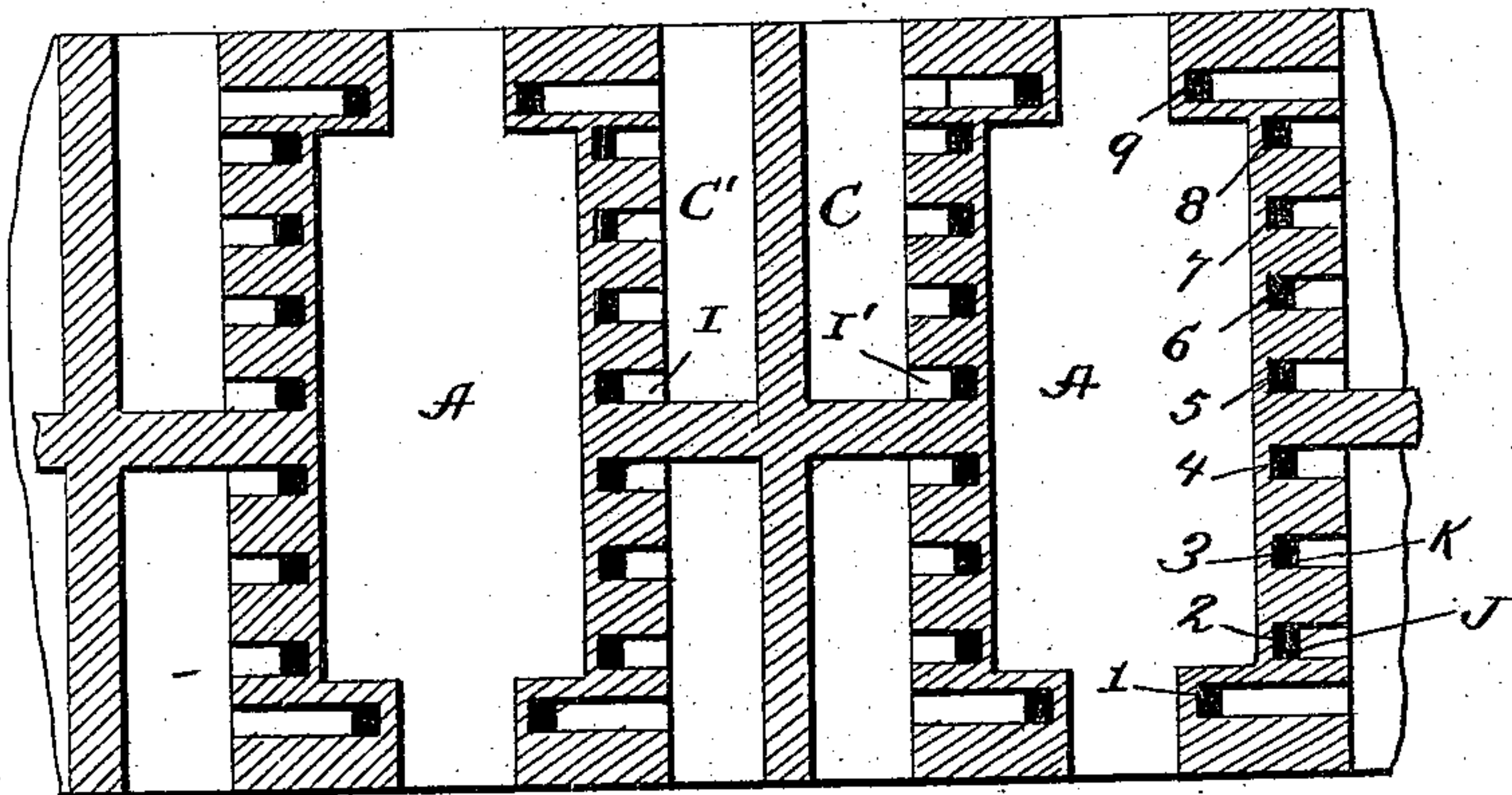
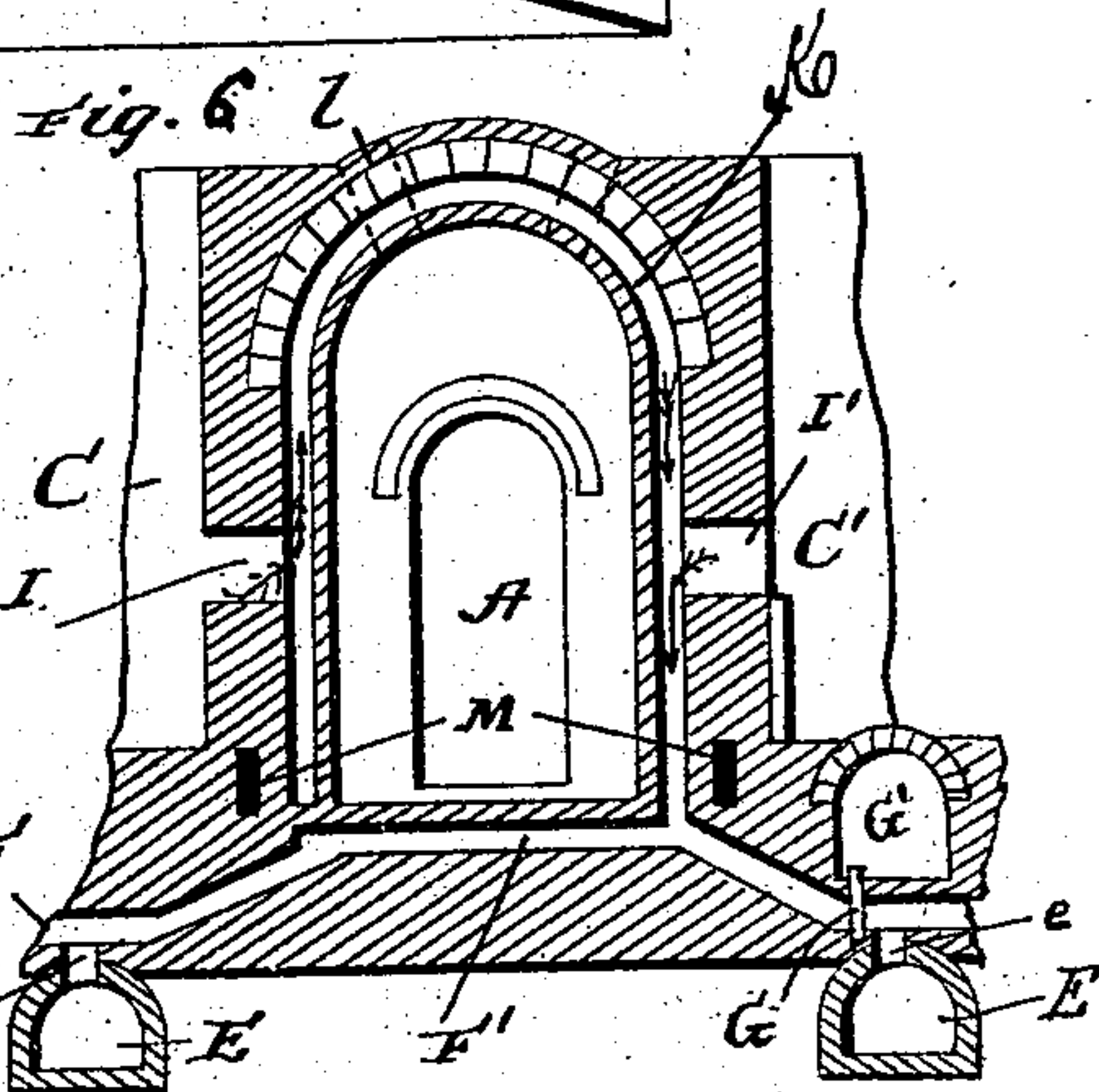
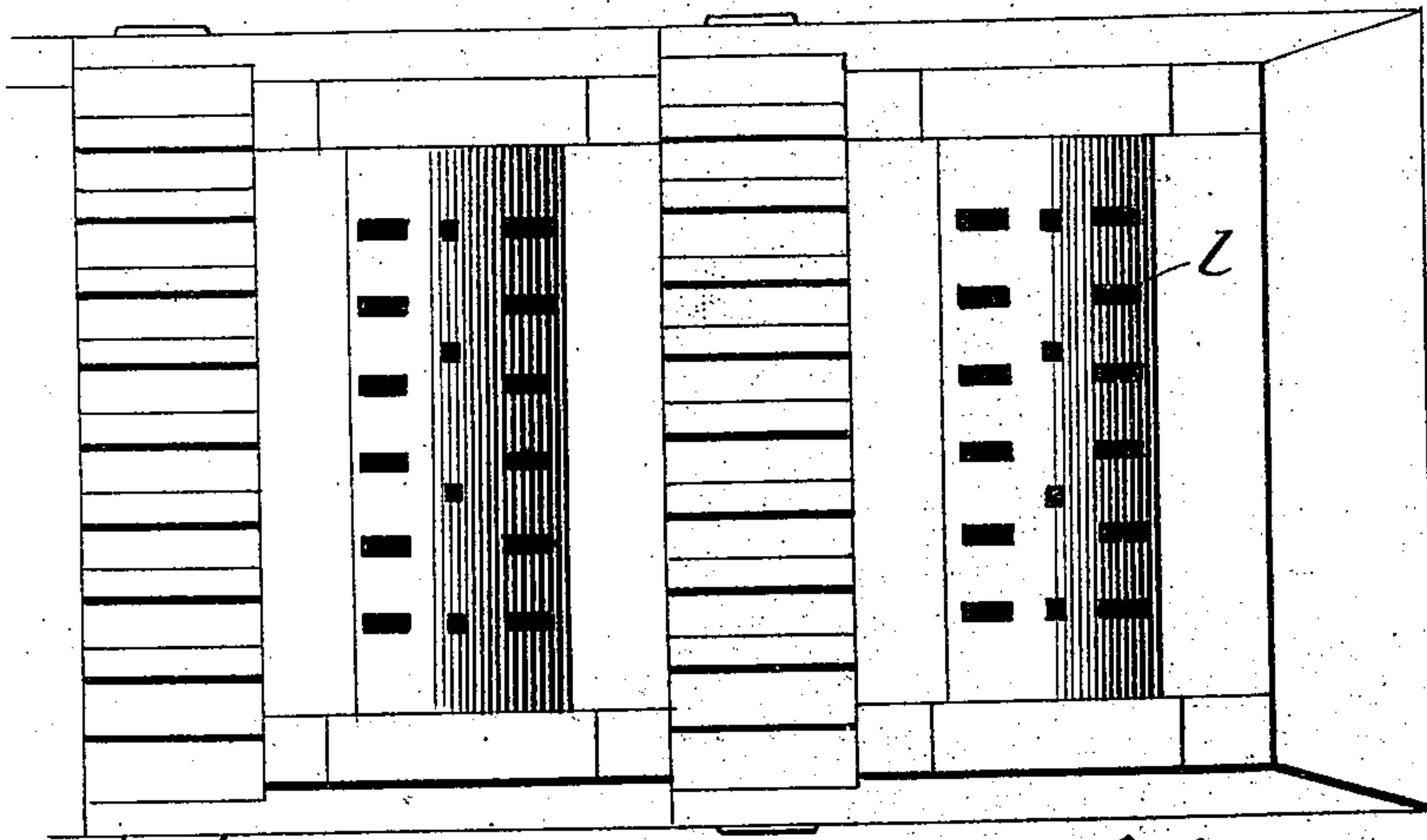


Fig. 5.



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Attorney



# UNITED STATES PATENT OFFICE.

FRED MACARTHY, OF SAYREVILLE, NEW JERSEY, ASSIGNOR OF ONE-HALF  
TO THE SAYRE & FISHER COMPANY, OF SAME PLACE.

## KILN FOR BAKING OR BURNING BRICKS.

SPECIFICATION forming part of Letters Patent No. 518,153, dated April 10, 1894.

Application filed June 15, 1892. Serial No. 436,774. (No model.)

*To all whom it may concern:*

Be it known that I, FRED MACARTHY, a subject of the Queen of Great Britain, residing at Sayreville, in the county of Middlesex and State of New Jersey, have invented certain new and useful Improvements in Kilns for Baking or Burning Bricks, &c.; 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.

The present invention relates to a kiln adapted for burning or baking bricks, tiles, terra-cotta, or any analogous goods to the necessary degree of hardness, and the object of the invention among other things, is to reduce to a minimum the large quantity of fuel required to properly burn the wares.

My improvements relate more especially to that class of kilns known in the art as "muffle-fired" kilns in which the products of combustion do not come at any point in direct contact with the wares placed in the chambers of the structure, but the heat required to burn or bake the wares is generated in a separate furnace and passed through flues situated in the burning chamber and is radiated from said flues into said chamber.

In the preferred embodiment of my invention, I provide a series of kiln-chambers which are each provided with four furnaces and two sets of independent flues that extend along the vertical sides, the crown or arch, and the bottom of said kiln chamber, and in which flues the drafts pass or flow in reverse directions so that the cooler products of combustion in one series of flues are adjacent to the hottest products of combustion in the other series of flues and thus the heat in the kiln chamber is rendered more nearly uniform and equalized than has heretofore been possible.

The invention further contemplates the combination with the series of kiln chambers and flues arranged therein as described, of a main longitudinal flue common to a series of kilns and discharging to a stack, a series of transverse connecting flues leading between the kiln-chambers, below the same, and discharging to said main longitudinal flue, and two series of connecting flues between each

pair of kiln chambers and one series arranged to receive from one series of flues and conduct the heat, &c., from the flues of one kiln across and in direct contact with the bottom of the next adjacent kiln and the other series of connecting flues connected to the up-draft flues so as to pass with the heat from the furnace around through said flues over the crown of the kiln chamber, thence down the opposite side of the kiln chamber, and finally out under the bottom of said chamber, and thence in like manner through the connecting flues to the next kiln chamber. The passage of the heat from one kiln chamber to the other through the connecting flues is controlled by means of dampers operating in separate damper-tunnels and adapted to cut off or establish communication between the connecting flues and the transverse flues leading to the main longitudinal flue, so that when the products of combustion have become cooled and lost their utility by passage through a series of kiln chambers, such waste products can be turned into the transverse flues, thence to the main flue, and finally to the stack.

The invention further contemplates the provision of novel means whereby the steam arising from the green wares when the fires are first started can be allowed to have direct exit from the chamber, and which also provides for the admission of cold air in cooling off the kiln; also in a novel form of furnace without direct union with the kiln chamber so that in event of deterioration of the furnace it can be readily torn out and rebuilt without disturbing the kiln chamber; and finally in the novel construction, combination, and arrangement of parts which will be hereinafter fully described and particularly pointed out in the claims.

In the accompanying drawings I have fully illustrated my invention, referring to which—

Figure 1, is a vertical sectional view through two of a series of kiln chambers showing the arrangement, in each chamber, of one series of flues, the connecting flues therefor, and the furnaces appropriate for the two kiln chambers. Fig. 2, is a horizontal sectional view on the plane of the connecting flues between the flues of the kiln chambers, the plane of sec-



tion being indicated by the dotted line 2—2 of Fig. 1. Fig. 3, is another horizontal sectional view, but on the plane indicated by the dotted line 3—3, of Fig. 1, showing the damper-tunnel, the cold air flues and the exit flues for the escape of steam from the kiln chambers in the cold air flues. Fig. 4, is another horizontal sectional view, such section being on the plane indicated by the dotted line 4—4, of Fig. 1, and showing the furnaces, the kiln chambers, the flues, and the leaders from the furnaces to the flues. Fig. 5, is a view illustrating by plan the arches of the kiln-chambers and the exit flues by which steam from the green wares is permitted to escape into the cold air flues. Fig. 6, is a vertical detail sectional view of one of the kiln chambers showing the arrangement therein of one of the series of flues and connecting flue, the other series of flues and connecting flues being indicated by Fig. 1.

Like letters and numerals indicate corresponding parts in the several figures of the drawings, referring to which—

A, B, designate two chambers of a series of chambers forming parts of my improved kiln for burning bricks, tiles, terra-cotta and other wares. As usual, these chambers are constructed of masonry and spaced at suitable intervals apart, and each chamber is supplied with heat and products of combustion from two furnaces C, C', which however are located on opposite sides of the kiln chamber but do not supply the heat directly into the kiln chambers, the heat and products of combustion passing directly into the innermost lining of each chamber formed by the flues presently described, and from which flues the heat is radiated into the kiln chamber and thus supplied to the wares placed therein. The furnaces C, C', of the adjacent chambers A, B, are built in the space between the chambers, but the masonry of the furnaces has no direct connection or union with the masonry of the kiln chambers, the brickwork of which may be reinforced in any approved manner. By constructing the kiln chambers and furnaces separately and without direct connection or union, increased durability is secured, for the kiln chambers and the furnaces can be readily torn out for renewal or repairs which must inevitably take place in such furnaces and this can be accomplished without disturbing or affecting the kiln chambers.

The whole series of kiln chambers are designed to discharge their waste heat and products of combustion to a longitudinal main flue D, situated outside of the line of kiln chambers, and this main flue discharges to a stack, at one end of such main longitudinal flue. The connection between such main longitudinal flue and the kiln chambers is effected by the transverse flues E, which are preferably provided with dampers E', and the connecting flues F, F', but the latter flues (the connecting flues) and the regulating dampers G, are so arranged that when the

said dampers G are raised the heat from one kiln chamber can be carried to the next adjacent chamber (one or more) and passed through the flues therein along with the heat from its furnaces and over the crown and beneath the bottom of such succeeding chambers before such heat from the first named chamber is finally discharged in the transverse flue, thence to the main flue and the stack, whereby the heat after passing around one chamber can be utilized in heating the succeeding chamber or chambers, thus effecting economy in the fuel required to properly burn the wares in the kiln chambers.

The transverse flues E, are situated in a vertical line between the kiln chambers, and below the connecting flues, F, F', and communication is established between the transverse and connecting flues E, F, F', by means of the ports or openings e, e, as shown in Fig. 1, of the drawings.

The dampers G, are arranged a short distance to one side of the ports e, between such transverse and connecting flues, so that when the dampers are lowered or closed across the connecting flue F, or F', the heat and products of combustion therein will be turned or deflected into the transverse flues E, which transverse flues extend at right angles to and open directly into the main longitudinal flue as indicated by Fig. 2 of the drawings. These dampers are preferably of the vertical sliding pattern, and they operate in the damper tunnel G', provided for their reception, such tunnels being situated immediately above the transverse flues E, and the connecting flues, and below the furnaces C, C', the damper tunnels having no connection with the furnaces. The dampers may be operated by any suitable mechanical appliances so that they can be adjusted to control the escape of the products of combustion into the transverse flues.

The adjacent furnaces C, C', between two kiln chambers are separate and distinct from one another, as a division wall c, is employed between said furnaces, which division wall terminates in the arched crowns c', that extend from the division wall, over the furnace-chambers, to the masonry of the kiln chambers. Any suitable kind of fuel may be burned in the furnaces, as coal, wood, hydrocarbon liquid or gaseous fuel, but in the drawings I have illustrated grates c'' in the furnace chambers for the consumption of coal, suitable ash pits c''' being provided below the grates c''.

The heat and products of combustion are discharged from the furnaces through the leaders I, I', which are formed in the walls of the kiln chambers and open into or communicate with the furnace chambers on a line above the grates in said furnaces. These leaders discharge the products of combustion to the flues J, K, which form the innermost lining of each kiln chamber and which are constructed of masonry in a manner similar to the rest of the kiln so that said flues are



adapted to radiate the heat into the kiln chamber and burn the wares therein to a sufficient degree of hardness without permitting the heat and products of combustion to have direct contact with the wares in the kiln chambers. The flues in each kiln chamber are arranged in series, and the flues J, alternate or are placed between the flues K, the former being designated specifically by the numerals 2, 4, 6, 8, Figs. 3 and 4 while the latter are indicated by the numerals 3, 5, 7; the muffles 1, and 9, being outside of the kiln chamber, proper, and formed in the end walls of said chamber around the doors of said chamber by which access is had to the kiln chamber to place the wares therein or to remove the same therefrom.

The series of flues J, designated at 2, 4, 6, and 8, are each divided at the middle of the bottom of the kiln chamber by means of a vertical partition wall *j*, seen in Fig. 1, and these flues J, extend from the partition wall under half of the bottom of the kiln chamber, then up the right hand side of said chamber where they receive the heat and products of combustion from the furnace C', thence over the crown or arch of the kiln chamber, down the left hand side of said chamber so as to receive the heat and products of combustion on their downward course from the furnace C, on the left hand side of the kiln chamber and finally across the remaining bottom half of the bottom of said chamber. The connecting flues F, are likewise divided by the partitions *j*, so as to permit the products of combustion therein to pass, when the dampers G, are open, up into the right hand updraft flues J, and continue over the arch and down the left hand side of the next kiln chamber; the heat, &c., from one kiln chamber being thus intermingled with the heat from an adjacent chamber and the waste heat from one chamber being thereby utilized to heat the bottom, sides and arched top of another chamber. The other series of flues K, (3, 5 and 7,) are up-draft flues from the left hand side of the kiln chamber, and they receive the products of combustion from the furnace C, which pass up the left hand side of the chamber, thence beneath the arched crown, down the right hand side of the kiln chamber so as to receive from the leaders I, the heat, &c., from the furnace C', and thence said flues discharge into the connecting flues F', in the manner shown, that is to say, the terminal ends of the flues K, 3, 5 and 7, discharge into the connecting flues F', on the right hand side of the kiln chamber, and the flues K have no direct connection with the connecting flues on the left hand side of the chamber, so that the products of combustion from the left hand furnaces and the flues K, 3, 5, 7, are carried directly across the bottom of the kiln chamber. The part of the connecting flue beneath the chamber is on a higher level than the intermediate parts between the chambers, and connected thereto by the inclines, so that the

connecting flues F', can radiate their heat into the bottom part of the kiln chamber.

It will be seen that the course of the products of combustion in adjacent alternate flues of the kiln chamber, is reversed, that is, in the flues J, the heat passes from the right to the left hand side of the kiln chamber, while in the flues K, the heat passes from the left to the right hand side of said chamber; and by thus reversing the draft in said flues I am enabled to bring the most highly heated part of each flue close to the coolest part of the adjacent flue, which results in securing a more thorough distribution of the heat and the consequent uniform heating of the kiln chamber throughout its whole interior. It will be further observed that the heat in the flues J, K, and connecting flues, passes entirely around the kiln chamber, up and down the sides thereof, over the top and under the bottom; and, further, that the waste heat from one kiln chamber can be passed around one or more adjacent chambers, or said waste heat can be deflected, by closing the dampers, into the transverse flues E, and thence passed to the main longitudinal flue, and thence to the stack.

The flues 1, and 9, which extend around the sides of the kiln chamber, over and below the doors thereof, are divided at the bottom of the kiln chamber and connected with the flues F, in a manner similar to the flues 2, 4, 6, and 8, J, in the chamber, so that the heat in said flues 1, and 9, pursues the same relative course as the heat in the flues 2, 4, 6, and 8, whereby the wares adjacent to the doors of the kiln can be burned or baked to better advantage than heretofore.

To facilitate the escape of steam that arises from the green wares when the kiln is first fired, I provide the air flues M, which are arranged in horizontal positions between the kiln chambers and are connected with said chambers by the passages L, through which air is admitted to the chambers to displace the steam or aqueous vapor which is forced out through the ports *l*, in the crown of the chamber. The flues M, passages L, and ports *l*, also serve to facilitate the cooling of the chambers.

When the kiln is in operation the ends of the flues M, which extend through the ends of the kiln chamber, are closed, as are also the ports *l*.

In the practical embodiment of my invention, I prefer to employ two series of kiln chambers, each series comprising six chambers which discharge to a common longitudinal flue; and the two series of chambers communicate by a transverse main flue so that the heat from one series of chambers may be caused to enter and traverse the other series of chambers. In Fig. 2, of the drawings, I have shown a kiln comprising two series of two kiln chambers each, together with the longitudinal flues D, and the end transverse flues E, E', which communicate with the con-



necting flues F, F', at opposite ends of the series. The transverse flue E<sup>8</sup>, is provided at one end with a stack E<sup>9</sup>, and is also provided with a damper E<sup>10</sup>, which is opened when it is not desired to conduct the heat and particles of combustion from one series to the other and is closed when it is desired to utilize the heat of one series to heat the other series. When the heat and particles of combustion of one series are utilized to heat the other series, said heat and particles of combustion may be discharged through the stack with which the end transverse flue E, is provided, or when the damper with which said flue is provided is closed, the heat and particles of combustion may be connected by the flue E, to the flues F, F', of the first series and caused to again traverse said series.

In some cases when it is not desirable to utilize the heat of one chamber to assist in heating the next succeeding chamber, the dampers G, are lowered as shown in Fig. 1, and the dampers E<sup>7</sup>, in the flues E, are raised so that the heat and particles of combustion may pass from the flues F, F', into the flues E, thence into the common longitudinal flue D, and finally out through the stack D'.

The number of chambers comprised in each series is not material and can be increased or diminished at pleasure, and the two series may or may not be connected, but to secure the best utilization of heat possible, it is recommended that connected series be employed.

I am aware that changes in the form and proportion of parts and details of construction of the embodiment of my invention herein shown and described, can be made without departing from the spirit or sacrificing the advantages of my invention, and I therefore reserve the right to make such alterations as fairly fall within the scope of my invention.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. A kiln comprising a series of chambers, a furnace C, arranged on one side of each

chamber, a furnace C', arranged on the opposite side of each chamber, the flues F, F', passing beneath the bottoms of the chambers, partitions j, arranged in the flues F, and extending to the bottoms of the chambers, the series of flues J, extending from opposite sides of the partitions j, around the bottom, sides and top of the chambers and communicating with the furnaces C, C', and also communicating with the flues F, on opposite sides of the partitions j, and the flues K, arranged alternately with respect to the flues J, and extending around the sides and top of the chambers and communicating with the furnaces C, C', and also communicating at one of their ends with the flues F', substantially as and for the purpose set forth.

2. A kiln comprising a series of chambers, a furnace C, arranged on one side of each chamber, a furnace C', arranged on the opposite side of each chamber, the flues F, F', passing beneath the bottoms of the chambers, partitions j, arranged in the flues F, and extending to the bottoms of the chambers, the series of flues J, extending from opposite sides of the partitions j, around the bottom, sides and top of the chambers and communicating with the flues F, on opposite sides of the partitions j, the flues K, arranged alternately with respect to the flues J, and extending around the sides and top of the chambers and communicating at one of their ends with the flues F', the transverse flues below and communicating with the flues F, F', the dampers adapted to close the flues F, F', so as to deflect the flame and particles of combustion into the transverse flues, and a main longitudinal flue communicating with the transverse flues, all substantially as and for the purpose set forth.

Intestimony whereof I affix my signature in presence of two witnesses.

FRED MACARTHY.

Witnesses:

PAUL R. LEWIS,  
GEO. F. HENDRICKSON.