(No Model.) 3 Sheets—Sheet 1.

J. B. GRISWOLD.

BRICK KILN.

No. 447,151. Patented Feb. 24, 1891.

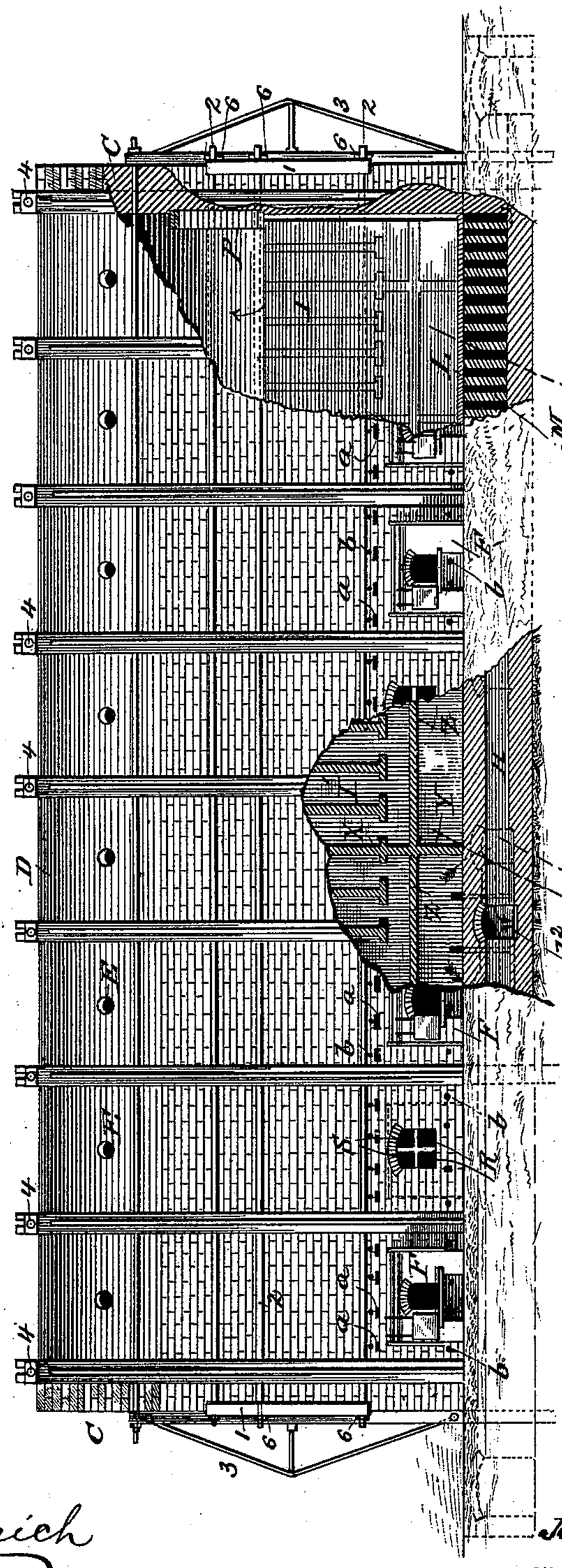

Fig. 1.

Fig. 3.

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(No Model.) 3 Sheets—Sheet 2.

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Fig. 2.

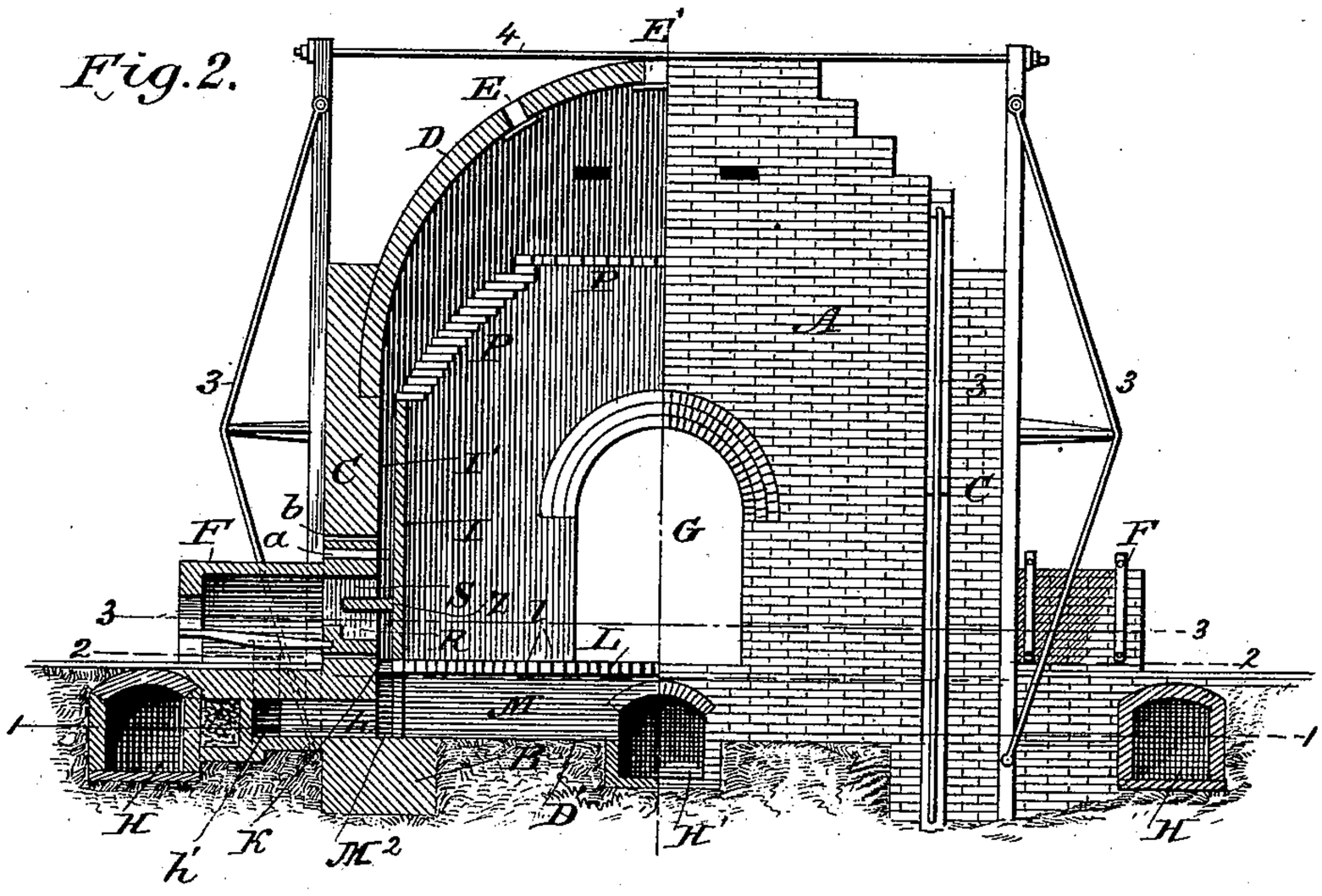
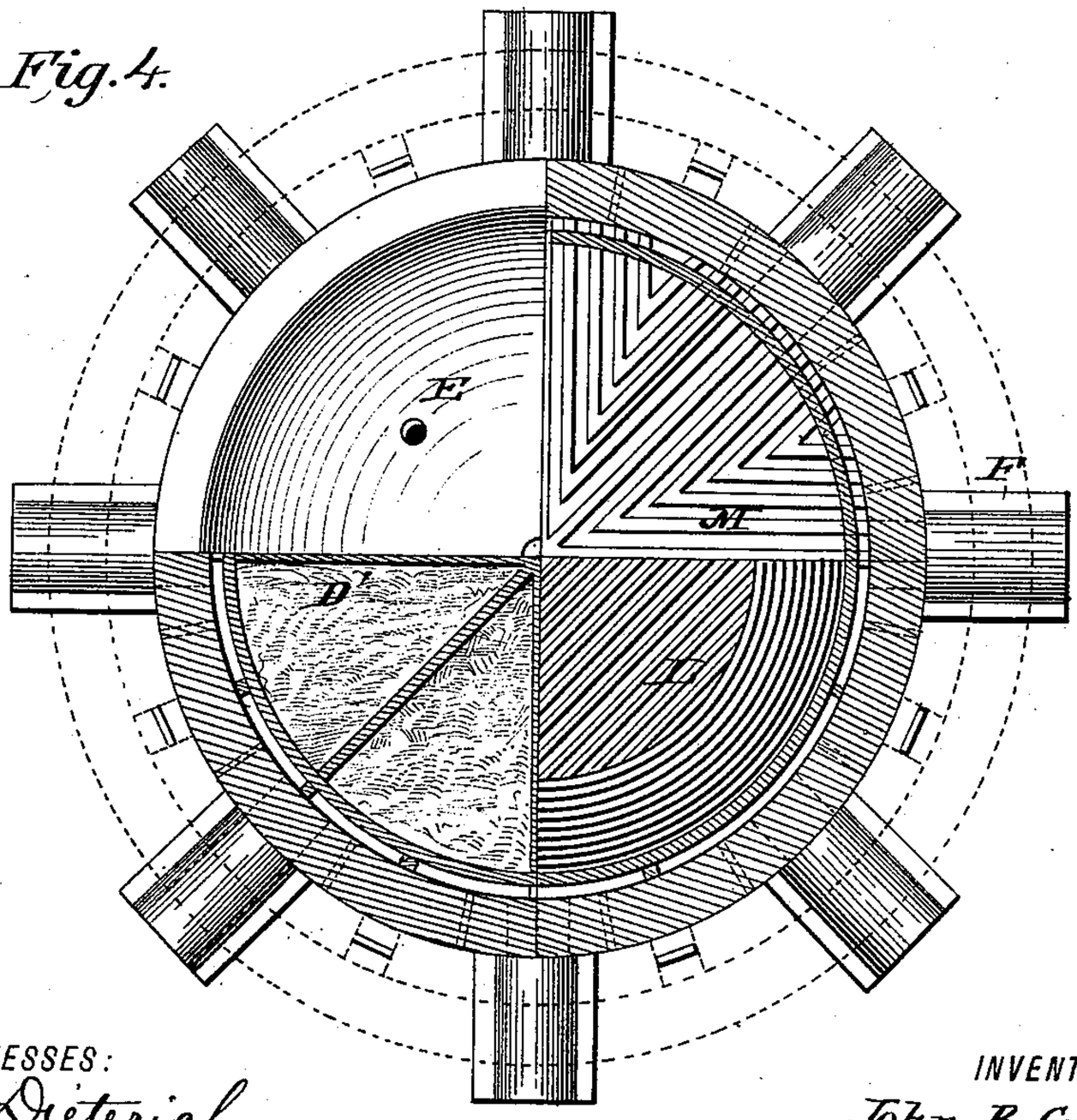


Fig. 4.



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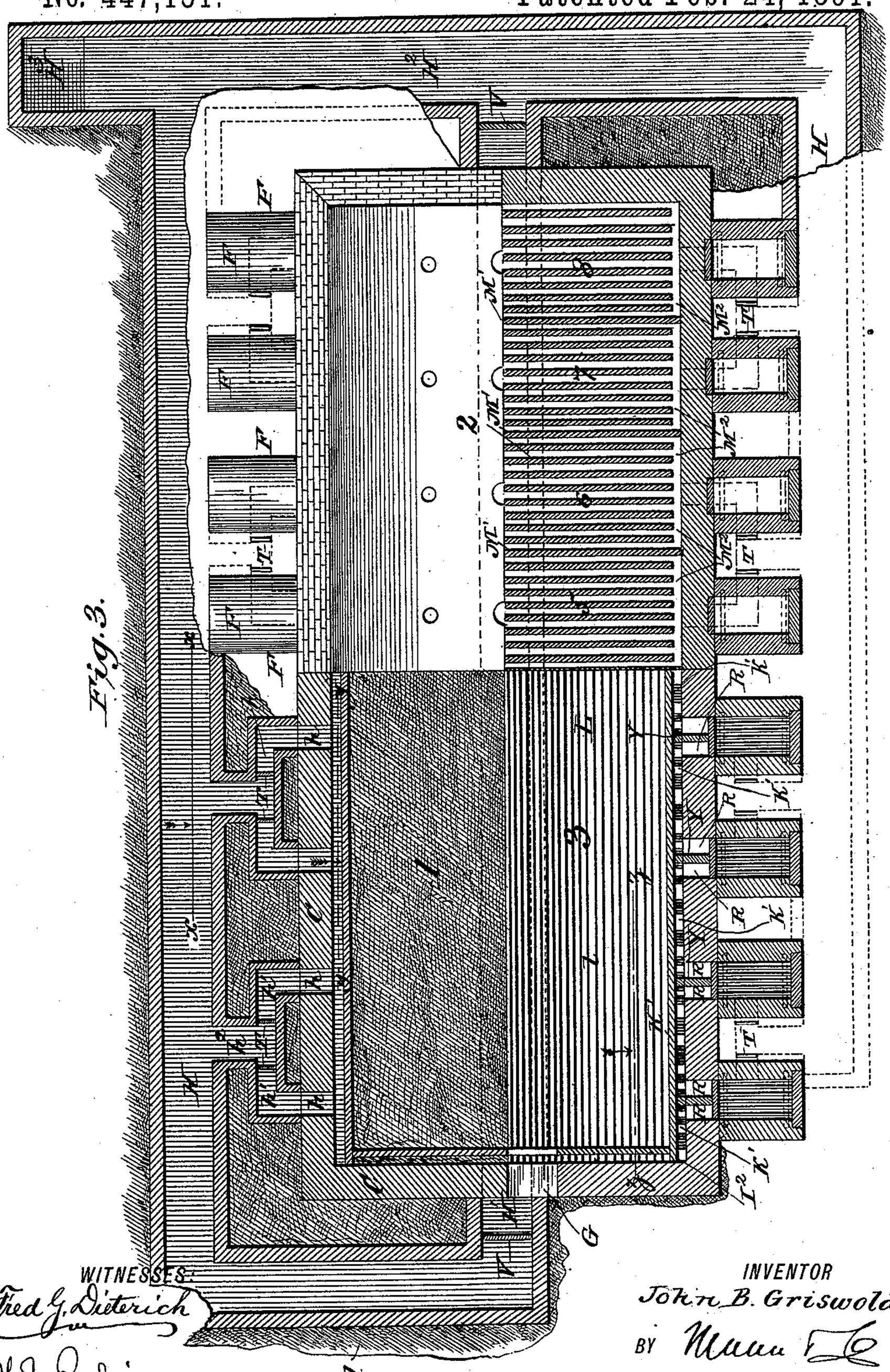

Fig. 3.

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UNITED STATES PATENT OFFICE.

JOHN B. GRISWOLD, OF ZANESVILLE, OHIO.

BRICK-KILN.

SPECIFICATION forming part of Letters Patent No. 447,151, dated February 24, 1891.

Application filed July 28, 1890. Serial No. 360,244. (No model.)

To all whom it may concern:

Be it known that I, JOHN B. GRISWOLD, residing at Zanesville, in the county of Muskingum and State of Ohio, have invented certain new and useful Improvements in Brick-Kilns, of which the following is a specification.

My invention has for its object to provide a kiln for burning brick, tile, or other ceramic material in such a manner that a perfect combustion of the gases and fuel can at all times be assured, in which the products of combustion enter at the top or bottom, and in which alternate direct or indirect up or down drafts may be used, or in which the heat can be quickly and effectively distributed to any part of the kiln, cut off at other parts, or sent through the kiln at different angles.

To this end my invention, which relates more particularly to the kiln shown and described in a patent granted to me February 4, 1889, No. 420,684, consists in certain novel features of construction and arrangement of parts, all of which serve to improve the aforesaid kiln and render it more effective for its desired purposes, all of said parts being hereinafter fully described in the annexed specification, and particularly pointed out in the claims, reference being had to the accompanying drawings, in which—

Figure 1 is a front elevation of my improved kiln, parts being broken away and shown in vertical section on the lines *x x*, *y y*, and *z z*, Fig. 3. Fig. 2 is a vertical transverse section of my improved kiln, one of the furnaces being sectioned on the line 5 5, Fig. 3, part of the kiln being shown in end elevation. Fig. 3 is a top plan view showing portions of the kiln in horizontal section, taken on the lines 1 1, 2 2, and 3 3, Fig. 2, said portions being designated by the numerals 1, 2, and 3, respectively. Fig. 4 is a top view, partly in horizontal section, of a round kiln constructed according to my improved plan.

While the general construction of my improved kiln is similar to that disclosed in the patent above referred to, I shall, for the sake of clearness, describe the present kiln in its entirety, and also set forth the operation and advantages of the same.

In the accompanying drawings, in which the same letters and numerals indicate like parts in all the figures, A indicates the kiln, which for burning brick is preferably made rectangular in shape, as shown in Figs. 1, 2, and 3, and for burning sewer-pipes and tiling it is preferably made round, as shown in Fig. 4, it being understood that either form can, however, be used, if desired.

B denotes the ground foundation, which is preferably built under the entire floor-space of the kiln.

C denotes the main walls; D, the crown; F, the furnaces, and E E′ the outlets in the crown or ceiling D.

Each end of the kiln is formed with a door-opening G. The bottom or base of the kiln is formed of three sections, of which D′ is a filling of earth placed on the foundation upon which is mounted a series of transverse flues or openings M, forming a transverse chamber which extends the entire width of the kiln. Upon these flues is supported the floor L, which is provided with a series of longitudinal openings *l*, which extend over the central portion and about one-third the width of the floor.

I indicates a thin wall running around the entire kiln on the inside thereof, and joining the main walls at the corners I^2, as shown in Fig. 3. This wall extends up to within a short distance of the ceiling, and at its ends it is joined with the end walls C C by the tie-bricks P P, which in practice are so arranged as to form openings over the end chambers I′, through which the heat passes from the said end chambers I′ to the interior of the kiln.

The lower portion of the kiln is formed in sections, as shown, and each section is provided with a furnace at each end.

H H H′ denote a series of parallel-arranged flues, the outer ones H of which are disposed one to each outer longitudinal side of the kiln, while the middle one H′ is disposed centrally of and extends lengthwise and under the slotted floor L and built through the two main end walls C, as most clearly shown in Fig. 1. The central flue H′ is also built so its upper end extends through and communicates with the flues M, being arched over so as to leave spaces the same as the said flues

M. (See Fig. 3.) Said flue H′ is made to connect with one of flues H at one end and with a cross-flue H^2 at its opposite end, which cross-flue H^2 connects the side flues H, as shown, and serving to connect them with the stack H^3.

V indicates valves arranged one in each end of the flue H′, where it connects with the side flue and the cross-flue H^2. By this construction the operator can draw all fire down through the center of brick in the kiln and not allow the fire to be distributed throughout all the brick in the kiln. This arrangement is very advantageous when the brick along the heads or thin side walls I are hotter and ahead of the brick in the center part of the kiln, since it is desired to throw more heat to the brick in the center part of kiln, and in this way bring the ware in center of kiln to the same heat and same settle as along the heads or sides of the kiln, and thus produce an even heat and settle all over the kiln.

The flue H′ may be used or not, as desired, by closing or opening the valves V and closing the dampers T in the side flues H. When, however, the valves V are opened and the dampers T closed, all the fire is drawn into the flue H′ and out into the flues H and H^2 into the stack H^3, and if one end of the kiln should be hotter or ahead of the other end the valve V at that end of the center flue H′ can be closed and the valve V at the other end opened, thereby drawing the fire to such end and out of said end into the stack, or vice versa. It will thus be seen that by the arrangement of the center flue under the kiln-floor the fire can be equally distributed throughout the kiln or the entire products of combustion drawn down through the center flue, thus providing for drawing the fire to any part of the kiln to both sides equally, or all to one side, or to one end of the kiln, and in this way secure an equal and even burn for the downdraft.

In the drawings I have shown a kiln formed of eight sections, numbered 1 to 8, which sections may all be in use at one time, or any one of them may be used separately, in a manner presently described.

Each of the furnaces F upon the outer longitudinal walls C is provided with two inlet or combustion openings R S, which pass through the main wall C, one of which S connects with the vertical flue I′, while the other R connects with a downwardly-extending opening K, which connects with the transverse flues M beneath the floor L.

The flues M are divided into sections by extending one of the walls M′ of each section entirely across the kiln and connecting the same to the main walls C, as clearly shown in Fig. 3, thereby forming a short longitudinal channel M^2 at each end of and communicating with the flues M M, and with which the openings H communicate.

The channels M^2, which are connected with the furnaces F, are also connected by means of the short passages *h* with longitudinal flues *h*′, which are provided with a series of openings h^2, which communicate with the main draft-flues H, as clearly shown in the drawings.

A pair of cut-off dampers T are provided for each section, which are located to operate in the flue *h*′, whereby the draft for any one or all of the sections may be readily cut off.

As before stated, the inner thin wall I extends entirely around the inside of the kiln, thereby forming a chamber I′ entirely around the kiln, being stopped off at the corners, as shown.

It will be observed by reference to part 3 of Fig. 3, that the end flues I′ are connected with the slotted floor L, by which construction it will be seen that when the dampers are adjusted to operate the kiln on an updraft a portion of the products of combustion will pass up through the slotted floor into the end flues I′ and discharge over the upper ends thereof into the kiln, thereby thoroughly heating the ends of the kiln.

The corner connections I^2 between the outer and inner walls are very essential, since were there no divisions at said corners the products of combustion, when it is desired to use a downdraft, would pass into the side chambers I′ from the opening S around in the end chamber down through the slotted floor into the flues M, H, and H′.

By reference to Fig. 2 of the drawings it will be seen that I arrange the furnace-openings S R one above the other instead of side by side, as in my other patent referred to, and I divide said openings centrally by walls Y, which extend from the slotted floor L up to the top of the partition-walls I, whereby a series of side chambers I′ and a series of downwardly-extending chambers K are formed. Thus it will be seen that the fire from the furnaces F in case a downdraft is employed, which is done by closing the openings R R in any desired manner, will pass through the openings S S, and, being divided by the wall Y, will pass into the chambers I′ up over same, down through the brick and the slotted floor into the flues H H′ and into the stack.

Above each of the openings S is located a damper-opening *a*, which communicates with the chambers I′ to each side of the wall Y. By this arrangement when both damper-holes *a* are opened the heat will pass up into the chambers I′ and be equally distributed to each side of the wall Y; but in case either one of the dampers *a* is closed more of the heat and products of combustion will be drawn into the chamber having the opened damper, thereby providing suitable and effective means whereby I am enabled to increase the heat in one chamber and reduce it in another as the condition of the ware may require, and yet employ the same furnace-fire, and thereby regulate the heat along the thin side walls as desired. The brick along this side wall are burned by radiated heat, and if one spot along-

side of the thin wall is hotter than another I can take the heat away from that spot and throw it to the next section by adjusting the damper-holes *a*, as described, thus always burning the ware along the heads or side walls to a uniform color and hardness.

The openings R R, which are located below the partition Z, which divides the furnaces F into the upper and lower sections, as stated, open into the flue-chambers K, thus leading the fire direct to the flues M. The same then passes transversely of the kiln through the perforated floor up into the kiln, and thereby burning same on an updraft, it being understood that when such a draft is used the openings S S are closed.

By extending the wall Y down to the slotted floor, as described, I am enabled to make the fire enter equally into each of the adjacent chambers K, or all into one opening R and chamber K, by banking the fire in the opposite opening or closing it entirely by a fire-clay block.

Each of the chambers K is formed into a series of graduated openings K′, which communicate with the flues M. By means of the openings K′, I am enabled to distribute and spread the fire equally as it comes from each furnace to all the flues M under the floor between each sectional partition M′, the said opening K′ being graduated in size, the smaller holes being made at and near the openings R R, and each one larger on each side of the partition-wall Y.

In practice I make five openings K′ to each section of flues M, between each furnace, the larger opening being in the middle of each of said sections.

The object of dividing the flue-sections as described is that the fire entering from the openings R R at either side of partition-wall Y cannot seek the nearest way to the flues M, but must seek all the openings K′. By this means I get the solid part of kiln-floor L and the brick at these points evenly heated.

X is a four-inch wall made to connect the thin wall I and main wall C, built downwardly from top of thin wall I to about the top of the furnaces, as shown in Fig. 3. Said wall, which serves to tie the two walls together, is made a little wider at its base, and at this point the several damper-holes *a* are made in the main wall C.

b b denote small openings made through main walls C on each side of kiln above and below the furnaces F, which serve as combustion-holes and allow for the admission of any quantity of air to the flues to assist and complete the combustion.

By reference to the drawings, it will be seen that I provide four openings *b* above and four below each furnace, and for a downdraft air is admitted through the openings *b* over the furnaces F into the flues I′, thus converting any unconsumed gases into heat or proper combustion before entering the kiln proper. For the updraft, this is done the same way by admitting the oxygen through the openings below the furnaces F.

E E′ denote openings in top or crown of the kiln, through which the fire escapes from the kiln when using an updraft. Three rows of these openings are provided the entire length of the kiln at equal distances apart, one row running through the center of crown and one row on each side about midway between center openings and side walls C. The central openings E′ are made larger than the outer rows E. By this arrangement it will be seen that when using the updraft by closing the center row and one outer row of the openings by suitable dampers the draft can be drawn to one side, or by closing the side openings and leaving the center ones open direct updraft is obtained, or by closing some of the openings at one end and leaving the others open a diagonal draft may be obtained.

Having thus outlined the general construction and operation of the kiln, I shall now proceed to describe the iron-work used to brace and support the same.

2 indicates a T-iron laid in the brick wall C, with the flat side out even with the face of the wall. In each end of the T-iron there is a slot for a key. On the corners of the kiln the angle-iron 1 has three slots made to receive the T-iron 2. After the angle-iron is placed in its proper position, the key 6 is put in the slot in the T-iron 2 and keyed up tight. This T-iron and angle-iron and key will hold the wall in its proper position, and when the kiln is under fire and the wall becomes heated from continual firing the brick-work will expand, and the iron, being also heated, will expand with the wall. Now after the kiln has been burned the walls become cool and contraction begins to take place, the T-iron will contract with the brick, and by this means of ironing it will prevent the brick-work or the walls from cracking, thus providing the most durable wall that can be constructed for kilns.

3 denotes a buckstay or brace made of two railroad irons.

4 indicates a straining-rod that runs from one buckstay to the other crosswise and lengthwise of the kiln. These bracing-rods will hold the arch of the kiln in its position longer than any other way, and as no woodwork is used about the kiln all danger from fire is thereby avoided.

In Fig. 4 I have shown a round kiln more especially adapted for burning sewer-pipes, tiling, &c., and as the construction of said kiln is substantially the same as the rectangular kiln a detail description thereof is deemed unnecessary.

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

1. The combination, substantially as set forth, with a brick-kiln, of the vertical flues I′, extending entirely around the inside of the side and end walls, said flues disconnected at

the corners I^2, the longitudinally-slotted bottom L, the transverse flues M, communicating with the slotted floor-furnaces F, communicating with the flues I′ and M, the outer longitudinal flues H, having an indirect connection with the flues M, a central longitudinal flue H′, having a direct communication with the flues M, said flue H′ provided with valves, whereby it may be used in connection with the flues H or be separated therefrom, substantially as and for the purpose described.

2. In a brick-kiln, the combination, with the fire-chamber, of the flues I′, extended entirely across the side and end walls and disconnected at the corners I^2, the furnaces F, connected with the flues I′, said furnaces formed with the vertical walls Y, dividing said flues I′ into a series of flues and arranged centrally over the furnace-openings, whereby such openings are divided, the slotted floor L, the transverse flues M under said floor, and the flues H H, connected with said flues M, all arranged substantially as shown and described.

3. In a brick-kiln essentially as described, the combination, with the kiln proper, the slotted floor L, the transverse flues M, and the discharge-flues H H, of the vertical flues I′, the furnaces F, communicating therewith, the division-walls Y, extended from the tops of said flues I′ down to the floor of the kiln and arranged to divide the mouth of the furnaces F, a series of vertical walls in the flues I′, extended to near the top of the furnace-openings, whereby a series of flue-chambers I′ are formed between the walls Y, and a series of dampers *a*, operating to close any or all of such chambers I′, whereby the fire can be sent up one or more of the flue-chambers I′ of each section or entirely cut off from such sections, substantially as and for the purpose described.

4. In a brick-kiln, the combination, with the kiln-chamber, of a series of flue-chambers I′, arranged in sections, each section divided by a series of vertical walls extended down to near the floor of the kiln, a series of dampers *a*, arranged to be operated from the outside of the kiln-wall, whereby any or all of the vertical ways of each flue-section may be cut off, a series of furnaces opening into the flue-sections I′, the mouth of such furnaces being divided by the division-wall of each flue-section I′, the slotted floor L, the tranverse flues M, and the flues H H, connected with the flues M, all arranged substantially as and for the purpose described.

5. The combination, substantially as set forth, of a kiln formed with the vertical flues I′ in its sides and ends opening into the kiln-chamber, a series of furnaces communicating therewith, a slotted floor L, a series of transverse flues M below the floor L, communicating therewith, a central flue H′, having a direct communication with the flues M, and a pair of longitudinal flues H, arranged below the furnaces and having indirect and valved connection with the flues M, said flues H H′ connected with each other and with the stack H^2, the flue H′ formed with cut-offs V, whereby the said flue can be used jointly with the outer flues H or the outer flues H separate from the flue H′, all arranged substantially as and for the purpose described.

6. A brick-kiln consisting of the main walls, the top formed with a series of valved openings E E′, the end flues I′, arranged on the inner faces of the end walls, a series of flues I′ on the inner faces of the side walls, said flues opening at their tops into the interior of the kiln, a series of furnaces opening into the side flues I′, the division-walls Y of the side-flue series extended down to floor of the kiln centrally of the furnace-openings, a horizontal division-wall Z, dividing the mouth of such furnaces into upper and lower outlets, a series of flue-sections K, extending from the lower furnace-outlets to the floor L, said floor slotted longitudinally, transverse flues M, arranged in a series below the floor L, and the discharge-flues H, connected with said flues M, all arranged substantially as and for the purpose described.

7. The combination, with the kiln, of the end flues I′, the top provided with outlets E, the longitudinally-slotted floor extended at its ends under the flues I′, the flue-sections K, the furnaces F, opening into said sections K, and the transverse flues M, formed in sections and arranged in communication with the flues K and slotted floor L, all arranged substantially as and for the purpose described.

8. The combination, with the kiln, of the end flues I′, the top formed with draft-openings E E′, the longitudinally-slotted floor, its ends extended under the flues I′, the downwardly-extending flues K, the furnaces F, opening into such flues K, the division-wall Y, dividing said flues K into sections K′ and arranged centrally of the furnace-opening, whereby such opening is divided, and whereby the fire from each furnace will enter the adjacent flue-sections K, and the transverse flues M, connecting the flues K′ with the slotted floor, substantially as and for the purpose described.

9. A brick-kiln consisting of a main wall, a top formed with valved draft-openings E E′, the end and side flues I′, the centrally longitudinally-slotted floor extended from end to end of the kiln, the flues K, located and in line with the side flues, a series of furnaces F, communicating with the flues I′ and K, a horizontal division-wall Z, dividing the flues I′ and K and the exit-mouth of the furnaces in upper and lower sections S R, the vertical walls Y, extended from the top of side flues I′ down to the floor of the kiln, dividing the flues I′ and K into sections, and the furnace-exit into side chambers, the transverse flues connecting the flues K and slotted floor, and the exit-flues H H, connected with the flues M, all arranged substantially as and for the purpose described.

10. The combination, with the kiln, of the end flues I′, the top formed with draft-openings E E′, the centrally longitudinally-slotted floor L, the furnaces F, the downwardly-extended flue-sections K′, communicating therewith, the combustion-openings *b*, opening into said flue-sections K′, and the transverse flues M, connecting the flues K′ and the slotted floor, all arranged substantially as and for the purpose described.

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