(No Model.) 4 Sheets—Sheet 1.

J. C. CULBERTSON & W. A. EUDALY.

KILN AND FURNACE FOR BURNING BRICKS, TILES, &c.

No. 281,029. Patented July 10, 1883.

Fig 1

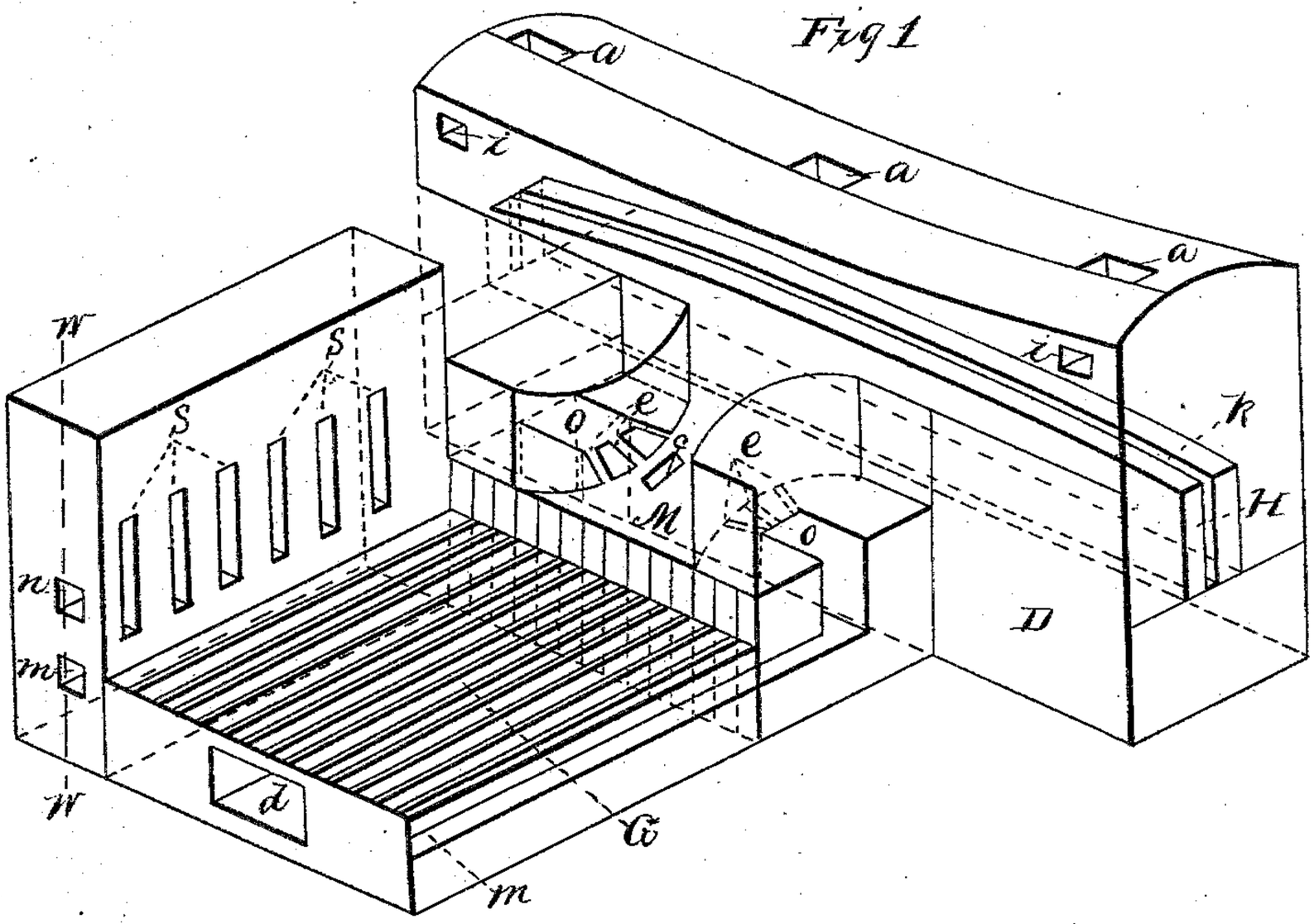

Fig. 2.

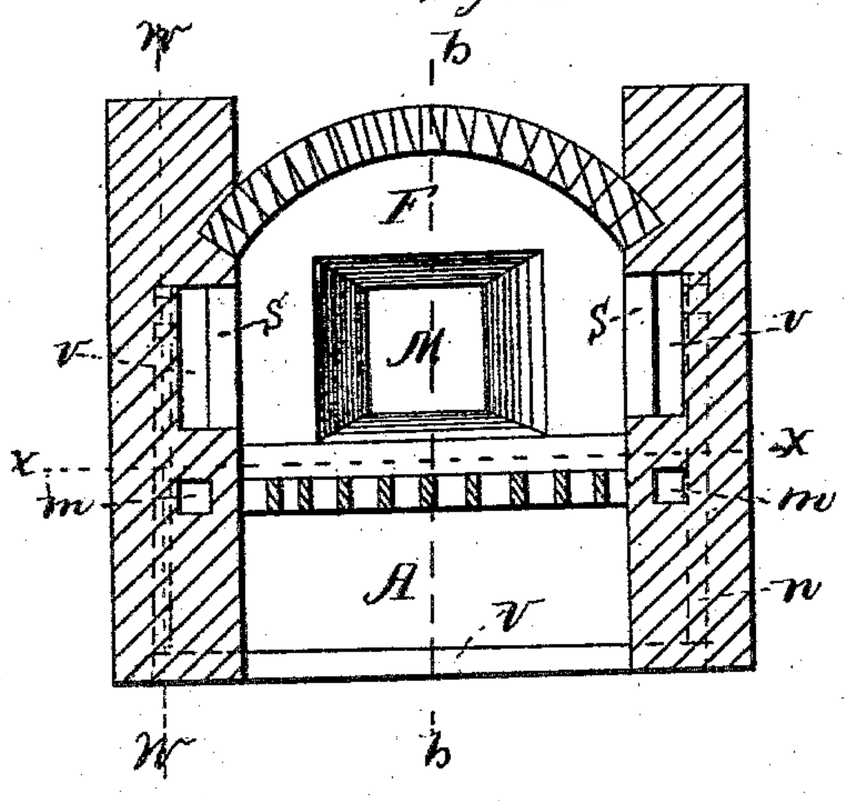

Fig. 3.

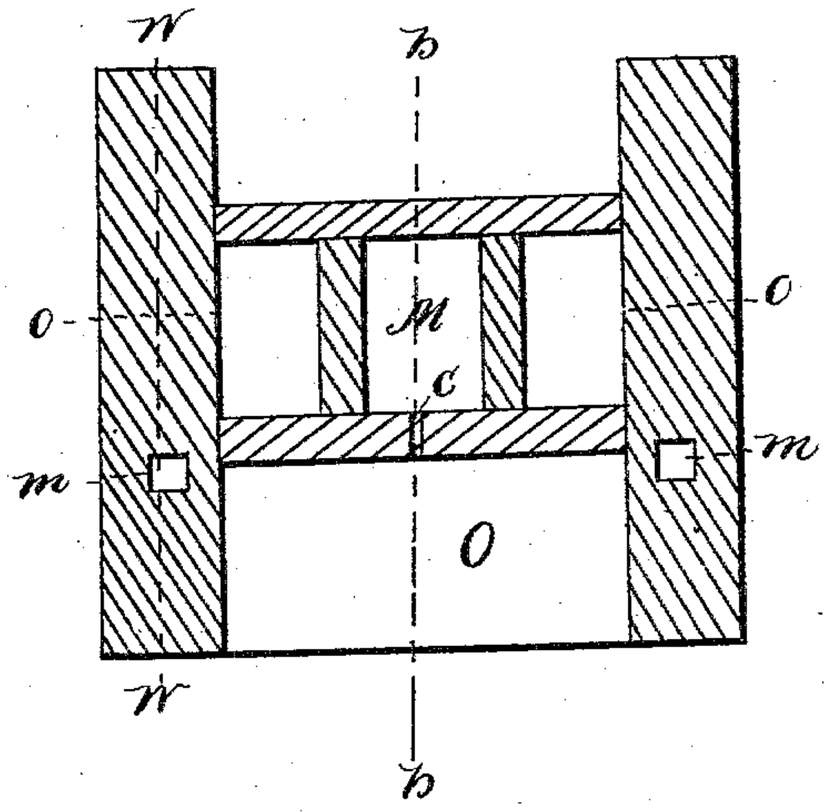

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Fig. 4.

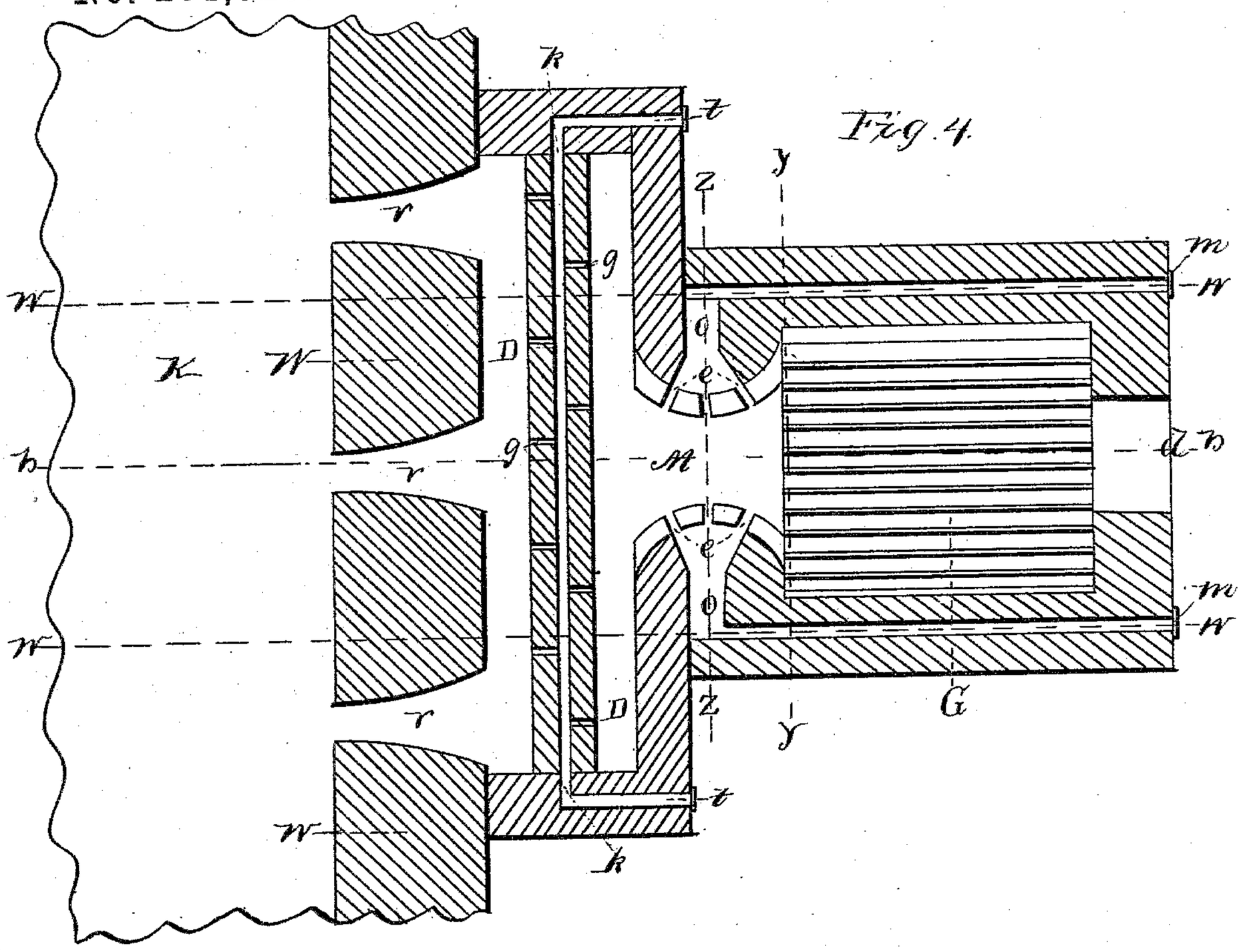
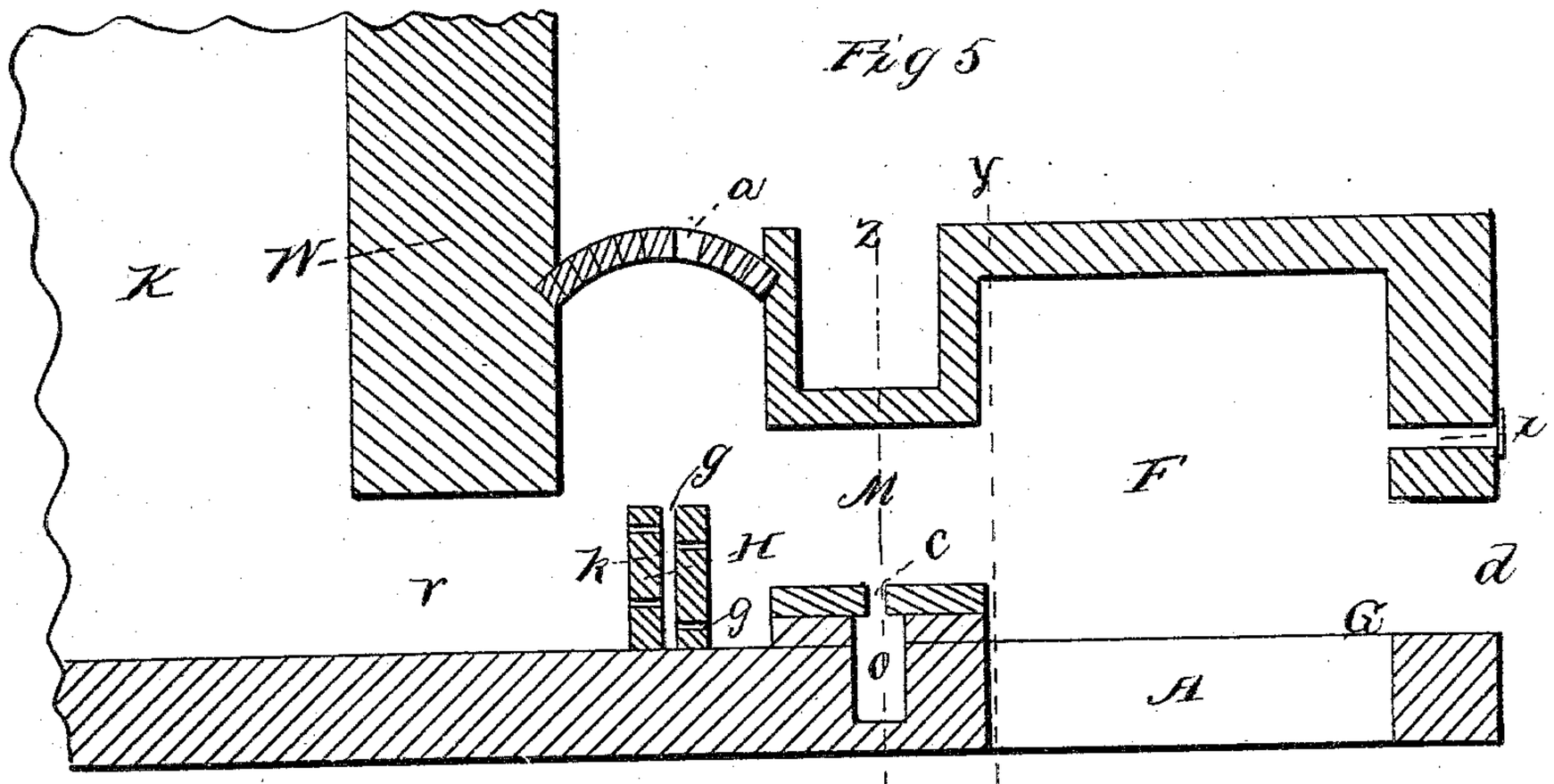


Fig 5



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KILN AND FURNACE FOR BURNING BRICKS, TILES, &c.

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Fig 6

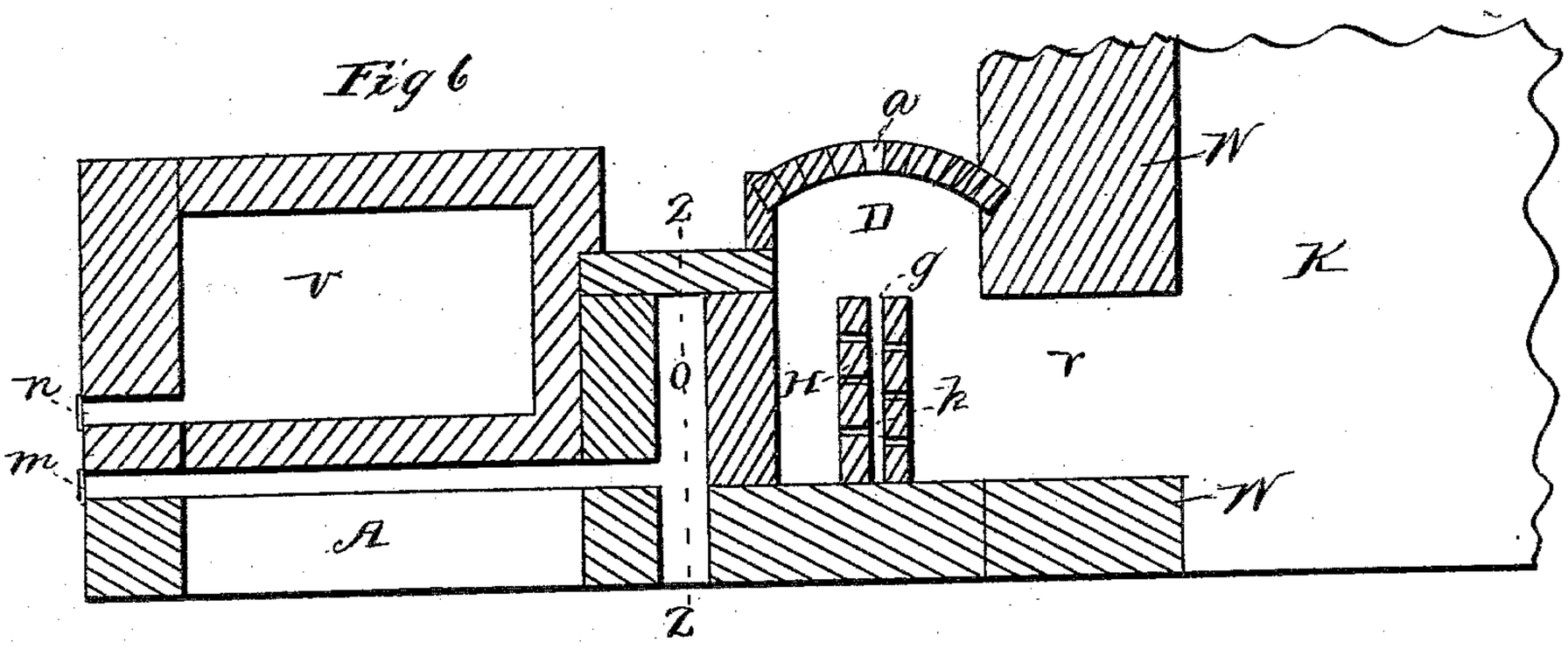


Fig 7

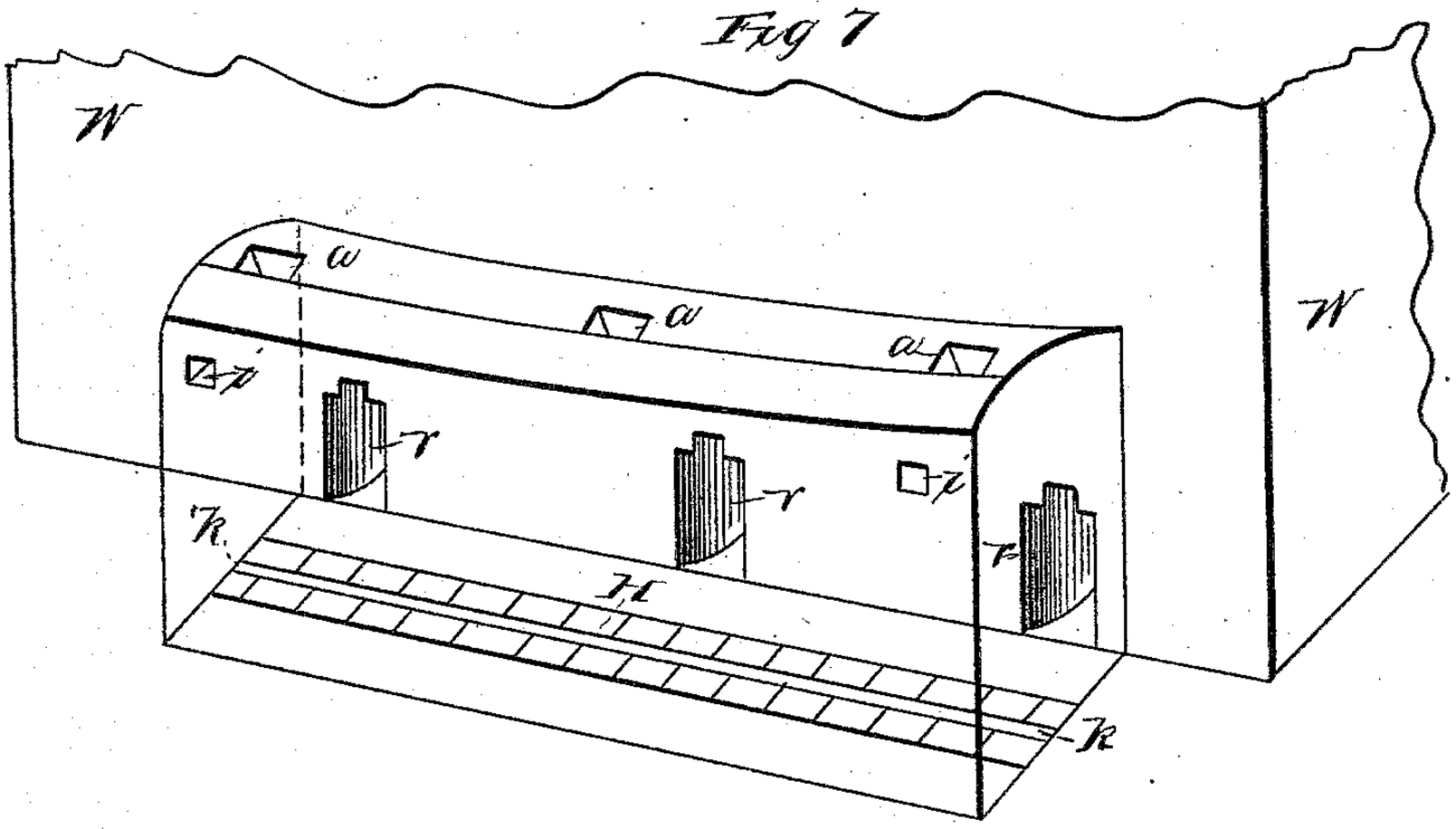
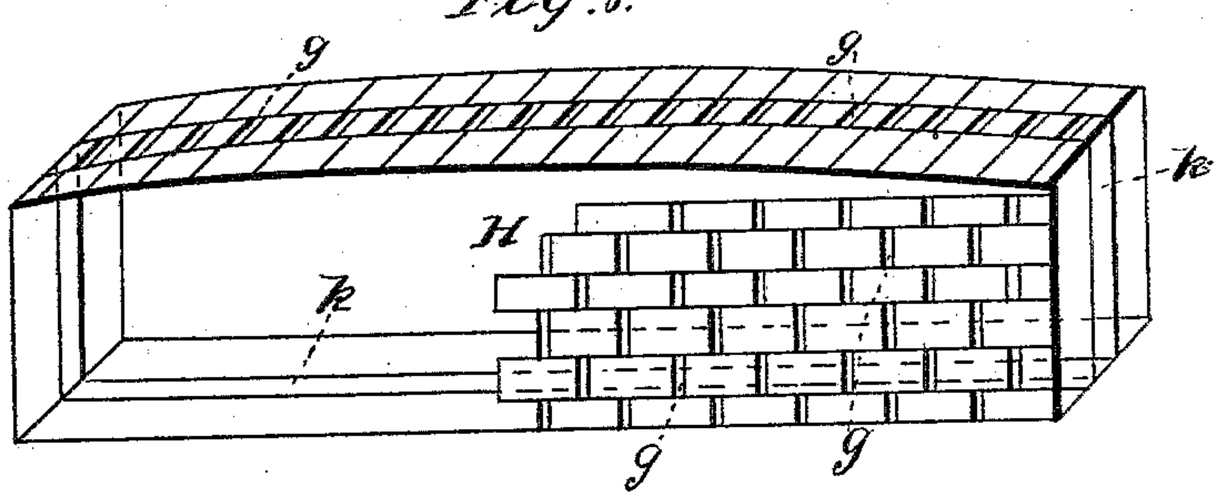


Fig. 8.



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(No Model.) 4 Sheets—Sheet 4.

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KILN AND FURNACE FOR BURNING BRICKS, TILES, &c.

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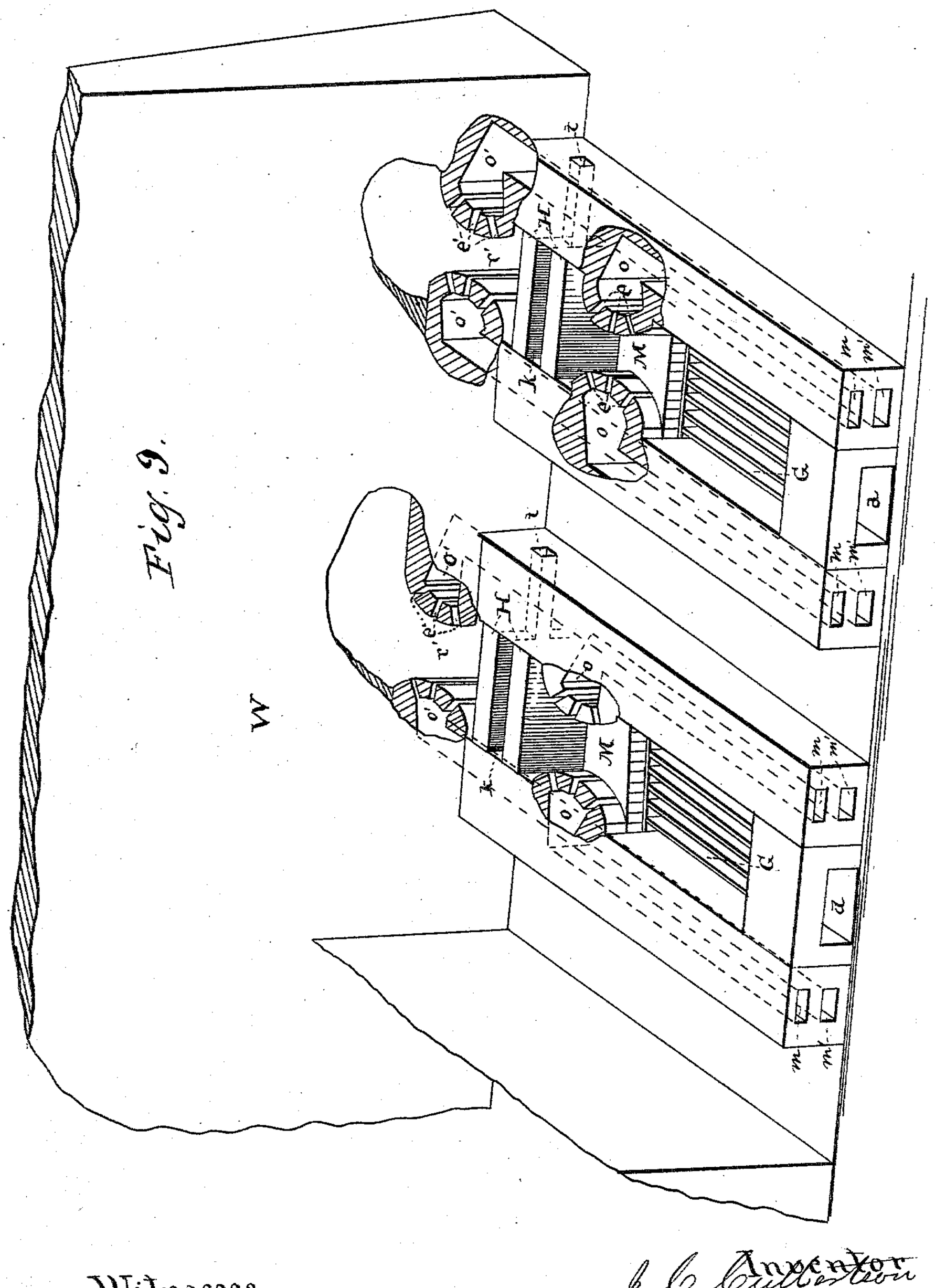

Fig. 9.

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UNITED STATES PATENT OFFICE.

JAMES C. CULBERTSON AND WILLIAM A. EUDALY, OF CINCINNATI, OHIO.

KILN AND FURNACE FOR BURNING BRICK, TILE, &c.

SPECIFICATION forming part of Letters Patent No. 281,029, dated July 10, 1883.

Application filed May 18, 1883. (No model.)

To all whom it may concern:

Be it known that we, JAMES C. CULBERTSON and WILLIAM A. EUDALY, citizens of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Kilns and Furnaces for Burning Brick, Tile, Pottery, and other Ceramic Products, of which the following is a specification, reference being had therein to the accompanying drawings.

Our invention relates to the class known as kilns and furnaces for burning brick, tile, pottery, and all kinds of ceramic products, and has for its objects the equal distribution of heat in the kiln, economy of fuel and labor, and the prevention of smoke.

To these ends our invention consists—

First, in providing a kiln-wall with oblong vertical funnel-shaped openings, situated with reference to the kiln near the bottom of the wall, with the flaring ends facing outward, so as to form a kind of nozzle through which the heat is admitted into the kiln.

Second, in providing a kiln-wall with oblong vertical flues, contracted in the center from side to side and flaring at each end, so as to form a centrally-contracted throat, through which the heat passes in entering the kiln proper.

Third, in providing kiln-furnaces with long narrow vertical influent air-ducts, situated above the grate-bars in the sides of the fire-box and flues. These ducts are so arranged as to be adapted to admit external air in thin sheets or waves directly from the sides of the furnace, or they may be connected with air-chambers situated in the sides and bottom of the fire-box.

Fourth, in providing a kiln with furnaces, having in the rear ends of the fire-box a narrow vertical flue flaring at each end, the sides of which resemble in appearance equal arcs of a circle with the convex sides facing the center. In this way a centrally-contracted throat is formed, through which the particles of combustion are made to pass on their exit to a rear or adjoining distributing-chamber. By this arrangement the gaseous matter and flames from the fire-box are focalized or impinged upon each other so as to be intimately mixed, and are immediately released by the flaring rear ends of said flue. In this way a kind of suction is formed which adds to the draft of the furnace and aids in carrying the heat directly to the center or opposite side of the kiln.

Fifth, in providing a kiln-furnace with a number of narrow openings situated in the sides and bottom of the centrally-contracted flue.

Sixth, in providing a kiln-furnace with air-chambers in the sides and bottom of the centrally-contracted flue, and connected with the external air by air-ducts controlled by dampers.

Seventh, in providing a kiln with furnaces having distributing-chambers in the rear of and adjoining to the contracted flue, and joining to and extending along the side of the kiln, so as to cover one or more oblong funnel-shaped openings in the kiln-wall. Said chamber, when covering two or more openings in the kiln-wall, should be constructed with the top curving downward from each end to the center, or to a point opposite the mouth of the centrally-contracted flue.

Eighth, in providing a kiln-furnace with a hollow wall situated inside of the distributing-chamber, at right angles with the contracted flue. Said wall is constructed with a curved top ascending from each end to the center, or to a point opposite the mouth of the centrally-contracted flue, so as to form, in combination with the curved top of said chamber, a horizontal flue or opening extending the entire length of said chamber, and very much contracted in the center, or at a point opposite the centrally-contracted flue in the end of the fire-box.

Ninth, in providing a kiln with narrow openings situated in the sides of the oblong vertical flues in the kiln-wall.

Tenth, in providing a kiln with air-chambers at the sides of the oblong vertical flues in the kiln-wall, said flues being connected with the external air by air-ducts controlled by dampers.

Our invention further consists in certain details of construction, which will be fully described hereinafter, and pointed out in the claims.

In said drawings, Figure 1 represents a perspective view of the interior of the furnace constructed in accordance with our invention, the front, arched top, and one side of the furnace being removed, except that part designated as the "distributing-chamber." Fig. 2 represents a transverse section of the fire-box, drawn through at the line *y y* of Figs. 4 and 5. Fig. 3 represents a transverse section of the contracted flue and air-chambers on each side, drawn through at the line *z z* of Figs. 4 and 5. Fig. 4 represents a horizontal longitudinal section drawn in the same plane with the bottom of the contracted flue at the line *x x* of Fig. 2. Fig. 5 represents a longitudinal vertical section drawn through at the line *b b* of Figs. 2, 3, and 4. Fig. 6 represents a longitudinal vertical section drawn through at the line *w w* of Figs. 1, 2, 3, and 4. Fig. 7 represents the distributing-chamber with curved top, the hollow wall with curved top, and the oblong funnel-shaped openings in the kiln-wall. Fig. 8 represents the oval-topped hollow wall and sections of the openings in the top, sides, and ends of the same. Fig. 9 represents a perspective view of our furnaces covering but one arch in the kiln-wall, the oblong vertical centrally-contracted flues in the kiln-wall, and the air-slits and air-chambers at the sides of said flue connected with the external air by air-ducts controlled by dampers.

K represents the kiln.

W represents the kiln-wall. D represents the distributing-chamber, having a concave curved top.

H represents the hollow wall, having an oval or curved top, and situated inside of the distributing-chamber.

M represents the centrally-contracted flue, situated in the end of the fire-box.

F represents the fire-box, and A the ash-pit.

s s represent the long narrow vertical influent air-passages in each side of the fire-box.

v v represent the air-chambers in each side of the fire-box.

n n represent the air-ducts leading to the air-chambers *v v*, and are controlled by dampers.

The combination of the furnace with the air-passages *s s*, air-chambers *v v*, and ducts *n n*, controlled by dampers, is such as to be adapted to admit any desired quantity of air from the opposite sides of the fire-box in cross-sections and in thin vertical sheets or waves at any stage of combustion and at any height from the grate-bars.

e e represent the openings in the sides of the contracted flue M. *c* represents the openings in the bottom of said flue.

o o represent the air-chambers at the sides and bottom of said contracted flue; and *m m* represent the air-ducts connecting said air-chambers with the external air, and are controlled by dampers.

The contracted flue M, in combination with the air-passages *e e* and *c*, air-chambers *o o*, and air-ducts *m m*, controlled by dampers, form a number of small jet-pumps, which are adapted to admit air heated to a very high temperature into said flue at such points as the escaping products of combustion are made to converge. In this way the carbon and gases rising from the fire-box are thoroughly commingled with oxygen before entering the distributing-chamber, which insures more perfect combustion and gives an additional impetus to the draft.

g represents the openings in the top and sides of the hollow wall H. *k* represents the air-chamber in said wall.

t t represent the air-ducts connecting the air-chamber *k* with the external air, and are controlled by dampers.

r represents the oblong funnel-shaped openings in the kiln-wall of Fig. 4.

r' represents the centrally-contracted flues or openings in the kiln-wall of Fig. 9.

The openings *r* are better adapted to a kiln having two or more arches or openings in the kiln-wall inclosed by a single furnace, as shown in Fig. 4. The openings *r'* are better adapted to a kiln having a furnace to each arch in the kiln, as shown in Fig. 9.

e' e' represent the openings in the sides of the centrally-contracted flue or throat in the kiln-wall *o'*.

o' represents the air-chambers at the sides of the flue or arch *r'* in the kiln-wall, and are connected with the external air by ducts *m' m'*, which are controlled by dampers. Said centrally-contracted flue or arch *r'*, said openings *e' e'*, and said air-chambers *o' o'*, connected with the external air by ducts *m' m'*, controlled by dampers, in combination with said furnace, are adapted to admit air heated to a very high temperature into said flue or arch, so as to come in contact with any unconsumed particles of combustion escaping from the fire-box through the combustion-chamber into the kiln.

a represents openings in the top of the distributing-chamber D, opposite and corresponding to the number of funnel-shaped openings or arches in the kiln-wall. These openings are adapted to be opened and closed at will for the purpose of introducing ashes or other foreign substances directly into said arches or funnel-shaped openings; or a water damper or valve may be used. In this way the heat entering the kiln may be partially or entirely cut off, or it may be allowed to enter at one point and not at another, to suit the different stages of burning in the kiln.

i i represent "peep-holes," located with reference to the funnel-shaped openings in the kiln-wall and the furnace in such manner as to allow the operator to see into the kiln at the ends of each arch, so as to examine and determine the state of burning in the kiln and the condition and workings of the furnace, chamber, and flues.

The operation of our furnace is as follows: The air admitted from the opposite sides of the fire-box comes in contact with the carbon

and gases as they rise from the fuel, and, being admitted in thin vertical sheets or waves at different heights, (which varies always in proportion to the depth of fuel on the grate-bars,) readily commingles with the flames. The commingled mass is then drawn into the contracted flue in curved lines. In passing through said flue the flames come in contact with the heated air in the openings in the sides and bottom of said flue, so as to form a series of jet-pumps. The products of combustion are in this way supplied with oxygen in proper quantities and heated to the temperature necessary to insure perfect combustion. The flames are then thrown in cross-sections from the flaring mouth of said flue against the wall H, by which they are divided and thrown upward and outward into the top of the distributing-chamber. They then dive or descend to the opposite side of said wall H, where they converge toward and enter the funnel-shaped openings in the kiln-wall, and are again met by the air from the openings in the sides of the flues in the kiln-wall. By opening the ducts *m* and *n* and closing the ducts *t t* the draft is increased and the heat is driven through the oblong funnel-shaped openings *r* and *r'* into the center or opposite side of the kiln. By closing ducts *m* and *n* and doors *d d* and opening the ducts *t t* and *m' m'* the draft is cut off and the heat rises immediately after passing through the openings *r r'* in the kiln-wall. We can by this arrangement close the draft in one furnace and open it in the one at the opposite side of the kiln, and in this way drive all the heat to either end of the arches in the kiln, which insures uniformity in size and hardness.

When our furnaces are properly constructed, we seldom have smoke enough to interfere with drying off properly, and as we allow nothing but the pure flames to enter the kiln, the brick burned by this method are free from discoloration.

We claim by our invention to burn successfully almost entirely with bituminous coal, slack, or any of the inferior or cheaper kinds of fuel. The parts of the kiln and furnace most exposed to the heat should be constructed of the best fire-proof materials.

Having thus described our invention and the best means at present known to us for carrying the same into effect, we do not desire to be confined to the exact construction and arrangement shown, as many modifications may be made of the same without departing from the spirit of our invention.

What we desire to secure by Letters Patent is—

1. A kiln having its walls provided with oblong funnel-shaped openings for the admission of the heating and burning agent, substantially as and for the purpose set forth.

2. A kiln having its walls provided with oblong openings or perforations, said openings being centrally contracted and flaring at each end, substantially as and for the purpose specified.

3. A kiln-wall provided with air slits or openings situated in the sides of the flues *r' r'*, substantially as and for the purpose specified.

4. In a kiln air-chamber, *o' o'*, situated at the sides of the flues *r r'*, connected with the external air by air-ducts *m' m'*, controlled by dampers, substantially as and for the purpose specified.

5. In combination with a kiln-wall, the oblong flues *r' r'*, the air-passages *e' e'*, and the air-chambers *o' o'*, connected with the external air by ducts *m' m'*, adapted to be controlled by dampers, substantially as and for the purposes specified.

6. In a kiln-furnace, the centrally-contracted flue M, flaring at each of its ends, substantially as and for the purposes specified.

7. In a kiln-furnace, the distributing-chamber D, extending over one or more arches in the kiln-wall, and having a downwardly-curved top, substantially as and for the purposes set forth.

8. In a kiln-furnace, a hollow wall, H, with an upwardly-curved top, situated within the distributing-chamber located in front of the flue M, substantially as and for the purposes set forth.

9. A kiln-furnace provided with air-passages, *e e* and *c*, situated in the side and bottom of the contracted flue M, substantially as and for the purposes set forth.

10. A kiln-furnace provided with air-chambers situated in the rear of the fire-box and at the sides and bottom of the contracted flue M, connected with the external air by air-ducts *m m*, and controlled by dampers, substantially as and for the purposes specified.

11. In combination with a kiln-furnace, long narrow vertical influent air-passages *s s*, and chambers *v v*, connected with the external air by air-ducts *n n*, controlled by dampers, substantially as and for the purposes specified.

12. The combination, in a kiln-furnace, of the vertical air-ducts *s s* and ducts *e e* and *c*, the centrally-contracted throat M, the air-chambers *v v* and *o o*, and air-ducts *m m* and *n n*, controlled by dampers, substantially as and for the purposes specified.

13. In combination with a kiln, a furnace having in the side of the fire-box air-passages *s s*, a centrally-contracted flue, M, in the rear of the fire-box, air-passages *e e* and *c*, and air-chambers *o o* in the side of said flue, a distributing-chamber, D, as described.

14. In combination with a kiln, a furnace having in the rear of the fire-box a centrally-contracted flue connecting the fire-box with a distributing-chamber, D, a hollow wall, H, situated inside of said chamber, with openings *g g*, air-chamber *k*, and air-ducts *t t*, controlled by dampers, substantially as set forth.

15. In combination with a kiln-furnace, a distributing-chamber, D, having in the top opposite and corresponding to each arch in the

kiln openings *a a* and side openings, *i i*, substantially as and for the purposes set forth.

16. In a kiln, a furnace having a primary combustion-chamber, a rear combustion and distributing chamber, D, and a dividing-wall having in its center a flaring mouth-flue, in combination with oblong funnel-shaped openings in the kiln-wall, substantially as and for the purposes specified.

17. A furnace for supplying heat to kilns and for other purposes, consisting of a contracted throat flaring at its front and rear ends, provided with elongated air-supply slits, in combination with a rear throat of similar character, the said throats forming an intermediate gas-commingling and combustion chamber, substantially as set forth.

18. A furnace for generating heat for kilns and other purposes, consisting of the double-contracted throat with the intermediate combustion-chamber, in combination with independent controlled air-supply ducts, substantially as described.

19. A furnace for generating heat for kilns and other purposes, consisting of a double-contracted throat having flaring front and rear ends, and provided with elongated air-supply slits, and having the intermediate gas-commingling and combustion chamber, in combination with the rear dividing-wall, as described.

In testimony whereof we affix our signatures in presence of two witnesses.

JAMES C. CULBERTSON.
W. A. EUDALY.

Witnesses:
L. W. PIERCE,
CHAS. W. SHORT.