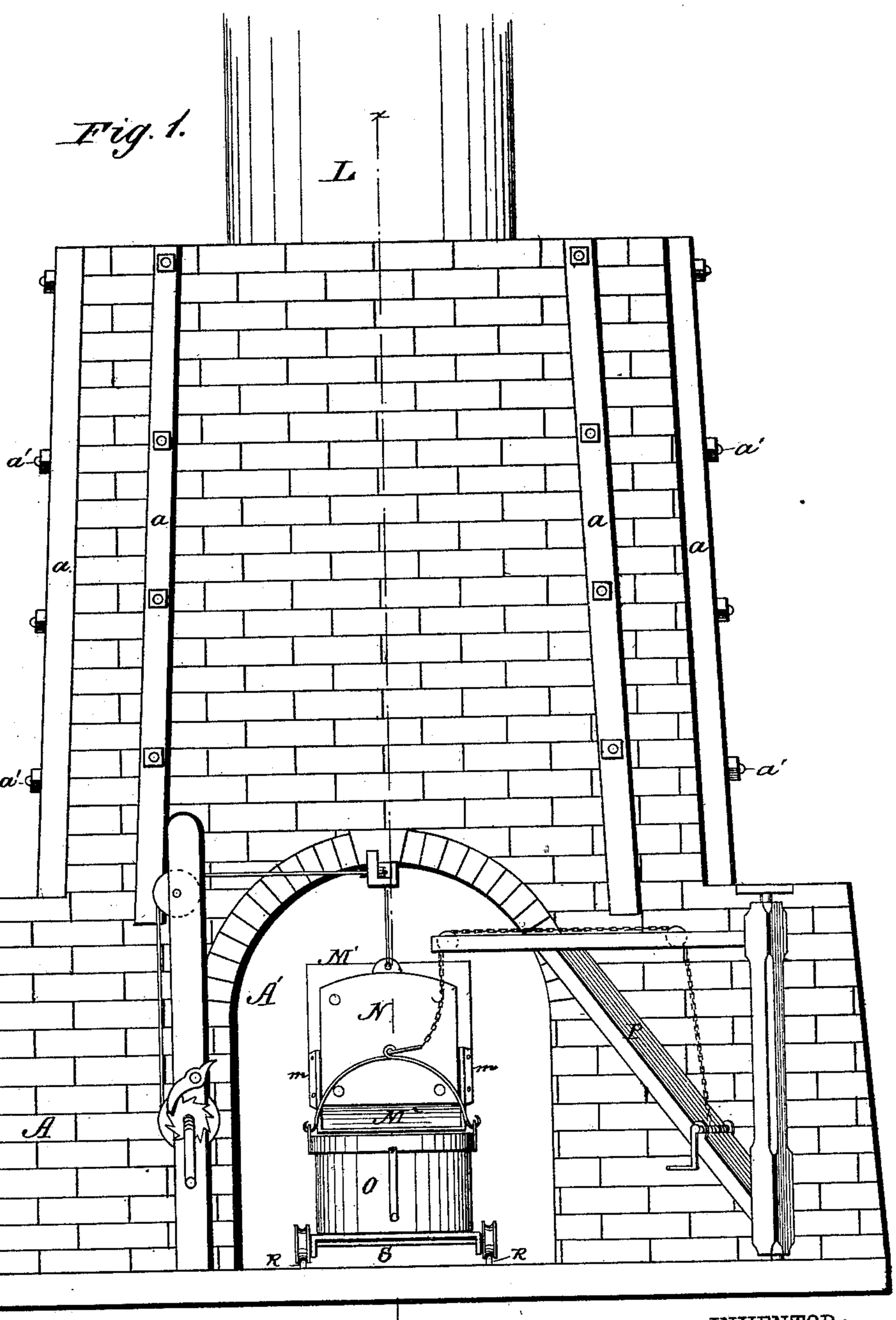
(No Model.) 3 Sheets—Sheet 1.

W. HUGHES & J. L. FOULK.

Limekiln.

No. 231,321. **Patented Aug. 17, 1880.**

Fig. 1.



WITNESSES:

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Wm. H. Rowe

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(No Model.) 3 Sheets—Sheet 2.

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Fig. 2.

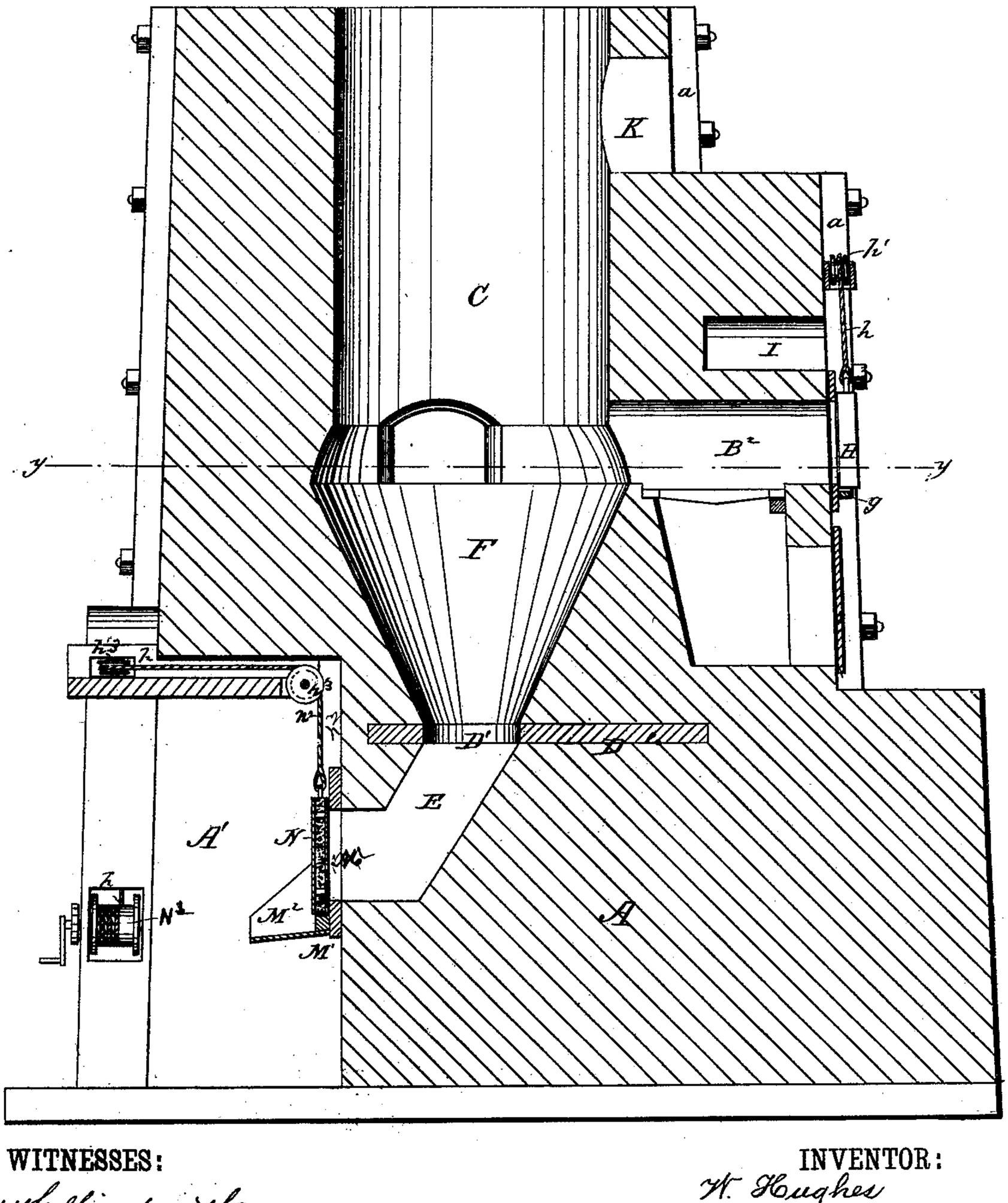

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Fig. 3.

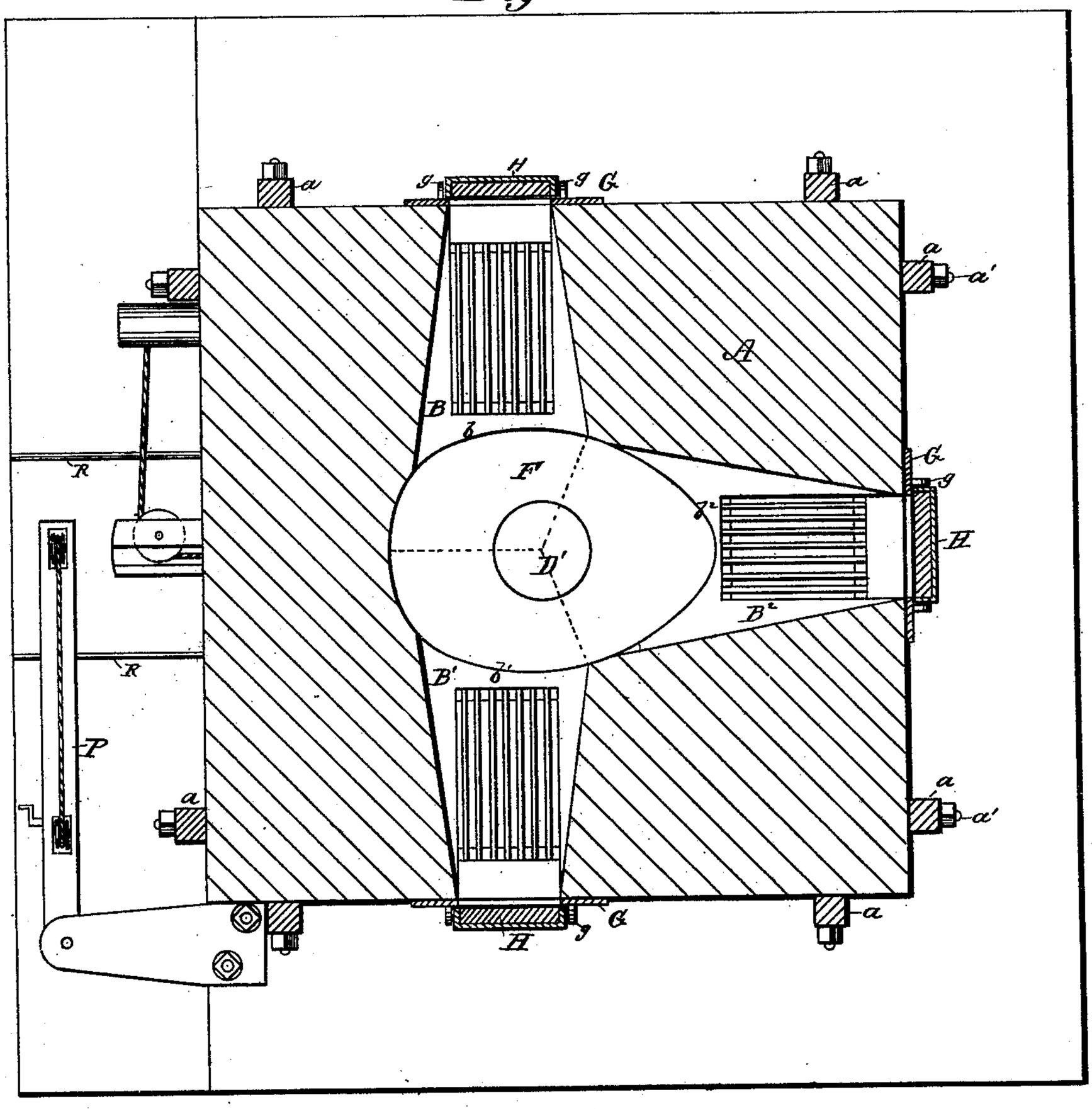


Fig. 4.

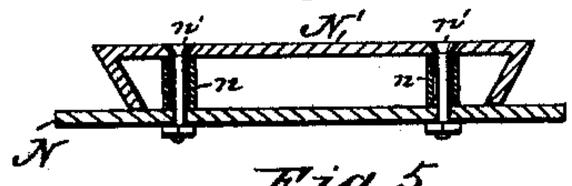
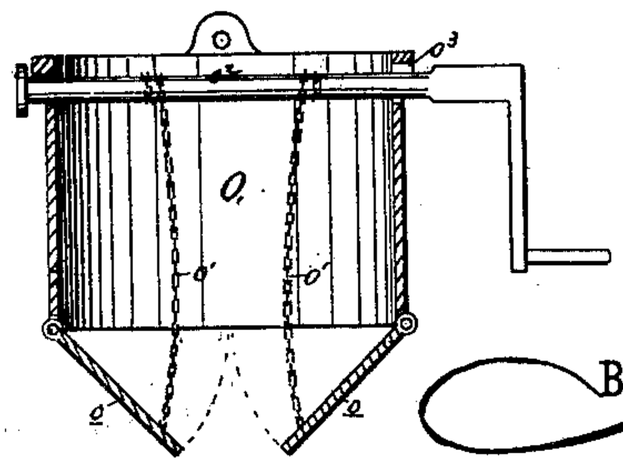


Fig. 5.



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UNITED STATES PATENT OFFICE.

WILLIAM HUGHES, OF AVONDALE, AND JOSEPH L. FOULK, OF STRASBURG, PENNSYLVANIA.

LIMEKILN.

SPECIFICATION forming part of Letters Patent No. 231,321, dated August 17, 1880.

Application filed July 1, 1880. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM HUGHES, of Avondale, in the county of Chester and State of Pennsylvania, and JOSEPH L. FOULK, of Strasburg, in the county of Lancaster and State of Pennsylvania, have invented a new and Improved Limekiln; and we do hereby declare that the following is a full, clear, and exact description of the same.

Our invention relates to that class of kilns known as "continuous" kilns, or those in which the limestone is supplied to the top of the stack, and as it settles during the calcining process the lime is drawn off at the bottom of the heating-chamber, and a fresh supply of limestone is added to the top of the unconsumed mass in the heating-chamber or stack.

Our invention consists, first, in an improved construction of combustion-chamber, in combination with a peculiar arrangement of furnaces to direct the flame equally across the entire area of the combustion-chamber to prevent the formation of cores or unburned masses of limestone, in connection with a relative arrangement of draw-chute or delivery-channel which will secure an economy of space together with the greatest effective volume of flame or caloric from the furnaces, as will hereinafter appear.

Our invention further consists in an improved construction of the base and hearth of the combustion-chamber to insure the proper cooling and concentration of the lime to the discharge-orifice in the hearth-plate, to admit of the withdrawal of the lime after it has been partially covered without sudden or unnecessary disturbance of the superincumbent mass of unconsumed limestone; and our invention finally consists in an improved construction of the door to the lime-discharge chute and in means for sealing and operating it, as hereinafter described.

In the accompanying drawings, Figure 1 is an elevation of the discharge side of the kiln, showing the means for operating the door and for removing the lime; Fig. 2, a vertical section in the line *x x* of Fig. 1; and Fig. 3, a horizontal section in the line *y y* of Fig. 2, showing the relative arrangement of the combustion-chamber, furnaces, and discharge-chute.

The improved kiln herein described is preferably erected against the side of a natural bank, or a mound is thrown up around three of its sides, to admit of safe and convenient access to the furnace-doors, which open upon three sides. This will allow the base of the remaining fourth side of the kiln to be on a level with the ground, for convenience in withdrawing and conveying the lime from the kiln.

A rectangular foundation or base, A, is built solidly of rough stone, except upon one side, which is recessed at A′, and channeled, to provide convenient means for discharging the lime, as hereinafter described. The furnaces upon the other three sides of the kiln are built upon the base, so that their ash-pits will be on a level with the bank or upper floor of the kiln, and the furnaces B B′ B² will enter at the base of the combustion-chamber C.

The combustion-chamber C is of egg shape in cross-section and slightly tapering at its base. The combustion-chamber is built in such manner relatively to the furnaces that two of the furnaces, B B′, will come opposite the base of the egg-shaped cross-section, parallel with and a little to one side of the minor axis of the chamber, and expose the entire rear portion of the chamber to the action of the flame, and the remaining furnace, B², will communicate with the smaller end of the chamber, to project the flame in the direction of its major axis and expose the entire remaining portion of the area of the chamber to the action of the flame and caloric from the furnaces.

A cast-iron hearth-plate, D, is built into the base of the kiln, a little below the bottom of the ash-pits of the furnaces, and is provided with a central circular opening, D′, by means of which the interior of the kiln C will communicate with an inclined discharge-chute, E, the mouth of which is a little above the lower level of the kiln, in the face of the recess A′.

The masonry of the kiln around the furnaces and discharge-chute E is built up solidly upon the cast-iron hearth-plate D, which insures a

smooth, even, and solid surface, upon which the fire-brick may be laid to accurately form the inner surface of the concave or ovoidal cooling-basin F at the base of the combustion-chamber. The plate D, with its central opening, D′, also insures a substantial and direct means for connecting the bottom of the cooling-basin with the upper end of the discharge-chute without weakening the walls of the basin or the thin edge of its discharge-orifice.

The furnaces are made somewhat flaring toward their inner ends, *b b′ b²*, to spread the flame over an increased area. The mouths of the furnaces are covered with a metal plate or facing, G, having guide-flanges *g* on their stiles or vertical sides, between which the doors H slide.

The doors are made of a hollow sheet-metal casing filled with soapstone or other non-conducting material, and are raised and lowered by chains *h*, which pass over pulleys *h′*, and are counterbalanced by weights, which allow them to be easily operated.

A hollow space, I, is left over the crown of each of the furnaces, which may be filled with loose material, if desired, and which serve as a convenient means of removing the fire-brick crown of the furnaces when they become burned out, and for replacing them without tearing away any of the pavement brick-work.

A lateral opening, K, may be formed in the upper end of the combustion-chamber for charging it with fresh stone, which may be covered by a suitable door, and a stack, L, of any required height may surmount the kiln above the combustion-chamber. The sides of the kiln may be braced by abutting plates *a* and tie-rods *a′*, arranged in any well-known manner.

The discharge-opening M in the face of the recess A′, and at the lower end of the discharge-channel E, is faced with a plate, M′, provided with dovetailed flanges *m m* upon its sides or stiles, into and between which the inner plate, N′, of a door, N, is made to fit snugly without binding. The door is formed of the inner plate, N′, with chamfered or dovetailed edges to fit the flanges of the face-plate, as described, and has an outer plate of larger area, N, to overlap the flanges of the face-plate, and bolted to it with thimbles *n* on the bolts *n′*, and between the plates, to leave a space between them of sufficient depth to hold a layer of lime, which is thrown up with the shovel of the attendant and plastered over to form a luting and closely seal the mouth of the discharge-opening when the door is closed, to prevent the outer air from being drawn in from the bottom, which would destroy the draft up through the combustion-chamber.

The discharge-door is raised by means of a chain, n^2, that passes over pulleys n^3 and around a crank-arm, N^2, upon one side of the recess, which will afford ample mechanical power to disjoint the luting of lime, which will become incrusted and require more power than can be applied directly to it by hand. A discharge-spout, M^2, upon the face-plate of the door completes the connection.

The burned lime may be drawn off from the kiln and discharged into a bucket, O, suspended from the end of a crane, P, secured to the side walls of the kiln, so that its end may be swung opposite the discharge-opening, and turned upon its pivots, to convey the bucket to one side and deposit into a bin or lime-house adjacent to the kiln. A bucket, O, provided with bottom plates, *o o*, hinged to and held in place by chains *o′*, that pass over a crank-axle, o^2, that passes diametrically across the top of the bucket, may be used in this connection, whereby the lime may be emptied by removing the axle from a catch-plate, o^3, which will allow the bottoms to drop and deliver the contents of the bucket.

A track, R, and truck or car S may be run into the recess, which may be used either of itself or in connection with the derrick for removing the lime from the mouth of the discharge-opening.

A thorough combustion of the limestone is secured by the arrangement of the furnaces, so that no cores or unburned stone will fall into the cooling-chamber and be discharged with the lime, while one face of the kiln is left unobstructed for use in removing the lime from the kiln. The improved form of cooling-basin affords ample surface and a desirable shape for concentrating the lime gradually to the discharge-opening without dislocating and suddenly disturbing the superincumbent mass, and an accuracy of form may be given to its inner surface and edges by means of the metal hearth-plate.

The method of luting the discharge-door and of operating it by means of crank, chain, and pulleys, will afford cheap, simple, and ready means for sealing the mouth of the discharge-opening.

What we claim as new is—

1. In a continuous limekiln built with rectangular exterior walls, the combustion-chamber of egg-shape cross-section, in combination with furnaces communicating with three of the sides of the outer wall, two of which project their flames in opposite directions at the base and in the direction of the minor axis, and the third of which will project its flame from the smaller end and in the direction of the major axis of the egg-shaped chamber, and the discharge-chute connecting the hearth of the combustion-chamber with the remaining side of the exterior wall, substantially as and for the purpose described.

2. In a continuous limekiln, the base of the combustion-chamber supported upon an iron hearth-plate and built up to form an ovoidal basin, the central portion of the bottom of

which communicates through an inclined chute with a recess in the base of one of the exterior walls, substantially as and for the purpose described.

3. A limekiln provided with a discharge-opening covered by a double-plated door sliding in dovetailed guide-strips upon the stiles of the door-frame, the plates of the door being separated to form an intervening space into which lime may be poured to form a luting, the said sealed door being combined with a chain, guide-rollers, and crank for operating it, in the manner and for the purpose substantially as described.

WILLIAM HUGHES.
JOSEPH L. FOULK.

Witnesses:
CHAS. C. HUGHES,
LEWIS A. LIPP.