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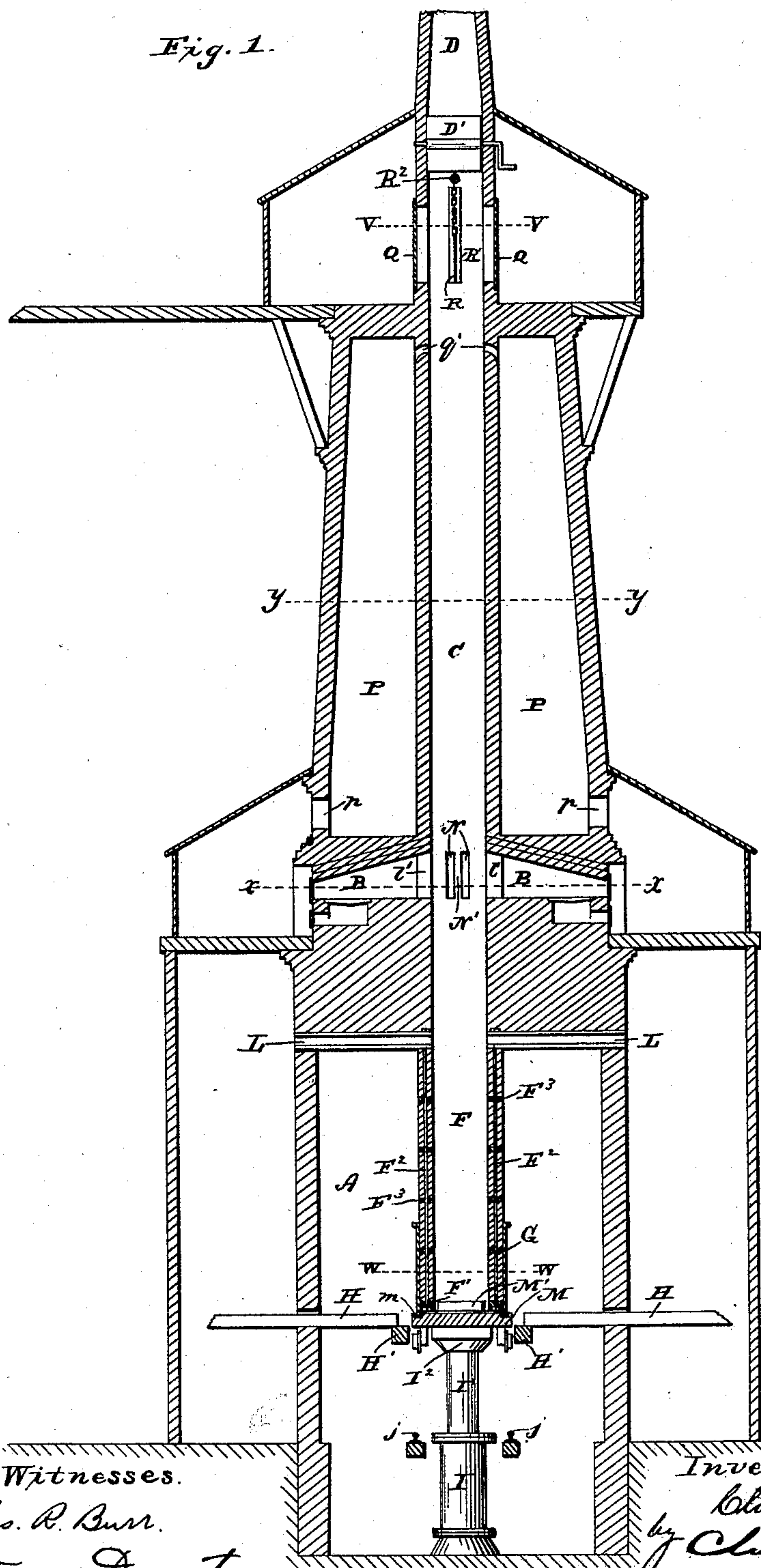
4 Sheets—Sheet 1.

C. D. PAGE.  
BRICK KILN.

No. 406,463.

Patented July 9, 1889.

*Fig. 1.*



Witnesses.

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(No Model.)

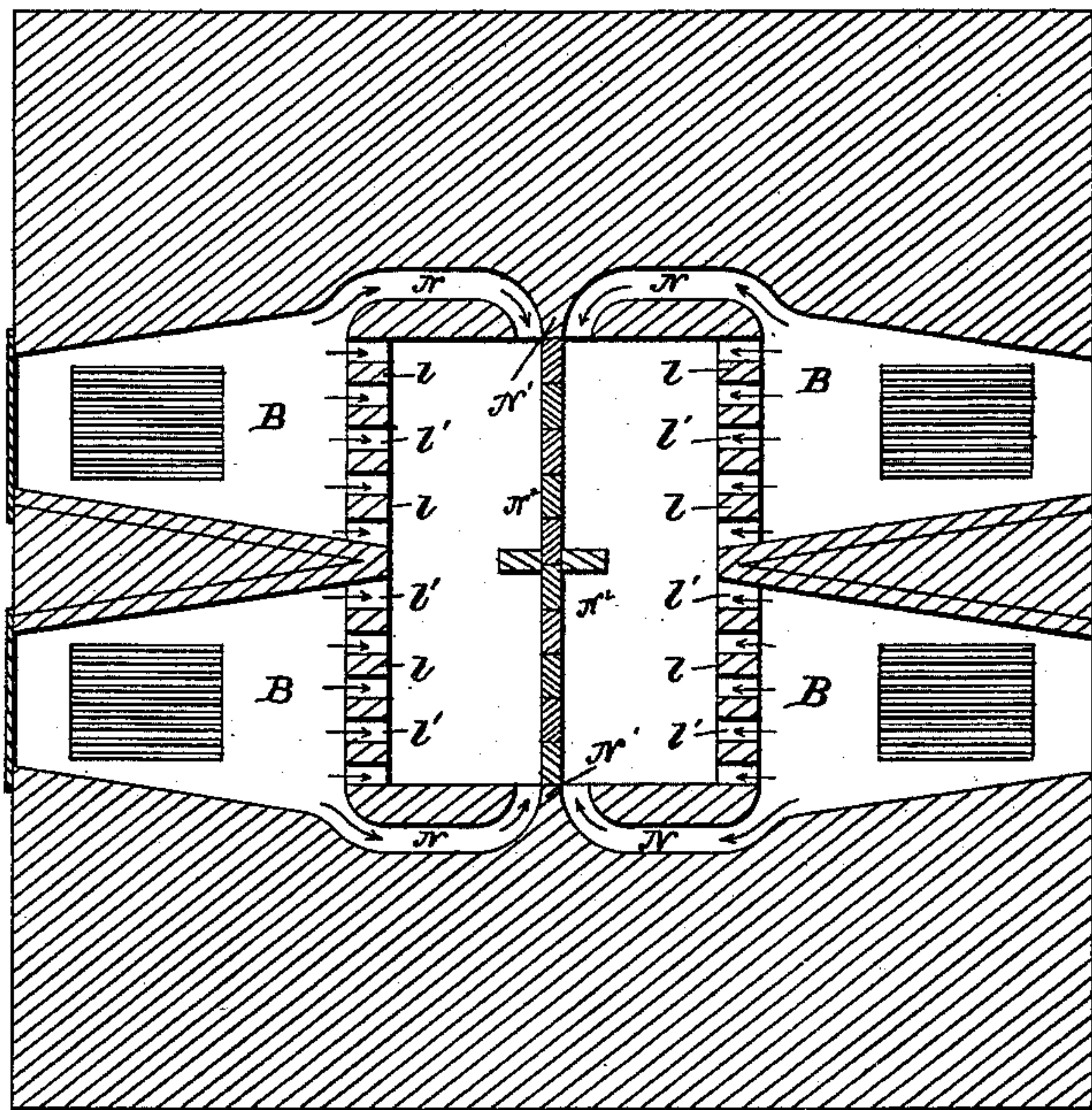
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C. D. PAGE.  
BRICK KILN.

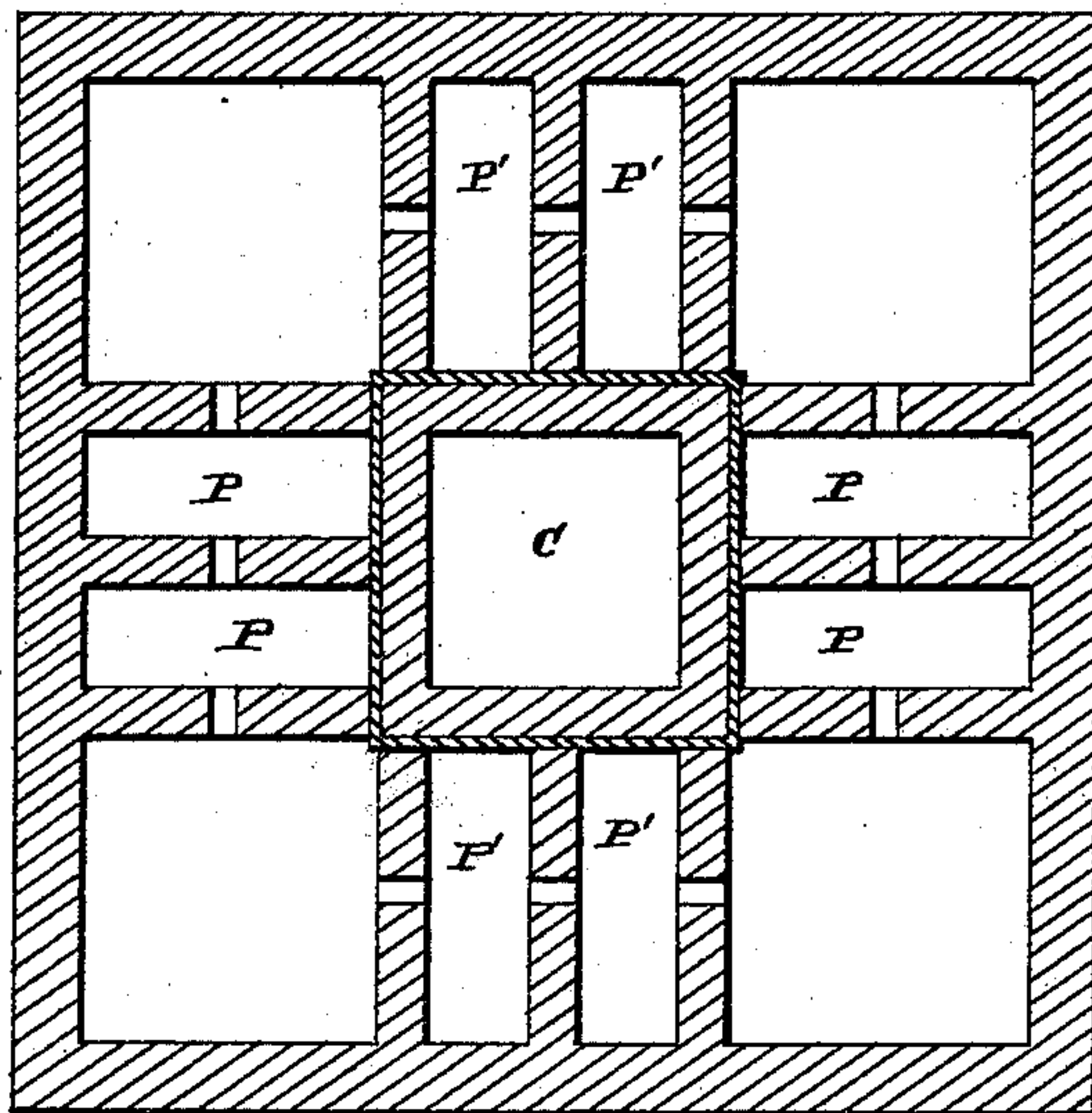
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*Fig. 2.*



*Fig. 3.*



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4 Sheets—Sheet 3.

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Fig. 4.

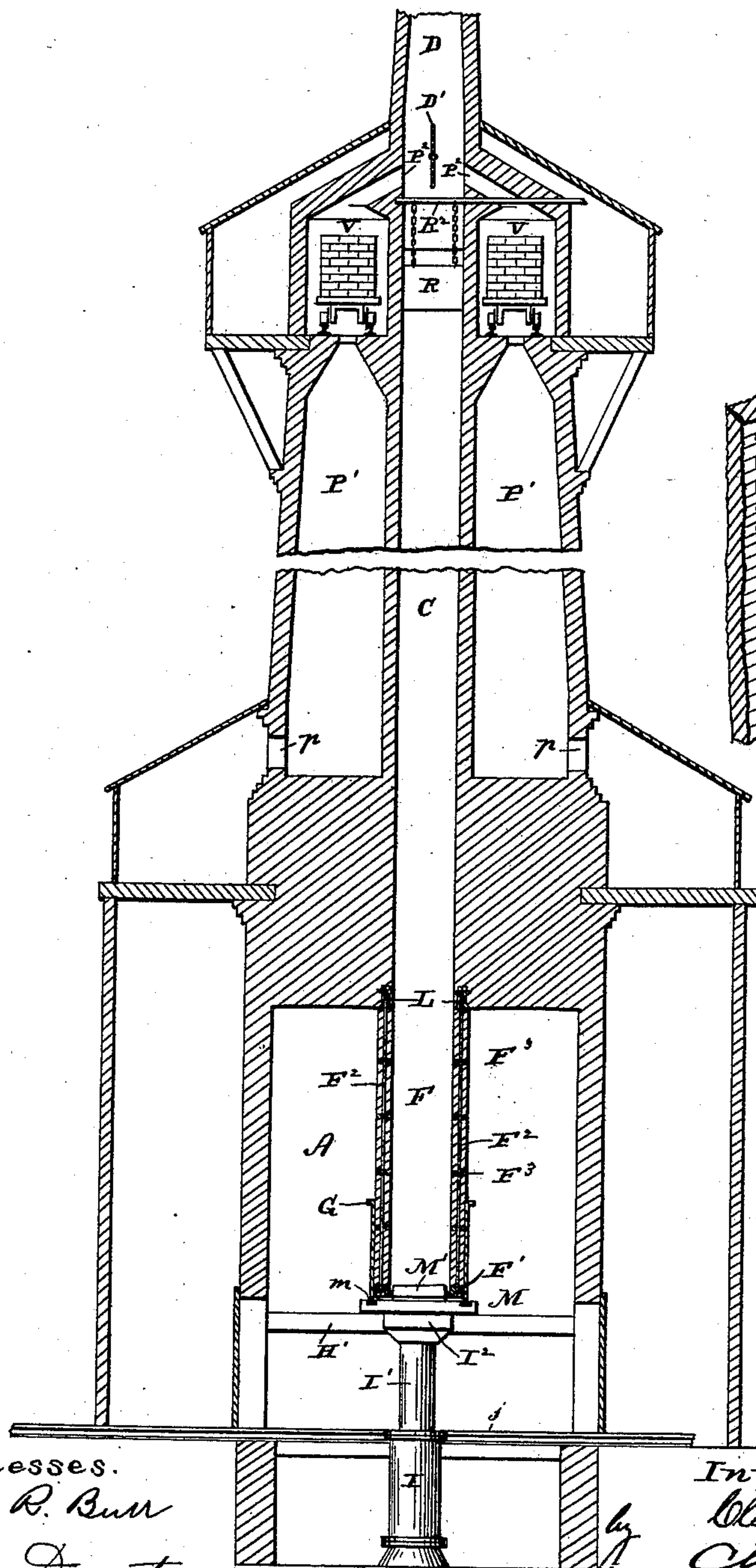
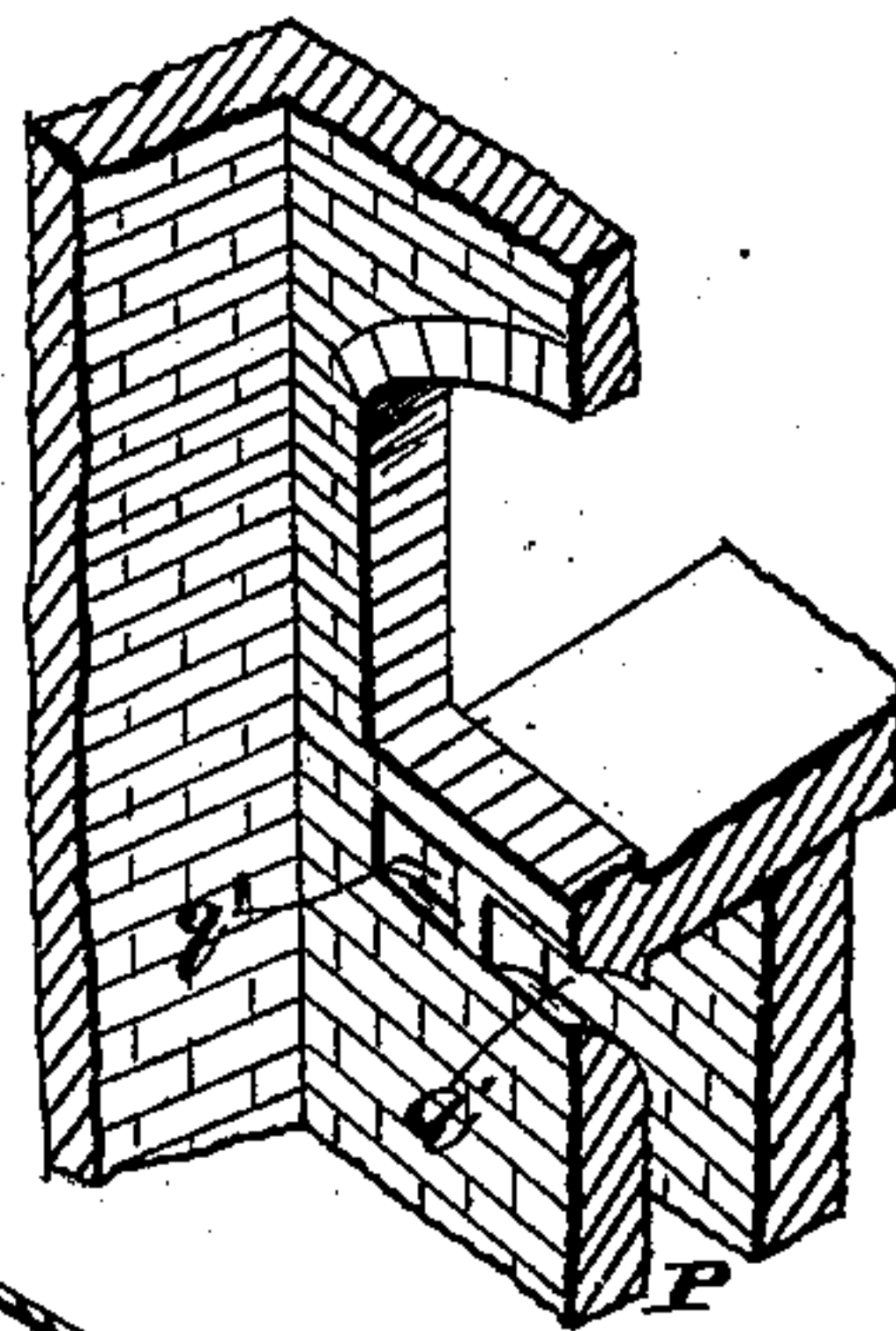


Fig. 9.



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4 Sheets—Sheet 4.

C. D. PAGE.  
BRICK KILN.

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Fig. 5.

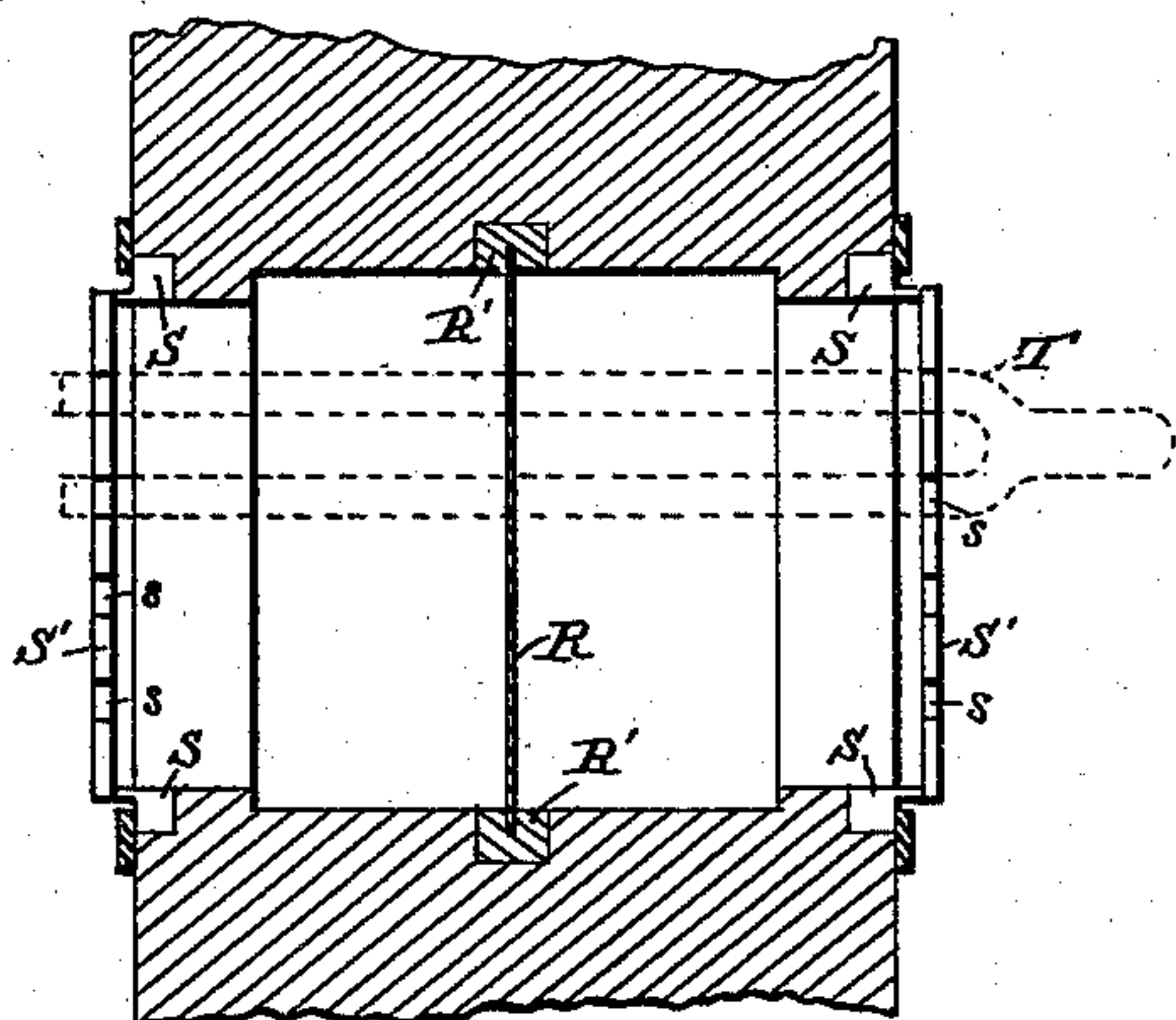


Fig. 6.

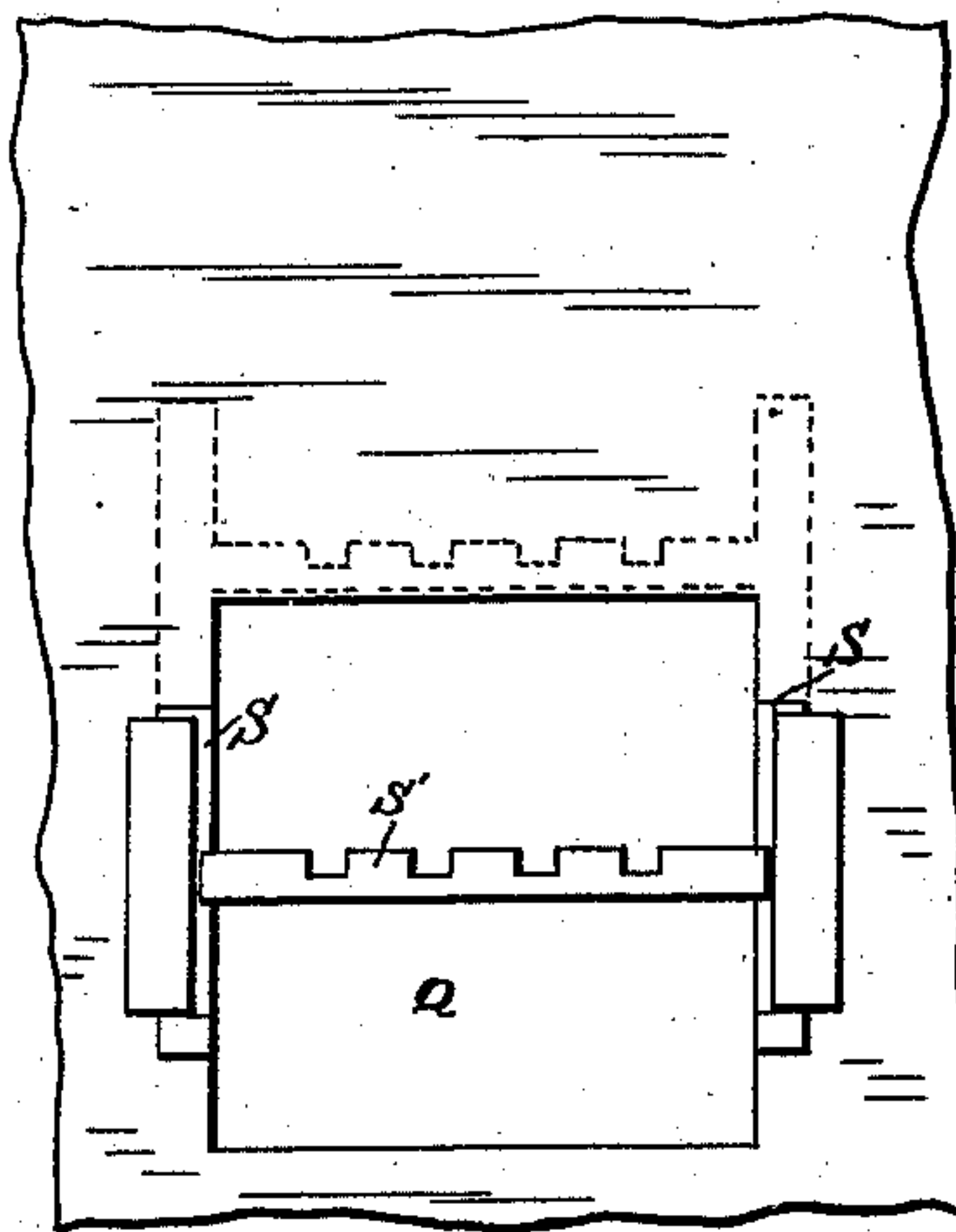


Fig. 7.

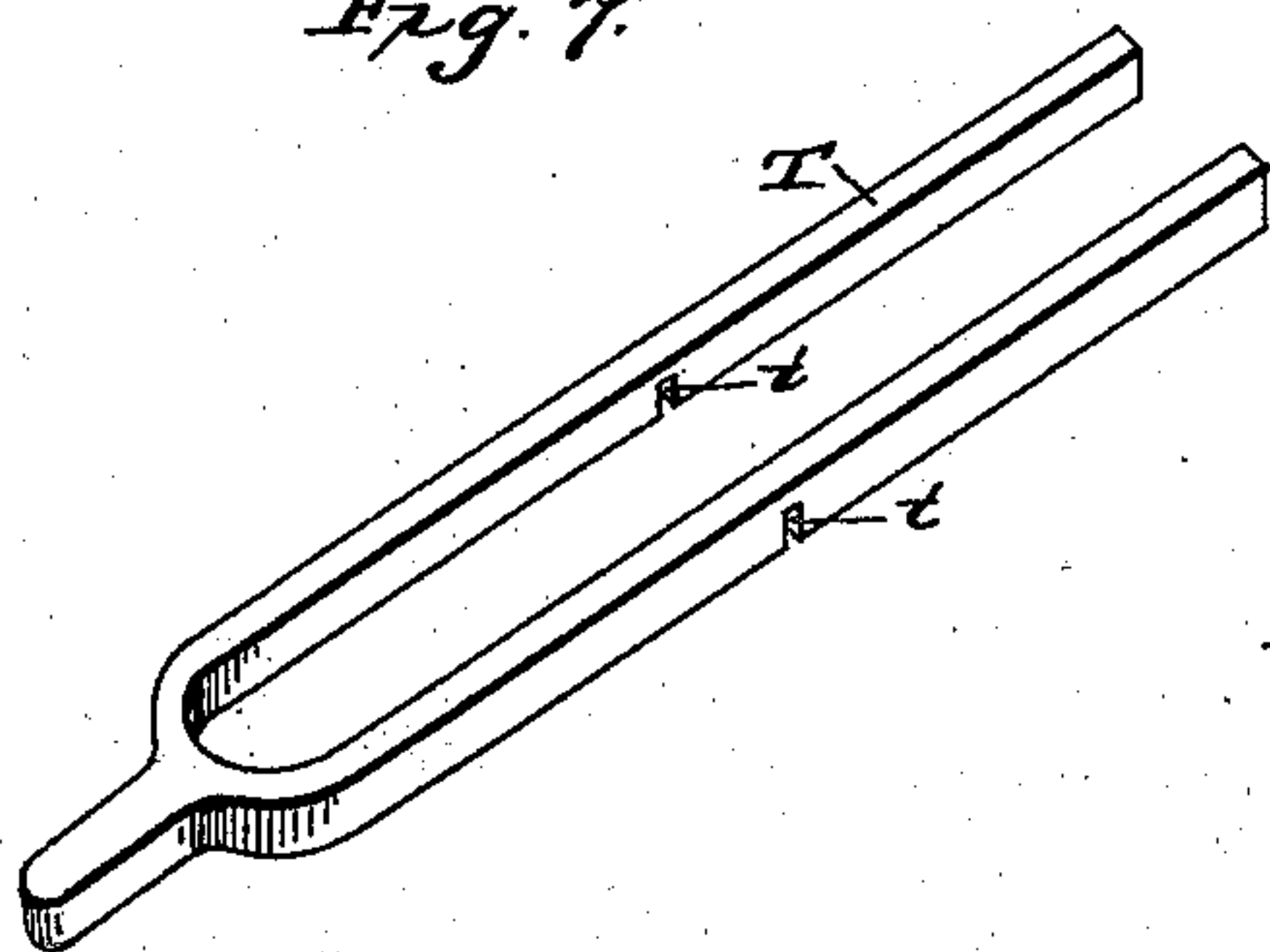
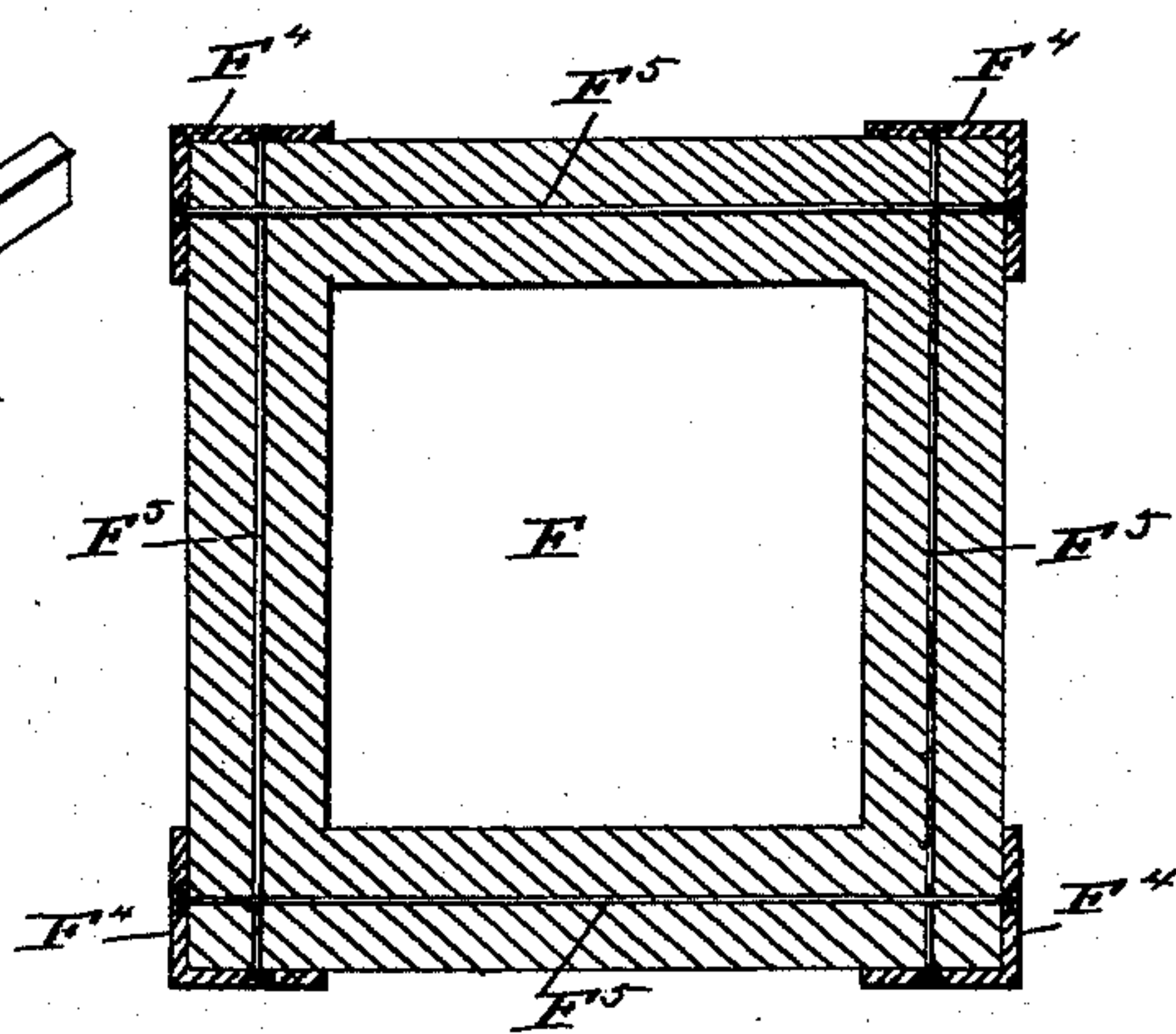


Fig. 8.



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# UNITED STATES PATENT OFFICE.

CLARK D. PAGE, OF ROCHESTER, NEW YORK, ASSIGNOR TO PAGE'S PATENT  
BRICK KILN COMPANY, OF SAME PLACE.

## BRICK-KILN.

SPECIFICATION forming part of Letters Patent No. 406,463, dated July 9, 1889.

Application filed May 15, 1888. Serial No. 273,927. (No model.)

*To all whom it may concern:*

Be it known that I, CLARK D. PAGE, of Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Brick-Kilns; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, and to the figures and letters of reference marked thereon.

My present invention relates to improvements in brick-kilns, particularly that class known as "perpetual kilns," in which the green brick are introduced at one end and removed from the other thoroughly burned; and it consists in a certain improved construction of devices and combinations of parts, hereinafter described, whereby the bricks are enabled to be burned in a more thorough and economical manner than heretofore, and to be readily and accurately applied and removed without danger of chilling the kiln, and thus destroying the whole charge, all as will be hereinafter more fully described and claimed.

In the accompanying drawings, Figure 1 is a vertical sectional view of a kiln constructed in accordance with my invention. Fig. 2 is a horizontal sectional view taken on the line  $x$   $x$  of Fig. 1. Fig. 3 is a similar view through the line  $y$   $y$  of Fig. 1. Fig. 4 is a vertical sectional view at right angles to Fig. 1. Fig. 5 is a horizontal sectional view taken through the line  $v$   $v$  of Fig. 1; and Fig. 6 is a side view of the top of the kiln, showing the gage-bars, and in dotted lines their position when raised. Fig. 7 is a perspective view of the spacing-bars. Fig. 8 is a section on line  $w$   $w$  of Fig. 1. Fig. 9 is a sectional perspective view of the inside of the shaft, showing the apertures  $q$  below the feeding-apertures.

Similar letters of reference in the several figures indicate the same parts.

As is usual in the class of kilns to which my present invention belongs, the furnaces or combustion-chambers for the fuel are located some distance above the lower extension of the kiln from which the burned brick are withdrawn, and below the point where

they are first placed in the cupola or burning-chamber, so that the products of combustion and heated gases pass up through the mass of brick between said furnace and the entrance, thoroughly drying and burning them, while that portion of the column below the furnace is gradually cooling off, and when removed in the sections, as usual, they will be cool enough to be readily handled.

The kiln proper consists of a lower or base portion A, extending from the ground to the level of the furnaces B, the cupola or portion C, in which the bricks are burned, and the chimney D, through which the gases and products find exit. The walls of the base portion are so disposed as to leave a space between them and the lower extension F of the kiln, the interior of which is substantially the same size as the interior of the kiln throughout. This portion is connected to the lower portion of the cupola and extends down to within a comparatively short distance of the ground, and is constructed preferably of fire-brick or similar refractory substance. A lower plate F', of substantially the shape of the kiln-shaft, is located at the bottom, connected by long rods F<sup>2</sup> F<sup>2</sup> with girders L L at the lower end of the cupola-section, as shown, and this forms the support for the lower extension. Suitable right-angle plates F<sup>3</sup> F<sup>3</sup> are interspersed in this extension at regular intervals, as shown, to form binders, and through these also the rods F<sup>2</sup> F<sup>2</sup> pass.

In order to provide corners for the more ready travel of the hood, (to be described,) I locate at each corner of the extension a corner-plate F<sup>4</sup> F<sup>4</sup>, connected by tie-rods F<sup>5</sup> F<sup>5</sup>, as shown in Fig. 8, that serve also as a means for binding the structure firmly together. At the lower end of the extension is located a hood or sleeve G, capable of sliding up and down thereon when required, and of such a height relative to the distance between the bottom of the trunk and the ground as to extend to the top of the car on which the bricks are supported when down. Any suitable means may be provided for raising and lowering this hood when desired.

On either side the lower end of the trunk are provided beams or girders H', (which may



assist in sustaining the extension,) upon which rest the ends of beams or bars H, adapted to be projected from one side beneath the column of bricks to support the same for a time when a charge is being removed; but as the particular construction and arrangement of these bars forms no part of my present invention no further explanation is necessary, they being known in the art. Just beneath this extension is located a hydraulic cylinder I, in which operates a piston I', connected to a suitable platen I<sup>2</sup>, the piston being adapted to be raised and lowered by the forcing in or exit of liquid from the said cylinder.

Track-rails *j* are provided at the sides of the platen, extending out into the yard or place of storing burned bricks. A car M is arranged to run upon this track, its upper side being provided with bars or projections M', and with a groove *m* near the edge adapted to be filled with sand or similar material to receive the lower edge of the hood G when moved down, said sand forming a seal and preventing access of air to the kiln during the burning. When the car is in position, so that the hood registers with the groove, it will also be directly over the platen, and when the latter is raised the car will be carried up with it. Across the outer walls of the kiln are located girders L, upon which the cupola and furnace section of the kiln is built, and to which the lower extension of the kiln is secured as described.

The bottom portion of the kiln is housed in, so that there will be no direct access of air to the interior of the kiln while the hood G is raised to permit the insertion of the bars by which the weight of the column of brick is sustained, as such air might chill the kiln and render the brick worthless.

The furnace and cupola section of the kiln is built directly over the base upon the girders L, on which it rests, as explained.

The furnaces B, preferably four in number, arranged in pairs on diametrically-opposite sides of the central chamber or shaft of the kiln, are preferably lined with fire-brick or other refractory material, (as is also the rest of the shaft,) and are wedge-shaped in horizontal section with the wider portions projecting toward the shaft. These rear ends are provided with suitable partitions or abutments *l* of fire-brick, forming channels *l'*, through which the products enter the kiln, pass up through the bricks, and thoroughly burn them.

Heretofore objection has been made to kilns having furnaces located on two sides only by reason of the insufficient burning of the bricks at the sides where there are no furnaces, and to obviate this I provide a channel or passage *n*, extending from the outer side of each furnace, and entering the shaft again near the center. Where these passages enter the kiln they are separated from each other by a partition *n'* of about the thickness of one brick, and in order that the products and gases may

not pass from one furnace to the other, and further to provide for the passage of said products to the center of the kiln, where they are permitted to rise up through the superposed column of brick, in laying the brick to charge the kiln I lay one course directly through the center, so that it will come in line with the partition *n'*, and provide two channels *n*<sup>2</sup> in every charge placed in the kiln that will register with passages *n* and receive the products, conducting them to the center, where an abutment in the shape of a brick is placed to impede further inward progress and permit their rising upward through the brick. These side and end channels are of importance in burning brick evenly, and particularly so in connection with the channels formed in the courses. The furnaces are provided with the ordinary grates, fuel-door, and ash-pit; but as these form no part of my invention, no further description is necessary. A platform is constructed just below the level of the furnace for the firemen and reception of fuel.

Above the furnace is provided the cupola proper, in which the bricks are burned, while in the portion below the cooling of them is alone accomplished. A series of vertical channels or passages P P P' P', communicating with each other by transverse openings, is provided around this cupola, their lower ends being open to the air at *p*. The shaft portion proper, which is composed of fire-brick, is sheathed with metal, so that cold air entering through openings *p* will not chill the outside, and more particularly so that, should the interior bricks become cracked or porous, the air cannot enter the kiln and in any way injuriously affect the contents.

The upper ends of passages P P at the front and rear (or furnace) sides open into the shaft through passages *q' q'* below the doors Q Q, through which the kiln is charged, and these openings into the shaft may be either broad ones extending the width of the latter, or a series of small perforations; but the single broad ones are preferred. The object of these chambers and openings is to provide for heating air by contact with the heated cupola and discharging it at or just below the mouth or charging place of the kiln, so that a sheet of warm air passing up to the chimney above will be formed in front of said openings of the cupola, whereby ingress of cold air will be prevented when the feeding-doors are opened, which otherwise meeting the vapor coming from the bricks being dried would condense the same and deposit moisture on the bricks being inserted, which would be perhaps a serious objection; and, further, by this means the steam or vapor is prevented from passing outward and incommoding the workmen placing the new charge in position, as it would do were no such air-currents as described created.

As is the case with all kilns constructed on this general plan, the green bricks are inserted from the top, and in the present con-



struction the kiln is charged through two openings at opposite sides, which are adapted to be closed normally by vertically-sliding doors. In the center of the kiln, between these openings, is located a partition-plate R, quite thin—say one-quarter of an inch in thickness—arranged to slide in suitable guides R' R', located in the sides of the kiln and to be raised and lowered from above by the rotation of a shaft R<sup>2</sup>, upon which is wound a chain or chains connected with said plate. The object of this plate is to divide the upper portion of the shaft into two parts, and afford an abutment against which the workmen setting the bricks from opposite sides can place them accurately without encroaching on each other's territory and laying them unevenly. This provision of filling from both sides simultaneously is advantageous in that it necessitates the workmen reaching but a short distance into the kiln, and the plate, in connection with other devices hereinafter described, insures the accurate setting of the brick for the purposes of operating the kiln as intended.

As before stated, the column of brick in the kiln is supported while the lowest charge is being removed by a series of bars passed through the column just above this charge, and of course it is necessary that some convenient manner of accurately positioning the brick to cause the apertures to always register with the bars is desirable, and the following devices have been found to answer this purpose well. On each side of the openings closed by doors Q are provided ways in which suitable bars S are arranged to slide vertically when desired, and each pair of these bars is connected by a cross-bar S' at such a distance from the lower ends relative the support or stop that limits their downward movement that it will be held above the floor or bottom of the charging-openings a distance equal to the height of a single charge for the kiln—in the present instance about four feet. The upper side of each of the bars S' is provided with corresponding recesses s, the distance between said recesses corresponding to the distance between the bars H below, and forming-bars T, consisting of two bars of the dimensions of the apertures to be formed and connected at one end, are arranged in the recesses s of bars S', when the top course of brick is being laid, so that the latter can be laid up close around the bars, and when they are withdrawn the recesses will also serve as cross-passages for products and also for the purpose mentioned. Of course as soon as two passages are formed around the bars T the latter are lifted up and moved into the next pair of notches, the bricks laid around them, and so on. While it is not absolutely necessary to hold the forming-bars from endwise displacement and also from twisting when the supporting-bars are not notched, I prefer to construct said bars T with notches t, formed at right angles to their length and of a size

to accurately fit the separating-plate R, so that when the bars are put in above the plate and pushed down with the plate in the slot no lateral or twisting movement is possible.

The chimney D extends a considerable distance above the supply-orifices for the maintenance of a good draft, and a short distance above the latter is located a damper D', operated by suitable means—such as a handle d—and adapted when turned to close the chimney and regulate or check the draft through the kiln, this feature being valuable in connection with the sleeve or hood below, as will be explained.

On the sides of the kiln between the feeding-apertures are located two drying-ovens V V, having track-rails on their bottoms, between which are apertures through which the heated air passing from the side air-chambers P' P' enters said chambers, while at the top are channels P<sup>2</sup> P<sup>2</sup>, conveying said heated air into the chimney above the damper preferably. These ovens are adapted for the reception of brick that may arrive at the top of the kiln too green or wet to be burned, the cars on which they are contained being run into these ovens, the doors closed, and the bricks subjected to the hot air until sufficiently dry, when they are placed in the kiln and burned in the ordinary manner.

It will be understood that there is a suitable platform at the feeding end for the green bricks and the workmen, which may or may not be covered, though I prefer to do this, and also that there is a suitable elevator for conveying the brick to the uppermost platform, and that the lower part of the kiln is housed, so that it can be closed up and the access of cold air cut off when the kiln is opened to remove a charge.

The operation will now be readily understood. Assuming that the kiln is full of bricks, those between bars H and the lower portion of the furnace-section having been burned and cooled in proportion to the distance from the latter and those between the furnace and the feeding-apertures in all stages of burning, from very green at the top to hard-burned opposite the furnace, the ram is in lowered position with the car upon it, the hood down in the sand-groove or other suitable packing making a tight joint, the column of bricks supported upon the ribs on the car, the charge last put in at the aperture at the top of the kiln is still up to the level of bars S' S' when in position, the doors Q Q closed, and the furnaces in operation burning the brick, the operator, wishing to withdraw the charge at the bottom, raises the hood G, at the same time signaling the workman at the feeding end of the kiln to close damper D' and cut off the draft, or suitable devices connecting the hood and damper might be employed for operating them simultaneously. The ram is then slightly raised, so as to bring the apertures between the sections in line with the bars H, which are then run in by any mechanical means—



such as a ram or a rack and pinion—until they emerge from the opposite side and rest upon suitable supports provided for them, as described. As soon as this is accomplished, the ram is allowed to descend by opening the discharge from the cylinder, and the car with one charge of bricks is carried down until it rests upon the rails and then is run off to discharge its load, the column being meantime supported upon the bars H H. An empty car is now run over the ram-platen and the latter raised until the lower course of bricks rests upon the ribs *m'* between bars H. Then a greater pressure is applied to the piston to cause it to raise the column and relieve bars H, after which the latter are withdrawn, the hood placed down on the car, and the ram and column allowed to descend until the car rests upon the ground-rails and the upper side of the highest charge is about on a level with the bottom of the feeding-apertures. When the hood is down in the packing, of course the damper D' can be opened, permitting the continuation of the burning, the only cessation being while the charge is being withdrawn and the hood raised. The operators at the top of the kiln now open doors Q Q and pile in the bricks to form another charge, arranging the bottom course to preserve the passage at the sides for the products, as described, and also manipulating the plate R. The top course is correctly placed by means of the notched gage-bars S' S', and the forming-bars T are used to form the transverse apertures, after which bars S S are slid up out of the way, as shown in Fig. 6, until the next top course is to be laid, the doors Q Q closed, and the burning of this charge accomplished in the same manner as before.

With a kiln of about the proportions shown I propose to draw a charge about once an hour, the space between the furnace and feeding-aperture being sufficient to accommodate about twenty-four charges, and as each charge or car-load contains about fifteen hundred bricks, I am enabled to produce approximately thirty-six thousand well-burned bricks every twenty-four hours, and the particular feature of this construction is that all the bricks will be burned precisely the same, providing, of course, the furnaces be kept running at the same heat, which is a matter easily regulated by a skilled operator.

There are many other advantages incident to the construction of the furnace—such as accuracy in setting, facility in drying brick too green to burn well, and in the prevention of the spoiling of the green brick at the top by so-called “water smoke,” and others that will readily occur to those skilled in the art.

A particular advantage to be noted in this class of kilns is that the bricks are put into the kiln at a distance from the furnace, and are gradually dried out and then burned by being subjected to a gradually-increasing heat, which effectually prevents cracking and renders them more homogeneous than when

they are subjected to the action of a fierce heat as soon as they are placed in the kiln.

I do not desire to be confined to the exact details of construction of the kilns herein described, except in so far as limited by the terms of the claims, as numerous modifications might be made to accomplish the same results without departing from the spirit of my invention.

It should be noted that the passages in the column of brick that lead to the center and the position of the furnace-openings and the movement of the column are so arranged relatively that when the column is in a state of rest the openings will register, as will be readily understood.

I claim as my invention—

1. In a brick-kiln of the character described, the combination, with the cupola and the girders supporting the same, of the downwardly-extending portion, and the tie-rods extending through the same and connected to the girders for supporting the extension, substantially as described.

2. In a brick-kiln of the character described, the combination, with the cupola and girders, of the lower depending extension of the cupola, formed of brick, with the interposed and bottom plates, and the tie-rods uniting the plates and connected to the girders for supporting the depending extension, substantially as described.

3. In a brick-kiln of the kind described, the combination, with the furnace and cupola, of the lower extension formed of brick, the protecting corner-plates, and the hood arranged to slide over said extension, substantially as described.

4. In a brick-kiln of the kind described, the combination, with the furnace and cupola, of the lower extension constructed of brick, the corner-plates and bolts or rods connecting them, and the hood arranged to slide over said extension, substantially as described.

5. In a brick-kiln of the character described, the combination, with the feeding-aperture, of a hot-air passage opening into the kiln below or at one side of the feeding-aperture and a discharge-opening above or at the opposite side of the same, whereby warm air is caused to pass in front of the said feeding-aperture and prevent contact of cold air with the vapor from the bricks in the center of the kiln, substantially as described.

6. In a brick-kiln of the character described, the combination, with the feeding-aperture, of the cupola below the same, the hot-air chamber surrounding the cupola and heated thereby, air-passages communicating with said hot-air chambers and opening into the cupola below or to one side the feeding-apertures, and the discharge on the opposite side, substantially as described.

7. The combination, with the furnace, of the cupola, the chamber formed at the side of the latter open to the air, the feeding-apertures of the kiln, and the drying-chamber located in



proximity thereto, heated by the air from the chambers at the side of the cupola, substantially as described.

8. The combination, with the cupola having the protecting-covering, of the air chamber or chambers at the sides, substantially as described.

9. The combination, with the furnace, the cupola, the hot-air chamber at the sides of the latter open to the air, and the feeding-apertures for the kiln, of the drying-chambers located in proximity and heated by air from said hot-air chambers and the openings from the hot-air chambers into the cupola below the feeding-apertures, substantially as described.

10. In a vertical kiln, the combination, of the furnaces having the broad inner ends opening into the shaft and the side passages extending to one side and discharging into the shaft at an angle to the direct passages, substantially as described.

11. In a vertical kiln, the combination, with the four furnaces having the broad inner

ends discharging into the shaft and arranged in pairs on each side thereof, of the side passages extending around from the outside of each furnace and entering the shaft in pairs at near the center of the sides, substantially as described.

12. In a brick-kiln, the combination of the feeding-apertures, the partition-plate, and the spacing or forming bar provided with the slot adapted to co-operate with the plate, substantially as described.

13. In a brick-kiln, the combination of the feeding-apertures, the central partition-plate, the horizontal notched bars, and the spacing or forming bar adapted to rest in the notches, substantially as described.

14. In a brick-kiln, the combination of the feeding-apertures, the horizontal notched bars, and the spacing-bar adapted to rest in the notches, substantially as described.

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