

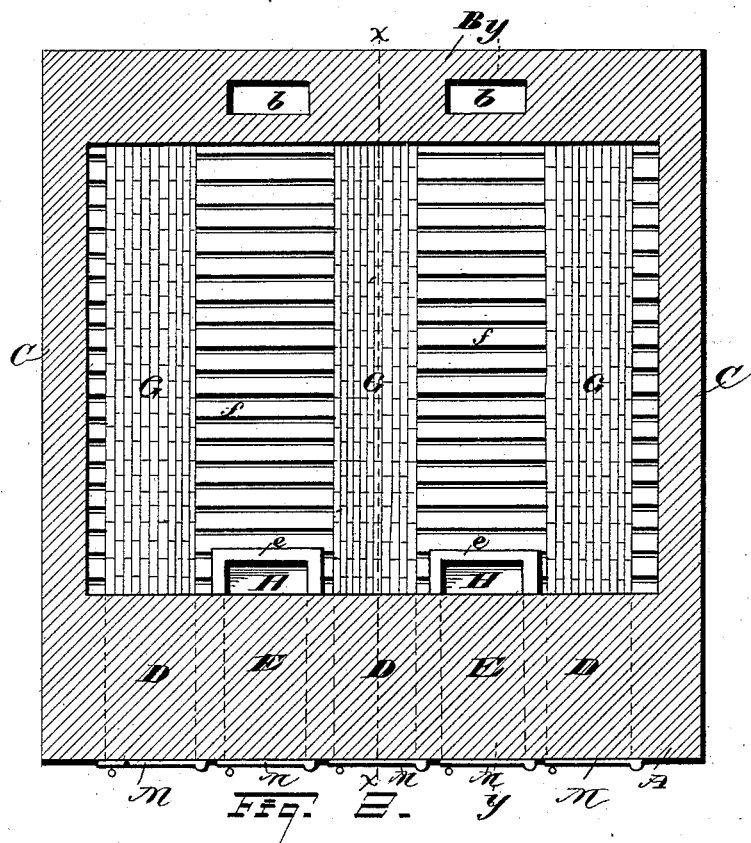
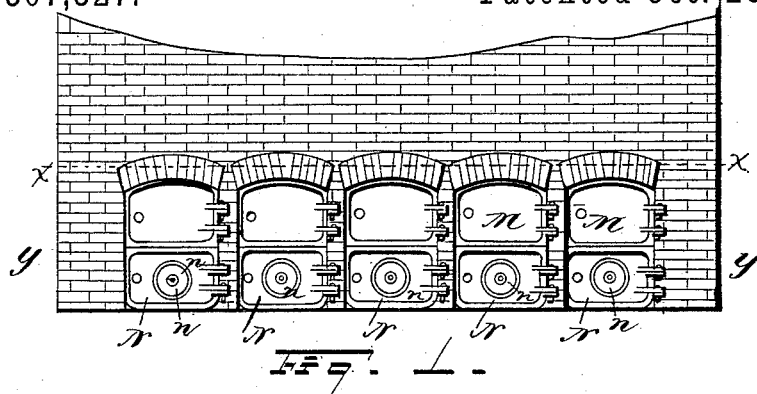
(No Model.)

3 Sheets—Sheet 1.

J. W. & R. C. PENFIELD.
BRICK AND TILE KILN.

No. 307,327.

Patented Oct. 28, 1884.



WITNESSES

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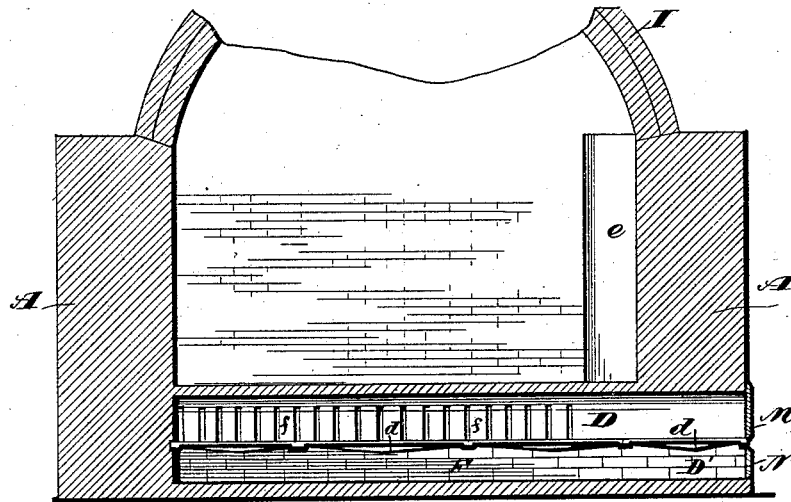


FIG. 3.

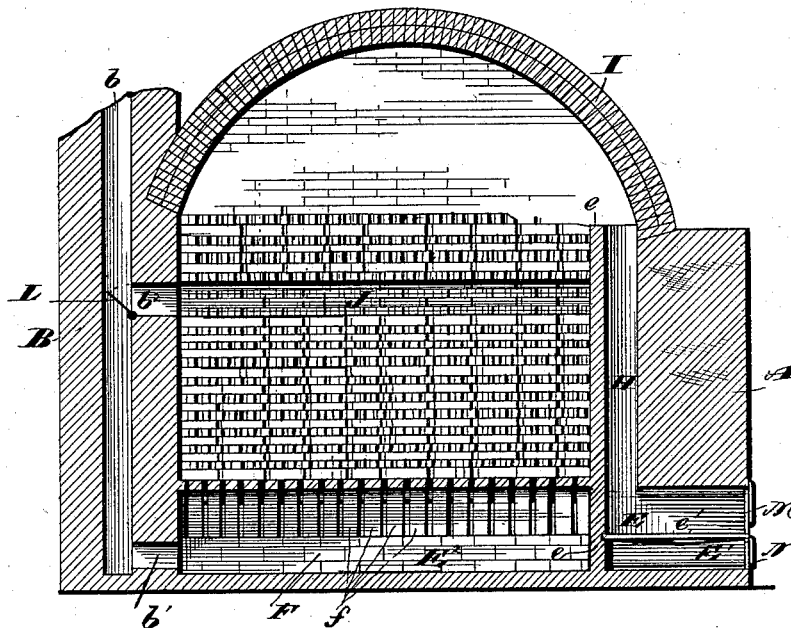


FIG. 4.

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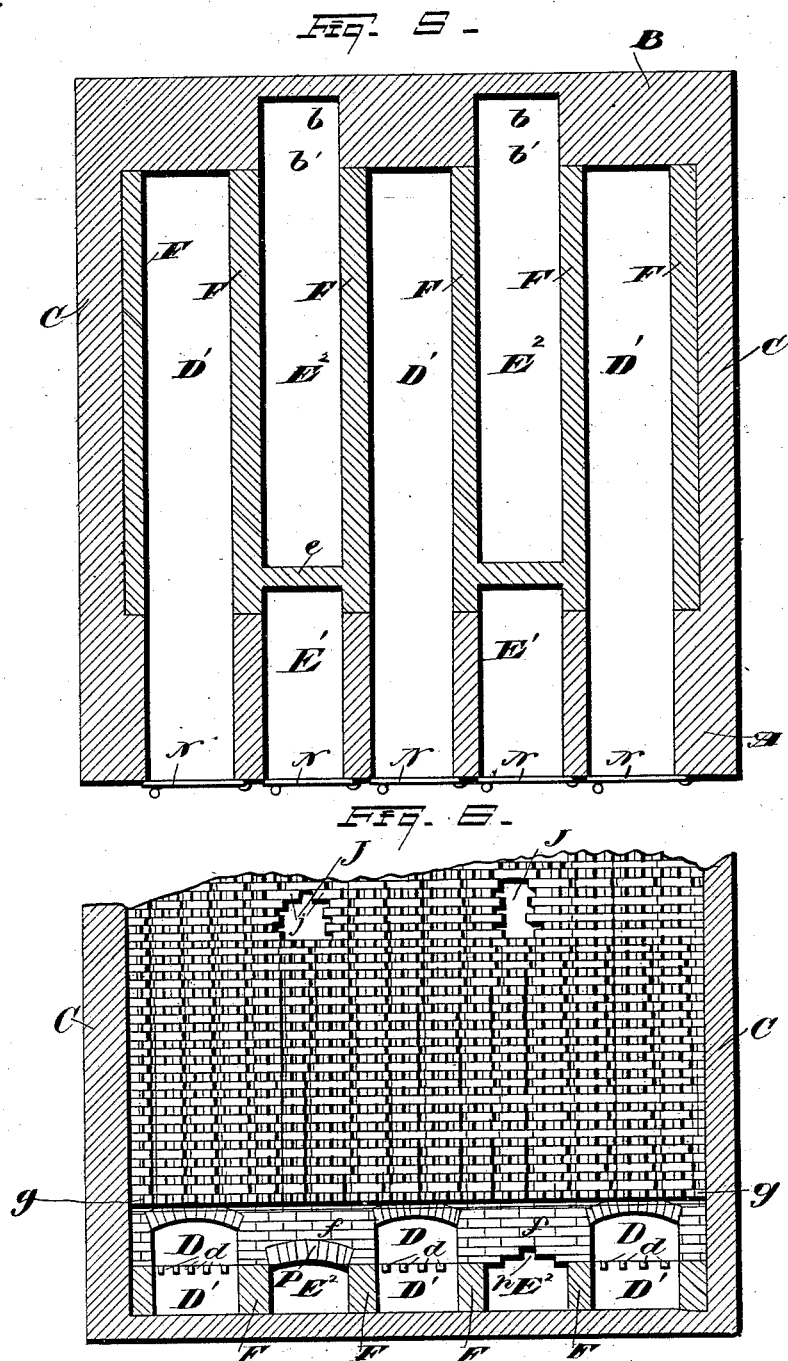
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UNITED STATES PATENT OFFICE.

JAMES W. PENFIELD AND RAYMOND C. PENFIELD, OF WILLOUGHBY, OHIO.

BRICK AND TILE KILN.

SPECIFICATION forming part of Letters Patent No. 307,327, dated October 28, 1884.

Application filed August 16, 1884. (No model.)

To all whom it may concern:

Be it known that we, JAMES W. PENFIELD and RAYMOND C. PENFIELD, of Willoughby, in the county of Lake and State of Ohio, have
5 invented certain new and useful Improvements in Brick-Kilns and Tile-Kilns; and we do hereby 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
10 it pertains to make and use the same.

Our invention relates to improvements in brick-kilns and to a method of setting bricks or other clay products therein to be burned, the object being to provide separate sets of
15 furnaces, respectively, for the "updraft" and "downdraft," and so arranged that either set of furnaces may be used alone, or the two sets may be used conjointly, when required. A further object is to provide chimneys that have,
20 respectively, lateral openings leading into the body of the kiln above the plane of the furnaces, and openings at the bottom of the chimney leading to chambers below the floor of the kiln, and so arranged that the chimneys may
25 be used with either set of furnaces, or for both sets of furnaces operating at the same time. A further object is to arrange the bricks or other clay products in the kiln in such a manner that passage-ways are had through the
30 product and in open relation with the chimneys, to the end that the heat, by means of these passage-ways, is drawn into the center of the kiln.

With these objects in view our invention
35 consists in certain features of construction, in combination of parts, and in the process or manner of setting the products in the kiln, as will be hereinafter described, and pointed out in the claims.

40 In the accompanying drawings, Figure 1 is a front elevation of the lower portion of our improved kiln. Fig. 2 is a horizontal section on the line *xx*, Fig. 1. Fig. 3 is a vertical section taken longitudinally through the center of one of the long furnaces on the line
45 *xx*, Fig. 2. Fig. 4 is a vertical section on the line *yy*, Fig. 2. Fig. 5 is a horizontal section of the kiln on the line *yy*, Fig. 1, or below the grate-bars. Fig. 6 is a transverse vertical
50 section through the center of the kiln.

A represents the front wall, B the rear wall, and C the side walls of the kiln.

D are long furnaces extending from the front to the inside of the rear wall, and are provided with the grate-bars *d* and the ash-
55 pit D'.

E are short furnaces, extending from the front to the walls *e*, and are provided with an ash-pit, E', and grate-bars *e'*.

In constructing the kiln the benches F extend the length of the inside of the kiln and join the front and rear walls, and are of solid mason-work up as far as the top of the grate-bars. Alternate spaces between the benches
60 are under the furnaces D, and form the ash-pits D'. The intervening spaces between the benches are divided by the walls *e*, so that the main and rear portions thereof form, respectively, the chambers E², and the front portion forms so much of the ash-pits E' as are
70 not inclosed in the front wall, A.

Above the line of the grate-bars the benches consist of detached piers *f*, usually about eight inches (more or less) in thickness, and with
75 intervening spaces of three or four inches (more or less) between the piers. These piers run crosswise of the benches, and extend the entire distance between the furnaces D, and consequently across above the chambers E². An arch, P, may span the chamber E² at each
80 pier; or, as these chambers are narrow, the brick in the piers may be breasted out from either side, as shown at *p*, Fig. 6. These piers support the arches G that are over the furnaces D, and the piers extend flush with
85 the top of the arches, as shown in Fig. 6, and a floor, *g*, of tiles is laid thereon, with spaces between the tiles, so that the heat that passes up between the piers and that is transmitted through the arches G may have access to the
90 body of the kiln. Sometimes the piers are laid a few inches above the floor *g*, and a second floor is laid similar to the floor *g*; but we make no claim to the construction or arrangement of the floors.

95 Upon the floor *g*, or upon the upper floor, in case there are more than one, the bricks or other clay products that are to be burned are set in the usual manner, except as hereinafter shown. The cross-walls *e*, as shown in Fig. 5, extend
100

from bench to bench and divide the ash-pits E' from the chambers E'' ; but above the grate-bars the walls c are brought forward and join the front wall, A , as shown in Fig. 2, and inclose the rear end of the furnaces E , and are carried up to near the top of the kiln, as shown in Fig. 4, inclosing, respectively, above the furnaces E , the flues H , that conduct the products of combustion from the furnaces E and discharge them into the kiln near the top arch, I . The short furnaces E have, therefore, no communication with the body of the kiln except through the flues H , and the heat passes over the top of and down through the body of the kiln, and therefore is known as the "down-draft." The heat from the long furnaces D passes up through the kiln, and is known as the "updraft." The flues or chimneys b are constructed within the rear wall, B , at the back end of the chambers E' , with which they are respectively connected by the openings b' . Openings b'' midway up the kiln lead from the body of the kiln to the flues b , and are provided with the dampers L , that may be made to close the openings b'' , or may be turned back so as to close the flues b below the openings b'' . The furnace may be provided with the doors M for firing, and with the ash-pit doors N , provided with the dampers n ; or the furnaces may be regulated in a more primitive manner, well known to brick-makers—to wit, more or less closing the mouths of the furnaces and ash-pits with mud and brick-bats.

In operating the kiln, whenever the furnaces D are fired, either alone or simultaneously with the furnaces E , the dampers L are always turned back so as to close the lower part of the flues b , leaving the openings b'' as the only exit from the kiln. Otherwise the heat from the furnaces D would pass into the chambers E' , and from thence would escape through the openings b' without passing into the body of the kiln, and consequently the heat from these furnaces would be lost.

When the furnaces E only are used, and it is desired to extend the downdraft through the entire kiln, the dampers L are turned forward to close the openings b'' , in which case the downdraft passes through the floor and between the piers f into the chambers E' , and from thence through the openings b' into flues b .

In the process of "burning the kiln," after both sets of furnaces have been in operation for some time it is usually found that the lower and rear portions of the kiln are further advanced—that is, the product is more nearly burned than in other portions. In such cases the fire is partially or entirely withdrawn from the furnaces D , and the fuel is used to feed the furnaces E , and the damper L is regulated accordingly.

The grate-bars at the rear end of the furnaces D usually become clogged, so that little or no draft passes through them, and for this reason tiles might be substituted for grate-bars at the rear end, where the fire usually

consists of live coals pushed back in firing the front part of the furnace. All of this, however, is rather an advantage than otherwise, as there is usually too much heat at the rear and not enough heat at the front and central portions of the kiln. The cause of this is that the heat, by reason of the draft, takes the shortest route toward the unobstructed openings b'' , and consequently passes diagonally either from above or below toward these openings. We remedy this difficulty by setting the bricks in the manner shown in Figs. 4 and 6, that differs from the usual manner only in this, that we leave open spaces or flues J , of considerable size, from front to rear through the product, and connect these flues at the rear directly with the openings b'' . If the flues J are of considerable width, the brick on either side are breasted toward each other, as shown at j , until a brick will span the space between the two side walls.

Another convenient manner of arranging the flues is to make them so narrow that a brick or tile will reach across above, as shown at the right-hand flue, and in this case the flue should be deep enough to give the required area, that should be at least as great as the area of the opening b'' . With this arrangement the products of combustion, following the same laws that, as aforesaid, cause them to take the shortest route to an unobstructed passage-way, would pass from the different points along the furnaces D directly to the nearest point in the flues J . The space above the product and under the arch I is filled with the heated air from the flues H , and this, instead of taking a diagonal route toward the opening b'' , takes shorter routes down through the interstice to the flue J . Usually the products near the exits are not so well burned as in other parts of the kiln, much of the heat having been absorbed before reaching these points, and by reason, also, of the heated currents meeting with less resistance as they approach the exits, passing more rapidly than in other parts of their route. Such would doubtless be the results along the flues J if hot-air currents from but one direction entered these flues; but the two opposing currents from above and below meeting at the flues J seem to react upon each other, and reflect the heat in a similar manner as two opposing jets of water would scatter their commingled volume in all directions; and it is found that the product in the vicinity of these flues is equally well burned as in other parts of the kiln.

With a kiln constructed as described, and with the brick or other clay products to be burned set in such manner as to form the flues J , located as aforesaid, no difficulty will be had in introducing the heat alike to all parts and burning the product evenly throughout the kiln.

By the arrangement of separate furnaces for the up and down draft, and flues and chimneys arranged as aforesaid, by which both

sets of furnaces are operated together, the products may be burned in about half of the time that is required for burning an ordinary kiln. Of course any number of furnaces may be used, according to the size of the kiln.

What we claim is—

1. In a brick-kiln, furnaces D and E, respectively, for an updraft and a downdraft, and so arranged that they may be operated separately or together, substantially as set forth.

2. The combination of the furnaces D and E and the chamber E^2 , substantially as set forth.

3. The combination, with the furnaces D and E and the chamber E^2 , of the flues b , provided with the openings b' and b'' , and the damper L, substantially as set forth.

4. In a brick-kiln, the combination, with two series of furnaces, one series of which is adapted to discharge heated air and products of combustion through the floor of the kiln, and the other series adapted to discharge heated air above the bricks or other products, of chimneys and escape-flues formed in the body of the kiln and communicating with the chimneys, whereby the heated air from one series of furnaces is caused to ascend and the air from the other series caused to descend, substantially as set forth.

5. In a brick-kiln, the combination, with two series of furnaces, one series of which discharges heated air below the bricks or other products, while the other series is provided with vertical flues for discharging air above the bricks or other products, of chimneys, chambers E^2 in communication with said chimneys, flues J formed in the body of the kiln

through the bricks and communicating with said chimneys, and dampers adapted to close the flues J, or close the chimney below said flues.

6. In a brick-kiln, the combination, with two series of furnaces, respectively, for an updraft and downdraft, of chimney and lateral flues located between the discharging-points of the two series of furnaces, whereby the air from one series is caused to ascend and the air from the other series descend before it can escape.

7. In a brick-kiln, chimneys located, preferably, in the rear wall of the kiln, and provided above and below the floor of the kiln with flues leading, respectively, directly into the body of the kiln above the floor, and the ducts leading into chambers under the floor, substantially as set forth.

8. In a brick-kiln, the combination, with the furnaces D, of the chambers E^2 , arranged alongside of said furnaces, and the piers f , with spaces between the piers, and so arranged that the said furnaces, chambers, and spaces between the piers are in open relation with each other through the width of the kiln, substantially as set forth.

In testimony whereof we sign this specification, in the presence of two witnesses, this 30th day of July, 1884.

JAMES W. PENFIELD.

RAYMOND C. PENFIELD.

Witnesses:

GEO. W. CLEMENT, Jr.,

JOHN W. MAYNARD.