

(No Model.)

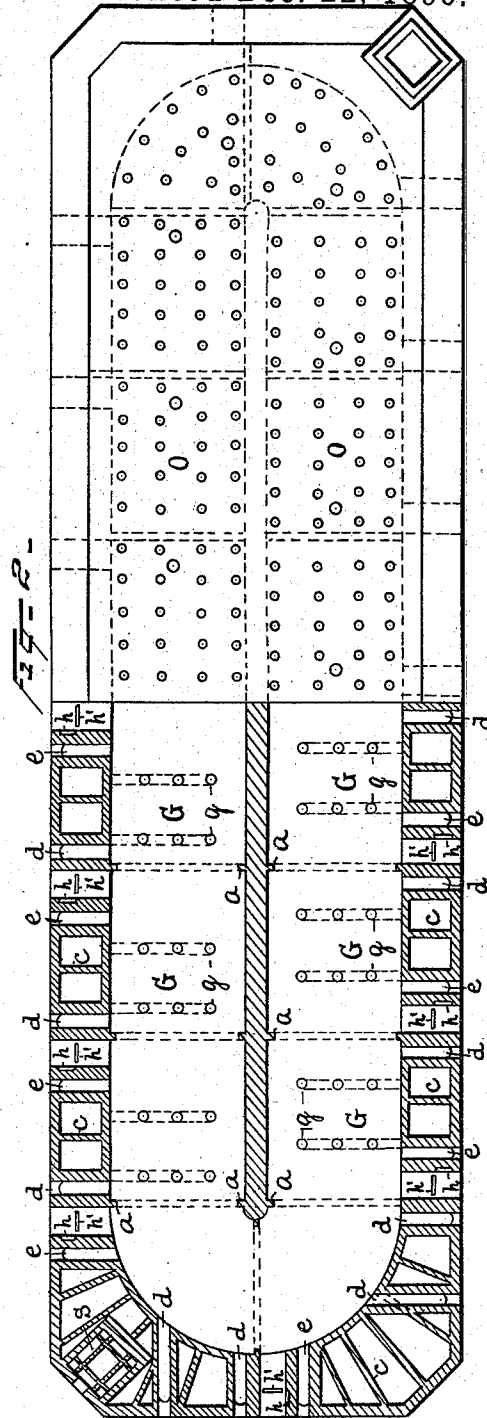
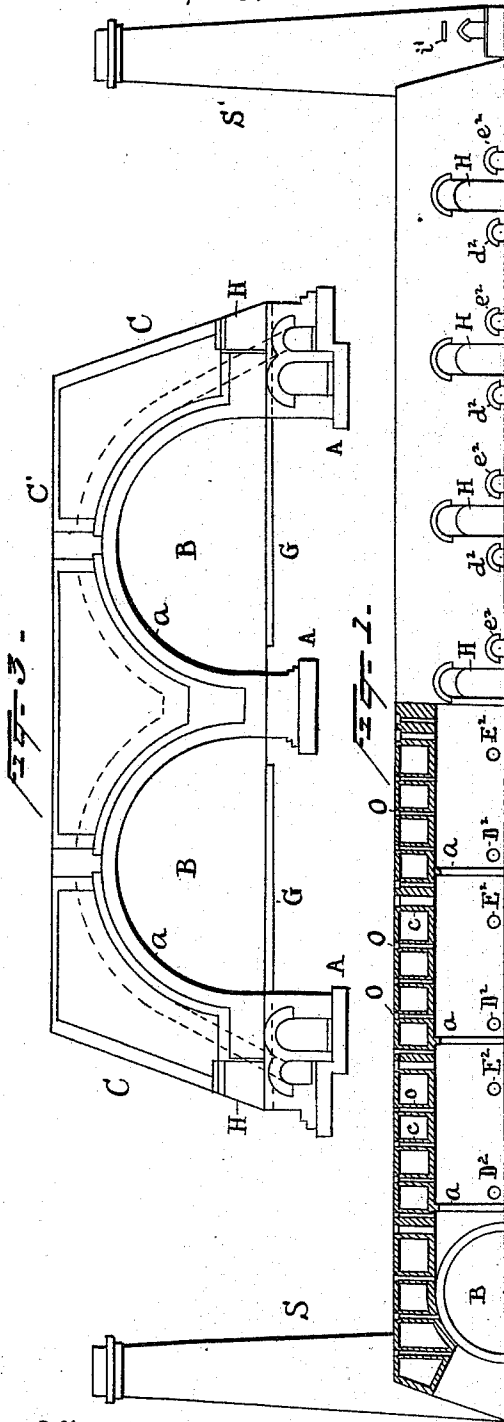
5 Sheets—Sheet 1.

C. E. COATES & L. HANCOCK.

BRICK KILN.

No. 573,445.

Patented Dec. 22, 1896.



Witnesses
Lorris A. Clark.
D. P. P.

Charles E. Coates Inventor.
Lewellyn Hancock.
By their Attorneys.
Dyer & Atwood

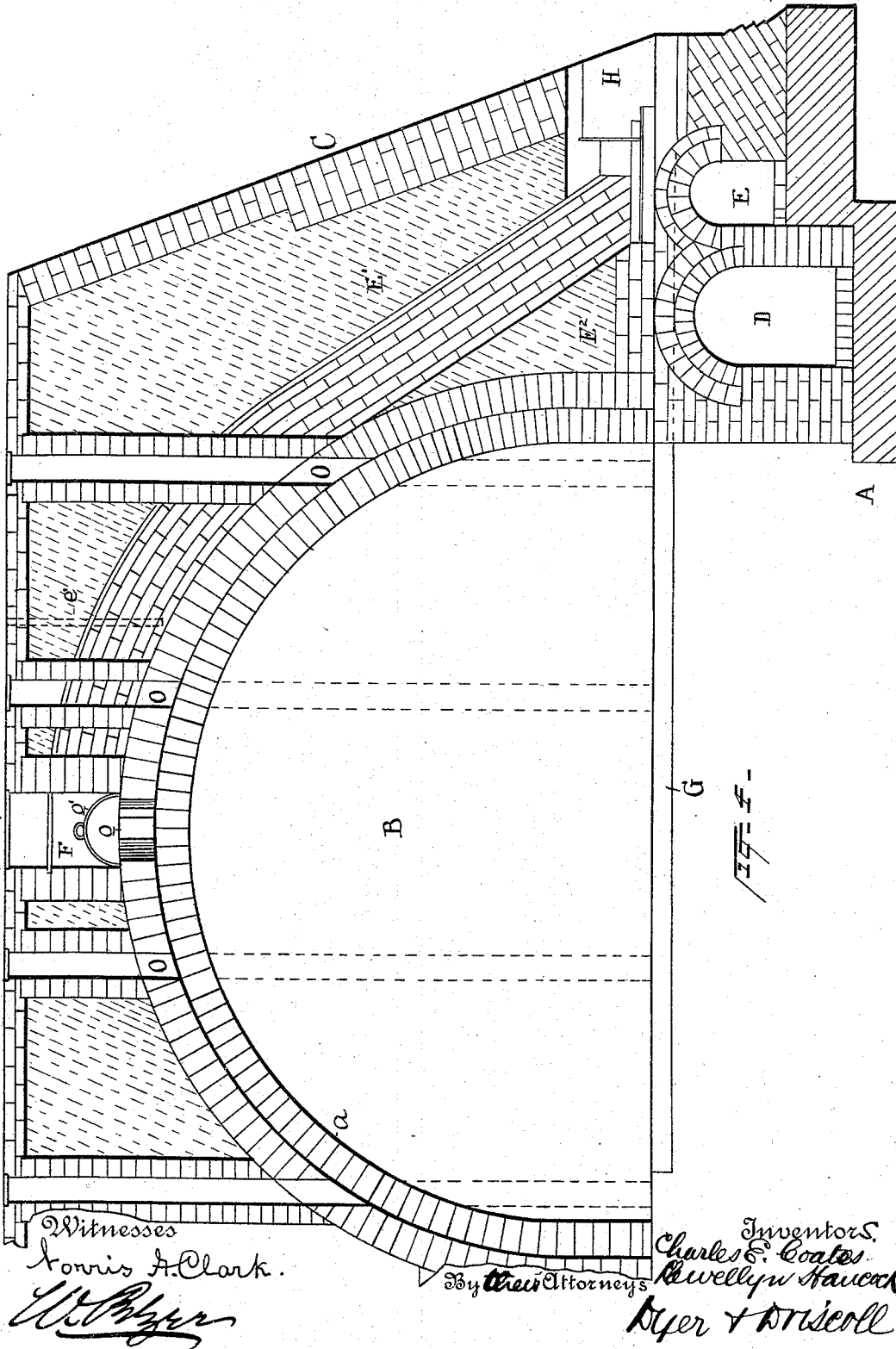
(No Model.)

5 Sheets—Sheet 2.

C. E. COATES & L. HANCOCK.
BRICK KILN.

No. 573,445.

Patented Dec. 22, 1896.



Witnesses

Norris A. Clark.

W. P. H. H.

By their Attorneys

Inventors

Charles E. Coates

Llewellyn Hancock

Dyer & Driscoll

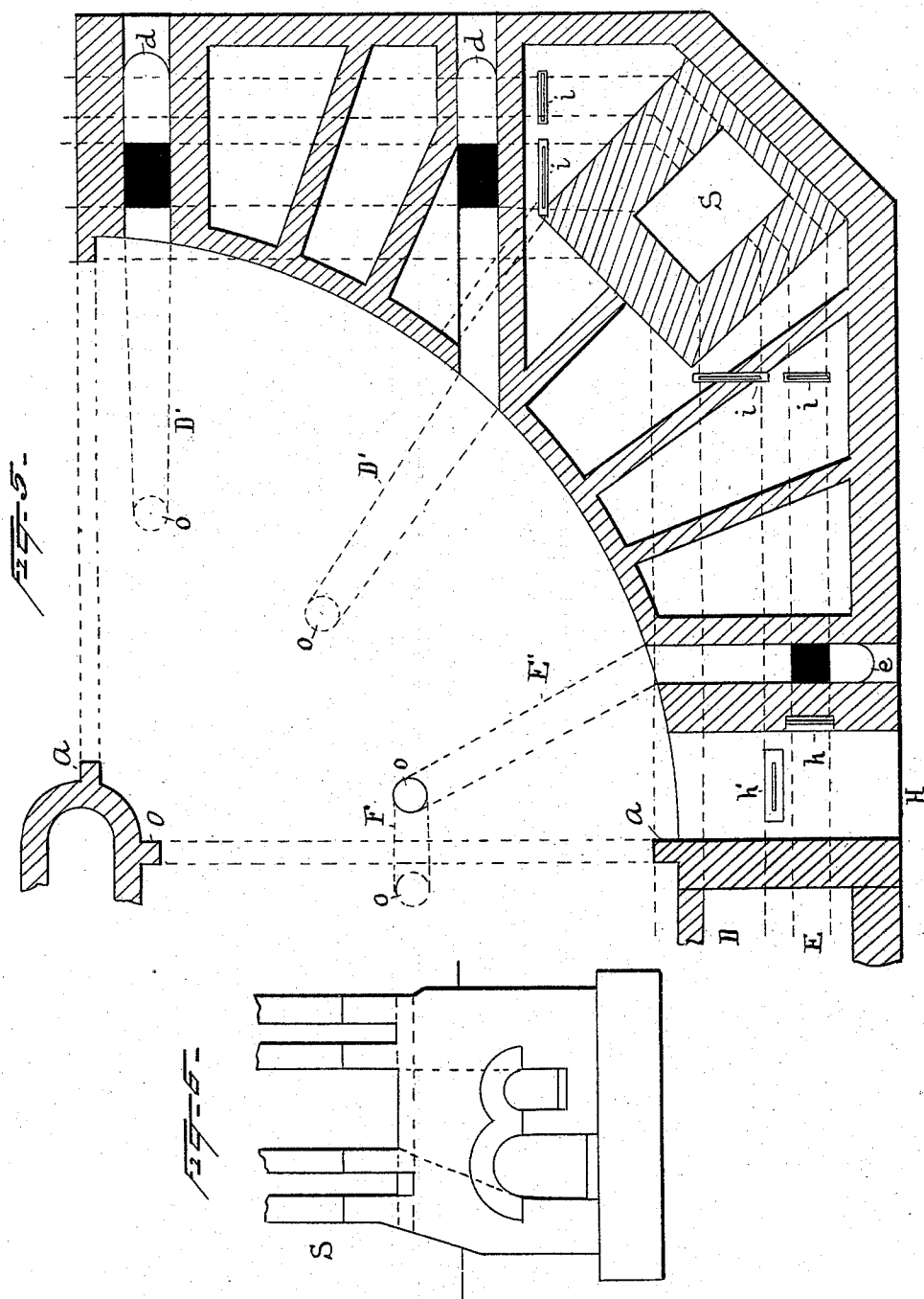
(No Model.)

5 Sheets—Sheet 3.

C. E. COATES & L. HANCOCK.
BRICK KILN.

No. 573,445.

Patented Dec. 22, 1896.



Witnesses
Norris A Clark
N. A. Clark

Charles E. Coates Inventors.
Llewellyn Hancock
By their Attorneys. *Nyer & Wiscoll*

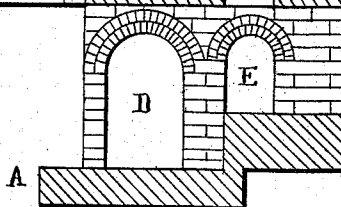
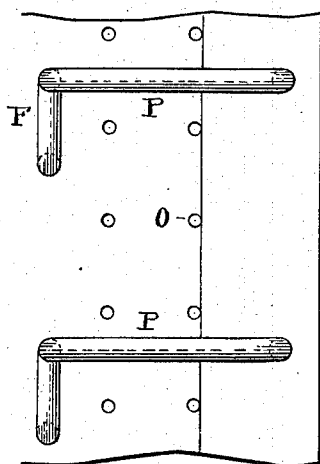
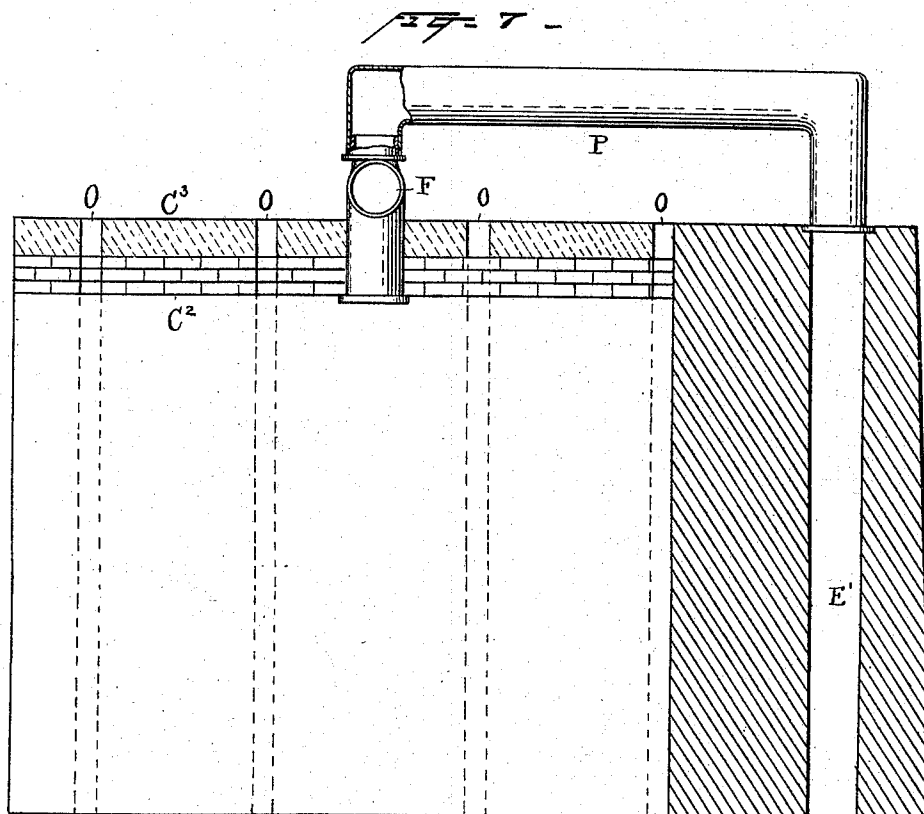
(No Model.)

5 Sheets—Sheet 4.

C. E. COATES & L. HANCOCK.
BRICK KILN.

No. 573,445.

Patented Dec. 22, 1896.



Witnesses
Lewis A. Clark.
W. P. H. J.

Charles E. Coates Inventors
Llewellyn Hancock
By their Attorneys
Dyer & Driscoll

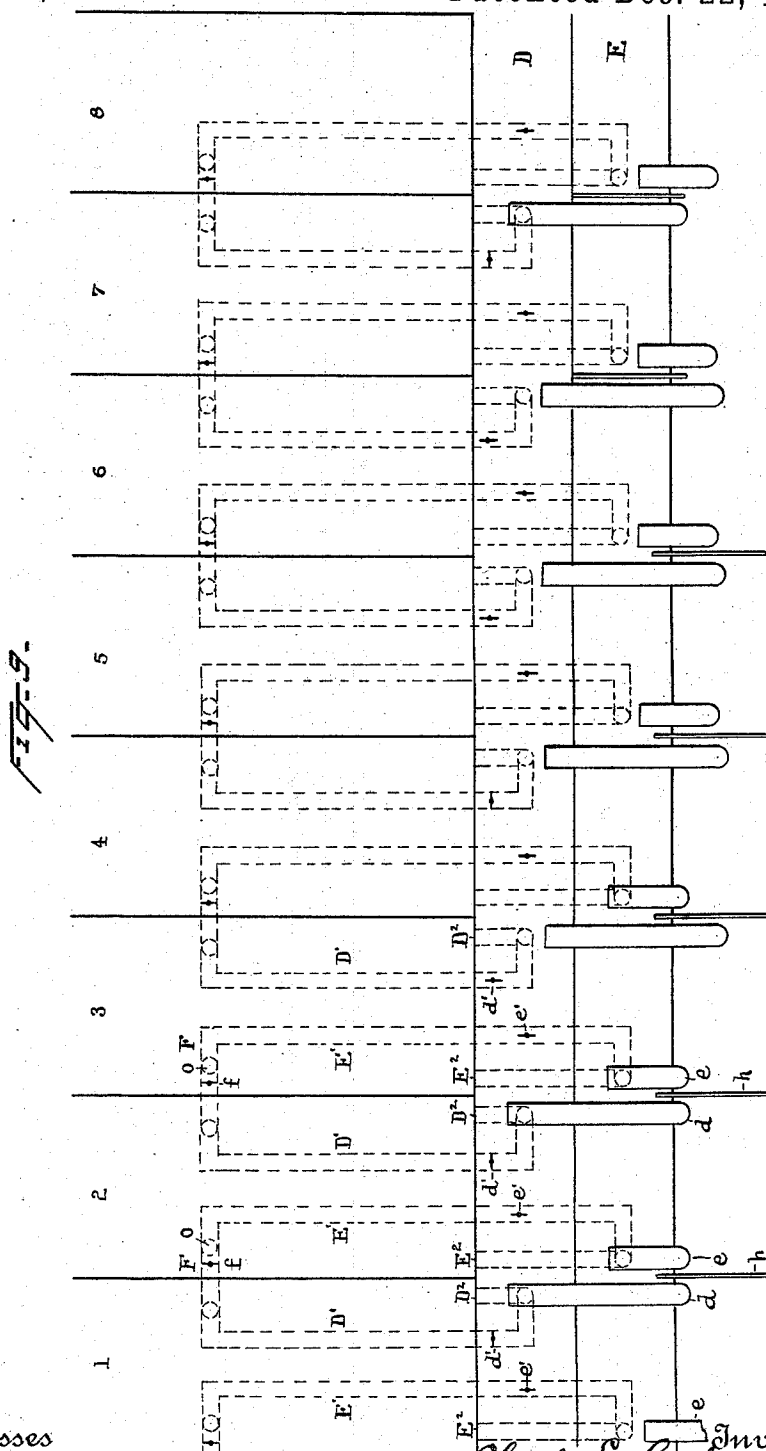
(No Model.)

5 Sheets—Sheet 5.

C. E. COATES & L. HANCOCK.
BRICK KILN.

No. 573,445.

Patented Dec. 22, 1896.



Witnesses

Horris H. Clark.

[Handwritten signature]

Inventors.

Charles E. Coates
Newellyn Hancock

By their Attorney:

⁵ ~~Myer~~ Horiscol

UNITED STATES PATENT OFFICE.

CHARLES E. COATES AND LLEWELLYN HANCOCK, OF WOODBRIDGE, NEW JERSEY.

BRICK-KILN.

SPECIFICATION forming part of Letters Patent No. 573,445, dated December 22, 1896.

Application filed January 25, 1896. Serial No. 576,777. (No model.)

To all whom it may concern:

Be it known that we, CHARLES E. COATES and LLEWELLYN HANCOCK, subjects of the Queen of Great Britain, residing at Woodbridge, in the county of Middlesex and State of New Jersey, have invented a certain new and useful Improvement in Brick-Kilns, of which the following is a specification.

Our invention relates to what are known as "continuous" brick-kilns, in which the drying, burning, and cooling is carried on as a continuous process, and wherein the heat escaping from the cooling-chambers is utilized for drying green brick in other chambers preparatory to firing; and our invention is designed to give greater economy and efficiency and to insure full control of the kiln in operation.

In carrying our invention into effect we employ two main flues, preferably of different diameters. The larger of the two serves as the draft-flue for the burning-chambers and for carrying off the products of combustion and the steam from the drying-chambers, and the smaller one is mainly for conveying the hot air from the cooling-chambers to the drying-chambers. These flues are preferably located beneath the level of the chambers and extend around the entire structure, under the outer walls thereof. Each chamber is provided with two sets of flues. One set leads from the main draft-flue to the top and bottom of the chamber at one end, and the other set leads from the main hot-air flue to the top and bottom of the chamber at the opposite end of the chamber. The adjacent branch flues which enter the tops of the chambers are connected by a flue provided with a damper to control communication between them. Each set of branch flues leading from the main flues is provided with a damper controlling communication with the main flues, and in addition to these dampers each of the flues leading to the tops of the chambers is provided with a separate damper for independently regulating the updraft. By providing the flues extending from the top and bottom of each chamber to the main draft-flue an up-and-down draft is produced, which results in a more uniform burning of the brick, and by providing similar flues leading to main hot-

air flue more hot air is conveyed from the cooling-chambers to the drying-chambers, the hot air being drawn out both at the top and bottom of the cooling-chamber, and this also results in a more uniform cooling of the brick. The hot air entering the drying-chambers at the top and bottom greatly facilitates the drying of the green brick and dries them evenly from the top and bottom, which guards against the crushing of the green brick at the bottom of the chamber. This objection exists in brick-kilns where the hot air enters the drying-chambers from the top only, in which case the brick dry from the top downward, which often results in the crushing of the green brick at the bottom of the chamber, which, being still wet, are unable to stand the weight of the mass of brick above. The drying of the brick from the top downward also tends to drive the moisture from the upper brick downward, which makes the brick at the bottom of the chamber more moist, rendering them more liable to become crushed. This is entirely avoided by our method of drying the brick both from the bottom and top of the chamber. The moisture and the air from the drying-chambers pass out both from the top and bottom of the chamber into the main draft-flue for the burning-chambers.

To increase the draft when necessary, we provide dampers between the two main flues at each chamber, which are designed to be opened beyond a drying-chamber, whereby the draft is greatly increased in all the chambers in operation. We also provide lateral flues entering the bottom of each chamber from the exterior of the structure to permit the entrance of cold air into a burning-chamber to regulate for any desired temperature, thus guarding against the burning of the brick beyond the desired degree. We may also connect the branch flues entering the top of the chambers on one side of the kiln with those entering the top of the chambers on the other side, and from these connections we may extend a branch through the central wall of the kiln to near the bottom of the chambers. Thus the hot air from one side may be directed to the other side of the kiln, if desired.

Our improved kiln in one form is con-

structed in two parallel arches joined at the ends by curved arches and the whole covered with brick and earth. The flues leading from the top of the arches are built directly over the arches through the brick and earth covering to the main flues. Where it is desired to have an open-top kiln, we provide vertical pipes or flues built within the outer walls and extending upward from the main flues, and these vertical flues are connected by removable pipes with openings provided in the covering for the mass of green brick in the chambers. The mass of green brick is preferably covered by several layers of brick and a covering layer of sand. The green bricks are piled up in the chambers in the usual manner, with vertical passages for the fuel in line with the fuel-holes in the top of the structure and with lateral passages to permit the radiation of heat and cold air to facilitate the drying, burning, and cooling of the brick.

Our invention is illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation and partial central vertical section; Fig. 2, a top plan view and partial horizontal section; Fig. 3, a vertical cross-section showing the arches; Fig. 4, an enlarged vertical cross-section of one arch; Fig. 5, an enlarged horizontal section of one of the chimney-corners of the structure; Fig. 6, an elevation of the base of the chimney. Figs. 7 and 8 are respectively a partial vertical cross-section and a partial plan view, illustrating an open-top kiln; and Fig. 9 is a diagrammatic view illustrating a number of chambers and their connection by branch flues with the main flues.

Referring to the drawings, A A are the foundations upon which the two arches B B are built.

C C are the outer walls of the structure, and C' is the roof. The arches and the outer walls are connected by transverse webs *c*, and the intervening spaces are filled with earth or other suitable material. Extending around the entire structure under the outer walls are the two main flues D and E, the flue D being the draft-flue for the burning-chambers and for carrying off the products of combustion to the stack, and the flue E is for conveying the hot air from the cooling-chambers to the drying-chambers. Both main flues beyond the drying-chambers may be employed to carry off the steam and air from the drying-chambers. The two arches are provided with ribs *a* at uniform distances apart, which mark the chambers for piling up the brick. In Fig. 2 of the drawings sixteen of such chambers are indicated. For each chamber branch flues D' and E', at opposite ends of the chambers, are provided. These flues lead from the top of the chambers and connect, respectively, with the main flues D and E, and the flues D' and E' of adjacent chambers are connected by a short flue F. In line with the flues D' and E' are branch flues D² and E², Fig. 1, also connecting, re-

spectively, with the main flues D and E and entering the chambers near the floor.

For controlling communication between the main flues D and E and the branch flues D' D² and E' and E², respectively, dampers *d* and *e* are provided, which are accessible through the side walls of the structure, and in addition to these dampers the flues D' and E' are provided with separate dampers *d'* and *e'*, which are controlled from the roof of the structure by suitable rods passing down through the walls of the structure. The openings *o* in the top of the arches where the flues D' and E' enter are provided with suitable covers *o'*, accessible from the roof of the structure for controlling communication between the chambers and said flues, and the short flues F, connecting the adjacent openings *o*, are provided with dampers *f*.

The main flues E are provided with dampers *h* opposite each chamber for directing the hot air from the cooling-chambers into the drying-chambers, and opposite each chamber is also placed a damper *h'* for controlling communication between the two main flues for regulating the draft. The dampers *h'* are designed to be opened beyond the drying-chambers to increase the draft in the main flue D when necessary.

Each chamber is provided with an entrance II, and the dampers *h* and *h'*, before referred to, are accessible at these entrances. At each side of entrance II are openings *d*² and *e*², through which the dampers *d* and *e* are accessible. The entrances II and openings *d*² and *e*² are closed with brick and clay during the operation of the kiln, as is customary. The chambers at the four corners of the structure are each provided with an extra pair of flues D' and D², Figs. 2 and 5, connecting with the main flue D. The object of these additional flues is to balance the draft at the curved ends of the arches. The flues for admitting cold air to regulate the temperature of the burning-chambers are indicated at G and extend under the floor of the chambers, two being shown for each chamber and having openings *g*. These flues extend to the exterior of the structure and are provided with suitable doors or covers. (Not shown.)

Both main flues communicate with the stacks S, and both flues are provided with dampers *i* *i*, Fig. 5, at each side of the stack. When the kiln is worked in two sections, one stack for each section, dampers *i* on one side of the stacks are closed to prevent back draft. The stacks S are also provided with dampers *i'*, Fig. 1, located within the stacks for shutting them off entirely from the main flues when it is desired to work the kiln with one stack only, and thereby increasing the draft. In such case all the dampers *i* will be opened at the stack whose damper *i'* is closed. The stacks are provided with double walls, leaving spaces *s*, Fig. 2, which allow for expansion and contraction.

In the open-top kiln illustrated in Fig. 7

the green bricks are stacked almost as high as the walls of the structure, and over the green brick for a covering several layers C³ of finished brick are placed and the whole covered with a layer C³ of sand or other suitable material. In this form of kiln the flues D' and E' rise vertically in the side walls of the structure, and pipes F connect adjacent chambers similarly to the branch flues F in the arched kiln. The pipes F are connected with flues D' and E' by cross-pipes P. In a double open-top kiln having sixteen chambers, eight on each side, about four sets of the pipes F and P are required on each side, and these pipes are removed from one chamber to another as the operation of the kiln proceeds. With the exceptions just noted the flues and their controlling-dampers are the same in the arched and open-top kilns, as is also the mode of operation.

The green bricks are stacked in the chambers in the usual manner, with spaces in line with the fuel-feeding holes O, and lateral passages are also formed to permit the radiation of heat in all directions to thoroughly and uniformly burn the brick, and also to permit the heat from a cooling-chamber to radiate entirely through the mass of green brick in a drying-chamber, as is well understood. The ribs *a* mark the ends of the chambers, and in stacking the green brick, when a rib *a* is reached, a heavy paper partition is placed over the pile of brick, as usual.

In practice our kiln may be operated by carrying on the drying, burning, and cooling separately in the two sides of the kiln in the same direction, so that the two sides are operated practically as independent kilns, the work in one side following up the work in the other side, or, if desired, the kiln may be operated from one side, working around the entire structure instead of working from both ends.

The operation of our improved kiln is as follows, assuming that the brick in the diagonally opposite chambers 1 have already been burned and are cooling and that the brick in chambers 2 and 3 are burning, that the green brick in chambers 4 are fully dried, and that the green brick in chambers 5 and 6 are being dried by the heat escaping from chambers 1, in which the brick are cooling: To operate in this manner, the covers *o'* at the crown of chambers 1, controlling communication with flue E', will be removed and dampers *e'* and *e* of that flue will be open, and the dampers *h* in the main flue E will be open opposite chambers 1 to 6 and closed at 7, and the dampers *e* and *e'* of flues E' and E² at chambers 5 and 6 will be open and the covers *o'* for openings *o*, to which the flues E' of those two chambers lead, will be removed and the dampers *f* in the connecting-flues F at those chambers will be closed. Thus the hot air from chambers 1 passes out at the top and bottom through their flues E' and E² into main flues E and into chambers 5 and 6 at the top and bottom

through their flues E' and E². To regulate the entrance of the hot air into chambers 5 and 6, the dampers *e* and *e'* may be adjusted to direct more or less hot air into either flue E' or E², causing more or less hot air to enter the top or bottom of the chamber to meet all requirements. Under the conditions assumed the brick in chambers 2 are burned to about the desired degree, the burning of the brick in chambers 3 being well under way and the brick in chambers 4 just fired. All connections between chambers 2, 3, and 4 with main flue E are shut off, and the dampers of flues D' and D² at chambers 2 are also closed. At chambers 3 the covers *o'* are removed and the dampers *d* and *d'*, controlling communication with main flue D, are open, producing an up-and-down draft in those chambers, and at chambers 4 the covers *o'* are in place and dampers *d'* are closed, but dampers *d* are open, producing a downdraft only. As the fire reaches chamber 5 the position of the various dampers are altered to correspond with the positions just described, and these changes are made progressively, as will be readily understood. If it is desired to dry and burn in more or less chambers at one time than the number stated, the various dampers may be adjusted as desired; or if, for instance, in the operation described it may be desired to burn in chambers 3 with a downdraft only and in chambers 4 with an up-and-down draft the dampers *d* and *d'* and covers *o'* may be adjusted to operate in that manner, and, as before stated, the various dampers may be opened partially or entirely to meet different conditions or requirements.

The operation will be the same when the kiln is worked from one side only, and this applies also to the open-top kiln.

What we claim is—

1. The combination in a continuous brick-kiln, of a main draft-flue leading to the stack, branch flues from said draft-flue to the upper and lower part of each section of the kiln, and dampers for controlling communication between said branch flues and draft-flue whereby the kiln may be operated with an up-and-down draft, a hot-air flue, branch flues extending therefrom to each section of the kiln, and dampers in the said last-named branch flues and in the hot-air flue for directing the hot air from the cooling-sections to the drying-sections, substantially as set forth.

2. The combination in a continuous brick-kiln, of a main draft-flue leading to the stack, branch flues from said draft-flue to the upper and lower part of each section of the kiln, and dampers for controlling communication between said branch flues and draft-flue whereby the kiln may be operated with an up-and-down draft, a hot-air flue, branch flues extending from said hot-air flue to the upper and lower part of each section of the kiln, dampers in said last-named flues for controlling communication between the same and the main hot-air flue, and dampers in the

main hot-air flue whereby the hot air from the cooling-sections escapes at the top and bottom of each section, and whereby such hot air may be directed into the drying-sections at the lower or upper parts thereof, or both, substantially as set forth.

3. The combination in a continuous brick-kiln, of two main flues, branch flues extending therefrom to each section of the kiln, and dampers opposite each section of the kiln for controlling communication between said main flues, by the manipulation of which the draft in the main flues may be regulated, substantially as set forth.

4. The combination, in a continuous brick-kiln, of two main flues D and E, branch flues D', D² and E', E² extending from the main flues respectively to the top and bottom of each chamber, dampers for controlling communication between said branch and main flues, and dampers in the main flue E opposite each chamber, substantially as and for the purpose set forth.

5. The combination, in a continuous brick-kiln, of two main flues D and E, branch flues D', D² and E', E² extending from the main flues respectively to the top and bottom of each chamber, dampers for controlling communication between said branch and main flues, a flue F connecting the flues D' and E' of adjacent chambers, and dampers in the main flue E opposite each chamber, substantially as and for the purpose set forth.

6. The combination, in a continuous brick-kiln, of two main flues D and E, branch flues D', D² and E', E² extending from said main flues respectively to the top and bottom of each chamber, dampers for controlling communication between said branch and main flues, separate dampers d' and e' in flues D' and E' respectively, a flue F connecting the flues D' and E' of adjacent chambers, dampers f in said flues F, and dampers h in the main flue E opposite each chamber, substantially as and for the purpose set forth.

7. The combination in a continuous brick-kiln, of two stacks, a main draft-flue extending entirely around the kiln and communicating with both stacks, branch flues extending from said main flue to each section of the kiln, and dampers in said main flue whereby the kiln may be worked independently in two sections in either direction, or as one continuous kiln in either direction, substantially as set forth.

8. The combination in a continuous brick-kiln, of two stacks, a main draft-flue extending entirely around the kiln and communicat-

ing with both stacks, branch flues extending from said main flue to each section of the kiln, dampers in the main draft-flue at each side of both stacks, by the adjustment of which the kiln may be worked independently in two sections in either direction, and a damper in each stack for cutting out of use either stack to operate as one continuous kiln with either stack, substantially as set forth.

9. In a continuous brick-kiln, the combination of a main draft-flue extending entirely around the kiln, branch flues extending therefrom to each section of the kiln, two stacks located at opposite points and with which said main draft-flue communicates, a main hot-air flue, branch flues extending therefrom to each section of the kiln, and controlling-dampers for said main and branch flues and said stacks, substantially as set forth.

10. The combination, in a continuous brick-kiln, having a number of chambers or sections, of the main hot-air flue, branch flues extending from said hot-air flue to each section, whereby the hot air from a cooling-section is conducted to the drying-sections in advance of the burning-sections, and crossover connections from the sections on one side of the kiln to the sections on the other side of the kiln, whereby the hot air from the cooling-sections on one side of the kiln may be conducted to the drying-sections on the opposite side of the kiln independently of the main hot-air flue, substantially as set forth.

11. The combination, in a continuous brick-kiln, having a number of chambers or sections arranged in two rows with a dividing-wall between the two rows, of a main hot-air flue extending entirely around the structure, branch flues extending from said main hot-air flue to each section, whereby the hot air from a cooling-section is conducted to the drying-sections in advance of the burning-sections, and crossover connections from the sections on one side of the kiln to the sections on the other side of the kiln, whereby the hot air from the cooling-sections on one side of the kiln may be conducted to the drying-sections on the opposite side of the kiln independently of the main hot-air flue, substantially as set forth.

This specification signed and witnessed this 6th day of January, 1896.

CHARLES E. COATES.
LLEWELLYN HANCOCK.

Witnesses:

J. V. FREEMAN,
E. M. CLARK.