(No Model.) 2 Sheets—Sheet 1

C., A., S. & L. DUBOIS D'ENGHIEN.

KILN FOR BAKING EARTHENWARE.

No. 512,284. Patented Jan. 9, 1894.

Fig. I.

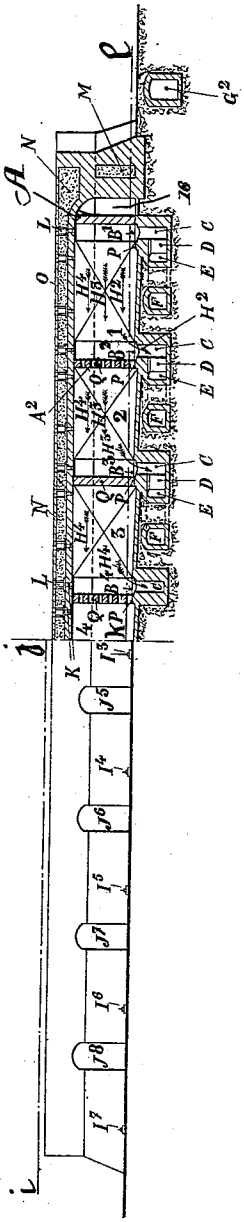
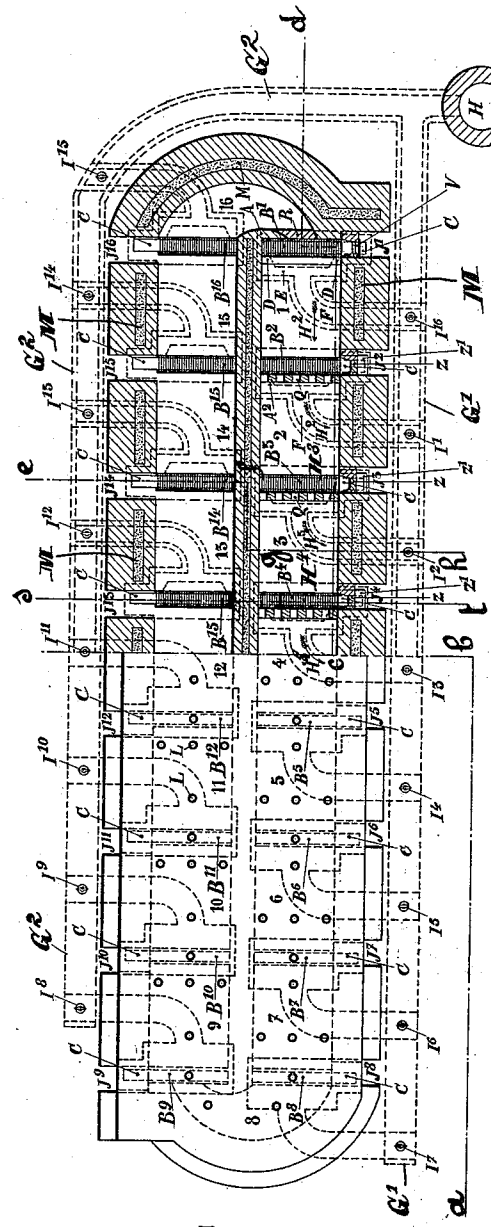


Fig. II.



Witnesses:
H. G. Victerick
M. J. L. Higgins

Inventors:
Charles Dubois d'Enghien,
Alphonse Dubois d'Enghien,
Silvain Dubois d'Enghien and
Léon Dubois d'Enghien
By Munn & Co
Attys.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

C., A., S. & L. DUBOIS D'ENGHIEN.

KILN FOR BAKING EARTHENWARE.

No. 512,284. Patented Jan. 9, 1894.

Fig. V.

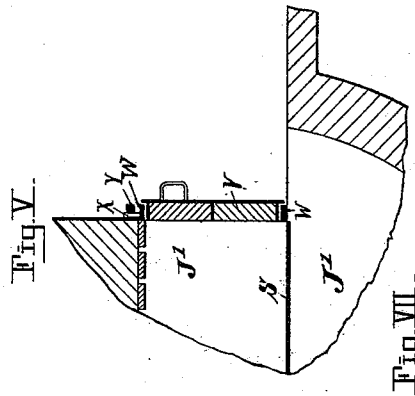


Fig. VII.

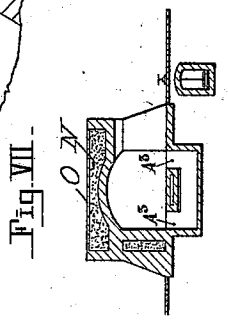


Fig. IV.

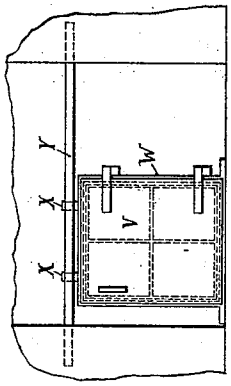


Fig. VI.

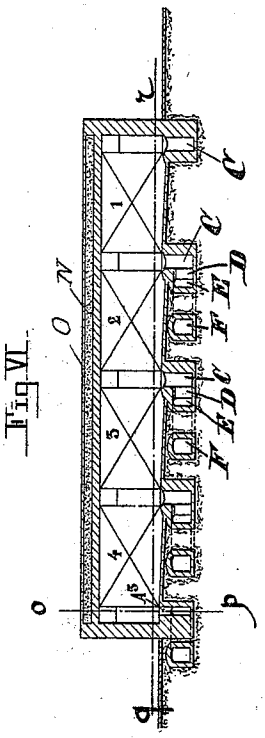


Fig. VIII.

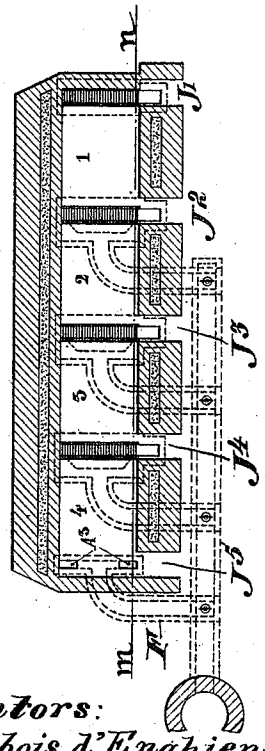
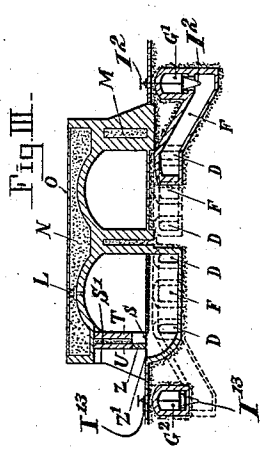


Fig. III.



Witnesses:
H. G. Wieterich
M. L. Higgins

Inventors:
Charles Dubois d'Enghien,
Alphonse Dubois d'Enghien,
Silvain Dubois d'Enghien and
Léon Dubois d'Enghien
By Munn & Co Attys.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

CHARLES DUBOIS D'ENGHIEN, ALPHONSE DUBOIS D'ENGHIEN, SILVAIN DUBOIS D'ENGHIEN, AND LÉON DUBOIS D'ENGHIEN, OF HENNUYÈRES, BELGIUM.

KILN FOR BAKING EARTHENWARE.

SPECIFICATION forming part of Letters Patent No. 512,284, dated January 9, 1894.

Application filed May 8, 1893. Serial No. 473,480. (No model.)

To all whom it may concern:

Be it known that we, CHARLES DUBOIS D'ENGHIEN, ALPHONSE DUBOIS D'ENGHIEN, SILVAIN DUBOIS D'ENGHIEN, and LÉON DUBOIS D'ENGHIEN, subjects of the King of Belgium, residing at Hennuyères, in the Kingdom of Belgium, have invented certain new and useful Improvements in Kilns for Baking Earthenware; 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 it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

Our invention has relation to kilns for baking or firing earthenware of all descriptions, and has for its object a construction whereby the operation of firing may be made a continuous one, and whereby other advantages are obtained which will hereinafter be referred to.

In the accompanying drawings—Figure I is a side elevation partly in vertical section on the line *a*, *b*, *c*, *d*, of Fig. II, which is a top plan view partly in section on the line *i*, *j*, *k*, *l*, of Fig. I. Fig. III is a cross section of the kiln on the line *e*, *f*, *g*, *h*, of Fig. II. Fig. IV is a detail elevation of one of the furnace doors or gates, Fig. V showing the same in section. Fig. VI is a section on the line *m*, *n*, of Fig. VIII, and Figs. VII and VIII are like views on the lines *o*, *p*, and *q*, *r*, respectively, of Fig. VI.

The kiln for continuous firing or baking consists of two vaulted or arched galleries connected at opposite ends by segmental chambers, the vertical walls of the kiln above the ground or floor being preferably made hollow, the vacant space in said walls being filled with a non-conductor of heat, as sand, to prevent loss of heat by radiation, as shown at M, Fig. II. The encompassing vertical walls of the kiln are also projected above the arched roofs of the two galleries and the space filled in with sand, as shown at N, and paved, as indicated at O, Figs. I, III, VI, and VII, whereby a perfectly level roof is obtained which can be utilized as a drying floor.

In order that the progress of the baking or firing may be supervised, we provide in the roof of each space, 1 to 7, and 9 to 15, respectively, three, more or less, sight openings, formed by flanged tubes resting on the arch and closed in any suitable manner, as by means of plugs or bell shaped covers, or the like.

The two galleries are divided into substantially polygonal spaces, preferably of equal dimensions, as indicated by the numerals 1 to 7, and 8 to 15, inclusive, by means of grates indicated by the letters B′ to B^{16} inclusive. Below each grate there is an ash pit, C, to which access is had through a man hole $C^{\times}$ flush with the floor, substantially as shown in Fig. V, and in said side walls of the kiln at the end of each grate we form a man-hole, said man-holes being indicated by the letters J′ to J^{16}, inclusive. Each ash pit is separately connected with a main flue, as G′, or G^2, through passages D, E, and a branch flue, F, said main flues, G′, and G^2, extending along the two galleries and being connected with a chimney, H, as shown in Fig. II in dotted lines. The flues, F, G′, G^2, are all of the same cross-sectional area for the purpose of securing a uniform and regular draft, and at the point of junction between said branch flues, F, and their main flues, G′, G^2, we arrange a damper, the rod of which extends through the floor for manipulation, as shown in Fig. III, and said dampers and their rods are indicated by the letters I′ to I^{16}, inclusive. We have shown the dampers in the form of cone valves, see Fig. III, though any other construction of damper may be resorted to, the form shown having been chosen on account of the facility of manipulation.

As shown in Fig. I, the floor of each space, 1 to 7, and 9 to 15 respectively, is inclined slightly toward the right of the kiln, a pier, P, being thus formed at the left side of each grate, for a purpose presently to be explained.

From an inspection of Fig. II it will be seen that the end chambers, 8 and 16 are gradually

contracted. In the chamber 8 the contraction takes place from grate B^8 to grate B^9, or from the front chamber to the rear chamber, the reverse being the case in chamber 16. This construction has for its object to compel the hot gases and products of combustion to impinge upon the outer curved wall of the chambers, to be thereby deflected onto and between the material therein, said hot gases and products of combustion escaping from said chambers into spaces 9 and 1 respectively through comparatively narrow vertical openings, the opening, Fig. II, leading to space 1 being shown as bricked up, as indicated by the letter R, for purposes hereinafter described.

The operation of the kiln may be briefly described as follows:—To start the kiln the space leading from chamber 16 to space 1, is temporarily bricked up, and said space 1 filled with the ware to be baked or fired up to grate B^2, and an open or checker-work temporary brick partition A^2 is built upon the pier, P, at the left of said grate B^2, and paper pasted over the left face of said wall A^2 to close the passages Q therein. The man holes J′ and J^2 are then closed up, (as shown in Fig. III, in reference to the man hole at the end of grate B^{14},) preferably by means of a double brick wall U T having an intermediate filler of sand, said wall being supported by a grating S at the outer end of the fuel grate B^2, and the man hole or opening $C^{\times}$ leading to the ash pit below said grate is closed by a metal plate Z′. In the aforesaid temporary wall U T an opening is left, the one in the wall that closes man hole J^2 being temporarily bricked up, as indicated at Z, Fig. III, while in that opening in the wall which closes man hole J′ is fitted a gate frame, W to which a gate or furnace door, V, is hinged, said gate being paneled and the panels filled out with brick or other non-conductor of heat, the frame, W, having lugs, X, that extend behind a retaining bar Y, fitted in suitable recesses in the opposite vertical walls of the man-hole. Instead of building the temporary wall U, T, on a grating and closing the openings leading to the ash pit C by means of a separate plate of cast iron, a single cast iron plate may be used for both purposes. The features last described are shown in Figs. III, IV, and V. In order to avoid loss of heat by radiation or through the loosely superposed bricks of the temporary wall, U, T, the outer face of wall U is plastered over with clay and the cast iron plate, Z′ is covered with sand. The damper I^{16} of branch flue F, leading to ash pit under grate B′, is now closed and the damper I′ in the corresponding flue leading to ash pit under grate B^2 is opened, and a fire of wood or coal kindled on grate B′, the fuel being introduced through doorway of door or gate, V, the air necessary to the combustion being supplied from below, said air entering the ash pit through opening in front of man-hole J′. Inasmuch as the openings Q in partition wall A^2 are closed while the communication by way of grate B^2, its flue, F, main flue, G′, and chimney H is open, the hot gases and products of combustion will pass through chamber 1, and grate B^2, as indicated by arrow H^2, Figs. I and II, to chimney. Space 2 is now filled with ware to be baked or fired, through man-hole J^3, a temporary wall A^2 erected on the pier P at the left of grate B^3, and its left face papered as described. The man-hole J^3 and the opening leading to ash pit under grate B^3 are now closed as described in reference to man-hole J^2, the damper I′ is closed and the damper I^2 opened. In view of the fact that the communication between grate B^2 and chimney H is now cut off the hot gases and products of combustion will strike the wall A^2 at the left of grate B^2, burn the paper, pass through chamber 2, grate B^3 and its ash pit C, as indicated by arrows H^3, Figs. I and II, to chimney H by way of the described branch flues; the arrows H^4, H^5 indicating the course of the hot gases and products of combustion as the described operations are repeated for the successive spaces 3 and 4. The said operations are of course repeated for all the spaces, 1 to 7 and 9 to 15, until all are converted into separate kilns or chambers, and together with chambers 8 and 16 charged with the ware to be baked or fired, the hot gases and products of combustion from grate B′ passing successively through chambers or spaces 1 to 16, all the dampers except damper I^{15} being closed, so that the gases and products of combustion finally pass from said chamber 15 by way of ash pit below grate B^{16} and the connecting flues, D, E, F, to flue G^2, thence to chimney H, as will readily be understood by an inspection of Fig. II. Inasmuch as the contents of chamber 1 are nearest the source of heat they will be baked or fired sooner than those in the next succeeding chamber, and when so baked or fired the bricks Z and the plate Z′ that close the gate opening in the temporary wall U, T, that closes the man-hole J^2, and the opening leading to the ash pit under grate B^2 are removed, and a gate, V, applied to said gate opening, as above described. The gate, V, in man-hole J′ is now removed and its opening in the temporary walls U and U′ is bricked up and the opening leading to the ash pit closed by a plate Z′, which is covered with sand to prevent loss of heat, thus allowing the contents of chamber or space B′ to cool slowly. Fuel is now supplied to grate B^2, the hot gases and products of combustion flowing as before through the successive chambers, except chamber 16, to the chimney H. The same operation is repeated as to chamber 2 as soon as the contents thereof are baked or fired, and as soon as the contents of chamber 1 are sufficiently cooled they are removed, fire being then started on grate B^3. The cooling may be expedited by opening the sight holes in the arch of chamber 1, the heat escaping being utilized in the drying of green ware

placed on the level top of the kiln, air being at the same time admitted to chamber 1 through its grate door and ash pit. After removal of the contents of chamber 1 through man-hole J′ the temporary wall R is also removed and the chamber 1 supplied with ware to be baked or fired, after which man-hole J′ is bricked up as before described, but not supplied with a fuel gate, the opening leading to the ash pit being also closed as set forth. During this time the hot gases and products of combustion do not traverse the chambers 16 and 1, but as soon as the contents of chamber 2 are removed and paper pasted over the partition at the left of grate B^2 the damper I^{15} is closed and that I′ opened, so that the hot gases and products of combustion will now flow from grate B^3 through chambers 3 to 16 and 1 by way of grate B^2, its ash pit and flues D, E, F, to flue G′, and chimney H, a continuous operation of baking or firing being thus carried on as the described operations are repeated at each successive kiln chamber.

The partition walls A^2 may form a permanent feature of the kiln; we prefer, however, to resort to temporary partitions for the reason that a merchantable brick can thus be obtained, thereby utilizing the space which would be lost if a permanent partition were used, these brick partitions being removed with the contents of the chambers whenever the bricks thereof are sufficiently baked or burned, and new partitions built of green bricks before introducing the wares into the chambers.

We have stated that the floors of the chambers 1 to 16 are inclined from one grate to another. The result of this is that the introduction and removal of the wares to be baked or fired are greatly facilitated.

The described construction of kiln is also available for intermittent baking or firing, one of the end chambers being replaced by a wall of masonry, or such wall may constitute the end wall of a kiln having a less number of spaces or chambers than the kiln shown in Fig. II; such end wall may, for instance, be erected on the line *s*, *t*, of said Fig. II. When so constructed the capacity of the kiln may be readily enlarged, and when the business admits of it converted into a continuously operating kiln. On the other hand, when the business is limited the kiln may be constructed with a single gallery, as shown in Figs. VI to VIII, the spacing by means of the grates as well as the arrangement of the flues being the same as hereinabove described except that the end space 4 has ports A^3, A^3, leading from the kiln floor to a branch flue F instead of a grate, which is obviously unnecessary, there.

A kiln of the last described construction may also be readily enlarged to increase the capacity thereof according to requirements, and readily converted into a kiln for continuous operation without reconstructing the original kiln.

The advantages derived from the described construction of kiln will be readily understood by those conversant with this branch of the art.

Having thus described our invention, what we claim as new therein, and desire to secure by Letters Patent, is—

1. A kiln comprising a gallery, ash pits arranged transversely of and below said gallery, a grate above each ash pit, said grates dividing the gallery floor into spaces, a man hole in the side wall of the gallery opposite each grate and ash pit, a chimney, a main flue connected therewith, a branch flue for and connecting each ash pit with said main flue, and a damper at the point of connection of each branch flue, with the main flue, for the purpose set forth.

2. A kiln comprising a gallery, ash pits arranged transversely of and below said gallery, a grate above each ash pit, said grates dividing the gallery floor into spaces each space having its floor inclined from one grate to another, a man hole in the side wall of the gallery opposite each grate and ash pit, a chimney, a main flue connected therewith, a branch flue for and connecting each ash pit with said main flue, and a damper at the point of connection of each branch flue with the main flue, for the purpose set forth.

3. A kiln comprising an arched gallery provided with a level roof and with sight holes at intervals along the same, ash pits arranged transversely of and below the gallery, a grate above each ash pit, said grates dividing the floor of the gallery into spaces, the floor of each space inclining from one grate to another, a man hole in the side wall of the gallery opposite each grate and ash pit, a chimney, a main flue connected therewith, a branch flue for and connecting each ash pit with said main flue, and a damper at the point of connection of each branch flue with the main flue, for the purpose set forth.

4. A kiln comprising a gallery, ash pits arranged transversely of and below said gallery, a grate above each ash pit, an open or checkerwork partition in front of and a man-hole opposite each grate and ash pit, a chimney, a main flue connected therewith, a branch flue for, and connecting each ash pit with said main flue, and a damper at the point of connection between the branch and main flues, for the purpose set forth.

5. A kiln comprising two parallel galleries connected at both ends, ash pits arranged transversely of and below each gallery, a grate above each ash pit, said grates dividing the galleries into spaces and end chambers, a manhole opposite each grate and ash pit in the opposite side walls of the galleries, a chimney, a main flue extending along each of said galleries, said main flues connected with the chimney, a branch flue for and connecting

each ash pit of a gallery with its respective main flue, and a damper at the point of connection of said branch flues with their said respective main flues, for the purpose set forth.

6. A kiln comprising two parallel galleries connected at both ends, ash pits arranged transversely of and below each gallery, a grate above each ash pit, said grates dividing the galleries into spaces and end chambers, the diameter of said end chambers being gradually contracted from one gallery to the other, a man-hole opposite each grate and ash pit in the opposite side walls of the galleries, a chimney, a main flue extending along each of said galleries, said main flues connected with the chimney, a branch flue for and connecting each ash pit of a gallery with its respective main flue, and a damper at the point of connection of said branch flues with their said respective main flues, for the purpose set forth.

7. A kiln comprising a series of chambers formed by open or checker-work partitions, a grate on one side of each partition flush with the floor of the chamber, an ash pit below each grate, a man hole leading to the grate and ash pit, a chimney, a main flue connected therewith, a branch flue for and connecting each ash pit with the main flue, and a damper interposed at the point of connection between the main and branch flues, for the purpose set forth.

8. A kiln comprising a series of chambers each provided with a grate at one end, an ash pit below each grate, flues for connecting the ash pits with a chimney, and man-holes leading to said grates and ash pits, in combination with a gate frame adapted to be fitted in a man-hole opposite a grate and a gate hinged to said frame, for the purpose set forth.

CHARLES DUBOIS D'ENGHIEN.
ALPHONSE DUBOIS D'ENGHIEN.
SILVAIN DUBOIS D'ENGHIEN.
LÉON DUBOIS D'ENGHIEN.

Witnesses:
GREGORY PHELAN,
GEO. W. ROOSEVELT.