

(No Model.)

3 Sheets—Sheet 1.

R. HEILMANN.

KILN FOR BURNING POTTERY, CLAY, &c.

No. 523,469.

Patented July 24, 1894.

Fig.1:

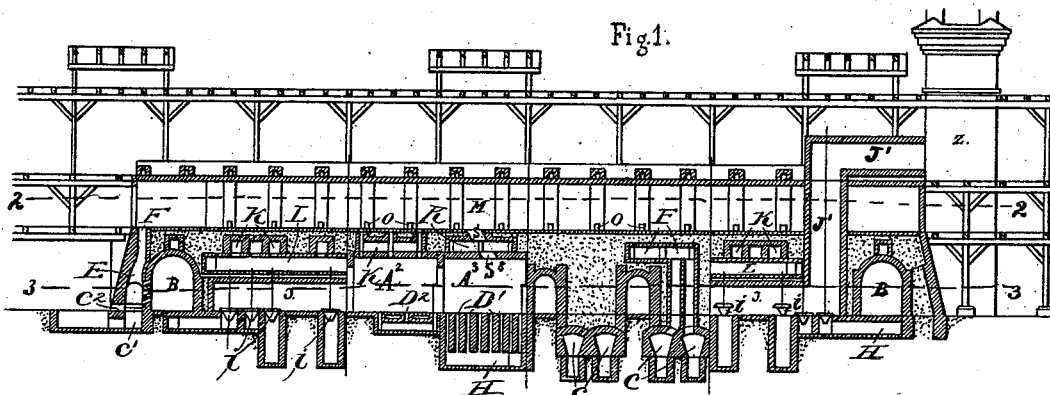


Fig.2.

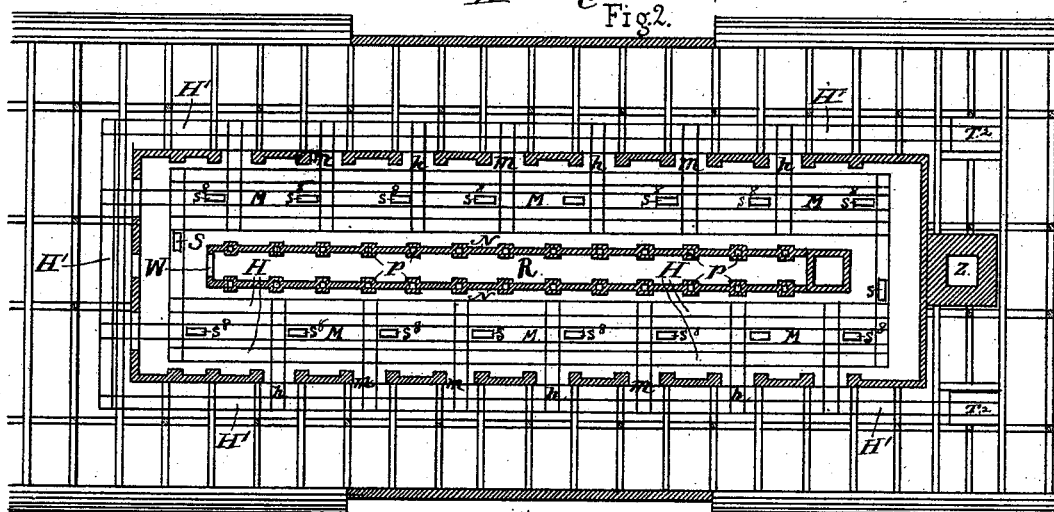
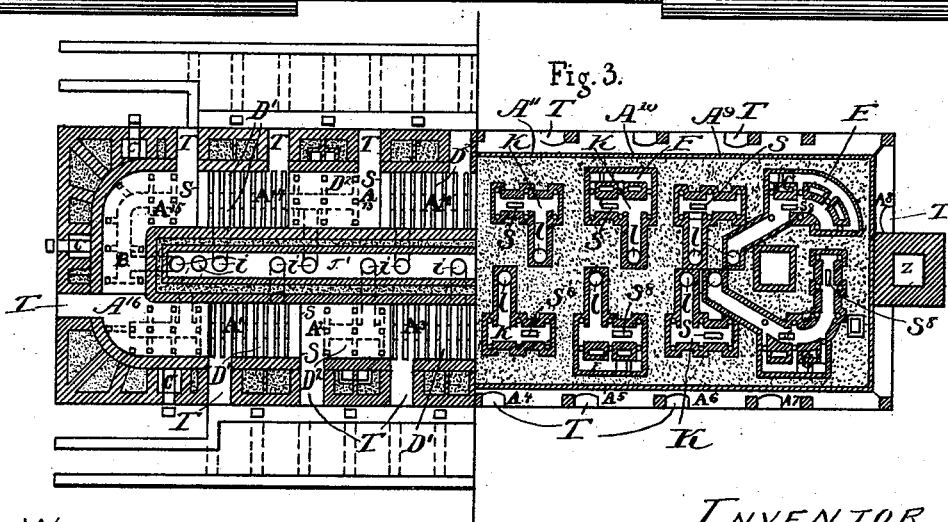


Fig. 3.



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(No Model.)

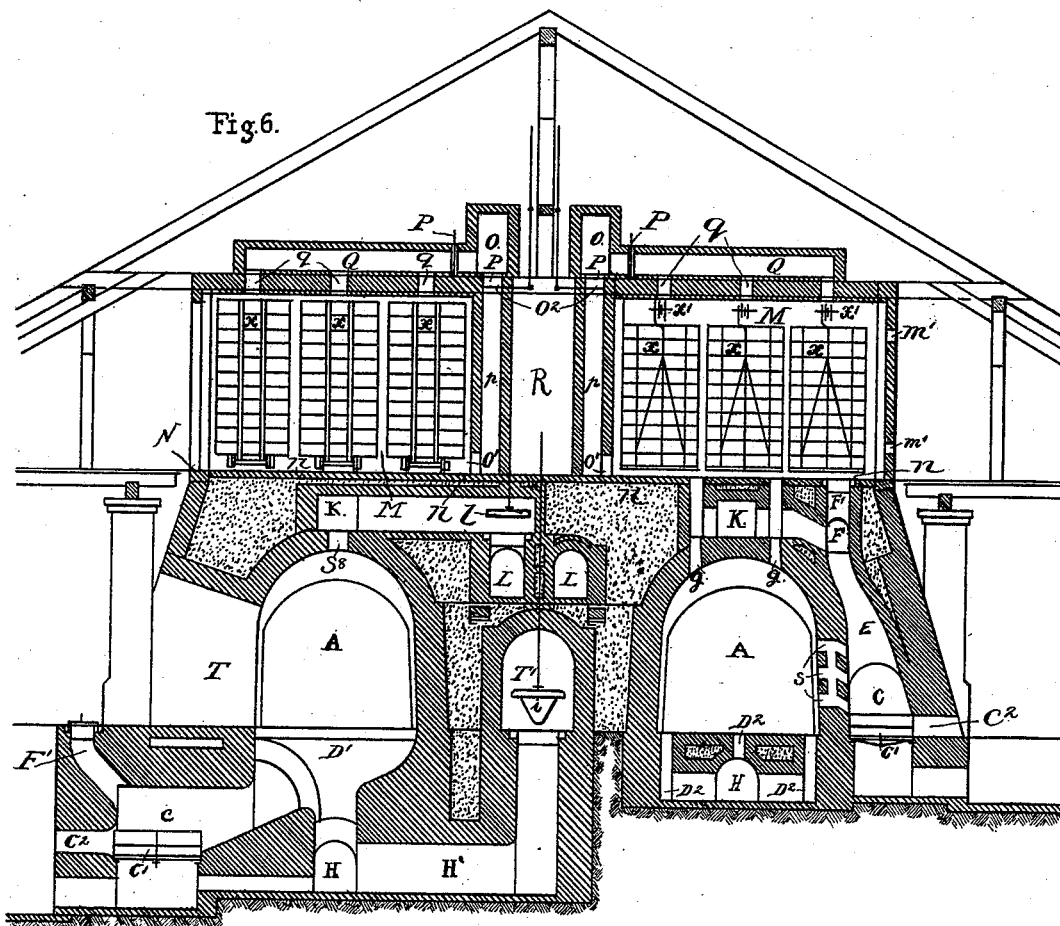
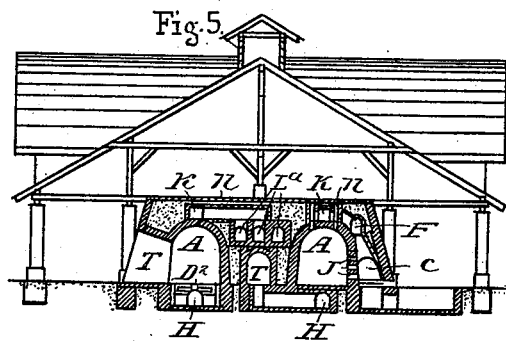
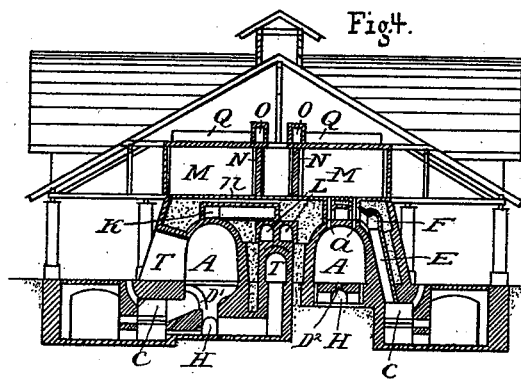
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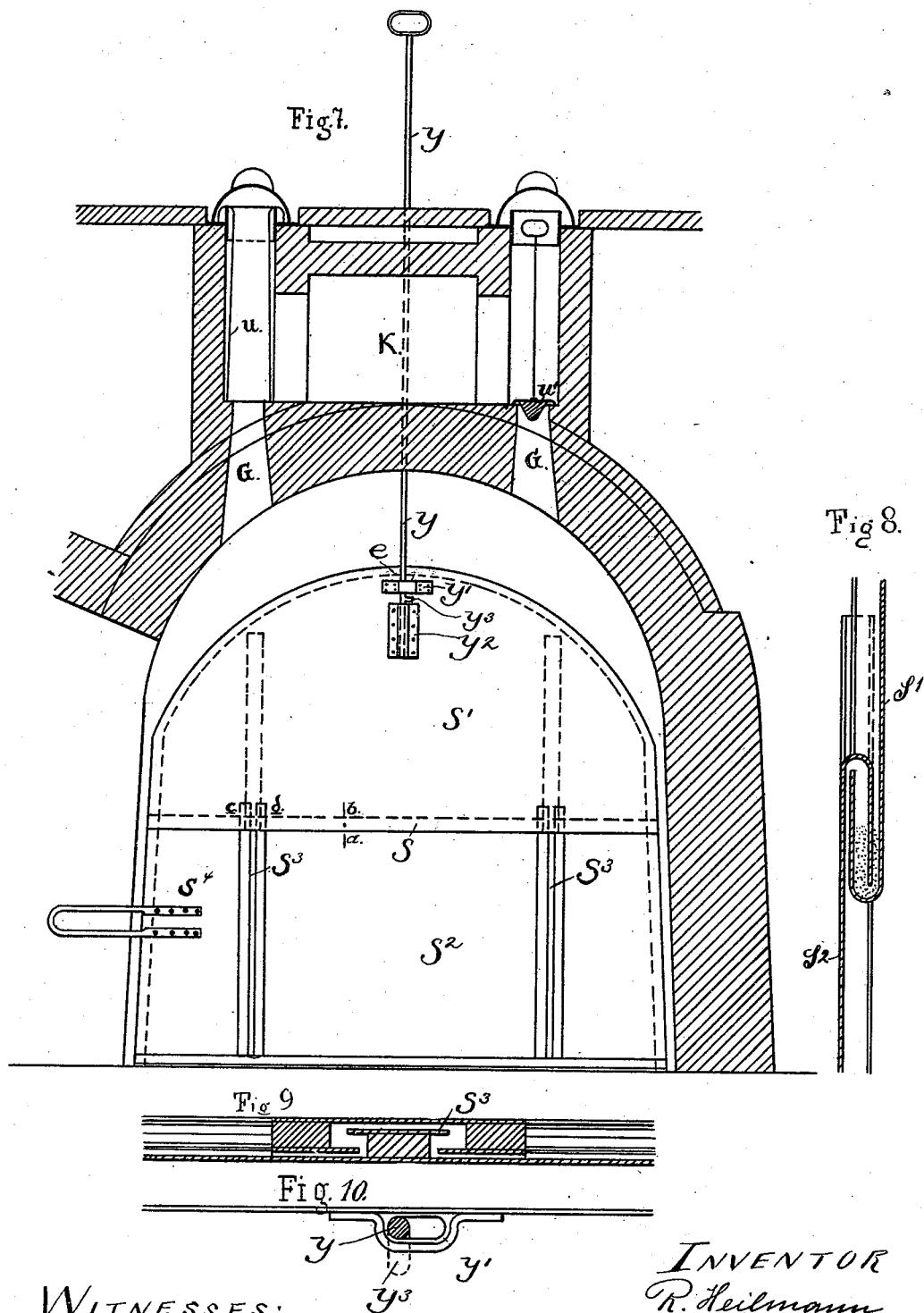
3 Sheets—Sheet 3.

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# UNITED STATES PATENT OFFICE.

RICHARD HEILMANN, OF STUTTGART, GERMANY.

## KILN FOR BURNING POTTERY, CLAY, &c.

SPECIFICATION forming part of Letters Patent No. 523,469, dated July 24, 1894.

Application filed December 15, 1891. Serial No. 415,115. (No model.)

### *To all whom it may concern:*

Be it known that I, RICHARD HEILMANN, of Stuttgart, Württemberg, Germany, have invented certain new and useful Improvements in Kilns for Burning Pottery, Clay, &c., of which the following is a specification.

This invention relates to an improved kiln for burning bricks, pottery and other articles, in which the combustion-chambers and drying-chambers are arranged relatively to each other in such a manner that the soft and wet goods can be placed at the point of forming the same into movable trucks, conducted into the drying-chamber located above the corresponding combustion-chamber of the kiln, then dried in said drying-chamber and then lowered directly into the combustion-chamber below the drying-chamber. The drying of the formed and pressed goods is thereby made entirely independent of the change of the weather, or of special drying arrangements, as the drying is accomplished by the surplus-heat of the kiln, which would otherwise escape without being utilized.

The operation of the kiln is a continuous one, as the goods to be burned are in the different compartments of the kiln, and, by a corresponding control of the fires, subjected to preliminary heating, drying and final burning, so that the continuous charging and discharging of the different compartments of the kiln can take place.

My improved kiln is adapted for direct as well as for indirect or generative firing and furnishing, owing to the novel construction of the fire-places and flues and of the heating conduits a uniform, clear and perfect burning, even of the finest wear, without inclosing the same; while by the application of a new folding partition between the combustion-chambers, the quick and easy removal of the same is obtained, so as to connect or separate the different combustion-chambers with or from each other as required.

In the accompanying drawings, Figure 1 is a vertical, longitudinal sectional view of my improved kiln. Fig. 2 is a horizontal sectional view on the line 2—2, of Fig. 1. Fig. 3 is a horizontal sectional view on the line 3—3, of Fig. 1. Figs. 4 and 5 are vertical transverse sectional views of the kiln showing dif-

ferent constructions. Fig. 6 is a vertical-transverse-sectional view on an enlarged scale, showing two different constructions and arrangements of the fire-places for heating the combustion-chambers. Fig. 7 is a vertical transverse-sectional view through one of the combustion-chambers of the kiln on a still larger scale. Fig. 8 is a longitudinal transverse-sectional view on the line *ba* of Fig. 7. Fig. 9 is a horizontal-sectional view on an enlarged scale on the line *cd* of Fig. 7. Fig. 10 is an enlarged horizontal-sectional view on the line *ef* of Fig. 7.

Similar letters of reference indicate corresponding parts.

In the lower part of the kiln two parallel burning chambers A are formed, which are connected at the ends by the transverse chambers B, which are slightly narrower than the chambers A.

At one end of the kiln the smoke-stack Z is provided.

The chambers A and B are divided by arches into a series of separate compartments A', A<sup>2</sup>, A<sup>3</sup>, &c., to A<sup>16</sup>, which can be separated from each other by iron sliding-gates or partitions S, each chamber being provided with an opening T in the outer wall of said chamber. Each iron-gate or partition S Fig. 7, consists of two sections S', S<sup>2</sup> having the guides S<sup>3</sup>, by which the upper section S' is adapted to slide on the lower section S<sup>2</sup>. When the upper section is raised as high as possible, the downwardly-bent upper edge of the lower section S<sup>2</sup> enters into a trough formed by the upwardly-bent lower edge of the upper section S', which trough is filled with fine sand, so as to form an air-tight joint, as shown in Fig. 8. Two keepers V' and V<sup>2</sup> are secured to the upper section S', and through the same a rod V passes, which is provided with a laterally projecting pin V<sup>3</sup>. When said pin projects from the face of the upper section S', as shown in dotted lines in Fig. 10, the upper section can be raised and lowered by means of the rod V, and when the rod K is so turned that the pin V<sup>3</sup> is parallel with the face of the upper section S', said rod can be withdrawn from the keepers, and removed. When the sliding partition or gate is to be removed, the upper section is moved downward by means of the

rod V; the rod V is removed, and by means of the handle S<sup>4</sup>, on the lower section S', both sections can easily be pulled laterally out of the chambers through the opening T. As the partition can easily be handled, very little time is required to remove the same, so that the chamber is not exposed to the cold air for any length of time, and does not cool off to any great extent.

Below the floor of the combustion-chambers A B, fire-places C with grates are built in the outer walls, two for each chamber, which are alternately connected by openings D' in the floor of the chamber, or by supply-channels E and heat-holes G' in the arches of said chambers, as shown respectively on the right and left hand sides of Fig. 6.

Below the floors of the chambers A B flues H are formed, which are connected with said chambers by the openings D', as shown at the left hand side of Fig. 6, or by the openings D<sup>2</sup>, as shown at the right-hand side of Fig. 6.

The smoke-flues H are connected with the longitudinal smoke-conduit J of the kiln, by lateral channels H' terminating in the base of said conduit, where they can be closed by conical valves i.

Above the combustion-chambers the heat-flues K are arranged, which are connected by the heat-holes G with the arched tops of the combustion-chambers. The flues K lead to the heat-conduits L, above the smoke-conduit J, the flat valve l serving to close the openings between the connecting flues K and the conduits L.

The smoke-flues H and the heat-flues K are arranged in the longitudinal axes of the combustion-chambers, so as to bring the heat-holes G and openings D<sup>2</sup> as closely together as possible and at a uniform distance from each other, as thereby the draft-action of the smoke-stack is the same for each opening, and the connecting channels which produce much friction and resistance are reduced in length. For the same purpose and also for the purpose of preventing the hot air from being cooled off, the heat-conduits L are arranged as double flues in the center of the kiln, as shown in Fig. 6, or as a triple flue as shown in Fig. 5. The heat-conduits L are connected by lateral flues having flat valves l with the flues K, and then again with the gas-channels E and F.

For the purpose of controlling the passage of gases or hot air through the heat-holes G, each is provided with a cone-valve u', Fig. 7, by means of which it can be opened or closed.

By means of the above-described combination of channels and valves, warm air, hot air or gases can be conducted from the top, side or bottom into the combustion-chambers.

Over the combustion-chambers A B and forming the top of the kiln, are arranged the drying-chambers M, Figs. 1 and 2. The side-walls of the same are constructed of brick or other fire-proof material. The roof is formed of arches or in any other fire-proof manner.

Corresponding to the combustion-chambers A B the drying-chambers M are likewise divided into sections M' to M<sup>16</sup>, each of which has a door m in the outer wall and also four openings m', Fig. 6, through which air can enter, and which also serve for making observations, and can be closed by suitable gates. Between the two parallel drying-chambers M a space R, Figs. 2 and 6, is formed to permit of manipulating the cone-valves i, and the flat valves or gates l, which space R can be entered at that end opposite the smoke-stack through the door W, Fig. 2.

In each drying-chamber two flues p, Figs. 2 and 6, are provided, which each have an opening o' near the floor n of the drying-chamber and which are connected at o<sup>2</sup> with a collecting-channel O, at which point they can be closed by valves P', Fig. 6.

Each drying-chamber is provided in the roof with draft-openings q, of which there are as many as there are smoke-openings D<sup>2</sup>, and which end in the transverse-channels Q, which latter before entering the collecting-channels O can also be closed by suitable gates or valves P. The collecting-channels O are connected with the smoke-collecting conduit J', Fig. 1, and by the same with the smoke-stack Z.

In the floor of each drying-chamber a filling-opening S S<sup>3</sup>, Figs. 1 and 2, is provided, which passes through the heat-flues K and the arched top of the combustion-chamber, said openings serving to form a communication between the drying-chambers and the combustion-chambers below the same.

In each drying-chamber M tracks H are arranged, which are connected by transverse tracks h with tracks H' located outside of the drying-chambers M.

At one end of the drying-chambers M the tracks H' at opposite sides are connected by transverse tracks H<sup>4</sup> and at the other end with elevators T<sup>2</sup> which are arranged alongside of the smoke-stack Z, from which elevators tracks lead to places where the articles to be burned, such as bricks, pottery, &c., are formed. At the said places where the articles are made they are placed in the carriages or drying-frames X, Fig. 6, which frames are raised by means of the elevators, and then conducted on the tracks H' to the transverse tracks h, and over the latter into the drying-chambers.

In case it is necessary to build the drying-chamber on the top of an old kiln, the arches and walls of which have not sufficient strength to support the frames X on the tracks H', the said frames can be suspended from tracks X' fastened to the ceiling of the drying-chambers, as shown at the right-hand side of Fig. 6, but in this construction the frames must be filled in the drying-chamber, and separate vehicles are required to convey the articles from the place of manufacture to the kiln.

In case the plant is already provided with a drying-chamber, then the kiln can be built

without the drying-chambers M, and in this case the kiln has to be built with three conduits L, as shown in Fig. 5.

When on account of ground-water or for other reasons, the fire-places cannot be arranged below the combustion-chambers A, then they are heated by gas, generated in the fire-places as shown at the right-hand side of Fig. 6. The fire-places are then supplied with fuel through the chutes F' from the floor n of the drying-chambers M. The fire-gases are then drawn for side-firing through the openings s s, in the walls of the combustion-chambers, as shown at the right-hand side of Fig. 6, or the heated gases are drawn for top-firing through the openings G into the combustion-chambers. The fuel is ignited on the grates C', some fuel being first introduced through the fire-doors C<sup>2</sup>, and later on, when the walls of the fire-places are heated, fed through the chutes F'. The gas produced is ignited in the combustion-chamber A, as soon as it comes in contact with the heated atmosphere in the same. The ingress of the gases can be controlled by the valves u' or cut off entirely, as shown at the right-hand side of Fig. 7.

By using one or the other methods of firing, the generation and introduction of an oxidizing or reducing flame is fully within control so that the finest glazed goods can be burned without extra-care to perfection.

The goods are burned in my improved kiln in the following manner:—After the fires have been burning for a sufficient time and the chambers A' and A<sup>2</sup> are heated to the desired degree, the chambers A<sup>3</sup>, A<sup>4</sup>, A<sup>5</sup>, A<sup>6</sup> and A<sup>7</sup> to the preliminary heating temperature and the chambers A<sup>8</sup> and A<sup>9</sup> in condition for the preliminary heating and drying, then the partitions S are placed in position in the chambers A<sup>7</sup>, A<sup>8</sup> and A<sup>9</sup>, the chamber A<sup>10</sup> is filled with fresh articles and the chamber A<sup>11</sup> is discharged, whereas the chambers A<sup>12</sup> to A<sup>16</sup> are left to cool off. The cone-valves i of the chambers A<sup>8</sup> and A<sup>9</sup> are likewise raised and also the flat valves l of the chambers A<sup>8</sup>, A<sup>12</sup> and A<sup>13</sup>. The air which is heated by the cooling of the contents of the chambers A<sup>12</sup> and A<sup>13</sup>, which has a considerable upward pressure is conducted through the heat-conduit L to the chambers A<sup>8</sup> and A<sup>9</sup>, where it heats up the articles in the same before it passes into the smoke-stack. In this manner the articles are subjected to the same or even a higher temperature than that of the fire-gases that are drawn off, whereby the condensation of steam or other gases that might discolor the goods is prevented. If for some reason or other the drying-chambers are not provided, then as stated above, the three-conduit system, as shown in Fig. 5 is used, so that at all times three to four chambers will be in a state of drying and preliminary heating. In this case the hot air is taken from the chambers A<sup>11</sup> and A<sup>12</sup> into the chambers A<sup>6</sup> and A<sup>7</sup> by means of the heat-flues K and the

side heat-conduits L; but the hot-air is taken from the chambers A<sup>13</sup> and A<sup>14</sup> by means of the same hot air-flues over the closed valves of the side-conduits L, Fig. 5, to the central-conduit L, from which it is conducted into the chambers A<sup>8</sup> and A<sup>9</sup> either from the top or side, or drawn off either at the bottom or top, saturated with steam-vapors, to the smoke-stack.

The drying-chambers M<sup>3</sup> to M<sup>8</sup> and M<sup>10</sup> to M<sup>16</sup> are filled with fresh material to be dried, whereas the chambers M' and M<sup>2</sup> are emptied, so as to permit the men to regulate the valves and regulate the fire when feeding from above. The chamber M<sup>9</sup> is filled with fresh goods and from the chamber M<sup>10</sup> the goods are passed through the openings S S<sup>8</sup> into the corresponding combustion-chamber A below. To accomplish this, two men are sufficient, even for the largest kilns, there being the additional advantage that the goods are dried uniformly and need not be selected, and that this manipulation of the goods is not interfered with by the emptying of the next adjacent chamber, which takes place sidewise on a level with the floor of the chamber. The fresh goods in the section M<sup>9</sup> are subjected to the action of a slightly warmed current of air as the freshly filled section of the combustion-chamber has cooled off to a considerable extent and does not give much heat.

In the direction toward the chambers receiving the full heat, that is in the drying-chambers M<sup>3</sup>, M<sup>7</sup>, M<sup>6</sup>, &c., which contain goods that have been subjected to heat for a greater or less time and have greater resisting powers, the temperature is greater and the radiated heat increases. When the fire for the chamber A' has burned out and chamber A<sup>8</sup> is receiving the full heat, the articles in the chambers M<sup>3</sup> are conducted back to the chamber M' by means of the carriages. The heat in the drying-chamber always increases, and is considerably increased in the chambers M<sup>12</sup> and M<sup>11</sup>, as the air is permitted to pass directly from the combustion-chambers containing the goods that are cooling into the drying-chambers. The moisture from the fresh goods is drawn off through the smoke-stack Z in connection with the collecting-channels O and the draft-openings q, but as the lowest layers of the goods that are nearest to the floor of the drying-chambers, would dry too rapidly and might thus be injured, the moisture is drawn off through the openings O', O<sup>2</sup> to the smoke-stack Z by opening the valves or slides P', Fig. 6. The goods are placed at the point where they are formed directly upon the frames X, on which they remain until they are to be removed into the drying-chambers. This avoids the necessity of handling the still moist and soft articles, and the articles produced are much better in quality and appearance than those burned in the ordinary kilns. The drying of the goods does not depend upon the state of the weather, as it can take place at all times.

When ordinary bricks or lime is to be burned in the same kiln, this can be done by means of direct fire from above. In this case the iron heat funnels *u* and the valves *u'* shown in Fig. 7 are used. The former are used for conducting the coal to the heat-holes *G* and to prevent the coal from dropping into the heat-flues *K*, as otherwise the coal would burn in said channels and would also heat the coal stored on the floors of the drying-chamber, and would extract the gases from the same. Furthermore the ashes from the combustion-chamber would be drawn into the heat-flues *K* and would reduce the cross-section of the same. For the same reason the heat-holes of the combustion-chambers in which there is no fire, are covered by means of the valves *u'*, the hot air is then compelled to remain in the combustion-chambers. The goods do not cool off so rapidly, and there is no necessity of adding more coal for the purpose of keeping up the proper temperature while the atmospheric air is supplied in heated state for combustion. By closing the openings *G* of those chambers that are in the first stage of heating, the escaping smoke and gases that have a natural tendency to move upward, cannot pass into the heat-channels *K* so as to uselessly heat the same, nor can they condense on the articles while they are burned, but they pass off quickly and evenly through the smoke-flues to the chimney.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination, of a series of combustion-chambers, transverse movable partitions between said chambers, openings in the outer walls of said combustion-chambers, for said partitions, a series of drying-chambers superposed above the combustion-chambers, openings in the floors of the drying-chambers connecting with openings in the tops of the combustion-chambers, so as to permit a direct charging of the dried articles from the drying-chambers into the combustion-chambers, substantially as set forth.

2. The combination, of a series of combustion-chambers, transverse movable partitions in said chambers, a corresponding series of drying-chambers superposed above the combustion-chambers, flues connecting the tops of the combustion-chambers with said drying-chambers, vertical flues along the inner side-walls of the drying-chambers, transverse top-flues on said drying-chambers, draft-openings connecting the bottoms and tops of the drying-chambers with the transverse top-flues, and longitudinal collecting-flues, connected with the chimney, substantially as set forth.

3. The combination, of a series of combustion-chambers, having movable partitions,

fire-places for each combustion-chamber, openings in the floors of the combustion-chambers, smoke-flues below the floors of the combustion-chambers, a central main smoke-flue leading to the chimney, valved transverse flues between the smoke-flues and the main smoke-flue, heat-openings in the top of the combustion-chambers, longitudinal heat-flues above the same, a heat-conduit or conduits above the main smoke-flue, and valved lateral connecting flues between the longitudinal heat-flues and the heat-conduits, the latter also leading to the chimney, substantially as set forth.

4. A brick-kiln, consisting of a series of combustion-chambers, divided by transverse arches and having openings in their outer side-walls and sectional partitions separating said combustion-chambers, said partitions being adapted to be removed through the side-openings of the combustion-chambers, substantially as set forth.

5. A brick-kiln composed of a series of combustion-chambers, having lateral side-openings, transverse partitions separating said combustion-chambers, each partition being composed of two vertically-guided and sliding sections, adapted to be reduced in height and removed through the side-openings of the combustion-chambers, substantially as set forth.

6. In a kiln, the combination of a combustion-chamber, with a transverse partition composed of two sections, the upper section having its lower edge bent upward to form a trough, and the lower section having its upper edge bent downward to fit in the said trough, substantially as set forth.

7. In a kiln, the combination with a combustion-chamber, of a transverse partition composed of two sections guided to slide one on the other, the upper section being provided with keepers, a rod inserted into said keepers and provided with a lug for engaging the upper or lower keeper and raising or lowering the upper section, substantially as set forth.

8. In a kiln, the combination, with a combustion-chamber, of a transverse partition formed of two sections guided to slide on each other, a detachable rod attached to the keepers of the upper section, and adapted to raise or lower the same, and a stationary handle attached to the lower section for moving the partition in or out of the combustion chamber, substantially as set forth.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

RICHARD HEILMANN.

Witnesses:

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W. BLOPFEROR.