(No Model.) 5 Sheets—Sheet 1.

W. H. R. KUNSTMAN.

KILN FOR BURNING EARTHENWARE.

No. 519,814. Patented May 15, 1894.

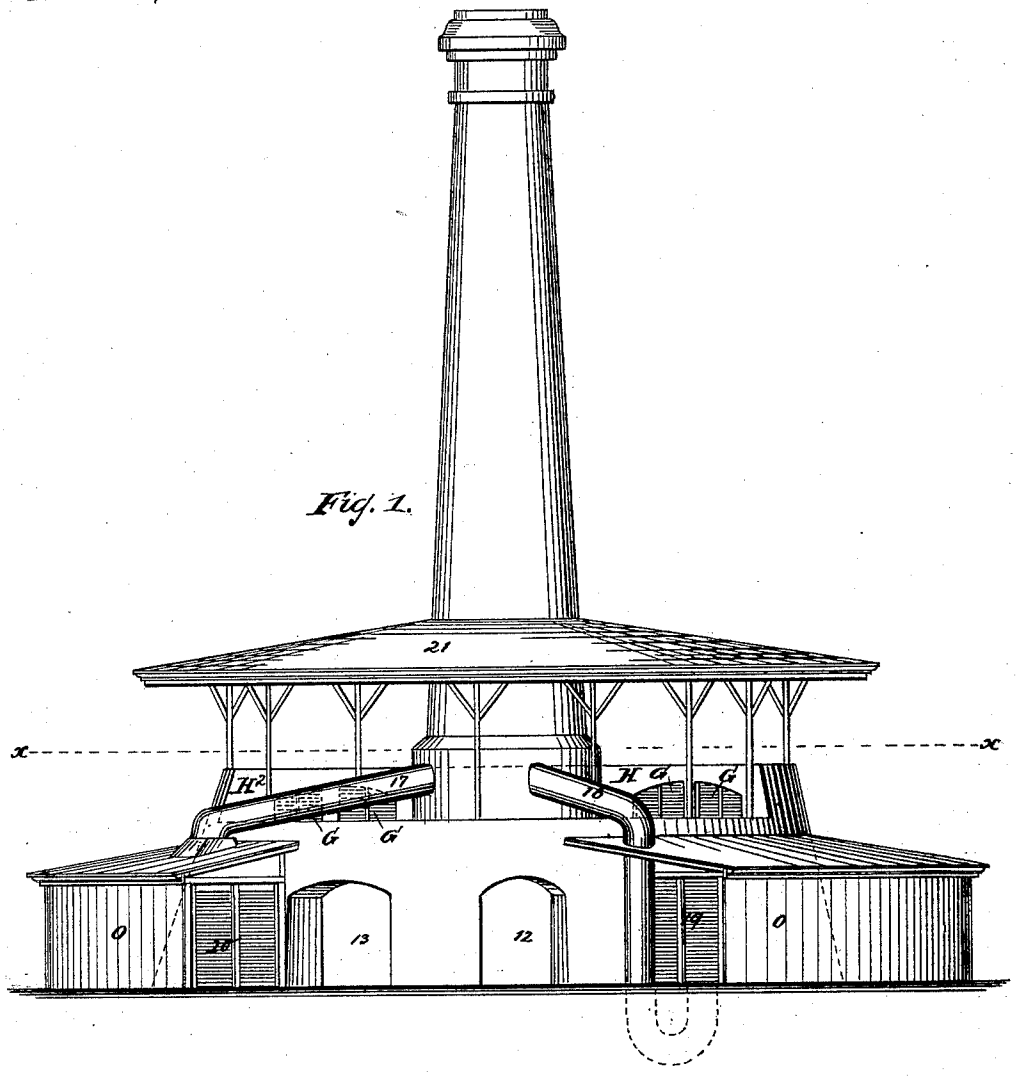

Fig. 1.

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Fig. 2.

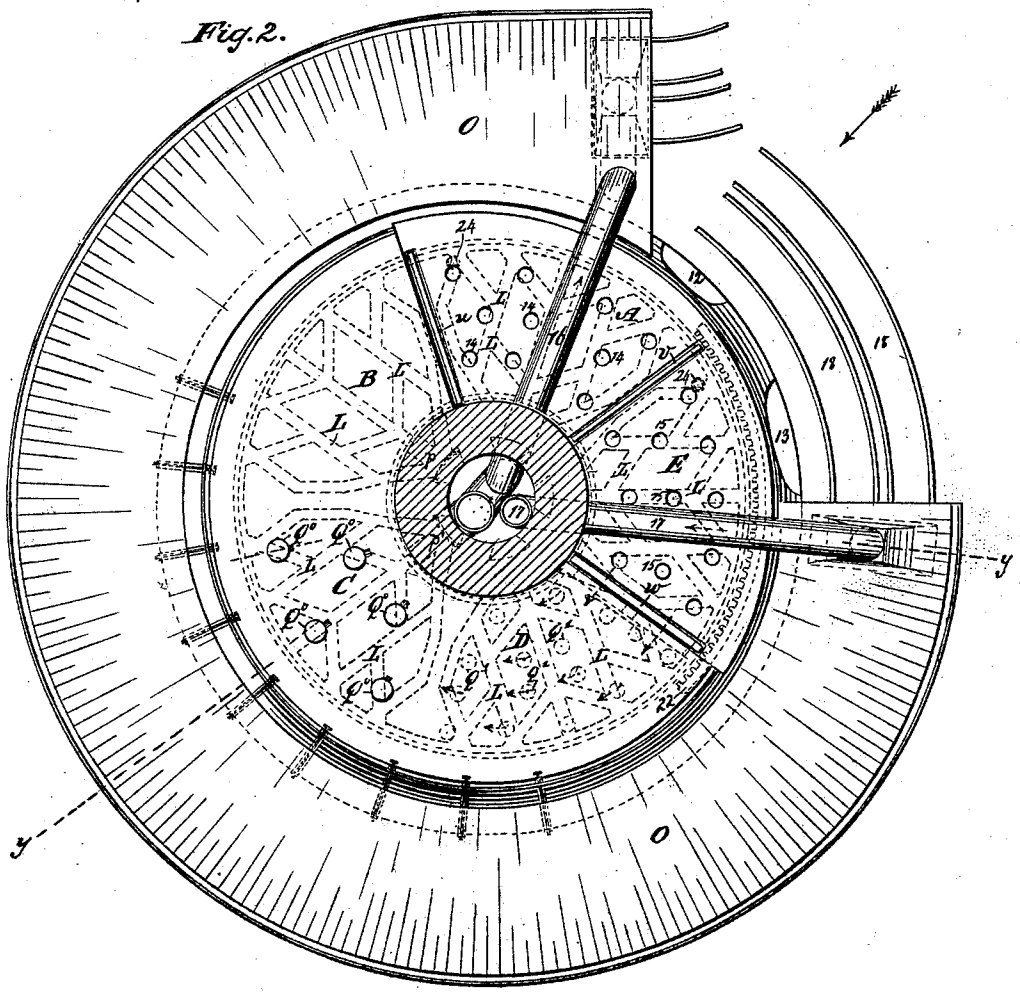

Fig. 8.

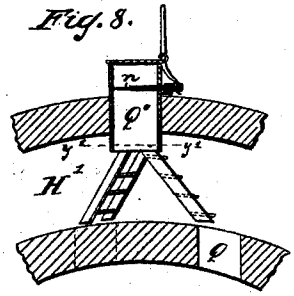

Fig. 9.

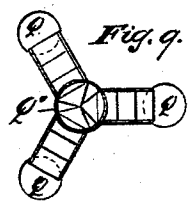

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Fig. 3.

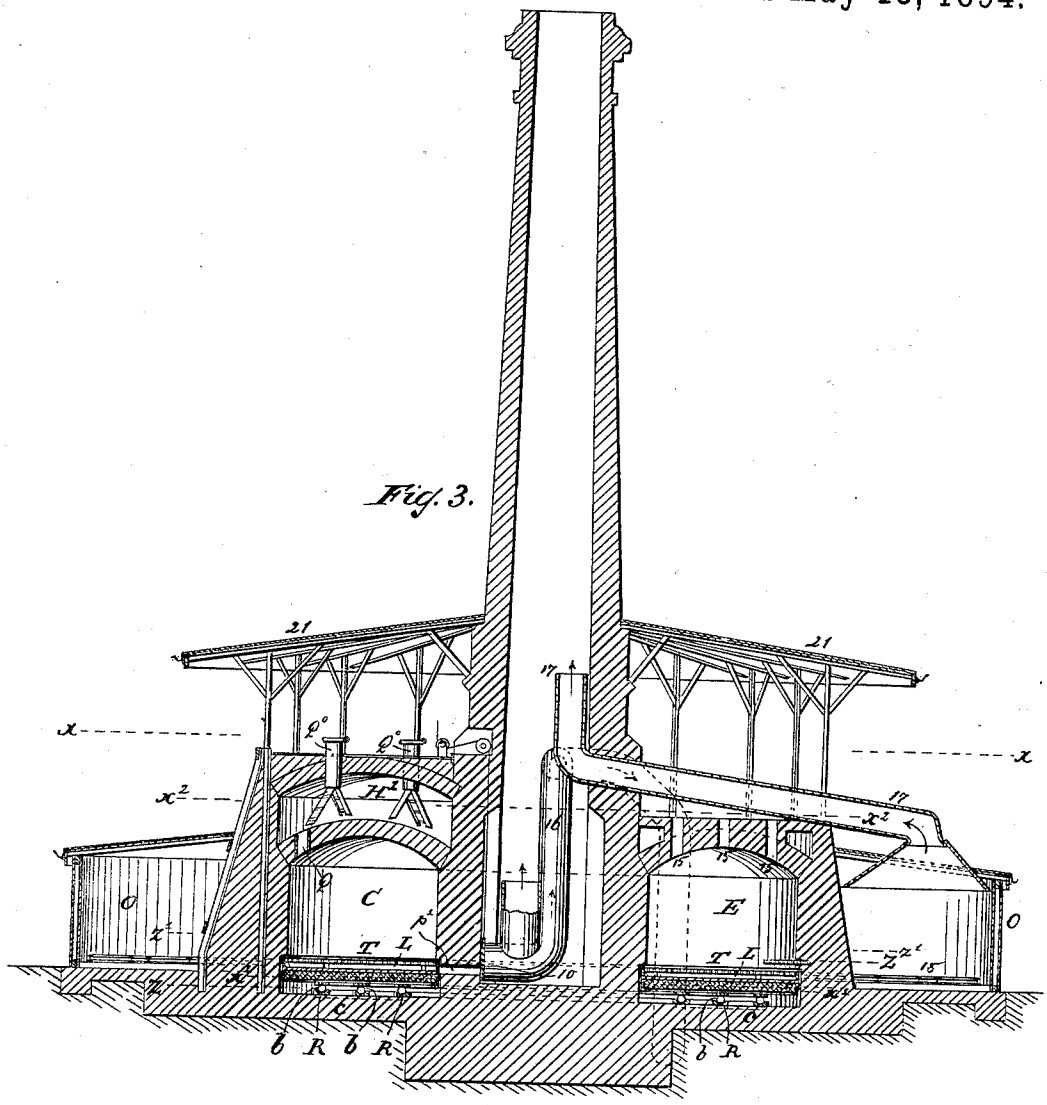

Fig. 6.

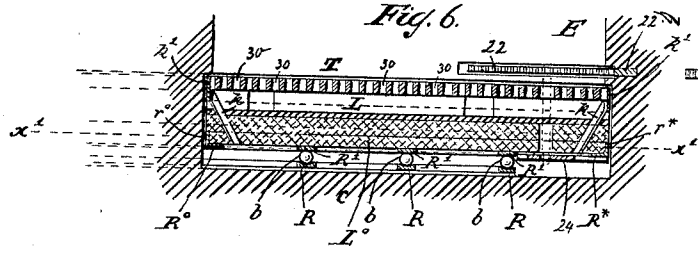

Fig. 7.

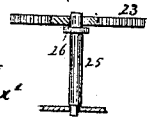

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Fig. 4.

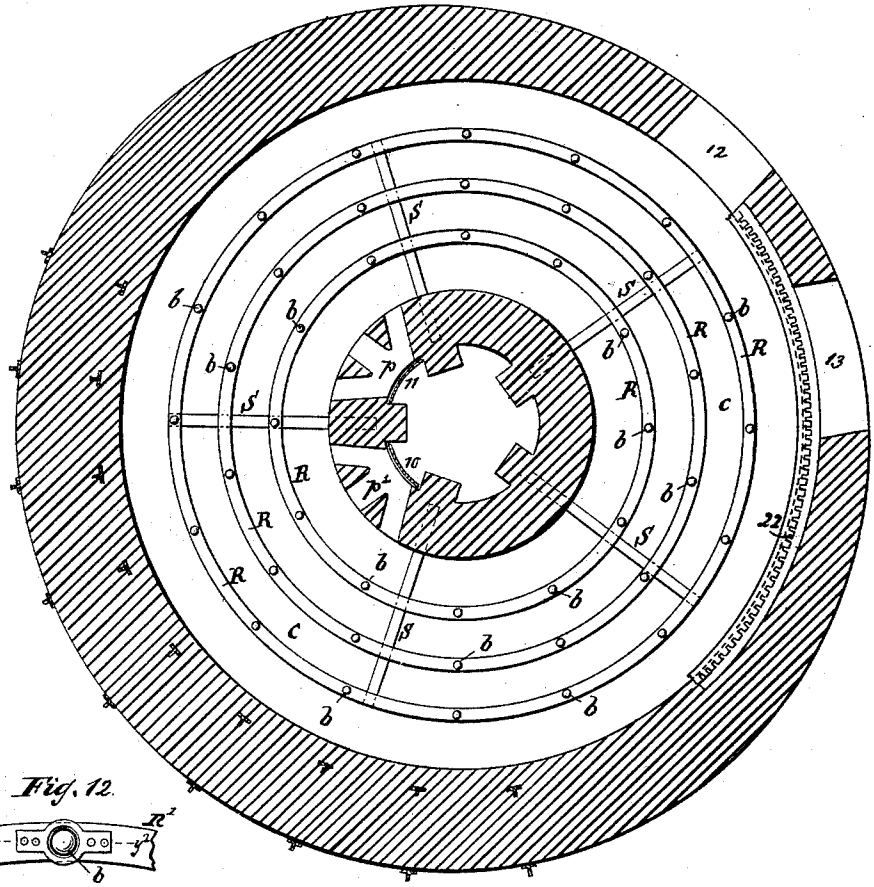

Fig. 12.

Fig. 13.

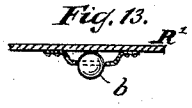

Fig. 5.

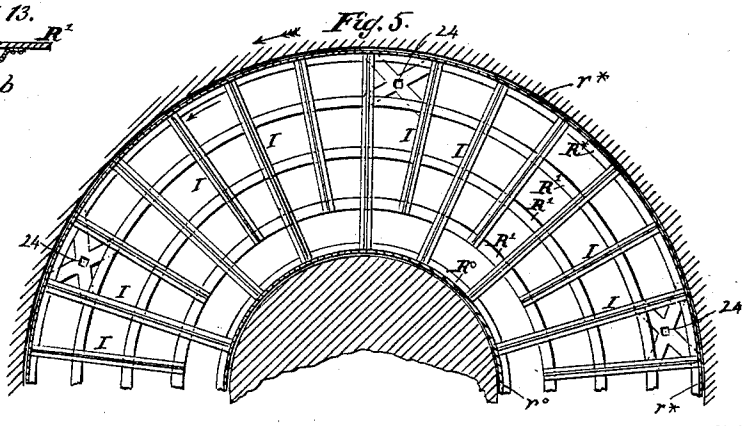

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Fig. 10.

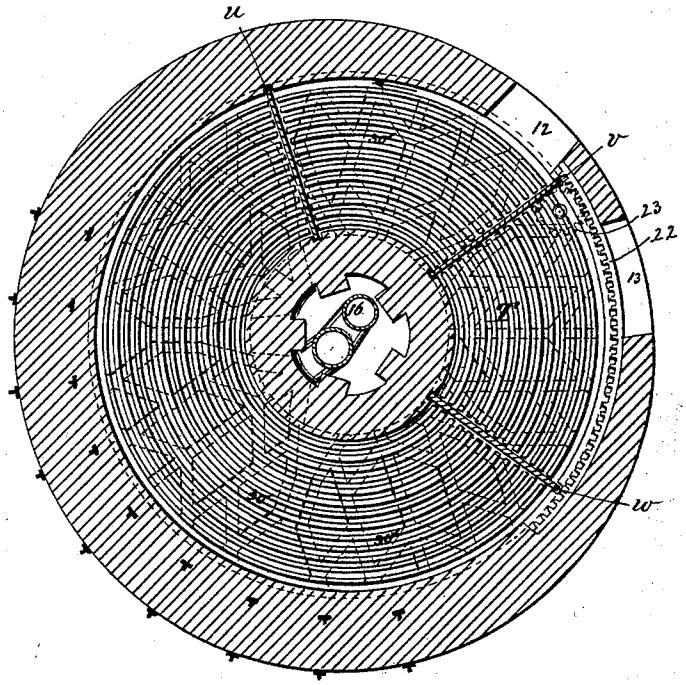
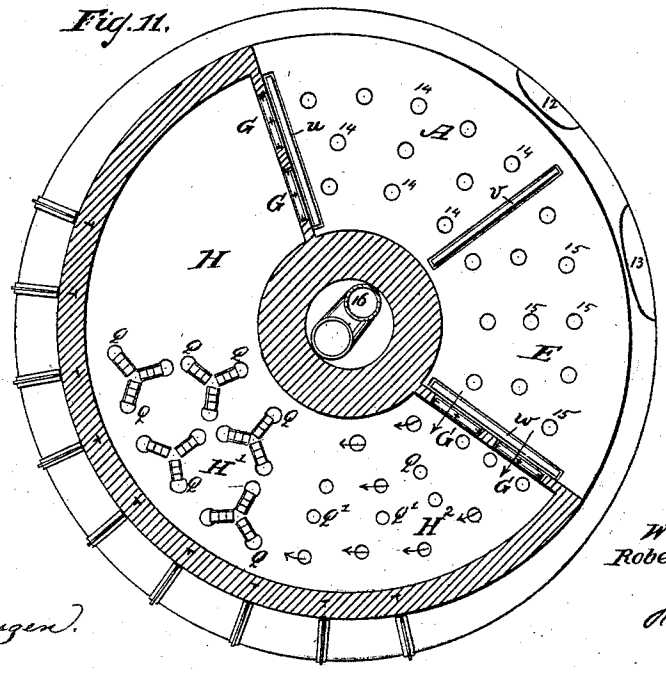


Fig. 11.



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UNITED STATES PATENT OFFICE.

WILLIAM HENRY ROBERT KUNSTMAN, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE COLUMBIAN POTTERY AND BRICK KILN COMPANY, OF SAME PLACE.

KILN FOR BURNING EARTHENWARE.

SPECIFICATION forming part of Letters Patent No. 519,814, dated May 15, 1894.

Application filed August 24, 1893. Serial No. 483,981. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM HENRY ROBERT KUNSTMAN, a subject of the Queen of Great Britain, residing at Chicago, in the county of Cook and State of Illinois, have invented new and useful Improvements in Kilns for Burning Earthenware and other Articles, of which the following is a specification.

This invention relates to certain improvements in kilns for burning bricks, tiles, earthenware goods, china ware, cement, lime and for making coke, roasting ore, annealing glass and other purposes of a similar nature.

In the accompanying drawings Figure 1 represents a front elevation looking in the direction of the arrow shown in Fig. 2. Fig. 2 is a horizontal section in the plane $x\ x$ Figs. 1 and 3. Fig. 3 is a transverse vertical section in the plane $y\ y$ Fig. 2. Fig. 4 is a horizontal section in the plane $z\ z$ Fig. 3 on a larger scale than the previous figures. Fig. 5 is a horizontal section in the plane $x'\ x'$ Figs. 3 and 6 on the same scale as Fig. 4. Fig. 6 is a partial vertical section of that division of my kiln which contains the mechanism for moving the floor on a larger scale than the previous figures. Fig. 7 is a sectional elevation of the mechanism for moving the floor. Fig. 8 is a sectional view of the means for introducing the fuel. Fig. 9 is a horizontal section in the plane $y'\ y'$ Fig. 8. Fig. 10 is a horizontal section in the plane $z'\ z'$ Fig. 3. Fig. 11 is a horizontal section in the plane $x^2\ x^2$ Fig. 3. Fig. 12 is an inverted plan view of part of the movable floor on a larger scale than the previous figures. Fig. 13 is a vertical section in the plane $y^2\ y^2$ Fig. 12.

My kiln consists of an annular chamber or vault which surrounds a central smoke chamber and smoke stack. This annular vault is divided into a series of equal divisions and in the example represented by the drawings I have shown five divisions A, B, C, D, E with vertically moving slides u, v, w to divide off certain of the divisions from the adjoining ones (Fig. 2). These slides are made of iron framing and lined with asbestus or fireproof materials when near the fire or are made of wood when not exposed to any heat and they are arranged to be easily lifted up and down from the top of the kiln through a radial slot left in the crown of the kiln by any suitable means such as are generally used for this purpose. When the slides are down they engage shallow radial grooves in the floor T of the kiln for the purpose of tight closing. The entire floor T of the aforesaid annular vault is made movable so that it can be rotated freely round the central smoke chamber and smoke stack in the direction of the arrow marked near it in Fig. 5 which shows a plan view of the bottom tray of said floor while Fig. 6 shows a transverse vertical section of the entire floor. Said floor rests upon a series of rolling supports b which in the example illustrated in the drawings are made in the form of solid steel balls but which may be made in the form of wheels and which move on circular tracks R, R, R (see Figs. 4 and 6). The rolling supports b may be connected to the rings R′ of the movable floor T in the manner shown in Figs. 12 and 13. The tracks R, R, R are connected by radiating bars S and they rest upon and are secured to a solid bed of stone or concrete c, c which forms the bottom of the annular vault. The bottom tray of the movable floor T consists of a series of flat iron rings R′ (Fig. 5) corresponding in number and position to the circular tracks R, an outer ring R* and an inner ring R°, both of which are provided with upwardly projecting flanges r^*, r° respectively, and radiating T-iron bars I which serve to retain the rings R′, R*, R° at the proper distance apart. From the bottom tray rise braces k which support a ring k' (Fig. 6) and on said tray is placed a layer of cement or concrete L° in the top surface of which are formed flues L (see Figs. 2, 3 and 6) and over these flues concentric rows of bricks are placed edgewise and with narrow spaces 30 left between them (see Fig. 6) bridging over the flues when crossing the same and forming a perforated bottom for bricks and earthenware goods to be placed upon for operation. The arrangement of the flues L is made essentially as shown in dotted lines in Fig. 2, so as to afford the fire and heat, when entering the kiln from the top, a very uniform distribution with the longest possible passage through the contents of the kiln. The heat is so to say made by this means to rain uni-

formly through all the bricks or other goods in the division C before reaching the passage connecting this division with the smoke stack.

By referring to Figs. 2, 3 and 4 it will be seen that both the divisions B and C communicate with the smoke stack by channels p and p' respectively. While the floors of all five divisions are provided with precisely the same kind of flues L and preparation for receiving goods, the divisions B and C only are provided with passages leading into the smoke stack, the division C being that which is in operation under fire and the division B that which precedes the division C. The interior of the annular vault is of uniform height and width all round so that all the goods subject to being burned can pass through the successive divisions where they will receive different treatment. On the top of divisions B, C and D are formed raised chambers H H′ H² (Figs. 3, 11 and 8). The raised chamber over division C is constructed entirely of fire brick while those over divisions B and D may be made of ordinary bricks. The first arch or crown of each of the divisions C and D is pierced by a number of apertures Q, those in the crown of division C being for the purpose of admitting to said division the products of combustion from a fire created on specially constructed grates, while the apertures Q′ in the crown of division D serve to allow the radiating heat to escape through them from the burned goods and by these means to heat the cold air on its way to the fire grates after being admitted through a series of iron louvers G G (Figs. 1 and 11) so that an economical combustion is attained. The fire grates over division C (being the only division where heat is permanently produced) are self-measuring and self-regulating step grates (see Figs. 8 and 9). Each consists of a series of iron steps terminating over one of the apertures Q in the crown of division C and radiating in inclined directions from an iron cylinder Q°, which projects through the crown of the chamber H′ over division C and is provided with a movable gate n at such a distance from the top of the cylinder as the regulation of the contents may require. This gate is connected to the hinged lid of the cylinder (Fig. 8) in such a manner that when the lid is opened, the gate will be closed and when the lid is closed the gate will be opened. By these means the introduction of fuel or coal previously filled into the cylinder and measured as regards proper quantity is taking place uniformly over the step grates which are attached to the bottom ends of the cylinder Q°. In the example illustrated in the drawings (Fig. 2) I have shown five cylinders Q° leading into the chamber H′ over division C but this number can be changed as may be found desirable. The heated air which issues from the apertures Q′ in the crown of division D reaches the fuel as the same passes down over the step grates and causes a very complete combustion, the products of which are uniformly drawn through the apertures Q in the crown of division C into the kiln and are there again evenly distributed over the contents of the kiln by means of the open spaces 30 and flues L which latter communicate with the channels p'. Regulation as to access and quantity of air for the combustion chamber H′ is established by the opening or closing of the iron louvers G and by the damper 10 placed at the inner ends of the channels p' which lead from the bottom part of division C into the smoke chamber. A similar damper 11 controls the channels p which lead from division B into the smoke chamber and both the dampers 10 and 11 can be raised or lowered by chains extending up through the brick wall of the chimney as indicated in Fig. 3. If oil or any other liquid or gaseous fuel is to be used, suitable nozzles will be substituted for the step grates with provision to burn such fuels in a manner best suited for the purpose. A manhole may be provided in the crown of the fire chamber H′ to afford access to the interior whenever it may be required.

Divisions A and E have each a large arched opening 12 and 13 respectively (Figs. 1, 2 and 4) the opening 13 in division E being intended for taking out burned goods and the other opening 12 being for introducing dry and unburned goods into division A. Furthermore in the crowns of each of said two divisions A and E is a series of small openings 14 and 15 respectively (Figs. 2 and 3) for the purpose of ventilating and cooling said divisions during the time of discharging ready burned goods from division E and setting the unburned goods into division A. From division C a reduction in the thickness of walls is taking place (see Fig. 4) toward those divisions in which no fire exists and almost any ordinary building material that is not fireproof, can be used for such divisions. Provision is also made to utilize all surplus heat which may emanate from the sides of the kiln and particularly the heat which leaves division C before the same enters the smoke stack, for drying unburned goods. For this purpose an iron duct 16 is provided the mouth of which is close to the damper 10 (Fig. 3) so that when this damper is raised the heated air which escapes from division C through the channels p', is received by said iron duct. This duct rises up in the smoke stack (Fig. 3) then it passes out through the side of the smoke stack (Fig. 1) and down beneath the grounds whence it finally turns up into a tunnel O which extends round the kiln from one side of the arched opening 12 in division A to the opposite side of the arched opening 13 in division E as seen in Fig. 2. Specially constructed trucks will receive the bricks and earthenware goods subject to being dried and keep them exposed to the action of all the heated air while going through the tunnel. At the end of the tunnel near to the arched opening 13 the air escapes through a second iron duct 17 which passes into the smoke

stack (see Fig. 3). In the tunnel is laid a double track 18 on which the trucks are propelled by wire cable or any other suitable means. The ends of the tunnel O can be closed by means of suitable shutters 19, 20 and I can use with advantage revolving iron shutters working self balanced in an upward and downward direction.

An iron roof 21 is constructed over the whole kiln as shown in Figs. 1 and 3 which serves to protect the same against rain or snow.

The actual moving of the revolving platform T is effected in the following manner: A toothed iron segment 22 comprising a little over one fifth of the outer circumference of the revolving platform is suitably and firmly fixed in the inner face of the outside wall of division E at such a height that a cogwheel 23 can be brought in gear with it. It is obvious that this purpose may be effected in many different ways which will readily suggest themselves to skillful mechanics. In the example illustrated in the drawings the revolving platform T is provided in its bottom tray (see Fig. 5) with a series of square sockets 24 the number of these sockets being made to correspond to the number of divisions in the kiln; and the spindle 25 (see Fig. 7) is provided with a square step at its bottom end which is intended to engage the square sockets 24. On its upper part said spindle is provided with a collar 26 and that portion of the spindle which extends above this collar is round, the cogwheel 23 being provided with a central hole which fits this upper round portion of the spindle. When the platform is to be turned round, the spindle 25 and the cogwheel 23 are brought into the division E after the same has been emptied of its contents, the square step of the spindle is dropped into the square socket 24 which at the time is in position to receive it, the cogwheel 23 is placed on the upper round portion of the spindle where it is in position to engage the toothed segment 22 and then the cogwheel is turned in the proper direction by levers or other suitable means until the empty portion of the platform is brought in the proper position to form the bottom of division A.

Operation of the kiln.—Assuming the platform of the kiln is in the position shown in Fig. 10, the following operations are to be performed within a working day of eight to ten hours: A division (which may be supposed to have been emptied the previous day) is being filled with dry goods as obtained from the drying tunnel and this operation will have to be completed at the end of the day. About twenty thousand to twenty-five thousand bricks or the equivalent quantity of earthenware goods will be placed in division A. B division had been filled on the previous day and the goods will receive the benefit of drying from the burning chamber or division C while steam formed from the moisture expelled from the goods is let off direct to the smoke stack through the lower connection; the slide *u* between divisions B and A is down. C division is under fire; the spare heat and heated air pass into the drying tunnel O and operate upon the goods therein. The time for heating can be extended to twenty-four hours. D division had been under fire the previous day; radiating heat from this division serves to heat air admitted through the iron louvers G and the air so heated serves to facilitate the combustion in division C, being admitted either from above into the combustion chamber above said division or from below directly into the division. The slide *w* between divisions D and E is down. Cooling takes place within twenty-four hours. E division is being emptied and the contents removed, an operation to be performed within eight to ten hours. The slide *v* between divisions E and A is down in order to obtain a proper guide for the space to be filled and to prevent the dust from reaching division A. On the following day all slides *u*, *v*, *w* are drawn and the platform is turned one fifth of the circumference, the slides are replaced and the operation of the previous day is repeated.

What I claim as new, and desire to secure by Letters Patent, is—

1. The combination with a smoke stack, an annular vault surrounding said smoke stack and communicating with the same, and a combustion chamber which communicates with the annular vault, of a rotary floor fitted into the annular vault substantially as described.

2. The combination with a smoke stack of an annular vault surrounding the smoke stack, channels leading from the vault into the smoke stack, a rotary floor fitted into the annular vault, flues L formed in said rotary floor and a combustion chamber communicating with the annular vault substantially as described.

3. The combination with a smoke stack of an annular vault surrounding the smoke stack, channels *p'* leading from the annular vault into the smoke stack, a combustion chamber communicating with the annular vault, a tunnel which partially extends round the annular vault, means for closing the ends of the tunnel, a duct 16 leading from the channels *p'* into one end of the tunnel and a duct 17 leading from the other end of the tunnel into the smoke stack substantially as described.

4. The combination with a smoke stack, an annular vault surrounding said smoke stack and communicating with the same, a combustion chamber which communicates with the annular vault and a rotary floor fitted into the annular vault, of movable slides fitting the annular vault and serving to partition the same off into several divisions substantially as described.

5. The combination with a smoke stack, an

annular vault surrounding said smoke stack and communicating with its interior and a rotary floor fitted into the annular vault, of an arched chamber H′ formed on top of the annular vault and communicating with the same through openings Q, means substantially as described for introducing fuel into this arched chamber and openings or louvers for admitting fresh air into the chamber substantially as described.

6. The combination with a smoke stack, an annular vault surrounding said smoke stack and communicating with its interior and a rotary floor fitted into the annular vault, of two arched chambers H′ H^2 formed on top of the annular vault and communicating with each other, means substantially as described for introducing fuel into the arched chamber H′, openings or louvers for admitting fresh air into the arched chamber H^2 and means for heating the air in its passage through the chamber H^2 substantially as described.

7. The combination with a smoke stack, an annular vault surrounding said smoke stack and communicating with its interior, a rotary floor fitted into the annular vault and movable slides fitting the annular vault and serving to partition the same off into several divisions, of a combustion chamber communicating with one of the divisions of the arched vault and an aperture communicating with a different division of the arched vault and serving to introduce the materials to be burned and an aperture communicating with another division of the arched vault and serving to remove the materials which have been burned substantially as described.

8. The combination with a smoke stack, an annular vault surrounding said smoke stack and communicating with the same, a combustion chamber which communicates with the annular vault and a rotary floor fitted into the annular vault, of circular tracks R secured on the bottom of the annular vault and rolling supports *b* secured to the rotary floor substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

WILLIAM HENRY ROBERT KUNSTMAN.

Witnesses:
CHAS. J. MOREY,
W. ALE ACKENHAUSEN.