

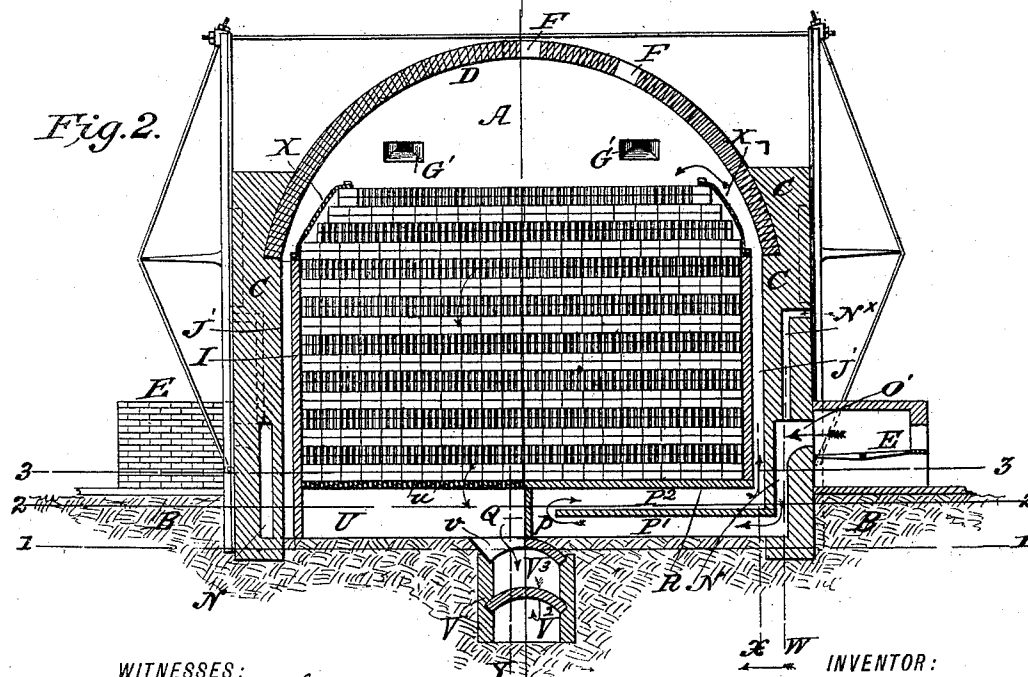
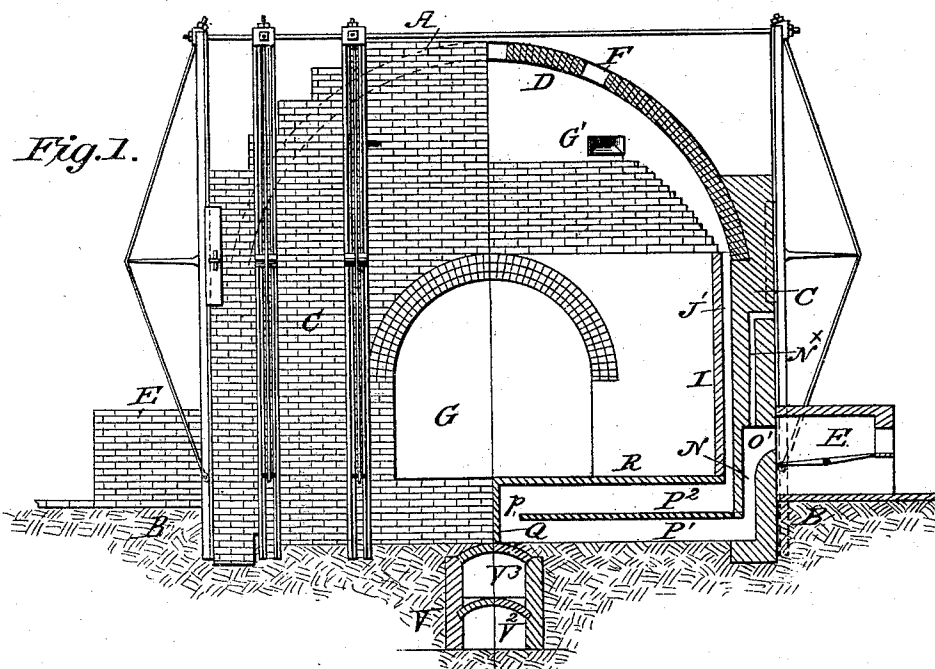
(No Model.)

4 Sheets—Sheet 1.

J. B. GRISWOLD.
BRICK KILN.

No. 466,676.

Patented Jan. 5, 1892.



WITNESSES:

Witnesses:
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H. J. Robinson.

E. W. INVENTOR:

John B. Griswold

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ATTORNEYS

(No Model.)

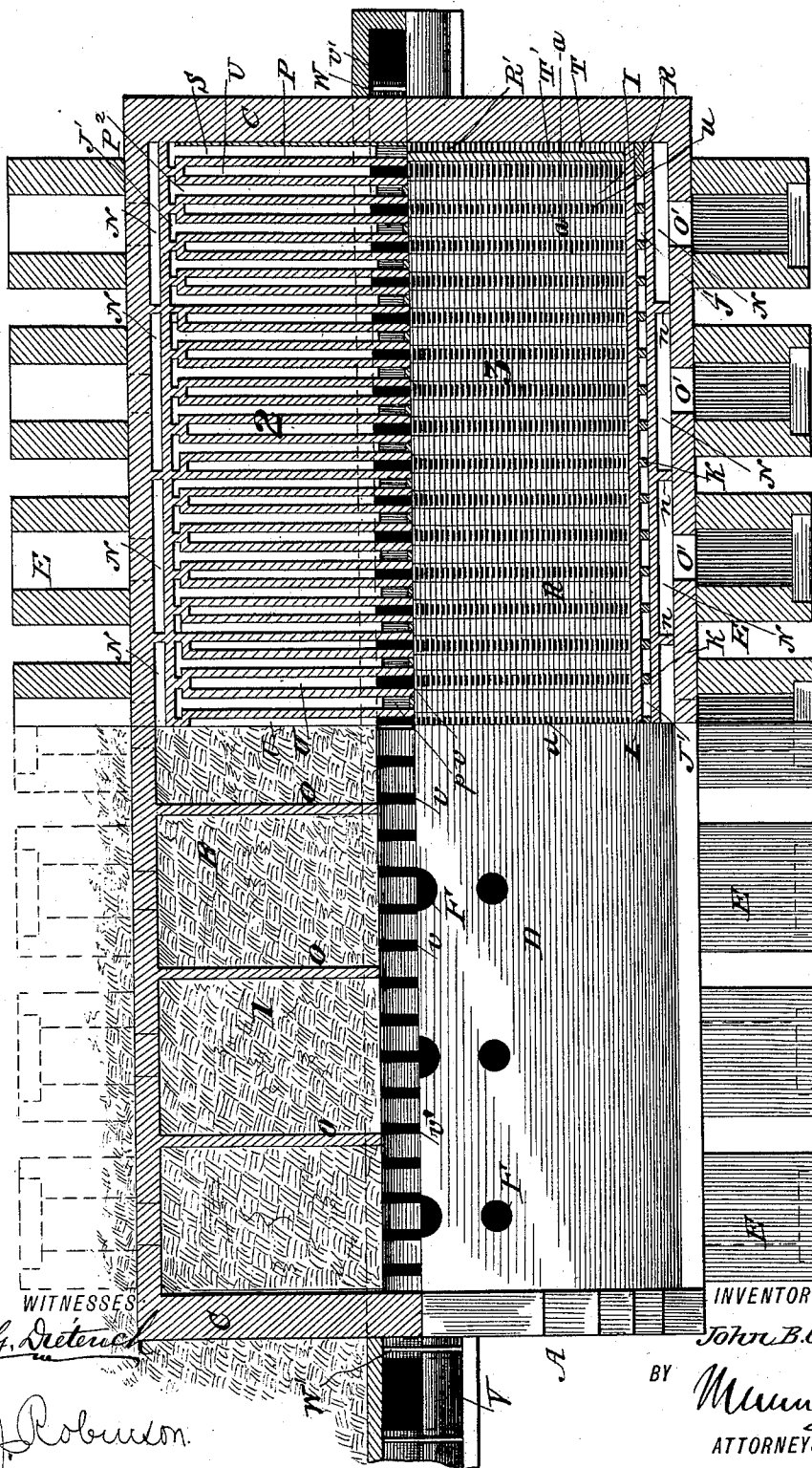
4 Sheets—Sheet 2.

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Fig. 3.



(No Model.)

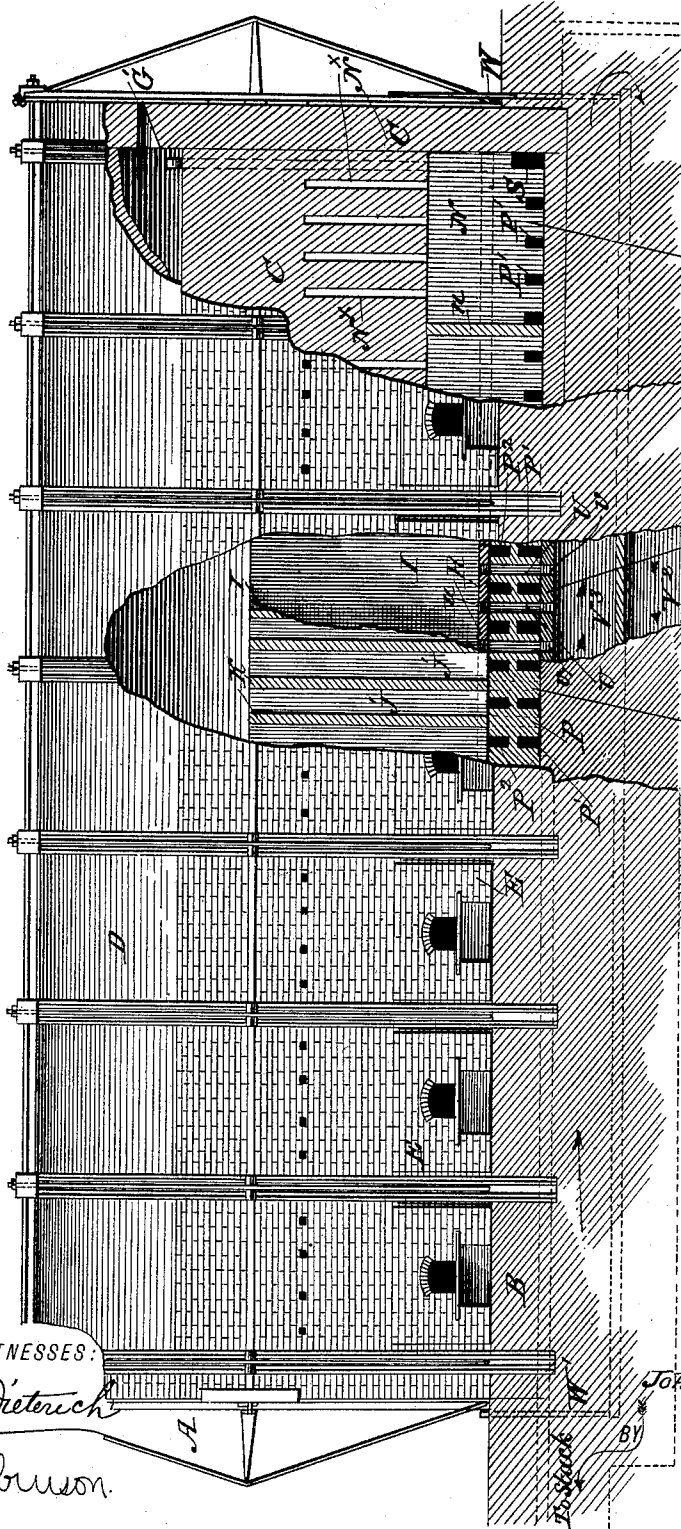
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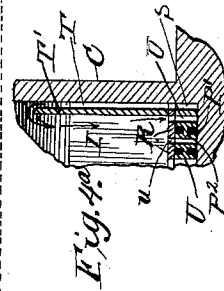
Fig. 4.



on line W.

on line Y.
see Fig. 2.

on line X,



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(No Model.)

4 Sheets—Sheet 4.

J. B. GRISWOLD.
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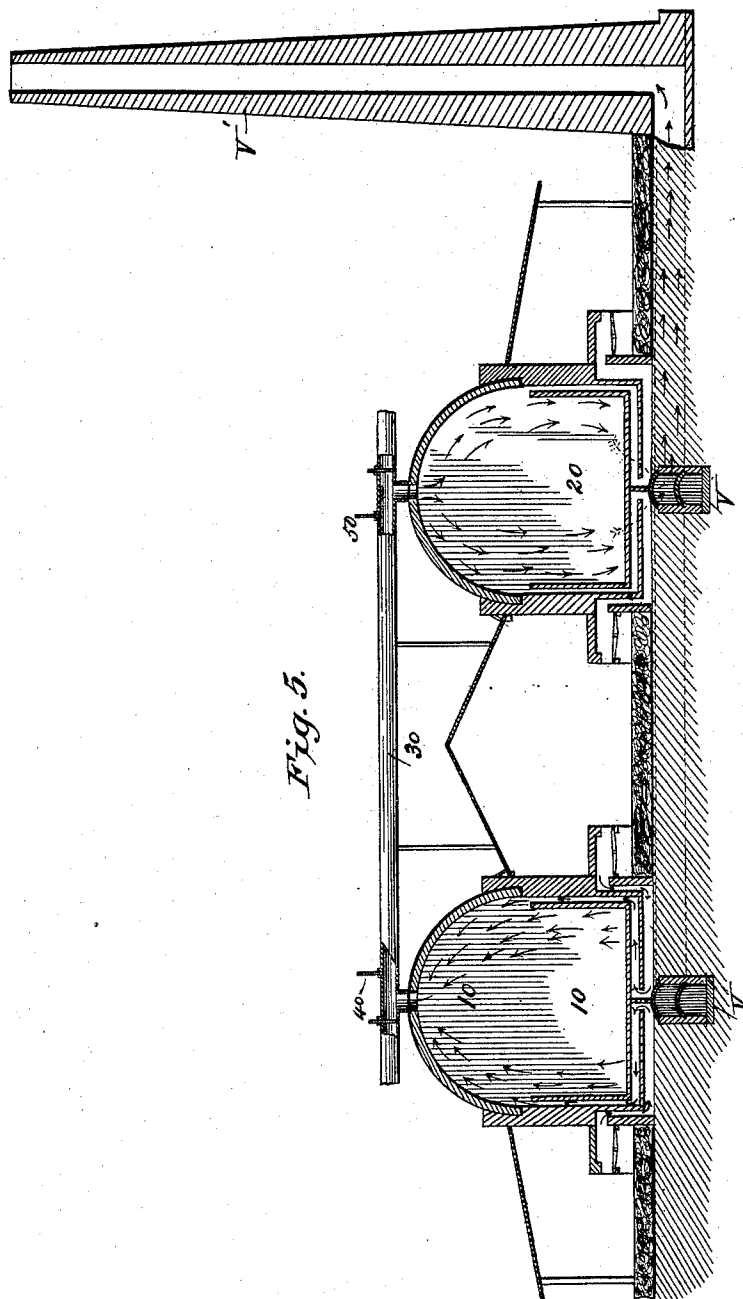


Fig. 5.

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UNITED STATES PATENT OFFICE.

JOHN B. GRISWOLD, OF ZANESVILLE, OHIO, ASSIGNOR OF ONE-HALF TO
CLARENCE V. GRAHAM.

BRICK-KILN.

SPECIFICATION forming part of Letters Patent No. 466,676, dated January 5, 1892.

Application filed January 24, 1891. Serial No. 378,991. (No model.)

To all whom it may concern:

Be it known that I, JOHN B. GRISWOLD, residing at Zanesville, in the county of Muskingum and State of Ohio, have invented certain new and useful Improvements in Brick-Kilns, of which the following is a specification.

My invention has for its object to provide a kiln for burning brick, tile, or other ceramic material in such a manner that uniform burns of even hardness are secured and in which a perfect combustion of the gases and fuel can at all times be assured; in which a large part of the ware is burned by radiated heat before the fire touches it, whereby the ware is protected from direct contact with the fire at its hottest points, thereby preventing it from being blackened or fire-marked.

It has also for its object to provide for arranging my improved kilns in a series and connecting them together and to a single stack in such a manner that I am enabled to make use of such connection for carrying the waste heat from a kiln just burned off to a green kiln.

To these ends my invention consists in the sundry novel arrangements and peculiar combination of parts, all of which will be hereinafter fully described in the annexed specification and particularly pointed out in the claims, reference being had to the accompanying drawings, in which—

Figure 1 is a combined partial end view and partial vertical transverse section. Fig. 2 is a transverse section of my improved kiln with the bricks arranged in place. Fig. 3 is a top plan view showing portions of the kiln in horizontal section, taken on the line 1 1, 2 2, and 3 3, Fig. 2, such portions being designated by the numerals 1, 2, and 3, respectively, on Fig. 3. Fig. 4 is a side elevation, partly in section, of my improved kiln; and Fig. 4^a is a detail section on the line *a a*, Fig. 3. Fig. 5 is a side view, partly in section, of two kilns joined together and with the stack.

In the accompanying drawings, A indicates the kiln, which is preferably rectangular in shape, as shown, it being understood, however, that for burning certain kinds of ware it may be formed round.

B denotes the ground foundation, built under the floor-space of the kiln; C, the main side and end walls; D, the crown or top of the kiln; E, the furnaces, and F the openings or outlets in the crown; G, the doors or openings in the ends of the kiln, and G' the peep-holes.

In the practical construction of my kiln I arrange the furnaces and heating-flues in such a manner that the heat of each furnace will be carried under the kiln-floor to the center thereof, then deflected and brought back toward the furnace, then up along the side of the kiln-chamber, then into the kiln, and out through the floor of the kiln into the draft-flues. I also arrange the heating-flues in section, each section being supplied by a single furnace, whereby all the sections may be in use at one time or any one of them may be used separately, as the condition of the kiln may require.

By referring to Figs. 2 and 3 of the drawings, in which the arrangement of the heating-flues is most clearly shown, it will be observed that each of the furnaces connect with vertical flues N, separated from each other by the divisions *n n*, such flues N being of a length equal the space between the transverse division-walls O, which extend across the kiln below the floor and serve to form the flues into a series of sections, seven being shown in the drawings, each of such sections being again divided centrally in the following manner:

P P indicate a series of walls extending transversely across the kiln under the floor, between which transverse flues P' P² are formed, such flues being disposed, one P² horizontally above the other and divided centrally by a division-wall Q, which serves to divide the flue-chambers P' P² into two sections, as shown most clearly in Fig. 2. By reference to it and Fig. 3 it will be seen that the lower flues P' of each section communicate at their outer ends with flues N and at their inner ends with the flues P² through the openings *p*, the upper wall of the flues P² serving to form the solid portion of the bottom R of the kiln, the outer ends of the flues P² communicating with vertical flues J', which are formed inside the side walls of kiln by the thin wall

T'. By this construction it will be seen that while the walls O serve to divide the kiln into seven sections, as stated, by arranging the flues P' P² as described each section is again
 5 divided into two distinct heating-sections, each connected with a single furnace.

T indicates vertical flues, which extend entirely across the ends of the kiln, such flues being formed by means of the thin walls T',
 10 which extend up to the same height as the vertical flues J', said flues extending down to a slotted floor-section R', under which are disposed the flues S, said flues communicating with the flues N of the end sections of
 15 the kiln in a manner clearly understood by reference to Fig. 3 of the drawings, said flue S, however, not having any division-walls Q, it extending entirely across the ends of the kiln below the floor, they being connected with
 20 flues T by the slotted floor R', as stated, said slots r' being graduated, the larger openings being nearer the center of the kiln, as shown.

U indicates a series of flues, which extend transversely under the floor of the kiln, said
 25 flues being also formed by the transverse walls P, the upper wall of such flues being formed with a series of perforations u, extending entirely across the kiln. By this construction it will be seen that the floor of the
 30 kiln is formed of alternate solid and slotted portions, said slotted portions forming the exits for the products of combustion, as will hereinafter appear.

V represents the main flue, running longitudinally under the entire length of the kiln and under the flues P' and U, one end thereof leading to the stack V' and the other end extending beyond the farther end of the kiln proper. The main flue V is formed of two
 40 horizontal flue-sections V² V³, the upper one of which V³ is formed with a series of openings v, which communicate with the transverse exit-flues U, as will be understood by reference to Fig. 3 of the drawings. The said
 45 flue V³ communicates at v' with the lower flue-section V², suitably-arranged dampers W W' being provided, whereby the draft may be drawn directly from the flue V³ when the damper W is open, or all or part of the draft
 50 is caused to pass to the opposite end of the flue V³ into the flue V² and forward through the opening v' into flue V³ and stack when the said damper is partly or wholly closed and the damper W' opened.

55 The manner in which my kiln is operated and some of the advantages obtained by its construction as described is explained as follows:

The kiln, after being filled with brick or
 60 other ware, which when brick is disposed as shown in Fig. 3, has its fires started in all the furnaces, from which the heat and gases pass into the several flues N, mingling at its entrance with such flues with air taken from
 65 the outside of the kiln above the furnaces through the flues N^x, thereby producing complete combustion of all the gases. The heat

then passes from the furnaces on opposite sides toward each other in the flue P' until it strikes the division-walls Q at the center of the kiln, then up into the flues P²,
 70 thoroughly heating the entire bottom of the kiln by radiation, the radiated heat from such bottoms serving to evenly and thoroughly heat the ware at the bottom of the kiln, causing the moisture or steam in the ware which
 75 usually settles at such part of the kiln to be superheated, which materially aids in forming a draft to draw the hot air up through the vertical flues J', serving to heat the sides of
 80 the kiln evenly, and over the walls J into the kiln, where the fire is drawn down through the ware and then out through the slotted portions of the floor into the main flue V and stack. In all kilns where the heat first strikes
 85 the ware at the top and passes down into the ware the bottom of the kiln remains to a certain extent cold. In the operation of such kilns the water-smoke or steam is first generated at the top of the kiln and seeks its
 90 exit at the bottom of the kiln through the cold or unheated portion of the ware, where the greater portion of it condenses, thereby producing a sluggish movement of the water-smoke, clogging of the kiln at the bottom, and
 95 discoloring of the ware by the sulphur deposited on the moist brick, which afterward burns into them. By arranging my heat-flues as described this very serious objection to the effective operation of the kiln is entirely
 100 avoided, as the floor of the kiln is first heated, thereby generating the water-smoke or steam at the bottom, from whence it rises, and, coming in contact with the hot ware at the top,
 105 is superheated, thereby effectually preventing danger of condensation or clogging. Furthermore, as the floor is always hot from the moment the kiln is started, a free vent and draft is created to immediately draw the water-smoke out into the stack-flues, thereby
 110 giving the ware at the top a chance to be also heated by radiated heat from the hot dry ware below it and heating the entire ware in much less time and with greater evenness. By arranging the flues N, P', P², and J' as
 115 stated it will be seen that the heat in its greatest intensity first serves to heat the wall just to rear of the furnace-outlet O', and, passing thence to the center of the kiln, enters the flue P² against the solid part of
 120 the floor, and then outward toward the wall C, and as it passes up to the inside of the flue N it is superheated by contact with hot wall C as it passes up the flues J' J', thus restoring the intensity of the heat lost while
 125 passing under the kiln-floor, thus serving to thoroughly but gradually bringing the heat to the sides and bottom of the ware in a uniform manner, and thereby producing a finished article of uniform color and hardness. 130

As the advantages of forming the kiln in sections, each of which can be controlled so as to increase or diminish the heat as the condition of the ware may demand, are apparent

to those skilled in the art of brick-making, further comment thereon is deemed unnecessary.

By arranging the double main flue as described and connecting it with the floor in the manner shown I can get the floor thoroughly hot and the brick on and above the floor thoroughly burned and at the same time not interfere with the egress of the fire from the kiln to flues leading to stack. Arranging the end flues, as described, in combination with the transverse flues S permits the fire entering such flue T direct from the furnace and out over the thin wall T' into the kiln, where it commingles with the other heat. This is a great advantage, as it enables the ends of the kilns to become heated regularly and uniformly along with the sides and bottom and produces ware burned from radiated heat on the ends, along the sides, and over the floor. The slotted floor R gives the fire a chance to follow under it close to the end walls C and in front of doorways G, emptying through the openings into the flues T.

In reference to the end flues T, I would state that I am aware that it is not new to form end flues and connect them with exhaust-flues under the kiln-floor, as such construction is shown in my patent dated February 4, 1890, No. 420,624. In all cases, however, so far as I know, where the end flues have been employed no direct connection with such flues and the furnaces is shown, it being necessary on down-drafts to pass the heat over the wall T' down into the flue T. This has been found very objectionable, because the heat in passing down in this manner has lost most of its intensity and is practically worthless for heating the lower outer ends of the wares in the kiln; but by the construction shown I employ a downdraft for burning and yet send the heat up the end flues direct from the furnaces, thus heating that part of the ware usually the hardest to burn evenly with the balance of the ware.

By providing a series of air-openings N^x, which extend up some distance in the main walls C and out to the outside of kiln, the air while passing down to the flues N will become heated, so as to aid combustion in the flues N, thus admitting fire and heat into the kiln in a pure and consumed state, relieving a large percentage of the discoloration and fire-marks on the ware. While these flues N^x in their arrangement serve to provide for heating the cold air drawn in from the outside, such air entering the flues serves at the same time to assist in cooling the side wall C. Arranging the flues P' P² as stated allows for heating either half of the kiln-floor, as desired—i. e., should one side be a little hotter than the opposite side the opposite furnace can be regulated to bring the heat up equal to the hot furnace. This construction and the construction of the slotted floor and the exit draft-flues prevents any possibility of hot spots forming at any one part of the kiln,

and also prevents the heat from one furnace running over to the opposite or warmer side of the kiln.

Another feature of my invention is the flexible non-combustible protector X, (shown most clearly in Fig. 2,) which serves to protect the ware at the top of the kiln as high as the ware may be set.

Usually where thin inside flue-walls are in use and the ware is piled up above such walls it is customary to lap a fire-clay protector, which is supported on its lower end on or against the thin wall and at its upper end against the ware. From practical experience I have found this plan very objectionable, for the reason that as the ware settles in the kiln the fire-brick settles against the ware, breaks or displaces it, and injures the thin flue-wall. By providing a flexible non-combustible protector—such as asbestos—it will readily yield with the settling of the ware, and at all times protect the upper rows from the intense heat which passes over the thin wall against the ware and discolors them without the danger of breaking or displacing them.

Having thus described the construction of one of my improved kilns, I shall now describe the manner in which two or more kilns constructed according to my invention are connected in such a manner that the waste heat of one or more kilns can be utilized by the remaining kilns.

In Fig. 5 I show two kilns connected together and with the stack, such kilns being numbered 10 and 20, the central openings F in the crown of kiln 10 being connected with the openings F in kiln 20 by means of a flue 30, provided with dampers 40 and 50, arranged as shown.

The manner in which the kilns are operated when connected as stated is as follows: After kiln 10, which is filled with ware, has been burned sufficiently the fires in its furnaces are disconnected therefrom by the dampers in the flue V, and the dampers 40 and 50 in the pipe or flue 30 are opened. This allows the waste heat from kiln 10 to pass into the flue 30 and down into kiln 20, which is filled with green brick, the said waste heat being utilized to dry off and force out the water-smoke, and at the same time heat up the ware in kiln 20, thereby creating a good draft in kiln 20. The fires then being started in furnaces of said kiln will thereby the more effectively and quickly burn the ware in a uniform and even manner.

While I have shown but two kilns connected, it is manifest that three, four, or more may be arranged together with a single stack.

I also desire it understood that while I have shown the main draft-flue formed in two parts arranged one above the other, such parts may be arranged side by side, if desired.

By running the fire under the kiln-floor and making its first contact therewith at the center of the kiln I can heat the floor-bottom at

center to as high a heat as desired, and in doing so heat the ware above center of kiln on floor to a sufficient heat by conduction, and in doing so the air at this point becomes

5 rarefied and creates a good draft down through the kiln toward the center to draw the fire over the ends and side flues equally, and thereby prevent the major part of the fire passing downward along the side and end walls.

10 Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a brick-kiln, the combination, with the main chamber, vertical flues arranged at the

15 sides thereof, opening at their tops into such chamber, and a series of outlet-flues arranged beneath the floor of the kiln and communicating with the main chamber, of the furnaces and a series of combustion-flues connected therewith extended toward the center

20 of the kiln, but not in contact with the floor thereof, then up to the floor under the same, and out to the vertical flues, substantially as and for the purpose described.

2. In a brick-kiln, the combination, with the main chamber formed with a floor composed of alternate solid and slotted portions and the furnaces, of a series of flues arranged under the solid portions of the floor and connected

30 with the furnaces, vertical flues on the sides of the main chamber, opening at their tops into the main chamber and connected at their lower ends with the furnace-flues, a series of flues U, arranged under and communicating

35 with the slotted portions of the floor, and a longitudinal exit-flue V, communicating with the flues U, leading to the stack, all arranged substantially as and for the purpose described.

3. A brick-kiln consisting of a main chamber having a bottom formed of alternate slotted and solid portions arranged transversely, a longitudinal exit-flue under said floor and communicating with the slotted portions

45 thereof, a series of furnaces, a series of combustion-flues connected therewith and extended transversely under the solid portions of the floor, a deflector-wall Q, arranged to centrally divide said transverse combustion-flues,

50 whereby to first lead the hot air toward the center of the kiln-floor and then deflect it outward again, and a series of vertical flues in the sides of the main chamber, opening at their tops into such chamber and at their lower

55 ends connected with the combustion-flues, substantially as and for the purpose described.

4. A brick-kiln having a single burning-chamber, a series of transverse flues located beneath the floor of the said chamber, such

60 flues arranged in a series, each series disconnected from each other, but connected at each end with one of the furnaces, each series consisting of a number of transverse flues P' P², a single flue N, connecting all of said flues P'

65 P² in each series with the furnaces, the vertical flues J', connected at their lower ends with the flues P² and opening at their tops

into the main chamber, a second series of flues U, arranged transversely under the floor and alternately of the flues P' P², their upper

70 wall communicating with the main chamber, and an exit-flue V, connecting said flues U and the stack, all arranged substantially as and for the purpose described.

5. In a brick-kiln, the combination, with the

75 main chamber and the furnaces, of flues connected with the furnaces and arranged under the bottom and up the sides of the kiln, whereby the bottom and sides of the ware will be heated by radiated heat, the vertical

80 flues opening into the main chamber, and a series of outlets formed in the bottom of the kiln and connected with the exit-flue and stack, substantially as and for the purpose described.

85

6. In a brick-kiln, the combination, with the main chamber and the furnaces, of the transverse flues P' P², arranged in a series under the kiln-floor and extended to the center thereof,

90 flues N in the side walls of the kiln, each connected with a series of the flues P' P², said flues P' P² communicating with the furnaces, as shown, a series of vertical flues J', registering with and communicating with the flues P² and

95 extending up in the side wall on the inside of the flues N and opening into the main chamber, and outlets formed in the bottom of the kiln communicating with the draft flue or flues, substantially as and for the purpose described.

100

7. In a brick-kiln, the combination, with the main chamber, the furnaces, and the draft-flues, of heat-flues extended under the bottom of the kiln to the center thereof, said flues

105 formed of the upper and lower sections P² P', connected at p, said upper section P² extending under the floor of the kiln, a series of vertical flues J', connecting the heat-flues P² with main chamber, a hot-air space or flue N, connecting all the flues P' and opening into the

110 furnaces, the flues N^x, opening into the chamber N and communicating with the outside air, and exits formed in the bottom of the kiln and communicating with the draft-flues, substantially as and for the purpose described.

115

8. In a brick-kiln, the combination, with the main chamber, the furnaces, a series of transverse heat-flues running under the floor, and a series of transverse draft-flues opening into the main chamber, said heat-flues connected

120 with the furnaces and extending up the sides and opening into the main chamber, of the draft-flue V, extending longitudinally under the transverse draft-flues and communicating therewith, said flue V formed of the upper

125 and lower members V² V³, connected at v' v', the dampers W W' in said flue V², and the stack connected therewith, all arranged substantially as and for the purpose described.

9. In a brick-kiln, the combination, with the

130 main chamber formed with vertical flues extending transversely across the ends of the main chamber and opening at its top into such chamber, of a slotted floor at the base of

such end flue, the flue S, extending transversely across the kiln under said slotted floor, and the flue-chambers N N, communicating with flues S S and opening into the kiln-furnaces, all arranged substantially as and for the purpose described.

10. The combination, with a main chamber, the furnaces, and a series of heat-flues and draft-flues arranged alternately under the floor of the kiln, said heat-flues extending up into the main chamber, said flues arranged alternately and transversely of the said floor, and openings formed in such floor and communicating with the draft-flues, of the transverse end flues T, the slotted bottom forming the base of such flues, the transverse flues S, and the flue-chambers N, connecting the flues S and the heat-flues with the furnaces, substantially as and for the purpose described.

11. The combination, with the main cham-

ber, the heat and exit flues, and the furnaces, all arranged to operate on a downdraft, of end flues formed in the main chamber connected with said furnaces and arranged to receive the fire direct from the furnace on an updraft and discharge it out at the top into the main chamber, substantially as and for the purpose described.

12. In a brick-kiln, the combination, with the main chamber, the flue-walls arranged inside the main chamber and ending near the top thereof, and the ware, of the flexible non-combustible protectors X, supported at their lower ends on the walls and at their upper ends on the upper portion of the ware, substantially as and for the purpose described.

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Witnesses:

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