

UNITED STATES PATENT OFFICE.

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CONTINUOUS KILN.

No. 822,580.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, WILLIAM A. BUTLER, a citizen of the United States, residing in the city and county of San Francisco and State of California, have invented new and useful Improvements in Continuous Kilns, of which the following is a specification.

My invention relates to improvements in continuous kilns for burning bricks and other ware.

It consists in a combination of parts and details of construction which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1 is a horizontal section through *yy* of Fig. 2. Fig. 2 is a vertical transverse section through *xx* of Fig. 1.

The basis of my improvements is the endless continuous kiln known as the "Hoffman" type.

My improvements consist in the employment of a series of regenerative furnaces upon both sides of the kiln, and a novel arrangement of said furnaces and means for a better control of the fires and air-inlets and dampers, as more fully described hereinafter.

A represents the walls of a kiln which are made continuous, having any suitable or desired length with relation to the breadth or the width and ends of any suitable form to connect with the sides so that a series of burning-chambers may be disposed continuously around the kiln. These burning-chambers are filled successively with the wares to be burned and the fires started, so as to heat up the chambers gradually and successively, and after the contents of the chambers have been sufficiently burned the heat is shut off from the completed chambers and they are allowed to gradually cool to a point where the contents may be removed. Thus one or two or more of said chambers may be under the condition of discharge, those that have been already discharged are being filled, and other intermediate ones are in various stages of burning.

In my invention I have shown a series of furnaces, as at 2, disposed at suitable intervals around the kiln and on opposite sides thereof, as plainly shown in the left-hand side of Fig. 1. The two sides of the kiln are sufficiently separated to provide for a walk or passage, as at 3, for the convenience of attendants to manipulate the furnaces. Exterior to the furnace-walls and below the base of the apparatus is a closed conduit 4, into

which passages 5 from the various chambers open, and through this conduit the water, smoke, and spent gases of combustion are conveyed to a chimney or stack, as at 6. Beneath the central portion of the burning-chambers and extending all around the apparatus is a channel or conduit 7, to conduct air which is admitted through suitable valves or dampers, as will be hereinafter described, and upon each side are the depressed channels 10, with piers at 14 between the furnaces.

The wares to be burned are placed in the kiln-chambers, leaving a space around them contiguous to the walls for the proper circulation of the heat, and paper partitions 15 are fixed upon the end surfaces of each division for the purpose of preventing a backward draft from the open chambers. These paper partitions are destroyed successively as the heat traveling forward from the fire becomes strong enough for that purpose. The piers 14 close the channels 10 and also serve as supports for bricks or other material, which being built upon the piers, substantially fill the arches and form a support for the edges of the paper partitions where they extend beyond the wares in the chamber, and thus prevent the paper from being burst or destroyed by the strong draft through the apparatus. Openings 14^a are made through the piers approximately in line with the channels 10, and these are also covered with a destructible paper. When the advancing heat becomes sufficient to destroy these partitions, a draft and circulation is set up through the next chamber, and thus each one is successively heated and fired.

In the section Fig. 1 I have shown the left side of the apparatus on a section Y, which discloses the furnaces and damper-controlled draft-flue. The section upon the opposite side is taken upon such lines that the dampers and the floor of the kiln and recharging and discharging doors are shown. The burners or injectors may be of any suitable or desired form and are illustrated at 8, Fig. 2. These burners disposed, as previously described, at intervals, open through the chambers or passages 2 in the walls of the furnace and are closed in by brick or other material, as shown at 9, so that only a sufficient amount of air is admitted at the burner-inlets to insure the proper combustion of fuel at that point, in connection with the regenerative gases from those chambers which are in process of cooling. The jet of flame thus

produced strikes against walls 10^a at the bottom of each channel 10, and these walls and the burner-passages being inclined, as shown, with relation to a horizontal line the products of combustion are diverted upwardly through the wares with which the kiln is charged and the tendency of the flame is thus upwardly, the curvature at the top of the kiln causing it to be deflected downwardly again through the wares and toward the draft-passage 7. The draft-passage 7, which passes beneath the kiln-chambers, is connected at intervals with the conduit 4 through transverse passages 5, and by means of dampers or controlling-gates (shown at 11) the draft for any chamber may be readily controlled. The passage 7 has valves or gates 12, corresponding with each of the chambers, and having suitable connections with levers or handles 13 by which the valves or gates may be opened or closed at will.

The operation of the kiln will then be as follows: After the burning has once been started, a certain number of the chambers will be filled with the wares to be burned and paper partitions are fixed between the chambers in such a manner as to prevent any draft of air except in the direction from the open chambers or those which are being discharged toward those in which the burning is taking place. The central flue 7 at the bottom is closed in order that the cold air (which moves along the lower part of the kiln from the discharging end) will travel through the side channels 10 as well as through the hot wares and become heated, so as to deliver hot fresh oxygen to the combustion-chambers and deliver sufficient oxygen for the complete combustion of the fuel and at a high temperature. When the fire has passed any damper 12, the open flue or passage 7 in the center of the chamber is closed and the draft then takes place through the next succeeding passage, and so on, the draft-openings being advanced as rapidly as the burning is completed and the burned wares are then allowed to gradually cool down to a point where the chamber can be opened and the wares removed. As the fire advances the paper over the pier-openings 14^a will be burned out, so as to allow the draft to pass through the next contiguous chamber, and so on around the circuit. When the draft-opening to the central flue in the floor of the kiln is closed, the air will follow through the openings in the walls and the channels in front of the furnaces, and will thus be fed to the kiln-chambers to supply oxygen to the fire as fast as the paper over the openings 14^a is destroyed. Small openings 15 are made in the top of the kiln, extending down to the burning-chambers, for the purpose of examining the fire and inspecting the settling of the burned wares. In the right portion of the section, Fig. 2, a larger opening is shown, as at 16, which may

be utilized for withdrawing surplus heat which may be employed for other purposes as required. By this arrangement of the burners I am enabled to place them in positions of greatest accessibility, so that any clogging or disarrangement can be readily rectified without cooling off the kiln, removing the bricks, or otherwise interfering with the operation except in the temporary cessation of operation of the particular burner which may be shut off. The burners 8 may be of such form as to inject either liquid or finely-pulverized fuel of any suitable description.

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

1. A regenerative kiln having burning-chambers and a series of passages directed inwardly from the sides and connecting with the lower part of the burning-chambers, said chambers having depressed channels at each side of the floor and with which channels the said passages connect, and burners disposed to discharge through said passages into the burning-chambers.

2. In a regenerative kiln, a successive series of burning-chambers having depressed channels at each side of the floor, fuel-passages opening inwardly and downwardly from the outer sides and connecting with the lower portions of the channels, said channels having deflecting-walls against which the products of combustion strike, and by which they are diverted upwardly into the chambers, and means for controlling the air-supply thereto.

3. In a regenerative kiln, a successive series of burning-chambers having passages opening inwardly and downwardly through the outer walls, fuel-burners discharging in line with said passages, deflecting-walls by which the products of combustion are delivered upwardly and circulated within the burning-chambers, means for controlling the air-supply around the burners, and means for controlling an independent air-supply to the interior of the burning-chambers.

4. In a regenerative kiln, a series of burning-chambers, passages extending through the walls on both sides of the lower part of the chambers, fuel-burners discharging through said passages and into the burning-chambers, a continuous subterranean air-conduit, gates operable across said conduit and corresponding with each of the burning-chambers, means by which said gates may be opened and closed.

5. In a regenerative kiln, a successive series of burning-chambers having depressed channels along each side of the floor with fuel-burners discharging into the chambers from opposite sides, means including a subterranean air-conduit for controlling an air-supply to the chambers independent of that

admitted around the burners, a discharge-flue and connections between it and each of the chambers, and gates or dampers by which said connections are controlled.

5 6. In a regenerative kiln, successive series of burning-chambers, intermediate piers on the sides, openings through said piers, destructible partitions covering said openings and separating the chambers, transverse passages through the exterior walls and burners through which products of combustion are delivered through said passages into the kiln-chambers, a passage or conduit beneath the center of said chambers, gates by which said passage may be closed behind the chamber in which the burning has been completed and air admitted to the succeeding chambers, a subterranean passage and escape flue or chimney with which it connects, passages connecting each of the kiln-chambers with said main escape-flue, and gates or dampers by which the discharge is controlled.

7. In a continuous regenerative kiln, successive burning-chambers, with depressed channels at each side of the floor, piers across the channels, corresponding with the divisions between the chambers, said piers having openings and destructible closures therefor, successive furnaces communicating with the channels through the outer walls, a continuous central draft-passage and gates by which said passage may be closed.

8. A continuous kiln comprising laterally-disposed regenerative combustion-chambers having channels at each side of the floor, perforated piers between said chambers and extending across said channels, and means for regulating the supply of air to said combustion-chambers.

9. A continuous kiln having combustion-chambers extending to the interior at an angle downward from a horizontal plane, said kiln having regenerative flue-openings along the sides, a damper-controlled open-topped central floor-flue, and damper-controlled draft-flues.

10. A continuous kiln having a series of laterally-disposed regenerative furnaces extending into the kiln at an incline downwardly, open-topped deflecting-flues contiguous to the inner sides of the kiln, perforated piers extending across and dividing said flues, a central floor-flue, means for controlling a supply of air to and from the said floor-flue, and means for controlling the supply of air to the said furnaces.

11. In a continuous kiln, laterally-disposed regenerative furnace, deflecting-flues disposed at each side of the floor of the kiln, perforated division-piers extending across said flues, a centrally-located flue extending through the kiln, dampers by which said flue is controlled, and pipes for the introduction of fuel.

12. In a continuous kiln, inclined laterally-disposed regenerative furnaces, floor-flues contiguous to the inner walls of the kiln and having the inner sides inclined toward the interior of the kiln, a central damper-controlled floor-flue, and damper-controlled draft-openings connecting with said flue.

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

WILLIAM A. BUTLER.

Witnesses:

H. NEUNABER,
E. A. BEHLOW.