G. E. GOLDNER.

CONTINUOUS KILN.

APPLICATION FILED FEB. 23, 1911.

1,011,050.

Patented Dec. 5, 1911.

3 SHEETS—SHEET 1.

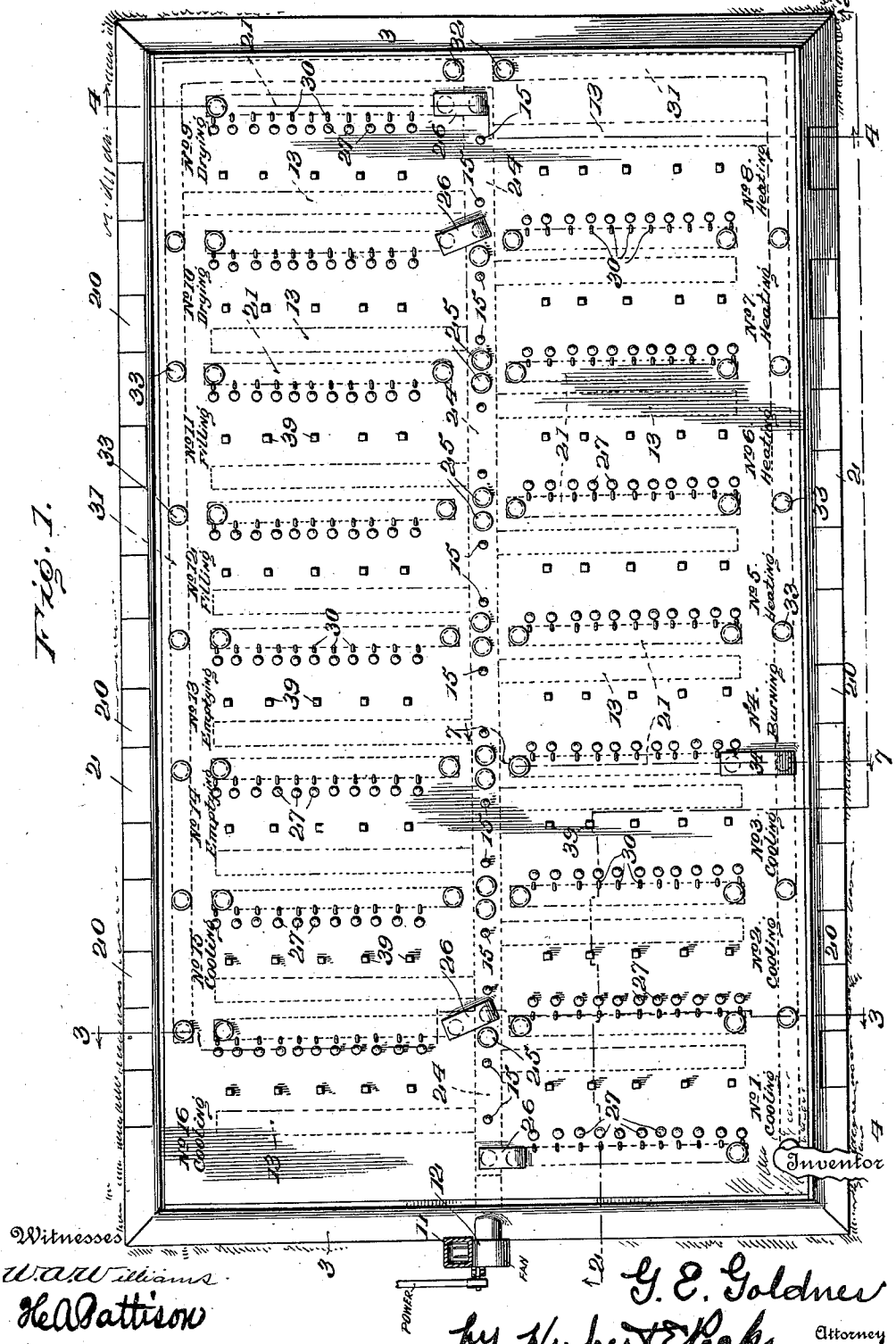


Fig. 1.

Witnesses

W. A. Williams.

H. A. Pattison

Inventor

G. E. Goldner

by Hubert E. Peck Attorney

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

G. E. GOLDNER.

CONTINUOUS KILN.

APPLICATION FILED FEB. 23, 1911.

1,011,050.

Patented Dec. 5, 1911.

3 SHEETS—SHEET 2.

Fig. 2.

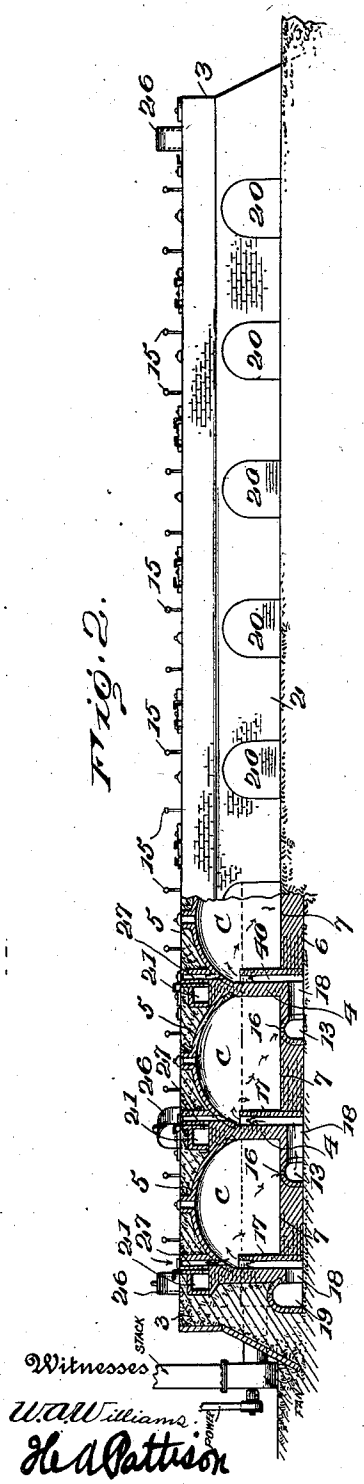
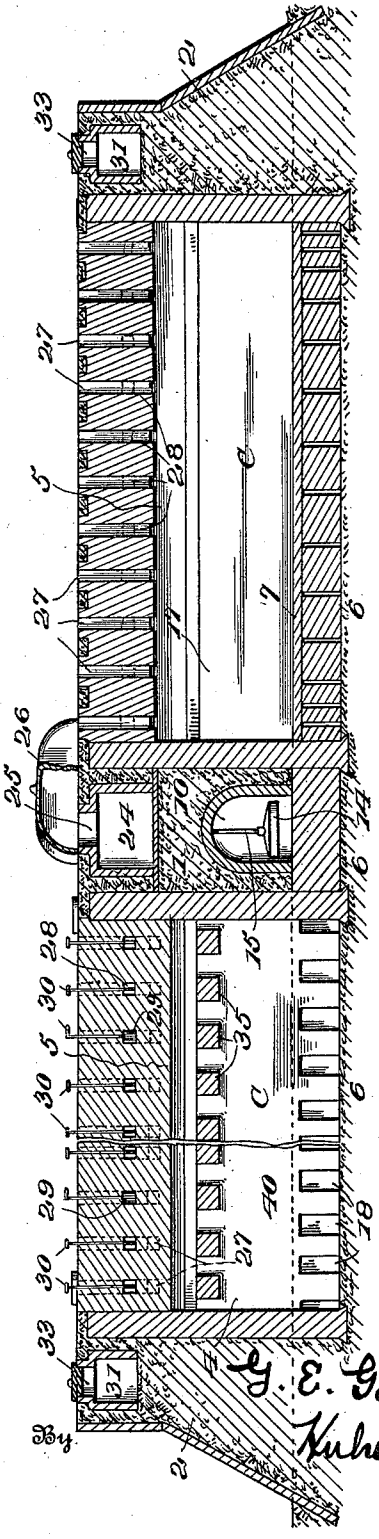


Fig. 3.



Witnesses

W. A. Williams.

H. A. Pattison

Inventor

G. E. Goldner

By Kuhn & Eckle

Attorney

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

G. E. GOLDNER.

CONTINUOUS KILN.

APPLICATION FILED FEB. 23, 1911.

1,011,050.

Patented Dec. 5, 1911.

3 SHEETS—SHEET 3.

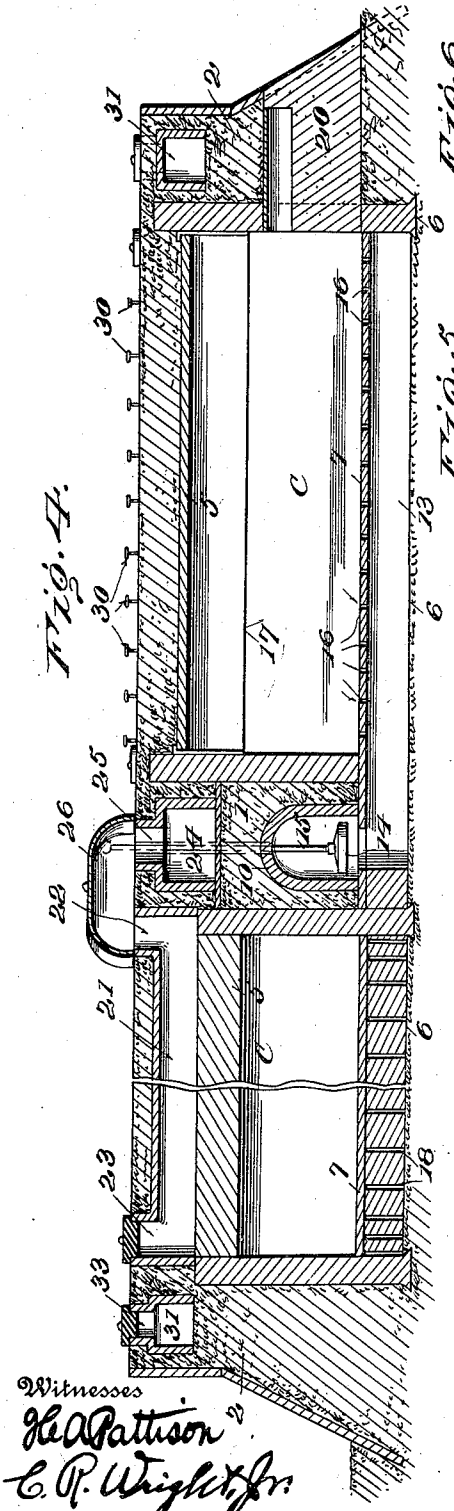


Fig. 4.

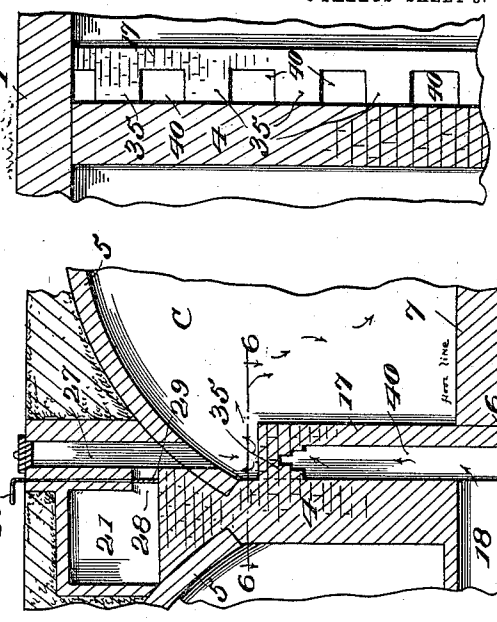


Fig. 6.

Fig. 5.

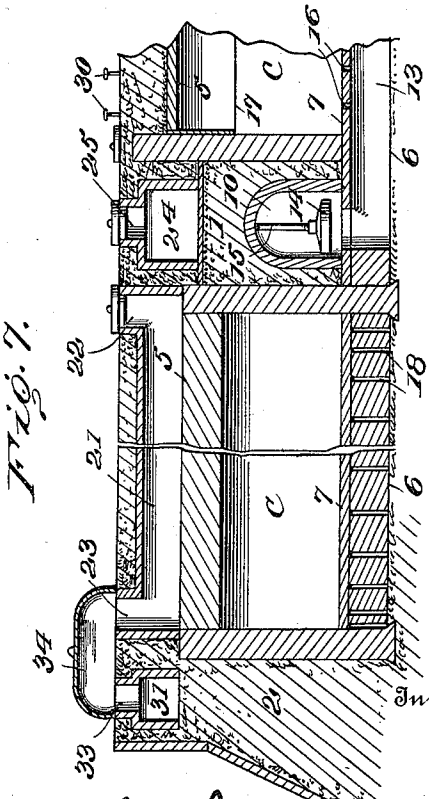


Fig. 7.

Witnesses

H. A. Pattison

C. P. Wright, Jr.

Inventor

By G. E. Goldner

by Whittemore & Peck Attorney

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

GEORGE ELMER GOLDNER, OF FORT DODGE, IOWA, ASSIGNOR TO HIMSELF AND VINCENT CLAY PRODUCTS COMPANY, OF FORT DODGE, IOWA, A COPARTNERSHIP.

CONTINUOUS KILN.

1,011,050. Specification of Letters Patent. Patented Dec. 5, 1911.

Application filed February 23, 1911. Serial No. 610,382.

To all whom it may concern:

Be it known that I, GEORGE E. GOLDNER, a citizen of the United States, residing at Fort Dodge, Webster county, Iowa, have invented certain new and useful Improvements in Continuous Kilns; and I 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.

This invention relates to certain improvements in continuous kilns for burning ceramic ware or other plastic material articles; and the objects and nature of my invention will be readily understood by those skilled in the art in the light of the following explanation of the accompanying drawings illustrating what I now consider to be my preferred embodiments from among other formations and arangements within the spirit and scope of my invention.

An object of the invention is to provide certain improvements in continuous kilns whereby such kilns are adapted for operation with various kinds of fuel, such as coal, natural gas, fuel oil, producer gas and the like.

A further object of the invention is to provide improvements in down-draft kilns whereby the space between the crown or arch of the kiln chamber and the ware piled therein to be burned, is utilized as the combustion chamber.

A further object of the invention is to provide certain improvements in continuous kilns whereby the air and fuel are brought together in the kiln chambers above the bag walls.

A further object of the invention is to provide continuous kilns with fire holes opening through the tops thereof and into the kiln compartments above the bag walls.

A further object of the invention is to provide hot air flues between the arches of adjacent chambers of continuous kilns, in connection with top fire holes into said chambers having valve controlled openings into said flues, whereby hot air can be introduced into the chambers or withdrawn therefrom through said flues and holes.

A further object of the invention is to provide the chambers of continuous kilns with series of fire holes opening thereinto at one side of the crown or arch thereof and above the bag walls therein.

A further object of the invention is to provide means for introducing the fuel into the chambers of continuous kilns through the portions of the arches or crowns thereof immediately above the bag walls.

A further object of the invention is to provide down draft kilns with elevated tables immediately below fire holes through the kiln crowns.

A further object of the invention is to provide elevated tables extending from the division to the bag walls of continuous kiln chambers and arranged directly below fire holes through the crowns of such chambers for the diffusion of heat, reception of glazing material, or the like.

A further object of the invention is to provide the chambers of a continuous kiln, each with a longitudinal series of fire holes opening through its crown with independent dampers for controlling said holes, respectively.

A further object of the invention is to provide certain improvements in arrangements of flues and combinations of parts whereby a highly efficient and advantageous continuous kiln will be produced.

The invention consists in certain novel features in construction and arrangement and in combinations as more fully and particularly set forth hereinafter.

Referring to the accompanying drawings:—Figure 1, is a top plan view of a contiuous kiln embodying various features of my invention. Fig. 2, is a sectional elevation taken in the plane of the line 2—2, Fig 1. Fig. 3, is a section on the lines 3—3, Fig. 1. Fig. 4, is a section on the lines 4—4, Fig. 1. Fig. 5, is an enlarged detail cross section. Fig. 6, is a detail horizontal section on the line 6—6, Fig. 5. Fig. 7, is a detail section in the plane of the line 7—7, Fig. 1, showing the arrangement when producer gas is used for firing.

In the specific example illustrated, the kiln is oblong or rectangular in form having suitable vertical end and side walls and a roof or top and is internally divided by various longitudinal and transverse partitions or walls into chambers or compartments C. Each chamber is arranged transversely of the kiln and in length is equal to something like one half of the width of the kiln. These chambers are arranged in two

series or rows longitudinally of the kiln. The two rows of chambers are separated by a strong heavy division wall 1, arranged centrally and longitudinally throughout the length of the kiln and forming the inner end walls of the chambers. The longitudinal side walls 2 of the kiln form the outer end walls of the chambers and are provided with door openings 20, one for each chamber. Heavy walls 3, are provided at the ends of the kiln and these end walls 3, form the outer side or longitudinal walls of the four end chambers and aid in supporting the roof or top of the kiln.

The chambers C, are separated by partition or division walls 4, arranged transversely of the kiln and extending from the center wall 1, to the side wall 2, and these walls 4, carry the crowns or arches 5, of the compartments 3 and extend therefrom down to the base or foundation 6, of the kiln on which the side and end walls 2 and 3, and the center wall 1, also rest. Each chamber C is formed or provided with an elevated horizontal floor 7.

The main draft flue 10, of the kiln is arranged throughout the length of the lower portion of the longitudinal center wall 1, of the kiln and at one end discharges into the stack 11, if so desired, through suction fan 12.

Each chamber C, is provided with a bottom draft flue 13, arranged throughout the length thereof resting on the foundation 6 and located below the floor 7. The chamber draft flues 13 at their inner ends open upwardly into the main draft flue 10, through the floor thereof, and dampers 14, are provided for opening and closing the outlets of the draft flues 13 into the common draft flue 10. An independent damper 14, is provided to control the outlet of each flue 13 into the common flue 10. In the specific example illustrated, I show these dampers in the form of bodily and vertically movable valves located in the flue 10, and operated by lift rods 15, extending vertically to readily accessible points above the kiln top for manipulation by the persons operating the kiln. These chamber draft flues 13, are arranged along the side portions of the chambers and communicate with the interiors of the chambers through perforations or ducts 16 in the floors 7, while at the opposite side portions of the chambers vertical bag walls 17, are provided extending throughout the length of the chambers and terminating a short distance below the spring of the chamber crowns or arches. These bag walls extend down to the base or foundation 6, and are spaced from the adjacent chamber side walls 4, a short distance to form vertical spaces or passages 40, opening into the chambers just below the spring of the arches and extending down to the foundation 6. Lateral passages 18, extend through the chamber side walls 4, and open into the sides of the chamber draft flue 13, placing said flue 13 in communication with the passages 40, behind the bag walls of the adjacent chambers, as will be readily understood by those skilled in the art.

Across the ends of the kiln, and in the walls 3, I provide bottom draft flues 19, extending the full width of the kiln and placing the chambers at the ends of the kiln in communication through their bottom draft flues and passages 40, behind the bag walls, as will be well understood by those skilled in the art, so that the draft can pass from one end chamber into its bottom draft flue and laterally through ducts from said bottom draft flue into said adjacent end draft flue 19, and therefrom through lateral ducts into the vertical passage behind the bag wall of the corresponding end chamber at the same end of the kiln.

In the top portion of the kiln, I arrange hot air or gas receiving and distributing branch or chamber flues 21, arranged between the crowns of the chambers and in and longitudinally of the side walls 4, separating the chambers. These flues 21, are closed at their ends usually by the side walls 2, and central longitudinal division wall 1. The flues 21, are usually arranged between the spandrels of the chamber crowns or arches, one of said flues being provided for each chamber C. At their inner ends, the flues are provided with vertical passages or ducts 22, opening through the kiln top and these outlets are normally closed by suitable caps or plugs. At their outer ends, said flues are provided with vertical ducts or passages 23, also opening through the kiln top and normally closed by suitable caps or plugs. A main hot air distributing flue 24, common to all the flues 21, is arranged longitudinally, and about throughout the length of the longitudinal division wall 1, and this distributing flue is preferably closed at its ends and is designed to receive hot air from any one or more chambers and deliver the same to any other chamber or chambers. The distributing flue is hence provided with top or vertical ducts or passages 25, opening through the kiln top and normally closed by plugs or caps. The passages 25, are so spaced and distributed throughout the length of the flue that there will be a passage 25, opening through the kiln top adjacent to each chamber flue passage 22, opening through the kiln top, whereby any chamber flue passage 22, can be placed in direct communication with a distributing flue passage 25 to receive or deliver hot air, by means of a removable hood or connector 26, arranged on the kiln top and extending from passage to passage and having its bottom openings registering therewith, as will be understood by those skilled in the art, said

hoods broadly being well known in the art. Of course, wherever pasages are to be placed in communication through the medium of such hoods, the plugs or caps sealing such passages are first removed. These hoods can be readily shifted from one set of passages to another.

Each chamber is provided throughout the length thereof with a row or series of comparatively closely arranged separate vertical fire holes or passages 27 at their upper ends opening through the kiln top and at their lower ends opening through the chamber arch or crown near the spring thereof and approximately directly over the chamber bag wall and the vertical passage 40, behind said bag wall. These fire holes are usually closed at their upper ends by suitable caps or plugs, excepting the fire holes of the chamber or chambers being fired by oil or natural gas applied through nozzles inserted in such fire holes. Each chamber flue 21, is placed in communication with all of the fire holes of its chamber by lateral passages or ports 28, opening from the lower portion of the adjacent side of the flue laterally into the fire holes intermediate their vertical lengths, a separate port 28, being provided between each fire hole of a chamber and said chamber flue. These ports 28, are separately controlled by swingable valves or dampers 29, arranged therein and carried by manually operative vertical rotatable valve rods or handles 30 extending to readily accessible points at the kiln top, whereby any port can be opened or closed independently of other ports between fire holes and the same chamber flue. These ports 28, and the fire holes place the chamber flue throughout its length in communication with the chamber throughout its length, to deliver the hot air thereto or to take hot air therefrom, and the flow of hot air can be controlled by the valves, and through the medium of said valves the chamber flue can be completely shut off from the fire holes.

Where fuel oil or natural gas are to be employed for firing the chambers, pipe lines can be arranged on the kiln top with nozzles or burners extending down in the fire holes of the various chambers, so that the fuel will be introduced into the chamber being fired through the fire holes. In the chamber or chambers being thus fired by fuel introduced through the fire holes, the swingable valves will be adjusted to close ports 28, between the fire holes and chamber flues 21.

Where coal is used as fuel, it can be introduced into the chamber being fired through the fire holes, as will be understood by those skilled in the art, so as to burn on the tables hereinafter described.

To provide for the use of producer gas as the fuel for firing the chambers, I provide flues 31, within the top portions of the side walls 2, and throughout the lengths thereof, and usually extending along one end wall to points 32 (see dotted lines Fig. 1) to receive gas from any suitable gas producer. The producer gas supply flues 31 are provided with top outlet passages or ports 33, opening through the kiln top opposite and adjacent to the vertical inlet ports or passages 23, of the chamber flues 21, and these ports 33, are closed by suitable plugs or caps except at the outlet port supplying gas to the chamber being fired. Gas is supplied to the chamber being fired by a suitable removable hood 34, on the kiln top and placed over the open ports 23, 33, of the flue 21, of said chamber and the opposite or adjacent producer gas outlet port. The producer gas is thus conducted into the flue 21, of said chamber and is distributed through the ports 28, into the fire holes and therefrom delivered into one side of the chamber above the bag wall and vertical passage 40. The proportion of gas delivered into the end and intermediate portions of the chamber can be accurately controlled by the valves 29, so that the ware in various portions of the chamber can be uniformly burned or fired.

Each chamber is provided with elevated horizontal combustion and diffusing tables 35, arranged directly under the lower ends of the fire holes and spaced a distance therefrom, and these tables are spaced apart a distance approximately equal to the spacing of the fire holes, a table being located under each fire hole. These tables can extend from the bag wall across the passage 40 to the adjacent chamber side wall 4. and in the specific example illustrated, I show the tables formed and supported by corbels built out from the bag and side walls with the tables spaced apart to provide spaces for the upward discharge of the hot air from passage 40, into the chamber to meet the fuel entering through the fire holes and to support combustion in the combustion space in the upper part of the chamber above the ware stacked therein. These tables will receive the fuel dropped through the fire holes when coal is used for firing and thus form fire or combustion beds or tables and means for diffusing or distributing the heat. Where oil or gas is used for fuel, the heat and burning gases are directed down against the tables and are thereby diffused throughout the upper portion of the chamber. The tables can also receive salt, borax or other material used for glazing the ware in the kiln, such glazing material being vaporized or reduced while on the tables by the intense heat at the portion of the kiln where the tables are located and distributed therefrom throughout the stack of ware in the chamber.

In Fig. 1, of the drawings, I show the kiln provided with sixteen chambers, arranged in two longitudinal rows of eight chambers each, which I have numbered consecutively 1 to 16, and indicated on each a possible condition of the interiors thereof as illustrative of a method of operation. For instance, assuming that chamber No. 4, is burning, for example being fired by producer gas introduced into the chamber flue 21, thereof from producer gas supply flue 31 through hood 34. The gas will pass through ports 28, and the fire holes 27, into the chmaber above the bag wall and diffusing tables. The chamber No. 3 will be cooling, the temperature therein being say approximately 1500°, and the hot air will be drawn therefrom through its perforated floor down into its bottom draft flue and laterally therefrom into the vertical passage 40, of the burning chamber 4. The hot air from passage 40, will meet the burning gas above the bag wall to support combustion in the combustion space of chamber No. 4 beneath the arch thereof and above the ware stacked in said chamber. The draft in chamber No. 4 will be down through the stack of ware therein and through the perforated floor to the bottom draft flue which is on the opposite side of the chamber from the bag wall, and from the draft flue the hot products will pass into chamber No. 5 through its vertical passage 40. Chambers Nos. 5, 6, 7, and 8, will be filled with ware under process of heating up preparatory to burning. The hot products from the burning operation carried on in chamber No. 4 being passed successively through said chambers 5 to 8, inclusive, by the suction or draft of the main draft flue or its suction fan. The bottom draft flues 13, of chambers Nos. 4 to 7, being closed from communication with the main draft flue 10, while the bottom draft flue of chamber No. 8, is open to communication with the main draft flue 10, the valve 14 of the bottom draft flue of chamber No. 8, being elevated.

In the specific example as illustrated by Fig. 1, the ware in chambers Nos. 1, 2, and 3 has been fired and these chambers are in process of cooling. A portion of the hot air from chamber No. 1, is being taken through the fire holes and flue 21, into the hot air distributing flue 24, by means of the hood 26. The hot air from chambers Nos. 2 and 3, is being drawn therefrom to supply the air for combustion in chamber No. 4, by the draft of the main draft flue 10, and its suction fan. Chamber No. 16, contains burned ware that is cooling and the hot air therefrom is being drawn through its fire holes and flue 21 into the hot air distributing flue 24 through the medium of hood 26, as hereinbefore described in connection with chamber No. 1. Chambers Nos. 9 and 10, contain green ware which is being dried, initially dried by the hot air supplied to the distributing flue 24, from chambers Nos. 1 and 16, also possibly 15. This hot air is taken from flue 24, through hoods 26 and conducted down into the chamber hot air flues 21 and is discharged therefrom into chambers Nos. 9 and 10, through the ports 28 and the fire holes, and the down draft of the hot air through said chambers Nos. 9 and 10, is maintained by placing the bottom draft flues of said chambers in communication with the main draft flue 10, by opening the valves 14 of the bottom draft flues of said two chambers. The chambers Nos. 11, 12, 13 and 14 are being emptied of burned ware and filled with green ware.

Air can be variously supplied to the chambers containing brick in the process of cooling, which air after being heated is drawn off to supply the chambers containing brick being dried and the distribution of the hot air for drying is determined and controlled through the medium of the independent valves or dampers 29. Cold air can pass into the kiln through chambers being emptied of burned brick. For instance, in the arrangement of Fig. 1, cool air can pass in through the open door of chamber No. 14, and down through the floor thereof, and into and through chambers Nos. 15 and 16, and then across through flue 19, and out at the top of the bag wall into chamber No. 1. A portion of the hot air from chamber No. 1, is taken out through the fire holes, passages 28 and flue 21, for supplying drying air and heat to chamber No. 10. A portion of the air drawn from the open chamber No. 14, is also taken off from the cooling chamber No. 15, for supplying hot air for drying chamber No. 10. The hot air travels through the hot air system for drying because the draft therethrough is stronger than is the draft ahead through chambers Nos. 2, 3, and 4, but it is in this connection that the several series of independent manually controlled valves 29, perform peculiar functions and attain important results in controlling the quantity of hot air delivered from the cooling compartments for drying and the distribution and equalization of the draft therein as well as in the drying compartments. Furthermore, these series of independent manually controlled valves arranged longitudinally of each compartment also perform important functions in controlling the draft as well as the distribution and equalization thereof longitudinally of burning compartments as well as heating compartments.

Those skilled in the art understand that the process of filling, drying, burning, cooling and emptying chambers is being carried on continuously, the burning process advancing from chamber to chamber.

It is also well understood that each cham-

ber is provided with center vent or testing holes or openings 39 through the kiln top, through which the condition of the ware can be tested or otherwise determined.

It is evident that various changes, modifications, and variations might be resorted to in the forms, constructions, arrangements, and combinations set forth without departing from the spirit and scope of my invention, and hence I do not wish to limit myself to the exact disclosure hereof, but consider myself entitled to all such departures as fall within the spirit and scope of the appended claims.

What I claim is;—

1. A kiln chamber provided with a series of elevated spaced diffusing and glazing material receiving tables, and means for directing heat downwardly against said tables.

2. A kiln having a chamber, a series of horizontally disposed spaced elevated tables arranged along the upper portion of said chamber, the crown of said chamber provided with a series of spaced fire holes opening downwardly into the upper part of said chamber immediately over said tables, respectively, and means for supplying fluid fuel in said fire holes, whereby the burning fluid fuel is directed downwardly from said fire holes toward and is diffused by said tables, substantially as described.

3. A kiln having a chamber, means for supplying air to the upper portion of one side of said chamber, means for maintaining down draft through said chamber, a series of horizontally disposed elevated tables arranged along one side of the upper portion of said chamber at said air supply thereinto, said chamber being provided with a series of fire holes opening downwardly into the upper portion thereof immediately over and directed toward said table, and means for supplying fluid fuel to said fire holes, whereby the burning fluid fuel is directed from said fire holes toward said tables in the presence of air supplied by said means for supplying air.

4. A kiln having a chamber, a bag wall arranged along a side thereof and providing a vertical air supply passage opening into the upper portion of said chamber, a series of elevated tables arranged along the top portion of said bag wall and bridging said passage and spaced apart to provide intervening air spaces, the crown of said chamber formed with a series of vertical fire holes opening into the upper portion of the chamber over said tables and adapted to direct burning fluid fuel downwardly into the chamber and toward said tables.

5. A kiln having a chamber, a vertical bag wall forming in connection with the adjacent wall of the chamber, a vertical air passage opening into the upper portion of the chamber, a series of elevated spaced tables extending from the bag wall to said adjacent wall and supported by corbels carried by said walls, the crown of the chamber being provided with fire holes opening thereinto immediately over said tables.

6. A kiln having a chamber provided with a longitudinal series of fire holes opening downwardly through the crown thereof into the upper portion of the chamber about at the spring of the crown arch, means for supplying fluid fuel to said fire holes, means for supplying air into the upper portion of the chamber immediately below said fire holes, and deflecting and diffusing means arranged immediately below said fire holes.

7. A continuous kiln having a series of chambers, means for maintaining draft therethrough, a wall of said kiln being provided with a depressed longitudinal fluid fuel supply flue having normally closed branch outlet openings through the kiln top and opposite said chambers, respectively, a depressed hot air distributing flue common to all of said chambers and having normally closed openings through the kiln top and opposite said chambers, respectively, chamber flues arranged longitudinally of said chambers, respectively, each chamber flue having a longitudinal series of side passages opening into the upper portion of its chamber, separate manually controlled means operative from the kiln top for independently controlling said passages, respectively, each chamber flue at its opposite ends having normally closed openings through the kiln top, one of said openings being adjacent to a fuel flue opening and the other adjacent to a distributing flue opening, and separate removable portable hoods on the kiln top and arranged to temporarily place any fuel flue opening in communication with an adjacent chamber flue opening, and the openings of other chamber flues temporarily in communication with adjacent distributing flue openings, substantially as described.

8. A continuous kiln comprising a series of chambers provided with means for maintaining draft therethrough, a hot air distributing flue arranged transversely thereof and having normally closed openings through the kiln top opposite said chambers respectively, chamber flues arranged longitudinally of said chambers, respectively, and each at one end having a normally closed opening through the kiln top arranged adjacent to an opening of said distributing flue, portable independent hoods on the kiln top adapted to temporarily place several of said chamber flue openings in communication with the adjacent distributing flue openings to deliver and receive hot air, each chamber flue having a longitudinal series of side passages into the upper portion of its chamber, and independent means for separately controlling said passages, respectively, having

independent manually actuated operating means operative from the kiln top, substantially as described.

9. A continuous kiln comprising a series of chambers and means for maintaining draft therethrough, chamber flues for said chambers, respectively, arranged longitudinally thereof, each chamber having a series of vertical top fire holes arranged longitudinally thereof, each flue having a series of passages arranged longitudinally thereof and opening laterally into the fire holes of its chamber, respectively, independent valves for separately controlling said passages, respectively, having vertical manually operated actuating means independently operative from the kiln top, and means whereby hot air can be taken from a chamber through said holes, passages and flue and distributed to another chamber through its flue, passages and holes, substantially as described.

10. A continuous kiln comprising a series of chambers, each chamber having a series of vertical fire holes arranged longitudinally thereof and opening into the upper part of the chamber, chamber flues for said chambers, respectively, arranged longitudinally thereof and having longitudinal series of lateral passages opening into the adjacent fire holes respectively, above the lower open ends thereof, each passage provided with a separate controlling valve having actuating means operative from the exterior of the kiln, whereby each valve of the several series can be separately and independently operated, and means whereby fluid can be drawn from or passed to said chambers through the medium of said flues, passages and holes under the distributing and equalizing control of said valves, substantially as described.

In testimony whereof I affix my signature, in presence of two witnesses.

GEORGE ELMER GOLDNER.

Witnesses:

LEON VINCENT,

H. S. VINCENT.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."