

R. C. PENFIELD & F. S. NAUGLE.

BRICK KILN.

APPLICATION FILED APR. 23, 1909.

Patented Oct. 11, 1910.

4 SHEETS-SHEET 1.

972,570.

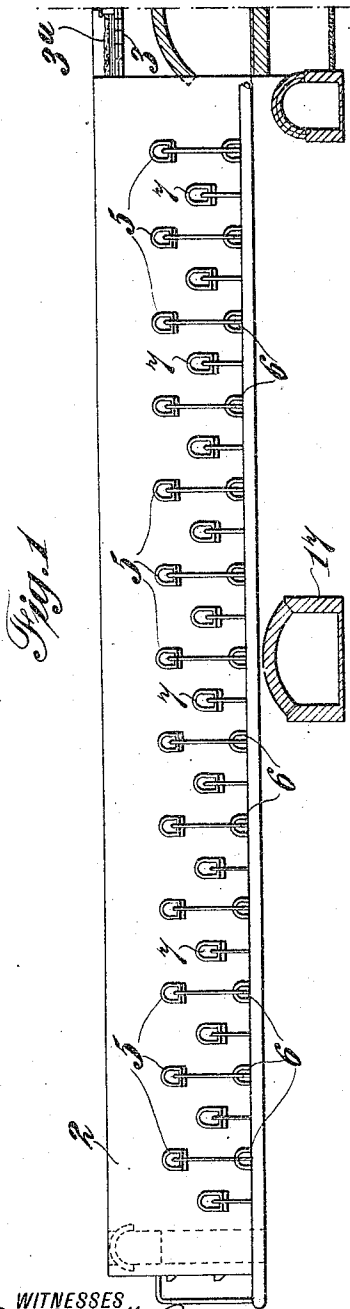


Fig. 1

WITNESSES

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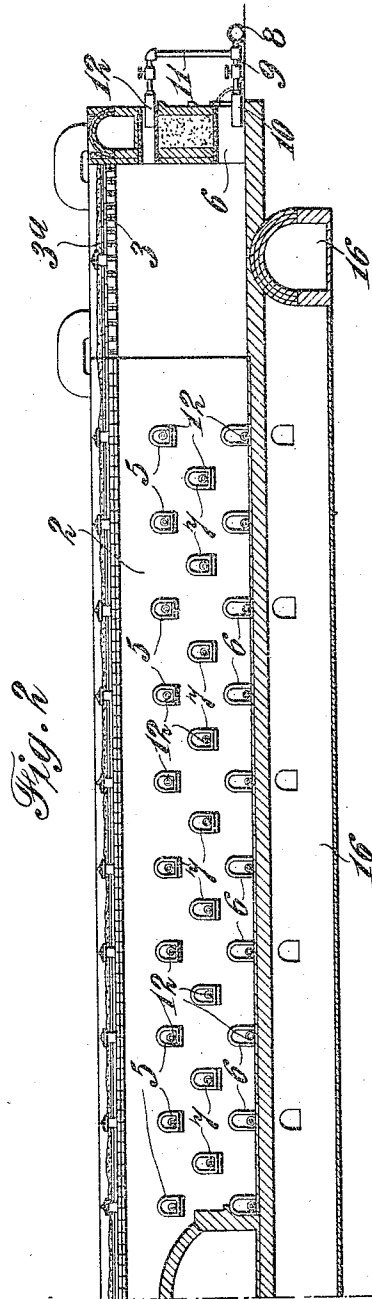


Fig. 2

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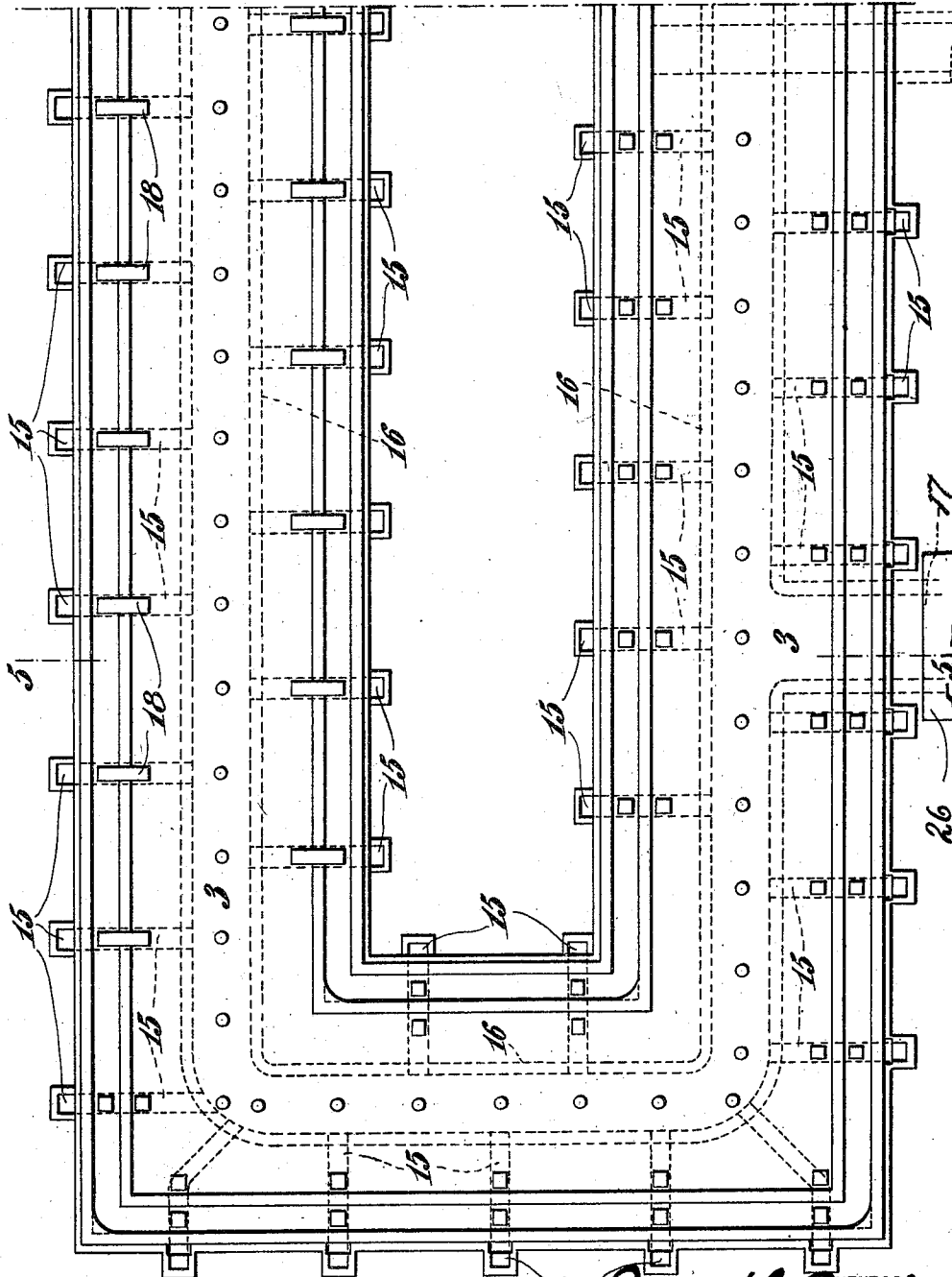
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4 SHEETS-SHEET 2.

972,570.



WITNESSES
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Fig. 3

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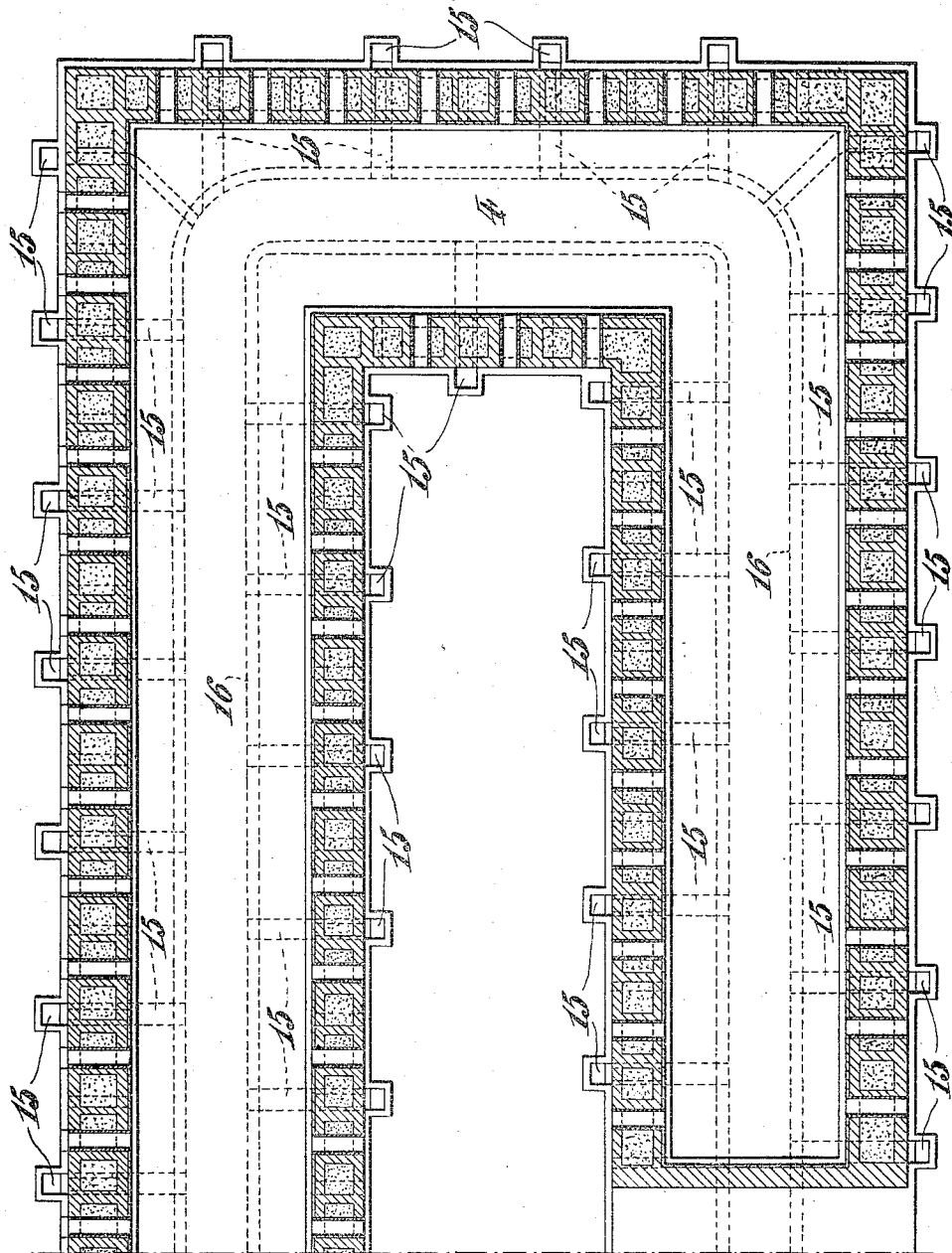
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4 SHEETS—SHEET 3.

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WITNESSES

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Fig. 4

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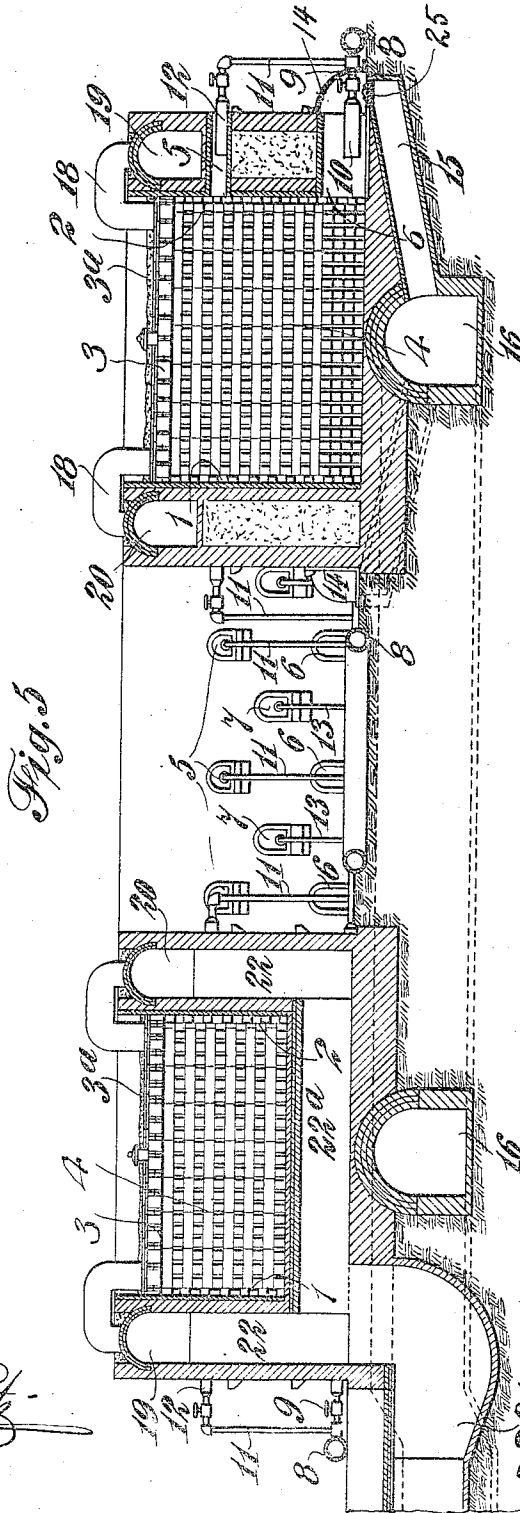


Fig. 5

WITNESSES
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UNITED STATES PATENT OFFICE.

RAYMOND C. PENFIELD, OF NEW YORK, AND FREDERICK S. NAUGLE, OF WARNER,
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BRICK-KILN.

972,570.

Specification of Letters Patent.

Patented Oct. 11, 1910.

Application filed April 23, 1909. Serial No. 491,700.

To all whom it may concern:

Be it known that we, RAYMOND C. PENFIELD and FREDERICK S. NAUGLE, citizens of the United States of America, residing, respectively, at New York city, in the county of New York and State of New York, and at Warner, county of Onondaga, and State of New York, have invented certain new and useful Improvements in Brick-Kilns, of which the following is a specification, reference being had therein to the accompanying drawing.

Our invention relates to a continuous brick-kiln, having for its object the even and thorough burning of all the bricks in the kiln from the bottom to the top thereof, so that there may be no cessation in its successful operation, but it may be burned continuously throughout its length by properly installing the green brick in a portion of the kiln and burning the same, immediately following this up with the installation and burning of the green brick in another portion, and so on throughout the length of the kiln, the operation going on continuously and uninterrupted.

The invention comprises essentially a continuous or endless kiln construction having a plurality of rows of furnaces arranged parallel to each other in two or more horizontal series and adapted for any desired kind of fuel, such, for instance, as liquid, gaseous or solid. Of course, natural gas or any other gaseous fuel, or any suitable liquid fuel, or coal, wood, etc., may be utilized accordingly as convenience may suggest and the circumstances require, the fuel depending upon its availability and its appropriateness for the kind of brick which is to be made, the character of the clay, etc.

The invention, moreover, consists in various details and peculiarities in the construction and combination, whereby a proper draft is created in connection with all of the furnaces or fires to promote combustion and secure the best possible results, and includes suitable ducts and passages for carrying off the waste heat resulting from the burning of the brick, which waste heat can be delivered and utilized at any distant point for any purpose whatsoever, all as will be hereinafter more fully described and pointed out, and then substantially set forth in the claims.

In the accompanying drawings, illustrat-

ing our invention, Figure 1 is a side elevation with certain parts in section of a half of our improved continuous brick-kiln. Fig. 2 is a side elevation of the other half, said Figs. 1 and 2 together representing a side elevation of the entire kiln. Fig. 3 is a top plan view of a half of the kiln. Fig. 4 is a horizontal sectional plan view of the other half, said Figs. 3 and 4 together representing the whole kiln, which is thus delineated half in top plan and half in horizontal section. Fig. 5 is a cross section of the entire kiln on the line 5, 5 of Fig. 3.

Similar characters of reference designate corresponding parts throughout all the different figures of the drawing.

Our continuous kiln may have any desired general form. It is commonly built in an elongated rectangular or oblong shape, as is clearly seen by matching together Figs. 3 and 4. It consists essentially of an inner continuous wall 1, and another outer parallel continuous wall 2. These walls are of any desired height, width and thickness, being generally of substantial thickness as shown, and preferably filled with earth or other material. They are connected together at the top as shown, and the kiln is what is known as an open top continuous kiln.

We have indicated in the drawings, at 3, a cover for the kiln which roofs over the chamber 4, which may be called the burning chamber and which is situated between the parallel vertical walls 1 and 2. The particular construction of the cover or roof 3 may vary within wide limits, and we do not wish to be restricted to any special type. In the present instance, it consists merely of bricks in rows overlapping each other and the whole covered with a layer of earth 3^a, or clay wash or some similar material which will make the roof air tight.

In the walls 1 and 2 of the kiln, we construct furnace openings, preferably in a plurality of banks. In the specimen of the invention illustrated in the drawings we show three of these banks arranged in horizontal parallel planes. They are illustrated more particularly in Figs. 1 and 2. The members of the upper bank are designated 5; those of the lower bank 6, and those of the intermediate bank 7. The exact form and condition of these furnace openings may be varied within wide limits, and we do not wish to be restricted to what we have shown in

the drawings; but they will be formed in the walls 1 and 2 by leaving apertures or vacant spaces which will be walled in by brick or tile, said spaces being of the right size to accommodate either liquid or gas burners, or such fuel as is to be used in the furnaces, and thereby enable the required combustion to take place which will provide the fires which heat the kiln and burn the brick.

It will be understood, moreover, that the bricks which are set in the burning chamber 4, will be built up therein with such a formation and in such a manner that a greater or less number of arches will be provided which will run transversely and connect the furnaces of corresponding banks together; that is to say, the furnace in one of the side walls, as 2, will connect through horizontal arches in the brick with opposite furnaces of the same bank located in the other side wall, as 1, so that a proper draft may take place when the fires are burning for the purpose of promoting the combustion and enabling the heat so generated to be effectively applied to the bricks. Of course it may not be necessary to connect all of the opposite furnaces with each other in this way, but it will be generally found desirable to use quite a number of these arches. These arches which are formed in the green brick are consequently located in several different horizontal planes corresponding to the number of rows for furnaces. In the present instance there may be three sets of arches, providing passages that connect the furnaces or fires of the three banks in the side walls of the kiln. In lighting the furnaces, we find it most convenient usually to light some of the furnaces 6, which are the lowermost, first and then lighting those immediately above in the rows 5 and 7, but we do not wish to be confined to this practice of first lighting a furnace or furnaces in the lowermost row.

As is well understood in the operation of a continuous kiln, and as we have already hereinabove said in describing the main principle of this kiln, a portion of the contents of the kiln chamber will be burned and then another succeeding portion and then another and so on until the green brick have been installed and burned in the full length of the kiln. When one section of the mass of green brick is being burned, the practice is to close the dampers 25 at the openings in the ends of the subterranean draft passages 15 belonging to those furnaces 6 which are now being fired, thus closing off said passages for the time being. A certain number of furnaces, including one or more furnaces 6 at the bottom, one or more of the furnaces 7, and one or more of the furnaces 5, will then be fired practically at the same time, so that their heat may be jointly applied to the green brick formation

at successive points in the vertical height of the same, so as to impart a burning effect to all the bricks from bottom to top, which effect will be even and uniform throughout the vertical height of the stack. At the time that this vertical group of furnaces is thus being fired, the hoods 14 will, as indicated in Fig. 5, be placed in position over the lower furnaces 6 which are ahead of or in advance of those that are being fired (the dampers 25 having been previously removed from the ends of the connecting passages 15 belonging to the furnaces that are thus hooded) so that by means of these hoods 14 said advance furnaces 6 may be connected with the underground passages 15 so as to form a connection with the trunk duct 16 and the stack for the purpose of promoting combustion, as will be hereinafter more fully explained. After the brick has been thoroughly burned in the chamber opposite to the group of furnaces thus fired, the practice is to remove the hoods from the lower furnaces which have just used them and transfer them to other furnaces beyond in the series, and then close the dampers 25 in the ducts 15 connecting with these furnaces 6 for they are the next to be fired. In this way the burning of the brick proceeds throughout the length of the kiln furnaces by an orderly succession of portions of the contents of the burning chamber, and the kiln is kept constantly and effectively in use.

This kiln may be provided with means for employing natural gas or some suitable gaseous or liquid fuel, in which case suitable supply pipes, as 8, will be arranged at some convenient point relatively to the kiln, and from these pipes 8 there will lead valve-provided pipes 9 having on the ends thereof burners 10 located within the furnaces 6. Also, in order to convey the necessary supply of oil or gas to the furnaces 5, suitable pipes may be connected to the branch pipes 9 or to the main pipes 10, and these pipes 11 will carry burners 12 situated in the furnaces 5 and preferably provided with valves to control the passage of the gas or liquid fuel to the burners 12, as indicated in the drawings. Other suitable pipes 13 also run from the pipes 9 or 8 to the furnaces 7 of the intermediate bank. In this way a plurality of banks of fires is provided, the fires being in the furnace spaces and consisting of ignited jets of gas or oil. Obviously, the furnaces thus arranged and supplied constitute very excellent and useful heating means, and by means of these burners an intense heat can be generated, and as the result of the multiple arrangement in both walls of the kiln and the special location of the various fires a very thorough burning of the bricks in the burning chamber is attained. Although banks of oil, liquid or gas fires of this kind are thus extremely effective, yet

we do not wish to be confined thereto, and hence reserve the liberty of utilizing in furnaces any other kind of fuel which may be found suitable.

5 Above the roof 3 is a series of elbows 18 which are sustained upon the roof and upon the walls 1 and 2. These elbows project through the roof 3 and communicate with the kiln chamber 4, and they also project
10 through the top of the walls 1 and 2 and communicate with horizontal passages 19 and 20, said passage 19 being in the wall 2, and said passage 20 being in the wall 1. These passages run the entire length of the
15 walls, and are of proper size to convey waste heat. The hot air which comes from the various furnaces passes horizontally along through the stack or stacks of bricks in the burning chamber 4 forward to the
20 point of outlet and then out through the various lower furnace openings that are hooded and into and through the hoods 14 connected thereto and into the ducts 15 leading to the stack or fan, while the waste or
25 latent heat behind the fires passes upwardly through the elbows 18 and by the latter is conducted into the horizontal endless passages 19 and 20. These passages or ducts carry away the waste heat and deliver it
30 finally into a subterranean outlet passage 21 which is below the kiln floor and from which any suitable ducts may lead off to the drier or any other point. There are suitable vertical connections shown in Fig. 5, at 22,
35 through which the waste heat reaches the outlet passage 21 from the longitudinal ducts 19 and 20, it being noted, moreover, that the vertical passages 22 are connected together by means of a horizontal duct 22^a.
40 The lower furnaces 6, when being fired, have their dampers 25 closed, while the furnaces 6 in advance of those being fired have their open sides, which are on the outside of the walls 1 and 2, covered by removable
45 sheet iron hoods 14, see Fig. 5. These receive the products of combustion from the chamber 4 and direct the smoke and hot air and moisture from the kiln into the branch ducts 15 which are formed beneath the sur-
50 face of the ground and below the side walls 1 and 2 and also below the kiln chamber 4. All the various branch ducts 15, leading from all the furnaces 6, connect centrally below the chamber 4 with the longitudinal
55 subterranean passage 16 which extends the entire length of the kiln underneath the burning chamber 4. This passage 16 is a trunk passage, and it has an outlet connection 17 as shown in dotted lines in Fig. 3
60 and in cross section in Fig. 4. The connection 17 carries the smoke to the main smoke stack, not shown, or it is provided with a fan 26. Thus the products of combustion pass from the kiln through the branch ducts
65 15 and trunk passage 16 and the right-angled

outlet 17 to the stack, or to the fan 26, and thence to the atmosphere. This arrangement of subterranean ducts, communicating with a chimney and also with the furnaces, promotes draft and enables the combustion in the various furnaces to be accelerated and controlled in a very effective and useful manner.

The fact that subterranean ducts are employed, which are thus placed out of the way and are connected separately with the different furnaces, provides a system of draft regulation which is found in practice to be very serviceable. Hitherto in regulating the draft of furnaces in a brick-kiln, the duct connections with the several furnaces are controlled by means of damper devices which are inside the furnaces or the walls, and being thus inside are consequently located in an objectionable manner as they form obstructions to the working of the furnaces. And also when there are concealed dampers in the kiln walls leakage is apt to occur. In our present arrangement the ducts 15 as well as the trunk connections 16 are entirely outside of the wall of the kiln being under the ground, and the ends of the ducts 15 which connect with the furnaces 6 being outside the walls and in a position where it is necessary to use a hood in order to make a connection between the furnace and the duct. The connections 15 and the trunk 16 being thus outside of and away from the walls are not in a position where they interfere at all with the working of the furnace, but are so located that the furnace has in itself no obstructions to the complete and successful application of the heat to the brick stacks which are to be burned. This is an important and novel point in our construction and we lay stress thereon. In this arrangement also the dampers are placed where they can be effectually sealed and may be subject to thorough inspection at all times.

Many changes in the precise arrangement of the various parts may be made without exceeding the scope of the invention, and we therefore reserve the liberty of modifying the various elements of our combination within wide limits in so far as such modification may be allowed by the claims.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent, is:

1. In a brick-kiln, the kiln chamber having vertical parallel walls, a plurality of rows of furnaces in said walls, burners in the said furnaces for burning liquid or gaseous fuel, supply pipes connected with said burners, hoods for covering the openings into the furnaces of the lower series, a longitudinal central subterranean duct beneath the kiln chamber for carrying off smoke and assisting in the draft, and branch ducts con-

necting the furnaces of the lower row with the said central duct, said ducts provided with dampers, substantially as described.

2. In a continuous brick-kiln, an elongated chamber having vertical parallel side walls, longitudinal ducts arranged in the upper part of said walls, vertical ducts connecting with the said longitudinal ducts and themselves connected with each other, a subterranean duct leading away from the kiln and receiving waste heat from the aforesaid ducts, elbows arranged in the upper part of the kiln for receiving waste heat from the kiln chamber and delivering it to the longitudinal ducts in the walls, plural series of fires or furnaces arranged in the vertical walls at points opposite to each other so that the result of the combustion may be to project flames toward each other and through arches built in the brick to be burned, and a system of ducts whereby the smoke is carried away and the draft in the various furnaces of the lower row is facilitated, substantially as described.

3. In a brick-kiln, a continuous chamber having vertical parallel side walls, furnaces arranged in a plurality of rows in said walls, burners in the said furnaces for burning liquid or gaseous fuel, supply pipes for said burners, branch ducts outside the walls of the furnace and arranged to lie in close proximity to the furnaces, means consisting of hoods for temporarily connecting said

ducts with the furnaces, a trunk passage common to all the branch ducts, and means for creating a draft through said trunk passage and the ducts, all substantially as described.

4. In a continuous brick-kiln, a chamber having vertical parallel side walls, longitudinal ducts arranged in the upper part of said walls, vertical ducts connecting with the said longitudinal ducts, a subterranean duct leading away from the kiln and receiving waste heat from the aforesaid ducts, furnaces in both walls arranged in parallel horizontal rows, those in one wall being opposite to those in the other, branch ducts outside the wall of the furnace and having their ends in close proximity to the outside ends of the furnaces of the lowermost row, means for connecting the ends of said ducts temporarily with the furnaces so that the smoke may pass from the furnaces into and through the ducts, and means for connecting the opposite ends of all of the said branch ducts together and with a stack or fan, all substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

RAYMOND C. PENFIELD.
FREDERICK S. NAUGLE.

Witnesses:

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WILLIAM H. MERKEL.