F. B. LAMBERT.

PROCESS FOR BURNING BRICK.

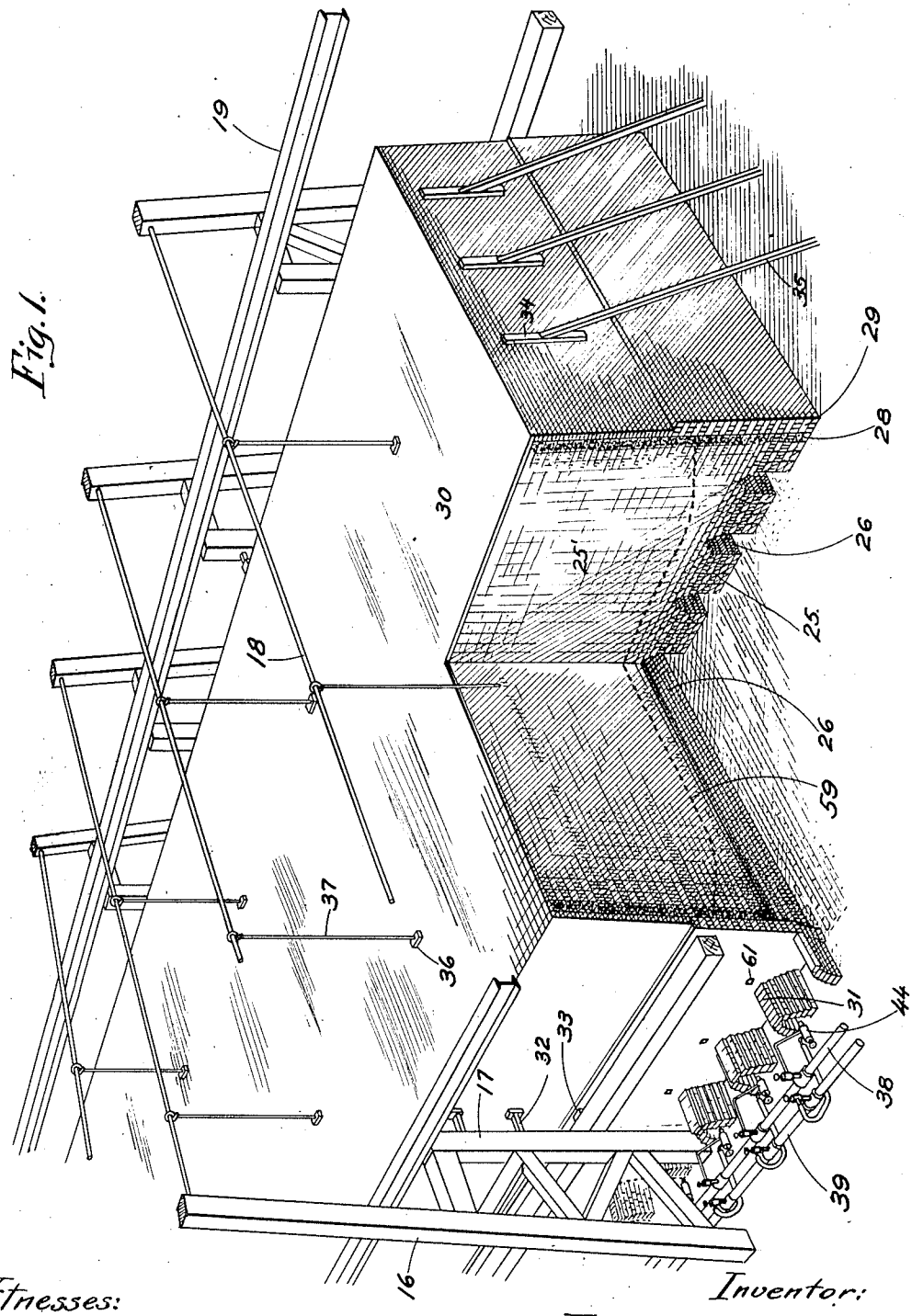
APPLICATION FILED MAR. 5, 1912.

1,311,978.

Patented Aug. 5, 1919.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

C. C. Burnap

Henry A. Parks

Inventor:

Frank B. Lambert

By Sheridan, Wilkinson, Scott & Richmond Atty's.

F. B. LAMBERT.

PROCESS FOR BURNING BRICK.

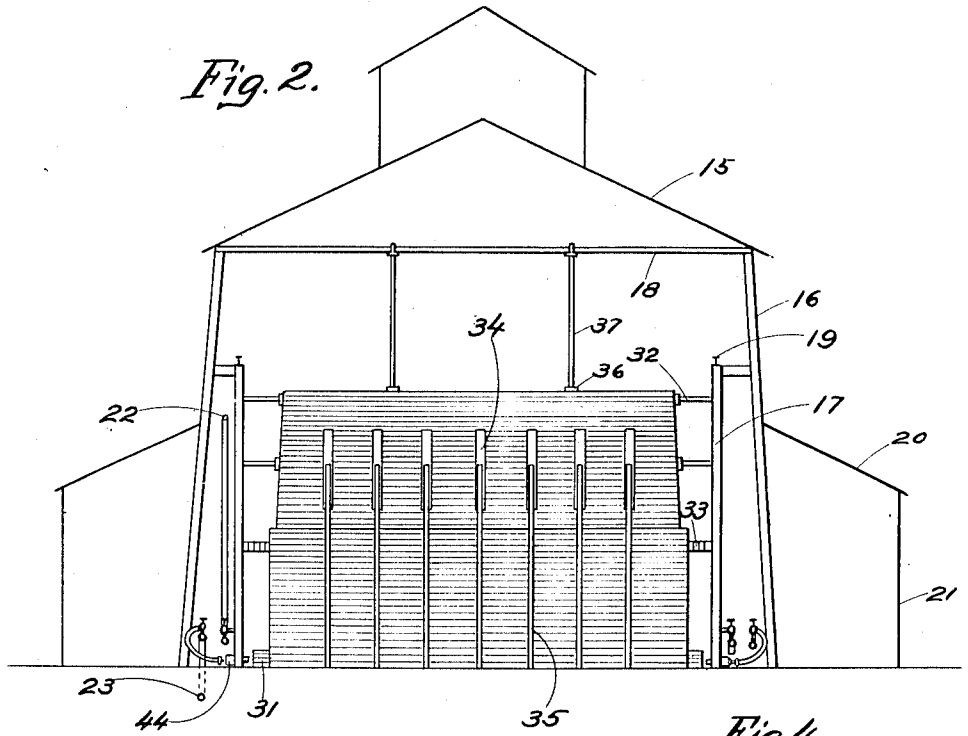
APPLICATION FILED MAR. 5, 1912.

1,311,978.

Patented Aug. 5, 1919.

3 SHEETS—SHEET 2.

Fig. 2.



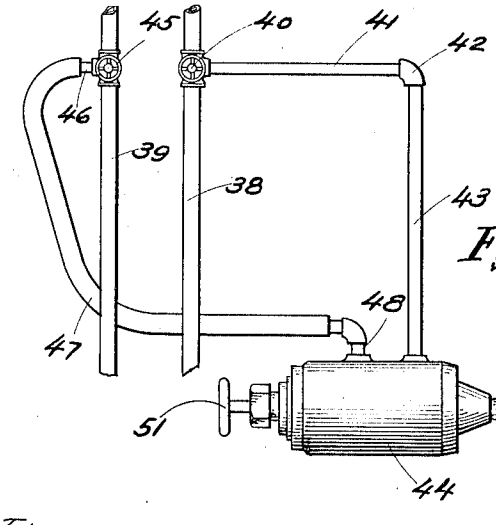
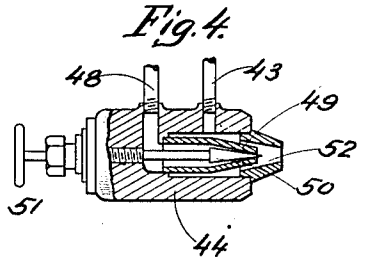
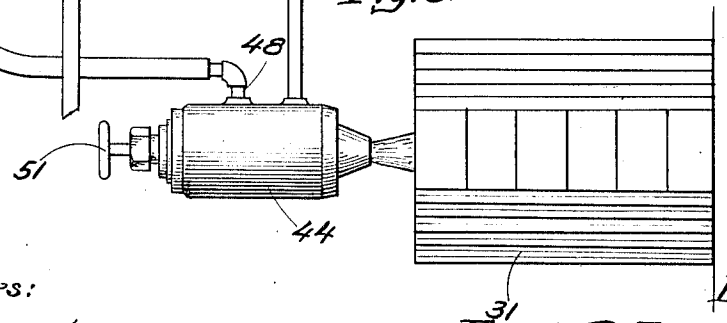


Fig. 3.

Fig. 4.





Witnesses:

C. C. Burnap

Henry Wierks

Inventor:

Frank B. Lambert

By Sheridan, Wilkinson, Scott & Richmond Atty's

F. B. LAMBERT.

PROCESS FOR BURNING BRICK.

APPLICATION FILED MAR. 5, 1912.

1,311,978.

Patented Aug. 5, 1919.

3 SHEETS—SHEET 3.

Fig. 5.

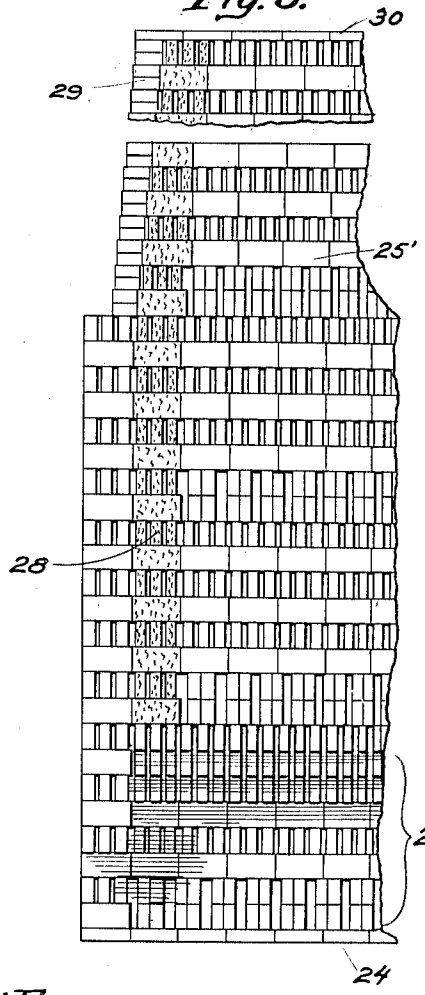


Fig. 6.

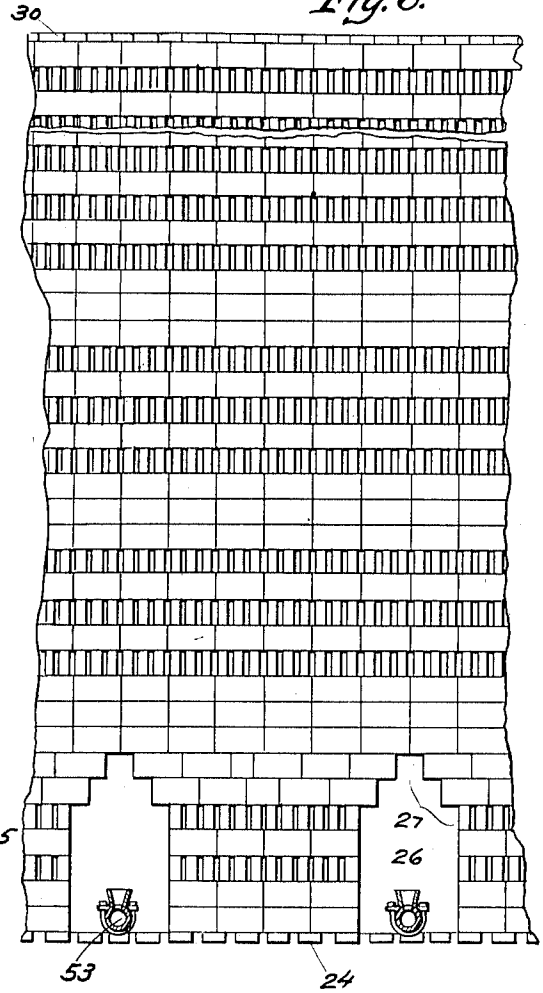


Fig. 8.

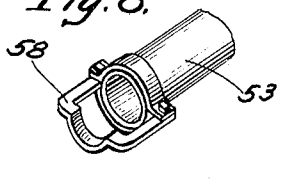


Fig. 9.

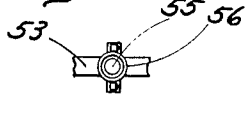


Fig. 10

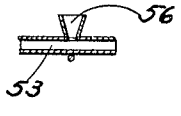
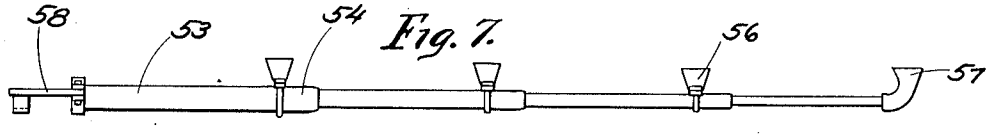


Fig. 7.



Witnesses:

C. E. Burnap

Henry A. Parke

Inventor:

Frank B. Lambert

By Sheridan, Wilkinson, Scott & Richmond Atty's

UNITED STATES PATENT OFFICE.

FRANK B. LAMBERT, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO CHARLES A. BROWN, OF HINSDALE, ILLINOIS.

PROCESS FOR BURNING BRICK.

1,311,978. Specification of Letters Patent. Patented Aug. 5, 1919.

Application filed March 5, 1912. Serial No 681,720.

To all whom it may concern:

Be it known that I, FRANK B. LAMBERT, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Processes for Burning Brick, of which the following is a specification.

The principal object of my invention is to provide a new and improved method for burning bricks in kilns. Another object of my invention is to provide a method of burning bricks with an economical use of fuel. A further object of my invention is to provide a method of burning bricks that shall cause the heat to be advantageously distributed in the kiln.

The fundamental and important conception of my invention is the double use of the heat. Heretofore when it was desired to burn a kiln of brick, it was considered necessary to supply enough heat to bring the whole kiln to the vitrifying temperature at one time. According to my invention only enough heat is supplied from the burning fuel to heat one part, for instance the bottom, of the kiln, and this heat is employed in a dual capacity. After it has brought the bottom of the kiln to the right temperature it is driven from the bottom to the top to raise the temperature of the rest of the stack to the proper point successively.

According to my method of procedure I heat the lower part of the kiln by forcing oil flames thereinto and after sufficient heat has been stored in the bottom of the kiln and after the lower courses have come to the right temperature, firing of further fuel is discontinued. To this end I turn off the oil burners completely and supply and burn no more fuel, but use only the heat which has been put into the kiln thus far to finish the entire kiln.

The matter of shutting off the supplying and burning of fuel is, however, incidental only to the main feature of my invention, which is a double use of the heat. It may be observed that certain conditions are required in order to make it possible to carry out my invention. These will appear more fully from the detailed description following. It may also be observed that complete and absolute shutting off of the burning of the fuel is not a strict requirement of my invention as the addition of a small amount of heat after the main body of heat is supplied and is being driven into the top of the kiln is a matter of no consequence. Such slight addition of heat might be useful in tempering the incoming air and the like, but would be of no consequence considering the process as a whole.

For the purpose of illustrating and explaining the nature of my invention, I shall in the following specification describe in some detail one particular series of operations and the apparatus used in connection therewith, all of which exemplify the invention. This will make the foregoing stated objects more apparent and other objects will also become apparent from the following specification and claims, taken with the accompanying drawings.

Referring to the drawings—

Figure 1 is a general perspective view partly broken away showing a kiln in readiness to be burned.

Fig. 2 is a transverse section of the same.

Fig. 3 is a plan view of one of the burner nozzles.

Fig. 4 is a longitudinal section of the same.

Fig. 5 is a fragmentary vertical section through one of the arches of the kiln.

Fig. 6 is a vertical section taken at a right angle to Fig. 5.

Fig. 7 is an elevation of a blower tube.

Fig. 8 is a perspective view of the end thereof.

Fig. 9 is a top plan view of a portion of the blower tube.

Fig. 10 is a vertical section of the same.

The kiln shown in the drawings is a so-called "temporary clamp kiln". It is constructed under a shed roof 15 supported at its eaves by posts 16 and 17 braced together so as to resist lateral thrusts as well as to sustain the weight of the roof. The boards of the roof 15 are removable so as to facilitate the escape of the gases and vapors from the kiln as desired. Tie rods 18 are provided for the roof 15, and the posts 17 support rails 19, which constitute a crane track. The shed has extension roofs 20 at

the sides and under these the side walls comprise removable panels 21 of wooden boards. A permanent steam pipe 22 with steam at about one hundred pounds pressure is carried above the ground along one side of the shed between the side posts 16 and 17, and a fuel oil pipe 23 with oil under gravity pressure is buried in the ground directly beneath and parallel with the steam pipe 22.

The parts described above are permanent, except that the board panels 15 and 21 can be placed or removed as desired. Within the shed, under the roof 15, the temporary clamp kilns are built up, burned, allowed to cool, and then the burned bricks constituting the kilns are taken down and hauled away.

Under one long shed 15 there may be several of these temporary clamp kilns at different stages of construction and burning. One kiln may be under the process of burning while another is being built up and still another is being torn down and hauled away.

In building one of these kilns a layer of previously burned bricks 24 is laid flat on the ground. Then the dried bricks are piled above. These dried bricks are handled by cranes which run on the tracks 19. The bricks come from the driers on cars piled eight brick widths deep, and the cranes pick up a cart-load at a time and place it in the proper position for building up the kiln.

The first installments of bricks 25 are spaced apart so as to leave transverse channels or spaces between them. Then men working with their hands draw the top layers of bricks over to form "jets" 27 and thus form the "arches" 26. After the arches are formed the spaces behind the jets are filled in with extra brick placed by hand and then additional dried, unburned bricks 25′ are piled on top by the crane. The bricks 25 and 25′ are all built up in the kiln so that they stand on edge crisscross with narrow spaces between them. On the sides of the kiln above the arches and on the ends of the kiln from the ground up, there is placed a wall 28 of "double coal" bricks, the thickness of this wall being equal to the length of a single brick. These double coal bricks are made by mixing anthracite coal screenings with the clay in the proportion roughly of eighty pounds to a thousand brick. Outside of the double coal brick 28 a wall of previously burned brick 29 is built up all around the sides and ends of the kiln. The thickness of this wall 29 is a brick length for the lower half, but only a brick width for the upper half. The outside face of this side and end wall 29 is then plastered over or "scoved" with a daubing made of sand and black loam so as to close the cracks between the bricks. Then a layer of previously burned brick 30, the platting, is laid flatwise all over the top of the kiln as closely as the brick can conveniently be laid, but the top brick 30 are not scoved, and the gases and vapors from the kiln can escape between them.

In completed form each kiln has the following dimensions: There are thirty arches in the kiln with about forty-two thousand brick per arch. The width of the kiln at the bottom is fifty-four brick lengths and at the top is fifty-one brick lengths. The height of the kiln is forty-eight brick widths exclusive of the bottom brick 24 and the top platting 30. The crane places the brick in loads each eight brick widths deep and then loads are placed six deep in the height of the kiln. Each pillar or leg between the arches has a horizontal thickness of four brick lengths and each arch is two brick lengths in width, so that the consecutive arches are six brick lengths distant from center to center.

The outside wall of burned brick 29 is built across the upper parts of the ends of the arches 26, but so as to leave openings to the lower parts of these arches. Then little extensions 31 called "dog houses" are built out from the open ends of the arches 26. Above each dog house there is left a peep hole 61 normally closed by a brick bat.

The side walls of the completed kiln are braced by struts 32 and bricks 33 against the side posts 17, and the end walls of the kiln are braced by struts 35 between the ground and the vertical bars 34 that lie against the end walls of the kiln.

On top of the kiln at regular intervals, brick-bats or piles of brick-bats 36 are placed and rods 37 are hung from the tie rods 18, the lower end of the hanger rods 37 barely touching the brick bats 36. This is so that later on the "settle" can be observed.

A temporary steam pipe 38 branching from the overhead steam main 22 is laid all along the sides of the kiln just above and beside the dog houses 31. This steam pipe 38 is paralleled by a temporary oil supply pipe 39 connected to the buried oil main 23. Beside each dog house each pipe 38 and 39 has respective valves 40 and 45 controlling branch outlets. An oil injector nozzle 44 is connected by the pipes 41 and 43 and elbow 42 forming an L to the steam outlet 40, and it is also connected by a flexible tubing 47 and the end pipes 46 and 48 to the oil outlet 45. Thus it will be seen that the injector nozzle 44 can be swung up and down about the pipe 41 as an axis and with the pipe 43 as a radial arm. The injector nozzle 44 has a central conical oil outlet 49 controlled by the needle valve 50, which is adjusted by the hand wheel 51. The steam outlet 52 is annular surrounding the oil outlet 49. The form of this burner nozzle may be varied.

For the purpose of blowing in steam and air at a certain pressure in this practice of

my improved method, as I shall describe presently, I provide the pipes 53. Each pipe 53 consists of four sections successively decreasing in diameter. Each section has an opening 55, just before the joint 54 with the next smaller section, and around each opening is a flaring conical outlet nozzle 56. The end of the last section has a specially formed conical outlet nozzle 57. The large end of the pipe 53 carries a yoke 58 having the shape shown in the drawings.

Having described this particular kiln and the apparatus employed in burning it, I now proceed to describe the particular operation of burning that I have employed therewith.

The kiln having been built up in the manner described, oil flames are blown into each arch 26 at each end thereof, the oil being injected by the annular steam jet issuing from the nozzle 52. At first only a moderate supply of oil and steam is injected and the fires burn rather close to the dog houses. As the bricks adjacent to the ends of the arches get dried out and hot the fire is forced, using more steam and oil, and at the end of about six hours the flames are driven way back into the arches so that the two flames coming in at the ends of each arch meet or nearly meet at the middle of the arch and thus the whole arch is filled from end to end with the oil flames. The kiln is burned in this way for about six hours more, the fire being forced to the utmost during this time. By this time all the bricks adjacent to the arches are beginning to be red hot; thereafter the operator begins to shut off the steam and oil supplies, tapering down for the next eight to twelve hours.

The burners are careful to force the fires at the ends of the intermediate arches and throughout the arches at the ends of the kiln. Also they burn with considerable air at first so that there is uncombined oxygen in the gases going up through the kiln. This oxygen enters the pores of the double coal brick 28 and burns the coal therein, thus affording a local supply of heat around the walls of the kiln. The more intense burning at the ends of the intermediate arches and throughout the end arches and the combustion of the anthracite coal in the outside wall of double coal brick, all insure proper burning of the dried brick adjacent to the side and end walls of the kiln. The ideal state which the burners try to attain, say after they have been burning from ten to twenty hours, is to have an isothermal surface or zone extending horizontally across the body of the kiln just above the arches, but rising a little all around its edges. This has been indicated diagrammatically on Fig. 1 by means of the dotted line 59.

At the end of from twenty to twenty-four hours after they commence burning, the operators notice a slight "settle," as indicated by a falling of the brick-bats 36 under the end of the hanger rods 37. This settle may be only a fraction of an inch, but it probably indicates that the bricks above the arches have become so softened by the heat that they are crushing together slightly by reason of the load of the bricks above them. Wherever the operators notice this settle, they promptly shut off the flames in the arch or arches directly beneath the settling point or points and swing the corresponding nozzles 44 up above the dog houses 31. Then they shove the tubes 53 into the arches at which the flames have been shut off, putting the small end 57 of each tube or pipe 53 in first and in such position that all the flaring nozzles 56 and 57 are directed upwardly, also so that the bracket or frame 58 lies directly below the nozzle 44. Then the nozzle 44 is swung down so that it rests on the frame 58 and the steam valve 40 is opened. The steam blast going from the nozzle 44 axially into the pipe 53 has an ejector action and draws in with it a large amount of air through the large open end of the pipe 53 around the nozzle 44. This mixed air and steam issue from the pipe 53 through the flaring nozzles 56 and 57 and then ascend up through the brick-work 25 and 25'.

This blowing of steam and air is continued for about twenty-four hours after the fires are shut off. Very soon after the blowing of steam and air commences the incandescence disappears, when looking into the arches through the peep holes. The force with which the steam is blown is regulated by the operators in accordance with the "settle". The more tendency the kiln shows in any place to settle the harder the steam and air are blown in all the arches under that place.

At the end of about twenty-four hours of blowing, that is, about forty-eight hours after the fires were started, the blowing is stopped and the dog houses are knocked down so as to give a good opportunity for air to go into the arches by natural draft. After about twenty-four hours more, that is, about seventy-two hours after burning is started, the zone of incandescence in the kiln gets up to the top so that the red hot brick can be seen through the cracks between the brick 30 on top of the kiln. This marks the completion of the burning and it only remains for the kiln to cool down by its natural draft so that it can be taken down and the bricks hauled away. I employ the term "vitrification" to designate the burning of bricks, or similar clay product, to such a condition that they are finished products. This term is employed not in its narrow sense of burning to a glass, as is required

in a certain type of clay product, but to cover the broad idea of burning to the finish required for the particular product.

While the bricks piled in the kiln are largely freed from their moisture by the preliminary drying, it is true that they have a considerable quantity of moisture in them which is driven off by the burning especially in the earlier stages. Soon after the fire is started a dense cloud of "water smoke" comes off from the top of the kiln escaping through the openings in the top layer of brick 30. At the time the fire is shut off this water smoke is still issuing from the kiln in some instances and continues to do so for a considerable time thereafter. But about the time the blowing is stopped, that is, at the end of the second twenty-four hours, the quantity of water smoke becomes less and when the zone of incandescence reaches the top of the kiln is has ceased entirely.

While I have practised the method defined in the appended claims in various ways, and with various clays, and at various places, I have given a specific description of only one particular series of operations according thereto. This description is for kilns built and burnt by me at yard No. 22 of the Illinois Brick Company just west of Blue Island in or near the city of Chicago. The clay of which these bricks are made is so-called "hard-pan", a stratum about twenty or twenty-five feet thick overlaid by blue clay and underlaid by boulders and gravel. The overlying blue clay at this yard has all been taken off and burned in past years. In burning the "hard-pan" I have found that my method is advantageous for the reason that the bricks made from the hard-pan had a tendency to clinker if burned by previously known methods, but they do not clinker when burned in accordance with my system. But my method of burning has other advantages, among which is the shortness of time required for the complete operation of burning, and the saving of fuel. I have burned many thousand brick by my method with a consumption of only eight gallons of oil per thousand of brick, whereas I know that it is not uncommon by other methods to consume as much as twenty to twenty-five gallons of oil per thousand of brick.

In the following claims I employ the term "elastic fluid" to comprehend gases or vapors, or mixtures thereof.

In many instances it may be desirable to vary the rate and quality of burning and the times stated above for the various steps in my process merely illustrate one method of carrying out the latter, and I do not wish to be restricted to the exact method and application of the same beyond the scope of the appended claims.

As I have above indicated, the important conception is the double use of heat in this particular connection. The specific method of procedure which I prefer to follow requires absolute discontinuing of the supply and burning of fuel. This is because the oil burners are used as injectors, and in order to get the injector pipe into place it is necessary to shut off the oil burners. Such complete shutting off of the fuel is in all cases desirable from the standpoint of saving fuel and of practising the process. Burning of further fuel thereafter would, so far as carrying out the process is concerned, be merely a waste of heat, but I wish it clearly understood that all of the advantages of my invention may be gained without complete and absolute discontinuance of the fire so long as the double use of the heat is gained. A small fire might be permitted to burn after the period of blowing the body of heat has begun, but such small fire would be merely an evasion of the term "discontinuing". I intend, therefore, to cover broadly the double use of the heat even where absolute and complete cessation of burning is avoided by adding a small amount of heat.

I claim:

1. A process for burning clay products consisting in first arranging the same in a kiln, next applying heat to said kiln and the products for a time sufficient to create a heating zone of the required temperature, then discontinuing the application of such heat and next applying gaseous fluid to said kiln and permitting said heating zone to traverse a portion thereof.

2. A process for burning clay products consisting in first arranging the same in a kiln, next applying heat to said kiln and products for a time sufficient to create a heating zone of the required temperature, then discontinuing the application of such heat, next applying gaseous fluid to said kiln and permitting said heating zone to traverse a portion of said kiln, and then discontinuing such supply of gaseous fluid and permitting said zone to travel the balance of said kiln.

3. A process for burning clay products consisting of first arranging the same in a kiln with a heating chamber therein, next in supplying and burning fuel in said chamber under pressure until a heating zone of the required temperature is established throughout said clay products adjacent said chamber, then discontinuing such fuel supply and burning, and next supplying gaseous fluid under pressure in said chamber until said zone has traveled through a portion of said kiln.

4. A process for burning clay products consisting of first arranging the same in a kiln with a heating chamber therein, next in supplying and burning fuel in said chamber under pressure until a heating zone of the

required temperature is established throughout said clay products adjacent said chamber, then discontinuing such fuel supply, and next supplying heated air under pressure in said chamber until said zone has traveled through a portion of said kiln.

5. A process for burning clay products, consisting in first arranging the same in a kiln with a heating chamber therein, next in supplying and burning fuel in said chamber under pressure until a heating zone of the required temperature is established throughout said clay products adjacent said chamber, then discontinuing such fuel supply and burning, and next supplying air and steam under pressure in said chamber until said zone has traveled through a portion of said kiln.

6. A process for burning bricks which consists in piling them into a kiln, then firing a part of them for a time with carbonaceous fuel, then shutting off said fuel and thereafter blowing elastic fluid into said kiln to burn the remainder of the bricks.

7. A process for burning bricks which consists in piling them into a kiln, then firing only a part of them for a time with carbonaceous fuel, and then shutting off said fuel and thereafter blowing elastic fluid into said kiln, said elastic fluid being introduced adjacent the points of previous firing.

8. A process of burning bricks which consists of piling them into a kiln, then firing them for a time with carbonaceous fuel until they reach the vitrifying temperature in a portion of said kiln only, and then blowing an excess of elastic fluid into said kiln and discontinuing firing with said fuel before all the bricks have reached the vitrifying temperature.

9. The process of burning bricks which consists of piling them into a kiln, then firing them for a time with carbonaceous fuel until they reach the desired vitrifying temperature in the part of the kiln adjacent to the fire, then discontinuing firing with fuel and then blowing elastic fluid into said kiln while the zone of vitrifying temperature travels to other parts of said kiln.

10. The process of burning bricks which consists in forming them into a kiln with arches adjacent the bottom thereof and extending therethrough, then burning fuel in said arches adjacent each end thereof until a zone of vitrifying temperature is established only in the stratum adjacent the said arches, next discontinuing the burning of said fuel, and then blowing elastic fluid into said arches.

11. The process of burning bricks which consists in arranging them to form a kiln with arches extending therethrough, then introducing a burning fuel under pressure in said arches until a zone of vitrifying temperature is established only in the stratum adjacent said kiln, then discontinuing such fuel burning, and supplying gaseous fluid under pressure to said arches.

12. The process for burning bricks which consists in setting the bricks in a kiln, then firing the kiln with fuel to bring a part only of the bricks to the temperature of vitrification, then blowing elastic fluid in excess of the amount required for firing into the kiln until all the bricks are burned and discontinuing firing before all of the bricks are brought to the temperature of vitrification.

13. The process for burning bricks which consists in setting the same in a kiln, then firing the kiln with fuel to heat a part only of said bricks to the temperature required for burning, then discontinuing the firing with fuel and blowing elastic fluid into said kiln until all the bricks have reached the temperature required for burning.

14. The process for burning bricks which consists in setting the same in a kiln, then firing the kiln with fuel to heat a part only of said bricks to the temperature of vitrification, then discontinuing the heating effect of firing with fuel and blowing air in excess of the amount required for burning into said kiln till all the bricks have reached the temperature of vitrification.

15. The process for burning bricks which consists in setting same in a kiln, then firing the kiln with fuel to heat a part only of said bricks to the temperature of vitrification, then discontinuing the firing with fuel and discharging jets of steam into said kiln until all the bricks have reached the temperature of vitrification.

16. The process of burning bricks which consists in setting the bricks in a kiln, then heating a stratum of said bricks to drive out the moisture and to bring said stratum to the temperature of vitrification, then shutting off the fuel supply and forcing elastic fluid under pressure through said stratum and into the adjacent stratum of unburned bricks, thereby causing the heat of said stratum to be carried to the unburned bricks.

17. The process of burning bricks which consists in setting the green bricks into a kiln having an internal heating chamber therein, then burning fuel under forced draft to drive off the moisture from the green bricks and to bring to the temperature of vitrification, a stratum of said bricks adjacent said heating chamber, then cutting off the fuel and continuing the forced draft to drive the heat from said heated stratum to the adjacent strata of unburned bricks driving off the moisture and bringing to the temperature of vitrification the unburned bricks in progression.

18. The process of burning bricks which consists in setting the bricks in a kiln with an internal furnace, then burning fuel under

forced draft, said burning being conducted to drive off the moisture and to bring to the temperature of vitrification a stratum only of bricks adjacent said furnace, then discontinuing the fuel supply and continuing to force the pressure draft to cause the heat to travel to an adjacent stratum of unburned bricks and to bring the same to the desired temperature.

19. The process of burning brick which consists in setting the bricks in a kiln having an internal furnace, then firing said furnace with fuel under a forced draft sufficient to cause the "water smoke" and other vapors to move from the stratum adjacent the furnace, and directing the fire in said furnace to extend the heating in a substantially isothermal zone across the kiln to heat the bricks in said zone, to the temperature of vitrification, then discontinuing the firing and continuing the forced draft to drive the "water smoke" forward from adjacent strata, and causing said heated zone to travel successively to said strata to bring to the temperature of vitrification the adjacent unburned brick in said kiln.

20. The process of burning bricks which consists in setting the bricks in a kiln having an internal furnace, then heating the furnace with fuel burned under a forced draft, said draft being great enough to force the "water smoke" from the lower stratum of bricks adjacent the furnace through the remaining bricks, said firing being continued until said entire stratum is brought to the temperature of vitrification, then discontinuing the firing and continuing the forced draft sufficient to drive the heat from said stratum into successive adjacent strata continuously until said desired temperature shall have been attained by said adjacent strata.

21. The process of burning bricks which consists in setting said bricks in a kiln with a furnace therein, then firing said furnace under a forced draft until a highly-heated substantially isothermal zone is attained adjacent said furnace, the bricks adjacent said zone being still at the temperature at which they give off "water smoke", then discontinuing firing and maintaining the forced draft by discharging jets of steam in said furnace to entrain large volumes of air, thereby causing said highly-heated zone to travel to the adjacent bricks.

22. The process of burning bricks which consists in piling them into a kiln, then firing a part of them for a time with carbonaceous fuel to vitrify said part, then blowing elastic fluid in excess into said kiln to vitrify the remaining bricks in the kiln, said firing being discontinued prior to the vitrification of said remainder.

23. The process of burning bricks which consists in piling them into a kiln, then firing only a part of them for a time with carbonaceous fuel to vitrify said part, and then blowing air in excess into said fuel to vitrify the remainder of the bricks, said firing being discontinued prior to the vitrification of said remainder.

24. The process of burning clay products which consists in arranging the same in a kiln, burning fuel to heat a stratum of said products to substantially the temperature of vitrification, injecting air in excess into said kiln and discontinuing the burning of said heating fuel before all of said products have attained the temperature of vitrification.

25. The process of burning clay products which consists in arranging the same in a kiln having a heating chamber therein, burning fuel in said heating chamber to heat a stratum of said products to substantially the temperature of vitrification, injecting large quantities of elastic fluid into said kiln and discontinuing the burning of said heating fuel before all of the strata of said products have attained the temperature of vitrification.

26. The process of burning bricks or the like which consists in piling the same into a kiln, then firing a stratum of said bricks with fuel to vitrify the same, then blowing air into said kiln in excess of the amount required to burn said fuel, and discontinuing the heating effect of said firing prior to the time when all of said bricks have reached the temperature of vitrification.

27. The process of burning bricks or the like which consists in piling said bricks into a kiln, then firing a part of said bricks to bring the same substantially to the temperature of vitrification, injecting air under pressure into said kiln in excess of the amount required for the burning of said fuel and reducing the fire and discontinuing the heating effect of the same before all of said bricks have been brought to the desired temperature of vitrification.

28. The process of manufacturing and burning bricks, which consists in mixing carbonaceous material with the clay, then forming the clay into bricks, then piling the bricks into a kiln, then firing said bricks with an excess of air to bring a part only of said bricks to the temperature of vitrification and to burn out the carbonaceous material, then discontinuing the heating effect of firing and blowing air through said heated bricks to said unburned bricks in order to burn out the carbonaceous material and to vitrify the same.

29. The process of manufacturing and burning bricks, which consists in mixing finely divided coal with clay then forming the clay containing the coal into bricks, then piling said bricks into a kiln, then firing said bricks with an excess of air to bring a part

only of said bricks to the temperature of vitrification and to burn out the carbonaceous material, then discontinuing the heating effect of firing and blowing air in excess through said heated bricks to said unburned bricks in order to burn out the carbonaceous material and to vitrify all of the bricks.

30. The process of manufacturing bricks which consists in mixing carbonaceous material with part of the clay, then forming the clay into bricks, then piling the bricks into a kiln, then firing said bricks to bring the lower strata to the temperature of vitrification and to burn the carbonaceous material in said bricks, then discontinuing the heating effect of said firing and blowing excess of air through said heated bricks to said unburned bricks in order to burn out the carbonaceous material and to vitrify all of the bricks.

31. The process of burning bricks which consists of setting the bricks into a kiln for burning, then heating one extreme of said kiln by blowing flames under forced draft into said kiln under as great a pressure as is required to force the major portion of the gases and products of combustion out of the opposite end of the kiln, said fire being directed to cause the formation of a zone of incandescence extending completely across said extremity of the kiln, thereafter shutting off the fuel and blowing gaseous fluid through said kiln in the same general direction as the line of movement of the products of combustion through the kiln, to move said zone of incandescence through the length of the kiln to the other extremity thereof.

32. In a process for burning brick, the following steps, setting the brick in a kiln in close relation, then applying a limited quantity of heat from an external source to the lower part of the kiln only, to bring said lower part to the temperature required for vitrification, and also to store a large body of heat in said lower part, then carrying said large body of heat as a body from the lower part to the upper part of the kiln and thereby bringing the upper part to the required temperature of vitrification by means of the stored heat in said lower part only.

33. In a process for burning brick, which comprises setting the brick in close relation to each other in a stack, applying heat from an external source to the lower part of the stack only, to heat the bricks in said lower part only to the temperature of vitrification and to a sufficient extent to store a large quantity of heat in said heated bricks, then moving said heat as a wave from the lower part of the stack through the rest of the stack and out of the end thereof and simultaneously cooling down the lower part of the stack as the heat is driven therefrom.

34. The process of burning bricks, which comprises stacking the bricks in a kiln, applying heat from an external source to the bottom of the kiln only to burn the lower portion of the kiln and store a body of internal heat in said lower portion while the upper portion is still green and wet, then burning the other portion of the kiln by the application of the internal heat contained in the lower burned portion and finally driving all of the body of heat out of the top of the kiln.

35. The process of burning bricks, which comprises stacking the bricks in a kiln, burning fuel adjacent the stack and applying the heat thereof to the bottom of the stack only, until a large enough portion of the lower part of the kiln has been brought to the temperature of vitrification, to store enough heat to burn the top of the kiln, then moving the heat from the lower heated portion up through the upper portion to complete the burning of said upper portion with said stored heat, and simultaneously cooling down the lower part of the stack.

In testimony whereof, I have subscribed my name.

FRANK B. LAMBERT.

Witnesses:
CARL A. RICHMOND,
HENRY A. PARKS.