(No Model.) 3 Sheets—Sheet 1.

E. V. JOHNSON.

BRICK DRYING TUNNEL.

No. 381,383. Patented Apr. 17, 1888.

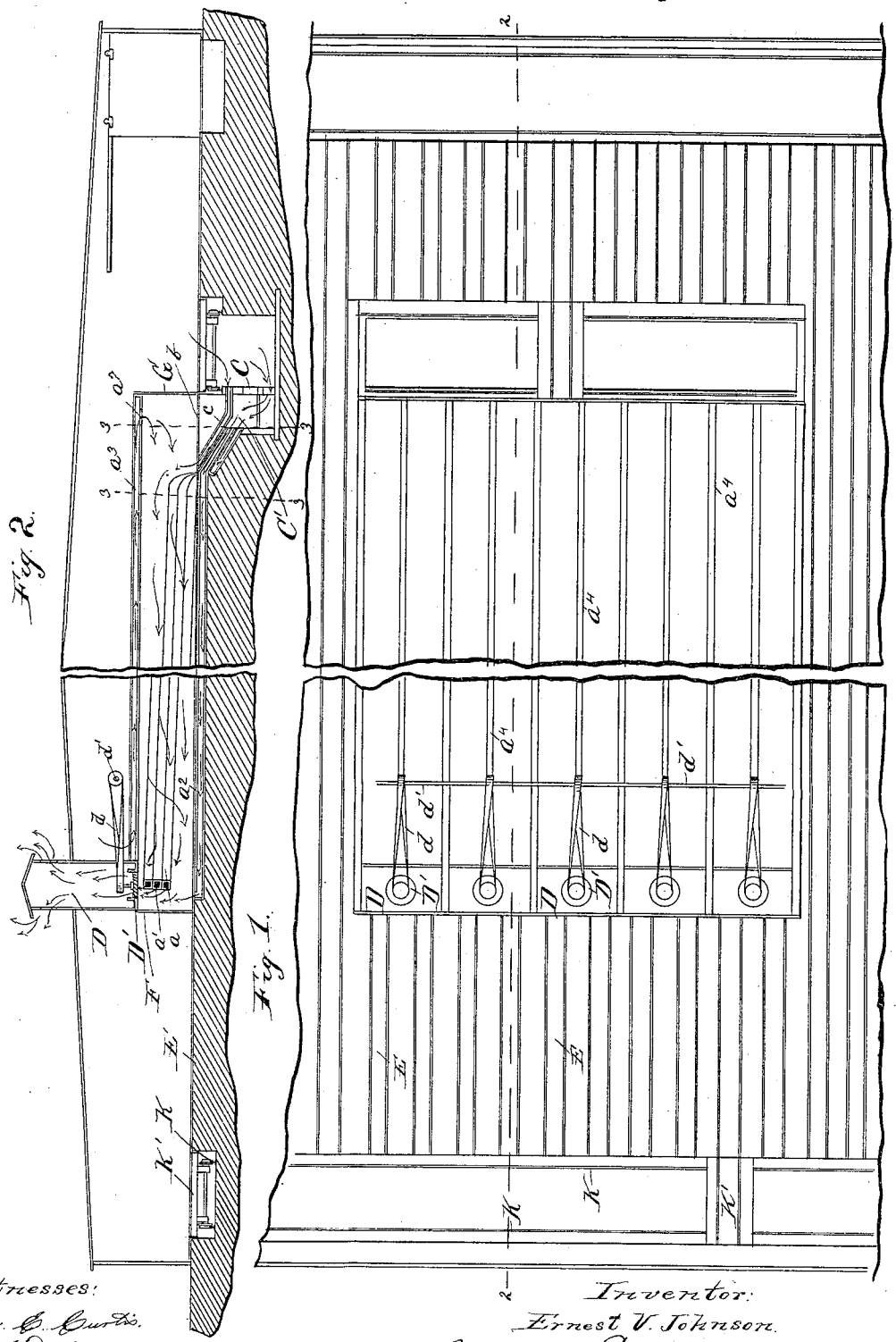

Fig. 2.

Fig. 1.

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(No Model.) 3 Sheets—Sheet 2.

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Fig. 3.

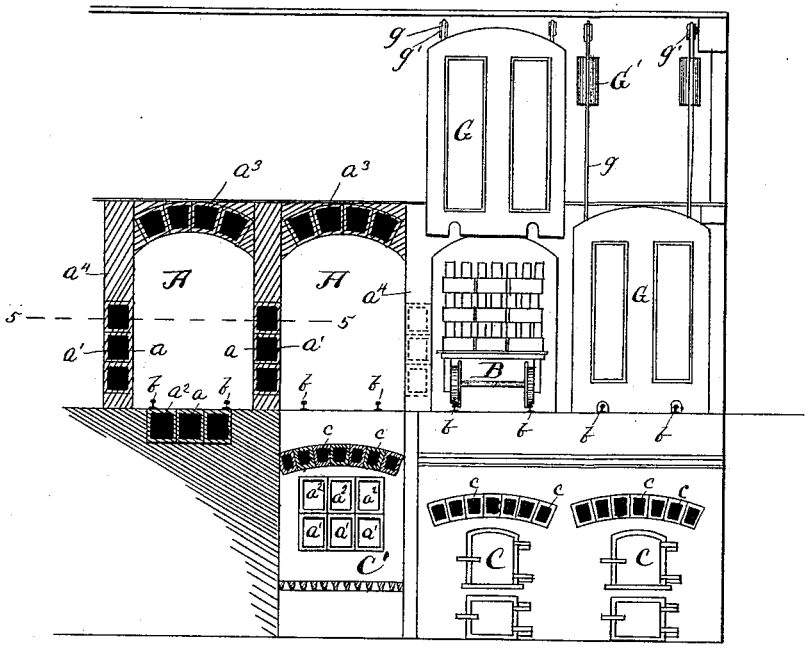
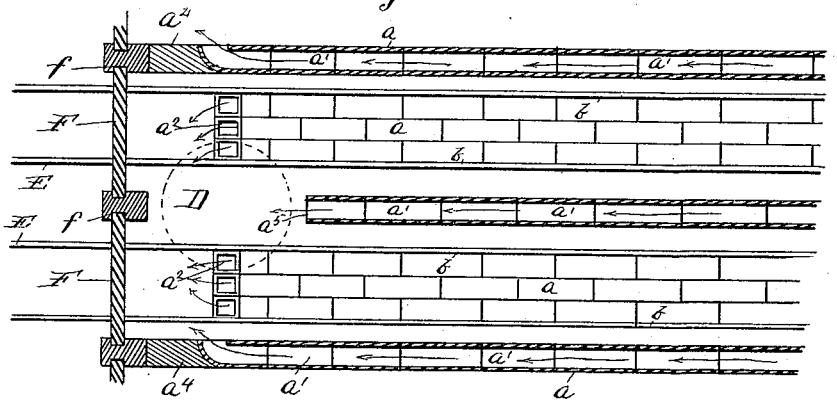


Fig. 5.



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(No Model.) 3 Sheets—Sheet 3.

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BRICK DRYING TUNNEL.

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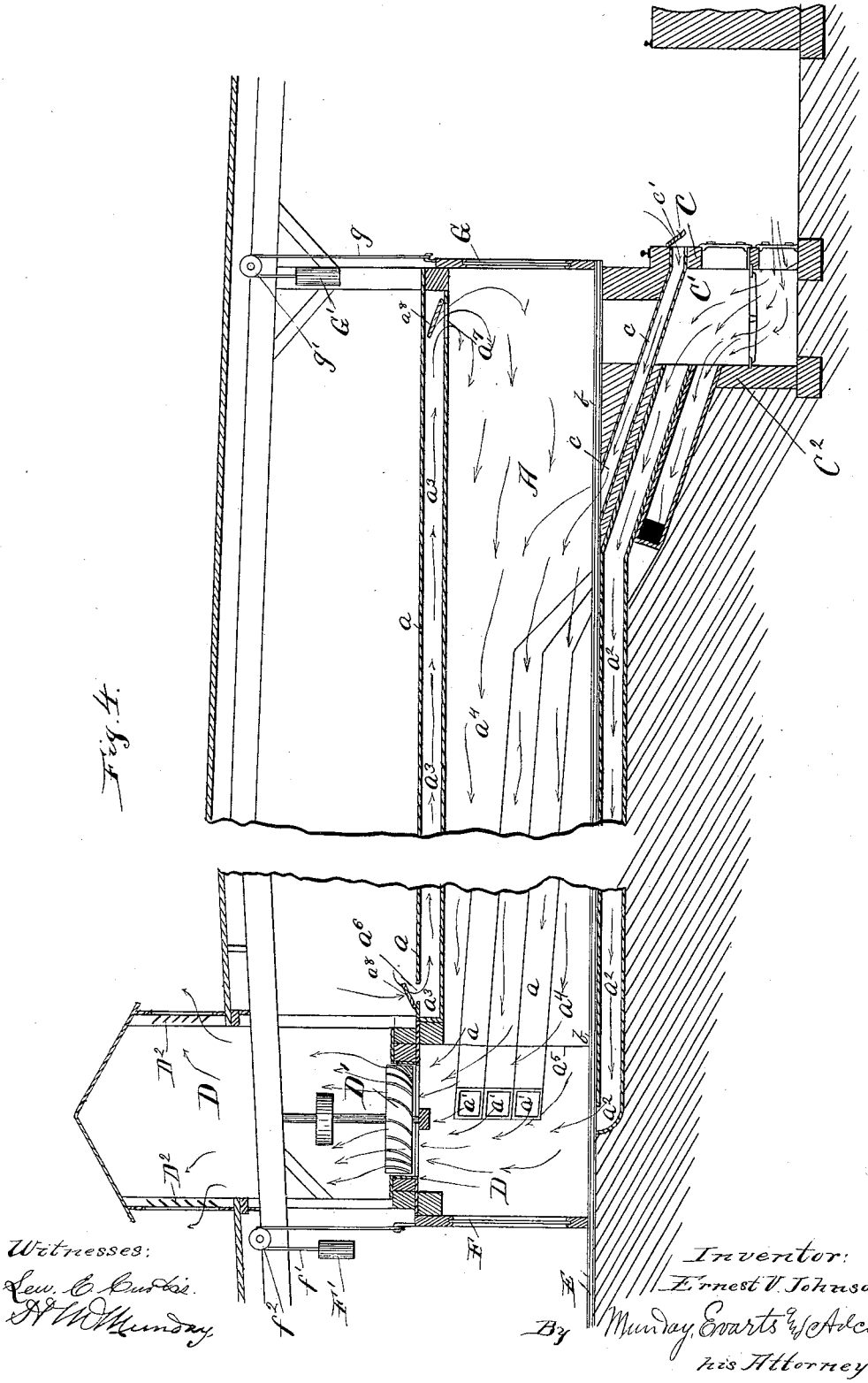

Witnesses:
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UNITED STATES PATENT OFFICE.

ERNEST V. JOHNSON, OF CHICAGO, ILLINOIS.

BRICK-DRYING TUNNEL.

SPECIFICATION forming part of Letters Patent No. 381,383, dated April 17, 1888.

Application filed September 8, 1887. Serial No. 249,115. (No model.)

To all whom it may concern:

Be it known that I, ERNEST V. JOHNSON, a citizen of the United States, residing in Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Brick-Drying Tunnels and Furnaces, of which the following is a specification.

My invention relates to means for drying green or fresh-molded brick preparatory to burning the same.

Heretofore drying tunnels and furnaces have been constructed in which the green brick were placed, the brick being suitably hacked or piled on cars, which were drawn through the tunnel from one end to the other. In these drying tunnels and furnaces the blast of flame and hot air, with the products of combustion from the furnaces, extends through the tunnel from end to end, the tunnel constituting part of the draft passage or flue of the furnace. The difficulty in the practical operation of such drying tunnels and furnaces is that the brick at the end of the tunnel adjacent to the furnace is subjected to a very high and much greater degree of heat than those at the opposite and farther end of the tunnel. In practice these tunnels are usually constructed about one hundred feet in length, and as the tunnel is ordinarily completely filled with cars loaded with green brick the heat of the air is very much reduced by the time it travels through the tunnel, the temperature often varying several hundred degrees at the two opposite ends of the tunnel. As the air becomes laden with moisture from the green brick over which it passes, this reduction in its temperature also causes a condensation of moisture upon the brick at the far or flue end of the tunnel, which tends to injure the brick and to interfere with the process of drying. In this method, also, the temperature of the tunnel depends directly upon the state of the fire in the furnace, which is liable to constant variation as new fuel is added, unless very great care is exercised by the fireman. Attempts have been made to obviate the difficulty due to the great difference in temperature at the opposite ends of the tunnel by introducing all the cars into the tunnel at the farther or flue end thereof and gradually moving them forward toward the furnace end of the tunnel, so that each car in turn is subjected to the heat of the tunnel at its different points and will be thus equally dried. By this means it was supposed that the brick would be gradually heated, and that by the time they reach the high heat of the furnace end of the tunnel they would be sufficiently dried and tempered to withstand such high heat without cracking or breaking them. In practice, however, it has been found that by this old method almost or quite twenty-five per cent. of the brick being dried is cracked and destroyed or injured in the process of drying. This percentage of loss adds very greatly to the cost of drying and manufacturing brick. Another difficulty, or rather objection, in the practical operation in this system of tunnels, arises from the fact that it is impractical to use other than hard coal as the fuel, which is a much more expensive fuel than soft or bituminous coal. This arises from the fact that the smoke and smudge produced by such fuel as bituminous coal or coal-dust would render it practically impossible for the workmen to open the doors of the tunnel at the flue end thereof and enter for the purpose of introducing new cars from time to time into the tunnels, as required. With anthracite coal there is little smoke, and it is practicable and customary for the workmen to open the doors of the tunnel and introduce new cars from time to time, notwithstanding the fact that the draft and products of combustion from the furnace come directly through the tunnels. In the old system of drying tunnels and furnaces it is obviously necessary also to employ fireproof cars and hacking-pallets upon which to hack the brick and convey them through the tunnels, which adds somewhat to the expense.

It is the object of my present invention to overcome these difficulties and to provide brick-drying furnaces and tunnels of a simple, cheap, efficient, and durable construction wherein the tunnels are or may be maintained at approximately the same temperature at both ends, and whereby the brick will be heated and dried uniformly at both ends of the tunnel and without subjecting the brick in any part of the tunnel to undue or excessive heat, so that the brick may be quickly, successfully, and completely dried, and without danger of appreciable loss or injury to any of the brick.

It is also the object of my invention to en-

able the temperature of the tunnels to be controlled independently of the state of the fire in the furnace, so that the brick may be maintained at a constant temperature and not subjected to variations.

It is further the object of my invention to so construct the furnace and tunnels that soft coal, or even coal-dust, which is a cheaper form of fuel, may be successfully burned without subjecting the workmen to inconvenience.

To this end my invention consists in a series of brick-drying tunnels and furnaces built contiguous to each other, and wherein the walls of the tunnels are built of hollow tile or furnished with fire-flues extending from the furnace to the chimney or exhaust-flue. The division-walls of the tunnel thus become radiating or heating surfaces throughout the whole length of the tunnel, thereby imparting an approximately equal heat to the tunnel at every part, or from end to end.

The invention also consists in furnishing the floor of the tunnels with similar hollow tile or fire-flues connected with the furnace and exhaust, so that the lower part of the tunnel will receive the heat.

The invention further consists in building the arch or top of the tunnels of similar hollow tile, or furnishing the same with air-passages, which communicate at one end with the tunnels and supply dry heated air thereto.

The invention further consists in providing the arch or top of the furnaces with air-flues communicating with the tunnels for supplying dry hot air thereto.

The invention further consists in the novel construction of parts and devices and their novel combinations together, herein shown and described, and more particularly pointed out in the claims.

In the accompanying drawings, which form a part of this specification, and in which similar letters of reference indicate like parts, Figure 1 is a plan view of a device embodying my invention, the middle portions of the tunnels being broken away or not shown, because of their comparative great length. Fig. 2 is a central vertical longitudinal section on line 2 2 of Fig. 1. Fig. 3 is in part an end view showing the tunnel-doors closed and one of the tunnel-doors open and a vertical cross-section taken on line 3 3 of Fig. 2 of the remaining two tunnels. Fig. 4 is an enlarged vertical longitudinal section similar to Fig. 2. Fig. 5 is a longitudinal horizontal section on line 5 5 of Fig. 3.

In said drawings, A A represent the drying-tunnels, furnished with tracks *b b* for the cars B, upon which the fresh bricks are hacked, and by which they are moved in and out of the tunnels or through the same.

C C are the furnaces, located beneath the tunnels at one end thereof.

D is the chimney or exit-flue at the opposite end of the tunnels, and D′ the suction-fan or exhaust device by which a suitable draft is produced both through the furnace and its flues and through the drying-tunnels. The division-walls of the tunnels are built of or in part of hollow tile, *a*, thus forming for each tunnel a number of continuous flues, *a′*, which communicate with or lead from the combustion-chambers or fire spaces C′ of the furnaces C. The bottoms or floors of the tunnels are likewise furnished with hollow-tile flues a^2, which also lead from the fire-spaces of the furnaces. The side or division wall hollow-tile flues, *a′*, are preferably three in number, and the hollow tile should, preferably, be large enough to constitute the whole body of the division-wall for about one-half the height thereof, as illustrated in the drawings, as thereby the hot air inside the flues will be separated from the air in the tunnels only by the thickness of the tiling, *a*. The inner or tunnel surfaces of the hollow-tile flues may thus be kept at a high heat and radiate rapidly into the interior of the tunnel. The tile flues a^2, which form the floor of the tunnel, are also preferably three in number. The number, however, of these, as well as of the side tile flues, *a′*, may be varied as desired.

Owing to the natural tendency of the heat to rise, I do not find it necessary to make the upper half of the division-walls of the tunnels of hollow tile, and I ordinarily build the upper half of these walls of brick. The side flues, *a′*, as illustrated in the drawings, open into the fire-chamber of the furnace just below the bottom flues, a^2, the flues being made at an angle or curved or bent from the point where the flues enter or form the division-walls to the point where they enter the fire-chamber C′ of the furnace, as is clearly indicated in the drawings. The coutinuous longitudinal side flues, *a′*, and the continuous longitudinal bottom flues, a^2, lead from the furnace longitudinally along the tunnel to the opposite end thereof, where they open into the chimney or exhaust-chamber D, a powerful upward draft through which is produced by the rotary exhaust-fan D′. This suction-fan or other suitable blast-producing device is mounted in suitable bearings in this vertical flue, shaft, or chamber D just above the top of the tunnel. The cars are introduced into the tunnel over the tracks E through the door F, which closes the mouth of the tunnel, so that the fan D′ may produce a draft through it.

A separate fan D′ may be provided for each tunnel and exhaust-chamber D; but I prefer, as shown in the drawings, to employ one chamber and fan D D′ for each pair of tunnels, each alternate division-wall a^4 extending through to the doors F, while the others terminate at a^5. Through the rear or back wall, C^2, of each of the furnaces the six flues *a′* a^2 for each tunnel enter, the three side flues, *a′*, entering just below the three floor or bottom flues, a^2. The three side flues, *a′*, for each tunnel are given a slight upward inclination from one end of the tunnel to the other, which will somewhat assist the draft through the same, and a similar but smaller inclination is given

to the bottom flues, a^2, and to the tunnel itself. This latter inclination is in part for the purpose of aiding the propulsion of the loaded cars through the tunnel. Each set of side flues, a', it will be observed, radiate their heat into the two tunnels, which are separated by the division-wall, of which the flues form a part.

The doors F slide vertically in suitable guides, f, and are furnished with counterbalance-weights F', suspended by lines f' over pulleys f^2. The top, roof, or arch of the tunnels is likewise made in whole or in part of hollow tile, a, thus forming continuous fresh-air flues a^3, which admit fresh air at their open ends or mouths a^6 and conduct the same along the whole length of the tunnel and deliver it, after being dried and heated in its passage, into the mouths of the tunnels A at the furnace end thereof. The hollow-tile fresh-air flues a^3 are furnished with openings a^7, leading into the tunnels just inside the doors G, which close the front or furnace end of the tunnels. The doors G, like the doors F, are vertically sliding doors and are furnished with counterbalance-weights G' and cords and pulleys g g'. To increase the supply of dry and partially-heated air to the tunnels, I provide the arch or top of each of the furnaces with hollow-tile flues c, which extend longitudinally over the furnaces and deliver their supply of hot dry air into the tunnels at the bottom thereof. The fresh-air flues a^3 thus deliver hot dry air into the tunnels at the top thereof, while the fresh-air flues c deliver it into the tunnel at the bottom, so that by their conjoint operation the air supply is well distributed from the bottom to the top of the tunnel. The flues a^3 are furnished with valves or dampers a^8, whereby they may be closed, and the flues c are furnished with valves or dampers c', for regulating the supply of air through them. When it is not desired to furnish dry hot air through the fresh-air flues a^3, as is sometimes the case during dry hot weather in the summer-time, or when the atmosphere is already sufficiently dry, by closing the ends of the flues a^3 the same will become dead-air chambers, and operate as insulators to prevent loss or escape of heat from the tunnel through its top or upper wall. The exit-shafts D are furnished with dampers or regulating-valves D^2, preferably near the top thereof, whereby the draft through the tunnels and through the furnace-flues may be regulated or governed.

The rotary fans D' are driven by belts d from the shaft d'. The draft through the furnace-flues and through the tunnels may be also regulated by varying the velocity of these fans. In place of fans other well-known or equivalent blast or draft producing devices—such, for example, as a high chimney—may be used. I, however, prefer to employ fans such as shown in the drawings, the same being an ordinary suction-fan. The doors G may, by opening them more or less, be used as the means for regulating the amount of draft through the tunnels, especially when the atmosphere is comparatively dry. These doors, in connection with the fresh-air flues a^3 and c, also afford a ready means of controlling the temperature of the tunnels at any degree desired independently of the particular degree of heat in the furnaces and furnace-flues.

K K are the tracks upon which the transfer or truck-bearing cars K' move in order to bring the brick-carrying cars B opposite the several tracks E E, which lead to and from the different tunnel-tracks b b.

In operation the brick hacked upon the cars B are run into the tunnels A through the doors F until the several tunnels are filled with cars. The tunnel-doors F and G are then closed and the brick subjected to the heat and hot dry currents of air of the tunnels for a period of from twelve to eighteen hours, when it will be found that the brick are thoroughly dried and ready to be taken out through the doors G. In practice I find that the brick dry about equally at both ends of the tunnel, the difference in temperature at the two ends of the tunnel, as indicated by my thermometers, being generally not more than 25° Fahrenheit. I usually maintain the tunnels at a temperature of about 170° Fahrenheit, which is sufficient to dry the brick in the time above named, and will not endanger or injure the brick. The fans D' produce a rapid current of dry hot air through the tunnels A and prevent the air therein from becoming saturated with moisture. As the air passes through the tunnels, its temperature is being constantly increased by the radiating or heating surfaces of the flues a' a^2, which extend the full length of the tunnels, and the air itself is thus continually dried as it passes through, or, rather, its capacity to hold moisture is continually increased as its temperature rises in its passage through the tunnel. The fresh-air heating and drying flues a^3 and c also serve to heat and dry the air before it enters the tunnels. By means of the valves or dampers in the fresh air flues and to the furnaces, and also by varying the velocity of the fan-driving shaft d', the draft of air through the tunnels, and also the temperature thereof, may be regulated as desired.

While the tunnels are specially designed for drying brick, they may of course be used for drying tile, pottery, or other clay-ware. The fire-flues a' a^2 may, if desired, be made of brick or other material than tile. I prefer, however, to make them of fire-proof tile.

I hereby disclaim the devices shown and described in Patents No. 266,959, to Graves; No. 268,771, to Dunnachie; No. 301,587, to Green, and No. 338,880, to Schefold.

I claim—

1. The combination of furnaces C with brick-drying tunnels A, each furnished with tracks b for the brick-carrying cars, and having their division-walls and floors furnished with a series of heating or radiating fire-flues extending longitudinally along the tunnels and leading from the furnace at one end of the tunnels

to the exit or smoke flue at the opposite end thereof, whereby the tunnels are continuously and uniformly heated and dried from end to end, said fire-flues being imperforate, so as to confine the products of combustion in the same, substantially as specified.

2. The combination, with furnaces C, of brick-drying tunnels A, furnished with tracks *b* for the brick-carrying cars, and having side or division walls composed of hollow tile, *a*, forming continuous longitudinal fire-flues *a'*, leading from the furnace to the exhaust or exit flue thereof at the opposite end of the tunnel, said division-walls being in part composed or built up wholly of hollow tile, so that the same hollow-tile fire-flue, *a'*, in such wall will heat the two contiguous tunnels separated thereby, said fire-flues being imperforate, so as to confine the products of combustion in the same, substantially as specified.

3. The combination, with furnaces C, of brick-drying tunnels A, furnished with tracks *b* for the brick-carrying cars, and having their floors or walls furnished with continuous longitudinal fire-flues leading from the furnace to the exit-flue at the opposite end of the tunnel, said fire-flues being imperforate, so as to confine the products of combustion in the same, substantially as specified.

4. The combination, with furnaces C, of brick-drying tunnels A, each furnished with tracks *b* for the brick-carrying cars, and having their division-walls or floors furnished with a series of heating or radiating fire-flues extending longitudinally along the tunnels and leading from the furnaces at one end of the tunnels to the exit-flue at the opposite end thereof, said tunnels being also furnished at their tops with fresh-air heating and drying hollow-tile flues a^3, opening into the tunnels at the furnace end thereof, substantially as specified.

5. The combination, with furnaces C, of brick-drying tunnels A, each furnished with tracks *b* for the brick-carrying cars, and having their division-walls and floors furnished with a series of hollow-tile heating or radiating fire-flues, *a'* a^2, extending longitudinally along the tunnels and leading from the furnaces at one end of the tunnels to the exit-flue at the opposite end thereof, said tunnels being also furnished at their tops with fresh-air heating and drying hollow-tile flues a^3, opening into the tunnels at the furnace end thereof, and said furnaces C having fresh-air heating and drying flues *c*, extending along their arch or top and opening into said tunnels, substantially as specified.

6. The combination, with furnaces C, of brick-drying tunnels A, each furnished with tracks *b* for the brick-carrying cars, and having their division-walls and floors furnished with a series of hollow-tile heating or radiating fire-flues, *a'* a^2, extending longitudinally along the tunnels and leading from the furnaces at one end of the tunnels to the exit-flue at the opposite end thereof, said tunnels being also furnished at their tops with fresh-air heating and drying hollow-tile flues a^3, opening into the tunnels at the furnace end thereof, exit flues or chambers D, and fans or blast-producing devices D', substantially as specified.

7. The combination, with furnaces C, of brick-drying tunnels A, each furnished with tracks *b* for the brick-carrying cars, and having their division-walls and floors furnished with a series of hollow-tile heating or radiating fire-flues, *a'* a^2, extending longitudinally along the tunnels and leading from the furnaces at one end of the tunnels to the exit-flue at the opposite end thereof, said tunnels being also furnished at their tops with fresh-air heating and drying hollow-tile flues a^3, opening into the tunnels at the furnace end thereof, and said furnaces C having fresh-air heating and drying flues *c*, extending along their arch or top and opening into said tunnels, and exit flues or chambers D, and fans or blast-producing devices D', said tunnels being furnished with doors F and G for closing their opposite ends, substantially as specified.

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