J. BÜHRER.

DRYING AND BURNING KILN.

No. 82,488. Patented Sept. 29, 1868.

Fig. 1.

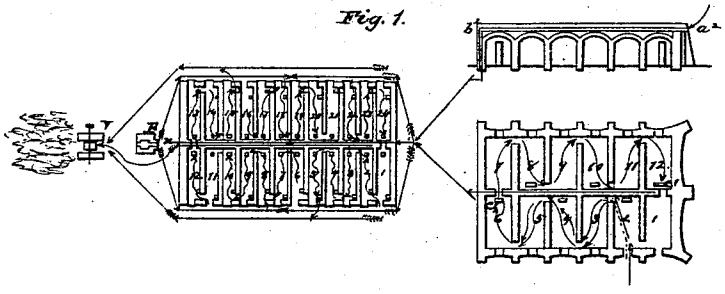


Fig. 2.

Section of X.X.

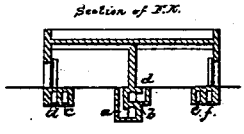


Fig. 3.

Section of G.H.

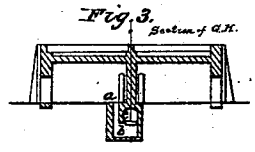


Fig. 4.

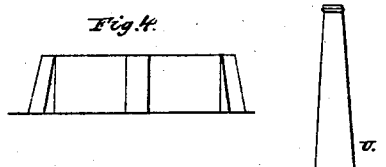


Fig. 5.

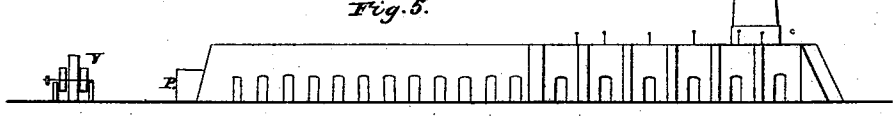


Fig. 6.

Section of I.M.

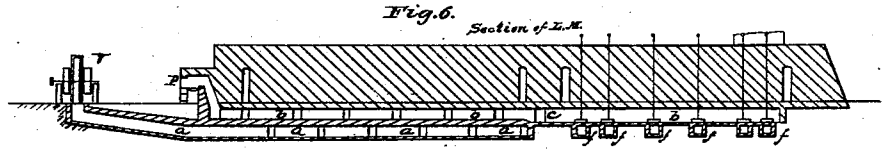


Fig. 7.

Section of G.D.

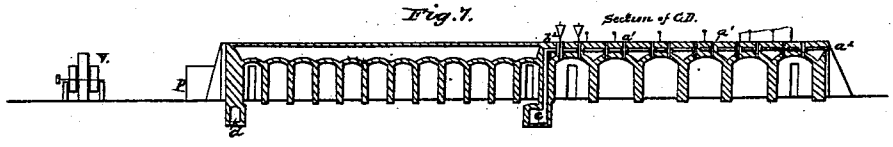
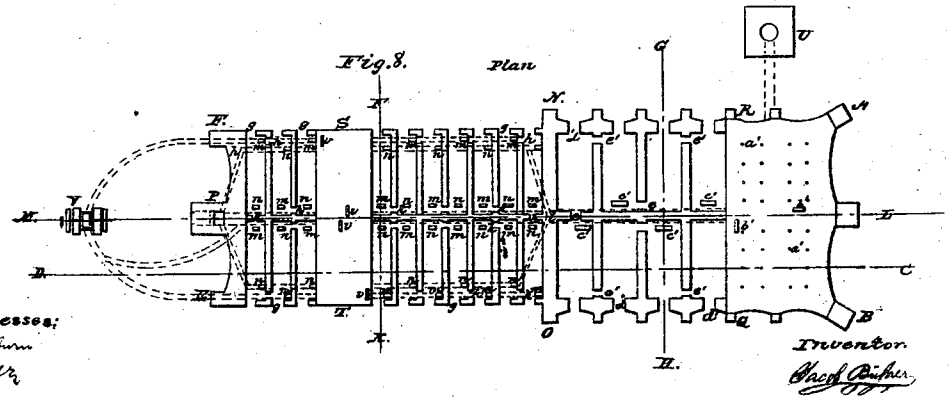


Fig. 8.

Plan



Witnesses;

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Letters Patent No. 82,488, *dated September* 29, 1868; *patented in England, February* 28, 1867.

IMPROVED DRYING AND BURNING-KILN.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL WHOM IT MAY CONCERN:

Be it known that I, JACOB BÜHRER, of Munich, in the Kingdom of Bavaria, have invented or discovered certain new and useful Improvements in Ovens or Kilns for Drying and Burning Bricks and other Articles; and I do hereby declare that the following is a full, true, and exact description thereof, reference being had to the drawings hereunto annexed; that is to say—

The chief object of this invention is to construct ovens and kilns for carrying on a particular mode of effecting the combustion of the fuel; and in order that this object may be fully understood, I will first describe the mode in which the combustion of the fuel is effected, although this mode forms the subject of a separate patent, already granted to me in the United States.

The fuel which I employ, consists of coal, anthracite, coke, shale, peat, or other like matter, in as fine a state of division as it is practicable to obtain it. This fuel, in a state of powder or dust, is allowed to fall through a suitable orifice, in such a way that the flow of the powder can be regulated, into a space in the oven or kiln, where it meets air previously heated, and whilst in the act of falling it takes fire, and is consumed whilst suspended in the air, thereby undergoing the most perfect combustion. This mode of applying the fuel resembles in fact the burning of gas, with this difference, that the gas is generated, in this instance, at or near the place where it is to be burnt. A draught carrying the burning particles of fuel along into the spaces left between the bricks or other articles, a perfect and uniform heat is obtained, which can be regulated with great facility, and which insures the bricks or other articles to be burned receiving a uniform temperature throughout and in every part of the kiln, which is an object of the greatest importance, not previously obtained by any other means or contrivance.

For the purpose of economizing the heat given off in the process of burning, I make use of a kiln of a peculiar construction, which, whilst it admits a continuous process of burning, is so arranged as to allow part of the heat retained in the burnt articles to be drawn away along with the gaseous products of the combustion, by means of a ventilator, or fan, or chimney, through a series of drying-chambers, in which the bricks are thus economically dried to such a degree that they are almost absolutely free from water previous to their being put into the kiln. From the description of the ovens and kilns hereafter given, it will be perceived that by their mode of working, nearly the whole amount of heat generated by the fuel is utilized, and in the case where a fan is used, it has been found that the moist air which issues from the fan is only about from 60° to 75° Fahrenheit higher than the ordinary temperature of the atmosphere.

I now proceed to describe the construction and operation of the ovens and kilns.

Now follows the description of kiln and drying-chamber, then the mode of working the same from the commencement.

My invention, in so far as it relates to ovens for drying bricks and other articles, consists in constructing them in a series of oblong rectangular compartments, placed side by side in two rows, the two rows being set back to back; in connecting each compartment with those next adjoining by openings in the dividing-walls, and in the arrangement of flues, doors, and dampers, as hereafter described, whereby I am enabled to regulate the supply of heat to the compartments, for the purpose of carrying on a particular process of drying, as hereafter explained.

My invention, in so far as it relates to kilns, consists in constructing them, in a similar manner to the ovens, of a series of oblong rectangular compartments, built side by side in two rows set back to back. The compartments communicate with each other like those of the oven, and there are flues, doors, and dampers to enable them to be worked in a similar manner to those of the oven. As the thrust resulting from the expansion of the brick-work will only be towards the ends of the rows, these end walls are constructed of the necessary thickness, with supporting piers, while the intermediate walls may be comparatively thin. According to this construction there will be little exposure to the air, and therefore little loss of heat, and a great economy in brick-work will be effected.

My invention will be fully understood by the annexed drawings, and the following description thereof.

Figure 1 is a general plan or view of the system of drying and burning combined.

Figures 2 and 3 are sections, through F K and G H respectively, of fig. 8.

Figure 4 is an elevation of the end A B of fig. 8.

Figure 5 an elevation of the side B E of fig. 8.

Figures 6 and 7 are sections respectively, through the lines L M and C D, of fig. 8; and

Figure 8 is a plan of the drying-oven and kiln combined. This figure is in section except at the parts marked S T and R Q.

I will first describe the drying-oven. It consists, as before mentioned, and as seen in the drawings, of a series of oblong rectangular compartments, set side by side in two rows, which are set back to back. I have shown twenty-four compartments, but any other convenient number may be employed. The side walls of each compartment have openings *h*, alternately at back and front, as shown, communicating with the next adjoining compartments, and the end compartments of one row communicate with the end compartments of the other row, by openings *h* in the middle wall. These openings *h* are thus so arranged, that were they all unclosed, there would be a zigzag passage for a current through the compartments in one row, which would be continued by a zigzag passage in the opposite direction through the compartments in the other row. The openings *h* are, however, provided with doors or dampers, as represented at *v v*, fig. 8, which can be opened and closed, as required, as the drying-process is being carried on. Under the middle wall, (see fig. 6,) two flues are formed, one marked *b* for the heated air for drying the bricks, and the other marked *a* for carrying off the air after leaving the bricks. Two similar flues are formed under each of the two outer side walls of the ovens, viz, a flue, *c*, for heated air, and one, *d*, for escape air under the wall to the left of fig. 2, and a flue, *e*, for heated air, and one, *f*, for escape air in the wall to the right of fig. 2. These flues communicate with the various compartments, that is to say, every compartment is in communication with one heated-air flue and with one escape-air flue. This arrangement or system will be understood by fig. 8, in which *m* are the communications with the escape-air flues, and *n* the communication with the heated-air flues. The escape-air flues are colored green and the heated-air flues red. The communications *m* and *n* are each provided with a door or damper, opened and closed as the progress of the drying-process requires. V is a ventilator or fan, for exhausting the air from the escape-air flues, and P is a furnace for heating and assisting the draught through the heated-air flues, with which it is in communication by short flues, as indicated in fig. 8. The heated air and draught are, however, chiefly derived from the kiln, which is in communication, at the point *l*, fig. 8, with the heated-air flues *b*, *c*, and *e*. Each compartment has an opening, *g*, at the front, provided with a door or damper.

The process of drying in this oven constructed with flues, as before described, is carried on as follows, and will be understood on reference to fig. 1.

I divide the compartments into, say, sets of five. No. 1 of each set will be in course of being emptied and refilled through the door at its front; No. 2 will be cooling by means of air admitted through No. 1; No. 3 will contain nearly dry bricks; No. 4 half-dried bricks, and No. 5 green or wet bricks. The necessary dampers and doors are open to allow the hot air from the kiln to enter No. 3 of each set, to pass from thence at a diminished heat to No. 4, and then at a still less heat to No. 5, from which it issues by one of the escape-flues. After a certain time the bricks in No. 3 will be quite dry, those in No. 4 nearly dry, and those in No. 5 half dried, while No. 1 will have received fresh green bricks, and the bricks in No. 2 will be sufficiently cooled for removal. I then close and open the necessary dampers and doors to make No. 4 of each set No. 3, or the compartments which first receive the hot air; No. 5 will thus become No. 4; No. 1 of the set in front will become No. 5 of the first set; No. 3 of the first set will become No. 2; No. 2 will become No. 1, and No. 1 will become No. 5 of the set behind. The operation is thus carried on continuously through the whole series of compartments of the oven. The red arrows in fig. 1 show the direction or course of the hot air, and the green arrows that of the escape air.

I now proceed to describe the kiln to the compartments of which the bricks are removed after being dried in the oven. The kiln shown has twelve compartments, which I consider a convenient number. There is one central flue with which every alternate compartment communicates, through openings *c'*, provided with dampers. The compartments communicate with each other by openings *e'* in the dividing-walls, and every alternate opening *e'* is provided with a door or damper, actuated from the top, as indicated by *b'*, fig. 8. It will thus be understood that these compartments are arranged, as it were, in pairs. The several pairs are worked progressively and continuously in an analogous manner to that before indicated in reference to the oven. Each compartment is provided with an opening, *d'*, at the front, fitted with a door or damper. The compartments are fed with fuel from the top, through apertures a^1. This fuel is in the state of fine division, and as it falls through the bricks, the combustion is effected by the great heat of the bricks themselves, which have previously been heated by the products of combustion from the compartments behind. On reference to fig. 1, it will be seen that the doors at the front of compartments 1 and 2 are open, and that fuel is being fed to 8. 3, 4, 5, 6, and 7 have previously been burnt, and 8, which is now being fed, has been made so hot by the products from behind, that the powdered fuel supplied to it is at once consumed. No. 1 is being emptied and refilled, cold air is rushing through No. 2 to cool the bricks therein, and after passing through 3, 4, 5, and 6, a portion of it issues in a heated state through the apertures *c'* of 6, into the flue below to go to the oven, while the remainder proceeds through 7 to 8 to support the combustion therein. The mode of drawing the cold air through the hot bricks in 3, 4, 5, and 6, and throught he aperture *c'*, direct to the drying-compartments, affords great advantages. The heat and products of combustion from 8, pass through 9, 10, 11, 12, and heat or partially burn the bricks therein, and finally issue in a heated state, by the aperture *c'* of 12, into the flue below leading to the oven.

When the bricks in No. 8 are sufficiently burnt, the necessary door and dampers are closed and opened to

admit of the same process being carried on from No. 9, which is then supplied with fuel, the door of No. 3 is opened to admit cold air, and the damper in 8 is opened to allow a portion of this air, after being heated, while passing through 4, 5, 6, 7, and 8, to issue into the central flue. The same process is carried on continuously and progressively through the series of compartments. In burning pottery and other articles, when it will be injurious to allow the fuel to come in contact therewith, a space may be left unfilled in each compartment of the kiln, into which space the fuel is dropped, and consumed in manner before explained. a^2 b^2, (see fig. 7,) is a flue or channel above the compartments, to allow of air entering it, and passing, after being heated, into the flues of the oven. The top of the kiln is filled in with clay or other suitable material, to prevent loss of heat as much as possible. It will be observed that very little surface of each compartment is exposed to the outer air, that the inner walls can be comparatively thin, owing to the arrangement of the compartments, and that the two end walls are of the necessary thickness to resist the force of expansion exerted by the heat. The end wall further from the oven is supported by piers, as seen in fig. 4, while the further end of the oven is similarly supported. U is a chimney, communicating by a flue with the kiln. This chimney may be employed for producing draught when a ventilator is not used.

I do not claim, as my present invention, the particular mode of effecting the combustion of the fuel in a state of fine powder, because, as before stated, this forms the subject of prior Letters Patent; neither do I claim the progressive and continuous manner of drying the bricks, or of burning the bricks when dried, as this process is very old. In 1841, one Joseph Gibbs obtained Letters Patent, for England, for a kiln constructed in a circular or annular form, divided into a series of compartments, with flues leading to one central chimney, and the process of burning was progressive and continuous, as in my kiln and oven. In fact the old common mode of burning bricks in stacks in the open air is progressive, because, as the fire is lighted at the bottom, the lowest layer of bricks is burnt first, the fuel above them then becomes ignited, and burns the next layer of bricks, and so on progressively to the top. I do not, therefore, I say, claim the mode of burning or drying bricks in a progressive or continuous manner; but

What I claim as my invention, and desire to secure by Letters Patent, is—

A drying-kiln, as shown, consisting of a series of compartments placed back to back in a double row, and provided with the openings *g*, hot-air supply and escape flues *a*, *b*, *c*, *d*, *e*, and *f*, and communicating-apertures *m* and *n*, in combination with a burning-oven, also consisting of a number of compartments similarly disposed to those of the kiln, and provided with the openings *d'* and *e' e'*, all the parts being constructed and arranged as and for the purposes herein set forth.

In witness whereof, I, the said JACOB BÜHRER, have hereunto set my hand, this 4th day of November, 1867.

JACOB BÜHRER.

Witnesses:

S. SETZ,
H. SALATHÉ, } *Basle, Switzerland.*