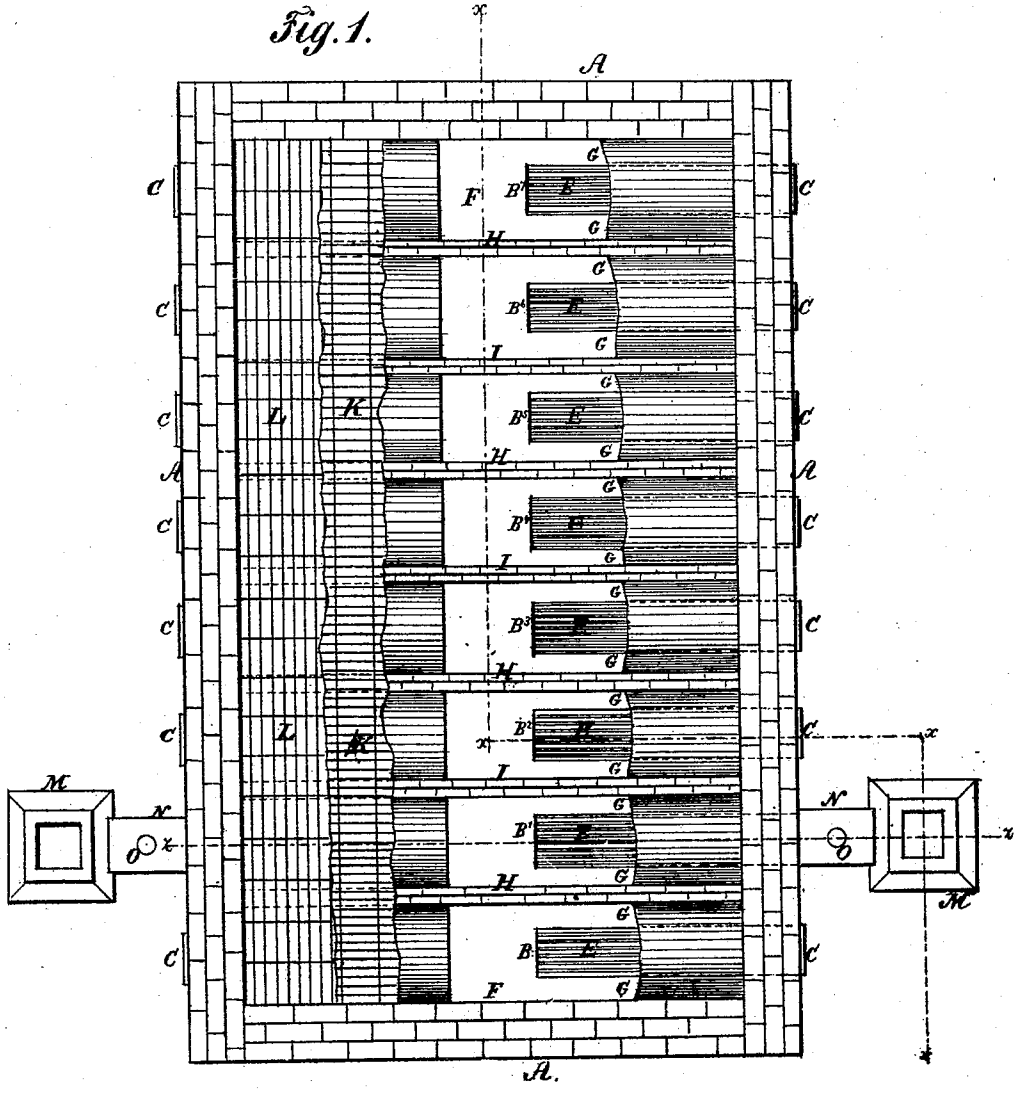
2 Sheets, Sheet 1.

W. S. Hall,

Brick Kiln.

No. 101,870. Patented Apr. 12, 1870.

Fig. 1.



Witnesses:

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A. L. Berry.

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2 Sheets - Sheet 2

Brick Kiln.

No. 101,870. Patented Apr. 12, 1870.

Fig. 2.

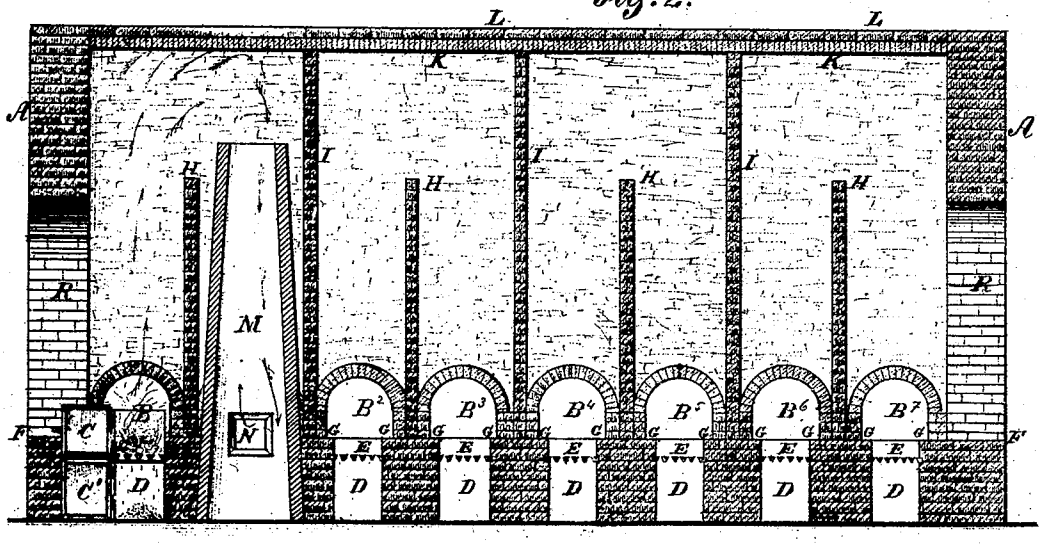
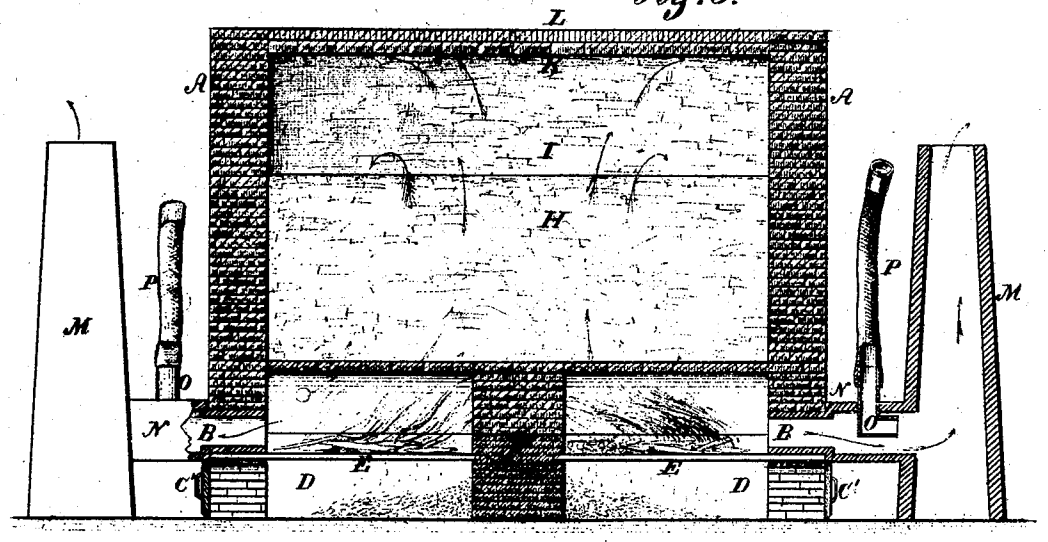


Fig. 3.



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UNITED STATES PATENT OFFICE.

WILLIAM SAMUEL HALL, OF NEW YORK, N. Y., ASSIGNOR TO HENRY W. ADAMS.

IMPROVEMENT IN KILNS FOR BURNING BRICKS, &c.

Specification forming part of Letters Patent No. **101,870**, dated April 12, 1870.

To all whom it may concern:

Be it known that I, WILLIAM SAMUEL HALL, of the city, county, and State of New York, have invented certain Improvements in Kilns for Burning Bricks, Pottery, Earthenware, and other articles composed of clay, of which the following is a specification.

The first part of my invention relates to the method of constructing the kiln.

The second part relates to the combination, with the burning-oven, of the mechanical contrivance for exhausting the burning charge of its "water-smoke," and advancing the heat progressively through a long or continuous kiln.

The object of my invention is to save fuel and burn bricks and other articles composed of clay more uniformly hard and perfect in color.

In the accompanying drawings, Figure 1 is a ground plan, as seen by looking down from the top. Fig. 2 is a longitudinal section. Fig. 3 is a cross-section.

A is the outside wall of the kiln, inclosing the burning-chamber. B B′ B^2 B^3 B^4 B^5 B^6 B^7 are the fire-places. C are the fire-doors, one of which is thrown open. C′ are the doors of the ash-pits, one of which is represented as open. The above letters are clearly seen in Fig. 2. Likewise the following are shown in the same figure: D D show the ash-pits. E E are the grate-bars.

In Fig. 1, F F is the space or cartway between the two opposite sets of grate-bars, running through the middle of the kiln. G G are the floors between the grate-bars, which are flush with the driveway F F.

In Fig. 2, H H H H are partitions between every other fire-place, carried only part way up to the top of the kiln. I I I are alternate partitions between every other set of fire-places, carried entirely up to the top of the kiln. K represents a course of hard-burned bricks laid down on the top of the kiln when set for a cover. L shows a second course of hard-burned bricks laid above the first and breaking joints with it.

In Fig. 3, M M show the chimneys. N N represent the flues connecting the chimneys with the mouths of the fire-places B B′ B^2 B^3 B^4 B^5 B^6 B^7, as in Fig. 2, and B B in Fig. 3. O O show the pipes for jets of steam, air, or water under pressure to discharge the water-smoke. P P represent flexible tubes attached to the pipes *o o*. R R are doorways.

The walls A of the kiln are built according to the best known methods of building such structures. They may inclose a larger or smaller space to hold the burning charge, to suit the amount of business to be done. It is better, however, to make the kiln much longer than it is wide. It may be a continuous kiln, or it may be built precisely like an old-fashioned brick-kiln. The only difference is that the longer it is less fuel it takes to burn a given charge.

In Fig. 3 the chimneys M M and the connecting-flues N N may be made of boards lined with sheet metal, so as to be light to handle and move from one fire-place to another. The heat passing through them is not intended to be greater than that of common water-smoke, or the vapor of water passing off from the drying-charge.

The chimneys may be made about two feet square, inside measure, at the bottom, and eighteen inches square at the top, and twelve feet long, more or less. The flues N N are some twelve inches square, inside measure.

The mode of setting and burning the kiln is as follows: Arches, composed of green bricks, are turned over the grate-bars E E in Fig. 1 in the usual manner, as shown broken off. These arches extend back to nearly the middle of F F; or they may stop at the end of the grate-bars, as shown in Fig. 1. Both sides of the kiln are set in the same manner. Between the arches, partitions, composed of green bricks H I, are set up, as shown, at the same time the arches and kiln are set. These partitions are made as tight as possible by putting down two courses flatwise, breaking joints, and then crossing them with a course resting on their faces. By setting these bricks, when green, close together in this way, or in an equivalent manner, it makes the dividing-walls tolerably tight. Otherwise the kiln is set in the ordinary manner and carried up to the usual height. The top is then sealed as tightly as possible by laying down two courses of hard-burned bricks edgewise, and breaking joints, as shown in Fig. 2. To render the top still

tighter, each course, or only the top course, may be plastered over with soft mud or plastic clay to fill up the joints. When the first two arches in Fig. 2, at the left end of the kiln A, are set, the walls I carried up to the top, and the cover put on over them, and the doorway R filled up with bricks and plastered over on the outside, and the wall H carried up part way toward the top, they are ready to be burned. The chimneys M M and flues N N are now adjusted to the fire-places B B, on the two opposite sides of the kiln, and next to the first high wall, I, as shown in Figs. 1 and 3. Fires are now built in the first fire-place, B, on both sides of the kiln, as seen in Fig. 2. A jet of steam, air, or water, under pressure, is then let into the pipes *o o*, in Figs. 1 and 3, to produce a powerful artificial draft. The wall I being packed closely with green bricks, and, when necessary, plastered on the outside with soft clay, and the top being tight, and the flues N N, as in Fig. 3, being fitted snugly in the fire-places, and the ash-pit doors C C′, under the fire-places in which the flues N N are fitted, being shut tight, as shown in Fig. 3, the heat will rise from the fires in the two opposite fire-places, B B, as represented by the arrows in Fig. 2, the wet bricks will grow warm, the water in them will be converted into vapor, and this vapor or water-smoke will be drawn down, after ascending above the partition-wall H into the second arch, and thence into the flues N N and hurled out of the two chimneys M M into the air. The office of the wall H is to prevent the draft in the second fire-place drawing the heat directly from B to B′ and into the chimneys M M. The natural tendency of heat being to ascend unless counteracted by a stronger side draft, it will rise from the fire-places B B above the wall H before it feels the draft sidewise, which causes it to descend, in the direction of the arrows, down through the compartment between H and I and escape in the form of steam or water-smoke, by the flues N N, from the chimneys M M. It is obvious from this view that several things here unite to produce this result. The wall H compels the heat to rise perpendicularly until it passes over its top. The wall I cuts off the air on its right and makes the compartment on its left, when covered above, an oven, by which means the draft in the flues N N, created by jets of steam, air, or water under pressure, introduced into the pipes *o o*, and escaping from them into the flues N N, and toward the chimneys, is felt all through the interior of the compartment thus sealed in, and the water-smoke is quickly exhausted. Were it not for the tight wall I, I should get no draft. Were it not for the tight wall H, the heat would be drawn sidewise from B into B′ and out through N N into M M. Were it not for the cover K and L on this compartment, the heat would escape into the air from the top. Were it not for the artificial draft, the other conditions remaining, the water smoke or vapor of the wet bricks would remain in the kiln, stop the fires, condense in the colder parts of the charge more remote from the fires, and cause the bricks to soften and mash together. This device enables me to remove the water-smoke in at least one-third of the time required by the old method. This is a great matter, for it takes more time and fuel to discharge the water from the wet bricks than it does to complete the burning. Meantime, while this process is going on, setters are at work wheeling or carting bricks through the doorway R, in the right end of the kiln, as seen in Fig. 2, and setting the compartment over the fire-places B^2 B^3, laying up the walls H and I, and putting on the top K L, as before. When this is done, and the water-smoke ceases, or nearly so, to flow from the first compartment through the chimneys M M, the movable chimneys and flues N N are removed from B′ B′ to B^3 B^3, the draft let on into the pipes *o o*, and fires are now built in the fire-places B′ B^2. The water-smoke now begins to boil out of the chimneys from the wet bricks in this second compartment. The fires in B′ B^2 now increasing on both sides of the wall I between them, begin to shrink it, and open cracks in it, to allow the heat from the fires in B B′ to pass through the crevices in it, made by said shrinkage, into the second compartment, and aid in removing the water-smoke therefrom. This wall I operates as a cut-off or damper, which, when the bricks are wet, of which it is composed, and laid tight together, is shut, and when the same bricks are dry, and begin to bake, opens. It adjusts itself. The crevices open wider and wider as the bricks composing the wall grow hotter, and, as wider openings are required to allow the redundant heat to escape from the hotter preceding compartment into the following one next succeeding, consequently no dampers nor movable cut-offs are required in my kiln. These walls, composed of green bricks, are set, burned, and discharged in the same manner and at the same time as the rest of the kiln. When the water-smoke ceases to flow from the chimneys in B^3, they are then removed and fitted to the fire-places B^5 B^5. The jet of steam, water, or air is again turned on at *o o*, and fires are kindled in the fire-places B^3 B^4 on both sides of the kiln. The water-smoke now is exhausted from the third compartment, the wall I between B^3 and B^4 shrinks, and opens crevices between the bricks composing it, for the heat to pass from the preceding compartments, while the first compartment, having been sufficiently burned, begins to cool down, by opening the doors B B, and allowing the air to enter and carry forward the heat into the next compartment, and so on. The result is that no heat is lost by escaping from the top, and no heat is allowed to pass into the chimneys above the temperature of the water-smoke, which is not far from 212° Fahrenheit. This process involves great economy of fuel. When the water-smoke is gone from B^5 B^5, the chimneys M M are re-

moved and adjusted to the fire-places B^4 B^4, and fires are built in B^5 B^6, and finally in B^7 when the water-smoke ceases to appear from that opening. Meantime the burned charges are being discharged from the door R at the left end of the kiln A, as seen in Fig. 2, and others set to be burned, as before. The chimneys may be made so light, either of boards or sheet metal, that two men can lift them and remove and adjust them from fire-place to fire-place in a few minutes. This renders such an attachment cheap and easily managed, and enables me to use my invention in combination with all the old brick-kilns in the country. The reason I employ hard-burned bricks to make the cover K L is because such bricks do not shrink by the heat below them and open cracks for the said heat to escape into the air. I have shown flexible tubes P P in Fig. 3, attached to the metal pipes *o o* for convenience in connecting the sources of the compressed steam, air, or water with the said pipes *o o*, when the chimneys M M and the flues N N are removed from one fire-place to another. I find it advantageous to build the ash-pits D D pretty deep to admit an abundant supply of air to the fires, and to keep the grate-bars cool.

Sometimes it may be cheaper to use water under pressure to cause the draft from the flues N N than either steam or air. In most cities the water-pipes are laid in the suburbs, where many brick-kilns are located. By tapping into the water-mains and attaching a hose like P P a jet of sufficient power can be cheaply supplied. Where there are no such mains, and it is deemed best to use a jet of water for the said purpose, a small portable fire-engine may be run round the kiln on wheels to force the necessary stream of water; or, in some localities, water can be had from certain elevations which will answer the desired purpose. It may escape from *o o* in several small jets, and thus increase the draft. The water will thus fall into the chimneys M M and escape from their bottoms into drains and run away. These jets of water cool the products discharged from the kilns and protect the flues N N and chimneys M M from too great heat.

When a jet of air is used to create a draft in the flues N N, it may be produced by any of the known modes of producing an air-blast. When a jet of steam is used, it may be made in a small portable boiler moved about on wheels, or in any other known method. In reference to the use of a jet of steam to create the said draft, I wish to disclaim the manner in which it was patented by Henry W. Adams, as set forth in his two patents dated, respectively, July 21, 1868, and July 20, 1869. In both of these patents he shows a kiln pierced with pigeon-holes in the end directly opposite to his fire-places. These pigeon-holes are collected finally into one main and a jet of steam introduced into this main, so as to draw equally from all the pigeon-holes, and draw the heat from the fires in the opposite end of the kiln through all parts alike to the remote end of the charge. It is a special mechanical device to secure uniformity of draft, instead of drawing from his fires toward one opening in the opposite end. This would have defeated his object, and made the heat travel through his kilns in the form of a cone, pointing its tapering end towards the single outlet. His device, therefore, for drawing the water-smoke out of a brick-kiln, by drawing it first through a series of equidistant pigeon-holes into one main and then discharging it into the air, I disclaim. I draw out my water-smoke from the fire-place through a single opening, communicating directly with the kiln, without any device whatever for producing an equally-divided draft from the fires in a straight direction towards many openings. My object is different from his. I wish to get rid of my water-smoke only, and not my heat. Therefore, after the water-smoke is gone, I stop the draft in that place and move it on to a more distant point, for the purpose of discharging the water-smoke from another compartment. I do not need this draft to urge the fires, for as soon as the water-smoke is gone the natural draft, created by the rarefaction of the heated products of combustion, which renders them lighter than the weight of the cold air rushing into the ash-pits and through the grate-bars, and pushing them forward, is sufficient to advance the heat as fast as the best economy of fuel will justify. The chief use of my artificial draft is, therefore, to discharge the immense quantity of water-smoke which is generated in a kiln of wet bricks, and which must be got rid of before the heat can be raised hot enough to burn the charge. Neither do I claim a continuous kiln, or a kiln composed of compartments provided with flues and dampers leading to a chimney, like the Hoffman kiln, and employing a removable or sheet-iron cut-off; but

What I claim is—

1. The kiln A, when set and operated substantially in the manner and for the purposes described.

2. The construction of the partition-wall H in the manner described, to prevent the heat of the fires in the fire-places B B in Figs. 2 and 3 from passing by a direct side draft into the flues N N, and for the purposes set forth.

3. In a covered kiln, A, the construction of the partition-wall I, in combination with the draft-flues N N, in the manner and for the objects described.

4. The construction and use of the gradually-shrinking partition-wall I, in the manner and for the purposes hereinbefore explained.

5. The draft-flues N N, in combination with the fire-places B B, in the manner and for the uses substantially as shown.

6. The draft-flues N N, in combination with the chimneys M M, in the mode and for the objects indicated.

7. The arrangement and use of the flexible

and adjustable hose P P, in combination with the blast-pipes *o o*, substantially in the manner and for the objects described.

8. The use of a jet of steam escaping from the blast-pipes *o o* into the flues N N toward the chimneys M M, for the purpose of drawing the water-smoke from a kiln charged with bricks or other articles composed of clay, directly from one opening, without the use or intervention of pigeon-holes, as shown.

9. The use of a jet of compressed air to exhaust the compartments of the kiln A of its water-smoke, substantially as explained.

10. The use of a jet of compressed water to discharge the water-smoke, substantially as set forth.

WM. SAMUEL HALL.

Witnesses:
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A. L. BERRY.