2 Sheets—Sheet 1.

C. BROWN.

Lime and Cement Kiln.

No. 220,337. Patented Oct. 7, 1879.

Fig. 1.

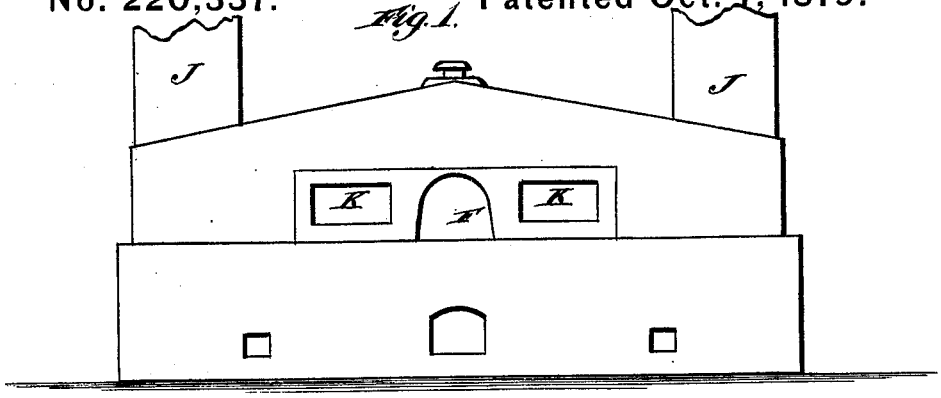


Fig. 2.

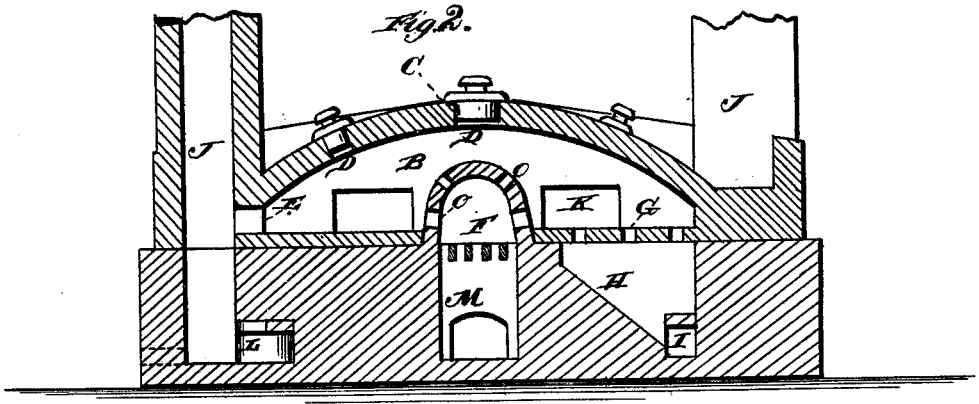
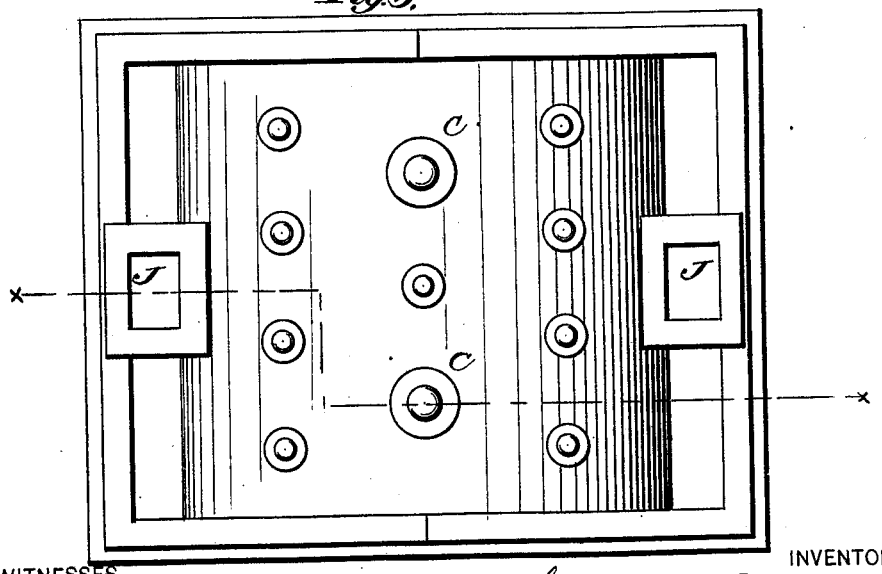


Fig. 3.



WITNESSES

Robt Everett

James J. Sheehy.

INVENTOR

Calvin Brown

Gilmore Smith & Co.

ATTORNEYS

2 Sheets—Sheet 2.

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Fig. 4.

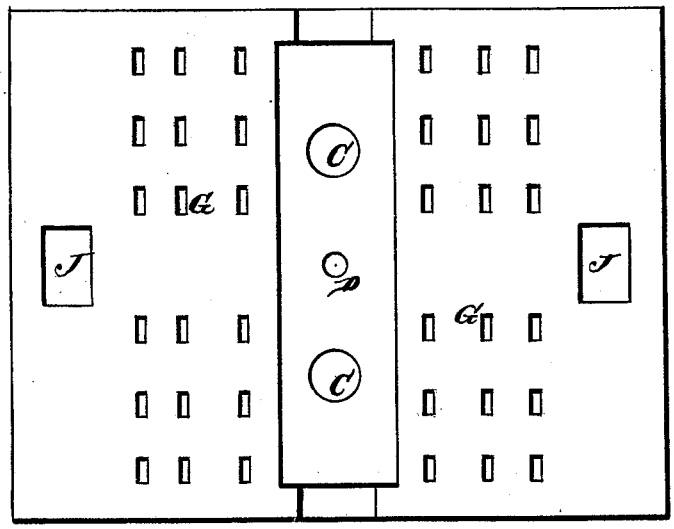
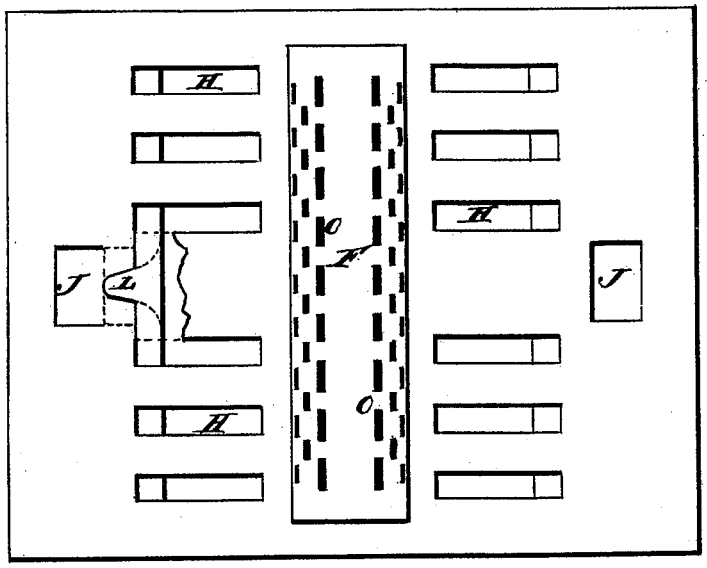


Fig. 5.



WITNESSES

Robert Everett

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INVENTOR

Calvin Brown

Gilmore, Smith & Co.

ATTORNEYS

UNITED STATES PATENT OFFICE.

CALVIN BROWN, OF MARE ISLAND, CALIFORNIA.

IMPROVEMENT IN LIME AND CEMENT KILNS.

Specification forming part of Letters Patent No. **220,337**, dated October 7, 1879; application filed July 12, 1879.

To all whom it may concern:

Be it known that I, CALVIN BROWN, of Mare Island, in the State of California, have invented certain new and useful Improvements in Lime and Cement Kilns; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the annexed drawings, making a part of this specification, and to the letters and figures of reference marked thereon.

Figure 1 of the drawings is a representation of a front of my lime and cement kilns. Fig. 2 is a sectional view through lines *x x* of Fig. 3. Fig. 3 is a plan view, and Figs. 4 and 5 are interior views.

My invention relates to an arrangement of a reverberatory burning-chamber with a central and perforated furnace and duplicate chimneys for the calcination or burning of lime, cement, plaster, &c.

Heretofore such kilns have been constructed upon necessarily large and expensive scales, in order to obtain maximum economical results. They entail a great and disproportionate amount of labor and expense in their use, not only in wear and tear, but in their loading and unloading, in the consumption of fuel, and the unavoidable mixture of its ashes, slag, &c., with the calcined materials. Besides these inconveniences there results the uncertainty of their operation from the impossibility of always properly regulating the required heat and of watching its effects, in consequence of the inaccessible nature of the chambers of the kilns, which forbids the necessary inspection of the calcining process while it is going on.

Two classes of kilns are embraced in the above statement, one of which consists of a massive and lofty construction, which, unless some natural and convenient eminence can be availed of in its location, involves the expense of incline-ways, platforms, &c., or of machine hoisting-works, and the labor for raising the materials to be calcined and its fuel to a height varying from twenty-five to fifty feet.

The other system is called the "annular" or "ring" kiln, which, though obviating the objections of high hoisting, involves elaborate and careful charging, and by its extensive and complicated construction requires great space and a lofty chimney, the consequence being a heavy outlay in the erection of the works. This sort of kiln admits, as a whole, of continued or perpetual use as distinguished from the intermittent sort, and has some advantages in economy over the high kilns; but its arrangement in numerous chambers, alternately subject to heating and cooling, is attended with the deranging effects of this operation; nor does the system admit of that uniform and exact burning especially necessary in the preparation of hydraulic cement.

Other inconveniences are encountered in all the kilns in common use, which are unnecessary to here state, but which are obviated in the construction of my kiln.

My kiln, instead of requiring massive and expensive structures, is of moderate dimensions and requires but a small space. It need not be over six feet high, with chimneys of twenty feet. Instead of necessitating large charges of mixed materials and fuel, whose proper proportions are impossible to be determined except by chance with the ordinary kilns, it needs only small charges of the lime carbonates or raw cement, having a separate furnace for the fuel, so that it can be accurately supplied for the required purpose and cannot mix with the materials to be calcined, nor deposit its ashes, slag, or cinders with them. In the use of the ordinary kilns, requiring large charges, the whole mass of raw materials, consisting of many tons, mixed with alternate layers of fuel, is subjected to a calcination which can only gradually proceed as each successive layer of fuel is ignited and its heat applied, an operation that requires several days before the entire charge can be acted upon, this process, in the meantime, being attended with an accumulation of ashes from the consumed layers of fuel, with the effect of diminishing the draft thereby, and consequently the degree of heat is rendered unequal and leaves portions of the material underburned, while in the more intensely hot parts of the kiln, where a freer draft happens to act, other portions are liable to be overburned, so that in all such kilns the burned mass, when cool enough to be

withdrawn and handled, has to be carefully picked over and the properly-calcined pieces separated from the rest.

It sometimes happens that an entire failure results from bad burning with these kilns, and thus entails a great loss upon the manufacturer, while with small charges, for which my invention is adapted, and in the case of poor fuel, bad management, or any other cause of an imperfect calcination, the loss would be limited to the small amount of a single batch of materials and the fuel consumed, while the experience of such an occasion would at once and in the time of a few hours reveal the fault and its remedy.

In my kiln the charges of materials to be calcined are proportioned to the capacity of the burning-chamber, the applied heat acting simultaneously upon the whole mass, converting it at once and in a short time to the desired condition, the fire in the meanwhile being duly regulated according to the requirements of the different stages of the calcination, whose progress can be readily watched by means of provided arrangements.

My improvement consists in comparatively small kilns in size, determined by considerations of maximum economies pertaining to the construction and use of calcining-kilns, and especially in thoroughness of the calcining process.

In capacity my kilns should not probably exceed that of the quantity of raw materials required to produce eight average barrels of hydraulic cement, or about one and one-half gross ton.

It also consists in a reverberatory-formed burning-chamber, with a perforated furnace placed through the center thereof, so that the charge of the materials to be calcined is shielded from direct contact with the fuel, and the heat radiated equally through the chamber and the entire mass.

It further consists in the use of two or more chimneys with flues leading to them, both directly from the furnace and through openings in the hearth or sole of the burning-chamber; and it finally consists in a general arrangement whereby ease of charging and unloading the materials to be operated upon is secured, as well as a thorough inspection of the whole process of calcination and a perfect control of the fire necessary therefor.

In the accompanying drawings, which fully illustrate my invention, B represents the burning-chamber, whose walls and top are constructed of fire-bricks, for the reception of the materials to be calcined. C C are charging-holes, by which these materials are introduced to the chamber, and D D are holes for removing samples of the matter undergoing calcination. All these holes are provided with heat-tight covers. K K are openings for unloading the chamber, and are provided with either swinging or sliding doors. F is the furnace, placed mostly above the level of the hearth, and passing entirely through the burning-chamber. This is constructed of fire-bricks, in whole or in sections, of suitable materials, provided with openings O for the passage of heat, &c., and provided with doors and grates. E E are the upper or direct flues to the chimneys, separated and spaced so as to favor the diffusion of heat. G G are openings through the hearth, communicating downward with the passages H H to the lower flues, I I. J J are the chimneys, provided with diaphragms L L, to secure uninterrupted draft by preventing the impingement of heat-currents, &c., entering from opposite directions. The chimneys are also provided with dampers placed on their tops or otherwise. M is the ash-pit, extending entirely under the furnace and provided with a door at each end.

The operation of the kiln is as follows: The materials to be calcined, supposing it to be for artificial hydraulic or Portland cement, are introduced into the chamber B through its charging-holes C C, and also, if desired, through the openings K, and properly distributed, by means of iron rakes or otherwise, over the hearth and over the top of the furnace F. All the openings of the chamber are then closed, and the furnace, charged with fuel, is fired. By the peculiar arrangement of the furnace-openings O the direct or upper flues, E, the hearth-openings G, communicating with the lower flues, I, and the reverberatory action of the soffit of the burning-chamber, the heat is radiated and thoroughly diffused through the entire mass subjected to its effects. By the especial disposition of the furnace-openings O, as shown, the heat is supplied according to the greater or lesser amount required at various points of the mass to be calcined. The tendency of heat being to rise, and thus to concentrate in the higher part of the furnace, over which the calcining material would be in less quantity, the openings are there made fewer, while upon its sides and near the hearth, where the great bulk of the mass is placed, they are more numerous and of a greater total capacity or outlet, and thus admit of a larger quantity of heat to act upon the greater bulk of the interior of the charge.

The fire in the furnace F is maintained until the process is completed, and, if necessary, additional fuel may be introduced directly into the burning-chamber B through the holes D D upon such portions of the charge as may appear to require it.

In the calcining process as involved in the conversion of artificial or even natural hydraulic-cement materials, the management of the fire is essential, and can be determined only by the indications of the different stages of this process, as shown by the inspection of samples of the charge taken from time to time from the burning-chamber, as provided for by the holes D. It is regulated by the fuel-supply and the operation of the chimney-dampers and that of the ash-pit and furnace doors, through which the oxygen for combustion is supplied.

Upon the completion of the calcination of the charge it is withdrawn, while still hot, through the openings K, and a fresh one of raw materials supplied to the chamber, thus making it available for perpetual operation, and, by constantly maintaining its heat, preventing its waste and the damaging effects of alternately heating and cooling the masonry and works of the kiln.

I have constructed kilns upon the general principle above described, with the central furnace placed entirely below the level of the hearth, the heat in such cases passing through openings in the hearth itself; but the method of placing it nearly upon and partly above this level, as herein specified and shown by the drawings, brings the fire nearer to and in closer action with the charge in the chamber, and thus reduces the amount of fuel and performs the work of calcination in less time.

I claim—

1. The combination of a reverberatory-formed burning-chamber, B, with a central perforated furnace, F, substantially as set forth.

2. The combination, with a reverberatory-formed burning-chamber and central perforated furnace, of two or more chimneys, J J, substantially as described.

3. The combination of direct flues E E with hearth-openings G G and down-draft flues I I, substantially as set forth.

In testimony that I claim the above I have hereunto subscribed my name in the presence of two witnesses.

CALVIN BROWN.

Witnesses:
WM. R. COX, Jr.,
E. A. WILLATS.