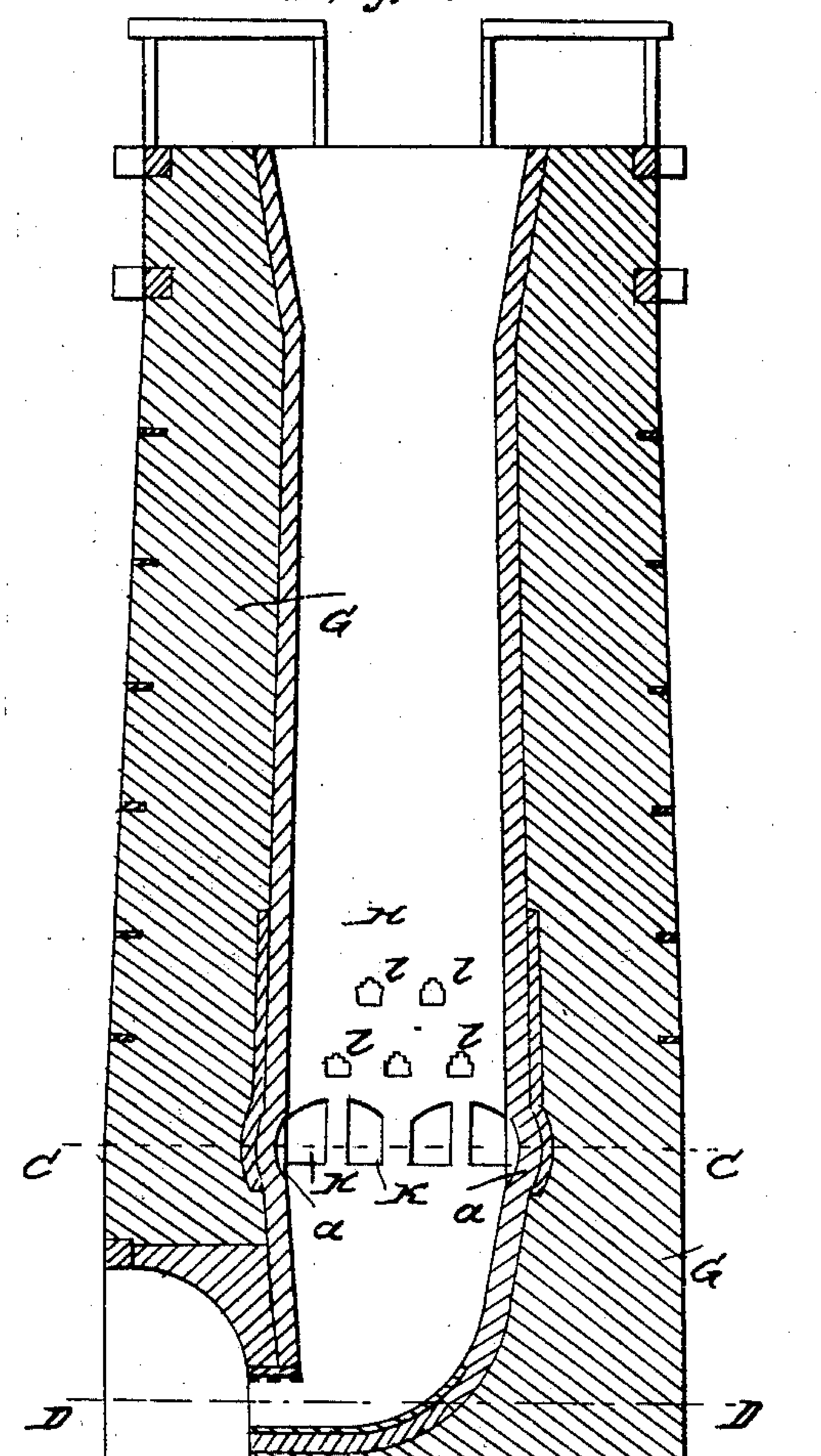
C. D. PAGE.

Lime Kiln.

No. 55,699.

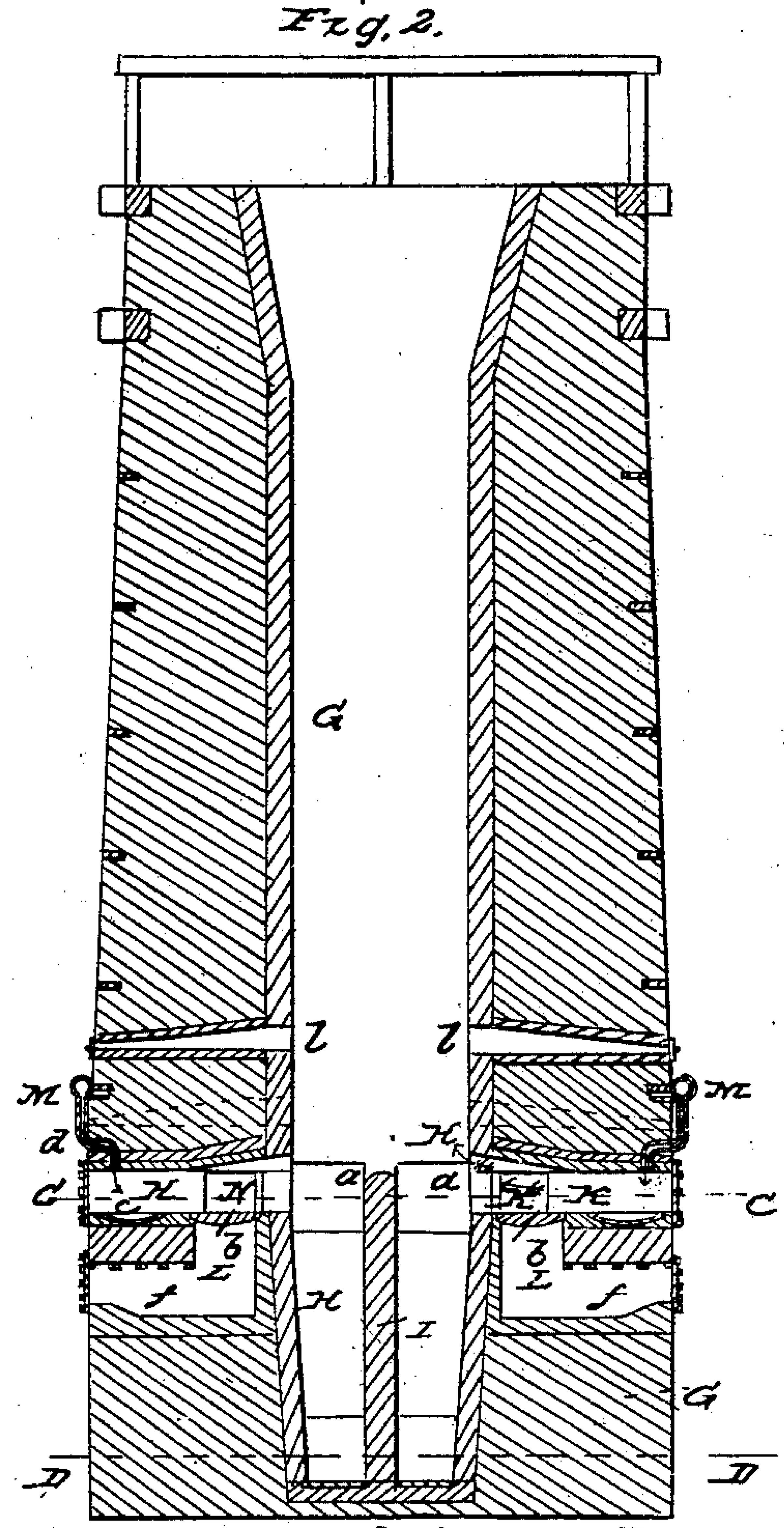
Patented June 19, 1866.

Fig. 1.



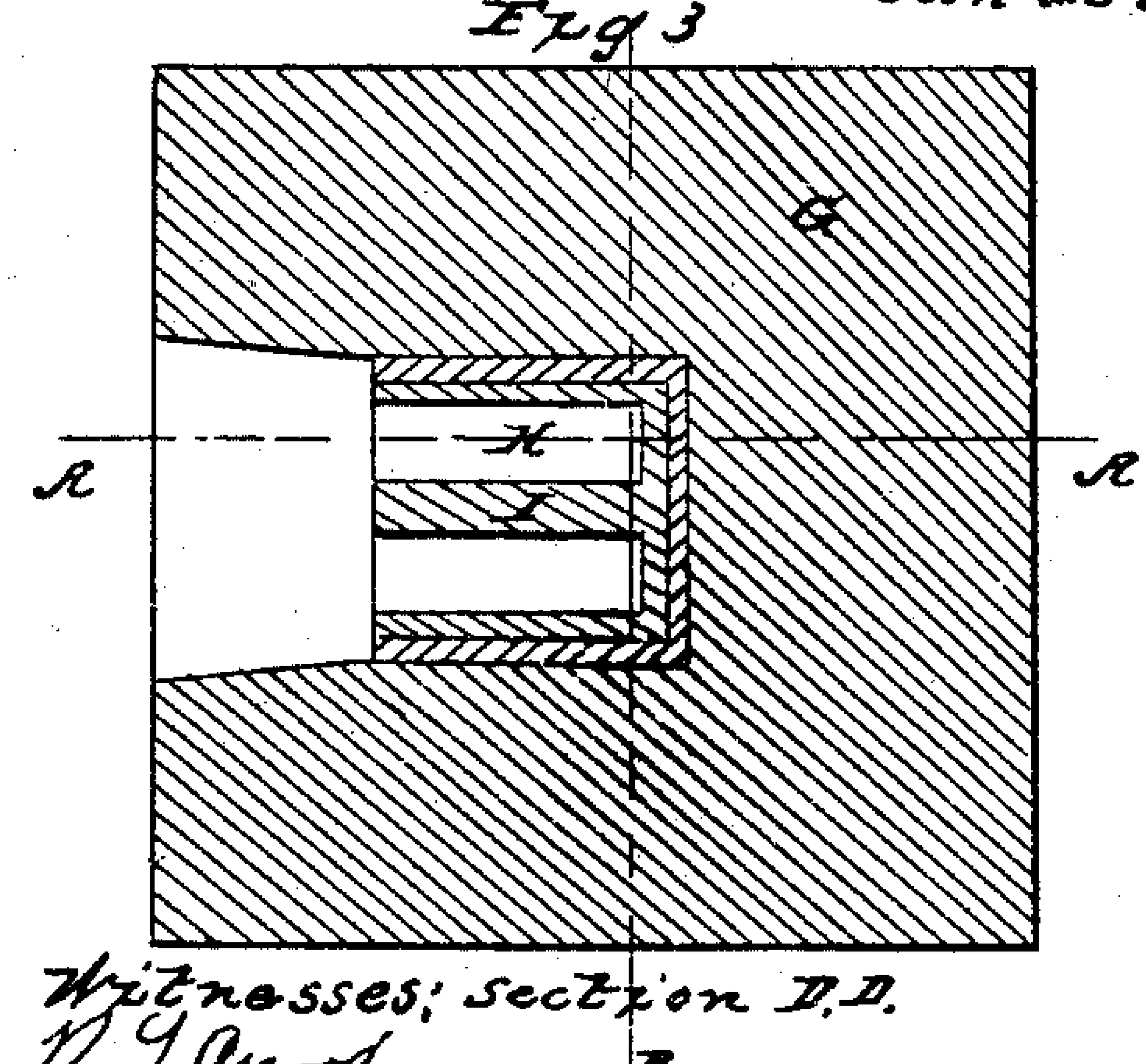
Section at A.A.

Fig. 2.



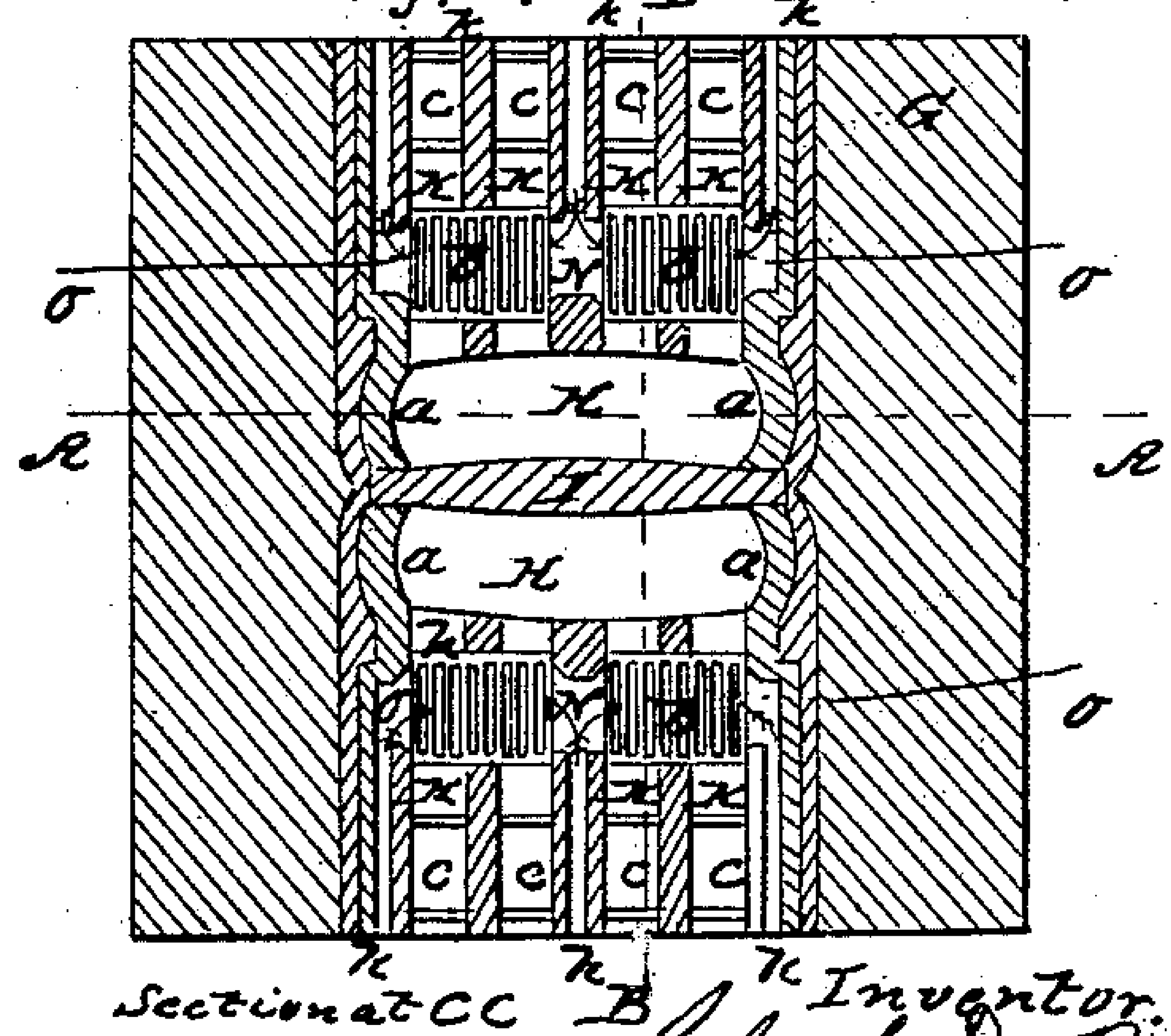
Section at B.B.

Fig 3



Section D.D.

Fig. 1.



Section at C C

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UNITED STATES PATENT OFFICE.

CLARK D. PAGE, OF ROCHESTER, NEW YORK.

IMPROVEMENT IN LIMEKILNS.

Specification forming part of Letters Patent No. **55,699**, dated June 19, 1866.

To all whom it may concern:

Be it known that I, CLARK D. PAGE, of Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Limekilns; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, making part of this specification.

Figure 1 is a vertical section of my improved kiln in the plane of line A A of Figs. 3 and 4; Fig. 2, a similar section in the plane of line B B of Figs. 3 and 4; Fig. 3, a cross-section in plane of line D D, Figs. 1 and 2; Fig. 4, a similar section in the plane of line C C, Figs. 1 and 2.

Like letters of reference indicate corresponding parts in all the figures.

It is the especial object of my improvement to substitute the burning of coal for the burning of wood in limekilns; and my invention consists in the adaptation of parts to accomplish this purpose.

As represented in the drawings, G is a limekiln, constructed of bricks or stone in the usual manner, and H the cupola. At the bottom the cupola is divided by a vertical partition or wall, I, as clearly represented. This partition is made sufficiently high to be nearly, but not quite, on a line with the top of the furnace-arches K K. The partition is preferably made somewhat thicker in the middle than at the sides, in order that the cupola on each side shall be of uniform diameter. At the sides or edges of the cupola concaves or hollows *a a* are produced, as represented in Figs. 1 and 4.

There are several advantages attained by this particular arrangement and form of the partition which I believe to be new. The lime opposite the arches becomes better burned, since the space is contracted, or, in other words, the center wall concentrates the heat on each side, and, as the lime at those points is comparatively thin, the heat extends through much more uniformly than would otherwise be the case. Where the whole area of the cupola is unbroken the charge is so thick that the outside would be overburned by the intense heat of coal of sufficient amount to reach the center. The partition is also of very great importance in sustaining the lime while the charge is being drawn and while being burned. When the charge is drawn the unburned rock will rest on and against the partition and effectually prevent passage from above till properly calcined. In ordinary kilns, where no partition is employed, much difficulty is experienced from the unburned rock falling when the charge is drawn, owing to the large area of the passage. The partition is also of great service in preventing the passage of blasts of air through from one furnace to the other.

Limekilns are usually much exposed to winds, which have a tendency to blow through from side to side, and thus greatly interfere with the fires. In my device the partition serves as a shield by deflecting the currents upward. The form of the cupola at this point has a particular relation to the partition, since the design is to make it of a uniform thickness to concentrate the heat. This is shown most clearly in Fig. 4, where it will be seen that the transverse diameter is unvarying.

The concaves or depressions *a a* are essential in a coal-burning kiln, since the intense heat will cut away the bricks at that point if built straight or square. This is accounted for from the tendency of the heat to pass around next the wall rather than strike deep into the body of the lime, and therefore, at that particular point where the space is narrow and where the turns are acute, the receding of the walls insures less exposure.

These particulars in the construction of limekilns have a special relation to the burning of coal. In a wood-burning kiln there is less intensity of heat, and such precautions are not so essential, though these features in such use are nevertheless valuable.

At a proper position within the furnace-arches K K are situated grates *b b*, suitable for burning coal, and beneath these grates are ash-pits L L.

Outside the grates, and just within the entrance of the furnace-arches, are situated flaring water-pans *c c*, which receive the coal as it is first thrown into the furnaces. Branch pipes *d d* open through the brick or stone work over the pans, connecting with main pipes M M, which, in turn, are also connected with a suitable water-reservoir. Water is thus constantly supplied to the water-pans in as large or small quantities as may be desired. Any equiva-

lent arrangement may be employed for supplying water to the pans.

The bottoms of the ash-pits are also formed into water-receptacles *f f*, being preferably made of cement, and the supply may be from the pipes M M, or from any other source desired.

The water falling in the pans *c c* becomes heated and steams the coal that rests therein. In this condition the coal becomes thoroughly wet and soaked, in which condition it is much better for burning in an intense fire, as is well known to all who have investigated the subject. By this means the cracking and snapping of the coal is, in a great degree, obviated, and it is consumed much more economically. It is also kept in a more compact condition and does not clog the grates.

As fast as needed the coal is fed from the pans to the fires. The water coming in contact with the intense heat is, to a certain degree, decomposed into the elements of two volumes of hydrogen gas to one of oxygen gas. The oxygen thus liberated burns and enters into chemical combination with the coal, and thus produces a more perfect and intense combustion, while the hydrogen of the water in burning with the coal and air also tends to increase the heat of the fire many degrees.

In the process of lime-burning the natural carbonate of lime is placed in the kiln and subjected to heat. The fire drives off the carbonic acid of the limestone in the process of changing it to a protoxide of calcium or pure lime.

If any oxygen escapes combustion during the decomposition of water in the furnace, it ascends through the lime and is absorbed by it.

There is also a more perfect combustion of the smoke or lamp-black of the coal, two parts of oxygen to one of carbon uniting to form carbonic-acid gas, which, being transparent, passes off through the lime without blackening it.

The falling of the ashes into a water-receptacle also prevents, in a great degree, the flying of the same into the lime, while at the same time their heat produces steam, which ascends into the fire to assist in producing the results above mentioned. The most important advantage resulting from this device, however, is that the steam thus arising from the ash-pits under the grates will keep the latter cool at all times, and therefore prevent "burning out," which would otherwise ensue from the intense heat necessary in burning lime.

It is obvious that all the water thus introduced to the fires will not be decomposed into gases, but that a large portion will be converted into steam. This steam will pass upward through the mass of limestone, and its effect will be, by keeping the stone to a certain degree moist, to render the calcium white and soft and prevents vitrification of the surface.

Between the grates in each furnace is made a recess or passage, N, connecting the two grates, and at each side of the wall is also made a similar recess, O. With each of these recesses communicates a cold-air flue, *k*, reaching to the outside. These recesses and flues open directly over the grates, and are not provided for the purpose of supplying the draft, (which comes from the ash-pits below the grates,) but simply for the purpose of keeping the grates and the sides of the furnace cool as possible at all times. Were it not for this arrangement or some similar one, the intense heat from the burning of coal would soon destroy the grates and burn out the sides of the furnace. By the introduction of cold air, as described, the coal is also prevented from clinkering onto the sides of the furnace, and therefore there is no danger of clogging. Where the clinkers accumulate on the sides of the furnace, it is impossible to remove them without breaking the fire-bricks. With the use of wood the heat is much less intense, and such an arrangement might be dispensed with, though in this connection, even, it might be valuable.

The ordinary peep-holes *l l* are provided for examining the state of the lime.

The improvements I have above described are particularly applicable to coal-burning limekilns, and as such are new, so far as practical operation is concerned, in this country. I believe the features described are novel.

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

1. The employment of water in coal-burning limekilns for the purpose of first steaming the coal to produce a more perfect and economical combustion and the absorption of all sulphurous-acid gas of the coal by said steam, and using the gases of the decomposed water in producing a greater degree of heat, substantially as described.

2. The combination of the pans *c c* and water-pipes M, or equivalent, operating substantially as and for the purpose specified.

3. The water-receptacles *f f*, in combination with ash-pits L L and grates *b b*, so arranged that the steam that is produced by the fire will pass upward around and through the grates to keep them cool, substantially as described.

4. The partition I, in combination with the particular form of the cupola at the base, the latter provided with the concaves *a a* and having the chambers on each side of uniform thickness, substantially as described.

5. The arrangement of the recesses N O and cold-air flues *k k*, in combination with the grates *b b* and the sides of the furnace, the same opening directly over the grates, and so constructed as to furnish cold air and prevent clinkering, substantially as described.

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