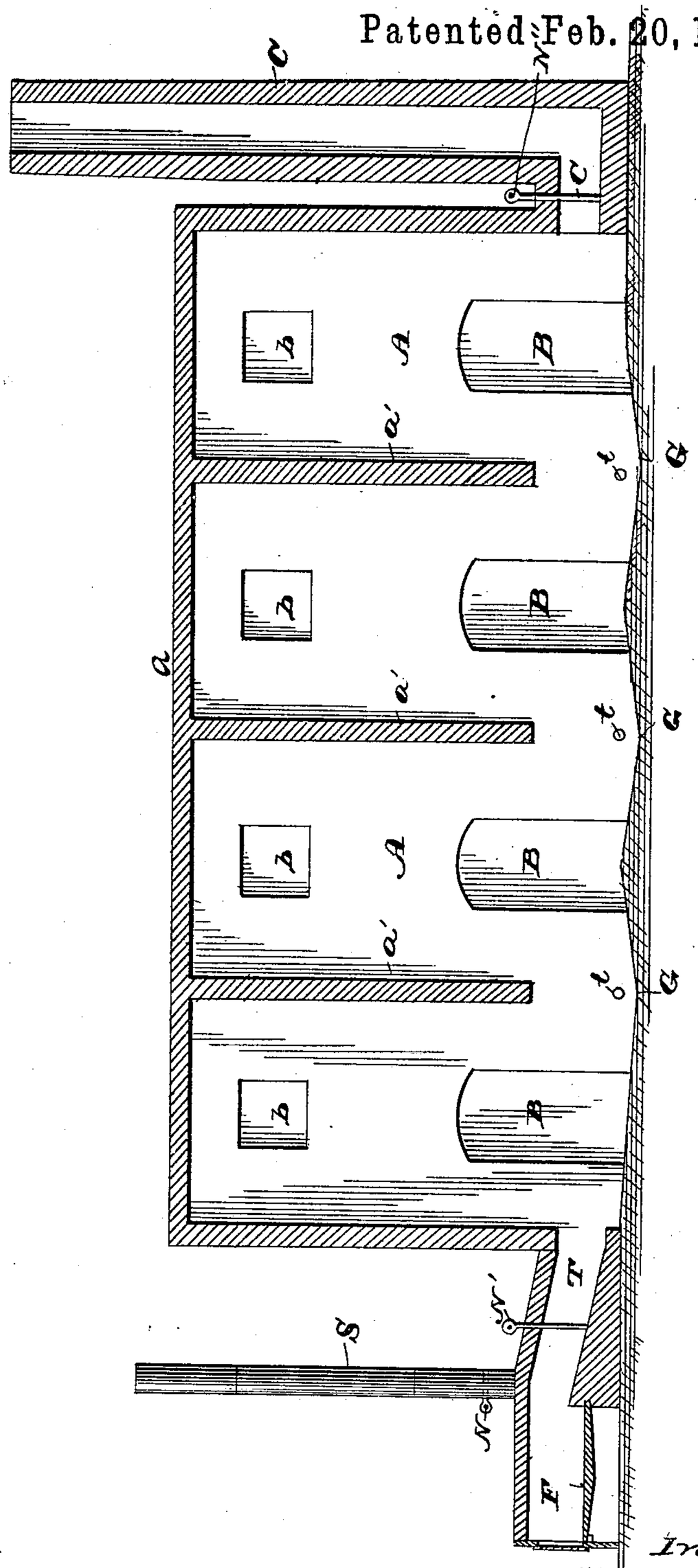
(No Model.)

H. M. PIERCE.

CHARCOAL KILN.

No. 272,766. Patented Feb. 20, 1883.



Witnesses
Wm J. Tanner
Chas H Bates

Inventor
By his Attorney Henry M. Pierce
F. H. Richards

UNITED STATES PATENT OFFICE.

HENRY M. PIERCE, OF CHICAGO, ILLINOIS.

CHARCOAL-KILN.

SPECIFICATION forming part of Letters Patent No. 272,766, dated February 20, 1883.

Application filed November 25, 1882. (No model.)

To all whom it may concern:

Be it known that I, HENRY M. PIERCE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Charcoal-Kilns and in the Manufacture of Charcoal; and I hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawing, wherein is shown a longitudinal vertical section of a kiln and accessories embodying my invention.

The object of this invention is to increase the yield of charcoal, in quantity, weight, and measure, per cord of wood, by improvements in kiln or oven construction and improvements in the method of generating and applying heat for the reduction of wood to charcoal. To accomplish this it is necessary to avoid certain very objectionable features in charcoal-kilns as now constructed, and to change the present method of reducing the wood in such kilns to charcoal.

Charcoal-kilns as now ordinarily constructed are either round or oblong, though sometimes rectangular kilns are used. The round are either strictly conical and taper to a point or have an oval or flattened roof. The former presents the appearance of a cone, the latter of a frustum of a cone. The oblong kilns have perpendicular walls, arched roofs, and square corners, and are sustained by upright posts that are properly braced at the lower ends and at the upper ends are tied across the top of the kiln. The objectionable feature is not so much in the form as in the height made necessary to give adequate capacity to the kiln.

It is well known that up to a certain extent better and more economical results follow from charring wood in large quantities. To accomplish this, especially in the case of round kilns, the excessive height amounts to a necessity. The same error is largely necessitated in the present method of constructing oblong kilns.

In the operation of these kilns the charring process continues rapidly until from one-half or two-thirds of the contents of the kiln has been reduced to charcoal. This is always the upper one-half or two-thirds. At this point, owing to the heat hanging in the upper part of the kiln, further carbonization is greatly retarded. The result is that it takes longer to char the one-third of the charge in the lower part of the kiln than the two-thirds in the upper part. In reducing this lower part of the charge to charcoal so great is the loss in wood and time that the collier often prefers to arrest the operation and leave a large part of the kiln contents uncharred or in the form of brands. In a kiln holding eighty cords of wood the uncharred portion and brands ordinarily aggregate twenty per cent. of the entire charge.

In the present method of making charcoal in kilns it is the common custom to generate the heat necessary to carbonization by firing the wood in the kiln itself. It is apparent that to make sufficient heat to carry on this process in large receptacles a considerable portion of the wood itself and also of the valuable wood-gases is actually consumed and destroyed.

To avoid the first objectionable feature—namely, error in kiln construction—I build my kilns low, with square corners, with as flat an arch as possible, and of unusual length. The great length is necessary to obtain the requisite capacity. Furthermore, in order to hold the heat near the bottom while traversing the kiln I introduce one or more pendent partitions extending from the roof of the kiln downward to a greater or less distance from the bottom. I have doors for charging and emptying the kiln in the sides of the kiln, between the partitions, instead of the ends of the kiln. In place of perforating the sides of the kiln with holes, as is customary, for the escape of the volatile gases thrown off in process of carbonization, I build one or more chimneys outside and adjacent to the kilns. These chimneys open at the bottom into the kiln, and are open at the top for the escape of the gases. These chimneys hold the carbonizing process to steady operation and prevent the fluctuations occasioned by winds. Continual fluctuations in the charring process occur in case gases are allowed to escape through outlets made in the circumference of the kiln. The floor of the kiln is made with brick grouted with cement and inclined to one or more gutters running across the kiln.

To avoid the second objectionable feature arising from internal firing, I construct in combination with the kiln herein described an out-

side heat-generating furnace and connect it with the kiln by a suitable flue. In this furnace I burn fuel that cannot be used for making charcoal, such as edgings, sawdust, tan-bark, the refuse of a wood-yard, gases, atomized tar, &c.

I will now specifically describe the kiln as illustrated in the drawings.

A indicates the kiln, which is a low rectangular chamber provided with an arch or crown, *a*, as nearly flat as the same can be made consistent with strength and security. This chamber is of unusual length—for purpose of description, say, twice the length of an ordinary rectangular kiln—and its upper portion is divided up by transverse pendent walls *a'*, which divide up the charge of the kiln and cause the descent into the line of draft of all gases and vapors which would otherwise accumulate in the upper portion of the kiln. The special value of this feature will be apparent when it is remembered that the charge sinks down as carbonization advances, and unless the kiln were so divided up a large chamber would result, in which a great volume of heated vapors and gases could accumulate at a point out of the line of draft, whereas the division-walls cause such heated gases to dip and circulate through every portion of the charge.

In the side walls of kiln A, at points between the partitions, are charging-doors B, and, if desired, other charging-doors, *b*, may be made in the upper part of the kiln. These doors are closed and luted when the kiln is charged, and with these exceptions there are no openings into the kiln except the induction and eduction flues, hereinafter referred to.

At one end of the kiln A, I erect one or more furnaces or fire-chambers, F, with suitable stacks, S, and dampers N, and connect said furnaces, by a flue or flues, T, provided with dampers N', with the kiln A at or near its base. In these furnaces any suitable class of fuel which will generate heated gases may be employed. At or near the opposite end of the kiln A, I erect one or more stacks, C, and connect the same with the kiln by a flue or flues, *c*, guarded by dampers N'' with the base of the kiln. It will be seen that the draft is substantially along the bottom of the kiln, and the highly-heated vapors and gases which are evolved from the charge in the kiln, though they may first rise in the separate compartments, must eventually, owing to their own pressure and the natural draft, descend and move toward the stack or stacks, which keep the heat near the bottom of the kiln. The bottom of the kiln is preferably made up of a series of transverse inclines, the highest points of which are opposite the charging-doors B and the lowest points beneath the pendent transverse partitions *a'*, thus forming gutters G, which will collect any liquids which may condense on the pendent partitions and prevent its escape by the doors, if the same are insufficiently secured. Traps *t* may be provided opposite the gutters G, for preventing the accumulation of liquid and for recovering and utilizing any valuable products. The stack or stacks C may be connected with a condenser, and the gas and vapor may be conducted from the kiln by a fan or other exhaust and utilized, if desired.

The operation of this improved kiln, in combination with the outer heat-generating furnace, is as follows: The kiln A is first charged with wood. Then the doors B B are shut and luted up and the kiln hermetically sealed. The furnace F, in connection with the kiln A, is then heated to a high temperature. During the preparation of this furnace the products of its combustion escape through stack S, and the air is regulated so as to make the combustion of the fuel in this furnace, as far as possible, complete. The damper N at foot of stack S is then closed and the damper N' of the flue T, communicating directly with the interior of the kiln, opened. The hot non-combustible gases from the furnace fill the kiln and rapidly bring it to a temperature necessary to carbonization. The gases issuing from the outer furnace, after communicating their heat to the contents of the kiln, mix with the gases evolved by the carbonization of the wood and find outlet through the chimneys C. No air being admitted to the kiln A and no air passing through the furnace F unconsumed, the carbonizing process continues from beginning to end without burning any wood or valuable gases. In the case of one furnace being employed and connected with one end of this oblong kiln, the chimney or gas-exits are placed near or at the opposite end. Thus the heated products of the outer furnace, together with the hot volatile gases evolved in the process of carbonization, traverse the entire length of the kiln.

In cases where a furnace is used at each end of the kiln, and both are operated at the same time, the chimney or chimneys for the removal of the volatile products of distillation are placed near the center of the kiln.

During the charring operation the partitions *a' a'* compel the heated gases to dip toward the lower parts of the kiln, instead of running along its roof.

The actual results of the operation are—

First. A positive increase of the quantity and quality of the charcoal per cord. This charcoal is less porous, heavier, and will carry a heavier burden in a blast-furnace than charcoal produced in any other way.

Secondly. A large increase in the valuable volatile wood products is obtained, as none of them have been burned in the process of carbonization.

This kiln A may be operated in the ordinary way by not using the outer furnace, F, but by internal firing and admission of air through holes in the bottom of the kiln.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. A charcoal-kiln having one or more trans-

verse pendent partitions which divide the upper portion of the kiln into a series of separate chambers, substantially as and for the purpose specified.

2. A charcoal-kiln having one or more transverse pendent partitions which divide the upper portion of the kiln into a series of separate chambers, and having its floor made up of inclines whose lowest points are beneath the transverse pendent partitions, substantially as and for the purpose specified.

3. The combination, with a kiln having one or more pendent partitions which divide the upper portion of the kiln into separate chambers, of an independent furnace or fire-chamber and a stack, both of which are connected with a kiln by suitable flues, substantially as and for the purpose specified.

4. The combination, with a kiln having one or more pendent partitions which divide the upper portion of the kiln into separate chambers, of a stack or chimney which communicates with the kiln at or near its base, substantially as and for the purpose specified.

In testimony whereof I affix my signature, in presence of two witnesses, this 20th day of November, 1882.

HENRY M. PIERCE.

Witnesses:
F. W. RITTER, Jr.,
H. B. MOULTON.