

No. 717,459.

Patented Dec. 30, 1902.

S. W. SHOOP.
LIMEKILN.

(Application filed May 6, 1902.)

(No Model.)

2 Sheets—Sheet 1.

Fig. 2.

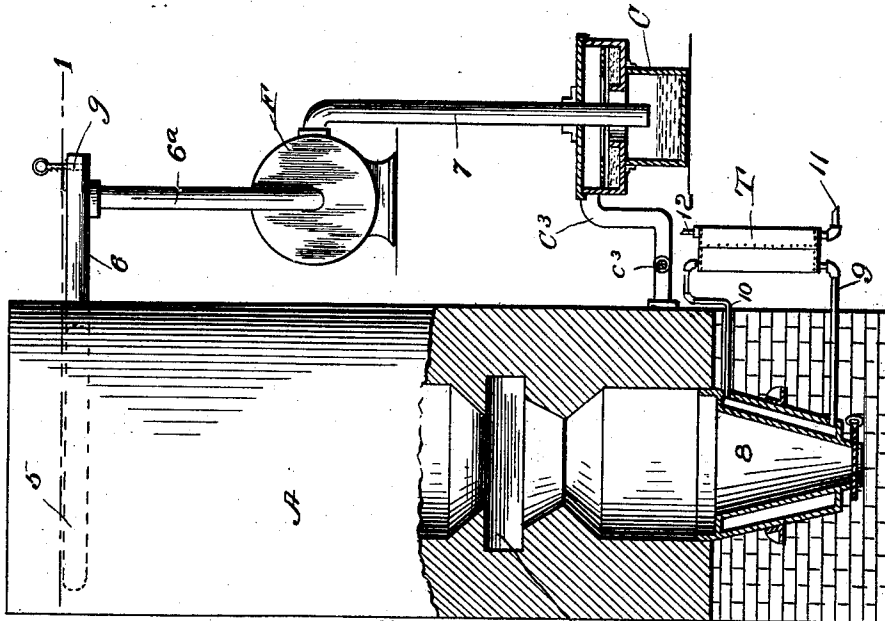
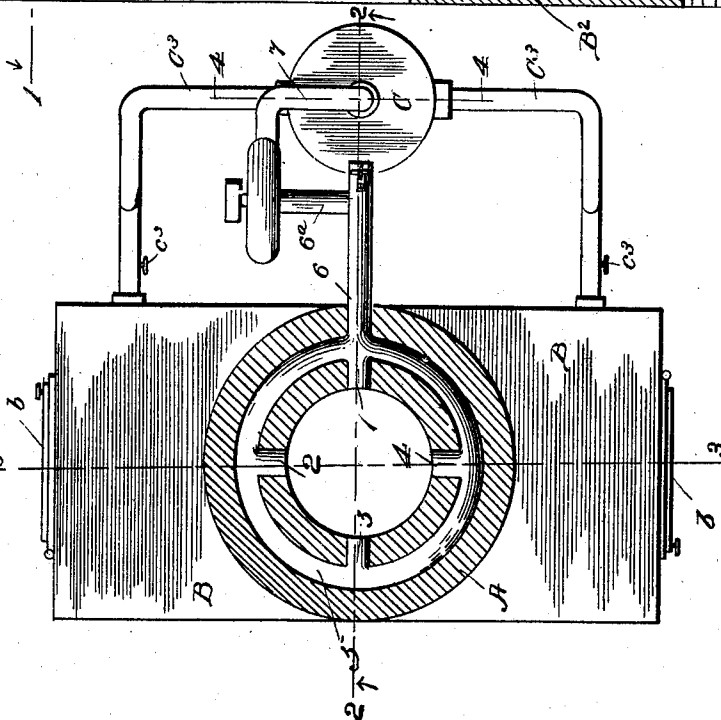


Fig. 1.



Witnesses
Bernard M. Offutt?
Dentist & Writers.

Saul W. Shoop, Inventor
by E. W. Bradford
Attorney

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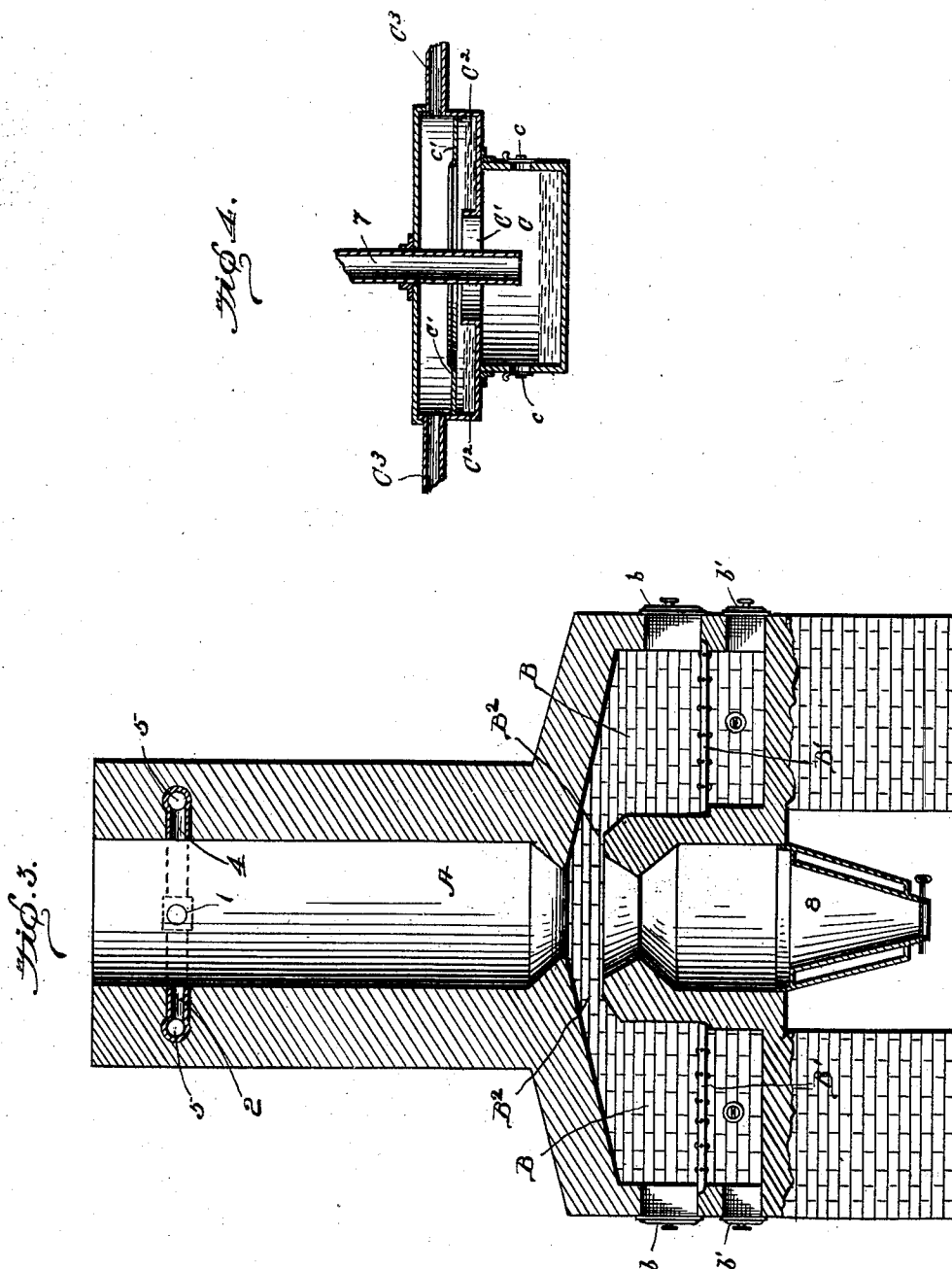
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Witnesses
Bernard M. Offutt.
David Street Painter

Inventor
Saul W. Shoop
by E. W. Burdick
Attorney

UNITED STATES PATENT OFFICE.

SAUL W. SHOOP, OF FRONT ROYAL, VIRGINIA.

LIMEKILN.

SPECIFICATION forming part of Letters Patent No. 717,459, dated December 30, 1902.

Application filed May 6, 1902. Serial No. 106,109. (No model.)

To all whom it may concern:

Be it known that I, SAUL W. SHOOP, a citizen of the United States, residing at Front Royal, in the county of Warren and State of Virginia, have invented certain new and useful Improvements in Limekilns, of which the following is a specification.

My said invention consists in various improvements in the construction of draft appliances particularly designed for use with limekilns or like combustion-chambers by which the combustible gases which are ordinarily wasted may be separated from the non-combustible gases and utilized, whereby the capacity of the apparatus is increased and the cost of its operation decreased, as will be hereinafter more fully described and claimed.

Referring to the accompanying drawings, which are made a part hereof and on which similar reference characters indicate similar parts, Figure 1 is a horizontal section looking downwardly from the dotted line 1 1, showing the parts in top elevation with the exception of the upper portion of the kiln; Fig. 2, a view, partly in section, on the dotted line 2 2 in Fig. 1, the upper portion of the kiln being shown in side elevation; Fig. 3, a central vertical section through the kiln on the dotted line 3 3 in Fig. 1, and Fig. 4 a detail section through the separating-chamber on the dotted line 4 4 in Fig. 1.

In said drawings the portions marked A represent the main body of the limekiln, B the furnaces or combustion-chambers, and C the gas-separating chamber.

The limekiln A is of a general construction suitable for the purpose and will be readily understood from the drawings by those familiar with the art without a detailed description thereof. It will be further understood that while I have shown the invention as applied to a limekiln, for which I regard it as particularly useful, yet it may be used with furnaces of other characters.

The furnaces B in the construction shown are arranged one on each side of the main body of the kiln, with which they are connected by suitable flues or passage-ways B². The arrangement, however, may be such as will be suitable for the use for which the apparatus is intended. Each furnace is provided with grate-bars B', as usual, beneath

which is the ash-pit. A door *b* is provided to the combustion-chamber above the grate-bars and a door *b'* to the ash-pit below the grate-bars. Each of said doors is of a character which will permit the openings to be entirely closed and the furnaces thus practically sealed when desired.

The chamber C, which constitutes a leading feature of my invention, is designed for the separation of the gases or products of combustion and consists of a box-like structure divided into an upper and lower compartment which communicate with each other through a central opening in the bottom of the top compartment. Discharge-openings are formed in the sides of the lower compartment covered by gates *c* for permitting the discharge of the heavier or non-combustible gases, such as carbonic-acid gases. The lower portion of said chamber is designed to contain a quantity of water, as indicated, or may receive a separate water-receptacle. The lower portion of the upper chamber C² is also formed to contain a quantity of water, as indicated, an upwardly-extending flange C' being provided around the central opening in its bottom for the purpose of forming a receptacle. The receptacle may be formed separately, if preferred, and mounted on said bottom, as will be readily understood. An inwardly-extending flange *c'* is provided within the compartment C² a short distance above the water-level therein for a purpose to be presently described. Pipes C³ lead from opposite sides of said compartment C² near its upper edge and above the flange *c'* to beneath the grate-bars in the respective furnaces B. Water is supplied to the compartment through pipes or in any suitable manner, as will be readily understood.

The body of the kiln at a point near its top is tapped by a series of radial conduits 1, 2, 3, and 4, (or any desired number,) arranged equidistant in its sides and at their outer ends joined to the circular conduit or pipe 5, which surrounds the barrel of the kiln, preferably embedded in its masonry. The horizontal pipe 6 leads from said pipe 5 out through one side of the kiln and is connected by the pipe 6^a with a fan-casing F of a suitable blow-fan positioned conveniently to the kiln. A pipe 7 leads from said fan-casing

down through the top of the chamber C to discharge just above the surface of the water in the lower part of said chamber. An adjustable gate *g* is provided in the outer end of pipe 6, by which an opening of variable size to the outside air may be secured for the purpose of mixing said outside air with the gases, as will be presently described. A flange *c*³ is provided in each of the pipes C³, leading from the separating-chamber to the furnaces, whereby the force of the draft may be regulated. Beneath the barrel of the kiln is formed a receptacle 8, into which the lime-rock falls as it becomes disintegrated by the heat from the furnaces. Said receptacle is formed with hollow walls, as shown, and a circulation of water from the tank T, located at a suitable point outside the kiln, is provided through the pipe 9, leading from the lower portion of said tank to the lower portion of said receptacle, and a pipe 10, which leads from the upper portion of said receptacle into the upper portion of said tank. Said tank is supplied with cold water through a pipe 11, which leads into the bottom of said tank, and a pipe 12, leading from the top of said tank, provides an outlet for the hot water. A continuous circulation of water through the hollow wall of said receptacle is thus provided for, which not only serves to prolong the life of this portion of the apparatus, but will permit the use of the water heated to a very high temperature for any purpose found desirable, and thus further increase the economy of the operation of the apparatus.

The operation of my said invention is as follows: The limekiln is filled with limestone in the usual manner and fire is started in the furnaces with any ordinary fuel. The blast-fan being driven in an ordinary manner operates to draw the products of combustion from near the top of the limekiln through the conduits 1, 2, 3, and 4 into the circular conduit 5 and from thence through the pipe 6 into the fan-casing F, from whence it is discharged by the same blast-fan through pipe 7 into the separating-chamber C. A quantity of pure air from the outside may be admitted through the gates *g* in the end of pipe 6 to mix with the gases and render them combustible. The gases being discharged onto the surface of the water in the lower portion of chamber C are of a very high temperature, from 300° to 500° Fahrenheit, and operate to raise the temperature of said water to a boiling-point, and said gases become mingled with vapors arising from said water. The lighter gases rise through the central opening of the upper compartment C², flow over the surface of the water contained in said compartment and mix with still more of the vapor arising therefrom and flow out through the pipes C³ into the furnaces B, beneath the grate-bars, where they rise and become mixed with the other fuel and adding to the combustion and the heat generated thereby. It will thus be seen that all of the combustible ma-

terial in the fuel is utilized, the gases being used over and over again until all of their combustible elements are consumed. The heavier or non-combustible gases flow out through the openings under the gates *c*. By sealing the furnaces by closing the doors *b* and *b'* the draft can be entirely controlled through the regulation of the valve *c*³ in the pipe C³, the regulation of the gate *g* admitting more or less air from the outside and the speed of the blast-fan, all of which are under the immediate control of the operator. By this means the blast admitted can be regulated and the draft controlled to secure the best results and the most perfect combustion of the fuel employed. It will be understood that inasmuch as the air and gases which pass through pipe 7 into chamber C are admitted therein under pressure from the blast-fan the water in the respective compartments will be agitated and recede toward the sides of the compartments under the pressure. The annular flange or plate *c'* above the water in the upper compartment is provided for the purpose of preventing the water under such pressure from being forced into the pipe C³ or flowing with the gases into the furnace. Said gases being also of a high temperature when admitted into the said compartments will serve to generate vapor or steam, which mixes with the gases, as before described.

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

1. The combination with a furnace of a separating-chamber for separating the combustible from the non-combustible gases or products of combustion having a water-compartment in its lower portion, a second compartment for containing water in its upper portion, a passage from one compartment to the other, pipes leading from the upper compartment to the furnaces, and pipes leading from the smoke-stack to discharge into the said chamber, substantially as set forth.

2. The combination with a furnace of a separating-chamber for the products of combustion, comprising a compartment containing water in its lower portion, a second compartment also formed to contain water and mounted above the lower compartment, a passage-way between said compartments, a pipe leading from the smoke-stack to discharge within said chamber above the surface of the water in the lower compartment, and pipes leading from the upper compartment to discharge into the furnaces, substantially as set forth.

3. The combination with a furnace of a separating-chamber for products of combustion formed to contain a quantity of water, a pipe connected with the smoke-stack and leading to within said chamber to discharge therein, a blast-fan interposed in said pipe, and pipes leading from said chamber to the furnaces, substantially as set forth.

4. The combination with a furnace of a sep-

arating-chamber for separating the combustible from the non-combustible gases in the products of combustion, comprising a lower compartment for containing water, an upper compartment also formed to contain water, a rim or flange above the level of the water in the second compartment, pipes leading from above said rim to the furnaces, and a pipe leading from the smoke-stack to discharge within said chamber above the surface of the water in its lower compartment, substantially as set forth.

5. The combination with a furnace, of a separating-chamber, comprising a lower compartment for containing water, outlets from said compartment for the escape of the heavier gases, a second compartment above the first also formed to contain water, pipes leading from said compartment into the fire-box of the furnace, a rim interposed between the entrance to said pipes and the level of the water, a pipe leading from the smoke-stack to discharge into the said chamber, and a blast-fan interposed in said pipe, substantially as set forth.

6. In a limekiln-furnace, the combination of the fire-box, the barrel of the kiln, conduits

communicating with the interior of the barrel, a pipe connected with said conduits, a blast-fan connected with said pipe, a separating-chamber containing a lower and upper compartment for containing water, a pipe leading from said blast-fan into said chamber, and pipes leading from said chamber back to the fire-box, substantially as set forth.

7. In a limekiln provided with conduits communicating with its interior near its top, the combination of a pipe connected with said conduits, a gate or valve in said pipe for admitting air from the outside, a blast-fan connected with said pipe, a separating-chamber containing water-holding compartments, a pipe leading from said blast-fan into said chamber, pipes leading from said chamber back to the fire-box, and valves in said pipes, substantially as set forth.

In witness whereof I have hereunto set my hand and seal, at Washington, District of Columbia, this 5th day of April, A. D. 1902.

SAUL W. SHOOP. [L. s.]

Witnesses:

E. W. BRADFORD,

DAVID STUART WAUTERS.