April 15, 1924.

1,490,542

W. S. SHAW

APPARATUS FOR CARBONIZING WOOD

Filed May 1, 1922 2 Sheets-Sheet 1

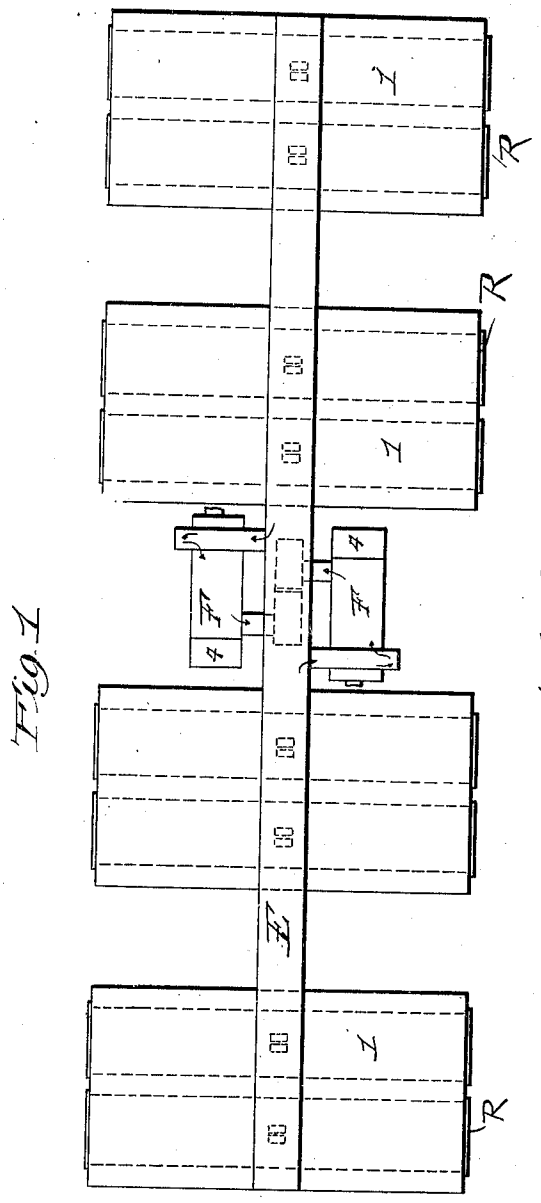


Fig. 1.

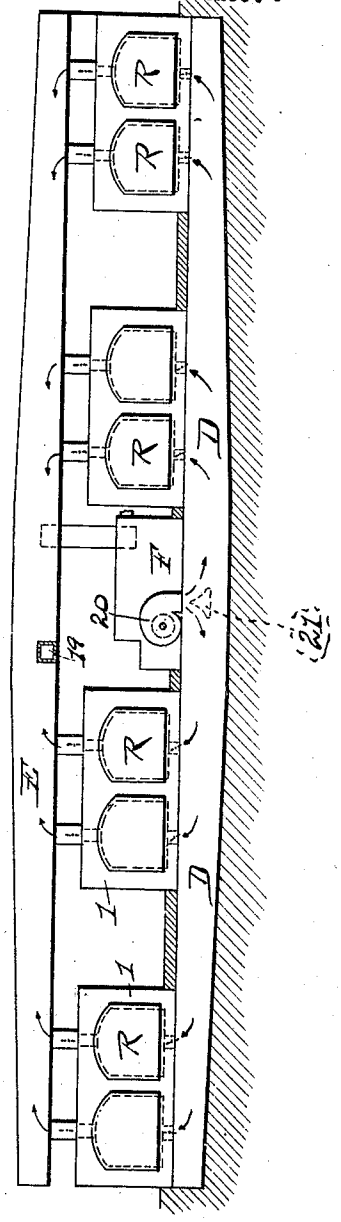


Fig. 2.

Inventor:
William S. Shaw.
By Taylor E. Brown
his Atty.

April 15, 1924.

1,490,542

W. S. SHAW

APPARATUS FOR CARBONIZING WOOD

Filed May 1, 1922 2 Sheets-Sheet 2

Fig. 3.

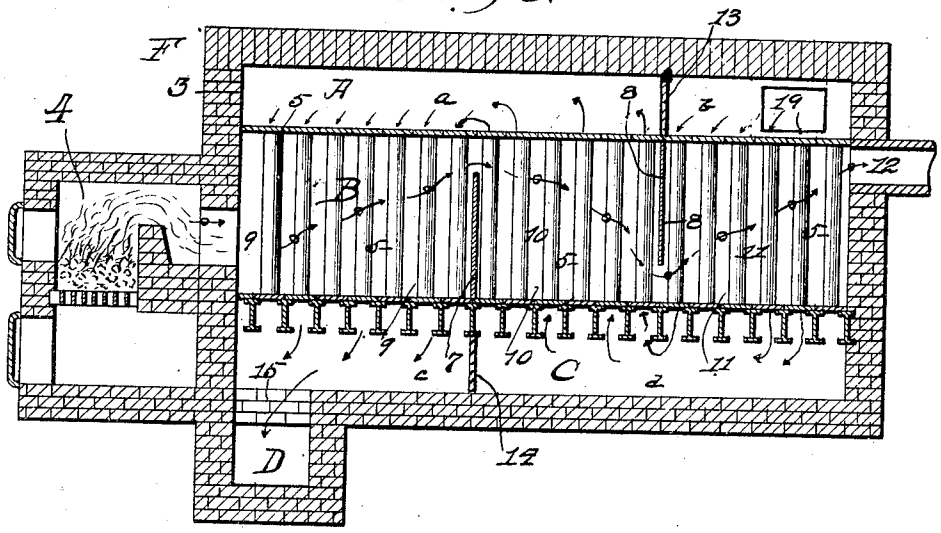


Fig. 5.

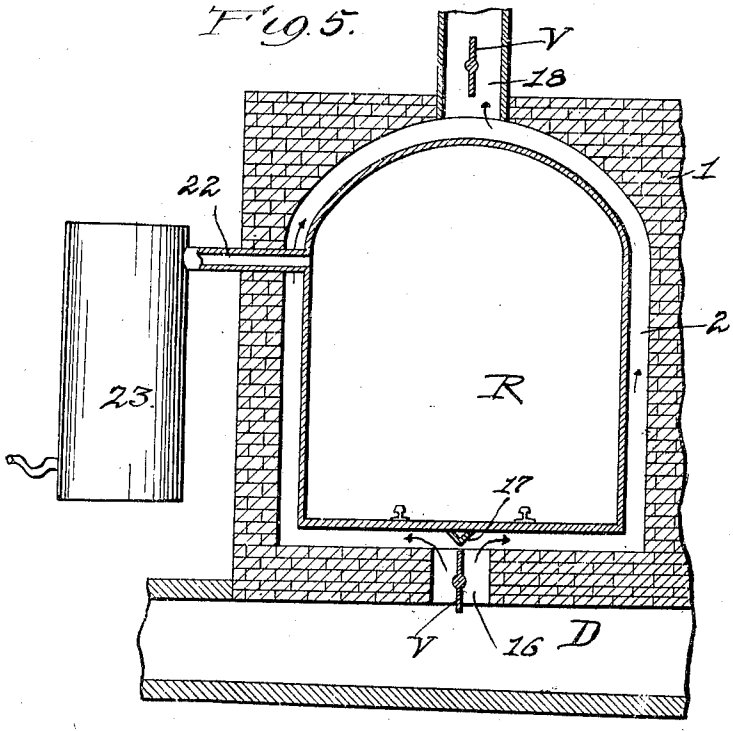
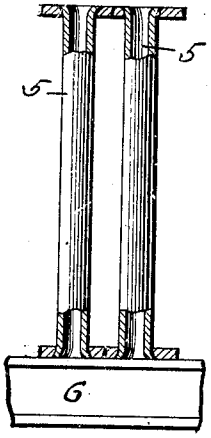


Fig. 4.



Inventor:
William S. Shaw,
By Taylor & Brown
his Attys.

Patented Apr. 15, 1924.

1,490,542

UNITED STATES PATENT OFFICE.

WILLIAM S. SHAW, OF CHICAGO, ILLINOIS.

APPARATUS FOR CARBONIZING WOOD.

Application filed May 1, 1922. Serial No. 557,765.

To all whom it may concern:

Be it known that I, WILLIAM S. SHAW, 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 Apparatus for Carbonizing Wood, of which the following is a specification, reference being had to the accompanying drawings, and to the reference characters marked thereon, which form a part of this specification.

This invention relates to an apparatus for carbonizing wood.

Heretofore, in the carbonization of wood, in the manufacture of wood alcohol and other products, enclosed steel retorts have been used, usually in horizontal arrangement, with a so-called oven at each end of each retort. The products of combustion have been passed from the ovens to heating chambers surrounding the retorts, so as to pass under, up and over the top of the retort and then out to a stack. The maximum of heat units have thus not been utilized, being wasted by passing out through the stack, and much of the heat being prevented from being transmitted to the retort by reason of the fact that the products of combustion deposit soot and ashes over the retorts.

Apparatus of this kind manifestly requires a considerable floor area and the use of a relatively large number of attendants. Moreover, the heat in the chambers surrounding the retorts has not been under control or regulation except as the oven itself may be regulated. The result has been great waste of heat units.

On of the objects of the present invention is to arrange an apparatus so as to be able to control and regulate the temperature in the heating chamber surrounding each retort and at the same time economize the floor space and reduce the expense of operation.

Another object of the invention is to provide a method and apparatus whereby a plurality of retorts, located preferably in pairs, may be positioned with relation to and connected with a source of heat so that a single heating device may be utilized, and whereby the heating medium may be circulated from the heat generator or furnace proper to the several retorts and back again; while at the same time the products of combustion from the heating device may be so directed as to avoid the fouling of the retorts by the deposit of soot and ashes thereon.

I accomplish this purpose by directing the products of combustion from the combustion chamber to an indirect heating device or furnace containing a plurality of pipes or tubes around which the products of combustion pass. These pipes are connected to conduits which lead to and from a heating chamber surrounding each retort. Suitable means, such as a fan, is used to force or circulate the indirectly heated air from the furnace to the heating chamber in each retort, and back to be reheated. The temperature in the heating chamber surrounding each retort may be controlled by dampers, preferably, thermostatically operated.

The advantages of the system are obvious and will be manifest as I proceed with my specification.

In the drawings:

Fig. 1 is a diagrammatic plan view of an apparatus embodying my invention.

Fig. 2 is an end elevation of the same, partly in section.

Fig. 3 is a sectional view of the indirect air heating furnace provided with a combustion chamber.

Fig. 4 is a detail view showing some of the pipes of the furnace.

Fig. 5 is a vertical sectional view of one of the retorts.

To illustrate my invention, I have chosen to show in the drawings, eight retorts, grouped in pairs, the same being indicated by letters R, R. Each retort is surrounded by a suitable brick casing 1, which contains a heating chamber 2 that completely surrounds the retort. Between the two central groups of retorts, I locate the indirect heating furnace F, preferably made in sections, as will be seen from Fig. 3. This furnace consists of suitable masonry 3, a heat generator or combustion chamber 4, and a plurality of vertically arranged tubes or pipes 5, supported upon I-beams 6, dividing it in three compartments A, B and C,—the tubes 5 being in the compartment B. Two baffle plates 7 and 8 divide the compartment B into substantially three chambers, 9, 10 and 11. The products of combustion from the chamber 4 pass into the compartment 9 near its lower portion, and follow the course indicated by the arrows around the pipes 5, to the top of and over the first baffle plate 7, into the compartment 10, around the pipes

5 therein and below the second baffle plate 8, to and into the chamber 11, around the pipes 5 therein, and finally pass out through the pipe 12, which may lead to a smoke stack. The passage of the products of combustion from the chamber 4 through the chambers 9, 10 and 11, thoroughly heats up the air which is in the hollow pipes or tubes 5.

Inasmuch as these products of combustion still retain many heat units, I prefer to lead them from the pipe 12 to a kiln where the wood to be placed in the retorts for carbonization may first be thoroughly dried.

A wall 13 divides the compartment A into two sections *a*, *b*, and a wall 14 similarly divides compartment C into two sections *c*, *d*. All the tubes 5 open above and below into the several sections of the chambers A and C. The chamber C connects by a passageway 15 through fan 20 with the conduit D, which extends on each side of the furnace F a distance sufficient to communicate with the farthest retort R, as clearly shown in Fig. 2, and this conduit D also communicates through passageways 16 with the several heating chambers 2. Preferably, although not essentially, the lower part of each retort R may be provided with a deflector 17, so that the heated air passing beyond the valve V will be deflected to the right and left and properly circulate in the heating chamber 2.

The upper part of each heating chamber 2 is provided with an air exit, valved passageway 18, which is connected with an air return conduit E extending above the top of the several retorts and terminating in a passageway 19 leading into section *b* of compartment A of the heating furnace F.

A fan 20 is located in such relation to the conduit D as to draw the heated air from the heater and deliver it to the retorts. It will thus be seen that a complete circulation of indirectly heated air will take place, from the furnace F through the passageway 15, the conduit D and the heating chamber 2 of each of the retorts, out through the passage 18, into the return conduit E, and back into the furnace F.

The returned air will then pass from section *b* downwardly through the tubes 5 into section *d* of the compartment C, up through tubes 5 into section *a* of compartment A and down through tubes 5 into section *c* of compartment C, and to conduit 15. The air will thus flow through the heated tubes 5, as indicated by one set of arrows, counter to the direction of the products of combustion passing from the fire chamber 4 to the outlet 12.

Where the retorts are positioned on both sides of the furnace F, as shown, it is advisable to place a deflector, indicated at 21, near the discharge opening of the fan 20 so as to deflect the air in both directions in the conduit D.

The condensible products from the retort are lead through a conduit 22 to any suitable condenser, indicated at 23.

In Fig. 1, I have shown a second furnace F and combustion chamber 4, which may be used in an emergency, in the event the first one requires repair, or may be used where it is necessary to increase the capacity of the heating medium, in order to take care of the number of retorts in use.

It will be manifest that instead of arranging the retorts in pairs, they may be used singly or in any desired multiple, and instead of being placed in a given arrangement such as in line, shown in Fig. 1, they may be otherwise arranged; the essential feature being that the several retorts may be so arranged in connection with a central source of heat as to permit the air to be circulated from the heater to the retort and back to the heater, and the temperature in the heating chamber of each retort controlled, as desired

I have indicated in the drawing, typical valves V which may be manually operated or thermostatically controlled as desired. By having separate valves for each retort, not only may the temperature in each retort heating chamber 2 be controlled, but the hot air may be shut off entirely from a given retort without interfering with the operation of the circulatory system as a whole, and with respect to the other retorts. This may be desirable when a particular retort is being charged, unloaded or repaired.

It will therefore be manifest that I am not concerned with the precise structural details herein shown, and that the same may be modified to suit the exigencies of any particular installation.

I claim as my invention:

1. In an apparatus for the purpose described, wherein a plurality of retorts are heated from a central heating furnace, a furnace provided with a tubular compartment, a combustion chamber communicating therewith, means for retarding the flow of the gases of combustion through said compartment, and means for passing the retort heating medium through the tubes in said compartment in a direction counter to that of the gases.

2. In an apparatus for the purpose described, wherein a plurality of retorts are heated from a central heating plant, the furnace described comprising a compartment having a plurality of tubes, baffle plates alternately open at the top and bottom whereby the products of combustion will have to describe a zig-zag course in passing around the tubes from one end of the compartment to the other.

3. An apparatus for the purpose de-

scribed, comprising a plurality of retorts arranged in pairs, a heating chamber surrounding each retort, a tubular furnace, a conduit for the passage of the heating medium within the furnace tubes to the lower part of the heating chamber of the several retorts, a second conduit leading from the retorts back to the furnace, means for causing a circulation of the heating medium through said conduits, and means including a valve for controlling the temperature in each retort heating chamber.

4. An apparatus for the purpose described, comprising a tubular heating furnace, a fuel combustion chamber therefor, a plurality of retorts arranged in pairs on both sides of the furnace, a heating chamber surrounding each retort, a conduit from the furnace to the several retorts and a second conduit from the retorts back to the furnace, means for causing a circulation of the heating medium, a control valve in each conduit, the said furnace being provided with a plurality of compartments whereby the products of combustion pass from the combustion chamber around the tubes in one direction and the heating medium passes through the tubes in the opposite direction.

5. In a circulatory heating system for the carbonization of wood, comprising a heating device, a plurality of retorts and conduits communicating with the several retorts and the heating device, a tubular furnace, an inlet at one end and an outlet at the other, each communicating with its appropriate conduit, baffle plates dividing the furnace into a plurality of compartments, a combustion chamber communicating with one of said compartments and an outlet for the products of combustion leading from another compartment, and means for circulating the heating medium.

6. An apparatus for the purpose described, comprising a fuel combustion chamber, a tubular furnace, baffle plates therein dividing the furnace into compartments, an inlet from the combustion chamber into one compartment, an outlet for products of combustion leading from another compartment, a plurality of retorts, a heating chamber surrounding each retort, a conduit leading from the lower part of the furnace near the combustion chamber, a valved passageway from said conduit leading to the lower part of each heating chamber, a conduit above the several retorts having valved communication with the top of each heating chamber, said upper conduit communicating with the upper part of the furnace at a point distant from the combustion chamber and a fan for continuously circulating the heating medium through the tubular furnace, the conduits and the heating chambers.

In testimony that I claim the foregoing as my invention, I affix my signature, in the presence of two witnesses, this 26th day of April, 1922.

WILLIAM S. SHAW.

Witnesses:
B. L. MacGregor,
Taylor E. Brown.