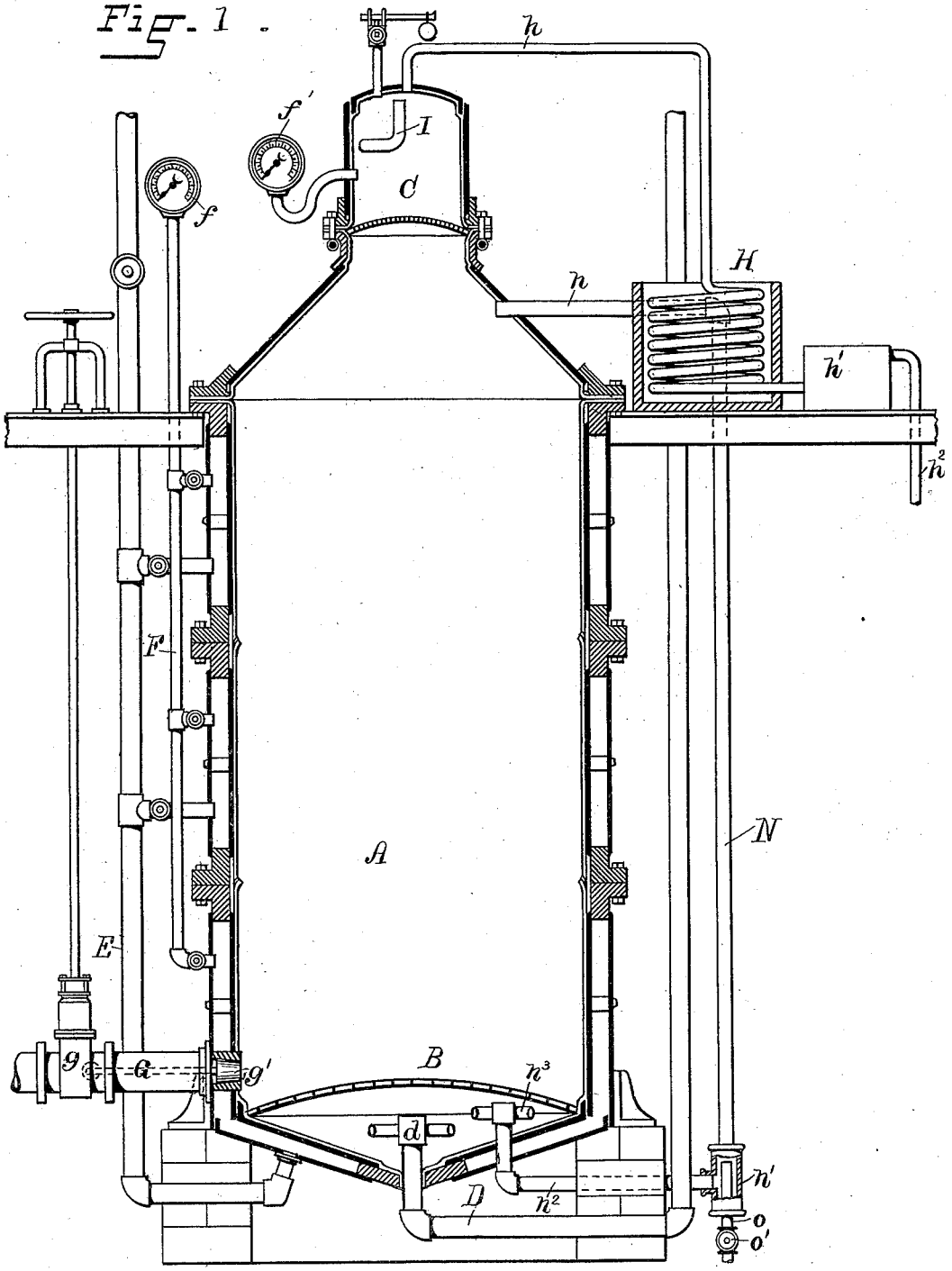
(No Model.) 2 Sheets—Sheet 1.

C. S. WHEELWRIGHT & G. E. MARSHALL.

APPARATUS FOR TREATING WOOD FOR PAPER PULP.

No. 307,609. Patented Nov. 4, 1884.

Fig. 1.



WITNESSES:
C. H. Luther Jr
Jno. L. Condon

INVENTOR:
Charles S. Wheelwright
George E. Marshall
by Joseph A. Miller & Co
Atty's

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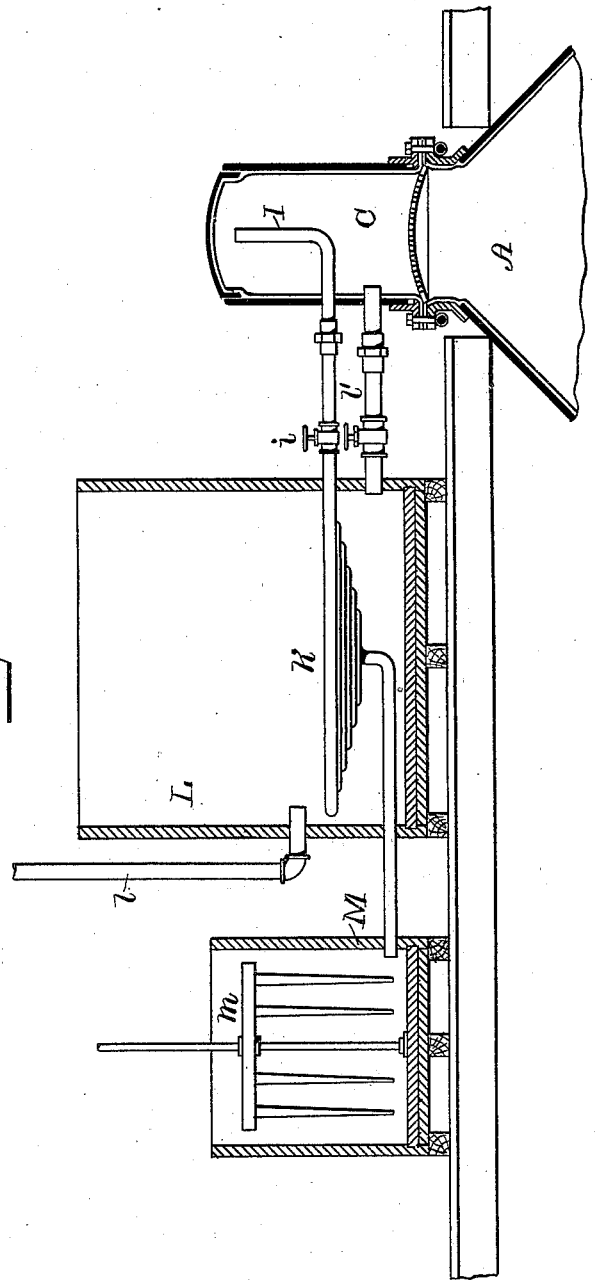
Fig. 2.



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UNITED STATES PATENT OFFICE.

CHARLES S. WHEELWRIGHT, OF PROVIDENCE, RHODE ISLAND, AND GEORGE E. MARSHALL, OF TURNER'S FALLS, MASSACHUSETTS.

APPARATUS FOR TREATING WOOD FOR PAPER-PULP.

SPECIFICATION forming part of Letters Patent No. 307,609, dated November 4, 1884.

Application filed May 10, 1884. (No model.)

To all whom it may concern:

Be it known that we, CHARLES S. WHEELWRIGHT, of Providence, in the county of Providence and State of Rhode Island, and GEORGE E. MARSHALL, of Turner's Falls, in the county of Franklin and State of Massachusetts, have invented a new and useful Improvement in the Method and Apparatus for Treating Wood for Paper-Pulp; and we hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification.

The object of our invention is to produce fiber from wood suitable for paper-making by boiling the wood under pressure at a reduced cost and with more facility than has been done heretofore. Another object of our invention is to regain the acids and chemicals used in the boiling process to a large extent, and thereby reduce the expense; and another object of our invention is to simplify the work by making the process more automatic than was heretofore possible and always producing uniform results.

The invention consists in the peculiar and novel construction of the digester and the improved method by which the gases are withdrawn from the digester automatically, as will be more fully set forth hereinafter. In the various processes now in use for disintegrating the fiber of wood or other substances by boiling the same under pressure, sulphurous acid is used to dissolve the resinous, albuminous, or other matter by which the fibers are inclosed and held together. The liquid in which the fiber is boiled consists of water containing from one to four or more per cent. of acid—preferably sulphurous—to which magnesia or lime is added in varying proportions. In this liquid the fiber is submerged, and is heated by steam in a jacketed non-corrosive metal-lined boiler, sufficient room being left in the upper part of the boiler or digester to form a steam-space. During the process of boiling, gases are formed in considerable quantity, which, by the absorption of oxygen from the steam, the water, and the fibrous material, form sulphuric acid, which is liable to injure the wood or other fiber by blacking the same. It has therefore heretofore been necessary to blow off the steam and gases from time to time. It required considerable time and attention to do this at the proper time, and the gases so blown off were lost. Another difficulty consisted in the sudden expansion of these gases, by which the pressure in the digester was increased on the top of the wood or other fiber under treatment and the free circulation of heat through the liquid prevented. To avoid all these difficulties and prevent the loss of the chemicals, we connect the steam-space of the digester with a worm or condenser surrounded with cold water, and controlled either by a valve, which can be more or less opened, or, as is shown in the drawings, with any one of the well-known forms of steam-traps, by which the condensed liquid is automatically withdrawn without the diminution of pressure in the digester. When the process of boiling the fiber is completed, the steam and gases are blown off, and to utilize the chemicals contained therein we provide a separate condenser consisting of a worm placed into a large tank of water, and connect this tank with the digester, so that the water heated by the escaping steam and gas can be readily used for washing the digester. The condensed acid is conducted to a stirrer, by which the condensed liquid is incorporated with any base required. In place of thus incorporating the sulphurous liquid, it may be drawn into any suitable receptacle for further use.

Figure 1 is a sectional view of the digester, showing the same connected with the steam-dome. Fig. 2 is a sectional view of the steam-dome of the digester, showing the blow-off pipe connected with a separate condenser.

In the drawings, A is the digester or vertical jacketed and non-corrosive metal-lined boiler.

B is a perforated false bottom.

C is the steam-dome.

D is a steam-pipe, by which the interior of the digester is supplied with steam. This pipe enters the bottom of the digester, the joint being made by a suitable flange. The end of

the steam-pipe D is provided with a suitable head, by which the steam is distributed laterally and equally in all directions.

E is the steam-pipe, by which steam is supplied to the sections of the steam-jacket surrounding the digester.

F is a pipe connecting the various sections of the steam-jacket with the steam-gage *f*.

f' is the steam or pressure gage connected with the interior of the digester.

G is the discharge-pipe, by which the contents of the digester are blown out. This discharge is controlled by the gate-valve *g*.

To prevent the fiber from entering the pipe G during the process of boiling, the plug-valve *g'* is placed into the discharge-pipe, resting against a suitable seat, so as to close the same and prevent any raw fiber or other substances from entering the blow-off pipe.

H is a worm-condenser consisting of a coil of pipe placed into a tank in which cold water is always kept to condense the vapor or gases.

h is a pipe connecting the condenser with the dome of the digester. A valve may be placed into the pipe *h* to control the flow of the vapor to the condenser.

h' is a trap, which may be of any one of the various forms of steam-traps, by which the condensed liquid is withdrawn without allowing the steam to escape.

I is the blow-off pipe, by which the steam and gases are blown off.

Referring now to Fig. 2, it will be seen that the blow-off pipe I is connected with the coil of pipe K, placed within the tank L, which is supplied with water by the pipe *l* and connected with the digester by the pipe *l'*, so that the water from the tank L can be readily run into the digester. When the steam and sulphurous vapor are to be blown off from the digester, the valve *i* is opened and the steam and vapor pass through the coil K, where they are condensed into liquid, which liquid flows into the receiver M, in which any suitable base, preferably magnesia, is stirred by the stirrer *m*, to facilitate the combination of the sulphurous acid with the base. The water from the tank L will be heated by vapor and gases passing through the coil K, and is used for washing the digester. By this improvement in the process and apparatus the wood or other fiber is subjected to the steam heat in the usual manner, the steam-pressure being gradually raised; but the accumulation of the gas-pressure is avoided, the circulation is more rapid, and all parts of the fiber in the digester are more evenly subjected to the action of the heat and the liquor. The formation of sulphuric acid is also avoided by the condensation of the gas and vapor, and the burning or blackening of the material prevented. All the chemicals not taken up by the resinous and fibrous matter are regained, the time required to boil the fibrous material diminished, and the care, attention, labor, and skill required to operate the boiling materially reduced, while the product is more uniform and superior in quality.

In order to subject the wood fiber to a more thorough treatment with the chemicals, we establish a constant circulation of the chemicals from the bottom of the digester out of the same, and then into the same through its top, from whence the chemicals pass downward again through the wood. The chemicals, after leaving the bottom of the digester and before entering its top, are brought into contact and mixed with steam, whereby they are heated and injected into the upper part of the digester. The arrangement whereby this result is accomplished is shown in Fig. 1, in which N designates a pipe which extends vertically outside of and parallel with the digester. At its upper end this pipe has a branch, *n*, which enters the top or steam-space of the digester, while at its lower end the pipe N is provided with a cylindrical chamber, *n'*, from which a branch, n^2, extends laterally and vertically into the digester through its bottom, and terminates in a T-head, n^3, which lies just below the perforated bottom B of the digester.

o designates a steam-pipe, the upper end of which enters the bottom of the chamber *n'*, and which is provided with a valve, *o'*. Now, when the valve *o'* is opened, the steam flowing up through the chamber *n'* will act as an injector, drawing the chemicals out of the bottom of the digester, through the branch n^2, into the chamber *n'*, and up through the pipe N, where they are heated by the steam, and thence into the top of the digester through the branch *n*, from whence they again descend through the wood.

Having thus described our invention, we claim as new and desire to secure by Letters Patent—

1. The improved process for treating wood and similar fiber suitable for paper-making, the same consisting in boiling the material, under pressure, in a solution containing sulphurous acid in a digester, the upper portion of which is connected with a condenser, by which the gases expelled are condensed, so as to prevent their accumulation or change, as described.

2. The process herein described for regaining the chemicals used in the boiling of wood or other fibers, the same consisting in passing the gases through a condenser or condensers connected with the digester, as described.

3. The combination, with the digester A, of the condenser H, constructed to condense the gases during the process of boiling, as described.

4. The combination, with a digester, of a condenser connected with the steam-space of the digester, and constructed to condense the gases during the process of boiling, as described.

5. The combination, with the digester and the blow-off pipe I, of the tank L and condenser K, constructed to condense the gases

and heat the water, as and for the purpose described.

6. The combination, with the digester A, of the blow-off pipe I, the valve *i*, the coil K, and the tank L, connected with the digester by the pipe *l'*, as described.

7. The combination, with the digester, constructed and arranged substantially as set forth, of the pipe N, having the branch *n*, the chamber *n'*, having the T-headed branch n^3, and the valved steam-pipe *o*, substantially as described.

In witness whereof we have hereunto set our hands.

CHAS. S. WHEELWRIGHT.
GEORGE E. MARSHALL.

Witnesses:
J. A. MILLER, Jr.,
M. F. BLIGH.