2 Sheets—Sheet 1.

I. HAYFORD.

APPARATUS AND PROCESS FOR PRESERVING WOOD.

No. 194,773. Patented Sept. 4, 1877.

Fig. 1.

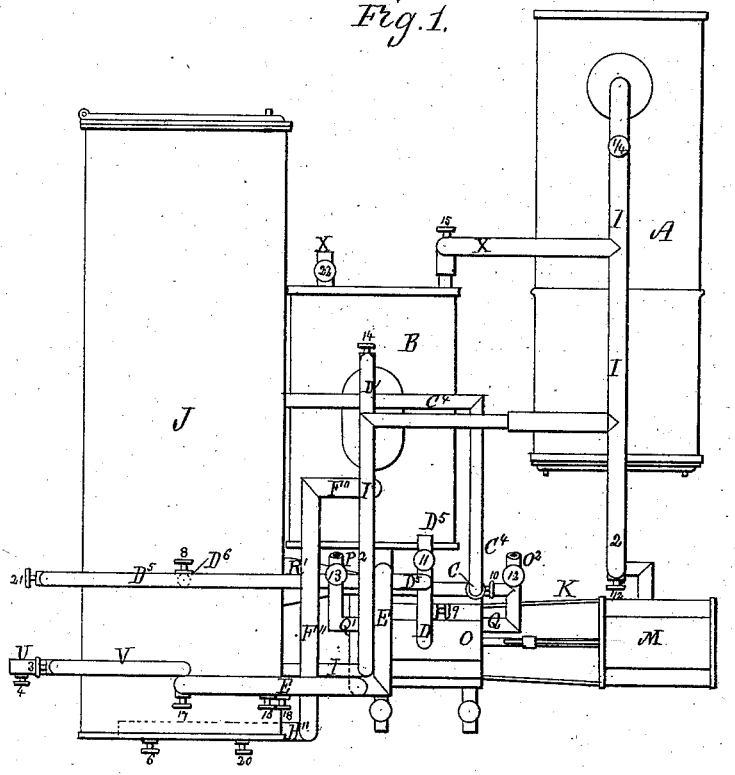
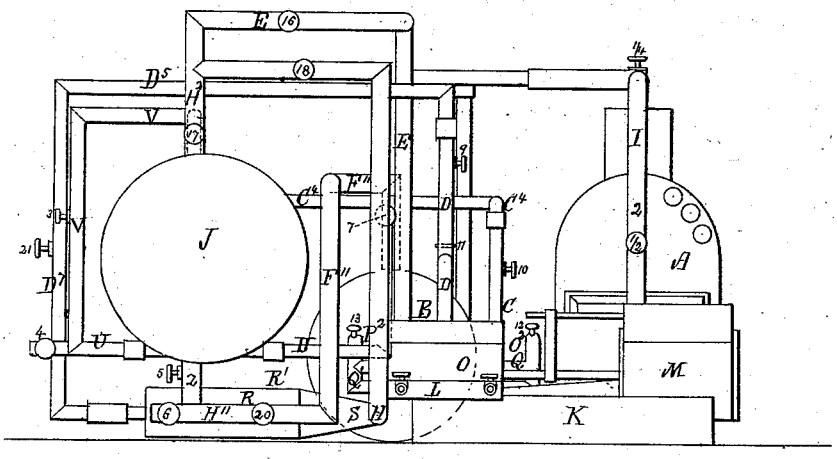


Fig. 2.



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2 Sheets—Sheet 2.

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Fig. 3.

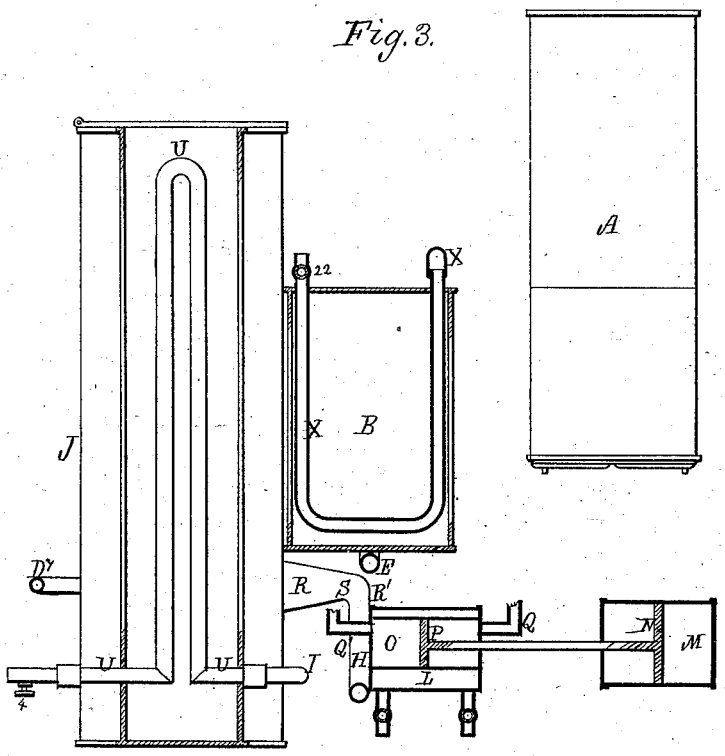


Fig. 5.

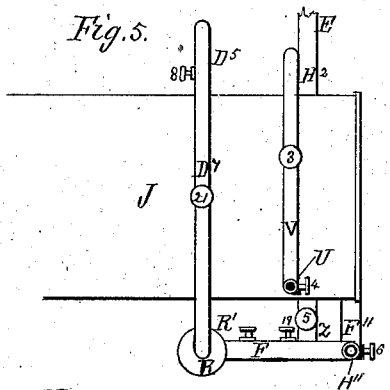
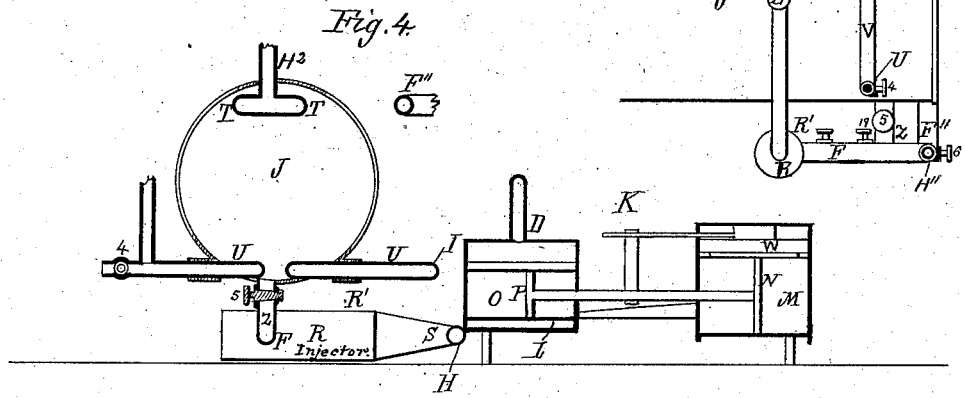


Fig. 4.



Witnesses.
F. Hunnewell.
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UNITED STATES PATENT OFFICE.

IRA HAYFORD, OF BOSTON, MASSACHUSETTS.

IMPROVEMENT IN APPARATUS AND PROCESSES FOR PRESERVING WOOD.

Specification forming part of Letters Patent No. **194,773**, dated September 4, 1877; application filed June 2, 1877.

To all whom it may concern:

Be it known that I, IRA HAYFORD, of Boston, Suffolk county, Massachusetts, have invented certain new and useful Improvements in Apparatus for Treating Wood, of which the following is a specification:

In my present apparatus I employ a reservoir or chamber for receiving and treating wood, a tank or vessel for containing the chemical substances or fluids with which the wood is to be charged, and an air-pump, which becomes alternately a vacuum-pump to extract the vapors from the wood-preserving chamber and the agent for forcing the treating fluids into the wood-receiving chamber. Steam from a suitable source is employed in connection with the above, and the whole operating substantially as hereinafter explained.

The apparatus is provided with means for creating a vacuum in said chamber after saturation of the wood by the steam and the withdrawal of the vapors of the latter, in order that the pores and cells of the wood may be distended and readily absorb the preserving agent, and with means for continuously reintroducing the preserving agent to the treating-chamber until the wood becomes saturated to the desired extent, together with means for enveloping the wood at the same time in a jacket of air to avoid checking and splitting.

The drawings accompanying this specification represent, in Figure 1, a plan; in Fig. 2, an end elevation; in Fig. 3, a horizontal section; and in Fig. 4, a cross-section of an apparatus embodying my improvements. Fig. 5 is an elevation of the front portion of the preserving-retort, with the pipes connected therewith.

In these drawings, A represents a steam-boiler, from which I obtain steam employed in the apparatus; while B represents the closed cylinder or tank to contain the creosote or other material with which the wood is to be charged; and J, a second tank or receiver, which constitutes the chamber in which the wood is treated, the latter being provided at one or both ends with a door, by which the wood is introduced into the interior.

K represents an air-pump disposed immediately adjacent to the boiler A and tank B, and constructed with an annular water-chamber, L, surrounding its air-cylinder, to contain a quantity of water and keep the interior of the air-cylinder cool, the steam-cylinder and piston of this pump being shown at M and N, respectively, and the air-cylinder and piston at O and P.

Suitable inlet and outlet pipes and cocks are combined with the water-chamber L, by which water from a suitable source is allowed to circulate through said chamber, and thereby maintain a low temperature within the cylinder to counteract the heat resulting from the compression of the air in the latter and of the vapors issuing therefrom. Each end of the air-cylinder O communicates with a bent pipe, Q or Q′, the outlet O^2 and P^2 of each pipe being provided with a cock, 12 or 13, by which air may be allowed to enter the cylinder, while the two pipes between the cocks and cylinder are united by and communicate with a ⊥-shaped pipe, C, the upright portion of this pipe being provided with a cock, 10, and extending by a horizontal portion, C^4, into the wood-preserving chamber J.

When the cocks 12 and 13 are closed and the pump is in operation, a powerful draft or suction takes place through the pipes Q, Q′, and C from the chamber J into the air-cylinder O of the pump, and exhausts through a pipe, D, leading from said cylinder. This exhaust-pipe extends vertically from the pump-cylinder, and continues by a horizontal portion, D^5, the outlet of the latter being furnished with a cock, 11.

From the horizontal portion D^5 of the pipe D rises a continuation or prolongation in the form of a bent pipe, D^7, the upright part of which is furnished with a cock, 9, while the horizontal portion extends over the chamber J downward in rear of it, and communicates with the barrel R of an injector, R′, while a branch pipe, D^6, of the horizontal portion D^5 of the pipe D extends into and communicates with the interior of the wood-preserving chamber J, the upright portion D^7 of said pipe D in rear of said chamber J being furnished with a cock, 21, and the pipe D^6 being furnished with a cock, 8. The barrel R is contracted at its outlet, as shown at S, and is prolonged into a bent pipe, H, which extends upward and over the chamber J, thence downward into

the latter by an upright portion, H^2, and terminates within said chamber J in one or more open or foraminous branches, T T, the said upright part H^2 having a cock, 17, while its upper horizontal part has a cock, 18. The upright portion H^2 of the pipe H rises above and extends horizontally by a portion, E, over the branch H^2, and is provided with a cock, 16, such portion E extending downward and entering and communicating with the lower part of the interior of the tank B.

A steam-conduit, I, leads from the boiler A into the lower part of the chamber J, and is provided with a cock, 7, and, after describing several turns or coils within the chamber J, to obtain a large heat-radiating surface, makes its exit from such chamber by a horizontal portion, U, which at its extremity is open to the atmosphere and furnished with a cock, 4. Between the cock 4 and the chamber J the horizontal portion U of the pipe I is continued upward by an extension, V, and enters and communicates with the upper part of the interior of said chamber J, and is provided outside of the chamber with a cock, 3. The steam-conduit I has a branch or extension, 2, which enters the valve-chamber W of the steam-cylinder of the pump K, and is furnished with a cock, $\frac{1}{2}$, while the main part of the conduit I, near to the boiler, is provided with a cock, $\frac{1}{4}$. Furthermore, the steam-conduit I has a second extension or branch, X, which extends to and enters the tank B, and, after coursing about the interior of the latter, makes its exit therefrom and discharges into the atmosphere, except when closed by a cock, 22, which is attached to it.

From the barrel R of the injector R′, and communicating with its interior, extends a horizontal pipe, F, which is furnished close to the barrel with a check-valve opening toward said barrel, and with a cock, 19, outside of such check-valve, such pipe F extending upward into and communicating with the interior of the chamber J by an upright branch, Z, which is furnished with a cock, 5, while the horizontal part of such pipe F joins and communicates with the horizontal pipe H″, one end of which is open to the asmosphere, except when closed by cock 6 applied to it, while its other end is continued upward by an extension, F″, and enters the upper part of the interior of the tank B.

A branch pipe, D^1, connects at one end with the pipe D^5, and at the other end with the interior of the tank B, and is furnished with a cock, 14.

The operation of this apparatus is as follows: Supposing steam to be up in the boiler, a proper quantity of creosote or other preserving fluid placed in the tank B, and the desired quantity of wood to be treated placed within the chamber J, and the doors of the latter closed, the cocks $\frac{1}{4}$, $\frac{1}{2}$, 3, 5, 6, 7, 8, 9, 12, and 13 being open, and all the rest hereinbefore named shut, with the exception of those applied to the circulating-pipe of the water-chamber of the pump-cylinder, which, of course, are always open when the apparatus is in operation. Steam from the boiler passes through pipe I into the interior of the chamber J, and, acting upon the wood, serves to soften the latter and expand its pores and vaporize the sap, which then escapes, while at the same time air is driven from the air-cylinder of the pump through the pipe D D^5 D^6, &c., into the interior of the chamber J with greater or less pressure, and, by surrounding the wood, prevents a vacuum, (which would otherwise result from the condensation of steam,) and thus prevents cracking or checking of such wood. This having been continued for a proper length of time, I now close all approach to the chamber J, except through the steam-heating coil, which I do by closing the cocks 8, 9, and 3, the steam thus circulating through the coil in the chamber J and exhausting by the cock or outlet 4. The heat radiating from the coil serves to thoroughly dry the wood. Simultaneously with the closing of the cocks 8, 9, and 3 and the shutting out of the entrance of steam directly into the interior of the chamber J, the cocks 10 and 11 are opened and 12 and 13 closed; consequently the pump is converted from a pressure to a suction or vacuum pump, and the vapors resulting from steam and the heat within the chamber J are withdrawn from such tank by means of pipe C and exhausted through the cock 11. This continues until the vapors cease to issue from the cock 11, (it being observed that the water-jacket of the air-cylinder of the pump serves at this time to reduce the temperature of such vapors,) when the cock 10, which, as will be seen, constitutes the means of communication between the air-pump and treating-chamber J through pipe C, is shut, by this means closing such communication, and the exhaust-cock 11 is also closed. I now open cocks 12 and 13, which permits inlet of air to the pump-cylinder, and also open cocks 9 and 14, (it being understood that said pump is continually in operation,) by which means air is forced by the pump through pipe D D^5 D^1, &c., through the cock 14 into the creosote-tank B, it being borne in mind that the cock 8 is at this time closed. The air entering the tank B under pressure from the pump, as last stated, drives the creosote or other preserving fluid from such tank into the chamber J, and forces the fluid into the pores and cells of the wood, which are distended and open from the action of the steam, the fluid, in its passage to said chamber J, passing through pipe E and cocks 16 and 17, which are now opened for the first time to permit this.

As soon as the preserving-fluid in the tank B has been driven from it in the manner last stated, I close the cock 14, which shuts off pressure of air from the pump to such tank, and also shut cock 16, which closes communication between the tank B and chamber J by way of the pipe E.

I next open cock 21 in the extension D^7 of the pipe D^5, which permits air under pressure from the pump through pipe D D^5 D^7, &c., to enter into and course through the injector-barrel R, where it unites with the excess of fluid flowing from the bottom of chamber J through pipe F by opening cocks 5 and 19, and carries it with it in its course through pipe H, cocks 18 and 17 being open, back into the foraminous pipes within chamber J, and thus forces the fluid into the cells and pores of the wood, this circulation being continued under pressure until the wood has taken up all the creosote or other preserving agent, or so much thereof as may be found desirable.

When the proper pressure has been reached in the treating cylinder or tank the cocks 12 and 13 may be closed and the cock 10 opened, so as to draw the air from the tank and return it thereto through the injector.

When the pores and cells of the wood have absorbed all the treating material which it is capable of receiving, or the predetermined quantity, whatever it may be, the air-pump is stopped, cocks 17, 18, 19, and 21, which open the communication with the air-injector R′, are closed, and cock 20 in pipe H″ F″ opened. Consequently any excess of creosote remaining in the chamber J not taken up by the wood is forced back to the tank B by the pressure remaining in said chamber.

The chamber J is now allowed to cool down, the cock 20 is closed, and the wood perfectly treated taken from such chamber.

As the action of creosote or other analogous preserving agents upon wood has been fully alluded to in former patents issued to me, I have not deemed it necessary to repeat the explanation in this specification. But in the present process of treating wood and the necessary apparatus heretofore described for the purpose, it will be observed that I employ steam, at such temperature as is necessary, for a certain length of time, for the purpose of softening the fibers of the wood and opening the pores and cells thereof, and vaporizing the sap and fluids contained therein, thus preparing the wood for the entrance of the preserving-fluid and a complete saturation of its tissues by the same.

Moreover, steam alone would cause the wood to crack and check from the expansion caused by the heat generated in the interior of the wood, which heat is necessary to effect the evaporation of the sap. Hence I force into the preserving-chamber the necessary pressure of atmospheric air to prevent the wood from checking.

Wood cannot be thoroughly impregnated with creosote or other preserving-fluids until the sap or water is drawn out of the pores of the wood. Hence the methods above described are essential for this purpose.

Moreover, in my former patents I used air for drying the wood after steaming; but I found in practice that it also caused the vapors to condense on the wood; hence in my present process, while using air under pressure sufficient to prevent cracking, I exhaust the vapors through a vacuum-pump, as described, maintaining the necessary degree of heat to prevent condensation by means of the coil of steam-pipe in the bottom of the preserving-chamber.

In withdrawing the vapors in the manner described, I also create a vacuum around the wood being treated—a condition favorable for its full and complete impregnation by the preserving-fluid, which is sucked into the dry, hot pores and cells, and driven in by a force-pump. The fluid is forced into the wood by the pressure of the air.

My method of introducing the preserving-fluid into the treating-chamber through foraminous pipes, so arranged as to shower upon the wood from every direction, and afterward by means of the injector, as described, keeping up a continuous circulation of the preserving-fluid, is superior to any method for soaking wood in a vat, the fluid entering the wood more thoroughly and insuring a perfect saturation of the wood.

Having thus described the nature, purposes, and advantages of my invention, and the manner in which the same is or may be carried into effect, what I claim as my invention, and desire to secure by Letters Patent of the United States, is as follows:

1. In the process of preserving wood, the method of preparing the wood for reception of the preservative by subjecting it in a closed tank to the action of steam, forcing air under pressure into the tank during the steaming operation, and then exhausting from the tank the resultant vapors, as set forth.

2. The combination, substantially as set forth, of the boiler, the wood-containing tank, and the air-pump, with their system of connections, arranged substantially as described, so that the pump may act as a force-pump to maintain air-pressure in the tank during the steaming operation, and subsequently as a vacuum-pump to exhaust from the tank the vapor arising from the action of the steam.

3. The combination of the air-pump, the wood-receiving tank, and the injector and their connections, arranged substantially as set forth, so that the preserving-fluid, as it passes from the tank, shall, by action of the pump and injector, be returned to said tank, to again act on the wood therein.

4. The combination, substantially as set forth, of the wood-receiving tank, the injector, the preserving-liquid reservoir, and the pump, connected substantially as set forth, so that the pump may be used at will to force the liquid from the reservoir to the tank, or to maintain the liquid circulation through the injector and tank, or finally to permit the return of the liquid to the reservoir.

5. The combination of the wood-receiving tank, the steam-generator, the preserving-liquid reservoir, and the air-pump and connections, operating to maintain air-pressure in

the tank during the steaming operation, to remove the steam and other vapors from the tank and to force therein the preservative liquid, substantially as set forth.

6. The combination, with the air-pump K and chamber or retort J, of the two systems of pipes, D D^5, &c., and O Q′ C^4, &c., with their respective cocks, substantially as herein shown, whereby such pump becomes at one time a force-pump to drive air into the treating-chamber J, at another time a vacuum-pump to extract vapors of the steam from such chamber and create a vacuum therein, and at another time a force-pump to drive the treating-fluid from its reservoir into the treating-chamber and the pores of the wood, and, finally, a force-pump to maintain a circulation of air and of the preserving agent throughout the preserving process, substantially as and for purposes stated.

IRA HAYFORD.

Witnesses:
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