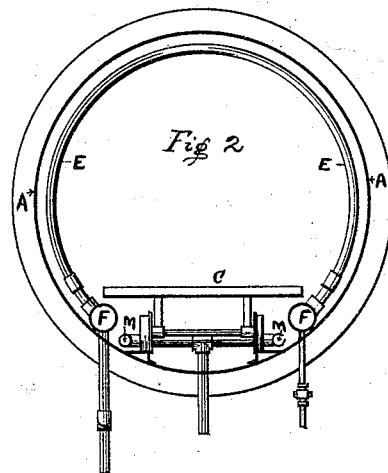
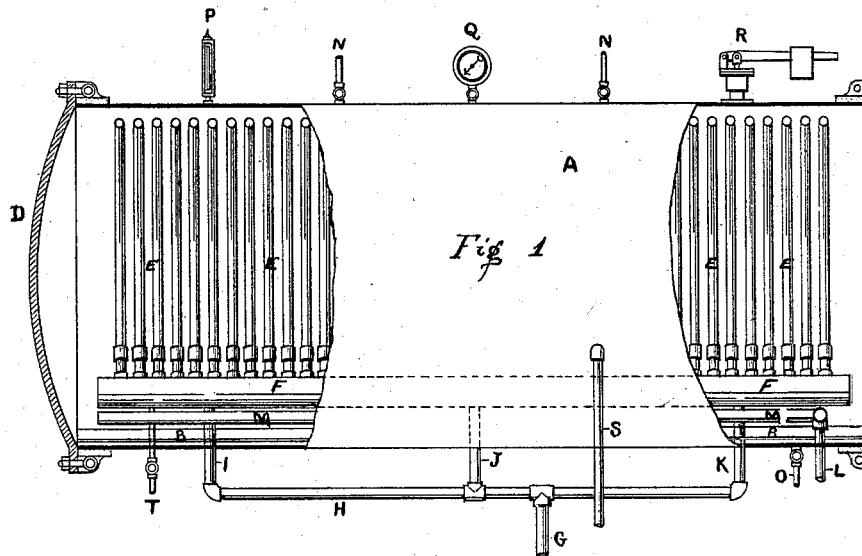


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Process and Apparatus for Treating Wood or Lumber.

No. 217,022.

Patented July 1, 1879.



WITNESSES

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IMPROVEMENT IN PROCESSES AND APPARATUS FOR TREATING WOOD OR LUMBER.

Specification forming part of Letters Patent No. **217,022**, dated July 1, 1879; application filed January 25, 1879.

To all whom it may concern:

Be it known that I, LOUIS S. ROBBINS, of the city of Elizabeth and State of New Jersey, have invented a new and useful improvement in apparatus and process whereby wood or lumber in its green state can in a few hours and at little expense be so treated that it will be in condition for immediate use for all mechanical and other purposes, and superior in all respects to the wood or lumber treated or seasoned by any other apparatus or process hitherto employed.

Figure 1 is a longitudinal elevation with portions broken away in section, and Fig. 2 a cross-section.

Wood has been kiln-dried, which is heating it for a length of time in a brick or wooden chamber or structure, for the purpose of expelling the sap or fluid matter from instead of solidifying it in the wood.

The object of this treatment is to prevent subsequent shrinking; but it is well known that by the long continued application of heat and the expulsion of the fluids from its pores the fiber of the wood or lumber is rendered brittle and its strength greatly decreased. Besides, in kiln-drying no means are employed which will establish and maintain a uniform heat. The slow and varying currents of air rising from the furnaces underneath the wood or lumber cause it to shrink more in some places than in others, and hence warp and crack it to such an extent as greatly to diminish its value. It is also true that wood or lumber by this operation becomes more porous and more readily absorbent of moisture.

Steaming wood or lumber as a mode of seasoning has been practically tested many years in this country, and also in Europe; but it has been found that free steam under high pressure, or when superheated, coming in contact with wood or lumber, condenses and completely saturates the wood with water, which dissolves and removes the albumen to such an extent as to destroy the cohesion of the fibers, thereby impairing the strength and integrity of the wood. This practice is now wholly abandoned in Europe, and but little used in this country.

Letters Patent No. 165,758, dated July 20, 1875, were granted to me for a process of pre-

serving wood by subjecting it to heat under atmospheric or gaseous pressure. In its practical application this process is in some respects similar to my present invention; but in the treatment of wood or lumber for mechanical purposes it does not produce the same results as I obtain by my new discovery.

The process part of my invention has for its object the coagulation of the fluid matter contained in the wood, so that it will become fixed in combination with the wood fiber; and it assumes, first, that it is necessary that the albumen contained in the wood should be quickly coagulated by a dry heat; and, secondly, that the steam employed to prevent the dry heat from scorching the wood should not be such as will penetrate the pores of the wood to such a degree that the albumen and other vital elements in the wood will be injured thereby.

What distinguishes my invention, therefore, from any process of treating wood heretofore practiced is the quickly heating of the wood by a dry heat up to a temperature that will prevent steam from condensing into the wood to an extent that will destroy its vital elements, then bringing into contact with the wood steam sufficient to keep the hot air and surface of the wood moist, the same as well as the heat being continued, while the heat is increased. The other steps in the treatment are for the purposes, and they effect what is ascribed to them.

In carrying out my process I preferably make use of the apparatus hereinafter described.

The wood or lumber is piled on a car, and the latter run into the heating-chamber, the lumber being piled so as to leave spaces throughout the pile.

The chamber is closed tight, and the temperature therein quickly—say, in from twenty to thirty minutes—raised by means of dry heat radiated from pipes placed therein through which steam or hot air is passed; also, by means of currents of hot air, to something like 215° to 225° Fahrenheit, or, in other words, to a temperature that will quickly coagulate the albumen contained in the wood, and that will prevent the steam from condensing into the wood to an extent, if at all, that will destroy the vi-

talizing elements of the wood. At this stage of the treatment free steam is admitted into the chamber and in contact with the wood through pipes leading from a steam-boiler, the steam admitted being sufficient to keep the surface of the wood moist, so as to prevent the dry heat, the temperature or degree of which is raised from this stage of the operation, from scorching the surface of the wood. This can be ascertained and maintained during the treatment by opening one of the stop-cocks at the top of the chamber, and allowing the hot air to escape against a piece of wood held over the opening. The wood will condense the steam and show about the quantity of moisture the hot air contains, and whether it contains enough for the purpose or not.

After steam is admitted the temperature within the chamber is raised to something like 300° Fahrenheit and upward, the temperature depending upon the kind and size of wood or lumber being treated and the uses to be made of it. If necessary the temperature can be raised up to 400° or 500° Fahrenheit.

The air is admitted into the lower portion of the chamber through perforations made in pipes laid parallel with steam-pipes running the length of the chamber, the perforations being made so that the air will issue against the steam-pipes and become thereby heated, and, rising, will pass up through and around the stacked lumber, keeping up a circulation of heated air from the bottom to the top of the chamber, whence it is allowed to escape by opening one or more stop-cocks at that point, and thus the air surcharged with moisture is allowed to escape, and prevented from retarding the heating of the wood or lumber.

I have given the time usually required for heating up the temperature in the chamber before steam is admitted, and I have also stated the degrees of heat necessary, generally, to prevent the steam from condensing into the wood. Further on, I state the degree of heat and time usually required to complete the treatment; but I do not mean nor intend to confine myself to them, for it is obvious that under some conditions differences in time and in the degrees of heat will suggest themselves. I have, however, given units of time and temperature with sufficient definiteness to enable skilled operators to use and work my invention.

In treating one-inch boards of spruce, pine, hemlock, and other species of wood that grow in North America, I have found that by raising the heat rapidly to about 300° Fahrenheit the treatment can be completed in about four hours.

In treating lumber of four, six, or eight inches in thickness I continue the heat a longer time, say, from five to seven hours, and use a higher temperature than that used for the one-inch boards.

If the lumber is to be used for such purposes as will constantly expose it to the changes of the weather, wet and dry—for instance, if

to be used for railroad-ties, bridge-timber, fencing, and the like uses—I raise the temperature on some kinds of wood from 300° to 400° or 500° Fahrenheit, so as to more thoroughly develop the antiseptic elements of the wood, which preserve it from decay.

A high heat employed as described will produce a chemical change in the fluids of the wood or lumber, by which, in cooling, they become solidified or fixed in combination with the wood fiber. The heat being moist and uniform the wood or lumber neither warps nor cracks during the treatment, and, retaining the natural fluids or elements in a solidified form, its strength, density, and toughness are preserved, and when manufactured the appearance of the grain and color shows that the treatment develops the oleaginous properties of the wood or lumber, which render it very beautiful for ornamental purposes without paint or varnish.

My apparatus consists in such an arrangement in all its parts as will furnish a perfectly uniform heat at all parts of the wood or lumber, and provide every possible facility for practically working the process of treating wood or lumber in the shortest possible time, and with the very greatest economy.

By no method hitherto known, so far as I am aware, can a quick heat be attained by the use of steam-pipes, or of what is known as a "jacket," that will raise the temperature of a cylinder eight feet in diameter by forty feet in length, filled with green wood or lumber, to 400° Fahrenheit.

By my invention a heating apparatus is so constructed that this temperature can be readily obtained when necessary. A high temperature quickly obtained is necessary to prevent the consequences of a slow heat, (as in kiln-drying,) and for treating wood of certain kinds and large dimensions.

Iron pipes, when heated by steam, expand, and when cooled they contract. Consequently, when two or three thousand feet of pipe are employed in continuous lengths, or in coil, passing back and forth from one end of a chamber to the other, and connected by couplings, the joints are affected by expansion and contraction to such an extent as to render it impossible to keep them from leaking, and it is with great difficulty and expense that repairs can be made.

Inventive genius has long been employed in trying so to arrange pipes for heating purposes that the steam might have the shortest distance to travel in the pipes from the boiler. To effect this, headers have been placed at each end of a chamber with lateral pipes of sufficient length screwed into them; but the joints have been in all cases destroyed by expansion and contraction, and in order to make repairs or stop a leak at a single point the whole structure had to be taken apart.

In constructing my apparatus, as shown in the drawings, I first make a chamber, marked A, of wrought-iron, in the manner of a steam-

boiler, and of any size suited to the dimensions of the material to be operated upon. It will generally be provided with a track in the bottom, marked B, with a car, marked C, on which the wood or lumber is piled, so as to have spans between and run into the chamber A, the end of which is closed by a suitable door, marked D.

Steam-pipes, marked E, one inch in diameter, and shaped to fit the inner circumference of wood-chamber A, are placed close to each other within said chamber, and connected at or near their ends by couplings with the four-inch pipes, marked F, at or near the bottom of the chamber. Each pipe F is to be fitted near the end with a cock, marked T, to discharge the water from condensation.

By this arrangement of the pipes three times as much radiating-surface as would be furnished by a jacket is provided, and a high heat can be quickly attained and with little condensation, the steam having to travel only the length of each of the one-inch pipes, which is less than the inner circumference of the chamber A.

If any one of the pipes should leak it can be removed, repaired, and replaced, or another substituted therefor in a short time and at little expense. When necessary the whole pipe-structure can be readily withdrawn by disconnecting from it the pipes that lead to the outside of the chamber, and it can be easily put back.

One of the four-inch pipes marked F is connected with a steam-boiler by pipes marked G H I J K, through which steam at three places is introduced into pipe F, and thence through all the pipes marked E into the four-inch pipes F on the opposite side of the chamber. The two pipes marked M, and connected with pipe L, are placed in chamber A, under the two four-inch pipes, and, being perforated with small holes, are used to distribute air, which is forced into them through pipes L by any suitable means employed for the purpose, and the perforations in pipes M are so arranged that the air is discharged directly against the under side of the four-inch pipes marked F. The high temperature of pipes F instantly heats the air, which then passing up expels the cold air from the wood and chamber out and through one or more cocks, marked N.

Cock marked O is placed in the bottom of chamber A, to discharge the condensation of any free water with which the wood or lumber may have been saturated before being placed in the chamber for treatment. A thermometer marked P, a pressure-gage marked Q, and a safety-valve marked R are placed in the top of chamber A. A pipe, marked, S connects the steam-boiler with the chamber, through which steam may be introduced at any time and in any desired quantity, after the wood or lumber has been prepared for it, in the manner heretofore described, the heat in the chamber being usually raised to 225° Fahrenheit before steam is admitted.

When a steam-boiler has been connected

with pipes G H I J K and the lumber to be treated run into the chamber, the door at the end being made steam and air tight, and securely fastened by bolts inserted in slots made for the purpose in the flanges of both door and chamber, steam (or heated water) is let into the pipes to raise the heat in the chamber, and at the same time a pump or other suitable means attached to pipes L and M is put in operation, furnishing and distributing hot air, as heretofore described, producing a uniform heat through the chamber and its contents.

In the operation the cold air is carried to the top of the chamber and is discharged through cocks n.

By this mode of heating I am able to raise the temperature rapidly to 400° Fahrenheit, or higher if necessary, and the scorching effect of dry heat upon the surface of the wood or lumber is prevented by the introduction of steam.

The thermometer will show when the required heat is attained, and thereafter the temperature can be regulated or maintained by the quantity of the steam let into the pipes. This mode of heating the green wood or lumber will, in a few hours, fix or prepare it for immediate use, and it can then be withdrawn and the chamber refilled for another treatment. The length of time of treatment varies, some kinds of wood requiring a longer treatment than others.

When withdrawn and thoroughly cooled it will be found upon examination that, by this treatment, the albumen and other elements of the sap have been coagulated and solidified with the fiber, and the wood or lumber is dense, firm, and strong, retaining all the vitalizing qualities of its fluid matter, while it has been made perfectly dry and fit to be used for the nicest mechanical purposes. These results cannot be attained by a low or slow heat.

The heat employed in kiln-drying, which is only gradually raised during two or three weeks to 120° Fahrenheit, is not sufficient to coagulate the albumen, but when applied for a great length of time it will cause the evaporation from the wood or lumber not only of the albumen, but the other fluids of the sap, which should be solidified with the fiber.

By the use of my apparatus and process, wood or lumber, which requires from one to five or more years to season in the open air, is so changed by the treatment in a few hours, and without warping, cracking, or injury to the fiber, that it is ready for use for all purposes. This saves stacking, storage, insurance, and interest of money on large capital employed in holding lumber.

Besides the retaining of the fluid matter and solidifying it with the fiber, it renders the wood hard, dense, and strong to such a degree that the commonest kind of soft woods, firs, &c., can be used in place of the hard woods, not only when strength and hardness are required, but for nice mechanical and ornamental purposes.

I am aware that it has been proposed to con-

struct a heating-chamber for wood with steam-pipes on the sides and ends of the chamber within the same; but my invention does not consist in that construction.

Having described my invention, what I claim is—

1. The herein-described process of treating and seasoning wood, consisting in subjecting the wood in a close chamber to a dry heat, and to currents of air quickly raised to a temperature that will prevent steam from condensing into the wood, then admitting into contact with the wood steam sufficient to prevent its surface from being scorched by the dry heat, then increasing the degree of heat and at intervals during the treatment allowing air surcharged with moisture to escape from the chamber, all substantially as set forth.

2. The longitudinal pipes E, connected by curvilinear pipes F, adapted to operate as de-

scribed, in combination with heating-chamber A, substantially as set forth.

3. The combination of chamber A, pipes E F, and perforated pipes M, substantially as and for the purpose set forth.

4. The combination of the system of steam-pipes E F, provided with means for admitting steam thereto and for removing water of condensation therefrom, pipes M, with means for admitting air to and from the same, and chamber A, provided with steam-inlet pipe, safety-valve, pressure-gage, and thermometer, and means for the exit of air or vapor therefrom, and for the withdrawal of water of condensation, substantially as set forth.

LOUIS S. ROBBINS.

Witnesses:

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