W. BUEHLER.

PRESERVING WOOD.

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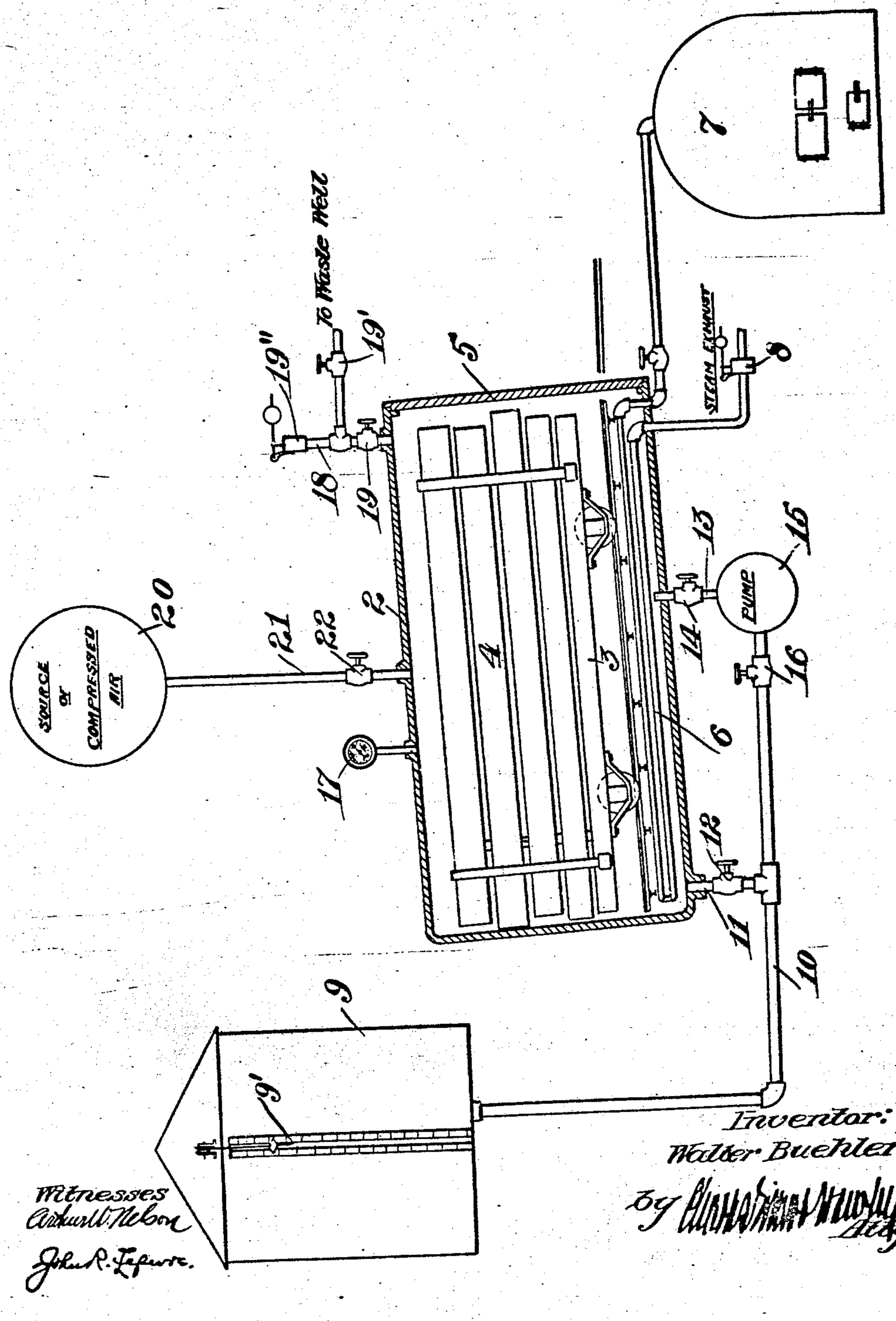
899,237.

Patented Sept. 22, 1908.



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UNITED STATES PATENT OFFICE.

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PRESERVING WOOD.

No. 899,237. Specification of Letters Patent. Patented Sept. 22, 1908.

Continuation of application Serial No. 418,094, filed February 27, 1908. This application filed July 27, 1908. Serial No. 445,639.

To all whom it may concern:

Be it known that I, WALTER BUEHLER, a citizen of the United States, and resident of Minneapolis, Hennepin county, Minnesota, have invented certain new and useful Improvements in the Art of Preserving Wood, of which the following is a full, true, clear, and exact description, such as will enable others to practice the same.

My invention relates to the art of preserving wood and has special reference to improvements in the art of drying or seasoning and preserving green and partially seasoned wood, with a view to increasing the effectual strength thereof for structural purposes and preventing decay and the ravages of insects and worms when the wood is submerged in water, buried in the ground or exposed to the weather.

Further, my invention is chiefly concerned with the effective impregnation of green and partially seasoned wood with bituminous liquids and distillates of bituminous substances commonly known as non-aqueous liquids that are substantially free from water, such as creosote oil. Green wood is strengthened by the removal of water and watery substances from its cells, pores and fiber, particularly the latter, and when freed from water may be impregnated with preservative liquid of the class named without loss of strength, for the reason that the oil, unlike water, does not penetrate the wood fiber. Such oil when uniformly distributed upon the walls of the cells and pores of the wood excludes moisture and retards and practically prevents decomposition or rotting of the wood. It also preserves the wood against the attack of land and marine insects, such as teredo, limnoria and termites.

Certain uses necessitate the complete saturation or permeation of wood with a non-aqueous preservative, in order that moisture shall be wholly excluded, to prevent the alternate swelling and shrinking of the wood when in use; but for most uses, I find that partial saturation suffices, provided the preservative is distributed in film form upon the walls of the cells and pores throughout the wood.

The object of my invention is to enable the effectual seasoning of green wood and partially seasoned wood within a short period of time and without weakening the wood fiber, and, further, to enable the complete and thorough impregnation of wood with preservative liquid within a like short period and at less expense than hitherto. To attain these objects I first extract or drive out the liquid matters in the wood by vaporizing the same within the wood. I do this by immersing the wood in a bath of non-aqueous preservative liquid and gradually raising the temperature of the liquid and wood to a temperature which is higher than the vaporizing point of the moisture, etc., in the wood. In this manner I effectually and quickly season the wood, preparatory to the next step of the process. When practically all of the liquid matters and air have been excluded from the wood and preferably while the wood is still in the bath, I force the requisite quantity of the preservative into the outer cells and pores of the wood, subjecting the body of liquid to pressure, if need be, and varying the charge or quantity driven into the wood, according to different requirements or specifications. After charging the wood with liquid in this manner, I remove it from the bath, *i. e.*, drain off the surplus liquid, and subject it to external pressure of non-aqueous gas to drive the liquid further into the wood. I prefer to employ air for this purpose and by means thereof, so to speak, force the charge home, that is, distribute the liquid uniformly upon the cell walls throughout the piece of wood. A predetermined air pressure is preferably continued until the wood refuses to take up further quantities of air.

My invention as above described, together with certain incidental steps thereof, will be more readily understood by reference to the accompanying drawings, forming a part of this specification and in which I have illustrated the apparatus that I have found to be best adapted to the purposes of the invention.

I shall first describe the apparatus and then fully define the nature and scope of my novel process.

In the drawings 2 represents a cylinder or receptacle of the kind usually employed in preserving wood. This cylinder is large enough to contain a car or truck, 3, and a load of wood, 4. A large door or head, 5, tightly closes the end of the cylinder, the packing being such as to permit a high pressure of liquid or air to be maintained in the

cylinder. A heating coil, 6, in the lower part of the cylinder and supplied with high pressure steam from the boiler, 7, is used to heat the contents of the cylinder. 8 is the steam regulating valve. A reservoir, 9, contains the preserving liquid. The capacity of the reservoir, 9, considerably exceeds that of the cylinder, so that the latter may be completely filled with liquid, as hereinafter mentioned.

9′ represents a gage for automatically registering the supply of liquid in and from the reservoir. This is used in determining the volume of liquid injected into the wood in the manner hereinafter described.

10 is the liquid main or conduit. A pipe 11, having a valve, 12, joins the main to the lowest part of the cylinder and is used in draining the cylinder.

13 is the main liquid connection of the cylinder and contains a valve, 14. A pump, 15, is interposed between the pipes, 10 and 13, and is adapted to forcibly transfer the liquid from the reservoir to the cylinder and create a high pressure of liquid in the latter.

16 is a cut-off valve between the reservoir and the pump.

A pressure gage, 17, at the top of the cylinder serves to indicate the pressure therein at different stages of the process. At the high point of the cylinder is a blow-off connection, 18, equipped with valves 19, 19′ and 19″, the latter being an automatic, weighted valve adapted to be opened by internal pressure of about one to five pounds.

20 represents an air pump or other source of compressed air joined to the cylinder by the pipe, 21, having valve, 22.

Upon arrival of a car of wood at the cylinder the door thereof is swung open and the car is placed in the cylinder, after which the door is closed and made tight. Meantime all the valves have been closed. Thereupon I open the valves 16, 14 and 19 and, starting the pump, 15, fill the cylinder with preserving liquid from the reservoir. As the liquid enters the cylinder it expels the air therefrom through the blow-off or waste pipe 18 and the automatic valve 19″, the valve 19, as stated, being then open. When the cylinder is nearly full of liquid the valve 14 is closed to trap the same in the cylinder and steam is admitted to the heating coil, 6. In this manner the wood is completely immersed in the liquid or oil and the apparatus is put in readiness for the next step of the process. This next step consists in gradually heating the contents of the cylinder and holding the same for a time at a temperature exceeding that at which vaporization of the watery substances in the wood takes place. In practice I slowly raise the temperature from that at which the liquid enters the cylinder to about 220° to 250° Fahrenheit, varying the temperature according to the character of the wood under treatment. The temperature of the wood, immersed in the liquid or oil, is in this way increased so gradually that the wood takes on a uniform heat without case-hardening and without checking or cracking, such effects being avoided by the slow seasoning of the wood within the enveloping liquid, which takes the place of the water in the surface pores of the wood and keeps the latter open. The predetermined high temperature, when reached, is maintained until practically all of the moisture and air have been driven from the wood, *i. e.*, at this high temperature the moisture in the cells and pores of the wood and also that contained in the wood fiber is rapidly volatilized and expanding, naturally forces its way to the surface of the wood. It carries with it most of the sap and gums and also the air contained in the wood. The air and the vapors on emerging from the wood enter the body of heavier liquid and being lighter, quickly rise to the top of the cylinder, *i. e.*, to the surface of the liquid or oil. The vapors and gases, principally steam, accumulate in the top of the cylinder but do not attain a high pressure therein; the relief valve 19″ permitting the escape thereof at a pressure that is considerable lower than that of steam at the temperature of the liquid. The low pressure at which the vapors are permitted to escape from the wood and the high temperature imparted to the wood through the preserving liquid, insure the rapid drying or seasoning of the wood. In practice I heat the wood, in this manner, from four to eight hours and effectually empty the cells and pores of the wood and also deprive the wood fiber of most of its watery content. The time varies with different woods and with the condition of the wood as to contained moisture, very green wood requiring more extended treatment than that which is partially seasoned. A valuable result of the closing of the cylinder and the maintenance of pressure therein during the heating period is that the oil is continuously confined and the loss of even the most volatile constituents thereof is prevented. It follows that the specific gravity of the preserving liquid is maintained at substantially a constant throughout the process, making it possible to accurately fix and measure the quantity and weight of liquid injected into the wood, as more fully explained hereinafter.

Considerable quantities of steam, sap, gum and other impurities collect in the top of the cylinder during the heating or seasoning period and at the end thereof I open the valve 19′ and permit these to escape into the waste well, (not shown), displacing them if need be by a further quantity of preserving liquid from the pump, 15. When the cylinder becomes full the valves 19 and 19′ are closed. The fall of pressure in the cylinder and the

entrance of a quantity of relatively cool oil causes a drop of temperature throughout the body of oil and the wood. This results in the condensation of the minute quantities of vapor remaining in the cells of the wood. This cooling and condensation may be and is preferably augmented by cutting off the steam from the coil, 6, and permitting the cylinder to cool for a space of time before proceeding with the next step of the process. During the time that the cylinder is heated and after the heat is cut off, the heavy oil, to a considerable extent, replaces the moisture which is driven from the wood, particularly in the surface or outermost cells and pores thereof. Thus the surface pores are closed by the heavy oil; the rarefaction of the contents of the interior cells tending also to increase the quantity of liquid absorbed by the wood. In cases where light treatment is sufficient and in the case of some very porous woods this initial charge of liquid suffices, and the wood may at once be subjected to air pressure to disseminate the oil in the wood, as explained hereinafter. But in most cases it is necessary to inject a further quantity of liquid and to this end I again start the pump, 15, and raise the liquid pressure to from 125 to 180 pounds and maintain this pressure until a sufficient quantity of the liquid has been taken up by the wood. In practice the pressure is varied according to the density of the wood and the length of the sticks under treatment, long pieces of wood ordinarily requiring the higher pressure. The pressure upon the liquid rapidly forces it into the wood and the penetration is augmented rather than resisted by the contents of the pores and cells, because of the hereinbefore mentioned vacuums therein, which vacuums, it will be noted, increase steadily as the temperature falls. A reading is taken from the indicator, 9′, of the reservoir before pressure is put upon the contents of the cylinder and the movement of the indicator is watched during the operation of the pressure pump. Such movement, obviously, measures the quantity of oil which is being injected into the timber and when the requisite quantity has been thus lodged therein the pump is stopped. Thereupon the pump is reversed and the surplus or residue of liquid is withdrawn from the cylinder. This operation may if desired, be supplemented by the admission of compressed air from the apparatus, 20; the valve, 12, in such case being opened to bypass a portion of the liquid direct to the reservoir main, 10.

After emptying the cylinder the valves, 12 and 14, are closed and the process is proceeded with as follows: Compressed air, or other dry gas, at approximately atmospheric temperature, is supplied to the cylinder from the source, 20, at a pressure usually approximating 25 pounds. This non-aqueous gas enters the pores and cells of the wood and, drives the charges of liquid therein further into the wood. This action continuing for an hour, or more in the case of dense woods, the liquid is ultimately disseminated or distributed uniformly throughout the piece of wood, forming thin films upon the walls of even the innermost cells. The actual distribution of the oil, as to quantity, is of course dependent upon the volume of the charge, but it is noticeable that even in the case of a small charge of liquid a deep and effectual penetration results from the use of the cool compressed gas as described. Apparatus which is adapted to continuously supply the air at stated pressure may be used, but I have found it most convenient to furnish the air intermittently, by the occasional opening and closing of the valve, 22. When, after the cylinder has been charged at maximum pressure, the indicator or gage, 17, remains stationary, it shows that a condition of gaseous equilibrium has been established in the wood, *i. e.*, that the oil and air have penetrated into the innermost parts thereof. This in a practical or operating sense marks the end of the process and at such time the pressure may be relieved, the door, 5, opened and the car removed from the cylinder. Upon relief of pressure, as by removal of the wood from the cylinder, the gas under pressure therein quietly expands and flows from the wood until atmospheric pressure is established. The injection of the charge of liquid, as above described, may be hastened by the employment of greater air pressure but I prefer the lower pressure named for the reason that air or gas under such pressure leaves the wood without violence and without disturbing or expelling the liquid contents of the wood. The cause of this is found in the fact that the adhesion of the films of liquid upon the cell walls exceeds the force of the expanding gas or air at the relatively low pressure of 25 pounds, or thereabouts. If liquid was expelled at the time of the removal of the wood from the cylinder, or immediately preceding its removal, the quantity ejected could not easily be determined and the actual quantity remaining in the wood would therefore be unknown. It is therefore obvious that my process possesses the important advantage and merit of accuracy, inasmuch as it provides for the injection and distribution of any desired, definite and easily determined quantity of preservative; and the liquid, after being lodged in the wood, is not thereafter removed.

For certain uses, wood, preserved in the foregoing manner, requires a further coating of material, to render it impervious to moisture. In such cases, before removing the car from the cylinder and after letting off the air, I fill the cylinder with a tar or asphalt composition, thus coating the pieces of wood

and closing the pores thereof. It is usually unnecessary to subject the heavy liquid to pressure and it may be drawn off at once.

As will appear from the foregoing, the steps comprising the process are subject to such modification as those who are skilled in the practice find necessary to obtain the requisite or desired results. For these reasons I do not confine my invention to the specific acts or steps as herein described.

This application is a substitute for my previous application, Serial No. 418,094, filed February 27, 1908; allowed April 7, 1908; formally abandoned July 18, 1908.

Having thus described my invention I claim as new and desire to secure by Letters Patent:

1. The herein described improvement in the art of preserving wood, that consists in immersing wood in a body of non-aqueous preservative liquid in a closed vessel, then heating the same sufficiently to expand the gaseous and watery contents of the wood and thus cause their expulsion therefrom, partially charging the wood with said preservative liquid, then draining off the surplus liquid, then immersing the wood in a body of low-temperature compressed gas until substantial gaseous equilibrium is established in the wood and then relieving the gaseous pressure, substantially as described.

2. The herein described improvement in the art of preserving wood, that consists in immersing wood in a body of non-aqueous preservative liquid in a closed vessel, then heating the same sufficiently to expel the gaseous and watery contents of the wood, then exerting pressure upon said confined body of liquid, until the wood is sufficiently impregnated therewith, then removing the surplus liquid, then immersing the wood in low-temperature, compressed gas and thereby disseminating the liquid in the wood and then releasing the pressure and permitting the excess gas to flow from the wood, substantially as described.

3. The herein described improvement in the art of preserving wood, that consists in immersing wood in a body of non-aqueous preservative liquid in a closed vessel, then heating the same sufficiently to expel the gaseous and watery contents of the wood, then withdrawing the watery accumulation from the surface of said body of liquid, then again confining the body of liquid and exerting pressure thereon until the wood is sufficiently charged with said liquid, then releasing and removing the surplus liquid, then immersing the wood in a low-temperature compressed gas until substantial gaseous equilibrium is established in the wood and then permitting the excess gas to flow from the wood substantially as described.

4. The herein described improvement in the art of preserving wood that consists of immersing wood in a body of non-aqueous preservative liquid, then heating the same sufficiently to expel the gaseous and watery contents of the wood, then cooling the wood, then forcing a quantity of said liquid into the wood by exerting pressure upon said liquid, then draining the surplus liquid from the surface of the wood, then immersing the wood in low-temperature compressed gas until substantial gaseous equilibrium is established in the wood, and then permitting the excess of gas to flow from the wood, substantially as described.

5. The herein described improvement in the art of preserving wood, that consists in immersing wood in a body of non-aqueous preservative liquid in a closed vessel, then heating the same until the gaseous and watery contents of the wood are substantially expelled, then reducing the temperature of said liquid and wood and exerting pressure upon the liquid to force a quantity thereof into the wood, then relieving the pressure and removing the surplus liquid from the wood, then immersing the wood in low temperature compressed gas, thereby disseminating the charge of liquid throughout the wood and then permitting the excess gas to flow from the wood, substantially as described.

6. The herein described improvement in the art of preserving wood that consists in immersing wood in a body of non-aqueous preservative liquid in a closed vessel, then heating the same sufficiently to expel the gaseous and watery contents of the wood, then exerting further pressure upon the confined body of liquid until the wood is partially charged therewith, then draining off the surplus liquid, then immersing the wood in low-temperature compressed gas until substantial gaseous equilibrium is established in the wood, then releasing the gas and then coating the surface of the wood with material which is impervious to moisture, substantially as described.

In testimony whereof, I have hereunto set my hand, this 18th day of July, 1908, in the presence of two subscribing witnesses.

WALTER BUEHLER.

Witnesses:
E. F. HUSSEY,
M. H. SPRAGUE.