No. 694,956. Patented Mar. 11, 1902.

J. L. FERRELL.

PROCESS OF IMPREGNATING WOOD.

(Application filed May 18, 1901.)

(No Model.) 2 Sheets—Sheet 1.

FIG. I.

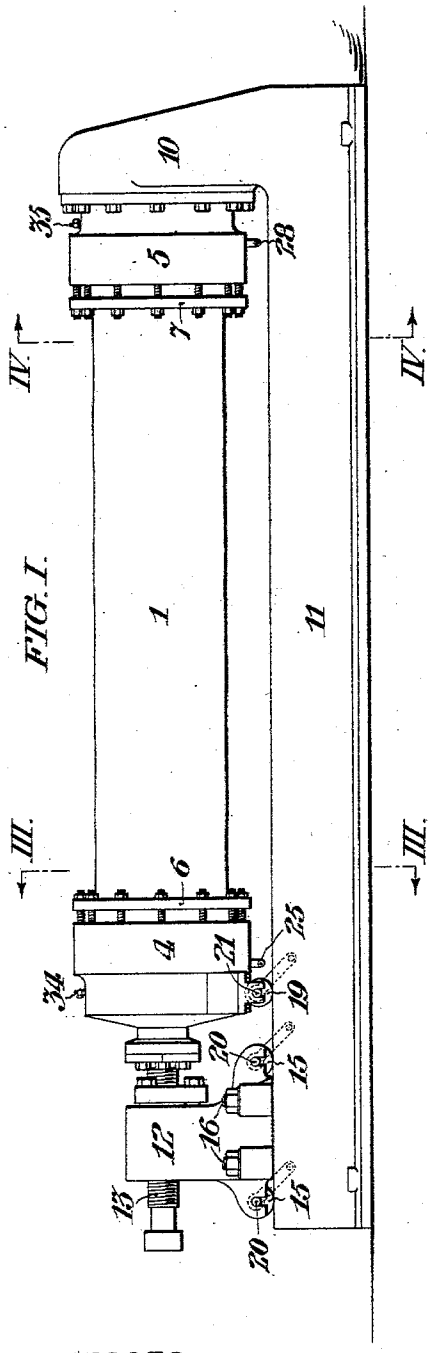
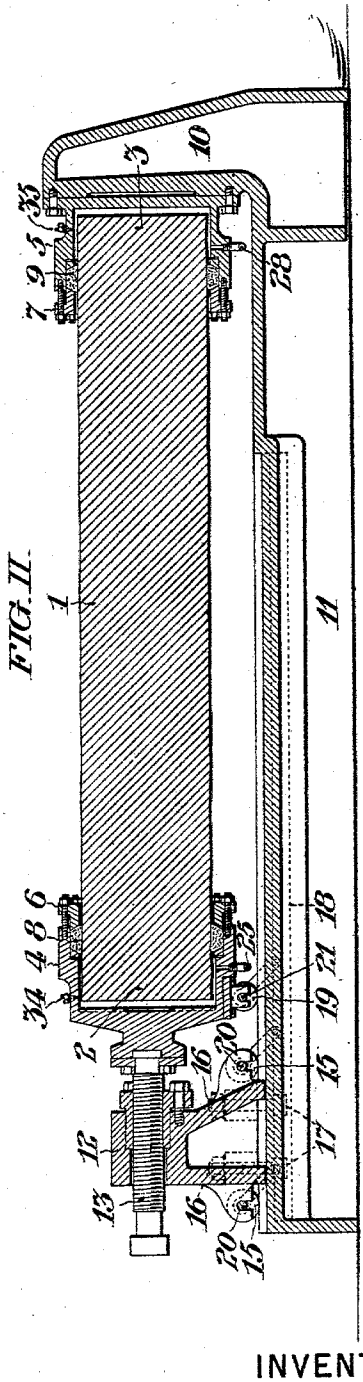


FIG. II.



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FIG. III.

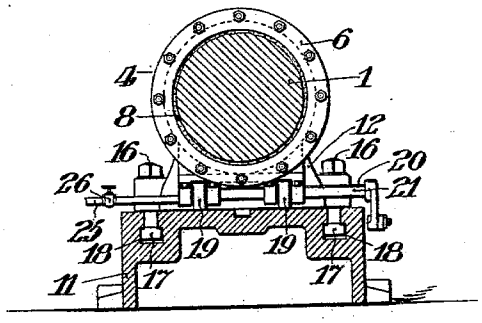


FIG. IV.

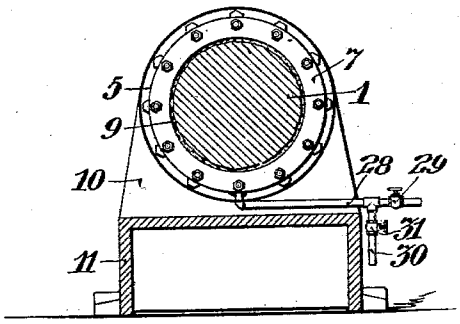
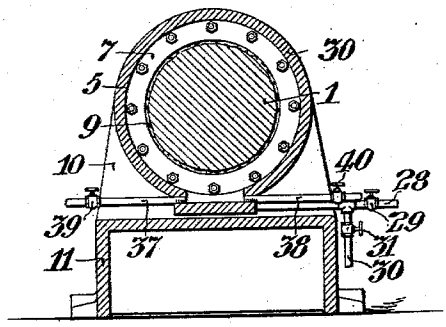


FIG. V.



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UNITED STATES PATENT OFFICE.

JOSEPH L. FERRELL, OF PHILADELPHIA, PENNSYLVANIA.

PROCESS OF IMPREGNATING WOOD.

SPECIFICATION forming part of Letters Patent No. 694,956, dated March 11, 1902.

Application filed May 18, 1901. Serial No. 60,800. (No specimens.)

To all whom it may concern:

Be it known that I, JOSEPH L. FERRELL, of Philadelphia, in the State of Pennsylvania, have invented a certain new and useful Improvement in Processes of Impregnating Wood with Fireproofing Preservative and other Reagents, whereof the following is a specification, reference being had to the accompanying drawings, showing an apparatus adapted for the conduct of said process.

The particular application of my process which I at present contemplate is the fireproofing of wood, and I will therefore simplify the following description by adverting only to such a process, it being understood, however, that I do not therefore intend to limit my claims accordingly.

The various systems for impregnating wood with fireproofing material which have heretofore come under my notice may be referred to one or the other of two general classes, as follows: It is characteristic of one class of said processes that the fireproofing material is applied externally upon all sides of the body of wood while the latter is inclosed in a suitable receptacle. It is characteristic of the second class of processes aforesaid that the fireproofing material is discharged through the wooden body in a solution applied under pressure in the direction of the grain of the wood. It has been found in the employment of the processes of the first class aforesaid that the impregnation of the body of wood is merely superficial unless the liquid is forced therein under very high pressure, and to secure the deposit of the fireproofing material through the body of wood to the center thereof a wasteful excess of said material must be forced within the periphery of said body, the density of deposit decreasing directly in proportion to the decrease of the radial distance of the region of deposit from the center of the body. On the other hand, it is characteristic of the processes of the second class aforesaid that the deposit of fireproofing material within the wooden body is insufficient, being limited to the grain-pores thereof, the cells and fibers intermediate of said pores being practically free from deposit and susceptible to attack by fire.

It is the object of my present process to eliminate the detrimental features of the processes of both of the aforesaid ordinary classes and to secure the advantageous features thereof in the provision of a process whereby a reagent may be deposited or formed throughout a body of wood, beginning first with the grain-pores extending from end to end of said body and ending in the disposition of said reagent radially through all of the cellular structure of said body from the center of the latter outwardly to its periphery.

Generally stated, my process consists in injecting a fluid reagent in a wooden body under pressure at one end thereof in the direction of the grain of the wood, discharging the fluid of solution from the opposite end of said body until the specific gravity of the fluid being emitted at the discharge end of said body is substantially equal to that of the fluid at the initial end thereof, thereupon preventing the escape of said fluid from said body at said discharge end thereof, and continuing the injection of the fluid under pressure until it is distributed radially from the center through the substance of the wood and appears at the circumference thereof.

As hereinafter described, my process is of particular advantage in the deposit or formation of an insoluble salt within a wooden body by submitting said body to the successive action of two chemical fluids which react upon each other in the production of such salt.

It may be here stated that I have made several hundred practical tests with my present process and with the aforesaid processes of the prior art with the object of ascertaining precisely the relative commercial value thereof, and as the result of said tests I find that by my present process the addition of approximately six per cent., by weight, of a given fireproofing material to a given wooden body suffices to impart to said body a fire-resisting capacity equal to that secured by the addition of approximately eighty per cent. of fireproofing material by the processes heretofore known. My present process is, therefore, highly advantageous in economy of the fireproofing material, which is the principal item of cost in fireproofing wood. Moreover, by my present process the addition of the required small percentage of fireproofing material may be accomplished in less than ten

minutes with a pressure of less than one hundred pounds per square inch, while, on the other hand, the addition of the large percentage of fireproofing material required by the old processes necessitates the application of said material under pressure of at least five hundred pounds per square inch during a period of approximately six hours, and therefore my present process is of additional advantage both in economy of time and in economy of fuel, &c., required to produce the necessary pressure.

In the drawings, Figure I is a side view of an apparatus conveniently adapted for the conduct of my process. Fig. II is a longitudinal sectional view of said apparatus. Fig. III is a transverse sectional view of said apparatus, taken on the line III III in Fig. I. Fig. IV is a transverse sectional view of said apparatus, taken on the line IV IV in Fig. I. Fig. V is a view similar to Fig. IV, but including a cylinder arranged to inclose the wooden body being treated.

I will now describe in detail the apparatus shown in the accompanying drawings as the same is employed in the conduct of my process.

In said figures, 1 is a wooden body whose opposite extremities 2 3 are respectively engaged by the adjustable heads 4 5, a fluid-tight joint between said heads and the circumference of said body being made by the respective stuffing-boxes 6 7, arranged to compress the packing 8 9 upon said body. The head 5 is conveniently mounted upon the standard 10, formed upon the bed-plate 11, and the opposite extremity of said bed is provided with a movable standard 12, through which is entered the screw-threaded stem 13, by which the head 4 may be adjusted to and fro with respect to the head 5 to conveniently receive wooden bodies of different length.

The position of the head 4 with respect to the head 5 is approximately determined by shifting the standard 12 upon its rollers 15, and after said standard 12 is clamped to the bed-plate 11 by the bolts 16, whose T-heads 17 engage in the channels 18 of the bed 11, the accurate adjustment of the head 4 is effected by rotation of the screw-threaded stem 13, said head 4 being conveniently supported upon the rollers 19, as indicated. Said rollers 15 are provided with eccentric-shafts 20, so that the standard 12 may be lowered upon the bed 11 or may be lifted clear thereof for transportation, and the rollers 19 are provided with similar eccentric-shafts 21.

The head 4 is provided with a piping connection 25, controlled by the valve 26. The head 5 is provided with the piping connection 28, controlled by the valve 29, and said pipe 28 is provided with a branch 30, controlled by a valve 31. I also find it convenient to provide the heads 4 5 with respective air-vent valves 34 35.

The apparatus above described is utilized in the conduct of my process as follows: The log or cut timber constituting the wooden body 1, having been engaged by the heads 4 and 5, sealed by the packing 8 and 9, above described, a fluid reagent is admitted by the pipe 25 to the head 4, from which the atmospheric air is permitted to vent at the valve 34 until the head is fully charged with the reagent fluid. The head 5 being open to discharge through the pipe 28, the continued injection of the reagent through the pipe 25 effects the distribution of said reagent from the end 2 of the wooden body through the grain-pores thereof to its end 3. The fluid at first emitted from the discharge end 3 of the wooden body 1 comprises any fluid previously existing in the body 1, such as water of sap, &c., which is driven forth by the incoming reagent. As soon as the fluid emitted from the grain-pores at the discharge end 3 of the body 1 is of the full strength of the fluid injected at the initial end 2 of said body the further escape of said fluid through the pipe 28 is prevented by closure of the valve 29, and thereupon the injection of the fluid being continued the latter is forced radially outward from the grain-pores through the surrounding cellular structure of the body 1 until it appears at the circumference of the latter. If it is desired to impregnate the wooden body 1 with but a single reagent, the process may be terminated with the last step aforesaid. However, if it is desired to produce a mixed salt by the association of two reagents within said body the operation aforesaid is supplemented as follows: The valve 29 is again opened to permit escape of fluid from the end 3 of the body 1 through the pipe 28, and a second fluid reagent of suitable character is admitted by the pipe 25 to the head 4 and thence distributed through the grain-pores of said body from the end 2 to the end 3 thereof. As soon as the fluid emitted from the discharge end 3 of the body 1 through the pipe 28 is of the full strength of the fluid injected at the initial end 2 of said body the further escape of said fluid is prevented by closure of the valve 29, and thereupon the injection of said second fluid being continued the latter is forced radially outward from the grain-pores through the surrounding cellular structure of the body 1 until it appears at the circumference of the latter, thus intimately associating the two reagents throughout all of the structure of the wooden body from the center to the circumference thereof and producing an insoluble mixed salt therein.

I find that after the grain-pores of a wooden body are impregnated from end to end thereof, as in the first step of my process above described, the time required to effect the radial impregnation of the remaining cellular structure of said body is materially shortened by injection of the fluid within said body simultaneously from both ends thereof, and for this purpose the branch pipe 30 may be connected with the same supply of fluid as the

pipe 25 and the backflow thereof through the pipe 28 be controlled by manipulation of the valves 29 and 31.

The apparatus shown in Figs. I to IV, inclusive, wherein the circumference of the wooden body is so exposed during treatment as to be readily observed by the operator, may be advantageously employed in the treatment of green or other perfectly-sound timber. However, it is well known that the ordinary seasoning of timber frequently develops lateral fissures therein on the lines of the medullary rays, and the aforesaid open apparatus cannot be employed to advantage in the treatment of such a fissured wooden body for the reason that the fissures aforesaid afford a ready vent for the reagent fluid injected within its grain-pores, and thus render it difficult to distribute the reagent throughout the structure. I find that the difficulty aforesaid may be entirely overcome by inclosing the body 1 with a cylindrical shell 30, as indicated in Fig. V, which shell may be united in fluid-tight relation with the opposed heads 4 5 by any convenient means. Said shell being provided with suitable piping connections 37 38, respectively, controlled by valves 39 40, any suitable fluid may be introduced to said shell surrounding the body 1 and form a hydrostatic band around the body 1 to prevent the splitting of said body during rapid treatment and also to check the discharge of the reagent fluid through any lateral fissures which may exist in said body.

It is to be noted that during the treatment of a wooden body with a reagent in solution, as above described, the liquid first emitted from the discharge end of said body is practically free from the reagent existing in the solution being injected at the initial end thereof, the reagent having been filtered from the solvent liquid during its passage through the wooden body. However, the injection being continued, the specific gravity of the liquid being emitted gradually increases until it is substantially equal to that of the original solution, at which stage in the process I find that the solution has distributed the reagent entirely through the grain-pores of the wooden body, but without penetration of the cellular and fibrous structure surrounding the grain-pores thereof, and the injection of the solution may be continued indefinitely without causing the reagent to penetrate said cellular and fibrous structure if the discharge of said liquid from the end of the wooden body is permitted to continue. Therefore the structure surrounding said grain-pores can only be impregnated with the reagent by preventing the further escape of the liquid at the discharge end of said body while the injection of the solution therein is continued, as hereinbefore described.

It is to be understood that the process herein described may be utilized in impregnating wood with any suitable fireproofing, preservative, or other reagent, and I do not desire to limit myself to the use of any particular chemical or chemicals. However, I cite the following as typical chemicals, which are both fireproofing and preservative: aluminium sulfate, used alone or with other ingredients, in a single aqueous solution, from which the salt is deposited without apparent decomposition; calcium chlorid followed by aluminium sulfate and producing insoluble calcium sulfate and aluminium chlorid; sodium silicate followed by calcium chlorid and producing insoluble calcium silicate and sodium chlorid.

The foregoing reagents are conveniently employed in aqueous solution. However, I do not desire to limit myself solely to the employment of reagents in liquid form. For instance, sodium silicate may be followed by carbonic-acid gas, with the resulting production of insoluble calcium silicate and sodium carbonate.

It is to be noted that although the resulting salts last named in each instance aforesaid—to wit, aluminium chlorid, sodium chlorid, and sodium carbonate—are *per se* hygroscopic, such salts when deposited with their companion salts as specified are prevented from manifesting their ordinary hygroscopic capacity, the atoms of hygroscopic salts being, as it were, enmeshed or entrained in the atoms of their companion salts which are not hygroscopic, so that wood treated with any one of the foregoing pairs of reagents is entirely free from any apparent hygroscopic tendency and practically moisture-proof. Moreover, although I have described a particular type of apparatus as a means by which my process may be conducted, I do not desire to limit myself to said means, as it is obvious that various forms of apparatus may be devised for the purpose described.

I claim—

1. The hereinbefore-described process of impregnating a body of wood, which consists in injecting a fluid reagent through said body from one end thereof to the other, in the direction of the grain of wood; discharging the fluid from the opposite end of said body until the specific gravity of the fluid being emitted is substantially equal to that of the fluid being injected; thereupon preventing the escape of the fluid from said body at the discharge end thereof; and continuing the injection of the fluid, until it is distributed radially from the center through the substance of the wood and appears at the circumference thereof, substantially as set forth.

2. The hereinbefore-described process of impregnating a body of wood, which consists in injecting a reagent in solution through said body from one end thereof to the other, in the direction of the grain of the wood; discharging the solvent liquid from the opposite end of said body until the specific gravity of the liquid being emitted is substantially equal to that of the solution being injected; thereupon

preventing the escape of the liquid from said body at the discharge end thereof; and continuing the injection of the solution until the reagent is distributed radially from the center through the substance of the wood and appears at the circumference thereof, substantially as set forth.

3. The hereinbefore-described process of impregnating a body of wood, with a mixed salt, which consists in injecting a fluid reagent through said body from one end thereof to the other, in the direction of the grain of the wood; discharging the fluid from the opposite end of said body until the specific gravity of the fluid being emitted is substantially equal to that of the fluid being injected; thereupon preventing the escape of the fluid from said body at the discharge end thereof; continuing the injection of the fluid until it is distributed radially from the center through the substance of the wood and appears at the circumference thereof; terminating the injection of said first reagent; injecting a second fluid reagent through said body from one end thereof to the other, in the direction of the grain of the wood; discharging said second fluid from the opposite end of said body until the specific gravity of the fluid being emitted is substantially equal to that of the fluid being injected; thereupon preventing the escape of said second fluid from said body at the discharge end thereof; and continuing the injection of said second fluid until it is distributed radially from the center through the substance of the wood, and in association with said first fluid, produces an insoluble salt, throughout the substance of the wood from the center to the circumference thereof, substantially as set forth.

4. The hereinbefore-described process of impregnating a body of wood, with a mixed salt, which consists in injecting a reagent, in aqueous solution, through said body from one end thereof to the other, in the direction of the grain of the wood; discharging the solvent liquid from the opposite end of said body until the specific gravity of the liquid being emitted is substantially equal to that of the solution being injected; thereupon preventing the escape of the liquid from said body at the discharge end thereof; continuing the injection of the solution until the reagent is distributed radially from the center through the substance of the wood and appears at the circumference thereof; terminating the injection of said first solution; injecting a second reagent, in aqueous solution, through said body from one end thereof to the other in the direction of the grain of the wood; discharging the solvent liquid from the opposite end of said body until the specific gravity of the liquid being emitted is substantially equal to that of the second solution being injected; thereupon preventing the escape of said second liquid from said body at the discharge end thereof; and continuing the injection of said second solution until the second reagent is distributed radially from the center through the substance of the wood, and in association with said first reagent produces an insoluble salt throughout the substance of the wood from the center to the circumference thereof, substantially as set forth.

In testimony whereof I have hereunto signed my name, at Philadelphia, Pennsylvania, this 14th day of May, 1901.

JOSEPH L. FERRELL.

Witnesses:
ARTHUR E. PAIGE,
PHILIP PISTOR.