May 28, 1929. H. P. VANNAH ET AL 1,714,701

METHOD OF IMPREGNATING WOOD

Filed May 20, 1927 2 Sheets-Sheet 1

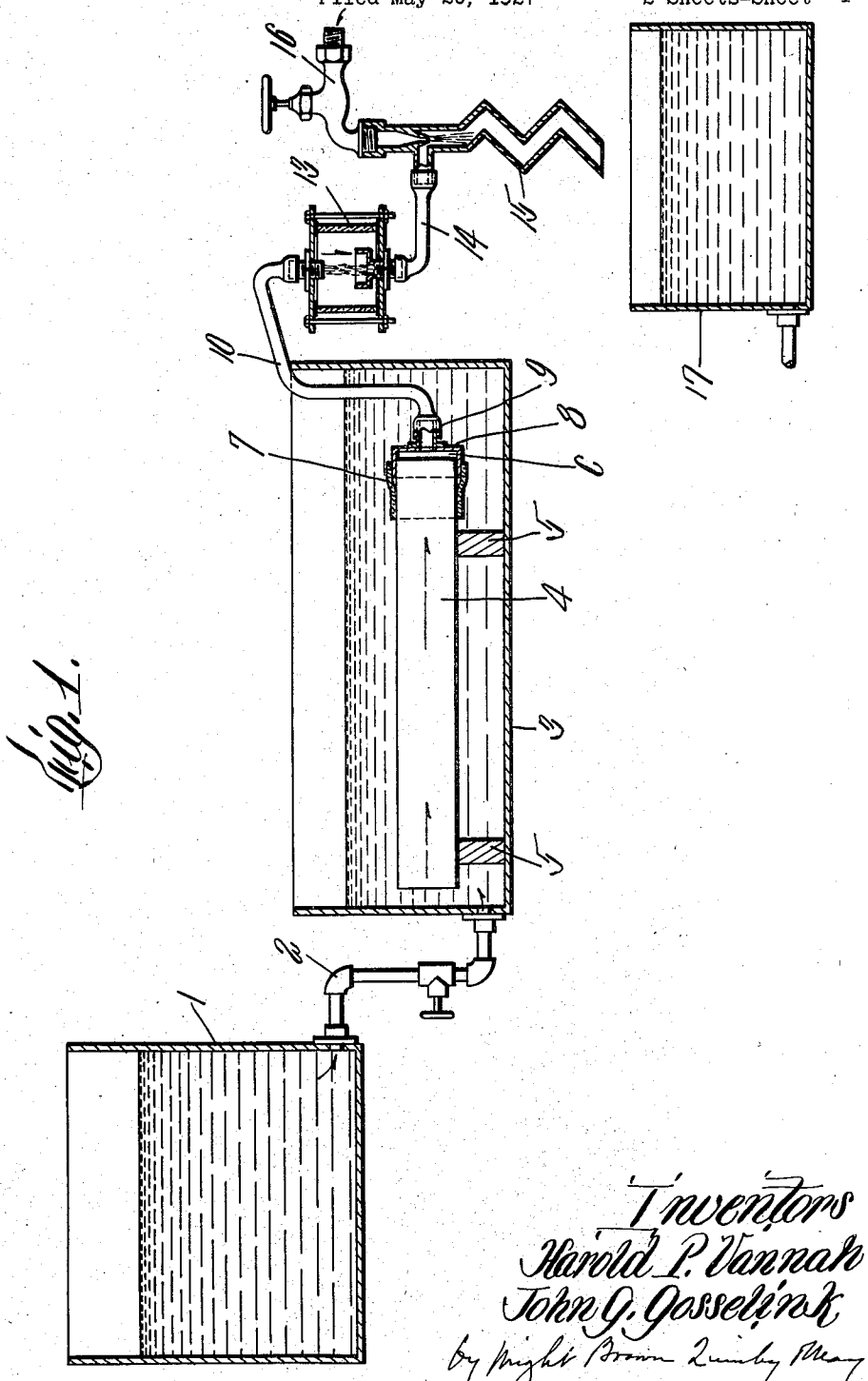


Fig. 1.

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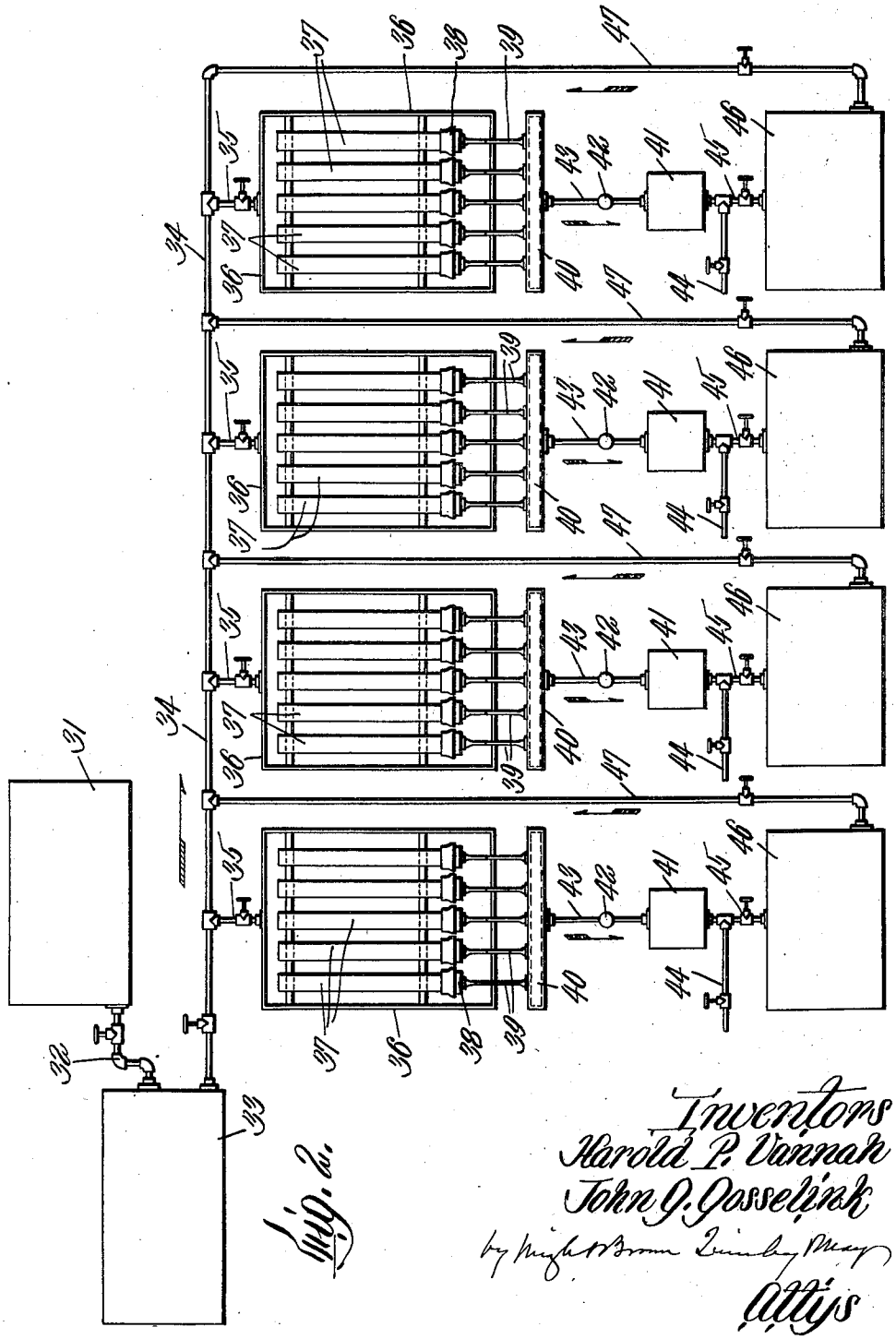


Fig. 2.

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UNITED STATES PATENT OFFICE.

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METHOD OF IMPREGNATING WOOD.

Application filed May 20, 1927. Serial No. 192,870.

This invention relates to the impregnation of wood with fluids, and has for its object to provide an effective and economical method of, and apparatus for, thoroughly impregnating wood with various fluids, such as staining or fireproofing reagents, preservatives, or the like, whether liquid or gaseous.

Generally stated, our method comprises applying suction to one portion of the wood while another portion is in contact with the desired fluid. This method may be practised most expediently while the wood is in log form, by applying suction to one end of the log while it is enveloped in the desired fluid. Suction thus applied removes not only the air from the wood cells and interstices, but also free moisture or sap which may be present therein, thus causing the desired fluid to be sucked into and through the wood, and thus to effect a rapid and thorough penetration thereof.

A method such as described finds utility, for example, in staining a relatively inexpensive wood, such as birch, to a color simulating expensive woods, such as walnut, mahogany, and rosewood. Such staining may be accomplished more effectively and more economically than the staining methods heretofore employed. For instance, it has been proposed to stain wood by feeding staining reagents to the living tree. Such a method depends upon the circulatory or sap action of the tree, and is hence effective only during the season of sap-flow through the tree. Moreover, this method effects a penetration and staining of only the sapwood portion of the tree, for the heart wood, though living and constituting a valuable portion of the wood, does not have sap-flow therein.

Where our method is applied to the staining of wood, another feature of our invention resides in the employment of reagents of a certain class, namely, solutions which may be readily sucked through the wood to impregnate the same, and then chemically converted in situ in the wood into staining reagents such as dyes or pigments, preferably the latter, owing to their "fast" or firm fixation to the wood fibers. Thus, the solutions which we preferably employ are solutions of organic dye intermediates, which produce a stain or color in the wood by reaction with one or more of the wood components and/or by oxidation. Thus, while we may successfully employ solutions of such dye intermediates as 2–4 diaminophenol, hydrochloride, 2-napthylamine, 1-sulphonic acid, fast brown Y. S., or the like, we have found it to be difficult or impossible to employ the usual dyes which are mixtures or semi-colloidal solutions. Thus, in the case of mixtures, one constituent of the mixture may penetrate into and through the wood more rapidly than the other, and thus produce streaky effects; in the case of semi-colloidal solutions, penetration may take place slowly, if at all.

Inasmuch as solutions of dye intermediate such as we employ tend to oxidize in the air when neutral or alkaline, and to precipitate insoluble pigments, premature oxidation must be prevented, as the precipitated pigments retard penetration of the solution into the wood. This may be accomplished effectively in either one of two ways: either the solution is protected from the air by a superficial layer of a suitable oil, such as kerosene; or the solution is made slightly acid and therefore unsusceptible to oxidation. In such latter case, after the acid solution has been sucked through the log, a weakly alkaline solution, such as aqua-ammonia, is then sucked therethrough, to permit oxidation of such intermediate in situ in the wood. Where the solution is protected from premature oxidation, the oxygen of the air effects an oxidation of the intermediate in situ in the wood.

A better understanding of our invention may be obtained from the following more complete description thereof when considered in conjunction with the accompanying drawings, wherein

Figure 1 represents diagrammatically a single log being impregnated by our method.

Figure 2 represents a plan view of apparatus which may be employed commercially in practising our method.

While our method will be described as applied to the staining of wood, it is to be understood that it may find application in the impregnation of wood with various other reagents.

Referring to Figure 1 of the drawings, 1 represents a tank in which a supply of the desired staining reagent or solution of dye

intermediate such as previously described is maintained. The reagent gravitates from the tank 1 in regulated amount, through a valved pipe 2 into a tank 3, wherein a log 4 to be stained is submerged in the staining reagent. The log is shown supported near its ends on a pair of supports 5. While the log is thus submerged, suction is applied to one of its ends. For this purpose, a cap 8, constructed to fit loosely over the end of the log, is assembled therewith, so as to form a vacuum chamber *c* at its end. The clearance opening between the open end of the cap and the periphery of the log is then closed off, as with a suitable sealing material, such as coke-oven pitch or "Smoothon" cement, or with a rubber collar 7, as shown. The closed end 8 of the cap is provided with a nipple 9, communicating with the vacuum chamber *c* and a suitable wet vacuum pump. As shown, the nipple is connected by tubing 10 to a sight glass 13, which, in turn, is connected by tubing 14 to a water jet aspirator 15 supplied with air from a water supply cock 16. The liquid effluent from the aspirator is discharged into a tank 17. When suction is initially applied to the log, the liquid effluent contains sap and moisture sucked from the wood, which may be discarded. Later, as the staining reagent is sucked into and through the log, the effluent begins to show characteristic colors, and its reagent content gradually increases. If desired, the effluent obtained during the later stages of impregnation may be recovered and used in preparing a fresh solution of staining reagent.

By our method, a rapid, uniform, and complete staining of the entire log is effected, as suction not only removes the air present in the wood cells and interstices, but also free moisture and sap which would otherwise impede penetration, to form voids into and through which the reagent is sucked.

While our method is particularly applicable to wood in log form—particularly unbarked logs which are free from cracks which tend to prevent removal of moisture and sap from the wood—nevertheless very good results may be obtained by treating wood in the form of lumber having straight grain, as presumably the action which takes place is like that in a log, the reagent passing through the wood along the lines of the grain. Such lumber may be produced by cutting slabs from a log to produce boards of square or rectangular section, substantially free at its sides from end grain, which would tend to interfere with the speed and efficacy of penetration.

We have found that seasoning wood for several months, as might be necessary when handling, does not interfere with its impregnation. Complete seasoning for a year or more, or kiln-drying, on the other hand, decreases its penetrability quite markedly, as apparently shrinking and closing of the wood cells takes place.

Referring to Figure 2, which shows apparatus which may be employed commercially in practising our method, 31 represents a storage tank in which a supply of reagent is maintained. The reagent is fed in regulated amount through a valved pipe 32 to a supply tank 33 from which it is withdrawn in regulated amount through a valved distributing pipe 34 and passed through a series of pipes 35 into a series of impregnating tanks 36. In each tank, there are a plurality of logs 37 submerged in the reagent and having communication through caps 38 at their ends, and pipes 39, to a suction manifold 40 communicating with a wet suction pump 41. A sight glass 42 is preferably provided in a pipe 43 leading from the manifold to the pump 41, to enable an operator to note the characteristics of the effluent being sucked from the logs, and thus to ascertain the extent of penetration at any time. The effluent from the pump is initially discarded through a pipe 44, but the effluent during the later stages of impregnation, being of higher reagent content, may be passed from the pump through a pipe 45 into a storage tank 46, from which it may be withdrawn and returned through a pipe 47 and thence through the pipe 34 to the supply tank 33, whereto fresh reagent in desired amount may be fed and mixed with the effluent to produce a reagent of the desired composition for the impregnation of fresh logs.

While our method has been described in connection with the staining of relatively inexpensive wood to produce a product simulating an expensive wood, as previously stated, it is to be understood that it may be applied in the impregnation of wood with various other materials, such as solutions of preservatives, e. g., zinc chloride or mercuric chloride, or solutions of fire-resisting materials such as phosphates, tungstates, or the like.

Having thus described our invention, it is evident that various changes might be resorted to in procedure, construction and arrangement of parts, without departing from its spirit or scope as defined by the appended claims.

What we claim is:

1. A method of staining wood, which comprises sucking through the wood a solution of an organic dye intermediate capable of precipitating pigments by oxidation, while preventing oxidation of such intermediate, and then effecting oxidation of such intermediate in situ in the wood.

2. A method of staining wood, which comprises sucking through the wood an acid solution of an organic dye intermediate capa-

ble of precipitating pigments when neutral or alkaline, by oxidation; and then sucking an alkaline solution through such wood to permit oxidation of such intermediate in situ in the wood.

3. A method of pigmenting wood with an organic dye intermediate capable of precipitating pigments by oxidation, which comprises removing the air from the wood pores and interstices while the wood is submerged in the intermediate, and then effecting the oxidation of the intermediate to precipitate pigments in situ in the wood.

4. A method of staining wood, which comprises sucking through the wood an acid solution of an organic dye intermediate capable of precipitating pigments when neutral or alkaline, by oxidation; and then sucking aqua-ammonia through such wood to permit oxidation of such intermediate in situ in the wood.

In testimony whereof we have affixed our signatures.

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