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WOOD IMPREGNATION

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This invention relates generally to the art of preserving wood and has special reference to a process of impregnating woods with preservative solutions of the character in which the active ingredient is dissolved in a light solvent.

Heretofore, in the practice of preserving wood, such as lumber, ties, timbers and the like, it has been the common practice to first subject the wood undergoing treatment to substantial pressures in order to effect a compression of the air and gases within the cells of the wood; then, while this pressure is maintained, a hot preservative, such as creosote, is applied. After the hot preservative has been sufficiently absorbed, the pressure is released, giving what is known in the art as "kick back," or recovery of preservative from the impregnated wood.

More recently, attempts have been made to utilize in the process just described, preservatives of the character in which an active ingredient, such, for instance, as a chlorinated-phenol, is dissolved in a light solvent. These efforts have not been generally accepted because they require the employment of precautionary measures as, for instance, the use of inert gases rather than air for subjecting the timbers to the preliminary pressure lest explosion of the light solvent occur when it is introduced into a chamber under considerable pressure and in the presence of oxygen.

The object of the present invention, generally stated, is to provide a process of pressure impregnating wood with preservatives so as to secure a substantial recovery of impregnated preservative.

Another object of the invention is to provide a safe process of impregnating wood in which a light solvent is used and which does not require the use of inert gases.

Other objects will become apparent to those skilled in the art when the following description is read.

In accordance with the present invention, generally stated, the wood to be impregnated is subjected to a bath of preservative solution at or near atmospheric temperature. Sufficient pressure is applied to the bath of preservative solution to secure the desired degree of impregnation in the wood. As the preservative solution is thus, by pressure, driven into the cells of the wood, the residual gases of the wood cells are subjected to compression. After the desired degree of impregnation has been achieved, the pressure is reduced to atmospheric, and the temperature of the wood is elevated sufficient to effect an expansion of the occluded fluids (both residual and absorbed liquids and gases) in the wood cells, with the result that the excess of the impregnated preservative is forced out and thus recovered.

Elevation of the temperature of the wood may be accomplished in a variety of ways. For instance, the bath of preservative solution may be directly heated in any suitable manner, or the original preservative solution (at atmospheric temperature) may be withdrawn and replaced with preservative solution at a higher temperature, which latter may, if resired, be directly heated in order to secure or maintain the desired elevated temperature.

The elevated temperature which is observed in the hot phase of the process of the present invention may be from 125° to 225° Fahrenheit, depending upon the species, seasoning and size of the wood, and the temperature at which the cold or pressure phase of the process is carried out. In any case, however, care should be exercised to secure a temperature differential, between the cold phase and hot phase of the present invention, sufficient to substantially expand the fluids occluded in the timber. A temperature differential of at least 50° Fahrenheit is usually necessary to accomplish high recovery, but the lower the temperature at which the cold (pressure) phase of the present process is carried out, the lower need be the temperature differential, other variables remaining constant.

After the elevated temperature has been maintained for a time sufficient to effect the desired expansion of occluded fluids and accomplish the desired recovery, the impregnated wood may either be removed from the bath of hot preservative solution or may be first subjected to a vacuum for further recovery of impregnated preservative solution.

While the invention is particularly applicable to organic preservative solutions of the character in which an active ingredient of the character of creosote, phenols, chlorinated phenols, such as pentachlorphenol, tetrachlorphenol, dichlorortho-phenylphenol, or beta naphthol, copper naphthenate, is dissolved in a light organic solvent, such as light fuel oil, furnace oil, engine distillate, mineral spirits, aromatic petroleum and coal tar solvents, or so-called Stoddard solvents, it may nevertheless be used in applying the common creosote-oil preservatives. In cases where such light solvents are employed, however, the process of the present invention may be carried out without hazard of explosions resulting from the introduction of a readily combustible hydrocarbon into a hot atmosphere of compressed air, and it is to

this aspect of the wood preserving art that the present invention is primarily addressed.

In carrying out the process of the present invention wherein the preservative solution consists of, for example, five percent of pentachlorphenol dissolved in light fuel oil, the wood, whether in the form of lumber, timbers, cross ties, poles, piling, or otherwise, may, in accordance with the usual practice, be loaded upon tram cars and placed in a retort which is capable of being hermetically sealed. The retort is then filled with the preservative solution at a temperature at or near atmospheric. It is desirable to completely fill the retort with the preservative solution, and hence provision is usually made for venting the air from the retort and the vent may be closed when the air is completely discharged. It will be understood, however, that the process of the present invention may be carried out with a pocket of air retained in the top of the retort. For example, if yellow pine is being treated, the preservative solution may be pumped into the retort until the pressure of approximately 200 pounds per square inch is obtained, and this pressure may be maintained until the desired gross impregnation has been accomplished. The extent of impregnation may be determined in accordance with the usual practice by ascertaining the volume of impregnating solution which has been forced into the retort.

After the desired gross impregnation has been achieved, the pressure in the retort is relieved as, for instance, by venting the retort to the atmosphere.

Thereupon, the temperature of the preservative solution in the retort is elevated. This may be accomplished directly or indirectly. For example, if it is desired to directly elevate the temperature of the preservative solution, suitable heating devices, such as steam coils, may be provided on the interior of the retort. In most instances, it is preferable to withdraw the cold solution from the retort and fill completely with preheated solution, which may be maintained at high temperature or raised by means of retort steam coils. All, or any part, of the cold solution may be withdrawn before any hot solution is introduced.

The specific temperature to which the bath is ultimately elevated in any given case depends not only upon the character of the wood being treated, but upon the seasoning and the size of the timbers.

In the case of the treatment of well seasoned yellow pine two-by-fours, it is desirable to elevate the temperature of the preservative solution to an ultimate maximum of 175°–200° Fahrenheit, it being understood that the higher the temperature, the greater the recovery of impregnated preservative solution and the less the retention, and vice versa.

For substantially green yellow pine two-by-fours, which have previously been either steamed or boiled in oil, in accordance with the usual practice, two alternatives present themselves. If the timber is first permitted to cool to about atmospheric temperature, the hot phase of the process of the present invention may be carried out at maximum elevated temperatures of about 150°–175° Fahrenheit. On the other hand, if the timbers are subjected to impregnation with the cold preservative solution while still hot from the steaming or boiling treatment, the temperature of the cold preservative solution will be elevated to some extent by heat exchange from hot timbers and, accordingly, it is necessary, in this case, to resort to higher temperatures for the hot phase. Satisfactory treatment in the latter instance may be accomplished by observing a maximum elevated temperature of 175°–200° Fahrenheit.

Larger timbers of well seasoned yellow pine are preferably heated to a maximum temperature of 175°–225° Fahrenheit, but heated for a longer period.

Optimum results are obtained with well seasoned oak two-by-fours by observing a maximum of elevated temperatures of 175°–200° Fahrenheit.

Douglas fir in the form of two-by-fours may be advantageously treated by observing a maximum temperature of the preservative solution between 140°–180° Fahrenheit.

Those skilled in the art will understand that the elevated temperature of the bath of preservative solution may be controlled so as to secure the desired recovery of absorbed preservative solution, thus to reduce the gross impregnation to the desired final net impregnation. The temperature to which the wood is subjected must be maintained below that which will produce excessive volumes of gas, by volatilization of residual or absorbed liquids within the wood, as such might effect splitting, disruption of the cell structures, or have other deleterious effects upon the wood being treated.

The elevated temperature of the bath is maintained for a time sufficient to equalize the temperature of the timbers being treated. For instance, in the case of two-by-fours, a time period of one hour is normally sufficient to bring the interior increments of each timber to the same temperature as the surface increments thereof, but the thicker the timber, the longer period required for such temperature equalization, as those skilled in the art will readily understand.

The elevation of the temperature of the bath effects an expansion of the gases occluded within the cells of the wood as well as expansion to the absorbed solution and, consequently, forces out some of the preservative solution which previously had impregnated the wood. When the desired recovery has been achieved, the hot preservative solution is discharged and, if desired, a vacuum may be applied to the retort to effect some further recovery of impregnated solution.

According to the present invention, it is possible to secure an initial or gross impregnation of twenty-one pounds, or three gallons per cubic foot of dry sap Southern pine lumber and then to recover two gallons, with the result that the treated timber retains one gallon, or less per cubic foot thoroughly and evenly distributed throughout the treatable area of the wood. In such case, the preservative solution consisted of five percent pentachlor phenol dissolved in a light furnace oil having the following specification:

Gravity A. P. I.		18.7
Flash tag C. C.	°F.	175
A. S. T. M. distillation:		
I. B. P.	°F.	386
F. B. P.	°F.	622
10% recovered	°F.	472
50% recovered	°F.	496
90% recovered	°F.	550

By means of the process of the present invention, a deep penetration of the treatable regions of lumber, timber or other forest products may be accomplished with a readily controllable final retention of preservative solution, and, if desired, with a minimum retention below that here-

tofore attainable with comparable treatments. The desirability of low final retention is recognized. This not only reduces the cost of treating, reduces the shipping weight of the treated wood, but produces a product which is clean and remains clean.

While several embodiments of the process of the present invention have been disclosed in detail, it is to be distinctly understod that the invention is not limited to the specific temperatures and pressures or to the specific materials which have been hereinbefore mentioned. On the contrary, it is contemplated that those skilled in the art may modify, adjust and adapt the temperatures, pressures and materials to particular circumstances of use so as to secure the best results. It is, accordingly, to be understood that the invention is not limited to the illustrative examples hereinbefore disclosed, but that modifications and variations may be made within the spirit of the invention as defined in, and without departing from, the scope of the appended claims.

Having thus described the invention, what is claimed is:

1. In the process of preserving wood by impregnation with wood-preserving fluids of the character in which an organic wood preservative is carried in a light organic solvent, the steps consisting of immersing wood in a bath of the preservative solution at atmospheric pressure and substantially at atmospheric temperature, increasing the pressure until a substantial degree of impregnation is effected, reducing the pressure to atmospheric, and, while the wood is immersed in preservative solution of the same composition to the aforesaid baths, heating the impregnated wood at atmospheric pressure at temperatures in the range of 125–225° F. until the temperature of the interior impregnated portions of the wood are substantially equalized with the exterior temperature of the wood.

2. In the process of preserving wood by impregnation with wood-preserving fluids of the character in which an organic wood preservative is carried in a light organic solvent, the steps consisting of immersing wood in a bath of the preservative solution at atmospheric pressure and substantially at atmospheric temperature, increasing the pressure until a substantial degree of impregnation is effected, reducing the pressure to atmospheric, and, while the wood is immersed in preservative solution of the same composition to the aforesaid bath, heating the impregnated wood at atmospheric pressure at temperatures in the range of 125–225° F. until the temperature of the interior impregnated portions of the wood are substantially equalized with the exterior temperature of the wood, said heating step involving elevating the temperature of said bath while the wood is immersed therein.

3. In the process of preserving wood by impregnation with wood-preserving fluids of the character in which an organic wood preservative is carried in a light organic solvent, the steps consisting of immersing wood in a bath of the preservative solution at atmospheric pressure and substantially at atmospheric temperature, increasing the pressure until a substantial degree of impregnation is effected, reducing the pressure to atmospheric, and, while the wood is immersed in preservative solution of the same composition to the aforesaid bath, heating the impregnated wood at atmospheric pressure at temperatures in the range of 125–225° F. until the temperature of the interior impregnated portions of the wood are substantially equalized with the exterior temperature of the wood, said heating step involving withdrawal of the cold solution and immediately replacing the same with hot solution of the same composition.

GALEN WOOD.