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IMPREGNATED WOOD AND PROCESS OF TREATING WOOD.

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This invention relates to the impregnation of wood for the purpose of improving its characteristics and in particular rendering it resistant to decay.

It is now a common practice to impregnate structural timber which is to be exposed to the weather with some preservative agent, creosote oil being that most commonly used. While this oil is a very effective preservative, it is objectionable for the reason that it oozes from the wood at high atmospheric temperatures so that wood impregnated with it cannot be used in locations where it will come in contact with the person or clothing of individuals. Such oozing or exuding of the creosote is also objectionable because it results in gradually reducing the quantity held in the wood. Furthermore, when wood so treated is exposed to the weather the creosote is gradually washed or leached out of it by rains and this action takes place far more rapidly when the wood is used under water.

In my prior Patent No. 1,556,570, granted October 6, 1925, I have disclosed a method of impregnating wood which overcomes these objections, the creosote or other preservative being combined with a sufficient quantity of a high melting point wax, preferably Montan wax, to prevent either the oozing of the preservative from the wood, or the leaching action above described. The wax thus retains the preservative in the wood indefinitely, and it is itself an important protective agent since it is highly waterproof and remains hard and relatively brittle even at high atmospheric temperatures. This earlier invention thus represents an important advance in this art, and it is especially valuable in the treatment of telegraph and telephone poles, piling, structural timber, and wood which is to be used out of doors.

The present invention aims to devise a process of impregnating wood which will produce the advantageous results of my earlier process and which can be practiced even more economically. The invention also involves a novel product. More especially the invention aims to reduce the time required for the impregnating process, to facilitate the impregnation of difficult species, and to make a more economical and efficient use of the impregnating materials.

In my prior patent above designated I have disclosed both a process of impregnating wood with Montan wax or with a compound in which Montan wax is predominating ingredient, and also a variation of this process in which preservative agents are combined with the Montan wax. The present invention also deals with both of these phases of my earlier invention.

Considering first a treatment with Montan wax or its substitutes, or with a compound in which one of these waxes is the important ingredient, the present invention proposes to effect the impregnation in two steps or two movements. The wood to be impregnated is prepared essentially at it is for impregnation by known commercial processes. That is, it is either seasoned thoroughly, or, if unseasoned, it is given some preliminary treatment to remove the surplus water. In case the wood contains an excessive amount of water, it may be placed in the treating cylinder, steamed, and then subjected to a vacuum to remove the excess water.

Assuming that the wood has been properly prepared, it is first impregnated with a liquid which blends readily with Montan wax, or in which the latter is miscible or soluble. Suitable solvents which may be used for this purpose are carbon tetrachloride, turpentine, kerosene and gasoline, but for most treatments I prefer to use a petroleum distillate which comes off between kerosene and gasolene and which is used quite extensively in the paint trade as a solvent. One grade of this oil which I have used very satisfactorily is on the market under the name of Atlantic Safety Solvent. This first impregnation may be effected in a manner similar to that used in impregnating wood with creosote and with the aid of any suitable apparatus. Usually it is preferable to practice the entire process with the aid of pressure apparatus such as is used commonly in commercial wood treating plants. The wood, which may be in various forms, as for example, bridge timbers or telephone poles, is placed in the cylinder, the cylinder is closed, and the treating liquid is forced into it, submerging the wood. A suitable degree of pressure then is applied. Assuming that the solvent used is the oil above mentioned, I consider it preferable to heat the oil to approximately 180° F. and to force the oil into the pores and tracheids

of the wood at this temperature, a pressure of, say, one hundred fifty pounds being used for this purpose. It is obvious, however, that the pressure and temperature used will vary widely with the nature of the solvent, the size and specie of the pieces of wood being treated, the moisture content of the wood, and various other conditions. The solvents above mentioned penetrate the wood very easily even at normal temperatures.

After the desired impregnation of the wood by this liquid has been produced, which can be determined by experience and by watching the pressure gages used on the apparatus, the pressure is relieved and a vacuum is applied to the cylinder for, say, one-half hour, in order to withdraw from the wood a large part of the liquid which has been forced into it. This leaves the cells in the wood comparatively empty, but leaves the cell walls saturated with the oil. Hot Montan wax is now admitted to the cylinder, preferably at a temperature of from 225° to 240° F. and is forced into the wood under a pressure which will depend upon the degree of impregnation desired and the nature of the material under treatment. The vacuum previously applied and the fact that the wood is hot, both facilitate the impregnation with Montan wax. If only the outer strata of the wood are to be impregnated with Montan wax, no pressure other than atmospheric pressure is necessary. On the other hand, if a thorough impregnation is required, a considerable pressure, say one hundred and fifty pounds or more, may be used.

The preliminary impregnation with the solvent seems to have two important effects, one of preparing the wood for the wax treatment so that the wax flows more readily into the pores and tracheids of the wood, and the other of transmitting the heat of the wax much more rapidly to the inner portions of the wood than otherwise would be possible. It is well known that dry wood is a very good heat insulator, and this fact has a very important bearing on the length of time required to make a treatment with such materials as high melting point waxes. Starting from a cold condition it takes several hours to transmit heat from the hot wax through to the heart of a fair sized piece of wood, such as a telegraph pole. If, however, the wood has previously been impregnated with oil, the transmission or transfer of heat takes place very rapidly, and the time required for impregnation is, therefore, greatly reduced.

In some cases it is desirable to give the wood its preliminary treatment with oil, then to remove it from the cylinder and store it for a time before it is given its Montan treatment. In these cases, also, it is found that the preliminary treatment greatly facilitates, and materially reduces the time required for, the second stage of the process, namely, the Montan impregnation. Usually when a considerable time is to elapse between the two steps of the process, the oil is only partially withdrawn from the wood at the end of the first step, and the withdrawal of the remaining oil which is to be removed is effected by applying a vacuum to the wood immediately after it has been introduced into the cylinder again preparatory to impregnating it with Montan wax. Obviously the manner in which the second step of this process is performed and the apparatus used in performing it will depend on the degree of impregnation desired, the equipment available, and similar practical considerations.

The foregoing process is adapted more especially for those cases where the ultimate object is an impregnation with Montan wax or some compound in which it, or one of its substitutes, is the important ingredient. Where the chief object of the impregnation is to preserve the wood, the process above described may be varied by making the first treatment with creosote oil instead of with a relatively inert solvent, such as those above mentioned. Creosote oil and Montan wax are readily miscible so that the same general relationship between the two impregnating agents exists that has been described above.

Assuming that telephone poles, piles, or the like, are to be impregnated to protect them from decay, they would first be given a creosote impregnation, preferably by the empty cell process, which is well known commercially. This treatment is then followed by the Montan wax impregnation, exactly as above described. In such a case, however, only the outer strata of the wood for, say, one-quarter or one-half an inch, need be impregnated with Montan wax. Poles so treated thus have their inner layers or strata impregnated with creosote oil, the pores and tracheids being more or less filled, as desired, while the outer strata of the wood are impregnated with Montan wax. The intermediate strata at a depth inwardly from the surface depending upon the degree of Montan impregnation, are impregnated with a mixture of Montan wax and creosote oil, the relative proportions of the wax and the oil varying as the depth increases.

It will thus be evident that the product produced in the manner above described has the toxicity or protection against decay afforded by the creosote oil, and this toxicity is permanently retained due to the fact that the Montan wax seals the creosote in the wood, protects it from leaching, and prevents the creosote from oozing from the wood when exposed to high atmospheric temperatures. The temperature of the outer

surface of a telephone pole, railroad tie, or the exposed portion of a pile may easily reach 120° F. when such wood is exposed to the sun in summer weather. At this temperature the oil would ooze very freely from the treated timber if the Montan wax were not present. The Montan wax, however, is unaffected at this temperature, and the outer surface of a pole treated as above described therefore remains hard, dry and non-tacky. In fact, the Montan wax will not soften at even a much higher temperature since its melting point is in the neighborhood of 180° F., and it has the characteristic of remaining very hard and brittle as its temperature is raised until the melting point is almost reached. It then passes very abruptly from a solid to a liquid state. Timber treated in this manner can therefore be used in many locations and for many purposes where creosoted wood otherwise would not be permitted.

This process requires very little more time than that necessary for a straight creosote treatment, and it has the advantage of being extremely economical of materials. Usually railroad ties, piles, bridge timbers, and the like, which have been impregnated with creosote contain at least six pounds of creosote per cubic foot of wood, and very frequently the quantity is considerably greater. It has been definitely determined that .34 of a pound of grade *c* of creosote oil per cubic foot of wood is sufficient to give the wood the necessary degree of toxicity to protect it from the fungi that produce decay. The excessive amount of creosote usually forced into the wood is required by the fact that the creasote leaves the wood so rapidly by oozing and leaching that a surplus must be provided in order to be sure that the wood will be protected after five or six years. By using my process above described, however, the necessity for impregnating with an excessive amount of creosote is obviated.

It is not economical to try to produce as light an impregnation as .34 of a pound of creosote per cubic foot of wood, but it is a very easy matter to obtain an impregnation of two and one-half or three pounds per cubic foot of wood. This is ample from a preservative point of view, and a very small quantity only of Montan wax is required to hold this amount of creosote in the wood. Since the Montan wax is highly resistant to weather and is extremely waterproof, it will retain the creosote in the wood for an indefinite period. In the treatment of fairly good sized sticks, such as telegraph poles, railroad ties, and the like, at least 80% of the total treating material used in the process above described will be creosote and less than 20% will be Montan wax. Of course the quantity of creosote per cubic foot of wood, or the proportion of Montan wax, can be increased if desired, but by using substantially the proportions above described, a treatment is produced which is even more economical than the creosote treatment ordinarily given, and it is far superior to this treatment for the reasons above pointed out.

While creosote has been especially mentioned in the above process, since it is the preservative most commonly used in wood impregnation, other preservative agents may be substituted for it. For example, beta naphthol which is an isolation or concentration of the more toxic constituents of creosote oil, may be used with some relatively inert oil, such as crude petroleum or a cheap grade of refined oil. Three percent of beta naphthol mixed with almost any of the common mineral oils will make them sufficiently toxic to fungi to be suitable for use in the process above described. Beta naphthol may also be mixed with the Montan wax to give it toxic properties. Under some circumstances it may be entirely satisfactory to impregnate the wood first simply with a mineral oil and then to seal or imprison the oil in the wood by impregnating the outer strata thereof with Montan wax. It is preferable in the latter case, however, to use beta naphthol, or some other toxic ingredient, in the Montan wax. Also solvents can be used with the Montan wax to facilitate penetration at lower temperatures than otherwise would be necessary.

A further variation of this process which may be successfully practiced is to impregnate the wood first with a water solution of sodium flouride, zinc chloride, or any of the other water soluble poisons, then to allow the wood to season or to drive off the surplus moisture, and finally to give a light treatment of Montan wax in order to prevent leaching. This same process may be used advantageously where it is desired to make the wood resistant to fire, the fire proofing agent, such, for example, as sodium biborate, being introduced in a water solution, and subsequently sealed in with a Montan treatment. In these latter variations, however, the first impregnation does not facilitate the second.

While I prefer to use Montan wax for the purpose of sealing or imprisoning the preservative or other agent with which the inner strata of the wood are impregnated, it is evident that other substances, such as oils, waxes, or the like, could be mixed with the Montax wax. The use of solvents with Montan wax has been mentioned above, and this wax is capable of being diluted or mixed with considerable quantities of other materials, particularly mineral oils, before its softening point is reduced to such a degree that it is rendered unsuitable for use in the present process. For this reason coloring compounds, particularly the oil soluble dies,

may be mixed with it in order to give the impregnated wood the desired color. Both candelilla and carnauba wax have properties similar to Montan wax and may be substituted for it, although they are far more expensive, and the Montan wax is preferable to either of them. Montan wax can be hardened by methods known to the producing industry, and an example of such hardened wax is known commercially as romalin wax. The essential characteristics of the Montan wax, however, remain unchanged.

It is entirely possible to paint the surface of wood treated as above described without having the paint peel or blister, since the Montan wax effectually separates the paint and creosote and protects the paint from attack by the creosote contained in the wood.

The above described process in which a freely penetrating solvent is first forced into the wood and then is followed by a Montan treatment, may also be used to advantage in the treatment of fibreboard, particularly if in the second step of the process the montan is diluted with a solvent. Such dilution facilitates penetration at a given temperature. Stated somewhat differently, a dilution of Montan wax with, say 10% of the petroleum distillate above mentioned, will permit a reduction in the impregnating temperature of from approximately 20° F. to 40° F. This is of advantage in impregnating fibreboard and in treating difficult species of wood.

While I have above referred to certain liquids as solvents for Montan wax, since this appears to be the nature of the relationship between them at impregnating tamperatures, it is possible that in the case of certain of these liquids they are simply readily miscible with the melted Montan wax.

Having thus described my invention, what I desire to claim as new is:

1. That improvement in the process of impregnating wood, fibreboard and the like, which consists in impregnating a piece of said material with a liquid which penetrates it freely, withdrawing a considerable proportion of said liquid, and then impregnating the material so treated with a waxy substance which remains hard and non-tacky at high atmospheric temperatures and which blends readily with said liquid.

2. That improvement in the process of impregnating wood which consists in forcing an oily liquid into the pores and tracheids of the wood, and subsequently forcing into said pores and tracheids a melted waxy substance which blends readily with said liquids but which is hard and non-tacky at high atmospheric temperatures.

3. That improvement in the process of impregnating wood with an impregnating substance which is hard and non-tacky at all temperatures below 120° F. which consists in forcing a solvent for said substance into the pores and tracheids of the wood, withdrawing a considerable part of said solvent from the wood, and then forcing said substance in a melted condition into the pores and tracheids of the wood.

4. That improvement in the process of treating wood to preserve it which consists in impregnating the wood with a preservative, and then sealing said preservative in the wood by impregnating the outer strata thereof for a considerable depth with a waxy material which remains hard and non-tacky at high atmospheric temperatures.

5. That improvement in the process of treating wood which consists in impregnating the wood internally with a substance adapted to improve the characteristics of the wood but incapable of resisting the action of the weather when exposed thereto under severe conditions, and then impregnating the pores and tracheids of the wood for a substantial depth inwardly from the surface thereof with a material which protects said substance from the action of the weather, seals it in the wood, and remains hard and non-tacky in the wood at all temperatures below 120° F.

6. That improvement in the process of treating wood to preserve it which consists in impregnating the wood internally with a preservative oil, and then impregnating the pores and tracheids of the wood for a substantial depth inwardly from the surface thereof with a waxy waterproof material which prevents said oil from oozing from the wood at all temperatures below 120° F.

7. An article of the character described consisting of wood, the inner and outer strata of which are impregnated, respectively, with an oil and a hard waxy material, intermediate strata of the wood being impregnated with a mixture of said substances.

8. An article of the character described consisting of wood, the inner strata of which are impregnated with a preservative, and the outer strata of which are impregnated with a waxy waterproof material which seals said preservative in the wood and remains hard and non-tacky at high atmospheric temperatures.

9. An article of the character described comprising wood, the internal layers of which are impregnated with a preservative which tends to ooze from the wood at high atmospheric temperatures, the outer strata of the wood for a considerable depth being impregnated with sufficient quantity of Montan wax to prevent such oozing at high atmospheric temperatures.

10. An article of the character described consisting of wood, the internal layers of which are impregnated with a toxic quan-

tity of a preservative oil, the outer strata of said wood for a substantial depth being impregnated with a waxy material which seals said oil in the wood and which remains hard and non-tacky at all temperatures below 120° F.

11. An article of the character described consisting of wood internally impregnated with a material poorly adapted to withstand exposure to the weather, the outer strata of the wood for a considerable depth being impregnated with a material consisting chiefly of Montan wax.

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