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METHOD OF TREATING WOOD

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This invention relates to the treatment of pine and other resinous woods for the recovery of turpentine and other substances therefrom. More particularly, the invention is concerned with a novel method of treatment of such woods, by the use of which steam distillation of the turpentine, and extraction of the rosin, etc. therefrom are facilitated and improved, and a woody material is produced which may be utilized for various purposes, such as in the production of a plastic composition suitable for conversion into various articles, such as roofing elements, etc.

In carrying out the new method, the wood used, for example pine, consists of stumps, branches, and otherwise unusable or waste pieces, and this wood is first reduced to chips or splinters of relatively small size, as for instance not substantially exceeding two inches in longest dimension. These chips are first reduced to the form of individual fibres or loosely associated fibre bundles, and I have found that this operation can be carried on rapidly and at low cost in a mixer of the internal type in which there are rotating elements cooperating with one another and with the inner walls of the mixing chamber to act on the pieces of wood with a rolling, crushing, and rubbing action. The pieces of wood are introduced into the mixer preferably with a small quantity of water, and are subjected to the defibering operations in the mixing chamber while under pressure.

In the operation of the mixer, the wood is defibered and the water present in the mixture facilitates this action by softening the wood and the substances which bind the fibres together. For best results, the operation is continued until the wood is reduced to the form of small fibre bundles loosely bound together and individual fibres, since the extraction may be carried on more easily and with a greater recovery from the wood in that condition, and the wood remaining is in a condition suitable for various uses, such as the production of the plastic composition.

The internal mixer which I prefer to employ for the purpose is that commonly used in the rubber industry and known commercially as the Banbury mixer. This mixer as now constructed and as illustrated in one form in Patent No. 1,523,387, includes operating elements which rotate within the mixing chamber and subject the wood under treatment to rubbing and crushing against the walls of the chamber. In addition, the mass of wood is maintained under pressure, so that as the elements rotate, they cause the

pieces of wood to rub against one another, the elements acting on the mass with a churning action. In this operation, the wood is reduced to the form of individual fibres and small fibre bundles, and the fibres and fibre bundles are twisted and bent so that the rosin ducts therein are disrupted and broken down.

After the reduction of the wood has been continued to the desired point, the fibrous material is discharged and is now ready for distillation by means of steam. In the reducing operation, the rosin ducts in the wood have been broken down and the extraction of the rosin is therefore greatly facilitated. The distillation may be carried on in any suitable type of apparatus as, for example, a vessel having a false bottom on which the material is placed, the steam being injected from below and passing up through the fibrous mass so as to carry off with it the more volatile compounds present in the wood. In the distillation operation, the rosin exudes from the ducts and remains on the surfaces of the fibres so that the fibres are substantially encrusted with the rosin, whereas when the wood has been reduced only to chip form, a large part of the rosin remains in the ducts so that its removal is relatively difficult.

The wood is subjected to steam distillation for a sufficient length of time to remove all or substantially all of the turpentine, pine oils, and other volatile materials, and when that operation has been completed, the wood is dried as a preliminary to the removal of the rosin. This drying operation can be carried on in any suitable drying equipment, and if desired, the wood may remain in the extracting vessel, hot air being introduced to effect the desired drying. After the drying has been carried on to an extent such that only a relatively small amount of moisture remains in the woody mass, the rosin is extracted by means of a suitable solvent, such as naphtha. This operation may be carried on in any suitable extracting apparatus and is preferably performed by causing the solvent to flow through the woody mass a number of times so as to insure thorough removal of the rosin. By reason of the reduced form of the wood and the presence of the rosin on the surfaces of the fibres, the removal of the rosin is easy and a large proportion of the rosin can be recovered in a short time.

When the extraction of the rosin by means of the solvent has been completed, the woody material is subjected to steam distillation for a short time to drive off any solvent which remains behind. This treatment with steam not only permits the recovery of the solvent still adhering to

the fibres, but also leaves the fibrous material soft, wet, and substantially free from resins and other gummy substances. Heretofore, the woody material remaining after the extraction of the turpentine and rosins has been discarded as useless or fit only for fuel, but I have found that the soft wet material is admirably adapted for use in the production of a plastic composition and it may be used at once and without further treatment in the production of that composition.

The method of producing the plastic composition which I prefer to employ is that disclosed in my copending application Serial No. 54,714, filed December 16, 1935. According to that method, the soft fibrous material is treated in an internal mixer, such as the Banbury mixer above referred to, in the presence of a suitable binder, such as asphalt, the binder being introduced gradually as the operation proceeds. For best results in the production of the plastic, I find it is desirable that there should be a sufficient amount of water present in the mixer to insure the formation of an inverted emulsion of asphalt, that is, one in which the water is dispersed through the asphalt. The woody material may, as a result of the final steam distillation, contain enough moisture for that purpose, but if the distillation has not been continued to a sufficient extent to insure the presence of the required amount of moisture, the deficiency may be made up by introducing water into the mixer with the wood and asphalt.

In this final operation in the mixer, the fibrous mass is thoroughly dispersed through the binder so that the latter coats and to some extent impregnates the individual fibres. The fibrous material is subjected, in the mixer, not only to the mechanical action of the rotating members, but also to hydraulic shear applied by the members through the viscous binding material. As a result of these actions, the fibre bundles are broken down and the fibres remain in single fibre form. These fibres are characterized by their extraordinary length and the unusual number of fibrillae present thereon, and the presence of the fibrillae in such amount is the result of the shearing action applied through the emulsified binding medium. Upon discharge from the mixer, the fibres in the discharged mass have the characteristics referred to. The plastic mass taken from the mixer may be extruded, pressed, and otherwise formed into various articles which are characterized by great rigidity and strength, high electrical and thermal insulating power, low susceptibility to heat changes, and capability of being cut, sawn, and nailed without fracture.

The new method offers many advantages over that heretofore employed in the recovery of turpentine and similar substances from wood in that the preliminary reduction of the wood in the internal mixer reduces the wood to a condition such that the recovery of the volatiles and resin-

ous substances may be carried on rapidly and with a greater recovery than has been possible when the wood is in the form of chips or splinters. Also, after the extraction operation, the wood is in an ideal condition for the production of the plastic, since it has been reduced almost to the desired final form and is soft and moist. The new method therefore not only insures a greater output of the extracted substances from a given quantity of wood in a shorter time, but also makes available a supply of fibrous material which can be used at once in the production of a valuable plastic composition, instead of having to be discarded as waste or used only as fuel.

I claim:

1. A method of treating wood which comprises defibering wood by subjecting a mass of small pieces of natural wood, while under pressure and in the presence of not more than a relatively small amount of water, to mechanical action which will cause the individual pieces of the wood of the mass to be rubbed one against another until said pieces are broken down into a state of elementary fibres and small fibre bundles in which the rosin ducts have been disrupted and the rosin therein is exposed on the surface of the fibres, and treating the fibrous material so produced with a solvent to extract the resins and similar substances therefrom.

2. A method of treating wood which comprises defibering wood by subjecting a mass of small pieces of natural wood, while under pressure and in the presence of not more than a relatively small amount of water, to mechanical action which will cause the individual pieces of the wood of the mass to be rubbed one against another until said pieces are broken down into a state of elementary fibres and small fibre bundles in which the rosin ducts have been disrupted and the rosin therein is exposed on the surface of the fibres, and recovering volatile substances and resin and similar substances from the fibrous material so produced by means of steam and a solvent employed successively.

3. A method of treating wood which comprises defibering wood by subjecting a mass of small pieces of natural wood, while under pressure and in the presence of not more than a relatively small amount of water, to mechanical action which will cause the individual pieces of wood of the mass to be rubbed one against another until said pieces are broken down into a state of elementary fibres and small fibre bundles in which the rosin ducts have been disrupted and the rosin therein is exposed on the surface of the fibres, recovering volatile substances from the fibrous material so produced by means of steam, extracting resins and similar substances from the fibrous material by means of a solvent, and removing the solvent from the residual fibrous material by steam.

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