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MOLDING, COATING, FILLING, IMPREGNATING, AND BINDING

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This invention relates to the production of molded, coated or impregnated substances or substances having two or more of these characteristics. The substances will have their surfaces relatively resistant to water, fire, acids, alkalis and the like. Likewise the interior or entire body of the substance may be also relatively resistant to water, fire, acids, alkalis and the like.

The invention is useful for impregnating wood fiber and other porous substances, coating porous substances as well as wood and metallic surfaces, making compound or molded lumber, making laminated products and veneer, finishing wood products and metallic surfaces, making composition articles of nonlaminated material and resin binder and making composition board of paper and duck and in other ways.

More specifically the invention relates to the production of articles consisting of or comprising wood or other fibrous or cellular materials coated, impregnated or saturated with a resinous material which is substantially insoluble and infusible and which may act as a coating or filling to finish and protect the wood or other fibrous or cellular material. It may also be used to cause it to adhere to other bodies. The completed product may consist of a unitary structure or a mass of fibrous or cellular material or layers of fibrous or cellular material which may be all or part only coated, impregnated or saturated with the resinous material or held together thereby. The resinous material used is made from peat as a base and consists of the condensation product resulting from causing an alkaline solution of peat to react with an aldehyde and a phenolic body substantially as described in Patent Number 1,681,155 issued August 14, 1928.

In carrying out the invention the resinous material may be associated with such fibrous or cellular or porous material as paper, paper pulp, wood pulp, paper board, textile fabrics, card board, parchmentized fibre, leather, ground leather, saw dust, wood flour, ground wood, exploded wood, linters, flock, asbestos fibers, china clay, talc, whiting, iron oxide and other pigments, textile or granular material. For some purposes metals, stones, or metal or stone surfaces may be treated with the resinous material. Two or more of these various materials may be employed or mixed, associated or combined in a single product.

In the treatment the resin may be employed in a liquid, syrupy, dissolved or powdered form or state. In any of these forms except when powdered, the resin may be used to impregnate or saturate cloth, textile material, paper, paper sheets, card board or any other such sheet material. The powdered resinous material when mixed with them may be used as a binder or adhesive for such loose granular or powdered materials as wood flour, talc, wood pulp, ground cork, ground leather and the like. These loose, granular or powdered substances are also adapted to treatment with the resinous material in the other forms. Likewise the powdered form of the resin may be spread or sprinkled on solid or sheet materials and by appropriate treatment coat them or bind them together.

The compositions described comprise cellular, fibrous or powdered material in combination with a binding, coating or impregnating resin. The composition masses have the virtue of being hard, strong and good electrical insulators.

As one method of carrying out the invention synthetic resin may be first allowed to begin to form according to the process described in Patent Number 1,681,155 and as the reaction product begins to approach the syrupy consistency there may be added fibrous or cellular material in the dry form or slightly moistened with water or other liquid in any desired proportion. The cellular or fibrous materials may be thus caused to swell and in so doing introduce the binder or resinous materials thoroughly about and into the said material and its particles. The mass thus formed may be of about the consistency of dough and so may be formed or pressed into molds and subjected to a pressure of from about 1000 to 10000 pounds per square inch while being raised to a temperature of from about 120° to 150° C. by which

treatment the resin is transmuted into the insoluble and infusible form. After mixing the fibrous or cellular material with the syrupy resin the mass, for ease of manipulation, may, if desired, be dried and ground and reduced to a granular or powdery state and in this dry condition pressed into molds or suitable containers and pressed and heated as indicated above for the final transformation.

In the usual phenol-formaldehyde condensation reaction there has been a formation of two liquids, one of which is water and the other is the condensation product which may be in its partially finished state. These two liquids will separate or stratify on standing which may indicate that the condensation product is not soluble in the liquid. In the process of making the peat-phenol-formaldehyde resin, there is no such separation, as the condensation product seems to remain more or less evenly distributed in the entire solution. If any of the above mentioned filling materials are added to the heretofore known phenol-formaldehyde resin, while in the process of making, the filling materials would be first wetted by the water, since water has a greater affinity for the said filling materials than the resin has, therefore the resin might have little or no opportunity to replace the water and penetrate the fibrous cellular filling materials. Since there is a separation of two liquids which may indicate that the condensation product is not soluble in water, it may be that the water penetrating the said fibrous material really retards the penetration of the resinous material. In the present process there is no such separation and when the fibrous material is added it is immediately penetrated by the resinous material. There is no separation of resin from water in the process of making and since water seems to have a great affinity for fibrous cellular material in this way when it penetrates the cellular structure it carries with it resinous material. The first deposit of resinous material may pave the way for and lead in the more concentrated resinous material which is formed in the latter part of the process thus producing a thoroughly saturated final product. Thus an aqueous solution of the peat-phenol-formaldehyde resin can be used for molding, coating, filling, impregnating and binding.

The resin in the stage in which it is syrupy when cold and liquid when hot may be used to coat or impregnate sheets of paper, parchment, paper board, laminated paper and the like by brushing, spraying or passing through the bath or in any other suitable way. These individual sheets may be individually dried and then heated and pressed as indicated above for the final reduction of the resin or they may be individually dried and then assembled and caused to adhere to each other by piling one on another and formed into a compact laminated mass by the heat and pressure treatment indicated, or the undried sheets may be similarly formed into a laminated pile and caused to adhere by the heat and pressure treatment indicated. Composition board or sheets may be made up of untreated layers alternately with treated layers, the resin in or on the treated layers being relied on to cause the sheets to adhere together and make a substantially unitary laminated structure from the whole after the final transforming heat treatment under pressure. Similarly one or more treated layers may be applied as coatings or veneers to treated or untreated bodies. Thus a layer of saturated material may be applied to stone or metal articles or they may be merely covered with the unadulterated resin to furnish a noncorrosive and/or ornamental surface. Saturated materials or those having a slightly inset surface coat may have the adhering surface resin cut or scraped off thus leaving a hard impregnated or filled surface capable of taking a satisfactory finish.

Another method is to allow the formation of the resin to progress further until it has reached the syrupy state when hot. In this state the resin will be solid when cold. This hot syrupy resin ordinarily may not readily enter into or saturate bodies or sheets, especially if they are thick. While the resin is hot and in the syrupy condition a solvent may be added in the proportion of about one part of resin to about 2 to 5 parts of solvent. This will make what will be termed a concentrated solution. A similar solution to which solvent has been added till there is but about one part of resin to about 10 to 20 parts of solvent will be termed a dilute solution. At first the fibrous or cellular material may be submitted to the action of the dilute solution of the resin. This solution has the property of penetrating the fibrous or cellular material and so paves the way for the penetration of the concentrated resin solution. After the material is saturated with the dilute solution of resin it may be placed in a bath containing the concentrated solution of the resin when the material will become more or less thoroughly saturated therewith and may be removed. Preferably the material will not be dried or otherwise treated between its subjection to the dilute solution and its subjection to the concentrated solution. After being subjected to both solutions it may be dried in an oven and then heated to from about 120° to 150° C. under pressure of from about 1000 to 10000 pounds pressure until the insoluble and infusible form of the resin is obtained. The treated material can be heated and submitted to pressure as indicated above without subjecting it to the preliminary drying in an oven. In coating, sat-

urating or impregnating fibrous and cellular materials, sheets, paper board etc. it is found to be better to first treat the materials with the dilute resin solution and then follow with a treatment with the concentrated resin solution.

A mass of fibrous or cellular material such as paper pulp and the like can be soaked first with the dilute resinous solution and then in the concentrated resinous solution. The mass of saturated or impregnated fibre and resin can be forced into a mold and molded by heat and pressure (about 120° to 150° C. and about 1000 to 10000 pounds per square inch) to any desired shape. The heat and pressure help to bring about the insoluble and infusible form. Or the saturated or impregnated mass may be heated until it dries. It may be then powdered and may be shaped and pressed into any convenient or desired form with the aid of heat and pressure.

When the materials are treated with the partly formed resin or even with the concentrated solution frequently the impregnation or penetration will be partial and incomplete. This is especially so when the material to be treated is in thick sheets or blocks. The dilute solution however, will penetrate and impregnate the whole body and the presence of the dilute solution within the body seems to act as an introduction or guide to the concentrated solution when subsequently applied. Thus a thorough impregnation or penetration may be obtained by the dual treatment, first with the dilute solution and then with the concentrated solution. This manner of proceeding insures successful operation even with materials usually hard to deal with in any form other than the thinnest possible sheets or strips or fragments.

There are various solvents for the partially formed resins at the stages when solution is indicated above. For both the dilute and concentrated solution alcohol or acetone, etc., are suitable and preferred. The solution may take place in a cold solvent but it is preferably aided by heat. The solution may effectively saturate or impregnate the materials treated when cold but the action is hastened and sometimes improved by heating the solution or the materials treated or both.

When a solvent is used the saturated or impregnated mass if desired may be heated or otherwise treated to remove the solvent before proceeding with the further steps in the treatment.

Laminated boards or sheets of any desired thickness and of any desired composition or combination of substances may be built up by any of the methods indicated.

The above described materials can be used for a wide variety of things. The product can serve as a raw machinable material which can be worked by any suitable means into any desired form. The products are of a high mechanical strength and can be used for numerous mechanical or electrical purposes. The resin derived from the peat base is relatively cheap and the resultant product made therewith is relatively cheap. Thus the material described above has improved characteristics over products now in use and may replace or take the place of other more expensive substances in a satisfactory economical way and without the loss of any required or desirable characteristics.

While various specific details of materials, quantities, temperatures, pressures and other items of procedure, operation or result have been set out to clearly disclose the invention it is to be fully understood that they are for illustrative purposes only and are not to be taken as limiting the invention.

I claim as my invention:

1. The method of saturating or impregnating material with the condensation product of an alkaline solution of peat reacting with an aldehyde and a phenolic body comprising, forming a solution of about one part of the condensation product when the mass is in a syrupy state to about 10 to 20 parts of solvent, treating the material to be impregnated with the solution, making a solution of about one part of the syrupy mass to about 2 to 5 parts of solvent, treating the material with the last mentioned solution, and completing the reaction by heating and pressing the impregnated material.

2. The method of saturating or impregnating material with the condensation product of an alkaline solution of peat reacting with an aldehyde and a phenolic body comprising, treating the material with a solution of about one part of the condensation product when the mass is in a syrupy state to about 10 to 20 parts of solvent, treating the material with a solution of about one part of the mass to about 2 to 5 parts of solvent, and completing the reaction by heating and pressing the impregnated material.

3. The method of saturating or impregnating material with the condensation product of an alkaline solution of peat reacting with an aldehyde and a phenolic body comprising impregnating the material with a dilute solution of the condensation product and subsequently impregnating the material with a concentrated solution of the condensation product.

4. The step in saturating cellular material with the condensation product of an alkaline solution of peat reacting with an aldehyde and a phenolic body comprising impregnating the material with a dilute solution of the condensation product to pave the way and lead in a subsequent concentrated solution of the condensation product and treating the material with a concentrated solution of the resin which is led in by the dilute solution.

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