UNITED STATES PATENT OFFICE

DILLON F. SMITH, OF PENSACOLA, FLORIDA, AND ERNEST J. PIEPER AND CLARENCE C. VOGT, OF LANCASTER, PENNSYLVANIA, ASSIGNORS TO ARMSTRONG CORK COMPANY, OF LANCASTER, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA

WATER RESISTANT FIBROUS ARTICLES AND THEIR MANUFACTURE


The present invention relates to water resistant fibrous articles and their manufacture, and more especially to an artificial fiber board of the type which we have designated as "varnish board". In this board the fibers are coated or sized with a varnish. Preferably, sufficient varnish is employed so that it acts not only as a sizing, but also as a binder holding the fibers together in a compacted, hard, structurally strong mass. In general, such board differs from the usual insulating board sold under various trade names and which consists of loosely matted or felted cellulose fibers and containing a considerable air space.

Such insulating board, because of its open porous construction, will readily absorb water. The board herein described is water repellent as a whole, and the varnish binder forms a substantially continuous binder for the fibers, so that the board is not a porous board like the ordinary insulating board, but is a rather hard dense board. Since the board does not have the large volume of inter-fiber air spaces characteristic of insulating boards, it does not have the heat insulating qualities of such insulating boards. On the other hand, it is not water absorbent and may be used in exterior work where it is exposed to the weather.

In making our varnish board, a varnish is put onto the fibers, preferably by forming the varnish in the fibrous pulp from which the board is made. The varnish saturates and coats the fibers, thus waterproofing the individual fibers. It holds the fibers together into a hard dense structure which is water repellent. The board is structurally strong and it may be cut and otherwise handled similarly to lumber.

We will now describe the preferred process of making such board, first with particular reference to the use of fibrous material containing, in itself, a resin. A pulp of this character may be formed by shredding or grinding resinous woods, such as the pines, spruces, etc. An available supply of such wood material is the refuse from plants which extract resin from light wood of the yellow or Southern pine. The light wood is the stumpage and logs of the yellow or Southern long leaf pine which has been exposed for several years in the fields or forest. This light wood is rich in resin and is extracted to recover the resin and turpentine. The wood is first chipped into chips generally about from \( \frac{3}{4} \) to \( 1\frac{3}{4} \)" long, from \( \frac{1}{4} \) to 1" wide, and from \( \frac{1}{16} \) to \( \frac{1}{8} \)" in thickness. The chips are first steam distilled to extract turpentine. They are then treated with naphtha or gasoline to dissolve the resin. The gasoline or naphtha solution is later evaporated and the resin recovered. This extraction process does not extract all of the resin from the chips. It leaves on the average about 5% to 6% of resin in the chips. These chips are at the present time a waste product and are usually burned.

In making our fiber board from such pine chips, the chips are shredded or ground, preferably with water, either hot or cold, to form a pulp. Any suitable shredding or grinding machinery may be used for this purpose. In the procedure now being described, no caustic is added to the water, so that the residual resin will be preserved in and upon the fibers.

A suitable quantity of a seccative oil, such as linseed oil, either alone or dissolved in some solvent, such as naphtha, is added and beaten into the pulp. The oil or mixture of oil and solvent is non-miscible in the water of the pulp and will be deposited upon the wood fibers. The oil which is deposited upon the fibers, and the resin in the fibers, furnish the materials from which a varnish is formed in the completed board. After the oil has been thus deposited uniformly over the fibers of the pulpy mass, the excess water is removed and the fibers are felted into a board or other desired shape in the usual way for making such articles. The wet board is dried at 180° to 200° Fahrenheit. During the drying, the resin and drying oil interact to form a water resistant film over the surface of the fibers. If a consolidating pressure is applied during the drying, a dense board not pervious to water may be produced. It is preferred to compress the board during the drying operation to form a board of this character. However, by regulating the pressure and the amount of varnish forming materials, a board
may be formed which is somewhat porous, although the individual fibers thereof are coated with the varnish and thus rendered resistant to the absorption of the water by the cellulose and the consequent swelling thereof.

The residual rosin in the waste chips from the rosin extracting plants may be otherwise combined with the drying oil to form the waterproof sizing or binder. For example, the pine chips containing the residual rosin left after the naphtha extraction may be shredded and cooked and ground with sodium hydroxide or lime, which will convert the rosin completely or partially into a resinate.

A suitable precipitant, such as aluminum sulphate, aluminum chloride, calcium chloride, etc., may then be added to the pulp to precipitate the rosin as an aluminum resinate or other insoluble size upon the fibers. A drying oil can then be added and the process carried out by forming the board and heating it so as to form the varnish upon the fibers.

In cases where the residual rosin is insufficient to produce enough varnish, rosin dissolved in a solvent, such as naphtha, or a resinate, such as sodium resinate, may be added to the pulp to furnish an additional supply of the rosin constituent of the varnish.

While the rosin-containing pine chips are a preferred raw material because they contain rosin which would otherwise be unrecovurable, and because they are a cheap source of already chipped material, other fibrous materials may be used in our process. Wood fiber, which does not contain a resin, may be used and the resin supplied to it. For example, an ordinary wood pulp may be suspended in water and a resin supplied to it in the form of sodium resinate, which is thoroughly mixed with the pulp. A precipitant, such as aluminum sulphate, may be added to convert the soluble resinate in and upon the wood fibers into an insoluble resinate or size, or, if desired, a resinate which is insoluble in water or resin or other resin, may be dissolved in some solvent, such as naphtha, and beaten with the wood pulp.

The naphtha solution, which is not miscible in the water, will tend to attach itself to and spread over the fibers, thus evenly applying the resin or resinate to them. The expressions "resin bearing fibrous material" or "resin bearing fibers" are intended to include not only materials containing resin originally existing in the fibers, but also fibrous materials to which resin has been supplied.

Then, a drying oil, such as linseed oil, alone or in a solvent to thin it, is thoroughly beaten with the pulp and the oil evenly distributed over the fibers. The excess water is then removed by suction or other means and the pulp made into the desired articles, such as board, which is dried at from 180° to 400° Fahrenheit. The drying causes the varnish-making materials, namely, the resin and oil, to interact and polymerize, and form a varnish upon and penetrating the surfaces of the wood fibers.

The varnish constituents may be added in other ways. For example, the oil may be first distributed through the pulp and afterward the resin solution or resinate distributed through the pulp, or the oil and resin or resinate may be added at the same time. This may be done, for example, by making a naphtha solution containing the drying oil and a resin and beating such solution into the pulp formed by the fiber suspended in water.

If desired, a varnish may be made in the usual way, such as by boiling an oil and resin together to give it body and the varnish thinned in a solvent and thus applied to a pulp. It is much preferred, however, to deposit the varnish-making materials upon the fibers and to thicken or give the body to the varnish during the drying and heating of the article.Various siccative oils or oleaginous materials may be used as the oily constituent of the varnish. The expression "siccative oils" is intended to cover such oils as linseed oil and china wood oil, which are known as drying oils, and also the semi-drying oils, such as soy bean oil, fish oil, etc.

While it is preferred to use a siccative oil as the oily constituent of the varnish, other sic-
Cative oily materials may be used, such, for example, as stearine pitch. Various solvents, preferably solvents which are non-miscible in the water, such as naphtha, gasoline, etc., may be used, if desired, to carry the varnish or varnish-forming constituents into the pulp and distribute them on the fibers. During the drying of the articles the solvents are evaporated and may be recovered.

The heating and drying of the board will usually sufficiently harden it so that it can be handled upon cooling. The cative oleaginous materials in the varnish, however, continue to slowly oxidize in the board. Apparently, the incomplete oxidation and the capacity to take up more oxidation, tends to give more "life" to the board, somewhat, as we believe, analogous to that of a paint film which is not fully oxidized.

The physical characteristics of the board may be varied by adjusting the amount of varnish formed and the pressure under which the article, such as the board, is made. If a small amount of varnish is formed, such, for example, as by using the extracted pine chips containing 5% to 6% of resin and a relatively small amount of oil with them, a board of an open fibrous construction, somewhat resembling the insulating boards now on the market, may be produced, but having superior resistance against swelling due to the protection against water afforded to the fibers by their varnish coatings. Ordinarily, however, the amount of varnish and pressure used in making the board will be sufficient to form a solid and rather non-porous board or other article. Such solid board can be used for exterior work as it will shed moisture when exposed to the weather. The board also has a high structural strength due to the varnish solidly binding together the fibers. It can, therefore, be used for purposes for which the ordinary insulating boards are unsuitable because of their lack of structural strength.

The invention has been described with particular reference to the manufacture of artificial board, but other fibrous articles may be produced, such, for example, as substitutes for various articles of furniture and wooden ware articles now made from natural lumber.

While we have described the preferred embodiments of our invention, it is to be understood that the invention may be otherwise embodied and practiced within its scope as defined in the following claims.

We claim:

1. The process of making fibrous articles, which comprises forming a water-containing pulp of resin bearing fibrous material, adding a cative oleaginous material to the pulp and distributing it over the resin-containing fibers, forming the articles from such pulp, and drying and heating them so as to cause the resin and oil to combine and form a varnish in situ on the fibers.

2. The process of making fibrous articles from the refuse chips from rosin extraction plants, such chips containing residual rosin, which comprises forming a pulp from the chips, adding a cative oil to the pulp, forming the articles from the pulp, and drying them so as to form a varnish in situ upon the fibers.

3. The process of making fibrous articles from the refuse chips from rosin extraction plants, such chips containing residual rosin, which comprises forming a pulp from the chips, adding a cative oleaginous material to the pulp, forming the articles from the pulp, and treating them so as to form a varnish in situ upon the fibers.

4. The process of making fibrous articles, which comprises forming a water-containing fibrous pulp having resin-bearing fibers, adding a cative oily material in a liquid condition to the pulp and heating the pulp so as to distribute it over the resin-bearing fibers, forming articles from such pulp, and drying and heating them.

5. The process of making fibrous articles, which comprises forming a water-containing fibrous pulp, distributing normally liquid varnish-making constituents on the fibers of such pulp while cold, forming the articles from the pulp, and treating them so as to combine the varnish-making constituents and form a varnish in situ on the fibers.

6. The process of making fibrous articles, which comprises forming a water-containing fibrous pulp, distributing an oil varnish liquid at normal room temperatures on the fibers of such pulp, forming the articles from the pulp, and drying and heating them.

7. The process of making varnish-bonded fibrous articles, which comprises forming a water-containing fibrous pulp, adding to the pulp material which will become distributed over the fibers in liquid form at normal temperatures and form an oil varnish thereon, and heating the mass to effect such distribution, forming the articles from the pulp, and drying and heating them.

8. A fibrous article containing the wood fibers of the residual-resin-containing chips from rosin-extracting plants, and having said fibers bonded with a varnish formed at least in part from the residual rosin of the fibers and an added cative oleaginous material.

9. A fibrous article containing the wood fibers of the refuse residual-resin-containing chips from rosin-extracting plants, and having said fibers bonded with an oil varnish formed at least in part from the residual rosin of the fibers and an added cative oil.

10. The process of making varnish-bonded fibrous articles, which comprises forming a water-containing fibrous pulp, adding to the pulp varnish-making material liquid at normal room temperatures which will become...
distributed over the fibers, beating the mass to effect such distribution, forming the article from the thus-treated pulp, and drying and heating the article to cause the varnish-forming constituents to form a varnish in situ upon the fibers.

11. A fibrous article containing fibers of resin-bearing wood, and having the fibers bonded with a varnish formed at least in part from the natural resin of the wood and an added siccative oleaginous material.

In testimony whereof we have hereunto set our hands.

DILLON F. SMITH.
ERNEST J. PIEPER.
CLARENCE C. VOGT.