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METHOD OF MAKING WATERPROOF FIBER BOARD

Edwin J. Elmer, Monroe, Mich., assignor to
Gagnier Fibre Products Company, Detroit,
Mich., a corporation of Michigan

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This invention relates to a water-proof laminated board and to a method of manufacturing same, whereby the water-proofing material will completely permeate the body of the board, as well as the portions forming the exposed surfaces thereof.

For many purposes it is desirable to provide fiber board or products with moisture resistant properties so that such material or produce can be used in situations in which they are exposed to dampness from any cause. Wall boards, insulating boards, fiber-boards suitable for use in automobile foundations and pyroxylin-coated panels, and like artificial boards, preferably, should possess moisture resistant properties to a high degree. Other products, not in the form of a board, but constructed of similar material and subjected to the same conditions, likewise must possess similar water resisting properties.

Heretofore, fibrous materials, composed chiefly of vegetable fibers, such as wood pulp, asbestos fiber, or any suitable paper making material having been rendered water-proof to varying degrees by one of two known procedures. The most commonly used method consists in impregnating the finished fiber board with the water-proofing substance, which may consist of asphalt, paraffin or various resins dissolved in a suitable solvent. The product resulting from this mode of procedure is not very satisfactory, due to the fact that the water-proofing materials, as a rule, do not penetrate the interior of the board sufficiently for efficient water-proofing. Generally, there is only a film of the water-proofing substance on the outside of the board, which film does not effectively resist the action of moisture.

It has also been, heretofore, proposed to water-proof fibrous products by adding to the stock, from which the fibrous material is made, an emulsified suspension of a normally adhesive pitchy or bituminous binder in water, the normally adhesive material being maintained in suspension by a suitable emulsifying agent. Such composition was added to the material or stock from which the fibrous products are made, so that after the fibrous products or material is dried, the particles of the binder in the emulsion coalesce and intimately unite the fibers throughout the sheets. In such arrangements the binder must be emulsified prior to application to the stock of which the fibrous material is made. The latter mode of procedure produces a board, having water-proof characteristics that are satisfactory, but is relatively expensive to practice.

This invention aims to provide a method or process of manufacturing water-proof boards of the kind in which the entire thickness of the board is permeated by a water-proofing substance that, at one stage of the manufacture of the board, is sufficiently fluid so that it may flow throughout the interstices in the board and serve to intimately connect the fibers, a flow of the water proofing substance in solution taking place from the interior of the board toward the exposed surfaces thereof, rather than by flowing the solution toward the interior of the board from the exposed surfaces, as has heretofore been the practice when water-proofing substances in solution have been used in the manner above stated.

A further object of the invention is to provide an improved process of manufacturing water-proof fiber board in which a normally adhesive water-proofing substance is included only in the stock which goes, in the completed board, to form the central portion or body thereof, the stock forming the liner layers of the board being maintained free of such adhesive water-proofing substances, so that the liner layers, which are applied to opposite sides of the body that carries the water-proofing substances, may serve during the passage of the material through the machine, to protect the felts and rolls thereof from contact with the adhesive substance.

Another object of the invention is to provide an improved process of manufacturing fiber board in which the normally adhesive water-proofing substance is distributed through the stock of which the board is made, while in a non-fluent condition. From this condition it may subsequently be converted so as to flow throughout the board when such board is saturated with a solvent for the water-proofing substance.

This invention also aims to provide a laminated board consisting of a plurality of layers, one or more of which contains the water-proofing substance in a form from which it may be readily converted into a water-proofing solution of substantial fluidity to permeate the adjacent layers of the laminated board, so as to fill the interstices in the lamination, that initially carries the water-proofing substance, as well as the interstices of the lamination or laminations that are disposed adjacent thereto.

A further object of the invention is to provide a method of making a laminated board, consisting of an intermediate layer and outer layers disposed on opposite sides of the intermediate layer, whereby adhesive water-proofing material, im-

tially applied to the intermediate layer, may be utilized to combine the surface layers to the intermediate layer, by causing said adhesive material to flow from the intermediate layer toward
5 said surface layer or layers and into the interstices therein.

A still further object of the invention is to provide a water-proof fiber board having its entire thickness thoroughly permeated by a water-
10 proofing substance in solution, and to provide a water-proof board in which the water-proofing substance in solution flows from the interior of the board toward the outer or exposed surfaces.

In practicing the present invention the usual
15 paper making materials are used and said materials are prepared in any well known and approved manner. To such paper making materials the water-proofing substance is added, preferably in the beaters. The water-proofing substance may be any natural or artificial asphalt
20 or other residual product of petroleum, coal tar pitch, or other pitches, and analogous fusible, soluble pitches, or resinous substances. Asphalt, paracoumarone resin, shellac, ester gum, gum damar, gum sandarac, gum copal, or rosin, are
25 examples of water-proofing substances that may be incorporated in the paper making materials in accordance with this invention.

If a water-proofing substance is used that is normally dry and can be powdered in such condition, the substance is ground, in any suitable
30 manner so that it is in a finely divided condition. In this condition it is incorporated in the paper stock in any suitable way, so as to substantially uniformly distribute the particles of the water-
35 proofing substance throughout the stock. In the event that a water-proofing substance is used, such as certain coal tar pitches for example, which can only be ground in cold water, the substance is reduced to a finely divided state in this form, and
40 the finely divided substance, in suspension in the water in which it was ground, is added to the paper composition without first drying the ground product.

Having added the water-proofing substance to the paper stock, as just described, said stock is prepared in the usual manner until it has reached
45 the condition required to form a satisfactory sheet on the paper machine.

The sheet resulting from the paper stock, prepared in the manner just described, will accordingly contain the usual paper making material and chemicals and, in addition, a water-proofing
50 substance in finely divided or comminuted form thoroughly distributed throughout the product. If desired, suitable mineral fillers may be incorporated in the stock with the water-proofing agents, such, for example, as asbestine, clay, diatomaceous silica, silica, mineral pigments, such
55 as red oxide, the ochres and umbers, chalk, magnesite and slate dust.

The paper stock including the finely divided or comminuted water-proofing substances, which are normally adhesive and have a tendency to
60 stick to the rolls and felts of the paper making machine, is, preferably, used only to form the body or central portion of the completed laminated board. This is accomplished by using the stock, containing the water-proofing substance
65 distributed therethrough, to form the filler, and by using stock prepared in well known manner, but without water-proof substance to form liner layers for the opposite surfaces of the filler. Since the liner layers include no normally adhesive
70 substance, they serve to protect the rolls and

felts from contact with the adhesive material included in the body of the board, thus preventing gumming up of the felts and rolls of the machine.

Accordingly, the board is preferably prepared
80 by running the stock, containing the water-proofing substance, between liner layers of stock containing none of said substance, and in forming a laminated board in this way. The product,
85 thus produced, is pressed, dried and may be wound into rolls in the usual manner.

The resultant board has a center or body that is fairly water-proof, but the liners for the board are capable of absorbing a percentage of moisture. However, even the center or body of the board, in
90 this incompleated condition, is not sufficiently water-proof, because the water-proofing elements are simply physically mixed with the stock in the form of individual particles, and in view of the fact that said particles are physically separated
95 from each other, and are not intimately united with the fiber, the board does not exhibit great strength, as determined by the well known Mullen test.

Its water-proofing qualities and its strength are then vastly improved by passing the product, prepared in the manner just described, through a solvent for the water-proofing substance contained in the center or body of the board. The
100 solvent selected for impregnation, in accordance with this step of the improved process, of course, depends upon the material to be acted upon. Benzol or toluol are efficient solvents for asphalt or pitch, or combinations of these solvents with
105 naphtha to reduce the fire hazard may be employed. Ethyl or methyl alcohol is a suitable solvent for shellac, while ester gum is soluble in benzol, toluol, alcohol, acetone, etc.; rosin is soluble in a wide variety of solvents such as ethyl alcohol, methyl alcohol, the esters such as ethyl,
110 butyl and amyl acetates, benzol, acetone, toluol and turpentine, for example. Inasmuch as the solvents for the water-proofing substance as above mentioned are well known by those skilled in the art, further examples of suitable solvents
115 need not be given.

The board containing the finely divided or comminuted particles of water-proofing substance may be passed repeatedly through the solvent, so that it becomes saturated with said solvent, with the result that the particles of water-
120 proofing substance are dissolved and the solution of the particles spreads throughout the adjacent fiber and causes a combination of adjacent particles. At the same time, the solution of the finely divided particles of water-proofing substance flows from the center or body of the product toward the outer surfaces thereof and thus serves to seal the interstices in the liner
125 layers of the board. The water-proofing substance in this way thus also serves to firmly unite the liner layers to the filler of the product producing a substantially homogeneous board.

If desired, in order to further water-proof the liner layers of the laminated product, just described, a small percentage of a water proofing substance may be included in the solvent prior to the passing therethrough of the laminated product, though as will be obvious, insufficient
130 water-proofing substance should be included in the solvent so that the effectiveness of the solution upon the finely divided particles of water-proofing substance within the body of the board is not materially diminished and so that the solution has a high degree of fluidity so that it
135 140 145 150

can penetrate the board. When this procedure is followed, the liner layers are water-proofed both by the application thereto of a water-proofing solution applied from the exterior of the board, and by virtue of the flow of the dissolved particles of water-proofing substance initially included in the body or central portion of the product.

After the board has been saturated by the solvent for the water-proofing substance included in the body or central portion thereof, or by the solution combining such solvent in a small percentage of a suitable water-proofing substance, the board is thoroughly dried, resulting in a product in which the individual fibers of the board are intimately combined and the interstices between said fibers are sealed by the water-proofing substance, producing a board that is highly resistant to moisture and in which the center or body of the board is at least as thoroughly impregnated with the water-proofing substance as the portions thereof that are more nearly adjacent to the outer surfaces. Inasmuch as the steps necessary to produce this improved product, just described, are extremely simple it is apparent that the product may be manufactured at a relatively low cost.

If desired, water-proofing substances that are not in powdered form may be included in the stock from which the filler of the board is manufactured, though pulverulent materials are preferred because of the ease with which the small particles can be distributed throughout the mass from which the filler is made. Asphaltic emulsions in water may be incorporated in the filler of the board and subsequently the asphaltic material in said body may be caused to flow into the liner layers by saturating the board with a suitable solvent for the asphaltic material in the manner above described.

Various combinations of the board prepared in the manner fully described may be made to provide a board of greater thickness. For example, two or more plies of paper board, prepared as above described and possessing a high degree of resistance to moisture may be combined with chip, container, kraft, celutex, chestnut or any standard paper or insulating material by combining the sheets or layers by means of a suitable water-resisting adhesive. For example, a very good water-resisting board of eighty points can be constructed by using two outside liner plies of board processed in accordance with the present invention to a thickness of twenty-three points, and one ply of thirty-four points Chestnut board for the filler, the water-proof liner layers being combined to the filler by a suitable water-resisting cement or glue such as casein, asphalt, blood albumin and the like. Various other combinations may be made involving the improved board and further layers of fibrous material having inferior water-proof characteristics to produce inexpensive boards of good quality.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present

embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. The process of manufacturing water-proof fiber board composed of a filler disposed between liner layers, which consists in mixing a water-proofing substance with the stock of the filler in a relatively non-fluent form, combining said stock with the liner layers so that the latter prevents contact of said substances with the felts or rolls, and then saturating the product with a solvent to cause said substance to flow into the interstices in the filler and in the liner layers.

2. The process of manufacturing water-proof fiber board composed of a filler disposed between liner layers, which consists in applying a soluble water-proofing substance to the filler while maintaining said liner layers free of said substance during the formation of the board, and then saturating the board with a solvent to cause said substance to flow from the filler toward the exposed surfaces of said liner layers.

3. The process of manufacturing water-proof fiber board composed of a filler disposed between liner layers, which consists in mixing a normally adhesive water-proofing substance in pulverulent form with the stock of the filler, combining said stock with liner layers so as to prevent contact of said substance with the felts or rolls, and then saturating the product with a solvent to cause said substance to dissolve and flow into the interstices in the filler and in the liner layers.

4. The process of manufacturing water-proof fiber board composed of a filler disposed between liner layers, which consists in applying a pulverulent water-proof substance to the filler while maintaining said liner layers free of said substance during the formation of the board, and then saturating the board with a solvent to cause said substance to flow from the filler toward the exposed surfaces of said liner layers.

5. The process of water-proofing laminated fiber board which consists in including in the stock from which one or more laminations of the board is made a water-proofing substance in non-fluent form, combining another lamination with said first named lamination and then saturating the laminated product with a solvent to cause the substance to spread through the board.

6. The process of water-proofing laminated fiber board which consists in including in the stock from which one or more laminations of the board is made a water-proofing substance in pulverulent form dispersed throughout said lamination, combining other laminations with said first named lamination and then saturating the laminated product with a solvent for said substance to cause the solution thereof to spread through the laminations.

EDWIN J. EIMER.