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## WATERPROOF FIBROUS PRODUCT

No Drawing.

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This invention relates to waterproof fibrous products and more particularly to waterproof sheet material and a process of producing the same.

5 Among the objects of the invention, I aim to provide sheet waterproof material composed of a minor proportion of fibre, and a major proportion of filler materials adapted to impart various desirable characteristics to the sheet, as will be hereinafter pointed out.

10 Another object of the invention is to provide a sheet of this character which, despite its low fibre content, will nevertheless possess sufficient structural strength to permit its ready handling as it is taken in the form of a wet web from the forming mechanism, and to withstand when dry and finished, the ordinary wear to which it is subjected in use.

15 Another object is to provide a fibrous product of this character having thermo-plastic properties, and which because of its low content of fibre, lends itself very readily to processes of thermo-moulding for the production of sharp cameo or intaglio effects, without tearing, breaking, or otherwise injuring the fibre.

20 Still another object is to provide a fibrous sheet of the character described, in which the fibrous content thereof is so low, and so related to the other constituents of the sheet, that swelling and shrinking, due to absorption and elimination of water or moisture, is reduced to a minimum.

25 In accordance with the invention, the fibrous sheet contains not more than 35% of its weight of fibre, the remainder being composed of the waterproofing constituents and other filler materials. I regard a sheet of this character having a maximum fibre content approximating 35% of its weight, as one of the novel features of the invention, inasmuch as prior to my invention it has not been generally feasible to produce a sheet of felted material of sufficient strength with such a small proportion of fibrous constituents.

30 In carrying out the invention I may employ fibres of various descriptions, such as wood pulp, either chemical or mechanically ground, animal fibre, as for example hair or

vegetable tan or chrome tan leather, or I may employ mineral fibres such as asbestos, of the like. In certain instances the fibrous stock may be composed of a suitable mixture of the fibres above indicated, it being obvious that in selecting the fibres to be used one is to be guided by the requirements for tensile strength desired in the sheet, within the scope of the invention.

35 In carrying out the invention the wood pulp or other fibrous stock is placed in a beater engine, together with sufficient water to permit ready circulation during the beating operation.

40 To the fibrous stock in the beater engine is then added the waterproofing material. The latter is intended not only to afford waterproofing properties in the product, but is adapted also to serve in binding the fibres, strengthen the sheet and provide also a substantial degree of thermo-plasticity in the product. The strengthening of the sheet is thus accomplished both in its dry and finished state and in its wet state upon formation, so that the wet sheet, having the low fibre content contemplated by the present invention, is not so tender and devoid of tensile strength as to disintegrate when being removed as a wet web from the forming instrumentality.

45 As the waterproofing material, I may use any suitable bituminous substance such as asphalts, pitches, tars, resins or resinous materials, or the like, and I prefer to incorporate the same with the fibrous stock in the form of a dispersion in water. The dispersion should be any suitable type which is not broken down by flocculants or precipitants, and which is stable to the pressures and other influences to which the sheet may be subjected during its formation, so that no gumming of the forming instrumentalities will ensue. Preferably the dispersion is one produced in accordance with a method described in Patent No. 1,615,303 issued to Lester Kirschbraun. Such dispersion may be of a Mexican asphalt of 100° to 200° F. melt point, the dispersion whereof has been attained as described in said patent with any one or a mixture of dispersive media enumerated therein, or with any

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other suitable dispersing agent. The dispersion may be composed of, say, 50 parts of the asphalt, 10 parts of the dispersing agent and 40 parts water.

5 Instead of bitumens as heretofore enumerated, I may in certain instances, employ other hydrocarbons such as rubber, the latter being preferably made into an aqueous dispersion as set forth in Patent No. 1,498,387 issued to Lester Kirschbraun on June 17, 1924.

10 I may also, in certain desirable instances, utilize as the waterproofing material a combination of rubber and bitumen in aqueous dispersed form, produced as for example by the method disclosed in my prior application 15 Serial No. 100,714 filed April 8, 1926.

The dispersion, by whatever method it is prepared, and diluted, if necessary, with water, is then mixed with the stock in the beater engine and thoroughly disseminated through the same by the action of the beater roll. The quantity of dispersion mixed with the fibrous stock will depend largely upon the properties desired in the final product to be 25 produced. Thus, where asphalt is used, and the product desired is one which is substantially rigid, waterproof, and thermoplastic, I may add the asphalt dispersion in amounts sufficient to produce a sheet in which the fibrous content is substantially equal to the asphaltic content thereof. Thus, where the sheet is composed of about 30% fibres, the asphalt may constitute 28% to 33% of the sheet, the balance being made up of the filler.

35 The filler may be any suitable material adapted to provide the necessary weighting and bulking of the sheet and may include rosin powder, cork, sawdust, rubber dust, or similar material, as well as insoluble mineral pigments to impart the desired color to the product. If desired, vulcanizing agents such as powdered sulphur or the like, may be added to vulcanize and render infusible the bitumen or rubber hydrocarbon used. The filler 45 should preferably be comminuted sufficiently fine to pass a sieve of 20 mesh. While, as above stated, the filler functions to bulk and weight the sheet, there is an additional advantage inherent in the present invention, and that is, that with a sheet whose fibrous constituents comprise only 30% to 35% thereof, the large amount of solid amorphous filler and asphalt acts as a separator between the fibres to prevent swelling and shrinking action from taking place and compounding itself to such an extent as to cause warping or similar distortion of the sheet.

50 The filler is added to the fibrous stock and the dispersion in the beater and thoroughly admixed therewith, whereupon any soluble reacting salts such as soda ash, sodium silicate, and alum, may be added to the mass in the beater, whereby to form a precipitate which is adapted to cause the dispersed asphalt particles to be fixed on the fibres. Pref-

erably, the alum is employed in such quantities as to adjust the hydrogen ion concentration of the stock to the iso-electric point of aluminum hydroxide, say of pH 4.5 to 5.5.

In a typical furnish which has been used 70 in carrying out the invention, the fibres were composed of 360 parts of mixed paper and 90 parts of soft leather. The dispersion, on the dry basis, comprised about 500 parts of the furnish, and the filler was composed of about 75 100 parts of sawdust, 200 parts asbestine, and 200 parts of yellow clay, and a small quantity, say, 10 to 15 parts of bone black.

In order to fix substantially all the asphalt in such a furnish upon the fibres thereof, 80 about 15 parts of soda ash, 20 parts of sodium silicate, and 60 parts of alum are required.

The illustration here given will result in the production of a black waterproof fibre board. Where colors are desired, the composition of the filler may be modified to produce 85 the desired effects. Thus, where a red board is desired, having substantially the fibrous and asphaltic content as given in the first example, the filler may be composed of 85 parts 90 sawdust, 15 to 20 parts asbestos, 40 parts asbestine, and 400 parts red oxide.

In another run, where an asbestos product was desired, the stock was composed of 20 to 25 parts of low grade asbestos fibre, 70 parts 95 of asphalt dispersion containing about 50% asphalt, and 40 to 45 parts of mineral fines in the form of an impalpable asbestos dust. To this stock was added the necessary amount of precipitating agents such as sodium silicate and alum, as above described. 100

It should be obvious however, that the above figures are given merely by way of example, and that wide variations may be made therein, within the scope of the invention. 105

As soon as the precipitating agents have been incorporated, the stock is transferred to a wet or cylinder machine for formation into a web, which is then carried by blankets from the forming cylinder to the make-up roll where a sheet of desired caliper may be built up. 110

If desired, mottled effects may be obtained by using stocks of contrasting colors.

For non-skid properties, any suitable powder such as rubber-dust or the like may be dusted onto the web after formation and during its transfer by the carrying felt. The same expedient of dusting powders onto the web at this stage may be employed to create 120 various decorative or ornamental effects. In certain instances, as where a rigid board is desired, the Portland cement, plaster of Paris, or other hydraulic cementitious material may be dusted onto the wet web at this 125 stage, so that the cement combined with the successive convolutions as built up on the make-up roll, will be hydrated and set up by the water present in the wet sheet.

When a web of desired caliper has been 130

built-up, it is then stripped from the make-up roll and dried to remove the water.

The sheet may then be passed through hot calender rolls, or heated and passed through cold calender rolls, or otherwise treated so as to heat the same to a temperature sufficient to cause the particles of waterproofing material to coalesce and fuse on the fibres, and form a hard, rigid and thermoplastic board-like structure. Where vulcanizing agents have been included, the heat and pressure will also serve to vulcanize the hydrocarbon in situ, so as to render the same infusible.

If desired, the sheet may be subjected to the action of a hot press-plate to cause the necessary fluxing and obtain a smooth appearance.

By virtue of the thermoplastic properties of the sheet as thus produced, it may be molded in various shapes under heat and pressure, or embossed or impressed with designs either simultaneously with, or subsequent to the pressing action, and the outlines of such designs may be made as sharp and distinct as desired, and by reason of the low fibre content of the sheet, the embossment or indentation may be carried on effectively without giving rise to cracks in the sheet as by the breaking of the fibres thereof.

The board may if desired, be cut into various shapes and sizes, either simultaneously with or after the pressing action, and employed for such purposes as wall panels, ceiling panels, gaskets, friction wear surfaces, commercial signs, and the like.

Another particularly novel and advantageous feature of my invention resides in the fact that the wet fibrous sheet, after being removed from the make-up roll, may, while in its wet state, be shaped as by stamping, into articles of various shapes and designs. In this way, any waste produced during the moulding or shaping process, being free of coalesced asphalt, may be recovered and returned to the beater for re-use. The article fabricated from the sheet may then be placed between suitable dies or the like, whereby it is subjected to heat and pressure to cause fusion and coalescence of the asphalt.

I find that the board as made by the present invention is admirably suited as a flooring, because of its rigidity, resistance to wear, and its waterproof qualities. For this purpose, the board may be cut up into individual tiles, or individual tiles may be simulated in the board by indenting the surface thereof at regular or irregular intervals, by means of heat and pressure. Where individual tiles are actually cut from the board, desirable ornamental effects for flooring purposes may be had by selecting tiles of various colors or shades and adhesively securing the same as by asphalt cement, either in regular or haphazard fashion, upon a backing sheet

of suitable material such as asphalt saturated felt.

If desired, the tiles cut from the sheet may be secured to the backing sheet of asphalt saturated felt or other base by means of an asphalt dispersion which acts as a bonding coat when the water is removed.

In another form of using flooring tiles cut from a sheet as produced by the present invention, the individual tiles may be adhesively united to any flooring surface as by means of asphalt cement, or an asphalt dispersion as a bonding coat.

When the individual tiles are thus applied to a backing sheet or to a floor, the bonding coat, especially where the same comprises a dispersion, may, if desired, be permitted to dry before the tiles are placed in position over the supporting surface. In such case, the union of the tiles to the supporting surface may be accomplished by pressing the same as with a hot iron or the like so as to flux the asphalt and cause the tiles to be embedded in the fluxed bonding layer.

In still another form, the waterproof sheet may be cut into narrow strips of desired size, and a plurality of such strips laminated in face to face contact so as to provide a thick and rigid laminated structure, in which the separate laminæ are each disposed in edge-wise relation, the thickness of the laminated board being determined by the width of the strips of which it is made up. As many of these strips as desired may be laminated to provide a board of the desired dimensions. The union of the separate laminæ may be accomplished in any suitable manner, though preferably, asphalt or similar dispersion, or other similar adhesive may be employed with advantage.

A laminated structure as here described possesses certain advantages, especially where used as a flooring, since under the normal impact pressure of traffic, the asphaltic content of the separate laminæ will flow so as to cause the latter to become more firmly united with each other and form a unitary homogeneous structure. This is especially so where the asphaltic content of the board from which the laminæ are cut, is relatively high.

By the use of the expressions "cameo, intaglio or like effects" I desire to embrace effects of regular or irregular raised and/or depressed portions such as letters, figures, or artistic indicia formed on the surface, as exemplified by advertising or commercial signs, or displays, or by a pictorial representation.

I claim as my invention:

1. A felted fibrous sheet, containing in addition to the fibres thereof, filler and thermoplastic material fused onto the fibres thereof, the fibre content of said sheet being so low

as to be incapable, in the absence of said thermoplastic material, of fabrication into a felted form-sustaining sheet.

2. A felted fibrous sheet containing in addition to the fibres thereof, filler and thermoplastic material fused onto the fibres thereof, all in such relative quantities that the fibre content thereof is incapable, in the absence of said thermoplastic material, of fabrication into a felted form-sustaining sheet.

3. Felted fibrous material comprising less than 35% fibres, thermoplastic material fused onto said fibres, said thermoplastic material being present in amounts substantially equal to the fibrous content, and filler.

4. Felted fibrous material comprising less than 35% fibres, thermoplastic material coalesced on said fibres so as to coat the same substantially completely, said thermoplastic material being present in amounts substantially equal to the fibrous content, the remainder being filler material including coloring pigments.

5. A waterproof sheet containing less than 35% of fibres, and thermoplastic waterproofing material fused onto said fibres, said sheet possessing the characteristics of a felted sheet, and being rigid at normal temperatures but mouldable under heat and pressure the relative proportions of the fibres and thermoplastic waterproofing material being such that the fibre content thereof is incapable, in the absence of said thermoplastic material, of fabrication into a felted form-sustaining sheet and being moldable to produce cameo, intaglio, or like effects.

6. The process of making a hard waterproof board-like structure which comprises mixing fibrous stock with filler including a heat fusible asphalt retained in an aqueous dispersion, the constituents being combined in such amounts that the fibrous content of the product will comprise less than 35% by weight thereof, forming the mass into a sheet in which the fibres are in felted relation, drying the sheet, and causing the asphalt to flux and fuse on the fibres.

7. The process of making a hard waterproof board-like structure which comprises mixing fibrous stock with filler including a waterproofing substance retained in an aqueous dispersion, the constituents being combined in such amounts that the fibrous content of the product will comprise less than 35% by weight thereof, forming the mass into a sheet in which the fibres are in felted relation, drying the sheet and thereafter pressing the sheet at elevated temperatures to cause the waterproofing substance to flux and fuse on the fibres, and form a hard and rigid structure, the relative proportions of the fibres, filler, and waterproofing material being such that the fibre content thereof is incapable, in the absence of said thermoplastic

material, of fabrication into a felted form-sustaining sheet and capable of being molded into intaglio, cameo, and like effects.

8. Waterproof fibrous sheet material containing less than 35% of fibres, said fibres having thermoplastic material fused thereon so as to coat the same, said sheet possessing the structural characteristics of a felted sheet, relative quantities of the fibre content being such as to be incapable, in the absence of said thermoplastic material, of fabrication into a felted form-sustaining sheet, said felted sheet material being moldable to produce irregularly shaped objects.

9. The method of making fibrous waterproofed objects of ornamental character having cameo and intaglio or like effects formed therewith, which method comprises admixing fibrous stock and an aqueous dispersion of thermoplastic waterproofing material, forming said mixture into a sheet on a paper making machine, the character and relative proportions of the fibre and waterproofing material being such that the board is sufficiently thermoplastic when dry to permit it to withstand molding action without tearing or otherwise injuring the unitary nature of the board, subjecting the sheet to drying action whereby to coalesce the waterproofing dispersion upon the fibres and form a rigid thermoplastic board; and then subjecting the board thus formed to a molding action whereby to draw portions of the thermoplastic board into cameo, intaglio or like effects.

10. A method of making ornamental fibrous objects having cameo, intaglio or like effects formed integral therewith which comprises admixing fibrous stock and an aqueous dispersion of thermoplastic waterproofing material, forming said mixture into a sheet on a paper making machine, the character and relative proportions of the fibre and the thermoplastic waterproofing material being such as to render the sheet thermoplastic when dry to permit it to withstand embossing action without tearing, breaking or otherwise injuring the unitary nature of the board, subjecting the sheet to drying action whereby to coalesce the waterproofing material upon the fibres and form a rigid thermoplastic board and then subjecting the thermoplastic board thus formed to an embossing action whereby to draw portions of the thermoplastic board into cameo, intaglio or like effects.

11. The method of making waterproofed fibrous objects of ornamental effect having cameo, intaglio or like effects formed integral therewith which comprises the steps of subjecting a dry waterproofed board consisting of fibres and coalesced thermoplastic waterproofing binder of a character sufficiently thermoplastic when dry to permit it to withstand embossing action without tearing,

breaking or otherwise injuring the unitary nature of the board, to an embossing operation whereby to draw portions of the thermo-plastic board into cameo, intaglio and like effects.

5 In testimony whereof I affix my signature.

HAROLD L. LEVIN.

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