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PROCESS OF MAKING FELTED STRUCTURES

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Our invention relates to the manufacture of felted structures from a pulp in water suspension, which pulp contains in some form of association and/or dispersion, heat plastic water proofing substances generally of bituminous character. The object of our invention is to facilitate the manufacture of such articles which shall contain harder or less heat-susceptible heat plastic substances than are ordinarily convenient to use in processes involving the use of the said pulps.

Copending applications Ser. No. 316,611 filed Nov. 1, 1928, by Earl P. Stevenson and Harry A. Buron, and Ser. No. 314,551 filed Oct. 23, 1928, by Harry C. Fisher, teach ways of producing true pulps in which a bituminous substance exists in uncoated particles of minute size in stable association with a fibrous material. Pulps of the character produced in accordance with the teachings of these applications we term "bituminous pulps" as a convenient term to distinguish them from pulps which contain water proofing or bituminous substances not in a stable association; but our invention is not restricted to the use in whole or in part of bituminous pulps. It will however, be described in connection therewith, this being a convenient and exemplary illustration.

As exemplary of the manufacture of a bituminous pulp, but without limitation, we may take a quantity of wet fibrous material such as waste papers or the like and place this in a mixer of the Werner Pfleiderer type equipped with heating means. We then may introduce into this mixer a quantity of bituminous substance, say asphalt, in proportions which for this illustration may be 60% of bitumen by weight to 40% of the fibrous material, dry by weight. We may then start our mixer and mix these substances together, maintaining the mixer contents by heat at such a temperature that the bituminous substance will be non-solid. If the temperature is high, water may be added from time to time to compensate for that which is lost by evaporation. The mixing may be continued to the point of bringing about an association between the fibrous material and the bitumen, accompanied by considerable individualization of the fibrous aggregates, but preferably it is stopped short of the point at which, due to loss of moisture or very complete mixing, the mixer contents go together into a homogeneous plastic mass. Short of this point then we may add more water to our mixer contents until the mixture breaks down and comes into a preliminary suspension, whereupon we may transfer it to a beater and, with or without the addition of more water, beat it into a pulp in which the fibrous material is in a condition for proper felting and in which the bituminous material exists in a stable dispersion of minute particles, which particles may be in some contact association with the fibrous material.

The beaten or refined stock may then be run on to the screen of a paper machine and felted into a sheet. Thereafter, as in ordinary paper or board manufacture, the felted sheet will be pressed and dried by being passed over heated drying rolls or cylinders. The heating effect will preferably cause the bitumen to flow. In this way may be made sheets which have some of the characteristics of a saturated web and some of the characteristics of a plastic compound.

It is advantageous both in the manufacture of a bituminous pulp and in the manufacture of felted sheets therefrom to use a bitumen of comparatively low ball and ring softening point, or with a short softening or liquefying range regardless of softening point, providing the ranges are within the effective heat of the paper machine driers. It is also advantageous for many uses to employ a bitumen which will be hard and non-tacky at room temperature. Some bituminous substances combine these qualities; and a stanolite asphalt with a penetration of from less than 1 to around 10 and coal tar pitches and wood pitches of varying hardnesses are examples. They mix well with the fibers during the pulp-forming stage, come into a stable association readily in the pulp, and are easily melted by the ordinary heat of a drying cylinder on the paper machine. On the other hand, bitumens such as 20 penetration steam-blown Mexican asphalts or the like, or residuums air-blown to around 20 penetration,

are examples of materials of comparatively low softening points but longer liquefying ranges than the stanolite mentioned above; the steam-blown materials having the lower softening points and shorter liquefying ranges. These form good quality bituminous pulps, but do not diffuse so easily throughout the drying sheet upon the paper machine driers, and therefore tend to produce a mottled product. The same thing may be true of harder air or steam-blown products. Again, very hard heat plastic substances, for example hard asphalts or hard coal tar pitches, may have a softening point so high that regardless of a sharp liquefying range, imperfect fluxing on the driers may result.

Inasmuch as there are commercial uses for sheets made of these bitumens, the object of our invention is essentially to provide a way of overcoming their limitations. This we do by that certain process of which we shall now describe a preferred embodiment and examples.

Essentially our invention contemplates the production of a felted substance containing a bitumen of the desired hardness, penetration and softening point from a combination of at least two other bitumens, which individually do not possess the characteristics desired, which characteristics in a single bitumen might impede or prevent the successful production of a satisfactory sheet. Thus one of the bitumens may be softer than that ultimately desired, and the other harder, the two being fluxed together in the sheet after it has been formed. Or both of them may have substantially the ultimately desired hardness, but one, having a sharp melting range will assist in fluxing and diffusing the other throughout the felted sheet, while the combination of the two will produce a bitumen having all of the desired characteristics.

In one modification of our process, therefore, we make a bituminous pulp or other pulp containing a heat-plastic water-proofing substance which is comparatively soft and has a sharp liquefying range, and to this pulp we add either a quantity of harder, comminuted bituminous or other heat plastic substance with a higher or a less sharp liquefying range, or a quantity of bituminous or other pulp containing in association the harder heat plastic or bituminous substance. A sheet is felted from the composite pulp, and the several bitumens fuse together in the sheet during the passage thereof over the drying cylinders, the action apparently being that first the most easily liquefied material melts and diffuses through the sheet, and then fluxes or promotes the melting and diffusion of the other bitumen or heat plastic material. We may, of course, use more than two different kinds of heat plastic substance in a sheet. If desired bituminous pulps of different kinds or in different concentrations can be diluted in the beaters with plain fibers to obtain charges of modified asphaltic content. We desire the term "bitumen" to be construed broadly as covering thermoplastic substances to which our invention appertains. These include, besides substances of mineral origin, resins natural and synthetic, waxes, and resinous, pitchy or waxy materials of vegetable origin. By diffusion we mean that action in a sheet felted from pulps containing a heat plastic substance, when under the influence of the heat of the drying cylinders the said substance melts, more perfectly binds the fibers together, and spreads to any incompletely permeated parts.

As an example of a specific procedure within the scope of our invention, it was desired to make a board of .027 to .028 caliper using a hard asphalt of comparatively sluggish characteristics and of ball and ring softening point of 185° F., penetration of one. It was desired to obtain a product stiffer than that made with 10 penetration stanolite asphalt alone and due to commercial reasons a considerable supply of this 10 penetration asphalt pulp was available. Accordingly, a "soft" pulp was made comprising 60% of stanolite asphalt with a ball and ring softening point of 140 to 145° F., penetration 77/100/5 of 7 to 10, 20% kraft paper and 20% mixed paper. The finished pulp or sheet was to comprise 60% hard asphalt with a ball and ring softening point of 180 to 185° F., penetration 77/100/5 of one. A "hard" asphaltic pulp was then made with a formula of 60% hard asphalt of a ball and ring softening point of 200 to 210° F., penetration 77/100/5 of zero to one, and comprising approximately 50% of gilsonite and 50% stanolite fluxed together, and 20% kraft paper and 20% mixed paper. Six parts of this very hard asphalt pulp were then mixed in the beater with four parts of the soft stanolite pulp to prepare a furnish of the medium hard material. The stock was then run on a multi-cylinder board machine, and when felted and led over the driers, it gave a sheet of the desired hardness, the two asphalts fluxing together in the sheet.

Our invention is based on the discovery that if to a bituminous pulp containing a material that is not easy flowing on the paper machine driers is added a bituminous pulp containing material that is easy flowing on the paper machine driers, then the proper mixture of the two will produce a sheet in which the mixed bitumens or heat plastic material flux together and diffuse well throughout the sheets. As an example of a softer bituminous material which does not flux easily on the driers, the following is cited: 20 penetration steam-refined Mexican asphalt has a ball and ring softening point of

155° F. but a comparatively long liquefying range. Hence it is very viscous and slow to diffuse on the driers. To produce a sheet containing a bitumen which has the characteristics of the Mexican referred to above, it suffices to prepare a pulp containing, for example, 60% of the Mexican asphalt and another pulp containing 60% of an easy-flowing asphalt of the same penetration such as stanolite of 20 penetration made by air-blowing the 100 melt point variety, and when these two are mixed and run on the machine, the second easily melts, fluxes throughout the sheet and promotes the diffusion of the first. 20% of the stanolite pulp to 80% of the Mexican pulp will give a satisfactory result. A similar result is obtainable by taking a sluggish asphalt much harder than the 20 penetration Mexican and preparing a pulp of it and then mixing it with a pulp containing a very soft asphalt in such proportion that the fluxing together of the two on the paper machine driers will give a felted product having the same characteristics as though the 20-penetration material were practical to be used above.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent, is:—

1. That process of producing felted structures containing hard bituminous substances which comprises making a pulp containing feltable fibers with which is associated a softer bituminous substance in minute, uncoated particles in stable association with said fibers and in predetermined quantity, and a pulp of similar character but containing a harder bituminous substance in predetermined quantity, mixing predetermined quantities of the two pulps together, felting the combined pulp upon a screen and drying and heating the felted structure.

2. That process of producing a felted sheet containing a heat-plastic substance of a general nature unsuitable for melting upon paper machine driers, which comprises forming a pulp containing a plurality of heat-plastic substances in minute uncoated particles in stable association with feltable fibers in such proportion as will give a composite heat-plastic substance of the characteristics desired, at least one of said substances having a liquefying range within the effective temperature of paper machine driers, felting a sheet from said pulp, drying it, and subjecting it to heat whereby the softer heat plastic fluxes and assists the diffusion of the harder.

3. That process of producing a felted sheet containing bitumen of desired characteristics which comprises forming a pulp of feltable fibers with which is stably associated a plurality of bitumens of different characteristics in minute uncoated particles and in such proportion as will give when fluxed a composite bitumen of the desired characteristics, felting a sheet from said pulp, and drying said sheet under heat sufficient to melt at least one of said bitumens.

4. That process of producing a felted sheet containing a composite binder substance, which comprise forming a pulp of feltable fibers with which is stably associated one ingredient of said composite binder in predetermined quantity, producing a second pulp with which is stably associated another constituent of said binder in predetermined quantity, and combining said pulps to form a composite pulp having predetermined quantities of fiber and binder substances, felting said composite pulp upon a screen, drying the product so formed and causing the amalgamation of said constituent binder substances to form said composite binder.

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