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RUBBER ASPHALT DISPERSION

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This invention is concerned with the art of manufacturing waterproof fibrous products, and is directed particularly to improvements in the art of producing stocks, composed of fibrous pulp and waterproofing materials in admixture therewith, in condition rendering the same readily susceptible to felting on standard types of paper making machinery.

In prior patents I have disclosed methods of incorporating normally non-fluid, heat-liqueflable bitumens such as asphalt with fibrous stock, by first effecting a dispersion of the bitumen in water and mixing the dispersion with the fibrous pulp in the beaters or the stuff chests of the paper making machines to produce a stock which is capable of being felted into paper formation, dried, and calendered, all without incurring gumming or sticking of the bitumen to the paper making instrumentalities. Various adaptions of this general process are disclosed in my previous Patents Nos. 1,536,399, 1,725,645, 1,725,647, 1,722,434. These processes have gone into extensive use for the manufacture of water-resistant sheets, boards and other articles.

For certain articles, however, it is desirable to produce a sheet having homogeneously incorporated therein, substantial quantities of rubber in addition to substantial quantities of bitumen. To this end, it has been proposed to combine dispersions of asphalt, such as might be made by processes described in earlier patents of mine, with rubber latex, or with an artificially prepared dispersion of rubber, and then to mix the combined dispersions with fibrous pulp and felt the mixture on a paper making machine. It has been observed, however, that when an attempt is made to combine a dispersion of bitumen such as asphalt, with a dispersion of rubber, there is a marked tendency in many instances for the asphalt dispersion to cause breaking, or at least an excessive premature flocculation of the rubber dispersion, particularly so when rubber latex is employed, and it is necessary therefore to resort to special precautions in order to bring about a satisfactory combination of the rubber dispersion with the bituminous dispersion.

It is one of the objects of my present invention to provide a process of procuring a combination of rubber and a bituminous substance in the form of a dispersion which can readily be mixed with fibrous pulp of any desired character, for fabrication on standard types of paper making machines, into homogeneous sheets or boards having the bitumen and the rubber uniformly disseminated therethrough in the form of continuous films coating and surrounding the fibers.

Without intending to restrict the invention, beyond what may be required by the prior art my present invention briefly stated, consists in first making an artificial dispersion of rubber, then employing this primary dispersion as a medium for dispersing the bitumen thereby to form a dispersion system having what may be termed a double internal phase, and then combining this system with fibrous pulp and running the mixture off on a paper machine.

In the practical embodiment of the invention any suitable or desired grade of rubber may be employed, such for example as pale or brown crepe, smoked sheet, or the like and in order to effect dispersions thereof in water, the rubber is first subjected to a preliminary plasticization which may be accomplished conveniently by subjecting a mass of the rubber to the action of a rubber roll mill of the standard and well known types. This action of the rubber may be continued until the desired degree of plasticity is imparted to the rubber, the time required for this purpose varying from twenty to eighty or more minutes depending upon the toughness and other characteristics of the particular rubber employed. Generally, however, the skilled operator will be able to recognize when this condition of the rubber is attained by its comparative softness, and its ability to retain to a degree the form to which it is stretched, compressed or otherwise manipulated by the fingers. In this condition, the rubber may then be transferred to a kneading or masticating machine containing a relatively thick aqueous paste of colloidal material such for example as may be prepared by hydrating a colloidal clay such as bentonite with five to ten times its weight of water. The kneading or masticating machine is preferably of the two-blade type, with the blades rotating at different speeds, and preferably also is provided with jackets for circulation of steam or other temperature regulating medium. This machine may consist of the well-known Werner-Pfleiderer mixer. By the use of a kneading or masticating machine of this type, the preplasticized rubber may conveniently be dispersed in the aqueous paste with the result that a rather viscous or pasty dispersion containing three to ten parts by weight of rubber for each part of bentonite, and from 40 to 60% by weight of water is produced. It is to be understood, however, that any other suitable method of dispersing the rubber in water may be employed.

In accordance with the invention the aqueous dispersion of rubber in its thick pasty condition as it comes from the kneading or masticating machine is then employed as a media for effecting dispersion of the bitumen therein. The bitumen may comprise asphalt of 100 to 200° F. melting point, or any equivalent heat liquefiable bituminous substance that may be desired. The rubber dispersion is placed in a suitable emulsifier or retained in the same apparatus and if necessary or desired may be adjusted to the desirable hydrogen ion concentration for the particular bitumen to be dispersed whereupon the bitumen in molten and fluid condition is fed gradually into the emulsifier as rapidly as it can be assimilated by the rubber dispersion in the emulsifier under the attenuating action of the agitating blades. During the attenuation and subdivision of the bitumen, additional quantities of water may be fed to the emulsifier to maintain the mass therein at the proper viscosity for promotion of the interfacial trituration necessary to bring about the attenuation and subdivision of the bitumen into finely divided particles. The dispersion system thus produced may contain 20 to 30% rubber, 20 to 30% bitumen and 40 to 60% water. I believe, though I do not wish this belief to be taken as confining the scope of the invention, that in the final dispersion system as thus produced there are two separate internal phases, one of rubber and the other of bitumen, the clay colloid being adsorbed mainly on the surfaces of the rubber particles, and the bitumen particles being surrounded and precluded from coalescing one with another by the rubber particles which themselves carry adsorbed films of clay as well as by the clay itself. As the water is removed from this system by evaporation or otherwise the clay walls surrounding the rubber are permeated by the bitumen thus bringing about fluxing and coalescence of the rubber and the bitumen. The hereinabove described method of securing rubber and bitumen in aqueous dispersion involves substantially the same plant equipment and labor which would be required to make separately a dispersion of rubber and a dispersion of the bitumen, and possesses the distinct advantage of avoiding the labor and trouble normally incurred in mixing the separately prepared dispersions of rubber and of bitumen to produce the combined system.

The rubber-bitumen dispersion system produced as described is capable of ready admixture with fibrous stock for the formation of waterproof sheets or boards on well known types of paper making machines. For this purpose the dispersion system may be incorporated with any desired fibrous pulp, either in the beaters or in the stuff chest and with slight agitation the whole mass may be made uniform as to distribution of the dispersed material in the aqueous pulp. The relative quantities of dispersion and fibrous material will manifestly vary within wide limits depending upon the characteristics desired in the final product. In general, however, the quantity of dispersion employed for admixture with the fibrous stock will be such that the combined dry weight of rubber and of bitumen will range upwardly to 60% of the dry weight of the finished product.

After the desired quantities of the dispersion have been uniformly distributed through the aqueous pulp, a suitable precipitant such as lime, alum or sodium silicate and alum may be added to the mixture to cause the dispersed particles to be clotted or deposited uniformly upon the fibers whereupon the stock may be run off for felting upon any standard type of paper machine such as a Fourdrinier, multi-cylinder, or a wet-machine. The single or multi-ply formation, or the web stripped from the make-up roll of the wet-machine is then conducted over or through the usual driers and calenders to drive out the water and moisture and to bring about coalescence and fluxing of the rubber and bitumen into continuous films coating and surrounding the fibers. The finished sheets or boards may then be converted into the desired articles by cutting, stamping, embossing or other operations as required.

While I have herein referred to the use of colloidal clay in the production of the initial dispersion of rubber, it is to be understood that any paste forming hydrophilic colloid which will give a dispersion inert to electrolyte may serve as well in lieu of bentonite. It is further to be understood that while I have referred specifically to the use of asphalt, the process is not by any means limited thereto, and that any normally non-fluid but heat-liquefiable bitumen such as certain pitches, resins, and waxes may be employed in lieu of the asphalt, depending upon the characteristics desired in the finai product.

I claim as my invention:

1. The process which comprises effecting dispersion of rubber in an aqueous paste of a hydrophilic colloid, and subsequently effecting dispersion of a normally non-fluid bitumen in the rubber dispersion by employing said rubber dispersion in thick pasty condition as the dispersing media for the bitumen.

2. The process which comprises effecting dispersion of rubber in an aqueous paste of a colloidal clay, and subsequently effecting dispersion of a normally non-fluid bitumen in the rubber dispersion by employing said rubber dispersion in thick pasty condition as the dispersing media for the bitumen.

3. The process which comprises effecting dispersion of rubber in an aqueous paste of bentonite, and subsequently effecting dispersion of a normally non-fluid bitumen in the rubber dispersion by employing said rubber dispersion in thick pasty condition as the dispersing media for the bitumen.

4. The process which comprises effecting dispersion of rubber in an aqueous paste of a hydrophilic colloid, and subsequently effecting dispersion of asphalt in the rubber dispersion by employing said rubber dispersion in thick pasty condition as the dispersing media for the asphalt.

5. The process which comprises effecting dispersion of rubber in an aqueous paste of a hydrophilic colloid, subsequently effecting dispersion of a normally non-fluid bitumen in the rubber dispersion by employing said rubber dispersion in thick pasty condition as the dispersing media for the bitumen, mixing the resultant dispersion with fibrous stock and running off the mixture on a paper making machine.

6. The process which comprises effecting dispersion of rubber in an aqueous paste of a hydrophilic colloid, subsequently effecting dispersion of asphalt in the rubber dispersion by employing said rubber dispersion in thick pasty condition as the dispersing media for the asphalt, mixing the resultant dispersion with fibrous stock and running off the mixture on a paper making machine.

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