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BITUMINIZED FELT

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This invention relates to the manufacture of bituminized felts such as are used for the purpose of covering the walls, roofs, and other parts of a building and, when properly finished, as with linseed-oil-paint ornamentation, are serviceable as floor coverings or the like. The present invention is also centered about bituminized felts which may serve as the base sheet for roofing shingles and which, in addition to the bituminous binder occurring therein as a body impregnant, may carry on its surface to be exposed to weathering a coating of asphalt of high melting point, e. g., blown asphalt, and a surface layer of granular mineral material, such as crushed slate, stone, quartz, or the like, embedded in the coating.

Heretofore, felts to be bituminized for the foregoing purposes were fabricated from cheap rags as the main raw material. The rags were placed in the usual hollander or beater engine, wherein they were beaten in the presence of water until a smooth pulp or halfstuff, the fibers of which were of sufficiently reduced length to be feltable, was obtained, whereupon the pulp was appropriately diluted with water and delivered to the felt-making machine. The waterlaid felt thus made was then bituminized and put through suitable finishing operations, depending upon the ultimate service which the bituminized felt was to undergo.

In the roofing industry, various forms of shingles are cut from bituminized felt roofing material, some being equipped with interlocking tabs or similar elements which, during laying on the roof, undergo flexing. The usual bituminized rag felts are apt to be deficient in sufficient tear resistance to withstand rough handling during the laying of shingles cut therefrom, particularly when the shingles are interlocked by tabs or similar elements. Moreover, such shingles may be insufficiently flexible to withstand cracking when their interlocking portions are subjected to comparatively sharp bending during assembly on a roof. The fact is that the laying of such shingles must be done carefully, since, otherwise, the interlocking portions may be broken off or torn away from the main body. Even when such shingles are carefully handled, however, it may be difficult to make them lie flat or snugly against the roof particularly at the interlocking portions. When laying so-called "roll" roofing, the usual bituminized rag felts may give trouble over sharp corners because the felt base tends to crack or open up under sharp flexing or to become so greatly weakened as to tear off under slight provocation.

It has been established that a bituminized felt whose felt base is made largely or entirely from refined cellulose pulp in a substantially unhydrated condition represents a vast improvement over the conventional bituminized rag felt. For instance, the bituminization of a waterlaid felt whereinto substantially unhydrated refined wood pulp having an alpha cellulose content of say, at least about 93%, has entered as a principal raw material gives rise to a product of excellent moldability, pliability, and such high tear resistance as to be considered practically tearproof. Moreover, the felt itself can be folded on itself without cracking. We have now found that even when the refined but substantially unhydrated cellulose pulp is used as a subordinate fibrous component in the felt-making furnish, that is, in amount even less than 50% by weight of the dry fibrous materials constituting the furnish, it is possible to arrive at felts which, too, are practically as resistant to cracking when folded onto themselves as felts consisting mostly of refined cellulose pulp in substantially unhydrated condition, and which, when bituminized, display remarkably better properties than the usual bituminized rag felts. Indeed, we have found that the use of as little as 20% to 30% by weight of refined but substantially unhydrated cellulose pulp in a felt-making furnish is all that is necessary to enhance the pliability and folding endurance of the bituminized felt enormously even though the tear resistance of the bituminized felt is not so markedly benefited. For many roofing purposes, however, the ultimate or best tear resistance in the bituminized felt may not be vital, but an enhanced pliability or moldability may be of tremendous advantage. The point is that by using a preponderant proportion of rags and a subordinate proportion of refined but substantially unhydrated cellulose pulp as raw materials in the felt-making furnish, it is possible to arrive at bituminized felts which are surprisingly superior to the usual bituminized rag felts for roofing and other purposes, for instance, as the base sheet from which interlocking shingles are cut. Such shingles can be laid with much less danger of being cracked or torn at their interlocking portions, whereat they are weakest, and can be made to lie flatly against the roof more easily than the usual rag felt base shingles. It is thus seen that we accomplish the desired ends with a minimum usage of refined cellulose pulp, which is a far more expensive raw material than

the rags available for felt manufacture. The realization of these ends has heretofore been a serious problem even to the skilled felt-manufacturer, who has heretofore been on the lookout for an inexpensive and effective way of preparing felt which does not crack when flexed sharply as by being folded onto itself or over mandrels of small diameters. If wool, for example, as in the form of the so-called No. 1 roofing rags which contain about 30% to 50% of wool fiber, is added to the felt-making furnish, the sharp-bend flexibility is improved, but the strength of the felt tends to drop rapidly. On the other hand, the simple addition of comparatively little refined cellulose pulp to the felt-making furnish affords an inexpensive way of both realizing sharp-bend flexibility in the felt and of improving the toughness of the bituminized felt. The interesting aspect of the results which we secure is that the effect of the refined but substantially unhydrated cellulose pulp is not largely or entirely obliterated by the larger proportion of hydrated but unrefined rag pulp entering into the felt-making furnish, which, if it were made from only rags as raw material, would yield felt tending to flake or crack open very badly on the surface when folded on itself. In other words, it might reasonably be expected that the great dilution with inferior hydrated pulp which the refined but substantially unhydrated pulp undergoes would give rise to bituminized felts possessing little, if any, advantage over the usual bituminized rag felts. Apparently, the softness and other desirable qualities inhering in the refined but substantially unhydrated pulp persist in a felt containing only about 10% to 20% of such pulp and are responsible for the qualities of good moldability, pliancy, and tear resistance in a bituminized felt. In other words, such impurities and hydrated cellulose as arise from the rag pulp in the felt-making furnish evidently remain external to the refined fibers, that is, do not exist in intimate association with the fiber wall of the refined fibers as impurities occur in an unrefined wood pulp, for instance.

While there may be various procedures falling within the purview of the present invention, we shall give typical practice such as may be advantageously adopted in preparing a bituminized roofing felt in accordance with our invention. A beater engine may be charged with cheap rags such as are customarily employed for felt-making purposes and with sufficient water to ensure circulation of the mass. The beater roll may be put in operation with its knives or bars so clearing the bed-plate as to cut or reduce the rags sufficiently to yield a smooth pulp or halfstuff satisfactory for felt formation. At this time, the beater roll may be raised from the bed-plate and run as a mere circulating or mixing instrumentality while refined but substantially unhydrated cellulose pulp is blended into the rag pulp in appropriate amount. We prefer to prepare a furnish containing about 15% to 40% by weight of refined pulp of wood or other origin having an alpha cellulose content of say, at least about 93%. It is thus seen that the refined pulp is maintained in substantially unbeaten or unhydrated state in the furnish even though the rags have inevitably undergone considerable hydration or gelatinization while being reduced to a pulp. The mixed furnish may then be run off on a felt-making machine, the resulting felt bituminized as by passage through a bath of molten asphalt having a melting point of about 130° F. (ball and ring test) and at a temperature of about 385° to 400° F. in the bath, and the bituminized felt may be coated with blown asphalt or the like and be surfaced with ornamental, weather-resisting material, such as crushed, colored slate or its equivalent.

The refined cellulose pulp employed in the felt-making furnish of the present invention may be prepared as by exposing the usual chemical wood pulps, e. g., kraft or sulphite pulp, to the action of alkaline liquors under conditions resulting in an extraction of a substantial proportion of the non-alpha cellulose components from the pulp, for instance, bringing the alpha cellulose content of the pulp to at least, say, about 93% or greater. In some instances, as when sulphite pulp is being refined, a dilute alkaline liquor and comparatively high temperature may be advantageously relied upon in bringing about this refinement. On the other hand, a pulp may be refined in strong alkaline liquors at comparatively low temperatures, for instance, in liquors of sufficient concentration to mercerize the pulp. In any case, however, the refined pulp entering into the felt-making furnish should be maintained in a substantially unhydrated condition in order to yield a bituminized sheet of the desired characteristics. When pulps are refined in alkaline liquors, the impurities existing in intimate association with the fiber wall are evidently leached out, leaving the fiber wall in a more or less etched condition. The softness and flexibility of the refined fibers evidently remain unimpaired even when such fibers are commingled with comparatively impure hydrated rag pulp, whose impurities and hydrocellulose appear to remain as a phase external to the refined pulp fibers.

We claim:—

1. A bituminized, waterlaid felt whose fibrous base is made up essentially of at least about 60% to 85% of hydrated rag pulp and about 40% to 15% of substantially unhydrated wood pulp having an alpha cellulose content of at least about 93%.

2. A process which comprises beating unrefined rags in water to form a hydrated, feltable pulp, admixing with said pulp substantially unhydrated wood pulp having an alpha cellulose content of at least about 93% in amount to produce a furnish containing only about 15% to 40% of said wood pulp, making a waterlaid felt from said furnish, and bituminizing the felt.

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