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MANUFACTURE OF WATERLAID FIBROUS
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In making artificial leathers, it is sometimes the practice to use waterlaid webs of loosely felted and substantially unbeaten cellulose pulp as a foundation for an impregnant like rubber latex, which when dried out in the foundation tenaciously bonds together the fibers and imparts other leather-simulating qualities to the web. It has been established that those webs which have been fabricated with the application of little, if any, pressure during formation on machinery of the papermaking type and during drying are best suited for use as the foundations or carriers for the impregnant. So, too, it has been established that the presence of hydrated cellulose is detrimental when webs of the greatest degree of softness and leading to artificial leathers having a high degree of pliancy are desired.

I have observed that when so-called lap stock consisting of wet, substantially unbeaten cellulose pulp, e. g., substantially unbeaten wood pulp, is used as the raw material for fabricating webs of the kind described, maximum softness in such webs is not realized. The lap stock is prepared on cylinder machines and when hydraulically pressed, as is common practice, to ensure maximum de-watering, the harshness of the webs prepared from such stock is still greater. Even worse results are had when the pulp is used in dried condition in the form of so-called drier sheet, which is compacted and pressed during formation and drying.

In attempting to account for the harshness of webs prepared from cellulose pulp in the form of lap stock or drier sheet, I was impressed by the fact that these forms of raw material were disintegrated in water, as is customary practice in papermaking, to produce an aqueous suspension of individual pulp fibers such as is essential in attaining uniform web texture. In so doing, a certain amount of hydration of the pulp inevitably ensued and gave rise to harshness in the web prepared from the pulp suspension. In the case of drier sheet, one had to expend more energy in disintegrating the sheet in water and in realizing an aqueous suspension of individual pulp fibers than was required of the slush stock available in a pulp mill, and to this was attributable greater hydration of the pulp fibers and consequently greater harshness in the web prepared from the fibers.

I have found it possible to use dried pulp in making soft, waterlaid webs of interfelted fiber, if, rather than disintegrating the dried pulp in water, the disintegration is performed in a dry

way preferably so thoroughly that a loose mass of dry, substantially individualized fiber units is realized. The dry mass can then be suspended in water to form readily a uniform pulp suspension, preferably a highly dilute one, which can be run off on machinery of the papermaking type into a web which is dewatered and dried substantially as deposited from aqueous suspension. The web thus formed is substantially free from hydrated cellulose in the sense that it has undergone substantially no mechanical working in the presence of water; and its fibers are thus integrated into a unitary layer or sheet by virtue of their interfelting and the action of surface tension drawing them together during drying. Using such a method, it is possible to start with pulp even in the form of drier sheet and yet arrive at softer webs than those secured from wet laps of similar pulp which are disintegrated in water. In other words, the dry mass of individualized fiber units when suspended in water gives a suspension of greater freeness than the suspension derived from wet laps of similar fiber prepared on a wet machine, as the water associated with the lap stock seems to keep the cellulose hydrate content in an unset or gelatinized condition conducive to a stiffening effect in the webs prepared from the lap stock. It is well known, for example, that manufacturers of glassine papers prefer to purchase lap stock rather than drier sheet, because the lap stock can be converted more easily into the highly hydrated form of cellulose essential to the manufacture of glassine papers. A drier sheet although it may have been prepared from pulp having some cellulose hydrate or gelatinized cellulose, has these materials present therein to an appreciable extent in an irreversibly set or dehydrated condition.

By starting with wood pulp, preferably a refined wood pulp of an alpha cellulose content of say, at least about 93%, in the form of drier sheet, disintegrating the sheet into its component fiber units in a dry way, and forming an aqueous suspension of the fiber units, it is possible to produce waterlaid webs of interfelted fiber possessing maximum softness and absorbency and thus preeminently satisfactory for use as foundations or carriers for impregnants. The major part of the work for individualizing the fibers being done on the dry pulp, the fibers are kept from being hydrated as would not be the case if this work were performed in the presence of water. The individualized fiber units can be suspended in water to form a uniform aqueous suspension with

little additional work and hence with minimum hydration, in consequence of which the web deposited from the aqueous pulp suspension and dried with the application of little or practically no mechanical pressure is possessed of maximum softness and absorbency. The web so made can be impregnated with rubber latex or other form of liquid rubber and then dried to produce an artificial leather of improved pliancy and mellowness. The web can also be impregnated with bitumens, such as molten asphalt, in making a high-grade bituminized sheet for building, roofing, and analogous purposes. The web further lends itself nicely to impregnation with other binders, including waxes and resins of a thermoplastic nature, in the manufacture of a sheet having a high binder to fiber ratio and useful for various purposes in the arts.

There are various machines available for disintegrating drier sheets of pulp, including pickers or cards, such as used in the textile industry, although I have found it convenient and economical to use so-called hammermills. The hammermills may be equipped with blowers to convey the individualized fiber directly into a body of water, as in a beater engine. The beater engine should be operated with the beater roll well above the bed-plate so as to function merely as the means for uniformly mixing the fibers and the water while at the same time avoiding hydration of the fibers as much as possible in producing an aqueous suspension for delivery to the web-making machine. In passing from the hammermill to the body of water, the pulp may be delivered through coarse screens which serve to remove fiber clumps. These clumps may be returned to the hammermill, whereas the substantially individualized fiber units can be discharged directly into the body of water. The entire output of the hammermill may, however, be mixed with the water, in which case, mixing would be continued until the fiber clumps have been resolved into substantially individual fiber units.

An important advantage residing in the process of my invention is that I am enabled to use dried pulps and more especially drier sheets of pulp as raw material. Pulp in this form keeps better and can be stored and transported at lower cost than lap stock or wet-pressed pulps which usually contain as much, if not more, water than they do dry fiber.

The use of a hammermill in accordance with the principles of the present invention may be availed of to great advantage in cutting or chopping cellulosic fibrous material in dry condition, as well as individualizing its fibers, thereby putting it in the desired condition for formation into soft, wet-felted products of substantially uniform texture and high absorbency. Whereas little reduction need be accomplished in connection with wood pulp or like short-fibered raw material, long-fibered material, such as rags and manila, may be reduced in fiber length to form masses of shortened, individualized fiber units, which, when steeped in water, can be made into webs of good formation, yet soft and absorbent, because the fibers are preserved in a substantially unhydrated condition. Manila pulp, for example, can be made into good-looking, soft felts by this procedure, whereas if beaten in water in the ordinary way to reduce the fiber length and thus to permit smooth felt-formation, the resulting felts are made harsh and may yield latex-impreg-

nated, artificial leathers or other impregnated products of comparatively low tear resistance, pliancy, and other characteristics. Another instance is the fabrication of felts and so, too, the fabrication of ribbons to be furled in moist condition into yarns or rovings, using rags as the starting material. If the rags are reduced in the ordinary manner, they form a hard, harsh product because the fibers are hydrated materially by the time they are individualized and sufficiently shortened, but if the rags are reduced in dry condition to a fluffy mass by pounding, chopping, and teasing, as in a hammermill, in accordance with the present invention, the felts and yarns made therefrom are softer and more pliable.

I claim:

1. A process of producing a soft, absorbent, uniformly textured, waterlaid web of interfelted fibers, which comprises subjecting a substantially dry mass of aggregated, preliberated, virgin cellulose pulp fibers to a mechanical disintegrating operation in the absence of water to produce substantially individualized pulp fibers, mixing such individualized pulp fibers with water to form a substantially uniform pulp suspension while keeping them in a practically unhydrated condition, and depositing the fibers in their substantially unhydrated condition from the aqueous suspension as a waterlaid web of interfelted fibers.

2. A process of producing a soft, absorbent, uniformly textured, waterlaid web of interfelted fibers, which comprises subjecting a substantially dry mass of aggregated, virgin, chemical wood pulp fibers to hammermill action in the absence of water to produce substantially individualized pulp fibers, mixing such individualized pulp fibers with water to form a substantially uniform pulp suspension while keeping them in a practically unhydrated condition, and depositing the fibers in their substantially unhydrated condition from the aqueous suspension as a waterlaid web of interfelted fibers.

3. A process of producing a soft, absorbent, uniformly textured, waterlaid web of interfelted fibers, which comprises subjecting substantially dry sheets of preliberated, virgin cellulose pulp fibers having an alpha cellulose content of at least about 93% to a mechanical disintegrating operation in the absence of water to produce substantially individualized pulp fibers, mixing such individualized pulp fibers with water to form a substantially uniform pulp suspension while keeping them in a practically unhydrated condition, and depositing the fibers in their substantially unhydrated condition from the aqueous suspension as a waterlaid web of interfelted fibers.

4. A process of producing a soft, absorbent, uniformly textured, waterlaid web of interfelted fibers, which comprises subjecting substantially dry sheets of compacted, preliberated, virgin wood pulp fibers having an alpha cellulose content of at least about 93% to hammermill action in the absence of water to produce substantially individualized pulp fibers, mixing such individualized pulp fibers with water to form a substantially uniform pulp suspension while keeping them in a practically unhydrated condition, and depositing the fibers in their substantially unhydrated condition from the aqueous suspension as a waterlaid web of interfelted fibers.

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