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AIR-LAYING FIBER FELTS

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The present invention relates generally to the production of air-laid fiber felts by gravity deposition in a depositing chamber, and in particular to improvements to favor the economics of the process and the quality of the product by minimizing the formation of festoons.

It is well known to inject into a depositing chamber a continuous stream of substantially individualized vegetable fibers, commonly of wood origin, in a manner to suspend them in air in the chamber for gravity fall to form a felt at the bottom of the chamber on an endless conveyer slowly moving through the chamber. It is also well known to introduce into the chamber a fine mist of liquid which carries a bonding agent for the ultimate felt. The mist particles mingle with the suspended fibers to wet the fibers so that the chamber contains floating fibers carrying liquid adhesive material, and incidentally the chamber walls including ceiling become wetted by stray mist particles. While the bulk of the fibers deposit as a felt, there is incidental and undesired contact of the fibers with or without adhesive with the walls and ceiling which define the depositing chamber. Such fibers attach themselves to the walls and ceiling and in turn catch and hold other fibers, thus building up what are called festoons of loosely held fibers. The festoons are mobile with the air circulating in the chamber, and from time to time become detached and fall onto the felt being formed. The deposition of festoons creates departures from that uniformity of felt formation which obtains in the absence of falling festoons.

In practical operation, beginning with a festoonless chamber, the festoons first begin to build up, while a high quality felt is being formed. Gradually the festoons reach a point where they begin to fall, and then a point where they are so heavy that the process must be stopped to clean the chamber of festoons. The periods of shut-down for such cleaning operations are economically costly. The presence of festoons enlarges the surface on which fibers may land, so that the process of forming festoons is an accelerated one, and the quality of the felt grows progressively worse from a high-quality start.

The problem of festoon formation is set forth in the patent to Brownlee, U. S. No. 2,389,024 wherein the defects are minimized in various ways leading to mechanical troubles and being uneconomic and costly. One way described in the patent is to make the chamber wider than the endless conveyer on which the felt is formed and carried out of the chamber, so that the

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festoons on the side walls tend more to fall into lateral gutters than on the felt. Another feature is the provision of movable endless belts presenting a stretch as a moving chamber wall or ceiling on which belts festoons in course of formation are carried out of the chamber and cleaned away before growth to a danger point.

The present invention aims to lessen the disadvantages of festoon formation by minimizing the rate of growth and the size of festoons.

It is a particular object of the invention to add to the liquid introduced as a mist into the chamber an agent which is effective to lessen the rate of growth and the size of festoons.

It is a particular object of the invention to utilize triethanolamine oleate in one or more ways for the purposes described.

Various other and ancillary objects and advantages of the invention will become apparent from the following description and explanation of the invention.

In carrying out the process above described, which is generally set forth in the said Brownlee patent and also in the Heino Patent No. 2,493,194, it is common to use wood fibers, such as sulfite or Kraft cellulose, and aqueous starch solution as a binder. The starch is commonly used in an amount in the range from 5 to 15 and preferably 8 to 10 parts by weight to 100 parts of dry fiber. About 6 parts of starch and 94 parts of water are used to form the liquid binder, but the ratio may vary according to the temperature and kind of starch used, the objects being to subject the fibers to a starch sol before any gelation of the starch occurs, and to minimize excessive unnecessary amounts of water in forming the wetted fibers which deposit. Other ingredients may be present and among them are certain agents which in drying the felt react with the starch to render it resistant to ready dissolution on wetting, whereby the bonded felt is markedly resistant to disintegration when wet, compared to felts bonded by starch unmodified by such agents. Such modifying reactants are dimethylol urea (see Patent No. 2,450,377), monomethylol urea, urea-formaldehyde, melamine-formaldehyde, and potassium pyro-antimoniate.

In attempts to make the starch-bound felts resistant to water by adding wax emulsion to the binder liquid, it was found that festooning was greatly reduced, not only as evidenced by careful observation, but as measured by recorded times of operation before necessary shut-down of the process for clearing away festoons. Investigation has shown that the wax of the emulsion had no

effect on minimizing festooning, and that the emulsifying agent used with the wax was the active agent, which is effective to the desired ends when used in like manner but without the wax. The festooning was reduced by using triethanolamine oleate as an additive to starch, alone, or as the emulsifying component of a paraffin wax emulsion. The mechanism is not understood.

In carrying out the process it is only necessary to introduce into the chamber mist particles containing triethanolamine oleate. One set of spray nozzles may be used for the binder solution, and another set may be used for the anti-festooning agent, either without wax or with wax emulsified thereby. However, it is preferred to use one set of spray nozzles for a single aqueous liquid containing all the materials to be introduced to the suspended fibers by application of mist particles. This preferred method leads to minimizing the usage of water employed for the dry fibers. Reduction in water leads to a fluffier initial deposit, to lighter weight festoons, to less defects by fallen festoons, and to ease and lower the cost of drying.

The use of the wax emulsion described has other processing advantages. Where the felt is formed on a wire screen conveyer and compressed wet thereon, the compressed mat adheres more to the screen the greater the compression, due of course to the increase in number of fibers at the contact area of a wire. The presence of wax in the binder liquid materially reduces the sticking of the mat to the wire, making it easier to remove and transfer the mat to another conveyer for passage through a drying oven, such transfer being more particularly described in said Heino patent. Thus, the use of a wax emulsion having triethanolamine oleate as emulsifier, improves the uniformity of formation from face to face of the mat, and the uniformity and integrity of that face which is removed from the forming screen conveyer.

In carrying out the invention in the preferred manner there is used per 100 parts of fiber (oven-dry weight basis), a liquid binder containing from .04 to 4.0 parts by weight of triethanolamine oleate, whether or not it is present as an emulsifier for wax. In carrying out the invention using wax emulsion, the latter is prepared in concentrated form, independently of the starch binder solution, and the two are mixed in variable proportion to provide starch and triethanolamine at any preferred concentration within the limits above described. The following tabulation gives the total and parts, respectively of the two prepared liquids, the range of usage of each, and an exemplary use of each, as in one liquid composition providing starch and triethanolamine each in an amount approximately midway of its illustrated range.

Prepared Liquid		Usage per 100 Parts of Fiber	
		Range	Example 1
Starch Solution	100	83.3 to 250	167
Starch	6	5 to 15	10
Water	94	78.3 to 235	157
Wax Emulsion	100	.675 to 6.75	3
Paraffin	40	.27 to 2.7	1.20
Triethanolamine oleate	6	.04 to .4	.18
Water	54	.365 to 3.65	1.62

It is to be understood that only a small amount of the triethanolamine oleate is required for appreciation of its effect, and that it may be used over a wide range in proportion to fiber employed, as contemplated in the appended claims.

I claim:

1. The method which comprises projecting into a depositing chamber a continuous stream of dry substantially individualized vegetable fibers for deposition by gravity in the bottom of said chamber from suspension in air in said chamber, continuously injecting aqueous mist particles of liquid into said chamber for applying mist particles to fibers falling therein for deposition, said mist incidentally wetting the defining walls of the chamber and thereby causing fibers to collect on said walls and grow as festoons, there being mist particles containing a starch sol as bonding agent for integrating a felt formed by the deposited fibers and mist particles containing triethanolamine oleate in an amount to introduce into said chamber from 0.04 part to 0.4 part by weight of triethanolamine oleate to 100 parts of fiber, said triethanolamine oleate being effective to decrease the rate of formation and the size of festoons.

2. The method which comprises projecting into a depositing chamber a continuous stream of dry substantially individualized vegetable fibers for deposition by gravity in the bottom of said chamber from suspension in air in said chamber, continuously injecting aqueous mist particles of liquid into said chamber for applying mist particles to fibers falling therein for deposition, said mist incidentally wetting the defining walls of the chamber and thereby causing fibers to collect on said walls and grow as festoons, there being mist particles containing a starch sol as bonding agent for integrating a felt formed by the deposited fibers and mist particles containing emulsified wax and triethanolamine oleate as emulsifier therefor, the latter being present in an amount to introduce into said chamber from 0.04 to 0.4 part by weight of triethanolamine oleate to 100 parts of fiber, said triethanolamine oleate being effective to decrease the rate of formation and the size of festoons.

3. The method which comprises projecting into a depositing chamber a continuous stream of dry substantially individualized vegetable fibers for deposition by gravity in the bottom of said chamber from suspension in air in said chamber, continuously injecting a mist of aqueous liquid into said chamber for applying mist particles to fibers falling therein for deposition, said mist incidentally wetting the defining walls of the chamber and thereby causing fibers to collect on said walls and grow as festoons, said liquid containing a starch sol as bonding agent for integrating a felt formed by the deposited fibers and containing also triethanolamine oleate in an amount to introduce into said chamber from 0.04 to 0.4 part by weight of triethanolamine oleate to 100 parts of fiber, said triethanolamine oleate being effective to decrease the rate of formation and the size of festoons.

4. The method which comprises projecting into a depositing chamber a continuous stream of dry substantially individualized vegetable fibers for deposition by gravity in the bottom of said chamber from suspension in air in said chamber, continuously injecting a mist of aqueous liquid into said chamber for applying mist particles to fibers falling therein for deposition, said mist incidentally wetting the defining walls of the chamber and thereby causing fibers to collect on said walls and grow as festoons, said liquid containing a starch sol as bonding agent for integrating a felt

formed by the deposited fibers and containing also emulsified wax and triethanolamine oleate as emulsifier therefor, the latter being present in an amount to introduce into said chamber from 0.04 to 0.4 part by weight of triethanolamine oleate to 100 parts of fiber, said triethanolamine oleate being effective to decrease the rate of formation and the size of festoons.

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