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ABSORBENT PADS

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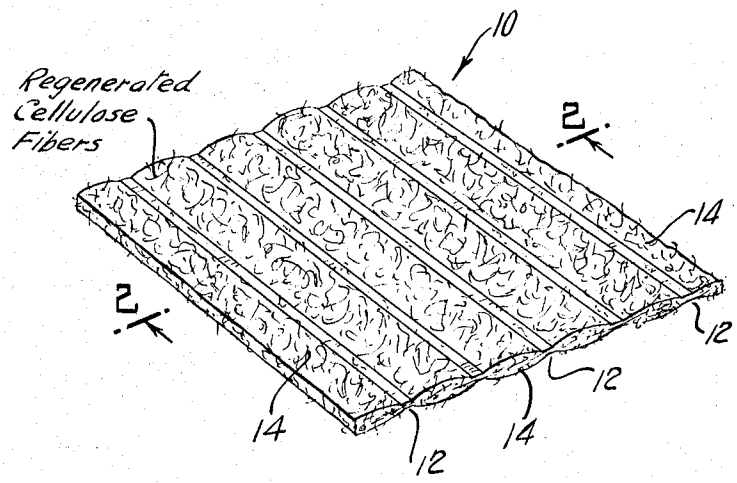
Fig. 1.



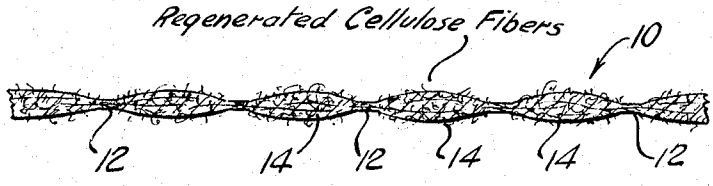


Fig. 2.

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ABSORBENT PADS

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This invention relates to non-woven fabrics and more particularly to non-woven fabrics in the form of bonded bulky webs of fibers having high loft and which are useful for cosmetic purposes, for absorbing purposes, as applicator pads and the like.

In U.S. Patent No. 2,834,703, "Tissue Faced Cotton Squares," issued May 13, 1958, there is disclosed a non-woven fabric of the type to which the present invention relates. The fabric is formed by highly compressing a laminate of a relatively thick layer of cotton and a relatively thin layer of paper along spaced, narrow lines of compression which alternate with relatively wide uncompressed areas. Highly compressing the cotton fibers along the narrow lines compacts the fibers in the lines of compression and bonds them together, thus integrating the pad. The uncompressed areas of fibers between the lines of compression have the loft, bulkiness, softness and absorbency which is characteristic of cotton. A non-woven fabric of this type has many uses, and particularly as a soft, absorbent, flexible pad in a form commonly known as "cotton squares" which are useful as applicators for cosmetics, lotions, powders and the like.

Bleached cotton fibers are particularly suitable for use in such products because they readily form strong yet flexible fiber-to-fiber bonds under high compression in the presence of small amounts of moisture. For example, a bleached, carded cotton web containing moisture equivalent to its regain value of from 7% to 9% (65% relative humidity at 70° C.) can be readily bonded together into a cohesive structure by subjecting the web to pressures of about 10,000 pounds per square inch.

While acceptable products of the type to which this invention relates can be made by using cotton fibers, in the interests of economy, it would be desirable to employ synthetic fibers, such as regenerated cellulose fibers, which have some of the characteristics of cotton, to eliminate the necessity for boiling and bleaching operations customarily employed in treating cotton fibers. In addition, by using regenerated cellulose fibers, there would be provided a product which is more stable and more uniform and pleasing in appearance because such fibers are more uniform in their physical properties than cotton.

Regenerated cellulose fibers are currently available with or without a finish. A finish is a coating on the fibers of a material, such as sodium oleate, oleic acid, or stearic acid, which is commonly used to lubricate the fiber surface so that the fibers can be processed on conventional carding and picking equipment. The coating may be continuous or intermittent and is approximately monomolecular in thickness. Although fibers of regenerated cellulose have many of the characteristics of cotton fibers, and are thus used for similar purposes, regenerated cellulose fibers which have no finish are difficult to pick, card and be otherwise treated in the same maner as cotton fibers to form slivers and webs preparatory to product manufacture. It has been found necessary, therefore, to apply a finish to the fibers to permit such processing.

When attempts were made to make products incorporating the invention with regenerated cellulose fibers instead of cotton fibers, two difficulties were experienced. In attempting to form bonds by highly compressing regenerated cellulose fibers having a conventional finish, it was found that suitable fiber-to-fiber bonds could not be

formed. It is believed that the bonds obtained by highly compressing cellulosic fibers are hydroxyl or hydrogen bonds, similar to the bonds formed in the manufacture of paper. Materials used as fiber finishes are generally good hydrogen bond breakers and thus their presence on the fiber surface adversely effects the formation of such bonds.

On the other hand, attempts to form bonds by highly compressing unfinished, or so-called "hard finish" regenerated cellulose fibers resulted in bonds which were boardy and stiff and entirely unacceptable in the types of products contemplated. In addition, the unfinished regenerated cellulose fibers could not be processed in accordance with conventional cotton fiber processing techniques, such as carding and picking, whereupon it was discovered that non-woven fabrics comprising one or more relatively thick layers of regenerated cellulose fibers may be effectively yet flexibly bonded under high compression without obtaining boardy and stiff areas by applying as a finish to the fibers polyoxyethylene sorbitol. Sorbitol is a hexahydric member of the polyol family. We have found that a relatively thick web of regenerated cellulose fibers having a finish of this type can be compressed to obtain fiber-to-fiber bonds which hold as well as the bond obtained by compressing cotton fibers. The bonded areas of the regenerated cellulose fibers provided with the finish, in contrast to the boardy and stiff areas resulting from compressing unfinished or "hard finish" regenerated cellulose fibers, are soft and pliable.

Sorbitol is hydrophobic and can be used as a lubricant to provide a finish for regenerated cellulose fibers so that they can be processed in accordance with conventional techniques. However, as in the case of other finishes, sorbitol is also a hydrogen bond breaker and thus its presence as a finish on the surface of the fibers affects the formation of inter-fiber bonds by compressing. It was then found that by forming ethylene oxide derivatives of sorbitol, its lubricating and hydrogen-bond breaking characteristics can be modified. It was determined that by increasing the number of ethoxy groups substituted on the sorbitol, the lubricating properties of the sorbitol as a finish are decreased at the same time the bonding properties of the fibers are improved.

We have found that by providing regenerated cellulose fibers with a finish of a particular class of polyethylene oxide sorbitols, the fibers can be processed and the desired inter-fiber bonds formed by compressing can be obtained. The particular polyethylene oxide sorbitols used in the practice of the invention are those which have a "dendro" number of from about 6 to about 30. The term "dendro" is indicative of the number of mols of ethylene oxide groups present on the sorbitol. A polyethylene oxide sorbitol which is below 6 dendro has more of the characteristics of sorbitol and therefore, while aiding in processing the fibers, does not permit the formation of suitable bonds. If the dendro number of the polyethylene oxide sorbitol is above 30, suitable bonds may be obtained, but fiber processing is adversely effected. Therefore, the range in the dendro numbers of the polyethylene oxide sorbitols which are employed in the practice of our invention is between 6 and 30 and preferably is about 20. Polyoxyethylene sorbitols of these types are available from the Atlas Chemical Company.

Reference is made to the accompanying drawing wherein a preferred embodiment of the invention is illustrated and wherein:

FIG. 1 is a perspective view of a pad incorporating the invention and

FIG. 2 is a view of FIG. 1 taken along lines 2—2.

In accordance with a preferred embodiment of the invention, a non-woven fabric in the form of a pad 10 comprising a relatively thick layer of regenerated cellulose

fibers is highly compressed along spaced narrow lines of compression 12 which extend across the pad and which integrate it to provide a stable article. These highly compressed areas alternate with relatively wide areas of uncompressed fibers 14 which have their customary bulk, softness, and loft. The bonding lines formed by high compression integrate and hold the pad together whereas the uncompressed areas provide the necessary soft, absorbent areas for cosmetic purposes, for wiping, for padding, for applying liquids, and the like.

The pad may be formed from two superposed plies of carded, bleached bright, crimped 1½ denier regenerated cellulose fibers averaging 1⅛ inches in length, such as that sold by American Viscose under the designation #2380. Together, the webs weigh approximately 16 ounces per square yard. Other non-woven webs of regenerated cellulose fibers, such as garnett webs, air-laid webs, or webs having randomly dispersed fibers may be used. Preferably, a major portion of the fibers in the web are oriented so that a substantial portion of the fibers extend in a direction transverse to the lines of compression.

By way of example, a suitable pad incorporating the invention may be two inches square having four spaced narrow lines of compression ranging in width from 1/32 of an inch to 1/16 of an inch between which are areas of uncompressed fibers approximately ½ inch wide. The pad may weigh about 6 grains.

The amount of compression applied along the narrow lines should be sufficient to effect the desired bonding of fibers, but should not be of such magnitude as to cut through the fibrous web in the lines of compression. If pressures too low are used, the bond will not be maintained when the product is used and the product will tend to fall apart. In a preferred form of the invention, the compression applied along the narrow lines of compression is approximately 2,000 pounds per square inch. In addition, if desired, compression may be effected at elevated temperatures, as for example at 80° F.

The narrow lines of compression are kept as small as possible in order to obtain in the finished product the desired characteristics of loftiness, softness and absorbency. However, if the lines of compression are too narrow, a high incidence of cutting through the web may be encountered.

A series of tests were conducted on pads made in accordance with the present invention and on like pads made from absorbent cotton. The pads tested were each two inches square and weighed about 6 grains. The peel strength in the lines of compression in the pad made from regenerated cellulose having a 20 dendro polyoxyethylene sorbitol finish was 22 grams per inch, whereas the peel strength of the cotton pad was 20 grams per inch. The softness and flexibility of the pads were essentially the same.

The resistance to bending of the pads made from regenerated cellulose fibers having the polyoxyethylene sorbitol finish was 16 milligrams in the direction of said bonding lines and 136 milligrams in the direction across said lines when tested on a Gurley Stiffness Tester in accordance with the procedure set forth by the W. & L. E. Gurley Engineering Instruments Company of Troy, New York. The pad bulk measured under 0.013 lb./square inch pressure was 1.5 cm.^{3}/gram and its absorbency was 13.0 grams of water per gram of pad. The pads made from cotton had a stiffness of 100 milligrams in the direction of said bonding lines, 117 milligrams in the direction across said lines, a bulk of 1.5 cm.^{3}/gram measured under 0.013 lb./square inch pressure and an absorbency of 9.95 grams of water per gram of pad.

The polyoxyethylene sorbitol finish is preferably applied to the regenerated cellulose fibers after spinning and before baling. However, the finish may be applied at any suitable stage prior to compressing to form the bonding lines. The amount of polyoxyethylene sorbitol applied

may range from about 0.2% to 0.4% based upon the weight of the fibers and preferably is from about 0.25% to 0.3%.

The particular polyethylene oxide sorbitols used are unique in the practice of the invention. Attempts to duplicate the results by using conventional finishes such as "Tween 20," a polyoxyethylene sorbitan monolaurate sold by the Atlas Powder Company, sodium oleate, oleic acid and stearic acid were unsuccessful. While such materials are suitable as finishes for processing regenerated cellulose in accordance with conventional carding and picking techniques, they prevented the formation of acceptable bonds. The polyethylene oxide sorbitols in the dendro range described above when used as a finish permitted conventional processing of the fibers and also the formation of eminently suitable bonds in the non-woven fabric.

The resulting products had all the desired characteristics of like products made from cotton, such as softness, absorbency, loft and bulkiness. In addition, the products had a more finished and neater appearance and exhibited less of a tendency for fibers to slough off. This latter difference is due primarily, it is believed, to the fact that available cotton fibers are considerably shorter than the regenerated cellulose fibers which were used and range in length. Because the regenerated cellulose fibers were longer and of more uniform length, most of them were secured at two positions along their length by adjacent bonding lines which were spaced about ½ inch apart. The cotton fibers were, on the average, bonded at only one position along their length due to the shortness of their length.

It is apparent, therefore, that a better and more acceptable product of the type described above may be made more economically in the practice of the invention. It is also apparent that variations, modifications and changes may be made in the foregoing illustrative embodiments of the invention while still remaining within its spirit.

What is claimed is:

1. An absorbent pad comprising a nonwoven bat of regenerated cellulose fibers, said pad having relatively narrow areas of compressed fibers and intermediate said narrow areas relatively wide areas of uncompressed fibers, the fibers in said compressed areas being bonded together and having a finish of polyoxyethylene sorbitol, said polyoxyethylene sorbitol having a dendro number of from about 6 to about 30.

2. An absorbent pad in accordance with claim 1 wherein the dendro number of said polyoxyethylene sorbitol is about 20.

3. An absorbent pad in accordance with claim 1 wherein the amount of said polyoxyethylene sorbitol in said pad is from about 0.2% to about 0.4% based upon the weight of said fibers.

4. An absorbent pad in accordance with claim 1 wherein the amount of said polyoxyethylene sorbitol in said pad is from about 0.25% to about 0.3% based upon the weight of said fibers.

5. An absorbent pad in accordance with claim 1 wherein a major portion of the fibers are oriented in a direction across said narrow areas of compression.

6. An absorbent pad in accordance with claim 1 wherein said compressed areas are from about 1/32 of an inch to about 1/16 of an inch wide and are spaced apart about ½ of an inch.

7. An absorbent pad in accordance with claim 1 wherein said bat is formed from a plurality of superposed plies of said fibers.

8. An absorbent pad comprising a nonwoven bat of regenerated cellulose fibers, said pad having relatively narrow areas of compressed fibers and intermediate said narrow areas relatively wide areas of uncompressed fibers, the fibers in said compressed areas being bonded together and having a finish of polyoxyethylene sorbitol, said polyoxyethylene sorbitol being present in amounts

ranging from about 0.2% to about 0.4% based upon the weight of said fibers and having a dendro number of from about 6 to about 30.

9. A pad in accordance with claim 8 wherein a major portion of said fibers in said pad are oriented in a direction across said narrow areas of compression.

10. An absorbent pad comprising a nonwoven bat of regenerated cellulose fibers, said pad having relatively narrow areas of compressed fibers and intermediate said narrow areas relatively wide areas of uncompressed fibers, a major portion of said fibers being oriented in a direction across said narrow areas, said narrow areas ranging in width from about $\frac{1}{32}$ of an inch to about $\frac{1}{16}$ of an inch, said wide areas being about $\frac{1}{2}$ of an inch wide, the fibers in said compressed areas being bonded together

and having a finish of polyoxyethylene sorbitol, said polyoxyethylene sorbitol being present in amounts ranging from about 0.25% to about 0.3% based upon the weight of said fibers, and having a dendro number of about 20.

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