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			3,424,643	1/1969	Lewis, Jr. et al.	161/129

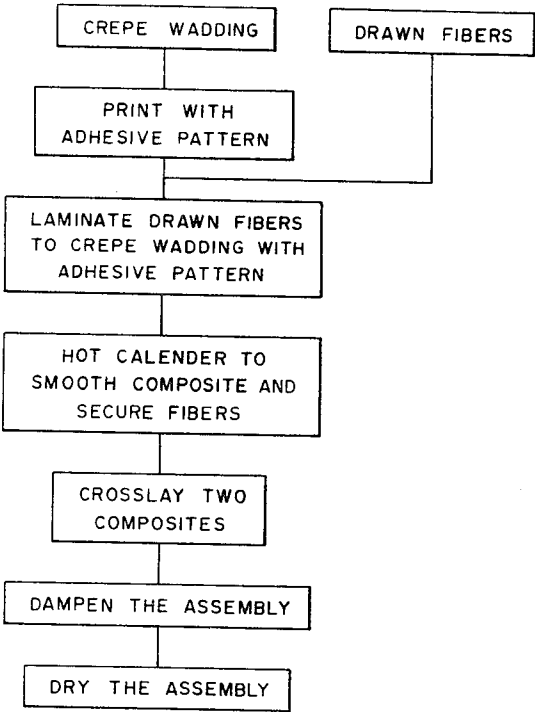
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Hanlon, Jr. and Raymond J. Miller

[54] METHOD OF PRODUCING A HIGH BULK MACRO-
CREPE PRODUCT
5 Claims, 4 Drawing Figs.

[52]	U.S. Cl.	156/83, 156/178, 156/179, 156/182, 156/183, 156/277, 156/292, 161/59, 161/129
[51]	Int. Cl.	B32b 31/00
[50]	Field of Search	156/83, 178, 179, 182, 183, 221, 229, 277, 280, 292, 59; 161/122, 128, 129, 141, 148

[56]	References Cited		
	UNITED STATES PATENTS		
1,503,451	7/1924	Klepper	156/280
2,314,876	3/1943	Greene	161/129

ABSTRACT: The production of a high bulk cellulosic wadding product which involves the dampening, preferably to a well wet stage, of creped padding secured by adhesive in well spaced zones to a drawn synthetic fiber web. The drawn fiber is substantially unaffected by the dampening while release of crepe distends the tissue between adhesive zones providing a macrocrepe structure on the creped tissue, the bulked nature of the tissue being retained upon subsequent drying. The process most suitably is carried out on an assembly of cross-laid composites of the tissue and fiber. The product is characterized particularly by bulk, strength and softness and has utility in applications such as that of facecloths.



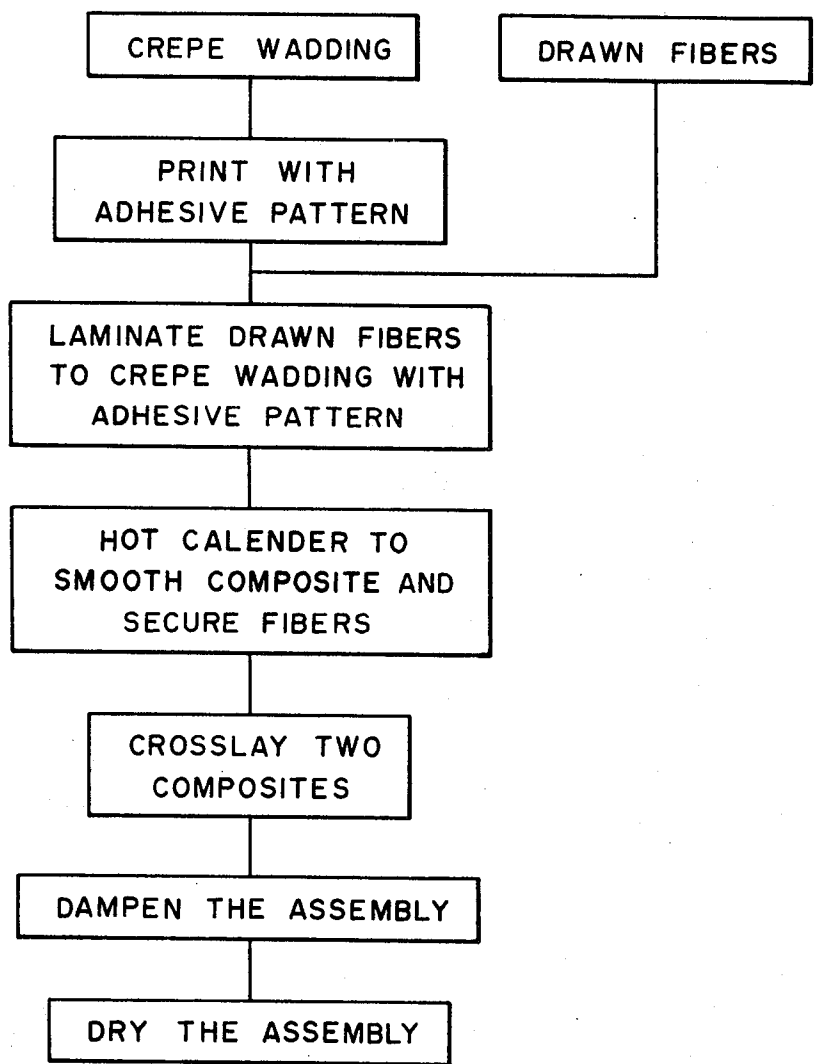


FIG. 1

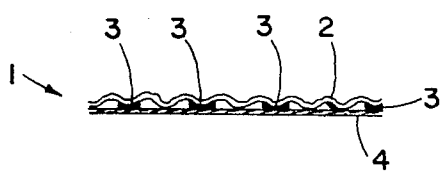


FIG. 2

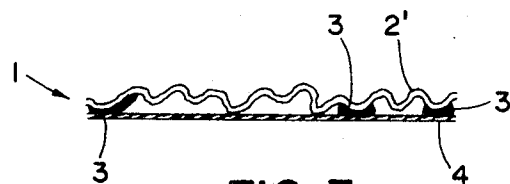


FIG. 3

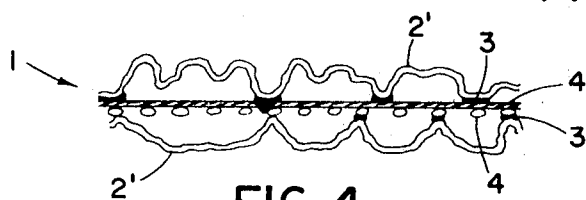


FIG. 4

METHOD OF PRODUCING A HIGH BULK MACRO-CREPE PRODUCT

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to a composite product of cellulosic wadding and drawn synthetic fibers and is more particularly concerned with an improvement in bulked webs and a process of producing the same.

The Invention

The bulked web contemplated herein exhibits a utility in applications requiring a degree of surface rugosity as well as softness, bulk and strength. Such characteristics provide the web with utility as toweling, washcloths and for wipe material generally, although it may have application in other areas such as drape and curtain material.

A particular object of the present invention is the attainment of a well relaxed cellulosic creped surface material having in the dry state a very large macrocrepe structure which is quite independent of the original crepe from which it is formed but dependent upon other controllable factors such as adhesive disposition and including a relationship of the adhesive pattern to the crepe ratio of the cellulosic wadding. The invention will be more fully understood by reference to the following detailed description and accompanying drawings within:

FIG. 1 is a flow chart of the primary steps of a preferred embodiment of the invention;

FIG. 2 is an exaggerated view in cross section of one embodiment of the composite material prior to the distending process;

FIG. 3 is similar to that of FIG. 2 but following the distension process; and

FIG. 4 is an assembly of crosslaid composites of the structure such as that illustrated in FIG. 3.

Referring more particularly to the drawings and initially to FIG. 2, numeral 1 generally designates a composite of creped tissue in the form of cellulosic wadding and a web of drawn fibers which extends transversely to the hills and valleys of the wadding. The wadding is designated by the numeral 2 and the web of drawn fibers by the numeral 4. The drawn web is tensioned and the fibers may be in close side-by-side contacting relation in known manner. The numeral 3 designates a zone of adhesive and, as will be noted from FIG. 2, such zones are well spaced along the length of the composite. The creped cellulosic wadding for the purposes of this invention should have a crepe ratio of at least 1.5:1. By this is meant that a tissue with a crepe ratio of 1.5:1 may be extended to one and a 1.5:1 times its length if all crepe were removed. Further, care is taken that the wadding retains substantially all of its crepe through lamination with the drawn web; this differs from many wadding operations which are followed by mechanical crepe removal by stretching and ironing to achieve a less stretchy and somewhat more soft product. In contrast to the creped wadding, the web of synthetic fibers supported on the creped wadding has a stretch of only about 10 percent or less and may be considered as nonshrinking. In accordance with this invention in the practice of the process, the fact that the synthetic fibers have very little or zero shrinkage is an important consideration in the development of the bulk characteristic by relative distension between the synthetic fibers and the wadding webs.

As indicated in FIG. 1, the creped wadding designated at 2 (FIG. 2) printed with an adhesive pattern as indicated at 3 (FIGS. 2 to 4 inclusive) and laminated to the drawn fiber web by means of the adhesive pattern may be hot calendered to the smooth surface of the composite and to intimately secure the fibers in the adhesive. In the practice of the invention the hot calendering may be practiced on the structure illustrated in FIG. 2. In such event the adhesive may envelop both hills and valleys of the crepe to a limited extent. Specifically, the zone occupied by the adhesive is preferably quite limited although it may be sufficient that in the calendering operation adhesive

binds several hills, for example, of adjacent crepes together. This is not a necessary characteristic of the procedure or product but results from the fact that in the application of adhesive some may, and usually will, occupy positions on the side hills rather than being confined simply to the peaks of the crepe. Rugosity is apparently somewhat enhanced by such disposition of the adhesive.

Following the calendering operation (FIG. 1) to smooth the composite structure and provide for securing of the fibers by embedment in the adhesive, commonly it is preferable to cross-lay two such composites. Most suitably, cross-laying is effected by positioning the fibers of two composites at right angles to each other and in contact with each other so that the outer surfaces are creped wadding. More suitably, the composites are simply pressed together to cause the adhesive already present to penetrate between layers and to secure the two composites together. Alternatively if desired, additional adhesive might be provided to retain the composites together. In any event, it is preferably, in accordance with the practice of this invention, to first form an assembly of at least two composites.

The assembly formed as described is subjected to a dampening operation. This is for the purpose of increasing the moisture content particularly of the creped wadding. The dampening operation will be simply the sprinkling of water on to the wadding of the assembly. Alternatively, the treatment may be with saturated steam or with immersion in an aqueous bath. In any event, the moisture content of the creped wadding should be raised to at least 30 percent based on the dry fiber weight of the wadding. Preferably, the moisture content is raised to 50-200 percent based on the dry weight of the fiber of the creped cellulosic wadding. Importantly, in these treatments the drawn fibers of the inner webs do not undergo any material length change. However, the creped cellulosic wadding distends, losing, in some instances, very nearly all of its fine initial crepe. When the moisture is supplied to the creped cellulosic wadding of the assembly in liquid form rather than vapor form, the time for distending of the wadding between adjacent adhesive zones is materially shortened. When the moisture content is obtained by saturated steam or high humidity in the air, the time for effecting the distending is materially increased and, in some instances, the relaxation of the crepe between the adhesive zones will be quite incomplete. Thus, by selection of the mode of distending the creped wadding, the extent of the release of the crepe and, consequently, the bulk of the product may be controlled. We prefer to provide the moisture content of the cellulosic wadding with steam to about 100 percent to 200 percent so that both moisture content and temperature tend to aid the distending of the wadding.

Following the wadding expansion, commonly to the extent that the length of wadding between adhesive zones is about twice that of the straight line distance between adhesive zones, the wadding is dried. Drying is effected simply by passing through any conventional heating means and may be over rollers if desired. This is for the reason that there is little adhesive between the creped wadding itself and the fibers of the product drying, the product attains, in the case of the assembly, a structure such as that illustrated in FIG. 4. There the section view of the assembly designated generally by the numeral 1 shows the creped wadding designated as 2' in the expanded state as secured at well spaced zones 3 to the crosslaid drawn fibers 4.

In some instances it may be desirable to simply expand the crepe in the form of composite as designated in FIGS. 2 and 3 rather than in the form of the assembly. In this instance the product will have on one side a drawn web of fibers secured to a materially expanded wadding 2' by the adhesive indicated at 3 in FIG. 3. Two such expanded composites may be combined to provide the assembly of FIG. 4 if desired. It will be noted that there is, in fact, a distending or lengthening of the creped wadding between adhesive zones in the practice of the invention and that such is controlled to provide the materially bulky

sheet noted. There is, in effect, a large macrocrepe structure which is dependent on the crepe ratio remaining in the sheet in contrast to the original crepe ratio, the distance between adhesive zones and, to some extent, the nature of the adhesive printing pattern, but it is largely independent of the original crepe. By this latter is meant that the original crepe structure may vary widely in the number of crepes per inch without materially affecting, it has been found, the nature and bulk of the final distended product.

The large macrocrepe remaining in the material is desirable when employed with the cellulosic creped wadding as it provides for a combination of softness and rugosity having particular utility in the area of absorbent wipe materials in the nature of toweling, facecloths and the like.

We prefer to employ in the practice of the invention creped wadding having a crepe ratio of between about 1.5:1 and 3:1 and substantially unstretched and unironed; a smaller crepe ratio tends to provide too little bulk and a larger crepe ratio tends to provide an excessive loosening of material between usually spaced adhesive zones; tissue webs of about 4 to 12 pounds per 2,880 sq. ft. basis weight before creping serve the purpose well. We also prefer to provide creped wadding of a relatively fine crepe structure as such tends to have a better and more regular adhesion to the strength member and gives a more abrasion resistant surface. The nature of the wadding which is employed also is a factor in the speed at which the process would be practiced since higher weights of wadding tend to hold more fluid and, therefore, require longer drying times. I therefore prefer to employ for toweling material, facecloths and the like wadding having a basis weight of between about 7 and 14 pounds per 2,880 sq. ft.

A suitable adhesive for the practice of the invention is a plastisol. One useful plastisol is 100 parts of polyvinyl chloride dispersed in 60 parts by weight of diisodecyl phthalate. This material is readily formed to a viscosity of 3,000 centipoises Brookfield as measured with a No. 4 spindle at 20 r.p.m. and may be applied by conventional roll applicator means. Other adhesives, however, preferably those which are water-insoluble, may be employed and they include polyvinyl resins, plasticized or unplasticized, such as polyvinyl acetate, and the acrylic resins such as the alkyl acrylates.

Additionally, it is preferable that the creped wadding have a wet strength treatment and it is preferred to employ conventional wet strength resin materials such as melamine formaldehyde, urea formaldehyde, or condensation products of polyamide epichlorohydrin and the like. Tappi Monograph 13 entitled "Wet strength in Paper and Paperboard" describes such resins.

It has been noted that the striated web or drawn tensioned web should exhibit little extension or shrinkage in the practice of the procedure. Generally, we prefer to employ synthetic fibers of a length of about one-half to 3 inches or longer and a denier in the range of 0.5 to 3 as such fibers will lie in closely parallel and aligned relation and provide a material strength to the product when formed of fibers of rayon to provide webs having a square yard weight between about 3 and 20 grams. The webs may be drawn at speeds of 520 f.p.m. without altering the physical structure of the web and while maintaining the fibers in a highly aligned condition (at least 80 percent aligned). Useful staple length fibers include the rayon mentioned, polyesters, acrylonitriles, polyamides, polypropylene and other synthetics. Importantly, the fibers chosen should remain dimensionally stable under conditions of temperature up to about 300° F. and in the presence of considerable moisture. A conventional pattern of adhesive places the adhesive zones spaced at a distance of about three thirty-seconds inch. Also, 50 crepes per inch would be considered a relatively fine crepe within the concept of the invention while 10 crepes per inch would be considered relatively coarse. The calender pressure exerted should be relatively high to insure of web smoothness and compaction of the fibers into the adhesive. The adhesive in the selected pattern should cover at least about 10 percent but not more than about 30 percent of the

area of the composite in order to provide for adequate bulking of the web.

In specific application a crepe cellulosic wadding sheet of a thickness of 0.025 inch and wet strengthened by polyamide-polyamine-epichlorohydrin having a crepe ratio of 2.1:1 and about 40 crepes per inch is printed with an adhesive pattern of conventional nature; such is commonly termed a brick pattern and is constituted by adhesive in spaced apart rectangular zones separated by nonadhesive areas. The adhesive is applied over 16.7 percent of the wadding area and to some extent coats both the hills and valleys of the fine crepe structure; the adhesive is applied by roll applicator means and is composed of a plastisol of about 100 parts of polyvinyl chloride and 60 parts by weight of diisodecyl phthalate. This adhesively treated crepe wadding is laminated to a drawn fiber web of rayon of a square yard weight of about 5.0 grams. The fibers have a denier of 1.5 and are parallel aligned to the extent of about 85 percent and in close contacting relation. The lamination step is followed by a hot calendering action which smooths the composite and simultaneously secures the fibers to the wadding. Cross-laying of such composite is conventional as already described. The resulting assembly was thoroughly wetted with water and then dried at a temperature of 80° C. Upon drying, the creped wadding had bulked up and the overall thickness of the two ply composite was 0.051 inch. Prior to the bulking process the composite had a bulk of 0.019 inch. Thus, the bulk increase was about 2.7 times.

The strength and elongation characteristics of the web are determined largely by the tensioned aligned fibers which cover the creped wadding; the wadding determines the important absorbency, wet feel and other characteristics important on facecloth and similar applications.

As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that I do not limit myself to the specific embodiments thereof except as defined in the appended claims.

We claim:

1.

The process of making a bulky web product which comprises printing wet strengthened creped and substantially unstretched and unironed wadding having a crepe ratio of at least 1.5:1 up to about 3.0:1 with an adhesive pattern which is disposed in spaced zones on the wadding and encompasses at least some valleys as well as peak areas of the crepe, laminating a thin web of drawn synthetic fibers to said adhesively patterned wadding to provide the fibers on the wadding in parallel aligned relation and substantially completely over the wadding surface, calendering the drawn synthetic fibers to the creped, unstretched and unironed wadding to smooth the crepe and to embed the fibers in the adhesive and secure the fibers to the wadding only with the adhesive of the mentioned pattern so that a composite of the wadding and fibers is formed, subsequently dampening the crepe wadding to the extent that the moisture content of the wadding is at least 30 percent by weight based on the dry weight of the fiber of the wadding to cause a release of the crepe structure and distending of the wadding between adhesive zones, and drying the composite while maintaining the distended structure to provide a macrocreped bulky web product.

2.

The process according to claim 1 in which, prior to dampening of the composite, two composites are cross-laid into a unitary assembly with the fibers in inner contacting layers and extending perpendicularly to each other, and the composites are then dampened in the form of the assembly to distend the outer wadding layers of tee assembly.

3. The process according to claim 1 in which the creped wadding is subjected to a steaming to effect the dampening and distending of the wadding.

4. The process according to claim 1 in which the creped wadding during the distending process has a moisture content in excess of 100 percent by weight based on the dry weight of the wadding.

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5. The process according to claim 1 in which the crepe ratio of the wadding and the dampening of the wadding between adhesive zones is such that the wadding distends so that the

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wadding length between adhesive zones is at least twice that of the straight line distance between adhesive zones.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,615,976 Dated October 26, 1971

Inventor(s) Dan D. Endres and Frank M. Lewis, Jr.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In column 2, line 60, three words are missing and one word is incorrect. The line should read: --drawn webs. Upon drying, the product attains, in the case of the as- --.

The incorrect word is "product", first occurrence, and the three missing words are "drawn webs. Upon".

Signed and sealed this 11th day of April 1972.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents