March 27, 1973 J. BAUER 3,723,217

METHOD OF PRODUCING BONDED TEXTILE FABRICS
WITH IMPROVED DIMENSIONAL STABILITY
Filed July 11, 1969

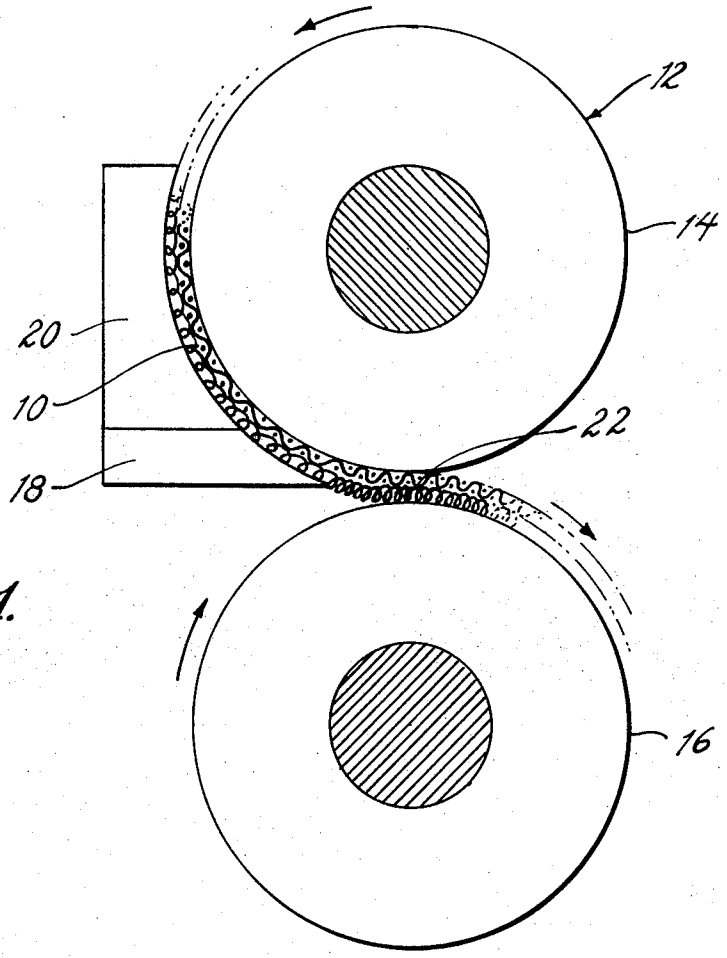


Fig. 1.

Fig. 2.

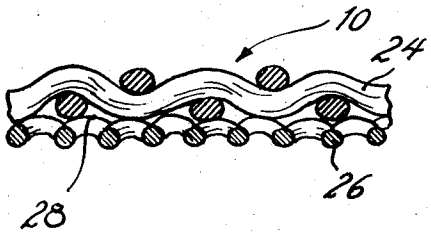
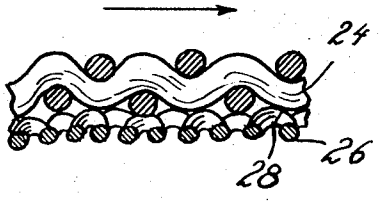


Fig. 3.



INVENTOR.
JACKSON BAUER
BY Paul & Paul
ATTORNEYS.

United States Patent Office 3,723,217
Patented Mar. 27, 1973

3,723,217

METHOD OF PRODUCING BONDED TEXTILE FABRICS WITH IMPROVED DIMENSIONAL STABILITY

Jackson Bauer, Croydon, Pa., assignor to Collins and Aikman Corporation, New York, N.Y.

Filed July 11, 1969, Ser. No. 841,042
Int. Cl. B32b 31/08
U.S. Cl. 156—164 6 Claims

ABSTRACT OF THE DISCLOSURE

A method is provided for producing a bonded textile fabric with improved laundering and dry cleaning dimensional stability in which a composite comprised of at least two plies of the same or different textile fabrics with the plies bonded together by an uncured to partially cured adhesive being compacted and then completely cured. The bonded textile fabrics of this invention are especially useful in the manufacture of wearing apparel, but also find uses in home furnishings and industrial fabrics.

BACKGROUND OF THE INVENTION

(1) Field of the invention

This invention relates to the method of producing bonded textile fabrics. More particularly, this invention is concerned with the method of producing bonded textile fabrics having improved laundering and dry cleaning dimensional stability which are comprised of at least two plies of a textile fabric.

DESCRIPTION OF THE PRIOR ART

A bonded textile fabric is a fabric which is comprised of at least two textile fabric plies which are bonded directly together with an adhesive which does not significantly add to the thickness.

The textile fabrics that are employed may be either knitted, woven or may even be a nonwoven construction with the combination of a woven fabric with a knitted fabric being commonly employed. The textile fabrics that are employed are of a rather open and loose construction.

The fabric plies are bonded to each other by various well known methods. One method is to use a curable bonding agent such as an acrylic or urethane adhesive. Another method is to use a ply of a foam such as a polyesterurethane foam and by the flame laminating method, completely collapse the foam so that it becomes the adhesive.

Bonded textile fabrics have many properties which make them especially useful for certain applications. The ability to bond an outer wear fabric to a lining fabric to make a self lined bonded fabric make the bonded fabrics especially useful in apparel application.

Bonded textile fabrics would be more extensively employed except for the fact that the bonded textile fabrics heretofore available had notoriously poor dimensional stability especially to home laundering and dry cleaning. It was not uncommon for the prior art, bonded textile fabrics, to shrink 5% to 15% after being laundered. In addition to the overall shrinkage of the bonded fabrics, the various plies comprising the bonded textile fabric tended to shrink at different rates which further caused the bonded fabrics to buckle or pucker which was highly undesirable.

Various methods have been suggested by the prior art to improve the dimensional stability of conventional single ply textile fabrics. One method which has proven to be especially useful is compacting. The methods of compacting are well known to those skilled in the art and are disclosed in patents such as Walton U.S. Pat. 2,765,513.

The methods of compacting conventional textile fabrics have not, however, proven to be successful in the manufacture of bonded textile fabrics. Attempts to compact the individual plies comprising the bonded fabric before bonding did not sufficiently increase the dimensional stability of the final product. The textile fabrics were difficult to maintain in the compacted state because the textile fabrics that are generally employed to make bonded textile fabrics are of a loose open construction which does not readily hold compacting. A further problem encountered was that each type of fabric employed had a different shrinkage and accordingly each had to be compacted a different amount. However, the fabrics when bonded together did not necessarily shrink the same amount as when unbonded and accordingly, some buckling and puckering still occurred. An additional problem encountered was that the process steps involved in bonding pulled out a considerable amount of the compaction before bonding occurred. A further objection to compacting the plies before bonding was that it was not economically feasible because of the additional processing cost involved in compacting each ply before lamination.

Attempts to compact the bonded textile fabrics after bonding and curing were not completely satisfactory in that the fabrics would not retain a sufficient amount of compaction to control the dimensional stability during laundering and dry cleaning.

It is accordingly, a primary object of this invention to provide bonded textile fabrics having improved laundering and dry cleaning dimensional stability.

It is a further object of this invention to provide a process for the manufacture of bonded textile fabrics which have improved dimensional stability to laundering and dry cleaning.

Other objects and advantages of this invention will become further apparent from a review of the drawings and subjoined specification and claims.

SUMMARY OF THE INVENTION

In accordance with the present invention, bonded textile fabrics having improved dimensional stability are obtained by compacting a composite comprising of at least two plies of textile fabrics in which the plies are bonded together by uncured to partially cured adhesive and then fully curing the composite to form the bonded textile fabrics.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic illustration of a compactor through which a composite comprised of a woven fabric, and a knitted fabric is shown being processed.

FIG. 2 is an enlarged cross sectional illustration of an uncompacted composite.

FIG. 3 is an enlarged cross sectional illustration of the compacted composite.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The initial step in the process of the present invention is the preparation of the starting composite. The starting composite is comprised of at least two plies of the same or different textile fabrics and the plies are bonded together by uncured to partially cured adhesive.

The textile fabrics that are used to make the composites are substantially identical to the fabrics employed by the prior art to make bonded textile fabrics, with the exception that somewhat lighter weight goods can be employed since the compacting will increase the weight per lineal yard of the goods. The fabrics may be knitted, woven

or nonwoven in construction and may be comprised of natural fibers such as cotton or wool, regenerated fibers such as viscose rayon, synthetic fibers such as acetate rayon, polyamides or polyesters or blends of these fibers.

The starting composite may be comprised of more than two plies of textile fabrics. However, in general, it is preferable to employ only a face ply of one type of textile fabric, such as a woven fabric and a backing ply of another type of textile fabric, preferably a knitted tricot fabric.

The adhesive that is employed to make the composite is a critical component of the laminate. The adhesive that is selected should hold the plies of the composite together during the initial processing steps and during compacting. The adhesive in the uncured to partially cured state must have sufficient flowability that the adhesive bonds placed under excessive stress by compacting will flow into positions where when the cure of the adhesive is completed, they will hold the plies together in the new configuration imparted by the compacting step. The adhesive should also be curable to a form wherein it will not be substantially affected by either dry cleaning or laundering. The ideal adhesive should have "green" tack, that is, it should have a sufficient adhesiveness in the uncured state that it will hold the plies together. However, it is possible to use adhesives which have to be partially cured in order to provide sufficient adhesion to hold the plies together. Liquid adhesives are most useful in the manufacture of the starting composite. Adhesives may be of the water dispersible types such as the aqueous dispersions of the acrylic polymers or may be of the solvent dispersed types such as the solvent solutions of the urethane adhesives. The adhesives are applied in the conventional manner, for example one or both of the adjoining surfaces of the plies are treated with a solution of the adhesive and then the adhesive is dried to a point where it acquires a sufficient tack to hold the plies together. The textile fabric plies are then brought into contact to form the composite. Care is taken in the bonding step to limit as much as possible the advancement of the cure of the adhesive.

When a ply of a polyesterurethane foam is used as the adhesive by collapsing the foam by the flame method, it should be noted that when the urethane is thermally degraded isocyanate linkages form. The isocyanate linkages are believed to form bonds with the fibers. The isocyanate due to exposure to hydroxyl groups for example the water vapor of the air, reforms into a urethane. During the period of reformation, the degraded material is in fact an uncured to partially cured adhesive.

The starting composite **10** prepared as indicated above is fed into a compactor **12**. The compactor **12** which is schematically illustrated in FIG. 1 is comprised of a feed roll **14** and a retarding roll **16**, a fabric indenter **18** and a steam heated shoe **20**. The feed roll **14** is driven so as to have predetermined peripheral speed. The retarding roll **16** is driven so as to have a peripheral speed which is less than the speed of the feed roll **12**. In addition, the surface of the retarding roll is somewhat roughened as by mild etching or metallic spray coating, so that it will grip the composite **10** with greater frictional force than the feed roll **14**, at the nip **22** of the feed roll **14** and the retarding roll **16**. The speed of advancement of the composite **10** is decelerated from the peripheral speed of the feed roll **12** to the peripheral speed of the retarding roll **14** because of the greater gripping effect of the retarding roll **14** on the composite **10**. The fabric indenter **18** is an elongated bar which extends across the width of the compactor parallel to the nip **22** of the feed roll **14** and retarding roll **16**. The fabric indenter **22** prevents a substantial portion of the compacting forces imparted to the composite **10** by the difference in speeds of the feed roll **14** and the retarding roll **16** from being fed into the section of the composite which is rearward of the forward edge of the fabric indenter **18**. The fabric indenter **18** is spaced from the nip **22** at a predetermined distance. The area between the fabric indenter **18** and the nip **22** is a deceleration zone wherein the compacting of the composite **10** occurs. The steam heated shoe **20** is used to preheat the composite before compacting.

In the compacting process, the composite **10** which is in frictionally restrained engagement with the retarding roll **16** is prevented from advancing at the same rate as the rate of speed of the feed roll **14**. This causes the composite **10** to expand in directions normal to the direction of advancement, thereby causing the composite **10** to become compacted. The speed of the feed roll **14**, the retarding roll **16** and the length of deceleration zone are selected so as to compact the composite to a predetermined amount without causing detrimental buckling of the composite **10** in the compacting process. It is, of course, possible to select the speeds of the feed roll **14** and the retarding roll **16** and the length of the deceleration zone so as to cause a certain amount of controlled pleating in wherein this is desired to obtain a decorative effect in the final bonded textile fabric. The present process is not limited to any one particular type of compactor, however, it has been found that the compactors of the type disclosed by R. R. Walton in U.S. Pat. 2,765,514 are particularly useful in the process of this invention. Since the actual mechanics of the operation of a compactor are to some extent dependent on the particular type of compactor employed and are within the knowledge of those skilled in the art, additional details on the actual operation of the compactor are not necessary.

It should be carefully noted that the effect of compacting on the composite **10** is quite different from the effect of compacting on a conventional single ply textile fabric. This can be seen by reference to FIGS. 2 and 3. The starting uncompacted composite **10** illustrated in FIG. 2 has a face ply **24** of a woven textile fabric and a backing ply of a knitted fabric **26**. The plies **24** and **26** of the uncompacted composite **10** are joined by an uncured to partially cured resin **28**. As the composite **10** is advanced through the deceleration zone between the fabric indenter **18** and the nip **22**, the composite **10** is compacted which causes the plies of the composite **10** to expand in directions normal to the direction of advancement indicated by the arrow in FIG. 3. The expansion in directions normal to the direction of advancement is obtained because the plies comprising the composite are formed by the compacting force into a curved fan-fold configuration as is illustrated in FIG. 3. It can be appreciated from the illustration in FIG. 3 that the outwardly curved surfaces of each ply are stretched somewhat by the compacting step, while the inwardly sections of each ply are somewhat compressed by the compacting step. This change in the surface area of the plies causes strains to be placed upon the initially bonded areas of the uncured composite. If the strain on the uncured bonds is excessive, the bonds will flow and because an uncured to partially cured adhesive is employed, the adhesive will flow into a configuration wherein it will tend to hold the laminate in the compacted form. When the adhesive is then fully cured, the fully cured bonds hold the bonded textile fabric in the compacted form.

The problem of both compacting the individual plies and realigning of the bonds between the plies is not encountered when compacting a conventional single ply textile fabric. However, when it was attempted to compact the fully cured bonded textile fabrics of the prior art, the bonds which were fully cured before compacting caused the fabric to resist compacting. Furthermore, even after fabrics were compacted, the presence of the cured bonds which were placed under stress by compacting tended to cause the fabrics to return to the uncompacted form. This should be compared to the process of the present invention wherein the bonds placed under stress by compacting flow so as to hold the bonded textile fabrics in the compacted form.

The amount of compacting to which the composite **10** is subjected depends to a large extent on the desired dimensional stability to laundering and dry cleaning required in the final bonded textile fabric. Even a relatively small amount of compacting of the uncured composite will increase the laundering and dry cleaning dimensional stability of the cured bonded textile fabric to some extent. It is preferable, however, to compact the composite in an amount at least sufficient to compensate for a substantial portion of the inherent laundering and dry cleaning dimensional instability of the bonded textile fabric. In this regard, it should be noted that bonded textile fabrics exhibit a shrinkage which is not necessarily a composite of the shrinkages of the various plies comprising the bonded textile fabric. Accordingly, in order to evaluate the amount of compacting which should be imparted to a given bonded textile fabric, the fabric should be completely cured in the uncompacted form and then subjected to the various tests for which dimensional stability is required such as dry cleaning and laundering. The uncured composite should be compacted in an amount at least sufficient to compensate for the inherent dimensional instability of the uncompacted bonded textile fabric plus an additional amount to compensate for the unavoidable loss of compacting caused by handling during processing. In this regard, it should be noted, however, that in general a shrinkage of up to 3% in either length or width is not considered to be objectionable. It should be further noted that it is possible to compact a bonded textile fabric in an amount considerably greater than the amount required to compensate for the inherent shrinkage of the bonded textile fabric and thereby obtaining a bonded fabric with stretch properties. It is further possible to compact the bonded fabric so as to form decorative pleating or folds in the final bonded textile fabric.

After the composite has been compacted, it is cured to fully set the bonded fabric in the compacted form. The method of curing employed is dependent on the particular type of adhesive used. With an adhesive such as the urethanes, it is possible for example, simply to roll up the fabric directly off the compactor and keep it in the rolled form for several days at room temperatures whereupon the adhesive will cure itself. It is also possible to use heat cured adhesives, such as the acrylics wherein the fabric is subjected to a heat treatment after the compacting so as to set the fabric in the compacted form.

The method described above for obtaining dimensionally stabilized bonded textile fabrics can be modified without departing from the scope of the present invention, for example other types of compactors can be employed than the type schematically illustrated in FIG. 1. In addition, the compacting step can be combined with other processes. For example, a variation of the above described method which has been proven to be especially valuable is to employ as one of the fabrics a heat settable material such as a polyamide knitted fabric. The uncured composite is compacted as described above in an amount considerably greater than the amount required to compensate for the inherent shrinkage of the bonded textile fabric. The compacted composite is then subjected to a heat treatment sufficient to both cure the adhesive and set the heat settable fabric whereby a stretchable, dimensionally stabilized bonded textile fabric is obtained.

What is claimed is:

1. The method for producing a bonded textile fabric with improved dimensional stability comprising: bonding at least two plies of textile fabrics together with an effective amount of an uncured to partially cured adhesive to provide a composite, said effective amount being sufficient to hold said plies together in a compacted configuration when fully cured; compacting said composite in an amount sufficient to at least compensate for a substantial portion of the laundering and dry cleaning dimensional instability of said bonded textile fabric in the uncompacted state; and thereafter curing said adhesive, wherein said compacting comprises positively advancing said composite from a first surface at a first speed toward a second surface separate from said first surface traveling at a second slower speed and carrying said composite into frictionally restrained engagement with said second surface, said composite passing through a deceleration zone of a predetermined length immediately prior to engagement with said second surface, said first and second speeds and predetermined length of said deceleration zone being related so as to cause said composite to expand in directions normal to and thereby be compacted in the direction of advancement.

2. The process according to claim **1** wherein said composite is comprised of a facing ply and a backing ply bonded directly together by an uncured to partially cured adhesive.

3. The process according to claim **2** wherein at least one of said textile fabrics is a knitted fabric.

4. The process according to claim **2** wherein at least one of said fabrics is a woven fabric.

5. The process according to claim **2** wherein at least one of said fabrics is comprised of a thermally settable fibrous material selected from the group consisting of polyamide and polyester and said composite is compacted in an amount in excess of the amount required to compensate for the dimensional instability of the bonded textile fabric when in the uncompacted state and thereafter said composite is heated to a temperature sufficient to heat set said fibrous material, whereby a stretch bonded textile fabric is obtained.

6. The process according to claim **2** wherein said adhesive is polymerizable acrylic or urethane resin.

References Cited

UNITED STATES PATENTS

2,235,682	3/1941	Hawley	156—164
3,255,061	6/1966	Dobbs	161—159 X
3,558,393	1/1971	Bolliard et al.	156—181
2,825,117	3/1958	Evans et al.	26—69
3,100,925	8/1963	Messinger	26—18.6
3,252,848	5/1966	Borsellino	156—307
3,359,156	12/1967	Freuler et al.	162—361
3,409,960	11/1968	Dusenbury et al.	28—76
3,471,907	10/1969	Beckers	26—18.6

BENJAMIN R. PADGETT, Primary Examiner

E. A. MILLER, Assistant Examiner

U.S. Cl. X.R.

28—73; 156—181, 292, 307; 161—156