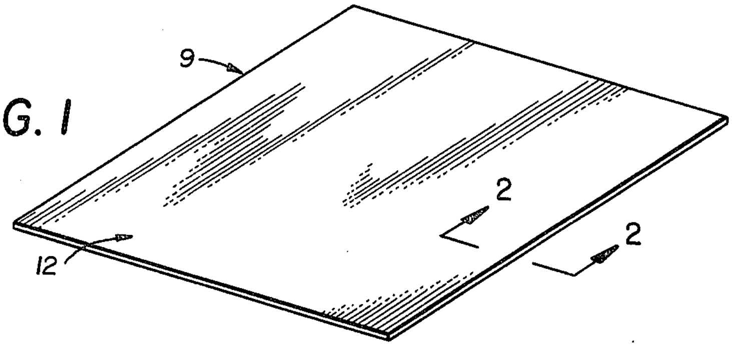
May 10, 1966 N. R. SEAMAN 3,250,662

COATED FABRIC

Filed Jan. 16, 1964

FIG. 1



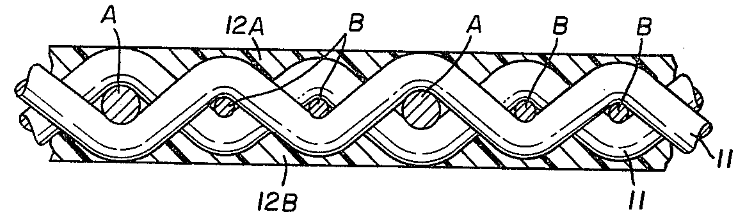


FIG. 2

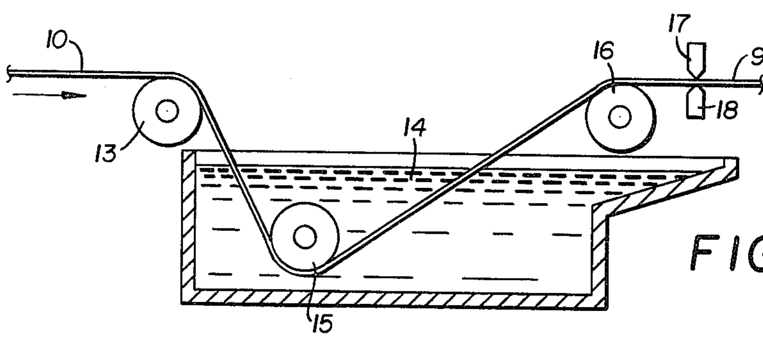


FIG. 3

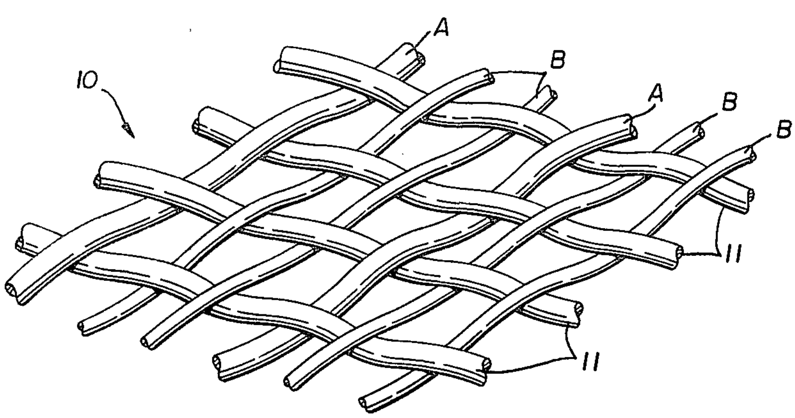


FIG. 4

INVENTOR.
NORMAN R. SEAMAN
BY Hamilton & Cook
ATTORNEYS

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3,250,662
COATED FABRIC

Norman R. Seaman, Holmesville, Ohio, assignor to Domestic Film Products Corporation, Millersburg, Ohio, a corporation of Ohio
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The present invention relates generally to fabrics. More particularly, the present invention relates to a particular fabric weave. Specifically, the present invention relates to a particular fabric weave especially adapted for coating by a liquid process.

Coated fabrics are especially suitable for covers, tents, tarpaulins and shelters which may be subjected to wide climatic change, hard usage and exposure to the elements.

While some work is currently being done with non-woven fabrics, the woven fabric provides a uniformity to the distribution of the fibers and therefore has the advantage of itself having mechanical strength which is in turn imparted to the finished coated fabric.

In coated fabrics an additional type of fabric strength is equally as important as the tensile and tear strengths of uncoated fabrics. That is, adhesion strength, or the strength of the bond between the coating and the fabric. Adhesion strength is the foundation for abrasion resistance, flex resistance and seam strength, particularly in bonded, as distinguished from sewn seams, where the only joinder is through the bonding of the contiguous coating material along the seam where the two fabrics are joined.

Heretofore, it has been axiomatic that adhesion and tear strength are inversely related. This was to a great degree the result of coating fabrics woven by previously known weaves. Loose weave fabrics are considered most favorable for providing a high degree of adhesion strength because the coating material can readily penetrate the interstices between the strands and form an homogenous bond with the coating on the opposite surface. However, the more open the weave the less tear strength because the strands are less capable of bunching to resist the tearing stress. Moreover, the more openly woven fabrics are far less stable in handling prior to being coated.

The loose weaves are less stable in that the adjacent strands of the warp or fill will easily slide apart—i.e., "pull" or "pucker"—when subjected to the least friction, as for example, when passing over a roller, bar or knife.

These pulls prior the coating further reduce the tear strength and in many cases cause too great a span between strands to retain the coating material, thus also affecting the appearance and acceptability of the cloth.

The tensile strength of the material may also be related to the type weave. For example, in a loose weave there are less strands per inch and accordingly less tensile strength than in more tightly woven fabrics where there are more strands per inch to resist tensile stress.

However, the particular type strand material is probably the greatest factor in tensile strength. The spun fabrics, such as cotton, wool and the like, with their short to medium fiber lengths, simply cannot provide the tensile strengths of the continuous filament strands such as nylon, Dacron, glass, or the like.

Here too any inverse relationship between adhesion strength and tensile strength exists unless elaborate preparatory processes are performed. Specifically, additional adhesion is obtained by the use of fibrous strands the roughened fibers of which can anchor in the coating material, but with non-fibrous strands of the continuous filament variety, no natural bonding can exist between the strand and the coating. Accordingly, it is the common practice to treat cloth woven of continuous filament strands with a cement to create a bond between the strand

material and the coating. Thus, an additional step is required to make the cloth bond to the coating. Aside from the fact that the preparation of the cloth requires the performance of an additional process, it is also expensive to apply the chemical and then dry the cloth before subsequent operations.

In addition to the considerations of the strand material and the weave, one must further consider the type of coating process.

The coating of woven fabrics may be accomplished by any of three methods: laminating, calendering or liquid coating. In laminating, a sheet, or film, of the coating material is placed on either, or both sides of the cloth and then, under high pressure, and generally with the application of heat, forced into the cloth. The high cost of the machinery required to accomplish this method and the necessity of an extremely open weave to obtain bonding virtually eliminates the practical feasibility of the lamination process for making continuous coated fabrics having both high tear and adhesion strengths. Furthermore, the vagaries incident to the exact application of heat and pressure as well as the variation in thread spacings in the loose weave cloth best suited for the lamination process are responsible for wide variations in the adhesion strength.

In the calendering process the fabric is passed between the opposed rolls of the calender. The coating is continuously charged into the bite of the opposed rollers in a viscous, or paste-like, consistency, whereby they are pressed into the fabric. The pressure utilized in a calendering operation can readily force the coating material into the fibrous strands of cloth woven of spun yarns. However, even the most extreme pressure cannot bond the coating material to continuous filaments. Hence, with cloths made from continuous filaments the weave must either be an available unstable open type, with an attendant decrease in tensile and tear strength, or the cloth must be preliminarily treated to impart a chemical adhesion.

The third process, liquid coating, merely requires that the fabric be passed across a series of guide rollers and through a liquid coating bath where enough of the fluid material adheres to the fabric to coat it.

This last method is not only continuous but requires the least amount of apparatus. However, here too the cloth, its strand material and weave, accounts for operational difficulties which have made it virtually impossible effectively to utilize this method. Loose weave fabrics appear excellent for liquid coating since the interstices between the strands of the weave permit the coating on either surface to bond together and thus impart a great mechanical adhesion between the coating and the cloth. However, as poined out supra, most loose weaves are unstable and are readily damaged by handling prior to coating. Moreover, these loose weaves do not completely retain the liquid coating when the fabric passes over rollers, bars or knives before the coating is completely gelled.

Nor is the panacea found in the use of tightly woven cloth. The tightly woven cloth is more expensive to weave, and, being tightly woven, has such small interstices between the strands that liquid does not sufficiently penetrate the cloth to impart a satisfactory mechanical adhesion.

Nor does the use of different strand materials effect any more favorable result than with the previously described processes.

It is therefore the primary object of the present invention to provide a cloth having stability—i.e., will not pull or pucker by normal handling or as it passes over rollers, bars, knives and the like—for handling and yet providing sufficient interstices to impart mechanical adhesion even when a continuous filament strand is coated.

It is another object of the present invention to provide a cloth, as above, permitting a sufficiently high order of mechanical adhesion with continuous filament yarns that chemical adhesion can be greatly reduced.

It is also an object of the present invention to provide a woven cloth suitable for liquid coating and which retains the coating even when the cloth comes in contact with external objects before the liquid coating is gelled.

It is a further object of the present invention to provide a stable fabric, as above, which can be woven with low count fill picks with high tear strength both parallel to and transversely of the warp.

These and other objects of the present invention which will become apparent from the following specification are accomplished by means hereinafter described and claimed, the invention being measured by the appended claims and not by the details of the specification.

In the drawings:

FIG. 1 is a top plan view of a section of coated fabric according to the concept of the present invention;

FIG. 2 is a cross section taken substantially on line **2—2** of FIG. 1;

FIG. 3 is a schematic representation of the liquid process; and

FIG. 4 is a trimetric perspective of the woven cloth prior coating.

In general, a cloth woven according to the present invention and suitable for liquid coating utilizes a warp having strands of two different denier so arranged that two of the smaller denier strands alternate with single strands of the larger denier. The fill strands, which are preferably of a denier equivalent to the larger of the warp strands, are woven to pass alternatingly above and below successive warp strands, irrespective of whether they are those of larger or smaller denier.

Referring more particularly to the drawings, a section of coated fabric is indicated generally by the numeral **9**. The base **10** of coated fabric **9** is woven with warp strands of two different denier. The larger of the warp strands A are alternatingly spaced with two strands of the smaller denier strands B such that the warp comprises a repeating pattern A, B, B; A, B, B; A, B, B; A, etc.

For best results it has been found that the denier of the B strands should be one-half the denier of the A strands. The fill, or woof strands, **11**, are woven to pass alternatingly above and below successive warp strands in a relatively open weave.

The most efficiently balanced strength of the cloth both along the fill and the warp, is obtained when the fill strands **11** are of a denier equivalent to the A strands.

With such a weave a stable cloth can be obtained with a relatively loose weave, thus resulting in a greater loom capacity.

The above weave is particularly desirable for cloth made from continuous filament yarns. The weave being loose, permits sufficient penetration of the coating material **12** to effect the mechanical adhesion bond between the surface coating **12A** and surface coating **12B**. Moreover, the smaller yarns of the warp are found to lock and thereby stabilize the fill in order to prevent puckers or pulls. At the same time, these smaller yarns will slide under the stress of a tear loading to bunch with the larger yarns and thus increase the tear strength.

Finally, the smaller yarns, so interposed between the larger yarns, remain substantially out of contact with the rollers, bars, knives and the like which the cloth contacts during the coating process. The smaller strands B thus provide a base by which the coating material can be held into the fabric and thus effectively bridge between the larger, or primary, warp strands as the fabric is brought in to contact with external objects before the liquid coating gels.

A fabric woven as above from continuous filament yarns can for the first time be satisfactorily coated with an elastomeric coating by the liquid process.

As shown in FIG. 3 the base fabric **10** can pass across a feed roller **13**, into a bath of liquid elastomer **14** beneath a submersion roller **15**, out across a withdrawal roller **16** and between wiper bars **17** and **18** and remain completely and uniformly coated. Little or no waste is involved. The base fabric is stable and the coating adheres uniformly, thus giving exceptional tear and adhesion strength, the latter being so high that the coated fabric may readily be joined by welds which bond the coatings.

It should thus be apparent that a coated fabric according to the concept of the present invention readily accomplishes the objects thereof.

What is claimed is:

1. A liquid coated cloth comprising, a base fabric and and elastomeric coating bridging and filling the interstices to define upper and lower surfaces on said coated cloth, said fabric having a warp of strands A and strands B, the denier of said B strands being approximately one-half the denier of said A strands, both said A and B strands being a continuous filament yarn and being oriented so that two of the B strands alternate with a single of the A strands, said B strands being substantially out of contact with said upper and lower surfaces of said coated cloth and fill strands, said fill strands woven alternatingly above and below warp successive strands.

2. A liquid coated cloth, as set forth in claim **1**, in which the denier of said fill strands is approximately equal to the denier of said A strands.

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ROBERT R. MACKEY, *Primary Examiner.*

DONALD W. PARKER, *Examiner.*

J. KEE CHI, *Assistant Examiner.*