May 3, 1955 J. C. PULLMAN 2,707,499

WOVEN FABRIC PREPARED FROM SYNTHETIC TWINE
AND PROCESS OF PREPARING THE SAME
Filed Jan. 16, 1952

Fig. 1.

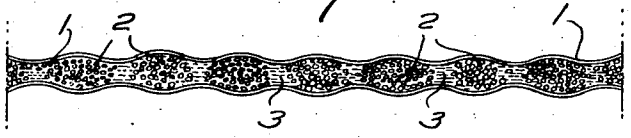


Fig. 2.

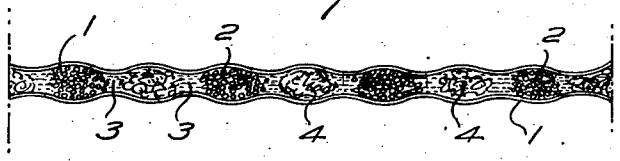


Fig. 3.

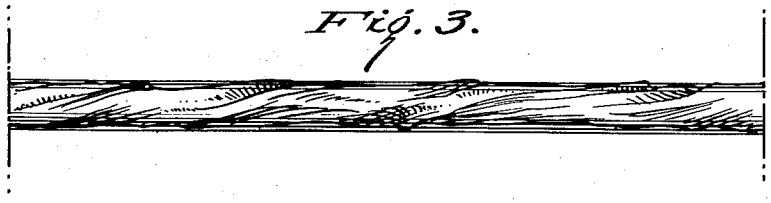


Fig. 4.

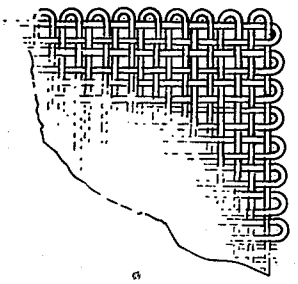
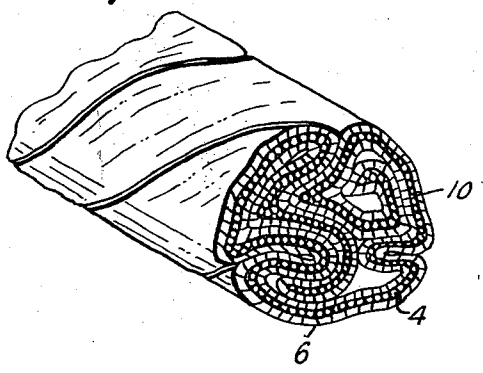


Fig. 5.



INVENTOR
JOSEPH C. PULLMAN,
BY
James T. Dunn
ATTORNEY

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WOVEN FABRIC PREPARED FROM SYNTHETIC TWINE AND PROCESS OF PREPARING THE SAME

Joseph C. Pullman, Stamford, Conn., assignor to American Cyanamid Company, New York, N. Y., a corporation of Maine

Application January 16, 1952, Serial No. 266,758

5 Claims. (Cl. 139—420)

This invention relates to an article of manufacture in the nature of a woven fabric and, more particularly, to a fabric woven of twisted strands wherein the strands are comprised of a plurality of spirally parallel glass strands positioned between at least two webs or layers of twisted tissue paper and embedded in an adhesive material which is coated on said paper web or webs. Still further, this invention relates to the manufacture of a fabric which is woven of twisted strands comprising a plurality of spirally parallel glass fibrous strands and organic fibrous strands positioned between at least two layers or webs of twisted tissue paper and embedded in an adhesive material coated on said paper webs wherein said glass strands and said organic fibrous strands are in alternate traverse arrangement. Still further, this invention relates to the manufacture of fabrics woven from either of the twisted strands as defined hereinabove in which the warp and the woof or weft are comprised of either of these two classes of twisted strands or where the warp is comprised of one of the classes of twisted strands while the woof is comprised of the other of the twisted strands or where the fabric is comprised of either a warp or a woof, either one of which is comprised of either of the twisted strands as defined hereinabove while the remaining weft or warp is comprised of some other conventional weave material such as woolen yarn, cotton strands or the like.

One of the objects of the present invention is to produce a woven fabric of the class described hereinabove which will have many general applications but which will have application, particularly as a substitute for burlap, for use in bags and other similar containers. A still further object of the present invention is to produce a woven fabric which will have application either directly as a floor covering material such as a rug or carpeting or which may have use after having been coated with an appropriate material as a finished floor covering material such as linoleum, rubberized tile and the like. These and other objects of the present invention will be discussed more fully hereinbelow.

Reference is made herein to my copending application, Serial No. 212,065, filed February 21, 1951, which relates to the adhesive coated paper, glass fibrous strand twine and to the process of preparing the same, of which the present application is a continuation-in-part.

Still further reference is made to my copending U. S. application, Serial No. 227,768, filed May 23, 1951, which relates to adhesive coated paper, glass fibrous strand organic fibrous strand twine and to the process of preparing the same.

Natural twine, generally referred to as sisal twine, is becoming increasingly short in supply and the price of said natural twine has been increasing steadily for a long time so that it has become a virtual necessity to find a synthetic twine which will be satisfactory for all of the general applications to which natural twine is put. Even jute and hemp have become very short in supply and the price of these natural fibers has been increasing steadily

so that manufacturers of burlap for packing purpose and for the manufacture of curtains have had extreme difficulty in procuring sufficient quantities of these materials to satisfy the demands of their customers.

I have discovered that I can make use of the synthetic twines and cords of my earlier invention for the production of woven fabrics in a wide class which will provide a much needed substitute for the products produced from the natural twine or cords. The glass fibrous strands which may be used to prepare either of the two general classes of twisted strands used in the present invention are made up of a great plurality of individual glass filaments, which are combined to form the strand.

The process for the preparation of these glass fibrous filaments and strands is well known in the art as represented by the U. S. Patents 2,133,236, 2,133,238 and 2,175,225, amongst others. These filaments are generally of extremely small diameter in the order of magnitude of about 0.0002–0.0004 inch and are combined to form a strand having a diameter of about 0.04 inch since there are generally about 200 or more filaments used to form a single strand. These glass strands have exceedingly high tensile strength and, in fact, have greater tensile strength than steel wire per unit weight. These strands, on the other hand, cannot be used directly to form twine because they do not have the flexibility which steel wire has nor do they have the flexibility which natural fibrous twine has. A further shortcoming of the glass fibrous strands resides in the fact that, if a twine were to be made from the glass strands without any protective coating surrounding the strands, the continuous rubbing of one strand against the other would result in a breakdown of the individual strands and eventually a breakdown of the entire twine. A still further shortcoming of ordinary glass strand twine resides in the fact that the flexibility in small arcs is so low and the attrition so great that it is nearly impossible to produce knots having adequate knot strength with such twine without experiencing continuous breaks in the twine. This is due to the sharp, sudden curve through which the twine is bent in knot tying. I have discovered that by coating a paper web with an adhesive composition, superimposing a plurality of parallel glass strands on the paper web, embedding the strands in the adhesive on the web and covering the strand embedded paper with another layer of paper to form a flat, unitary assembly, I can twist said assembly into a twine-like strand which can be woven into a fabric which will have a plurality of applications.

In my U. S. application, Serial No. 212,065, filed February 21, 1951, I have indicated that there are a plurality of ways in which this twine-like strand may be fabricated. Each of these minor departures from my essential concept are mere modifications, a few of which are set forth hereinbelow. Basically, it is preferred that the adhesive material be applied directly to strands before said strands are applied to the paper but if one so desired, the adhesive could be applied after the strands had been superimposed on the paper web or the adhesive could be applied to the web simultaneously with the glass strands or paper web could be coated with the adhesive composition and thereafter the strands could be applied to the coated paper web.

A still further embodiment of this invention resides in the modification, wherein the glass fibrous strands are placed in parallel positions on approximately one-half the width of the resin coated web whereupon the web can be folded by means of a plow-like device so as to cover the strands and to form a flat, unitary assembly of paper, adhesive and glass fibrous strands. Still further, one could superimpose a great plurality of fibrous strands on a wide paper web coated with adhesive and thereafter superimposing a second sheet on the strand

embedded lower web and by slitting this wide web assembly into a plurality of narrower webs of desired width, one could proceed to twist each of the narrower webs into the desired glass twine. Still further and, as a preferred embodiment of the present invention, one could make use of a pressing device in the nature of a pair of rollers covered with a resilient material which would roll the upper and lower paper webs together to form corrugations with the glass strands. Care must be taken in the selection of the pressure rollers to insure that the fibrous strands are not damaged while the unitary assembly is being pressed into a corrugated form. For this reason, it is advisable to use a combing wheel which is firm and resilient and yet sufficiently pliable so as to avoid damaging the strands. Still other embodiments of this invention will become obvious to anyone skilled in the art and, for this reason, further specific enumeration of detail is considered unnecessary.

Reference is made to the accompanying drawing wherein Fig. 1 shows a cross section in part of the untwisted tape comprising the glass strands, paper and adhesive which is used in the twisted form as the twine-like strands to produce the woven materials of the present invention. Fig. 2 shows in parts cross section the untwisted tape comprising the paper, adhesive and the glass fibrous strands and the organic fibrous strands in ultimate traverse arrangement. Fig. 3 shows a side view of a piece of the twine-like strands which are produced by twisting a tape such as those shown in Fig. 1 or Fig. 2. Fig. 4 shows in enlarged detail a section of the woven fabric. Fig. 5 shows a perspective view of the twine utilized in preparing the woven fabric, showing the twisted structure of said twine with a cross-sectional view of the end thereof. In Fig. 1, the symbols **1** indicate the lines of twisting tissue paper. **2** shows the glass strands and in more precise details the individual filaments making up the glass strands separated from one another and laid down in parallel alignment. **3** represents the adhesive material which serves not only to separate the glass strands from one another but also serves to bond the paper to the glass strands. In Fig. 2, the symbols **1**, **2** and **3** represent the same components as they do in Fig. 1. **4** represents the organic fibrous strands in cross section which are arranged with respect to the glass fibrous strands in ultimate traverse arrangement while the two groups of strands are laid down in a parallel alignment. In Fig. 5, the symbol **4** represents the glass strands, **6** represents the paper and **10** represents the adhesive bonding the glass strands and paper web together.

In the preparation of the twine-like strands of the present invention any adhesive material may be used to bond the paper web and glass strands together such as natural adhesives and synthetic resinous adhesives both thermosetting and thermoplastic.

Amongst the thermosetting resinous adhesives which may be used in the practice of the process of the present invention are the aminoplast resins such as those produced when an aldehyde is reacted with amino compounds such as urea, dicyandiamide and aminotriazines such as melamine, benzoguanamine, formoguanamine, acetoguanamine, halo substituted triazines such as 2-chloro-4;6-diamino-1,3,5-triazine, mono, di or trialkyl melamines, for instance, 2,4,6-triethyl triamino-1,3,5-triazine, the mono, di or triaralkyl or mono, di or triaryl melamines such as 2,4,6-triphenyl, triamino 1,3,5-triazine and the like. Other thermosetting resins which may be used are those produced by the coreaction of an aldehyde with phenols such as hydroxy benzene, resorcinol, bis-phenol and the like, or aldehydes reacted with ketones such as acetone, methyl ethyl ketone, diethyl ketone, ethyl propyl ketone, cyclohexanol and the like. Amongst the aldehydes which may be used in coreaction with any of the resin forming materials set forth hereinabove are acetaldehyde, propionaldehyde, crotonic aldehyde, acrolein and aromatic or heterocyclic aldehydes such as benzaldehyde, furfural and the like. Formaldehyde is generally the most commonly used aldehyde in coreaction with these resin forming materials and is actually generally preferred.

Amongst the thermoplastic resin adhesives which may be used are polyvinyl acetate, the alkyl esters of alpha, beta unsaturated carboxylic acids such as polymethyl acrylate, polymethyl methacrylate, polybutyl acrylate, polybutyl fumarate, alkyd resins of the unsaturated or saturated type, either oil free or oil containing, modified with styrene or other vinyl compounds, polyesters such as glycol succinates, or glycol sebacates, amide esters and the like.

Amongst the natural adhesives which may be used are casein, soya protein and other proteins, starch, animal glue, gelatin, blood, asphalt, pitch and the like.

The twine-like strand prepared by using the organic fibrous strands in addition to the glass fibrous strands are prepared in exactly the same manner as the all glass fibrous strand twine except, of course, that the organic fibrous strands and glass strands are positioned in an alternate traverse arrangement. It is not imperative that every other strand be an organic fibrous strand as it could readily be seen, for instance, that at the outer edges of a given tape prior to twisting, one may prefer to have all glass strands for certain purposes and all organic fibrous strands for other purposes. For the most part, however, it is preferred that these two different types of strands be set up in an alternate traverse arrangement.

Amongst the organic fibrous strands which may be used in the practice of the process of the present invention are both the natural organic fibrous strands such as cotton, linen, silk, wool and the like, and synthetic organic fibrous strands such as rayon, nylon, i. e., synthetic linear superpolyamides, polyacrylonitrile, fibrous strands or any of the conventional organic synthetic fibrous strands which are commercially available on the market today. Obviously, a plurality of these types of organic fibrous strands may be used in the production of the twine in keeping with the present invention provided that the same concept of alternate traverse arrangement is maintained between the glass strands and the organic fibrous strands. These organic fibrous strands may, in certain instances, be monofilamentary or polyfilamentary.

In the actual preparation of the twine-like strands one may perform the twisting operation on the tapes in a number of different ways, for instance, the tape may be passed through a water bath and then run directly to the twisting machine, or the tapes may be merely passed between heated rollers and directly twisted or as a further modification the tapes may be passed between a pair of parallel hot plates and twisted directly. A still further modification can be accomplished by applying heat, such as in the manners indicated hereinabove, passed through a water bath and then twisted to form the twine or the tapes may be passed through a water bath, twisted to form the twine and then heated. A still further modification resides in that embodiment in which a water bath is used wherein a sizing material such as glue, flour, etc. is incorporated into the water bath. Still further, one could apply to the paper web a softener in the nature of an oil such as mineral oil, vegetable oil or the like. Furthermore, one may apply water dispersions of resins, waxes, metallic soaps, and the like for imparting lubrication properties and scuff resistance.

The number of glass strands or the number of glass strands and organic fibrous strands used across a given web is in no way critical. It is possible to vary the number of strands rather substantially, depending on the thickness of the twine-like strands desired. If one wishes to produce a fabric comparable to burlap for use in making bags or curtains, one would select an appropriate number of organic fibrous and/or glass strands across a given

web that would be sufficient to produce a twine strand of a thickness comparable to that which is conventionally used in making burlap out of natural twine such as hemp or jute. Even in this particular application considerable variation can be expected if one elects to make fine burlap or coarse burlap. By way of illustration but not to be interpreted as a limitation, one could use, for instance, these twine-like strands having a diameter varying between about 1/64" up to 1/8". If one wished to prepare burlap curtaining material, one would select an appropriate diameter of the strand, depending on the ultimate particular use. Similarly, for foundations for floor coverings wherein a layer of the fabric of the class claimed is used as the base upon which a surfacing material is superimposed and bonded to form a floor covering material in the nature of linoleum or rubberized tile or the like, one may wish to use strands having a diameter varying between about 1/32" and 1/8".

The woven fabric produced according to the present invention may be treated in a plurality of ways. For instance, by coating the fabric with appropriate materials to improve the water resistance of the fabric such as by coating the strands of the fabric either before, during or subsequent to the weaving operation with a resinous material such as a melamine-formaldehyde resin to impart water resistance thereto. Still further, if one wished to enhance the scuff resistance of the woven fabric, one could coat it with conventionally known materials which will accomplish this purpose such as zinc stearate and the like. Still further, if one wished to produce a floor covering in the nature of a mat or rug such as those conventionally used in homes during summer weather, one could use strands having thicknesses varying between about 1/8" and 1/4". In making such floor coverings, one could produce a design effect in the same by dyeing certain of the strands with an appropriately colored dye either before or after the weaving operation has been completed. Still further, one could make use of appropriately colored paper in the twine manufacturing operation to accomplish the pattern effect.

I claim:

1. As an article of manufacture a fabric woven of twisted strands comprising a plurality of spirally parallel glass strands positioned between at least two webs of twisted tissue paper and embedded in an adhesive material coated on said paper web.

2. As an article of manufacture a fabric woven of twisted strands comprising a plurality of spirally parallel glass strands positioned between at least two webs of twisted tissue paper and embedded in an adhesive material coated on said paper web, in which the warp and the woof are comprised of said twisted strands.

3. As an article of manufacture a fabric woven of twisted strands comprising a plurality of spirally parallel glass fibrous strands and organic fibrous strands positioned between at least two webs of twisted tissue paper and embedded in an adhesive material coated on said paper web, wherein said glass strands and said organic fibrous strands are in alternate traverse arrangement.

4. As an article of manufacture a fabric woven of twisted strands comprising a plurality of spirally parallel glass fibrous strands and organic fibrous strands positioned between at least two webs of twisted tissue paper and embedded in an adhesive material coated on said paper web, wherein said glass strands and said organic fibrous strands are in alternate traverse arrangement, in which the warp and woof are comprised of said twisted strands.

5. As an article of manufacture a fabric woven of twisted strands wherein the warp is comprised of twisted strands comprising a plurality of spirally parallel glass strands positioned between at least two webs of twisted tissue paper and embedded in an adhesive material coated on said paper web and the woof is composed of twisted strands comprising a plurality of spirally parallel glass strands and organic fibrous strands positioned between at least two layers of twisted tissue paper and embedded in an adhesive material coated on said paper web, wherein said glass strands and organic fibrous strands are in alternate traverse arrangement.

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