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UNIDIRECTIONAL WOVEN FABRIC

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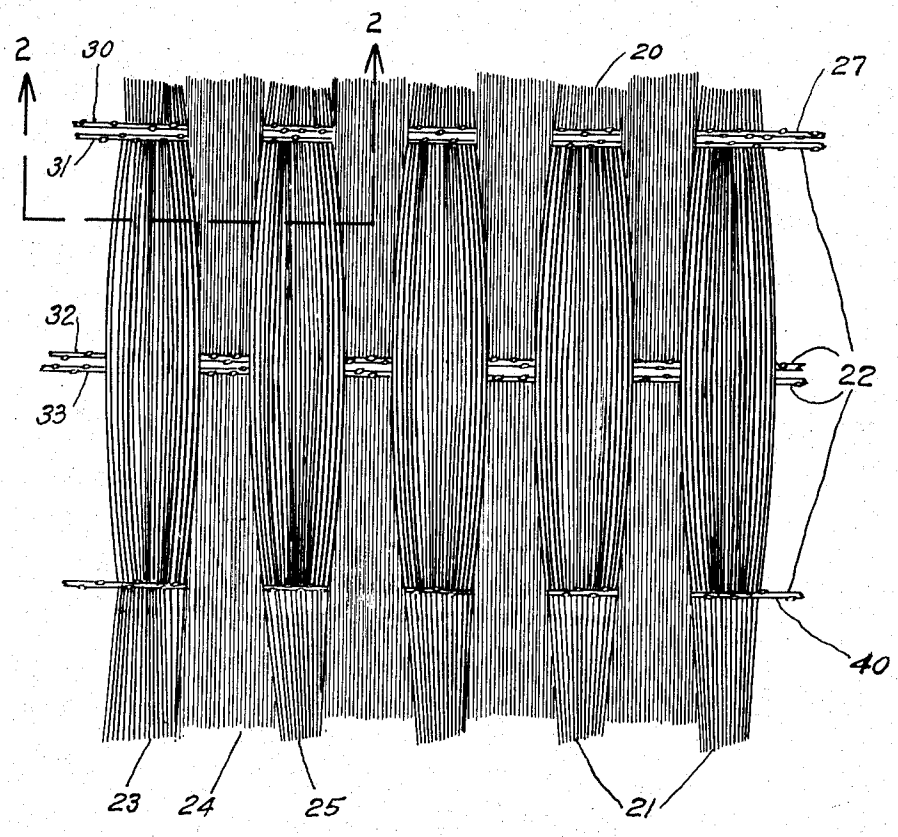


FIG. 1.

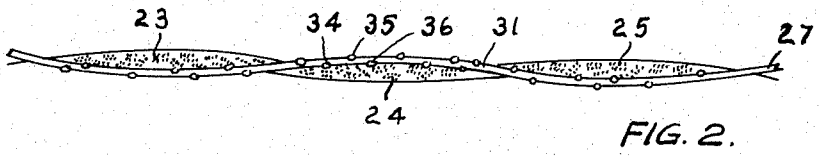


FIG. 2.

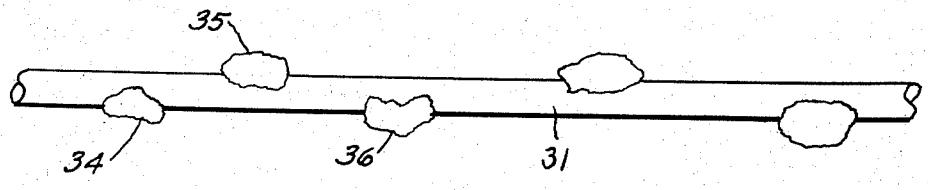


FIG. 3.

INVENTOR.
JOSEPH P. MANNING.
WILLIAM L. COLEMAN.
BY
Pearson & Pearson
ATTORNEYS.

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UNIDIRECTIONAL WOVEN FABRIC

Joseph P. Manning and William L. Coleman, Jaffrey, N.H.

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6 Claims. (Cl. 139—420)

This invention relates to an improved unidirectional, woven, textile fabric formed of glass fibres or the like.

Such fabric is used as a reinforcement in molded plastic articles, for example in chemical tanks, pipes, boats, etc., and is usually made in webs of twelve or less feet in width on a loom. The fabric is loosely woven with the warp containing the bulk of the fibres and the filling being widely spaced, light, fine yarns.

Glass fibre strands are smooth and slippery so that when a web of the unidirectional fabric is cut into smaller pieces for molding, the material tends to fall apart along the cut, or selvage, edges. Even before cutting there is a marked tendency for the warp yarns to shift laterally.

Various expedients have heretofore been proposed to maintain the glass fibre strands in place in such fabric. For example, a strip has been adhered to the fabric along proposed cut lines so that the two cut portions of the strip will form a false selvage. Such a strip tends, however, to adversely affect the molded plastic. It has been proposed to weave the filling threads with a leno weave, for locking the glass fibres in place, but leno weaving attachments are complicated and add to the cost of the fabric. It has been further proposed to weave a pair of yarns, with a leno weave, along the proposed cut lines or to apply a pair of adhesive yarns along the proposed cut lines. This procedure presupposes that the weaver knows where the cut lines are to be, which is not always the case, and usually requires means on the loom for curing the adhesive by heat or otherwise.

The principal object of this invention is to provide a woven fabric of unidirectional glass fibres in which the widely spaced, fine weft fibres lock the warp in place without adhesive, heat bonding, extra strips or other additional weaving steps.

Another object of the invention is to provide a woven fabric of unidirectional glass fibres in which drapability and cutting capability is maintained while retaining the loose weave of the material.

A further object of the invention is to provide a woven fabric of unidirectional glass fibres in which the glass fibres throughout the length of the warp are prevented from shifting, slipping, fraying or pulling apart by widely spaced, fine yarns having randomly spaced irregularities in cross section and running either warp wise or weft wise, or both.

Other objects and advantages of the invention will be apparent from the claims, the description of the drawing, and from the drawing in which:

Fig. 1 is a face view of a fabric constructed in accordance with the invention.

Fig. 2 is an enlarged cross sectional view on the line 2—2 of Fig. 1 and

Fig. 3 is a greatly enlarged, side view of one of the light, fine, locking yarns shown in Fig. 1.

As shown in the drawings, **20** is a loosely woven textile fabric having a warp **21** containing the bulk of the fabric and a weft **22** in which the filling yarns are so light, fine and widely spaced as to constitute almost no

bulk. The warp **21** is formed of a plurality of relatively wide and flat warp yarns such as **23**, **24** and **25**, which are closely spaced to each other. Each warp yarn such as **23** is formed by a multiplicity of strands of continuous filament glass fibres and each such filament is formed of several hundred individual filamentary fibres as fine as gosssamer and so fine as to be almost invisible. The warp yarns **23** are often untwisted whereby the thousands of continuous filamentary glass fibres in the warp form what is known as a unidirectional glass fibre fabric. The glass fibres are exceedingly smooth and slippery tending to easily slip on each other and pull apart while the yarns tend to easily shift laterally or crosswise of their length when woven with a plain weave or otherwise.

The weft **22** of the fabric **20** is preferably formed of a plurality of pairs such as **27** of relatively fine filling yarns such as **30**, **31**, **32** and **33**, the pairs being widely spaced from each other. Preferably the pairs of filling yarns are spaced apart a distance equal to the width of several weft yarns, as shown, to reduce the filling bulk of the fabric and serve as the minimum lateral connection between the weft yarns. Preferably also, each filling yarn is of a cross sectional area considerably less than one tenth the cross sectional area of the warp yarns for the same reasons. For example, a typical fabric, such as that shown, may have warp yarns of about a quarter inch in width and so flat as to be less than $\frac{1}{16}$ inches in thickness while the diameter of the filling yarns may be less than $\frac{1}{60}$th of an inch.

Each weft yarn such as **30**, **31**, **32** and **33** is provided with spaced protuberances therealong as best shown in Fig. 3 at 34, 35 and 36. Preferably the protuberances such as **34**, **35** and **36** are of irregular, non symmetrical configuration, randomly spaced along, and randomly distributed around, the weft yarn. A glass filament thread beaded with vinyl plastic is preferred for such weft yarns, although other threads having longitudinally spaced irregularities of a relatively hard rather than soft nature may, at least partially, accomplish the purpose.

Spaced pairs of filling threads, or picks, are used to secure a better scattering of the protuberances, thereby increasing the locking effect of the weft yarns, but as shown at **40** in Fig. 1 a single yarn similar to yarns **30**, **31**, **32** and **33** may be used if desired. It should be noted that, unlike slub yarns which are sometimes used to vary the design effect of woven fabrics by providing spaced irregularities of thickness in the soft fibres of a warp or weft yarn, the protuberances **34**, **35** and **36** are hard and so small as to be almost imperceptible to the eye. They thus have little or no design effect but serve to form a roughened surface which creates frictional resistance to the lateral shifting of the glass fibres as well as forming an actual barrier or abutment to such shifting.

Preferably the warp **21** and weft **22** including the weft yarn protuberances are colorless and transluscent in order that the structure of the fabric appears to be a plain weave and the protuberances blend into the background to the point of near disappearance. The fabric **20** may be cut weftwise or warpwise without the use of adhesive strips bonded yarns or lockweaves without falling apart or fraying, and without adversely affecting the molding process. Lateral cuts may be made between the filling yarns such as **30** and **31** of each pair and longitudinal cuts do not tend to destroy the fabric because of the presence of the locking weft yarns. If desired, a plurality of yarns such as **30** and **31** could be woven into the fabric warpwise to create a grid of such yarns but in practice this has not been found essential or especially desirable.

We claim:

1. A substantially unidirectional woven textile fabric comprising a warp formed of a plurality of relatively wide and flat warp yarns, closely spaced to each other, each

said yarn having a multiplicity of strands and each strand having a multiplicity of continuous filament glass fibres whereby said fabric is substantially composed of unidirectionally running, continuous glass fibre filaments and a weft formed of a plurality of relatively fine filling yarns widely spaced from each other, each said filling yarn having spaced protuberances therealong serving to lock said warp yarns in place and prevent slippage thereof.

2. A combination as specified in claim 1 wherein said warp yarns and said weft yarns are both colorless and translucent, whereby said protuberances are substantially imperceptible to the eye.

3. A combination as specified in claim 1 wherein said filling yarns are spaced apart a distance equal to the width of several weft yarns and are of a cross sectional area less than one tenth the cross sectional area of said warp yarns.

4. A combination as specified in claim 1 wherein each said filling yarn has randomly spaced protuberances and said filling yarns are woven in pairs of closely spaced picks with the pairs of picks widely spaced from each other.

5. A unidirectional woven fabric of glass fibres adapted to be cut into strips without slippage, said fabric comprising a warp of filamentary glass fibres all running in the same direction and constituting the major bulk of the material of the fabric and a weft of fine, widely spaced, filling yarns, each said filling yarn having randomly spaced integral protuberances therealong for frictionally retaining said glass fibres in place proximate cut lines in said fabric.

6. A woven textile fabric of unidirectional construction, said fabric comprising a warp of coarse yarn formed of unidirectional, continuous filament, glass fibres and a weft of fine yarn having integral protuberances distributed therealong for locking said glass fibre yarns in place.

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