Feb. 11, 1969 L. H. GIRARD 3,426,363

COMPOSITE LENGTH OF PILE FABRIC SHEET MATERIAL

Filed Feb. 17, 1965

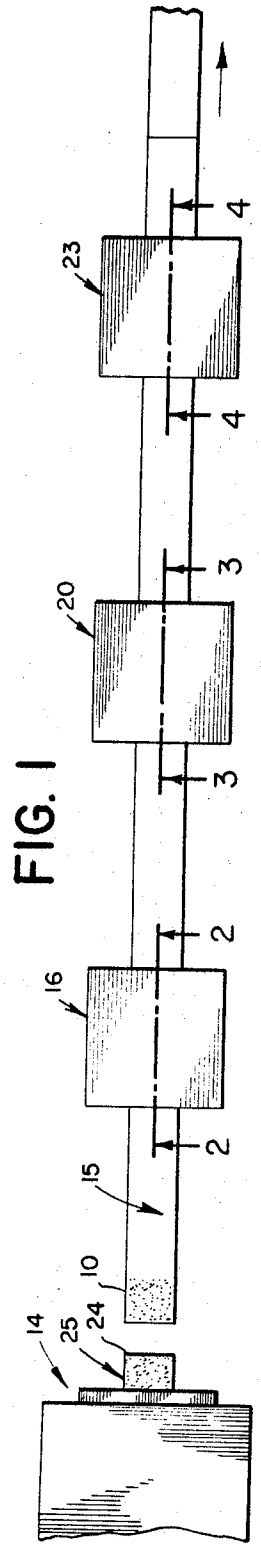


FIG. 1

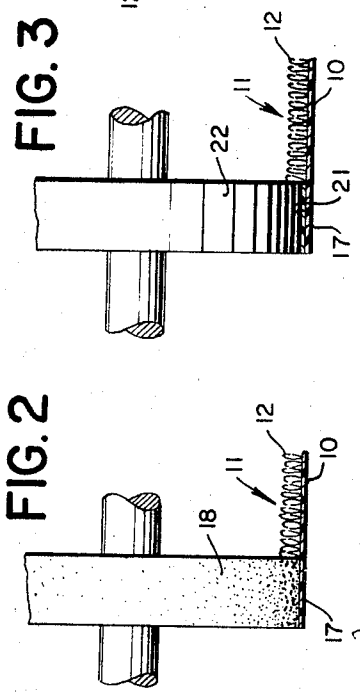


FIG. 2

FIG. 3

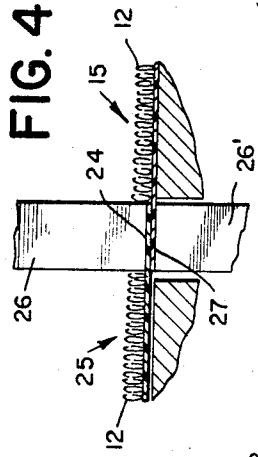


FIG. 4

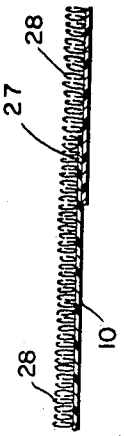


FIG. 5



FIG. 7

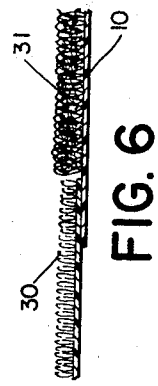


FIG. 6

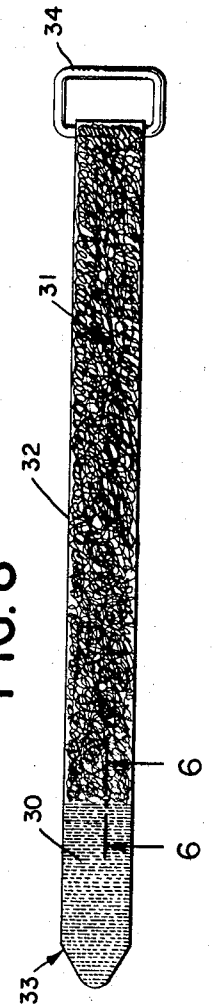


FIG. 8

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COMPOSITE LENGTH OF PILE FABRIC SHEET MATERIAL

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Int. Cl. A41f 3/62, 9/00, 15/00

This invention relates to a method of joining together lengths of sheet material, at least one of which is pile fabric sheet material of the type having a pile surface of hooking elements extending from one surface, and to the product resulting therefrom.

The pile fabric of this invention is generally described in U.S. Patent No. 3,009,235. Basically the pile fabric sheet material consists of a base of sheet material which has a surface defined by hooking elements secured thereto in positions extending generally vertically from one surface of the base of sheet material to which they are secured. The hooking elements can be formed from a flexible resilient material into either hooks or loops of the type characterized by the property that by pressing of a surface defined by said hooks in face-to-face adhesive relation with a surface defined by said loops will result in a large number of hooks engaging a large number of loops to secure the members in face-to-face relation.

In the manufacture and marketing of this type of pile fabric, it is often desirable and essential that two lengths of pile fabric be joined together lengthwise so as to form a more extended length of one type of hooking element or a composite structure of the two types of hooking elements. Many attempts have heretofore been made to join this pile fabric together without a break in the continuous pile surface formed on each of the two joined elements. Various types of butt seams have been attempted and several differently configured elements have been fixed to the abutting lengths of pile fabric for the purpose of effecting a butt seam therebetween without a break in the pile surface of the joined elements; none have been accepted as satisfactory. Obviously a lap seam could not be effected between the two lengths. The resilient hooking elements would not provide a flush surface between which a seam could be effected and the bulk and resiliency of the hooking elements would resist attempts to compress the elements if an effort were made to form a flush lap seam therebetween; also, if a seam were effected in this way the thickness of the seam would be objectionable in the finished product. Similar problems attend attempts to join lengths of pile elements to a length of other sheet material.

I have found that these elements can easily be joined together by first skiving or shaving the hooking elements down to the surface of the base material along a marginal end portion of a length of pile fabric so as to present a rather flat, smooth, marginal end portion which is substantially free from the vertically extending hooking elements. An adhesive is then applied over this flat marginal end portion and it is then overlapped with a second length of sheet material. When the second length of sheet material is of the type having one surface defined by said hooking elements with its hooking elements extending in the same general direction as said first length, its back marginal end portion opposite to the surface on which the pile elements extend overlaps the flat marginal end portion. The two lengths positioned in this way are then heat sealed together so as to define a unitary structure of two lengths of sheet material characterized by a substantially continuous surface of hooking elements along one surface thereof.

The product formed is a composite length of two joined

lengths of sheet material, at least one of which is the type having a surface of hooking elements as described above. The composite length is comprised of a first length of sheet material having one surface defined by said hooking elements with a flat marginal end portion of said first length being substantially free of said hooking elements. A second length of sheet material which also can have one surface defined by said hooking elements with its hooking elements extending in the same general direction as said first length and its back marginal end portion opposite to the surface on which the pile elements extend overlapping the flat marginal end portion and joined thereto in interfacial adhesive contact whereby the two lengths are joined and define together a substantially continuous surface of hooking elements. Of course, the hooking elements in the composite length can be all hooks or all loops, or loops on one length and hooks on the other length.

It has been found that the resulting product will withstand longitudinal separation far better than any butt seam, and with a proper choice of adhesive it will withstand the temperatures of cleaning and laundering of ordinary fabrics and in some special applications even will withstand autoclaving operations.

Although the method is particularly useful in manufacturing operations for making more extended lengths of pile fabric than are possible with weaving machines presently in use, it also has particularly novel applications when a length containing hooks as the hooking elements and a length containing loops as the hooking elements are joined to form a composite structure which is attachable to itself to form a closed loop. Simple attachment of a buckle to the end of one length gives this unique strap arrangement which has many holding and fastening uses. Similar products can be formed by combining alternate intermediate lengths of hooks and loops in various sequences. Optionally, lengths of non-pile sheet material can be joined with a sheet of pile fabric according to the invention where required.

A preferred embodiment of the invention is described hereinbelow with reference to the drawing wherein:

FIG. 1 is a schematic of the successive steps in the continuous formation of joined lengths of pile fabric sheet material;

FIG. 2 is a section taken along lines **2—2** of FIG. 1;

FIG. 3 is a section taken along lines **3—3** of FIG. 1;

FIG. 4 is a section taken along lines **4—4** of FIG. 1;

FIG. 5 is a section taken along the seam between two lengths of sheet material having hooks as hooking elements;

FIG. 6 is a section taken along lines **6—6** of FIG. 8 at the seam between two lengths of sheet material one having loops as hooking elements and the other having hooks as hooking elements;

FIG. 7 is a section taken along the seam between two lengths of sheet material having loops as hooking elements; and

FIG. 8 is a composite buckle and strap device in which a length of sheet material having hooks is joined to a length of material having loops.

As is known, the base material **10** is generally formed of a number of firmly woven weft threads and warp threads. The hooking elements **11**, which can comprise either hooks **12** or loops, are generally formed from supplementary warp threads in the weaving operation. The base material and the hooking elements are also preferably formed from artificial material such as nylon or some other material capable of being set by heat into a predetermined form. Once the hooking elements are formed in the known manner, they may be fixed or stabilized to retain their shape and position, generally vertically extending from the base material, by heat setting or by impreg-

nation of the fabric by resinous plastic materials or both. Although description will be made with reference to the woven base material construction it is intended that the base material can be a sheet of synthetic material, for example a resinous plastic material, and the selection of material used either for the base material or for the hooking elements can be varied in the many ways generally known in the art such as those described in the patent referred to above.

In this preferred embodiment, however, the base material is a woven nylon fabric and the hooking elements **11** are formed from nylon as a supplementary warp thread in the weaving operation. The hooking elements are held in position by a polyurethane resin deposited at the base of the hooking elements and impregnated into the interestices of the fabric by a solvent extraction process. This resin serves to hold the hooking elements in their upright position during the life of the fabric including laundering and drycleaning operations.

The schematic presentation in FIG. 1 is for a continuous operation of joining lengths of this type of pile fabric sheet material. As it is fed from an unwinding device **14** or directly from the weaving machine, a length of sheet material **15** is longitudinally passed through a series of stations. At the first station **16** a marginal end portion **17** of a trailing end of a longitudinally advancing length of sheet material **15** is positioned under a grinding wheel **18** to grind or skive the hooking elements from the marginal end portion. The grinding wheels used consisted of a vitrified bonded aluminum oxide or silicone carbide with a coarse to medium grain size abrasive which was run at surface speeds of 2750–6500 ft. per minute. By grinding the hooking elements to skive them from the marginal end portion **17** so that substantially no elements were extending vertically from the base material **10**, a substantially flat marginal end portion **17** was prepared on the trailing edge of this length of sheet material. When the fabric has been impregnated with a resin for holding the pile elements upright, the flat marginal end portion often has a surface coating defined by the resin, even after skiving. This is a factor to be considered in the selection of an adhesive as will be seen.

The length of sheet material was then passed to a second station **20** where an adhesive deposit **21** was applied to the flat marginal end portion **17** by means of an adhesive applicator **22**. The selection of the adhesive must involve a consideration of the materials at the interface between the two lengths. In the example being described, the base material is nylon and the surface of the base material in back of that from which the pile elements extend is essentially a nylon surface. The base material was impregnated with a polyurethane resin to hold the pile elements upright and after skiving the flat marginal end portion **17** is substantially defined by this resin. Thus, an adhesive seal must be effected between a nylon and a polyurethane surface. One adhesive which can effect the desired bond is a synthetic rubber resin, solvent type adhesive, Velcro-40 (tradename of American Velcro, Inc.), This adhesive contains approximately 20–28% by weight solids. The solids are comprised of 40–60% by weight butadiene acrylonitrile copolymer rubber and 60–40% by weight of a vinyl resin which is a copolymer of vinyl chloride and vinyl acetate. The solvent comprised approximately 50–50% mixture of acetone and methylethylketone. The ingredients were blended to form a liquid adhesive. The adhesive is applied to the skived marginal end portion **17** in liquid form and then is immediately passed to the next station in the operation.

This first adhesive is useful for most applications as it provides a bond strength of about 160 pounds and has a melting temperature of about 175° F. This strength and melting temperature permit its use in most normal applications as it will withstand all normal laundering and dry cleaning operations. Another example of an adhesive which can be used in bonding the pile fabric described is a phenolic adhesive Cycleweld 1–C–6 tape (tradename of Chrysler Corporation, Chemical Division). This adhesive is in tape form of thicknesses of .0035 inch and when used in this application should be used in double thickness. This second adhesive gives higher bond strength in the order of 350 pounds and has a melting point of about 325° F. If the joined fabric is to be used in the medical field where the fabric might be subjected to an autoclaving operation, the second adhesive should be used because of its higher melting point.

With the adhesive **21** applied to the skived end portion **17**, the length sheet material is then transferred to a heat sealing station **23**. At the heat sealing station the leading marginal end portion **24** of a second length **25** of pile fabric is lapped over the adhesive coated skived marginal end portion **17** of the first length **15** of pile fabric so that the hooking elements of each length extend in the same direction. The back marginal end portion opposite to surface from which the pile elements extend are placed in flush adhesive contact over the skived marginal end portion **17** with the adhesive **21** therebetween. A pair of oppositely positioned heating elements **26** and **26'** which are heated to a temperature of about 350° F. are brought together under air pressure of about 60 p.s.i. for approximately 10 seconds. The heating elements **26** and **26'** are then released and upon cooling a seam **27** has been effected between the lengths **15** and **25** to form a unitary extended length of sheet material containing hooking elements extending in the same direction which define a substantially continuous surface along one broad face of the joined lengths. By this method the portion of the joined length of pile fabric at which the seam is formed is increased only by a thickness substantially equal to the thickness of the base material, which is hardly noticeable, and will not interfere with any subsequent use of the material.

The product resulting from the operations described in FIGS. 1 to 4 is shown in FIG. 5 where the seam **27** effected a joining of two lengths of sheet material containing hooks **28** as the hooking elements. However, as shown in FIG. 7 the same seam can be effected between two lengths of sheet material containing loops **29** as hooking elements, or as shown in FIG. 6 a length containing hooks **30** can be joined to a length containing loops **31**.

In FIG. 8 a particularly useful product, of which FIG. 6 is a section, is shown which was formed by providing a length of sheet material **32** which has loops **31** extending from one broad face thereof and has a buckle **34**, or any similar means which essentially provide a ring-like element through which the length can be inserted, attached to one end of this length **32**. Attached to the opposite end of the length **32** in the manner of the invention is a shorter length **33** of fabric which has hooks **30** vertically extending from one broad face as the hooking elements. By threading the end of this composite product defined by the fabric containing the hooks through the buckle so that the hooking elements extend on the outside of the loop formed by this threading operation, the end containing the hooks **30** can then be folded back against the length **32** containing the loops **31** and can be pressed in face-to-face relation with the loop surface so that a large number of hooks engage a large number of loops to secure the members in face-to-face relation. Once attached in this manner, a closed loop is formed. This composite strap can be used for many different purposes, such as an arm and leg strap for holding hospital patients, and many other uses are also immediately suggested.

Although reference has been specifically made throughout to the attachment of lengths of pile fabric of the type having hooking elements extending from one surface, and reference has only generally been made to the attachment of a length of sheet material other than this type pile fabric to a length of this type pile fabric, it is intended that the method and product also offers novel features when attached to a length of leather, plastic or other non-pile type fabric.

I claim:

1. A composite length of at least two joined lengths of sheet material, at least one of which is a pile fabric sheet material of the type having a surface of hooking elements secured thereto in positions extending generally vertically from one surface of a base of sheet material to which they are secured, said hooking elements being a flexible resilient material of at least one of hooks and loops which are characterized by the property that pressing of a surface defined by said hooks in face-to-face relation with a surface defined by said loops will result in a large number of hooks engaging a large number of loops to secure the members in face-to-face relation comprising a first length of said pile fabric sheet material having one surface substantially defined by said hooking elements, a flat marginal end portion of said first length being substantially free of said hooking elements, and a second length of sheet material having a marginal end portion overlapping the flat marginal end portion of the first sheet and joined thereto in interfacial adhesive contact, whereby the two lengths are joined and define together a composite sheet of at least two lengths of sheet material.

2. A composite length of at least two joined lengths of pile fabric sheet material of the type having a surface of hooking elements secured thereto in positions extending generally vertically from one surface of a base of sheet material to which they are secured, said hooking elements being a flexible resilient material of at least one of hooks and loops which are characterized by the property that pressing of a surface defined by said hooks in face-to-face relation with a surface defined by said loops will result in a large number of hooks engaging a large number of loops to secure the members in face-to-face relation comprising a first length of said sheet material having one surface substantially defined by said hooking elements, a flat marginal end portion of said first length being substantially free of said hooking elements, and a second length of said sheet material having one surface defined by said hooking elements and having its hooking elements extending in the same general direction as said first length and its back marginal end portion opposite to the surface on which the pile elements extend overlapping the flat marginal end portion, and joined thereto in interfacial adhesive contact, whereby the two lengths are joined and define together a substantially continuous surface of hooking elements.

3. A composite length of two joined lengths of sheet material according to claim 2 wherein the hooking elements on both lengths are hooks.

4. A composite length of two joined lengths of sheet material according to claim 2 wherein the hooking elements on both lengths are loops.

5. A composite length of two joined lengths of sheet material according to claim 2 wherein the hooking elements on one length are hooks and on the other length are loops.

6. A composite length of at least two lengths of pile fabric sheet material of the type having a surface of hooking elements secured thereto in positions extending generally vertically from one surface of a base of sheet material to which they are secured, said hooking elements on one length being hooks and on the other length being loops which are characterized by the property that pressing of a surface defined by said hooks in face-to-face relation with a surface defined by said loops will result in a large number of hooks engaging a large number of loops to secure the members in face-to-face relation comprising a first length of said sheet material having one surface defined by said hooking elements, a flat marginal edge portion on one end of said first length being substantially free of said hooking elements, a second length of said sheet material having one surface defined by said hooking elements having its hooking elements extending in the same general direction as said first length and its back marginal end portion opposite to the surface on which the pile elements extend overlapping the flat marginal end portion and joined thereto in interfacial adhesive contact whereby the two lengths are joined and define together a substantially continuous surface of hooking elements, and a buckle attached to one end of the joined lengths through which the opposite end thereof can be inserted and folded back against itself with respective surfaces of hooks and loops in engaging relationship to form a closed loop.

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U.S. Cl. X.R.

156—153; 161—053, 161