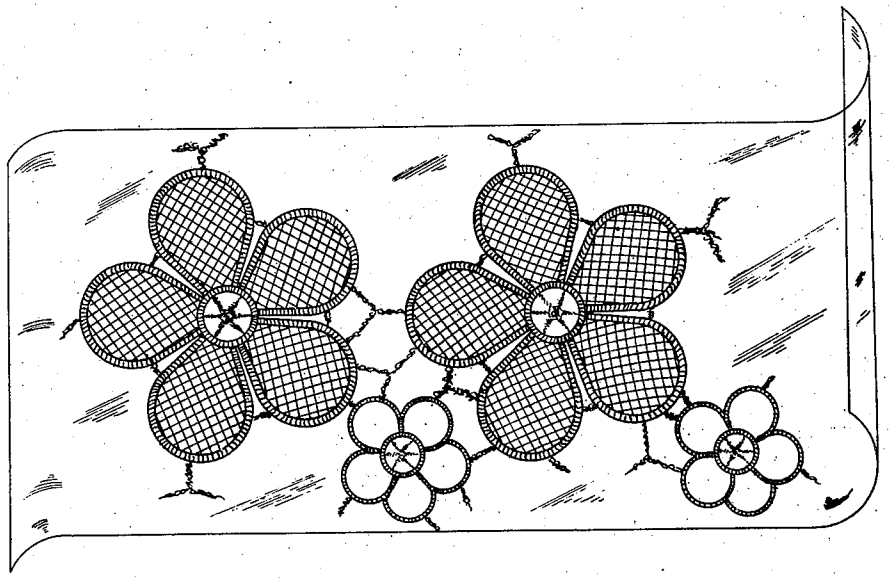
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MANUFACTURE OF FABRIC

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MANUFACTURE OF FABRICS

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This invention relates to improvements in the manufacture of embroidery and the like. More specifically, it relates to the use of polyvinyl alcohol film as the ground or support on which lace is formed.

The commercial manufacture of lace involves the use of a ground fabric or foundation upon which the lace is embroidered, stitched, or formed. The ground fabric or foundation used in lace-making is ordinarily of such character that it can be removed from the composite fabric without injuring the lace. Thus, for example the common ground fabric material chosen for use in lace-making is silk which can be removed by treatment with an aqueous solution of caustic soda without damaging the material, e. g., cotton, of which the lace fabric is composed.

There have been certain disadvantages in the use of materials which have been suggested for use as ground fabrics in the manufacture of lace. For example, where heat is used to carbonize the ground fabric, the lace is often injured by the acid vapors produced in the heat necessary to carbonize. Where the ground fabric is removed by solvent action, the solvent used may damage the lace fabric itself and may in the case of certain solvents, e. g., acetone, present a definite hazard on account of inflammability or similar dangerous characteristics. Furthermore, the prior art ground fabrics are expensive and their removal takes considerable time, thereby increasing the cost of the process. Silk backings, for example, which are in common use, take from one to three hours to dissolve in a caustic solution.

It is, therefore, an object of this invention to provide an improved type of foundation or support in the manufacture of lace and like fabric.

It is a further object of the present invention to provide a foundation or support in the manufacture of lace composed of a thin film of high durability, which can be sewed without tearing and on which embroidery can be stitched and accurately produced according to any desired pattern.

It is a further object to provide a foundation or support in the manufacture of lace, which can be easily and quickly removed from the lace without harming the lace fabric.

Other objects of the present invention will appear hereinafter.

The accompanying drawing illustrates graphically a partial lace fabric embroidered on a transparent film support, prior to removal of the support from the lace.

The objects of this invention are accomplished, in general, by the use of an adequately softened or plasticized water-soluble polyvinyl alcohol film as the foundation or support in the manufacture of lace by the embroidery method.

In the practice of the present invention, a film or sheet of water-soluble polyvinyl alcohol of suitable size, strength and thickness, is positioned on any of the known lace-making machines in the same manner as when using the ground fabrics of the prior art. The standard lace-making processes and operations are used to form lace on the film foundation. After the lace is stitched or embroidered onto the foundation or backing, the composite article is removed to the washing operation where the water-soluble polyvinyl alcohol foundation is dissolved from the lace with water or with an aqueous solution of sodium hydroxide or other suitable solution. The washing solution may be hot or cold, depending upon the particular polyvinyl alcohol used to make the film. For example, if the polyvinyl alcohol is prepared by saponifying polyvinyl acetate (100% esterified) until all but 35% of the acetyl groups are removed, the material is soluble in cold water, while if the saponification continues until all but about 5% by weight of acetyl groups are removed, hot water must be used to dissolve it. The resulting lace exhibits no undesirable effect resulting from the use of the polyvinyl alcohol film as a foundation or from its method of removal therefrom.

The polyvinyl alcohol sheets may be prepared in any of the conventional ways, for example, by evaporative (dry) casting (as disclosed in Izard United States Patent No. 2,176,903), by coagulation (wet) casting (as disclosed in Izard et al. United States Patent No. 2,236,061) or by any other suitable method. Sheet material especially adapted for use in the present invention can be produced by casting an aqueous polyvinyl alcohol solution on to a smooth metal surface and drying.

A film suitable for use in accordance with the present invention should be of sufficient thickness to be self-supporting and should not be so thick nor so elastic nor tacky that the needles can not get through it far enough to complete the stitches of the lace on the back side of the film. The water-soluble polyvinyl alcohol film should, therefore, have a thickness of from about 0.0005 to 0.01 inch and should preferably be from 0.0015 to 0.003 inch in thickness.

The film, in addition, should contain a material which softens or plasticizes the film in order to

impart proper softness, flexibility and toughness. Thus, a plasticizer such as glycerine, the alkylolamides (e. g., ethanolformamide and ethanolacetamide) disclosed in Watkins United States Patent No. 2,250,664, or the beta-hydroxy-alkyl ammonium salts, disclosed in Watkins United States Patent No. 2,271,468, may be incorporated into the film-forming composition or otherwise incorporated into the film. The plasticizer should be present in an amount from 2% to 25% based on the weight of the dry (solvent-free and water-free) polyvinyl alcohol in the film, and preferably the plasticizer should be present within the range of 12% to 18% based on the weight of the dry polyvinyl alcohol present in the film. Unplasticized film, however, may be used successfully in an atmosphere of high relative humidity, since the film absorbs moisture from the highly humid air and is plasticized by the absorbed moisture. Where water alone is used as the plasticizer for the film, the water content should be within the range of 6% to 25%, based on the weight of the dry polyvinyl alcohol in the film.

Useful results are obtained with polyvinyl alcohol film which contains little or no orientation of the molecules. For the best results, however, it is preferred that the molecules in the film be oriented, which orientation may be produced by stretching the film. Advantageous results are obtained with the molecules of the film oriented either in the longitudinal or transverse direction, or both. The orientation causes an increase in tenacity in the direction of stretch. For the optimum results, however, it is preferred that the film be oriented at least in the transverse direction since most of the tension or strain on the film is in that direction. For example, a film to be used on a machine which handles a ground fabric 31½ or 45 feet in length and 4 feet in width should be stretched in a known manner in the width direction in order to orient the film in the width or transverse direction since the strain imposed during the manufacture of the lace is greater in the transverse direction.

It is to be noted that where the film is oriented, no further substantial stretch in the direction of orientation takes place after the film is mounted on the embroidery frame because of absorption of moisture from the air, since the capacity of polyvinyl alcohol to stretch under tension, when its water content is increased, is much lower with oriented film than with unoriented film, and becomes less as the degree of orientation increases.

Polyvinyl alcohol is generally produced by the saponification of polyvinyl esters, e. g., polyvinyl acetate. The retention, after saponification, of 35% or less of the acetyl radicals contained in completely acetylated polyvinyl acetate, is sufficient to produce a water-soluble product. Similarly, a completely saponified polyvinyl acetate can be reacted with butyraldehyde to the extent of up to 9% of the hydroxyl groups of the polyvinyl alcohol with the formation of the partial butyral, without destroying the water solubility. Other aldehydes may be used in place of butyraldehyde in producing polyvinyl acetals provided that the amount of aldehyde incorporated into the polyvinyl product is not in excess of that which will produce a water-soluble product. If acetaldehyde is used in place of butyraldehyde, one can react up to 50% of the hydroxyls of the polyvinyl alcohol (completely saponified polyvinyl acetate) with the production of a water-soluble acetal. Such water-soluble compounds are all suitable for use in accordance with the present invention. However, polyvinyl alcohol which has been produced by the saponification of completely esterified polyvinyl acetate to remove at least 95% of the acetyl radicals has better physical properties and can be handled more readily than less completely hydrolyzed polyvinyl acetate; for example, the film is less tacky and since it resists the weakening effect of moisture absorbed from the air, facilitates passage of the needle therethrough instead of flexing away from the needle as in the case of the less completely saponified film. This type of polyvinyl alcohol is, therefore, a preferred species of the present invention.

In referring, throughout the specification and claims, to per cent of acyl radicals, groups or content in the polyvinyl compounds, it is intended to refer to the per cent of acyl as compared with the polyvinyl ester possessing 100% of the acyl groups which can be included in the molecule. Thus 100% acetyl content signifies completely esterified polyvinyl acetate.

The term "polyvinyl alcohol," as used throughout the specification and claims, unless otherwise limited, is intended to include only water-soluble polyvinyl hydroxyl compounds containing substituent non-hydroxyl groups such as acyl or aldehyde not in excess of 35% of the maximum possible content of such substituent groups.

In order for the film to have sufficient strength and durability to withstand the lace-making operation, the polyvinyl alcohol from which the film is made should have a molecular weight of between 10,000 and 22,000, and preferably the molecular weight should be between 15,000 and 19,000.

The following examples will specifically illustrate the invention. Parts are given by weight throughout the application unless otherwise specified.

Example I

Polyvinyl alcohol film, containing 15% by weight of glycerine (based on the water-free weight of the polyvinyl alcohol of the film) and having a thickness of 0.002 inch, is prepared by wet casting from polyvinyl alcohol produced by saponifying polyvinyl acetate down to 5% acetyl content, the resulting saponified compound having a molecular weight of 18,000. A piece of this film 31½ feet in length, 4 feet in width, is mounted on a standard lace-making machine in the usual manner and drawn tight. Using a standard operation, lace is formed on this support, using a 40 count cotton yarn. When the operation is complete, the film containing the lace thereon is removed from the machine and treated with water at 95° C. for forty minutes. At the end of this time, the polyvinyl alcohol support has been completely dissolved away leaving the lace.

Example II

A sheet of polyvinyl alcohol having a thickness of 0.0015 inch and containing 15% ethanolformamide (based on the water-free weight of the polyvinyl alcohol in the film) is prepared by wet casting in the usual manner from polyvinyl alcohol which is produced by saponifying polyvinyl acetate down to 3% of acetyl content, said polyvinyl alcohol having a molecular weight of 15,000. This sheet is oriented in the conventional way by stretching 100% in the transverse direction. A sheet of this material 31½ feet long and 4 feet wide is mounted on a standard lace-making machine and drawn tight. Using a standard pro-

cedure, lace is formed on this support, using an 80 count cotton yarn. The tendency of closely adjacent stitches to run into each other longitudinally during the embroidering operation is lessened by the use of the transversely oriented film. At the end of the operation, the support and lace which has been formed thereon are removed and treated with 6% caustic soda solution at 85° C. for 15 minutes. The polyvinyl alcohol support is completely removed in this period. A final washing with hot water at 85° C. removes the caustic remaining from the previous washing. A lace of excellent quality is obtained.

The films or sheets used in the present invention may be sized or not as desired. One size which has been used successfully is composed of polyvinyl butyral resins. The invention, however, is not limited to any particular size and is further not limited to the use of a size.

By the use of the present invention, lace may be made from yarns of any material not deleteriously affected by the liquid used in dissolving and removing the film. These yarns may range in size from 20 counts to 120 counts, which are the more common ones used in the lace art.

The invention has been described in terms of a process for the manufacture of lace. However, it is evident that the invention is applicable to all similar processes involving the use of a support, which is subsequently to be removed. In the specific process of manufacturing lace by embroidering, any of the standard lace-making processes and apparatus may be used.

The lace support or foundation of the present invention is easily produced by the manufacture of a film, thereby eliminating all of the spinning and weaving operations heretofore used to produce ground fabrics. The polyvinyl alcohol sheet is easily and quickly removed from the lace by the use of water or caustic solution and does not in any way harm the lace being made thereon.

In addition, by the use of the present invention, many different types of yarn may be used in the making of lace fabric. Heretofore, the use of silk, as the support in commercial lace-making, eliminated silk as the lace fabric material, since any attempt to remove the silk backing would destroy the lace. The present invention, therefore, promotes the use of silk and other fibers such as wool, cellulose acetate and other natural and synthetic fibers in the commercial manufacture of lace by embroidery processes.

The film of the present invention has a further advantage that pieces of film may be put together to form one large film to fit the lace-making machines by the simple procedure of heat-sealing the edges of the film. The pieces of film may be sewed together if desired. However, this latter procedure requires an extended dissolving period to remove the thread at the time the support is removed from the lace. This fact has been a disadvantage when woven ground fabrics of the art have been sewed together. However, if the pieces of film are sewed together with polyvinyl alcohol thread, this disadvantage becomes much less marked than where some other thread, such as silk thread, is used.

It is well-known that polyvinyl alcohol is an excellent size or finish for yarns and fabrics. A lace containing a size may be obtained by the process of the present invention by regulating the washing periods during which the foundation film is removed from the lace. In other words, a small amount of polyvinyl alcohol may be left on the lace as a size if desired. The presence of a small amount of polyvinyl alcohol on the lace will also aid in dyeing said lace. The use of the polyvinyl alcohol sheet of the present invention has also the advantage that the polyvinyl alcohol may be recovered from the washing solution and reused, if desired. A major requirement which the film of the present invention fulfills is that the foundation must be able to withstand sewing in which hundreds and even thousands of stitches are made per square inch. The lace foundation of the present invention has a very high resistance to tearing and permits the many stitches to be made in it as required in this art.

Since it is obvious that many changes and modifications can be made in the details described above without departing from the nature and spirit of the invention, it is to be understood that the invention is not to be limited to said details except as set forth in the appended claims.

I claim:

1. The method of making lace fabric and the like which comprises stitching the fabric on a support consisting of a polyvinyl alcohol film which contains a plasticizing medium.

2. The method of claim 1 characterized in that the polyvinyl alcohol molecules are transversely oriented.

3. The method of claim 1 characterized in that the polyvinyl alcohol contains 5% or less of acetyl groups.

4. The method of making lace fabric and the like which comprises stitching the fabric on a support consisting of a polyvinyl alcohol film which contains a plasticizing medium and removing the film by dissolving in an aqueous medium.

5. The method of claim 4 characterized in that the polyvinyl alcohol molecules are transversely oriented.

6. The method of claim 4 characterized in that the polyvinyl alcohol contains 5% or less of acetyl groups.

7. A composite article comprising a lace fabric stitched on to a support consisting of a polyvinyl alcohol film which contains a plasticizing medium.

8. The article of claim 7 characterized in that the polyvinyl alcohol molecules are transversely oriented.

9. The article of claim 7 characterized in that the polyvinyl alcohol contains 5% or less of acetyl groups.

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