June 8, 1937. J. D. McBURNEY ET AL 2,083,199

THERMOPLASTIC PRODUCT AND PROCESS OF MAKING THE SAME

Filed Nov. 4, 1936

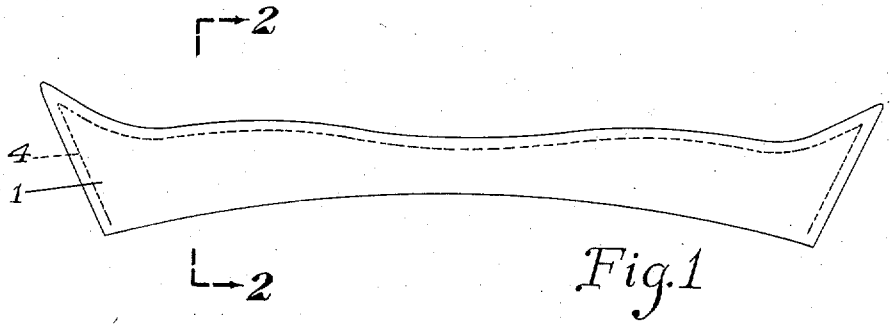

Fig. 1

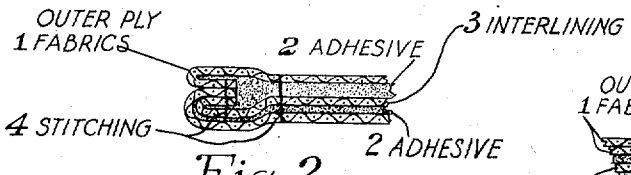

Fig. 2

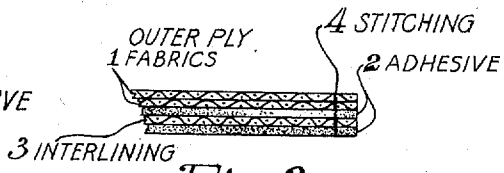

Fig. 3

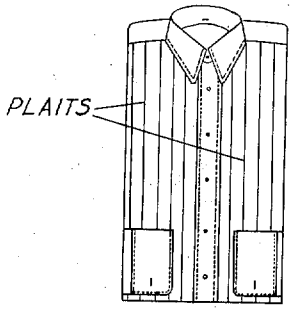

Fig. 4

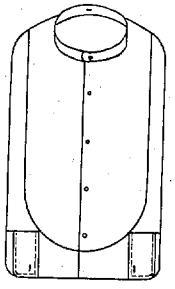

Fig. 5

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Patented June 8, 1937 2,083,199

UNITED STATES PATENT OFFICE

2,083,199

THERMOPLASTIC PRODUCT AND PROCESS OF MAKING THE SAME

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Application November 4, 1936, Serial No. 109,088

6 Claims. (Cl. 154—2)

This invention relates to wearing apparel of the type adapted to be laundered, and more particularly to wearing apparel such as shirts, collars, cuffs, plaits, and the like, as forming part of such wearing apparel.

There are several types of fabric garments manufactured according to the present state of the art as, for example, those which are manufactured and worn in the untreated state, that is, the collars and cuffs have no stiffening agent; those having collars and cuffs and similar exposed portions stiffened with a temporary stiffening agent such as starch; those having collar and cuff units stiffened by partial parchmentization, by means of suitable reagents, and those in which starched interlinings are used as stiffeners. Further, certain cellulose derivative coated fabrics have been proposed as stiffening interlinings in collars and cuffs; and garments in which the component fabrics of the collars and cuffs are laminated by means of certain cellulose derivative compositions have also been made.

Of these various types mentioned, none is entirely satisfactory: those garments which are made of untreated fabrics soil quickly and wrinkle easily. The starched type, while presenting a very satisfactory initial appearance, is sensitive to spotting by water and soon becomes wilted and wrinkled especially in warm weather. The collars and cuffs of multi-ply construction, the fabrics of which are laminated and stiffened by partially parchmentizing the fabrics with acid, present the disadvantage of lowered tensile strength and consequent unsatisfactory wearing qualities. In the case of the wearing apparel having the pre-stiffened interlinings with starch, for example, the treatment is effective only until the first laundering which removes the starch. While the collar or cuff can, of course, be restiffened by treatment with starch, it does not retain its appearance for any length of time, particularly in summer weather. Where certain cellulose derivative coated fabric interlinings are used the result is not satisfactory because of the tendency for the coating to disintegrate and disappear and often to discolor when the garment comes in contact with some of the commoner reagents used in laundering. The same condition prevails with respect to collars and cuffs in which the component fabrics are laminated directly by means of the common cellulose derivative compositions.

This invention has as an object the provision of wearing apparel having semi-stiff collars, cuffs and the like which are non-wrinkling, readily cleanable by washing or dry cleaning, and capable of retaining their shape after laundering without being subjected to a subsequent stiffening operation.

A further object is the provision of a two-ply or multi-ply collar or cuff and the like which upon repeated laundering and pressings, will not show the characteristic "stitch pucker" of present day wearing apparel.

A still further object is the production of collars which will resist distorting influences and will tend to resume their original appearance when the distorting force is removed.

These objects are accomplished in the present invention by laminating a plurality of specially treated fabrics, of a design and weave suitable for the manufacture of the desired wearing apparel, and more particularly by previously coating fabric with an adhesive composition, drying to expel the volatile materials present in the adhesive composition where the adhesive contains such volatile material, placing two or more layers of fabric together with at least one adhesive film between adjacent layers of fabric, and joining by means of heat and pressure.

The general construction of the wearing apparel described in the present invention will be readily apparent by reference to the drawing.

Figure 1 represents a diagrammatic sketch of a two-ply or multi-ply collar embodying the present invention, laid flat. Figure 2 represents a cross section along the line 2—2 in Figure 1 when Figure 1 is a three-ply collar. Figure 3 represents the assembly of the fabrics to which the thermoplastic adhesive has been applied before forming the collar. Figure 4 is a sketch of a finished shirt showing a collar, cuffs and plaits embodying the present invention. Figure 5 represents a dress shirt in which the front and cuffs have been rendered semi-stiff by the invention herein disclosed.

In Figures 1–3, 1 represents the outer ply fabrics of the finished collar; 2 indicates the thermoplastic adhesive; 3 indicates the interlining, and 4 represents stitching.

In order that the present invention may be more fully understood, the following definition of terms used is given.

By the term "thermoplastic" we mean the property by which certain materials have their adhesiveness increased sufficiently to enable them to firmly bond or unite fabrics or other materials to themselves, or to other materials, under the influence of heat and pressure, and by which they retain their bonding capacity after these influences have been removed. The adhesive should

soften to the extent that it will engage the materials to be united sufficiently intimately to produce a firm bond therebetween when the materials coated with such an adhesive are placed in contact and subjected to heat and pressure. The adhesive should become quite soft at temperatures between 250° and 350° F., which correspond approximately to normal ironing temperatures. On the other hand, the adhesive must be sufficiently flow resistant, at the temperature of boiling water and at the operating temperature used, to prevent the migration of the adhesive to the opposite side of the material through the interstices thereof when the material to which it is applied is of a porous nature, such as cloth.

The firm bond formed by the adhesive must also be resistant to the cleaning materials used in normal laundering operations so that it does not become softened thereby, and the adhesive must not become discolored to such an extent that it changes the appearance of the apparel in which it is incorporated.

By a three-ply collar is understood a construction in which an extra layer of fabric, usually of a cheaper and coarser grade, is interposed between the outer plies of the collar, the function of this intermediate layer being to add stiffness, thickness, and general body to the article. This ply is indicated as interlining 3 of the drawing.

By the term "semi-stiff" collar is understood one having a pliability or "hand" intermediate and unstarched, untreated soft collar on the one hand, and a fully starched collar or an old-style celluloid collar on the other hand.

In the practice of the present invention, the thermoplastic adhesive composition is applied to one side of a suitable fabric, such, for example, as a broadcloth weighing 3.40 ounces per square yard and having a thread count of 150 in the warp direction and 78 in the filler direction, by means of a doctor knife, squeeze rollers, spraying equipment, or by any of the methods known to those skilled in the art of coating fabrics. After application of the adhesive, the coated material is dried either in the air at room temperature, or by placing the coated stock in a chamber or oven where the volatile solvents are expelled by air which has been heated to 180° to 240° F. After the adhesive film is dried the fabric may be rolled up and stored until it is required for use.

In one form of the invention the plies, which ultimately form the collar, cuff or other portion of a garment, are next cut from the fabric in any convenient manner, as by means of suitable dies. The component pieces of the adhesive coated fabric thus obtained are then assembled by stitching, with the uncoated surfaces arranged face to face. The collar is then turned inside out to bring the two adhesive coated surfaces together inside the collar, and the joining of the parts is accomplished by applying heat and pressure simultaneously. Any means which will give a temperature of 250° to 350° F., and a pressure ranging from a few pounds per square inch to several thousand pounds per square inch, may be used to effect the firm bonding of the two fabrics. Where desired, a row of decorative stitching along the edges of the collar, except the edge to be attached to the neck band, may be put in before the collar is affixed to its neck band.

In a three-ply collar, as shown in Figures 2 and 3, the interlining, which is usually a cotton fabric of cheaper construction, as for example a sheeting weighing 4.7 ounces per square yard and having a thread count of 49 warp threads and 54 filling threads, is preferably coated on both faces with the thermoplastic adhesive composition by any suitable means, such as those disclosed above. The adhesive film is then dried, and the interlining is cut from this material by means of a die. The collar is then assembled by placing two die-cut plies together, laying the coated interlining on top of these, and stitching. The collar is then turned inside out so that the interlining will be between the two outer plies. The parts are then firmly bonded together as before, by means of heat and pressure. The ornamental stitching is then applied and the collar is ready for affixing to the neck band of a shirt where it is to be used in this way. When desired, however, this ornamental stitching may be done before the plies are cemented together, and/or the collar may be used as a separable collar.

If it is desired to fabricate wearing apparel having more than three plies of fabric, similar procedures are used.

The following examples of thermoplastic adhesive which have been successfully used in making collars in the practice of our invention are given by way of illustration, but not by way of limitation:

Example 1

	Parts
Methyl methacrylate	30
Iso-butyl methacrylate	10
Toluol	60

Example 2

	Parts
Methyl methacrylate	30
Cyclohexyl methacrylate	20
Toluol	50

Example 3

	Parts
Methyl methacrylate	30
N-propyl methacrylate	10
Toluol	60

Example 4

	Parts
Iso-butyl methacrylate	25.0
Toluol	62.5
Alcohol (denatured)	12.5

Example 5

	Parts
Methyl cellosolve methacrylate	25.0
Toluol	62.5
Alcohol (denatured)	12.5

Example 6

	Parts
Octyl methacrylate	50
Toluol	50

Example 7

	Parts
N-butyl methacrylate	25.0
Toluol	62.5
Alcohol (denatured)	12.5

Example 8

	Parts
N-propyl methacrylate	25.0
Toluol	62.5
Alcohol (denatured)	12.5

Example 9

	Parts
Methyl methacrylate	23.0
Dibutyl phthalate	14.9
Toluol	51.6
Ethyl alcohol	10.5

Example 10

	Parts
Methyl methacrylate	21.0
Di-ethyl phthalate	18.9
Toluol	50.1
Ethyl alcohol	10.0

Example 11

	Parts
Methyl methacrylate	21.1
Di-ethyl phthalate	18.9
Pigment	5.7
Toluol	45.2
Ethyl alcohol	9.1

The esters of methacrylic acid in the above examples may be prepared by any method known in the art. Methyl methacrylate may be prepared by any method set forth in U. S. Patent No. 1,980,483 to Hill. The other esters are prepared in a similar manner. In the above examples, the polymer is used. However, a mixture of monomers may be polymerized together. It will also be obvious that other polymers may be mixed to give special properties to the adhesive as will be apparent to those skilled in the art. Furthermore, pasticizers may be incorporated in a greater or lesser extent than indicated depending upon the degree of thermoplasticity desired in the finished adhesive.

The practice of the present invention is not confined to collars and cuffs of collar attached shirts, but also is capable of use where the collars and cuffs are prepared as separable units intended for attachment to the shirt by buttons or other means. Further, while wearing articles of two or three ply construction have been illustrated, this number may be increased indefinitely.

The purpose of the volatile solvent in those compositions in which one is used is principally to act as a carrier for the solid constituents of the adhesive. The volatile material does not necessarily play a part in the adhesion of the fabrics since it may be entirely removed by drying, as previously described. The use of volatile solvents in certain instances permits the deposition of a smooth film of the thermoplastic material and also assists in the ease of applying the adhesive to certain types of fabrics.

A modification of the above procedure which has been found to be very effective in cases where two porous materials are joined, such as cloth, consists in applying a solvent to one or more of the dried adhesive surfaces immediately prior to joining these parts by applying heat and pressure.

Inorganic pigments, such as titanium dioxide, may be used; and further, mineral pigments which are either translucent or opaque, white or colored, may be introduced into the adhesives. The use of barytes is advantageous in certain instances because combinations of the type described yield a translucent film. If colored pigments are used they should not be of a type which is bleached by ordinary laundering agents.

No limitation is placed on the type of fabric which may be used in the construction of the wearing apparel which is described in the invention. Common types of cotton fabrics used for producing collars, cuffs, plaits of shirts, and the like wearing apparel, such as broadcloth, madras, oxford cloth, etc., may be used. Further, silk fabrics and various types of fabrics woven from synthetic yarns, such as are made from regenerated cellulose, cellulose acetate, cellulose nitrate, cuprammonium cellulose, etc., are included within the scope of the invention. Linen fabrics as well as other natural type yarn fabrics may also be used.

The product of the invention finds particular use as a component part of shirts of the negligee type where it is desirable to have a garment retain its crisp freshly laundered appearance even under conditions of vary warm weather and high humidity, where the ordinary type of garments are found to wilt, wrinkle and become unsightly from the moisture of the atmosphere and perspiration of the wearer. As previously indicated, in addition to collars and cuffs on shirts and similar wearing apparel, the product of the invention finds itself applicable to the manufacture of plaits and demibosoms in the shirt industry, and it is also particularly adapted for collars, cuffs and other exposed portions of nurses', chauffeurs', and maids' uniforms and the like. The invention finds further application in the manufacture of neckties of various types, where several plies of suitable fabric are laminated to yield a non-wrinkling cravat.

While we have disclosed our invention with respect to collars, cuff, and the like, we do not wish to confine it to the manufacture of these specific pieces of apparel. For example, we have also found that suits of linen, cotton, light-weight wool or other similar fabrics may have the lapels and collars of the coat and the cuffs of the trousers treated as above described. We may also cement the fabrics making up the lapel and collar of rain-coats, particularly of gabardine material. This prevents the lapel from puckering when sewed or when the garment becomes wet from rain. "Stitch pucker" is also eliminated in collars embodying our invention because the plies are filmly bonded throughout the adjacent surfaces, and even the stitching is thoroughly anchored and embedded in the adhesive.

The adhesives disclosed above are not affected by ordinary dry cleaning methods and apparel embodying our invention will have a neat and orderly appearance characteristic of new cloth when so cleaned and pressed.

When a fabric to be treated is of a very open or porous weave the viscosity of the adhesive should be correspondingly increased, so that when the treated fabric is subjected to heat and pressure the adhesive will not strike through and stick to the heating iron or rolls. The proper viscosity can easily be determined by trial with the selected fabric or will probaby be evident to those skilled in the art.

Collars, cuffs, and other stiffened portions of wearing apparel prepared according to the preferred form of our invention have been found to withstand normal laundering much better than the garment to which they are attached. For example, it is generally considered that a man's negligee shirt of good quality may be laundered at least 20 times before objectionable fraying or failure of the cloth itself occurs. Collars prepared according to our invention have withstood a much greater number of launderings.

The interliner disclosed above for use in collars also has other uses. For example, it may be used as an intermediate ply for joining all sorts of materials such as wood, metals, paper, fabrics of all kinds, including leather, fibre, etc. The interliner may also be used to attach labels, initials, insignia, and designs of all kinds to wearing apparel, linens, etc., merely by the ap-

plication of heat and pressure such as would be afforded by a warm flat iron.

As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that we do not limit ourselves to the specific embodiments thereof except as defined in the appended claims.

We claim:

1. A semi-stiff collar having a plurality of fabric plies firmly bonded together by means of polymeric methyl methacrylate.

2. A semi-stiff collar having a plurality of fabric plies firmly bonded together by means of a thermoplastic cement containing methyl methacrylate in predominant amount.

3. A semi-stiff collar having a plurality of fabric plies firmly bonded together by means of a cement consisting of at least one polymeric ester of methacrylic acid, said cement being sufficiently flow-resistant at the temperature of boiling water to prevent the migration of the cement through the interstices of the outer plies.

4. A semi-stiff collar comprising an interliner impregnated with a polymeric ester of methacrylic acid and a face ply and a back ply firmly bonded to the said interliner by means of the said ester.

5. Process of preparing multi-ply semi-stiff collars which comprises coating a sheet of the intermediate ply material with a solution of a polymeric ester of methacrylic acid, allowing the solvent to evaporate, cutting out an interliner from the said sheet, and firmly bonding thereto a face and back ply by means of heat and pressure.

6. Process of making multi-ply collars, cuffs, and the like which comprises coating both sides of a suitable fabric with a thermoplastic adhesive having approximately the following composition:

	Per cent
Methyl methacrylate polymer	23.0
Diethyl phthalate	14.9
Toluene	51.6
Ethyl alcohol	10.5

allowing the adhesive to dry, cutting a desired pattern from the coated fabrics, interposing said pattern as an interliner between two fabrics forming the face and back of the finished collar, cuff, or the like, stitching the said fabrics along their edges, and subjecting the assembled fabrics to heat and pressure whereby the adhesive is softened and, upon cooling, forms a permanent bond between the surfaces of the fabrics contiguous with the adhesive.

JOHN DORMAN McBURNEY.
EDGAR HUGO NOLLAU.

CERTIFICATE OF CORRECTION.

Patent No. 2,083,199. June 8, 1937.

JOHN DORMAN McBURNEY, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, first column, line 32, for the word "and" read an; and second column, line 69, Example 8, for "Alcohol (denatured)" read Alcohol; page 3, first column, line 26, for "pasticizers" read plasticizers; and second column, line 10, for "vary" read very; line 27, for "cuff" read cuffs; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 22nd day of February, A. D. 1938.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.

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3. A semi-stiff collar having a plurality of fabric plies firmly bonded together by means of a cement consisting of at least one polymeric ester of methacrylic acid, said cement being sufficiently flow-resistant at the temperature of boiling water to prevent the migration of the cement through the interstices of the outer plies.

4. A semi-stiff collar comprising an interliner impregnated with a polymeric ester of methacrylic acid and a face ply and a back ply firmly bonded to the said interliner by means of the said ester.

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