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COLLAR, CUFF, AND THE LIKE AND METHOD
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This invention relates to collars, cuffs, shirt bosoms, and other articles of a similar nature, all of which will be hereinafter included, generically, where the context permits, in the term "collar." The invention is especially concerned with collars and with the problem involved in their manufacture and use, and accordingly, it will be herein disclosed in connection with the manufacture of such articles.

A typical collar of good quality, and as commonly made, comprises a facing ply of broadcloth, or of some other fabric of a good grade, an inner ply of the same or somewhat less expensive material and an intermediate lining ply which usually consists of a relatively coarse cotton fabric. The function of this lining material is to lend body to the collar and to hold the necessary amount of sizing to give it the desired degree of stiffness.

Since the quality of stiffness is imparted to the fabric entirely by the starch or other sizing with which it is impregnated during the laundering operation, and since this sizing disintegrates in water, such a collar in use quickly wrinkles and loses its shape when it becomes wet or even damp. In addition, the fact that the collar is composed of plies which are bound to each other only at their edges and which are affected to different degrees by laundering, introduces difficulties in this operation, particularly in the mangling or ironing, one ply frequently shrinking or stretching more than another, and thus tending strongly to produce wrinkles.

With a view to overcoming these difficulties and avoiding the necessity for re-starching a collar after each laundering operation, it has been proposed to substitute for the starched interliner some fabric containing a waterproof stiffening agent. Two forms of these stiffeners have gone into commercial use to a substantial extent, one consisting of a woven fabric composed of cellulose acetate and cotton yarns, and the second consisting of a cotton fabric coated with a thermoplastic cellulose acetate composition. Interliners of both types are incorporated in a collar by fusing the outside fabrics to the surface of the lining material or stiffener. In making a collar with a mixed yarn interliner, the fusing process involves two steps, the first consisting in moistening the collar with acetone to dissolve the acetate, and then hot pressing the collar to drive off the acetone and to cement together the plies of which the collar is composed.

The manufacture of collars having stiffeners made of mixed yarns has been found to introduce

many new difficulties, and since the present invention is especially concerned with these problems, they will be briefly discussed.

Foremost among these objections is the fact that these interliners are relatively expensive to manufacture. This is so for the following reasons:

First: The cloth must be woven from bleached cotton yarn because the acetate yarns will not withstand the bleaching process to which the fabric would have to be subjected if the cloth were woven "in the gray," as is the customary practice when cotton yarns only are used. It is a relatively inexpensive matter to bleach a web of fabric, but it is far more costly to bleach yarn.

Second: The weaving of fine cotton goods is best carried on in an atmosphere having a relative humidity of about 65 to 70. Weave rooms are equipped with humidifying apparatus designed to maintain such a degree of humidity automatically. Under these conditions the acetate yarns, however, are weakened and serious weaving troubles result.

Third: The normal warping procedure cannot be used satisfactorily when acetate yarns are to be woven with cotton yarns, and it is necessary to use double beaming or some similar expedient which complicates the weaving operation.

Fourth: It is usually considered impractical to introduce acetate yarns in the filling of a woven fabric and these yarns, therefore, are confined to the warp. Consequently, the variations in the acetate concentration in the final product are seriously limited by this condition.

In addition to the foregoing, the color of fused collars prepared with mixed fabric interliners has been found to be far from ideal. Perfect "whites" are demanded by the collar trade, and inasmuch as cellulose acetate is several shades darker than bleached cotton, the difference in shade of the two kinds of yarn is objectionable.

Another major difficulty of these products is the tendency of the acetate to "bloom" through the broadcloth and to deposit on the surface of the collar. This phenomenon occurs during the fusing operation and results from the impregnation of the outer broadcloth ply with an excessive amount of the acetate. It is most pronounced at the collar points and along the edges, these being the areas of greatest thickness, and consequently, the areas subjected to the maximum pressure during the fusing operation.

Those interliners consisting of cotton fabrics coated with cellulose acetate are incorporated in the collar in essentially the same manner as

those made of mixed yarns, with the exception that no wet pressing operation is necessary. The cellulose acetate coating contains sufficient solvent plasticizer so that heat alone will produce the necessary fusion.

As in the case of mixed fabrics, however, the use of these coated fabrics as interliners in the collar industry has also introduced new problems. These may be summarized briefly as follows:

First: The coating operation is expensive. It is necessary to subject the material to from six to ten coating operations in order to produce the proper degree of acetate concentration. This is occasioned by the fact that the acetate concentration used in the coating solution is limited to a maximum of about 20% because of the high viscosity of the coating liquid that is produced in attempting to use higher concentrations.

Second: The coating so applied is substantially continuous and therefore renders the collar non-porous and difficult to launder.

Third: The collars have a papery feel.

Fourth: The acetate constituent blooms during the fusing operation to an even greater degree than with mixed fabrics.

Fifth: In performing the coating operation above described it is necessary to stretch the cloth severely as it goes under the doctor knife and through the drying system. When such a fabric is incorporated in a collar the subsequent laundering operations produce a gradual shrinkage, which is objectionable for the reason above pointed out.

The present invention is especially concerned with the problem presented by these conditions. It aims to devise a collar, and a fabric from which collars can be made, which will be permanently stiffened, substantially non-wrinkling and will overcome the objections above mentioned.

In accomplishing these objects it is important to provide a lining material having that degree of permanent stiffness necessary to impart to the collar the desired quality of firmness, stiffness, or semi-stiffness, and to bond such a lining in a face to face relationship to the outer fabric or fabrics so that no substantial movement of either fabric over the surface of the lining ply is possible. However, the matter of producing a lining fabric having the desired degrees of permanent flexibility, stiffness and porosity, and in addition bonding said lining to the facing and backing fabrics while still preserving these qualities, has proved to be a very serious problem.

I have found that a satisfactory lining can be made by mixing textile fibers of one or more of the common kinds with other fibers having normally latent adhesive properties so that they may be made to serve as binders, working such a mixture into the form of a sheet with both kinds of fibers intimately co-mingled and heterogeneously disposed or unarrayed, and then treating the sheet to develop the adhesive properties of the binder fibers and thus cause them to bond to or unite with the non-adhesive or textile fibers. In addition, the fibrous web may be pressed to promote the adhesion of the two kinds of fibers to each other. Whether or not pressure is used, and the degree of pressure employed, will depend chiefly upon the nature of the final product desired. By selecting fibers of the proper character or quality, suitably proportioning them, and using them in appropriate weights, an unwoven lining fabric may be made in which the degrees of flexibility, thickness, stiffness, porosity,

and the like, can be accurately controlled, predetermined, and varied widely in accordance with the requirements of the use to be made of the fibrous sheet. For some purposes a sheet composed exclusively of binder fibers is preferred.

The textile fibers may consist of cotton, silk, artificial silks of the re-generated cellulose type, wool, and others. For the binder fibers, those made of cellulose acetate, ethyl cellulose, cellulose formate, cellulose propionate, and various other esters and ethers of cellulose, or the vinyl polymers can be used. Under present commercial conditions the binder fiber which I prefer to use is that made of cellulose acetate. The binder and textile fibers may be mixed together and sheeted in any machine suitable for this purpose, such as the carding machines or garnets used in the textile industry.

Subsequently a ply of fiber so produced is brought together with a facing ply of broadcloth or other fabric, and an inner ply of sheeting, or some other suitable material, in the event that such a ply is to be used, and either after or immediately before bringing these webs together the fibrous sheet may be treated in some manner capable of developing the adhesive properties of the binder fibers. Since all of the binder fibers above mentioned have thermoplastic properties, this step of the process may be accomplished by heating the web to such a temperature as to soften the fibers and make them sticky. The three plies may then be combined while the binder fibers are so rendered adhesive, the webs being passed simultaneously between heated rolls or being pressed together in any other suitable manner designed to produce the necessary contact of the binder fibers with the other fibrous constituents of the lining, and also with the surfaces of the facing and inner plies of woven fabrics, to unite all of these parts securely and permanently to each other.

Also, since the binder fibers are sensitive to, or are soluble in, a wide variety of organic solvents which do not affect the textile fibers to any substantial degree, the adhesive properties of the binder fibers can be developed and rendered active by subjecting the web to the action of some suitable solvent, either in a liquid, gaseous, or vapor form, as may be best suited to the requirements of individual processes. The solvents for the various binder fibers above described are well known and need not here be enumerated. Assuming, for example, that the lining web consists of a mixture of cotton and cellulose acetate fibers, it may be treated with acetone in a sufficient quantity of such concentration as to superficially dissolve or soften the latter fibers. The fibrous sheet, together with the fabric ply or plies may then be passed between pressure rolls to force all of these parts into that intimate contact with each other sometimes necessary to produce the desired bond between them.

The nature of the solvents employed necessarily will be determined by the character of the binder fibers and other practical considerations. A wide variety of solvents for the various binder fibers above mentioned are known, including acetone, methyl alcohol, methyl cellosolve, propylene oxide, methyl acetate, ethyl acetate, and acetic acid. The foregoing are volatile solvents but non-volatile solvents also are available such as butyl phthalyl butyl glycolate, ethyl phthalyl ethyl glycolate, methyl phthalyl ethyl glycolate, triphenyl phosphate, ortho and para toluene ethyl sulfonamides, ethyl, methyl and butyl ortho

benzoyl benzoates, dimethyl phthalate and triacetin. The solvents of the latter type of course remain in combination with the binding material and act as plasticizers. Consequently, they are of value both in producing the desired fiber-to-fiber bond and also in modifying the feel, texture and pliability of the lining material.

In some cases, also, it will be found desirable to use compound solvents, as for example, a mixture of acetone and ethyl or methyl alcohol or benzol. Such mixtures are useful in controlling the degree or severity of attack on the fibers by the solubilizing agent. In other words, assuming the binder fibers to be of cellulose acetate, which is readily dissolved by acetone, the extent to which the fibers will be dissolved can be controlled by mixing a suitable proportion of ethyl alcohol with the acetone and thus providing a solvent having a greatly reduced dissolving power, compared to that of acetone alone, and such power can be made consistent with the nature and size of the fibers.

In order to increase the strength of the fiber-to-fiber adhesion produced in the manner above described, or to facilitate the creation of such a union, it will be found preferable, at least in some cases, to select a binder fiber which has been treated with a plasticizing agent, or in which a plasticizer has been used in the composition of the fiber. The non-volatile solvents above mentioned are suitable for this purpose. Some of the synthetic resins, such as "Glyptals," "Santolites," "Rezyls" and, in fact, any resin compatible with the material of the fiber used also may be incorporated in the composition of the fibers, or in the treating agents, to increase the strength of the fiber-to-fiber bond.

For some purposes as, for example, in making a soft, flexible interliner, it is highly desirable to so control the bonding step that the fiber form of the binder fibers will be preserved, although some modification of this form necessarily occurs at the points where these fibers are united to each other or to other fibers due to the fusion and consequent flattening of the binder fibers at these points, especially when pressure is used in the bonding step. In some cases, however, a more or less complete destruction of the fiber form of the binder is desirable. This result may be obtained by subjecting the fibrous web to a temperature sufficiently high to melt the binder. These fibers thereupon break up into globules which wet the non-sensitive or textile fibers and are held by absorption and capillarity in contact with them. When the binder is allowed to cool it solidifies and is left in a discrete and discontinuous form where it secures the non-sensitive fibers together.

It will be observed that in the composite fabric made in the manner above described, not only are the binder fibers distributed with a high degree of uniformity throughout the composition of the lining, but, in addition, the union of the lining to the fabric ply or plies is, because of this fact, a discontinuous bond, the points of adhesion of the fabric plies to the lining being relatively small and spaced slightly apart but distributed substantially uniformly throughout the entire area of both fabrics. Nevertheless, the spaces between the points of adhesion assist in giving to the fabric the porosity or permeability to air and moisture essential to the comfort of the wearer.

In making a collar according to this invention, no change whatever is required in the usual methods. The common practice is to die out with cut-

ting dies facing, backing and lining plies, then to assemble these plies in superposed relationship and sew them together, the line of sewing extending around the extreme edges of the assembly, but those edges which are to be fitted on to the collar binding being left open. This assembly then is turned inside out, and subsequently the marginal lines of stitching are run in. At any convenient stage in the process, after the turning of the collar, the entire assembly is subjected to some process, such as one of those above described, designed to develop the adhesive properties of the binder fibers, and all of the plies are pressed together while the adhesive is in an active condition. The temperature used in the pressing operation is sufficient to produce an incipient fusion of the binder fibers and to cause them to bond to the non-sensitive or textile fibers, and also to the fabric plies. In order to facilitate the handling of the lining material, it may be desirable to give it a preliminary pressing, or possibly to treat it lightly with a solvent for the binder or to a moderate heat treatment in connection with the pressing operation, so as to make the binder somewhat adhesive and thus to give to the lining sheet that degree of firmness and cohesion necessary to facilitate the handling of it. The subsequent operations on the collar will depend on the manner in which it is to be used: If it is to be permanently attached to the neckband, this can be done at any time after the operations above described have been performed. On the other hand, if it is to be a separate collar, it will be sewed along the edge which later is to fit around the neckband, and it will be folded, provided it is a collar of this type.

Important advantages of this invention are that the interliner can be manufactured cheaply, all the difficulties associated with weaving in making mixed fabric interliners being eliminated. Manufacture of this sheet material consists essentially of three simple operations, namely, mixing, carding and unifying, whereas prior processes have involved spinning, weaving, bleaching, and in the case of the coated fabric, a series of coating operations. Moreover, any desired concentration of the acetate fibers may be easily obtained.

Collars produced in accordance with this invention are far superior to the prior commercial products. Because the binder fibers are distributed uniformly throughout the fabric with no interstices of large size separating them, the color of the product is uniform and can easily be made of the desired degree of whiteness. This result is aided by the fact that the adhesions of the binder to the outer plies are extremely fine, grained, numerous, and closely spaced, because fibers, as distinguished from yarns, are used. Furthermore, since binder fibers are available in either colorless or colored forms, any difficulty from the standpoint of color matching is readily obviated. The presence of the binder in a fibrous form substantially eliminates any danger of blooming, while at the same time leaving the product in a highly porous condition. It also simplifies the fusing operation and reduces the time required in wet pressing because the fine fibers dissolve, swell, or become softened more readily than yarns or coated surfaces. Since the binder constituents are not substantially affected by the solutions ordinarily used in laundering and are not materially affected by the temperatures employed, or at least those necessary in these operations, these collars are substantially laundry-proof. A further important advantage

of collars made by the method above described is that the inner and outer fabric plies and the interlining material remain permanently united to each other, and no differential shrinking or stretching of one with reference to the other takes place. This is extremely important in preventing wrinkling.

Having thus described my invention, what I desire to claim as new is:

1. A collar fabric, comprising a textile fabric and a lining adhesively but permanently united therewith in a face to face relation thereto, said lining being composed essentially of unwoven fibres co-mingled with each other and bound together in a sheet form by adhesive properties inherent in the composition of certain of said fibres.

2. A collar fabric, comprising a textile fabric and a lining adhesively but permanently united therewith in a face to face relation thereto, said lining being composed essentially of unwoven fibres co-mingled with each other and bound together and to said textile fabric by adhesive properties inherent in the composition of certain of said fibres.

3. A collar fabric, comprising a textile fabric and a lining adhesively united therewith in a face to face relation thereto, said lining being composed essentially of a mixture of different kinds of unspun fibers co-mingled with each other and bonded permanently together by an adhesive which is a break-down product of one of said fibrous constituents of the lining material.

4. A collar fabric, comprising a textile fabric and a lining adhesively united therewith in a face to face relation thereto, said lining being composed essentially of unwoven unarranged fibers co-mingled with each other and bound together and to said textile fabric by a waterproof adhesive present only in sufficient quantity to bind the fibers together at their intersections and to bond the fibers to said fabric at their points of contact with the fabric, said adhesive being substantially unaffected by laundering and consisting of a break-down product of certain of said fibres.

5. A collar fabric, comprising a textile fabric and an unwoven fibrous lining united thereto in a face to face relationship therewith by a laundry-proof adhesive present in the lining in a fiber form and constituting an important body forming constituent of the lining.

6. A permanently stiffened non-wrinkling collar, comprising a facing ply of textile fabric and a lining of unwoven fibrous web adhesively bonded thereto throughout the greater part of its area, said lining serving to impart substantially the desired degree of stiffness permanently to the collar, and containing a substantial proportion of fibers having normally latent adhesive properties through which the fibers of the lining are bonded securely to each other.

7. A collar fabric comprising inner and outer plies of textile fabric, and an intermediate lining ply of unwoven fibers co-mingled with each other, bound together and to said fabric plies by a laundry-proof adhesive present in the lining in fiber form and constituting an important body forming constituent of the lining, said lining

being porous and its union with said plies serving to hold all of said plies together substantially continuously throughout their areas.

8. That improvement in processes of making permanently stiffened, non-wrinkling collar fabrics, which consists in combining a woven fabric with an unwoven fibrous sheet lining containing a substantial proportion of fibers having normally latent adhesive properties, developing said adhesive properties, and pressing said lining and fabric together while said properties are so developed and the adhesive is in an active condition.

9. That improvement in processes of making permanently stiffened, non-wrinkling collar fabrics, which consists in bringing together a textile fabric and a sheet of cloth-like lining material composed essentially of unwoven, unorganized fibers co-mingled and including a substantial proportion of fibers having inherent but normally latent adhesive properties, treating said lining to develop said adhesive properties, and pressing the said fabric and lining together while said adhesive is in an active condition.

10. That improvement in processes of making permanently stiffened, non-wrinkling collar fabrics, which consists in bringing together a textile fabric and a sheet of cloth-like lining material composed essentially of an unorganized mixture of fibers including textile fibers and binder fibers containing normally latent adhesive properties adapted to be rendered active by the application of heat, and subsequently combining said lining and said fabric by the application of heat and pressure but preserving the fiber form of said binder.

11. That improvement in processes of making collar fabrics, which consists in bringing together a textile fabric and a sheet of cloth-like lining material composed essentially of unorganized, co-mingled fibers bonded together at their intersections by binder fibers dispersed throughout said lining material and having normally latent adhesive properties, and uniting said fabric and said lining sheet to each other in face to face relationship by developing the adhesiveness of said binder fibers exposed at the surface of said lining and in contact with the face of said fabric.

12. A collar fabric, comprising a textile fabric and a lining united therewith in a face to face relation thereto, said lining being composed essentially of a mixture of cotton fibers and cellulose acetate fibers unarranged and co-mingled with each other and bonded together into a porous structure and also to said textile fabric by discrete unions of substantially the same general nature as said cellulose acetate fibers.

13. A collar fabric comprising a fabric facing ply and a lining ply composed essentially of intermingled unarranged fibers bound together and to said fabric ply by a laundry-proof adhesive initially present in the lining in a fiber form, said adhesive being a break-down product of the fiber form and being distributed in discrete particles throughout said lining and having normally latent adhesive properties but uniting said lining and said fabric ply permanently together into a composite structure permeable to air and moisture.

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