July 8, 1969 G. WEISS 3,453,662

METHOD OF LAYING OUT, CUTTING, AND SEWING A GARMENT TO PROVIDE MINIMAL STITCH PUCKER

Filed Aug. 30, 1966 Sheet 1 of 3

Fig. 1.

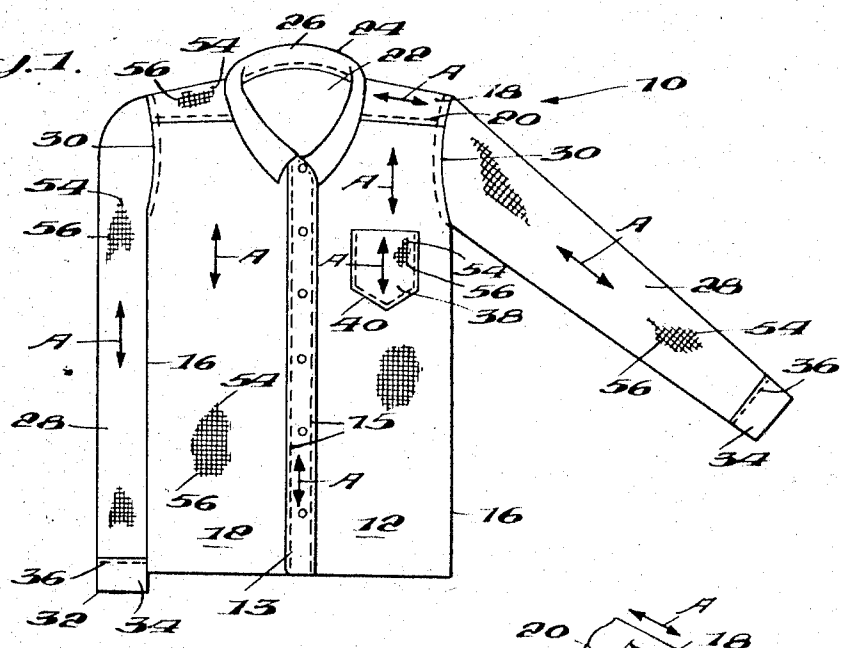


Fig. 4.

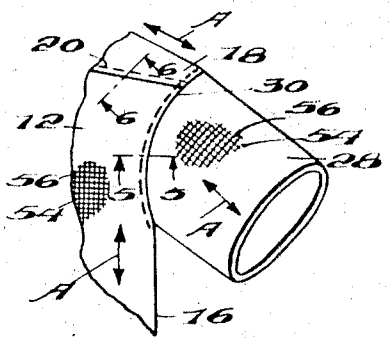


Fig. 2.

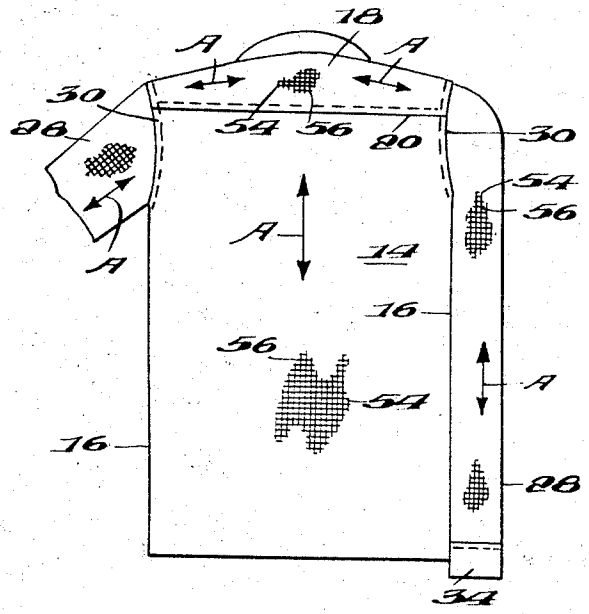


Fig. 5.

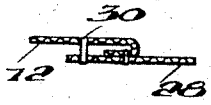
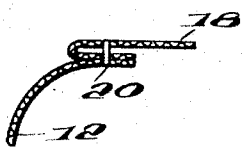


Fig. 6.



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Fig. 3A.

PRIOR ART

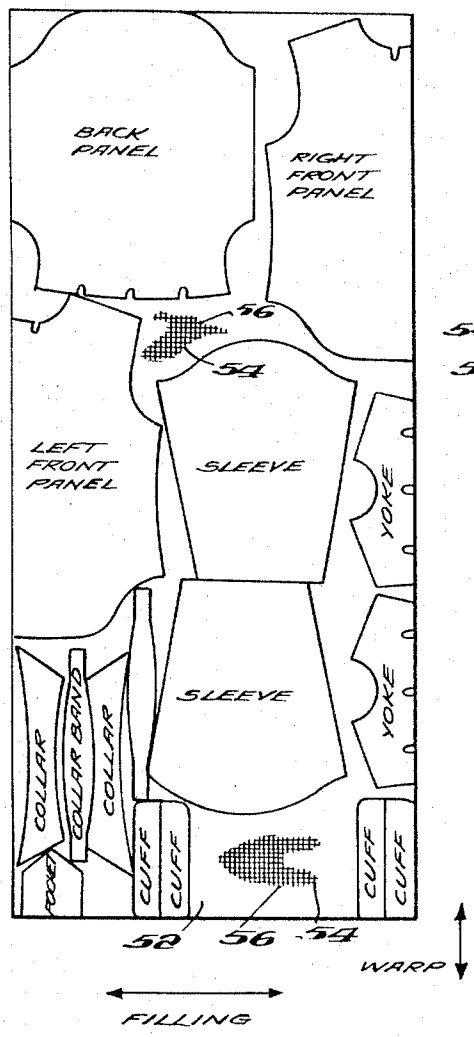
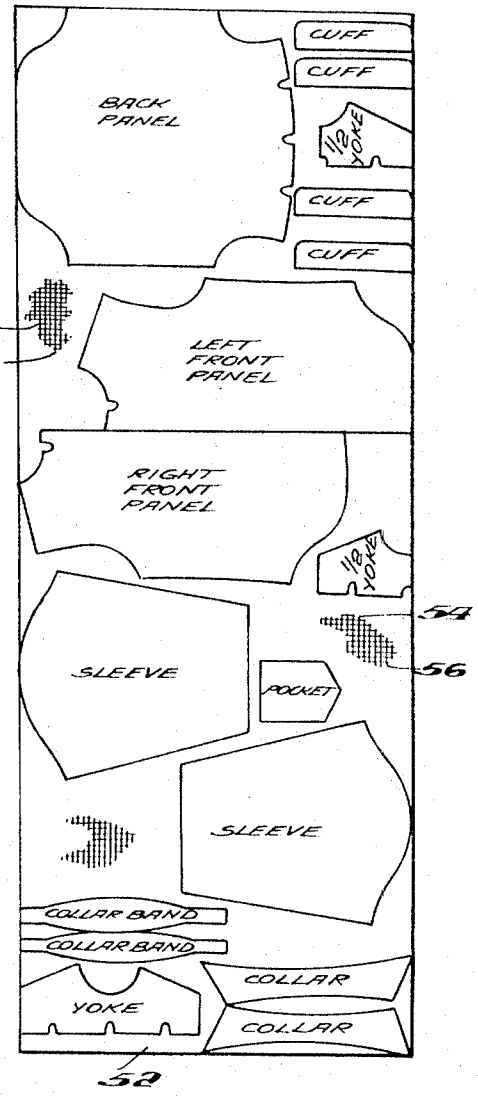


Fig. 3B.



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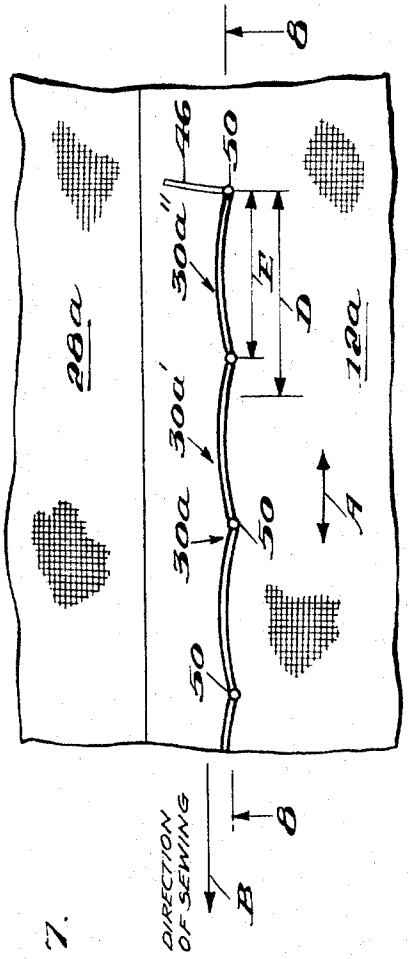


Fig. 7.

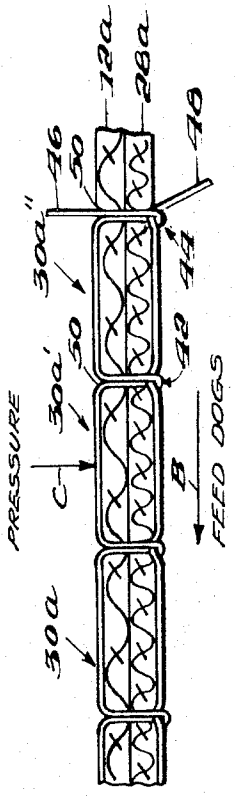


Fig. 8.

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United States Patent Office

3,453,662
Patented July 8, 1969

3,453,662

METHOD OF LAYING OUT, CUTTING, AND SEWING A GARMENT TO PROVIDE MINIMAL STITCH PUCKER

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Continuation-in-part of application Ser. No. 401,504, Oct. 5, 1964. This application Aug. 30, 1966, Ser. No. 576,520

Int. Cl. A41d *27/00;* A41b *1/00*

U.S. Cl. 2—243 11 Claims

ABSTRACT OF THE DISCLOSURE

A method of sewing together of fabric comprising: (1) providing plies of fabric having a low elastic modulus and at least a 12% recoverable stretch capability in at least one yarn direction, (2) arranging the plies in superposed arrangement with the outer ply's direction of stretch in the direction in which the seam is to be formed, and (3) sewing the plies to stretch the outer ply between successive interengagements of the sewing thread under low sewing tension. The method is useful in forming seams with minimal stitch pucker.

This application is a continuation-in-part of my copending application Ser. No. 401,504, filed Oct. 5, 1964, and now abandoned.

The present invention relates to the sewing of seams in fabrics. It is particularly related to sewing seams that are free of pucker or wrinkling and that remain free of pucker after the garments are worn and laundered.

Many garments are sold as "permanent press" types, meaning that after washing the garments will have neat, smooth appearance and will require little or no ironing. Such garments can be made from resin-treated fabrics which have been cured before the garments are made (precured) or the garments can be made from resin-impregnated fabrics and the finished garments then heated or pressed to cure the resin (postcured). A wide range of garment types is made by these two methods, including shirts, blouses, dresses, raincoats and other apparel.

However, these garments with either precure or postcure of the thermosetting resin have not been entirely satisfactory because of the puckering of seams in the garments. This pucker may appear, and usually does appear, immediately after sewing, but it may not appear until the garment is laundered.

Many efforts have been made to overcome this puckering but none have afforded a satisfactory solution to the problem. Johnson et al. in U.S. Patent 2,633,816 describe a modified sewing machine to avoid pucker when sewing, for example, nylon fabric with nylon thread. The sewing art did not readily accept such teaching as a solution to the pucker problem because of the modification required of conventional sewing machines in extensive use. Furthermore, such seams did not remain free from pucker after laundering.

Bloom in U.S. Patent 2,115,703 proposes that all seams be sewn on a bias, which as is well known to those skilled in the sewing art, gives seams which are free or nearly free of pucker. This does not solve the problem because shirts and blouses sewn on a bias would be unsightly and

would not be commercially acceptable. Bias seams tend to elongate and distort the shape of the garment. Furthermore, many fabrics, when sewn on the bias do not give nonpuckering seams.

The present invention offers a method of sewing seams and making garments that are free of pucker and remain free of pucker when the garments are washed. It offers a method of sewing seams in the warp or filling direction of the fabric which are free of pucker. Finally this invention offers a method of sewing puckerless seams in which an ordinary, unmodified sewing machine can be used.

These results are obtained in the present invention which provides an improved method of sewing together a superposed arrangement of plies of fabric with a stitched seam. The improved method comprises providing at least one ply of fabric having a relatively low elastic modulus and a recoverable stretch capability of at least 12% in at least one thread direction (i.e., the warp or filling direction). These plies are then arranged with at least the outer ply of the superposed arrangement with the direction of stretch of the outer ply in the direction in which the seam is to be formed. The arranged plies are then sewn on a conventional sewing machine which stretches the outer ply between successive interengagements of sewing thread under low sewing thread tension. Upon the subsequent relaxation of the outer ply, the sewing thread is relieved of tension and stitch pucker is minimized.

It has been the practice in making "wash-and-wear" or "permanent press" garments to use 100% resin-treated cotton or a blend of cotton with certain synthetic fibers, especially the polyester fibers. Such fabrics can be made into crease-resistant garments but have the problem of seam puckering. These puckers cannot be completely pressed out and they become worse upon laundering.

Until recently, commercially available fabrics could not satisfy the elasticity requirements heretofore stated. Woven fabrics of cotton, polyester, polyamide, rayon, cellulose acetate, or cellulose triacetate, or fabrics from blends of cotton with any of these other fibers ordinarily have about 5% stretch in the filling direction and about 2% stretch in the warp direction. Such fabrics pucker when sewed. Resin treatment of such fabrics accentuate the puckering and "permanent press" garments made of such fabrics are unsightly, especially so after laundering.

Stretchable fabrics are not readily made by standard operating methods but by certain modifications it is possible to make fabrics having greater stretch in the filling direction. Thus U.S. Patents 3,145,132 and 3,227,511 to Seltzer teach a method of producing fabrics from a blend of cotton and polyester fibers having stretch in the filling direction by slack mercerization with a 12% solution of sodium hydroxide. These fabrics have a filling-wise stretch of over 12% and are well suited to the method of the present invention. British Patent 1,028,020 to Thomaston Cotton Mills describes a similar process. These fabrics have a desirable but limited stretch which makes them particularly suitable for shirts and blouses.

Stretch fabrics can also be made by incorporating elastomeric filaments such as spandex filaments in a yarn. Such yarns are conveniently made by core-spinning a continuous filament spandex yarn with a sliver of polyester fiber and cotton. Other fibers are suitable but not in common use today. Cotton or rayon should be in the blend if the fabrics are to be resin treated. These elastic yarns have been used in filling but may be used in warp

or both directions if desired. Fabric stretch in the range of 25–50% can be easily attained by this route. Core-spinning of yarns of this type is a well known operation and is described in U.S. Patents 3,009,311 to Wang and 3,017,740 and 3,038,295 to Humphreys. Fabrics made by this route are suitable for use in the present invention and are especially desirable where considerable stretch is wanted in a garment.

Another method of producing stretch fabrics is to blend staple fibers of spandex with staple fibers of cotton, rayon or other fibers and spin into yarn by the method of U.S. Patent 3,007,227 to Moler. These yarns may also be used in warp and/or filling.

Stretch yarns can be made by other methods such as texturalizing, e.g., twisting, heat setting and untwisting. Fabrics from such yarns are claimed in British Patent 1,033,605.

To be suitable for use in the present invention, the aforesaid stretch fabrics must have a "recoverable stretch capability of at least 12% in at least one yarn direction." The term recoverable as used herein means that substantially all of the elongation is recovered, i.e., the fabric returns to at least about 90% and preferably greater than about 95% of its original dimensions upon release of the force used to stretch it. In most cases, the lack of recoverable elongation is due to the nature of the fiber used, although, the type of fabric weave is also a factor. For example, although a bias stretch may provide elongations greater than 12%, generally, a substantially large portion of the elongation is not recoverable. This is one factor for the nonsuitability of bias stretch in the present invention in addition to the aesthetics, (i.e., the yarns of the fabric do not run horizontally and vertically in the finished product).

A second important requirement of the present invention is that the fabrics have a "relatively low elastic modulus." The amount of force necessary to achieve the stretch capability must be relatively low. The elastic modulus is generally described in terms of the individual fibers, although the fabric weave also has a contributing effect. For example, a slack mercerized 65/35 polyester/cotton batiste fabric can be stretched the required amount by a force approximately equal to 2 pounds per inch of fabric (width). An elastic modulus of this magnitude is suitably low. Heavier fabrics of like material such as taffeta or broadcloth require slightly higher forces, but are also suitable. The elastic modulus is an important factor because some available fabrics, e.g., nylon taffeta, may have a suitable stretch capability, however, a very high amount of force is required to achieve this stretch. In the case of nylon taffeta, it is shown that stretch capabilities of as great as 20% can be obtained, but force considererably in excess of 2 pounds per inch are necessary. As will be seen hereinafter, this factor has considerable significance in that a conventional sewing machine can not exert the force required to stretch such high elastic modulus fabrics. However, fabrics having a suitably low elastic modulus (e.g., about 2 pounds per inch) can be stretched the required amount by a conventional sewing machine.

Another important aspect of the present invention is the arranging of the plies of fabric with their direction of stretch in the direction of seam to be formed. As previously stated, the heretofore commercially available fabrics had their stretch capability in the filling direction. Among the readily available fabrics are those produced by the slack mercerization method having suitable elasticity properties only in the filling direction. The prior art practice of cutting garment parts arranged the long direction of the garment part in the warp direction of the fabric to minimize the amount of fabric required for a given garment. However, for the purpose of the present invention, using fabric having stretch capability in the filling direction, a modified cutting technique is necessary. This is contrary to the prior art practice but the slight excess of fabric required is more than justified by the improvement in garment aesthetics. When fabrics having the required stretch capabilities in the warp direction are commercially available, the prior art cutting techniques can be employed with no additional fabric required.

Another important aspect of the present invention is that a conventional sewing machine can be used. By selecting the fabric as previously discussed, a conventional sewing machine has been found suitable to impart the required stretch during sewing. One simple but important adjustment must be made to these machines, namely: the sewing thread must be adjusted to low tension. Conventional sewing machines provide this simple adjustment. The term "'low tension" is well understood by those skilled in the art. For best results, whe na conventional sewing machine (for example, one having a needle thread and bobbin thread) is used, the tension should be adjusted at the bobbin until bobbin and case just "ride down" the thread. The top tension disc device is then adjusted until a balanced stitch is obtained. In this manner, the tension is reduced to a minimum level consistent with good sewability. This low tension coupled with the other requirements of the present invention results in a considerable excess of sewing thread. For example, single-needle lockstitch seaming of core-spun fabrics with 25% stretch resulted in an increase of 5.2% in the amount of thread used. This increase in thread partially on the fabric is subsequently reduced the sewing thread is similarly relieved of tension, minimizing the stitch pucker.

The two preferred fabrics for use in the invention are those made by slack mercerization of a fabric made from a blend of polyester fibers and cotton and those made by core-spinning a spandex yarn with a sliver made from a blend of polyester fibers and cotton.

To take full advantage of the technology of this invention, the following minimum recoverable stretch should be available in the various types of fabrics used in shirts or blouses.

Fabric:	Minimum stretch, percent
Slack mercerized 65/35 polyester/ cotton batiste	15
Slack mercerized broadcloth	12

Fabrics of core-spun spandex with polyester and cotton have more than ample stretch.

The use of the present invention makes it possible to make "permanent press" shirts with placket fronts which are required for the best styling and which are not feasible without using the technology of this invention. Placket fronts have not generally been used on many "permanent press" shirts because of the pucker problem, which the present invention now eliminates. Smooth collars can be made by the method of the present invention and, by using this invention it is possible to use more stitches per inch which lends to better styling of garments. Tucks and top stitches can also be used.

The method of carrying out the present invention is best understood by reference to the drawing described below, wherein:

FIG. 1 is a front elevational view of an illustrative garment according to the present invention;

FIG. 2 is a rear elevational view of the garment of FIG. 1, with only a portion of the extending sleeve thereof being shown;

FIGS. 3A and 3B are side-by-side plan views of cutting table layouts of the parts typically employed in the construction of the FIG. 1 garment, the layout of FIG. 3A being illustrative of the prior art practices and so labeled, and the layout of FIG. 3B being that employed in accordance with the present invention and illustrative of layout changes and modifications dictated by the teachings of the present invention;

FIG. 4 is a fragmentary perspective view, on an enlarged scale, of the shoulder region of said FIG. 1 garment and of the crucial seams in this region of the garment;

FIG. 5 is an elevational view, on an enlarged scale in section taken on lines 5—5 of FIG. 4, illustrating details of the vertically oriented seam joining the sleeve to the front panel;

FIG. 6 is a sectional view similar to FIG. 5, but taken on section line 6—6 of FIG. 4, and illustrating details of the horizontally oriented seam joining the yoke to the front panel of FIG. 5;

FIG. 7 is a diagrammatic plan view, on an enlarged scale, of a typical stitched seam, and in connection with which there is demonstrated the effect of the fabric stretching during sewing and the subsequent relaxation of this fabric by the portions of the figure depicted in regular and phantom perspective; and

FIG. 8 is an elevational view projected from FIG. 7, in section taken on line 8—8 of FIG. 7.

Shown in FIGS. 1 and 2 is a preferred embodiment of an article of wearing apparel according to the present invention generally designated **10**. The illustrated article of wearing apparel **10** will be recognized as a man's shirt. Although the invention is particularly useful when embodied in this particular article of manufacture and thus will be described herein in connection therewith, it will be understood that the invention may also be embodied in other tyes of articles of wearing apparel such as a woman's blouse or the like. The shirt **10** includes conventional interconnected parts such as a pair of front and back panels **12**, **14** connected to each other along opposite side seams **16** and adapted to fit over the upper torso of the wearer. Front panel **12** is shown having a placket front **13** with placket seams **15**. Connected to the front and back panels **12**, **14** so as to extend across the shoulders of the wearer is a yoke **18**, the connection there between being along generally horizontal front and rear seams **20**. A neck opening **22** is provided in a central location in the yoke **18** and is finished in a conventional manner with a fold-over collar **24** connected about the opening **22** by the run of stitching **26**. Completing the general construction of the shirt **10** is a pair of arm-encircling sleeves **28**, each of which is connected by the stitching **30** about armholes formed by the interconnected front and rear panels **12**, **14** and the yoke **18**. As is customary, the sleeve openings **32** are each finished with a cuff **34** stitched to the end of each sleeve **28** as at **36**; and the left front panel **12** is finished with a pocket **38** connected to it by the run of stitching **40**.

Although, as just described, the shirt **10** is constructed conventionally of conventional garment parts, it also embodies features according to the present invention which provide the shirt with exceptionally neat appearance. This is particularly so at the prominent front seams or stitching herein designated **15**, **20**, **30** and **40**. Conventional shirts in these critical areas exhibit ripples, wrinkles, pucker or other forms of surface unevenness along the sewing, which greatly detracts from the appearance of the shirts and also from the value as promotional "permanent press" products. In contrast to conventional shirts, the illustrative shirt **10** of the present invention will be understood to have exceptionally smooth seams, particularly at the locations **15**, **20**, **30** and **40**, due to methods of sewing and certain features of construction of the shirt **10** which promote smoothness and the avoidance of stitch-pucker, all as is hereinafter more particularly pointed out.

It will first be understood that the fabric of which the shirt **10** is constructed has a stretch capability as previously described, which stretch direction is herein collectively denoted on each of the garment parts by the double-headed reference arrow designated A. It will be noted that each of the garment parts of the shirt **10**, and using the yoke **18** and front panels **12** as examples, also happen to have a generally rectangular shape or pattern which provides a readily obvious and noticeable long dimension to each garment part. In the case of the yoke **18** this long dimension is horizontally oriented in the shirt **10**, whereas in the front panel **12** the long dimension thereof is vertically oriented. In both instances, and for that matter as regards all or substantially all of the previously described garment parts, the fabric direction of stretch A is arranged so that it is in the long dimension of each garment part in order to achieve the smooth seams of the present invention. An exception could be the rear panel **14** which also could be cut with the fabric direction of stretch A oriented horizontally, and in which direction the fabric stretch of the rear panel **14** is then best adapted to promote fit of the shirt **10**. Oriented in this direction, however, the fabric stretch of the rear panel **14** is not adapted to promote the removal of stitch-pucker from the rear portion of the seam **30**, but since this seam is located in the rear of the shirt **10** its appearance is of little consequence.

Having particular reference to FIGS. 4–6 and 7, 8 it will be better understood how fabric stretch of the garment parts to be connected to each other is utilized in accordance with the present invention to achieve or promote exceptionally smooth seams or sewing at the time of manufacture of the shirt **10**. As is diagrammatically illustrated in FIGS. 7, 8, the sewing together of two plies of fabric, herein designated **12**, **28***a* (assuming the same is illustrative of the interconnection of the left front panel **12** and the left sleeve **28**), involves the formation of a stitched seam **30***a*, each individual stitch **30***a'*, **30***a''* of which is in turn formed by successive interengagements, as at **42** and **44**, of a needle thread **46** and a bobbin thread **48**. As is generally understood in the operation of a sewing machine, in the process of sewing, the needle thread **46** is continuously unwound from a suitable supply spool, and being threaded through the eye of a needle, is carried by the needle through the fabric plies **12***a*, **28***a* to form the successive interengagements **42**, **44** with the bobbin thread **48** which is continuously unwound from the bobbin of the sewing machine beneath the fabric plies **12***a*, **28***a*. During this time, the feed dogs of the sewing machine are in engagement with the fabric ply **28***a* and are effective to advance both the plies of **12***a*, **28***a* in the direction of the arrow designated B which is the direction of sewing and so designated in FIG. 8. During sewing, the conventional pressure foot of the sewing machine is urged in the direction of the arrow designated C against the upper fabric ply **12***a*. A noteworthy contribution of the present invention is the teaching that stitch-pucker can be obviated during sewing by orienting the fabric stretch preferably of both fabric plies to be joined in the direction of sewing B, or at the very least, by orienting the fabric stretch of the upper fabric ply **12***a* in this direction since this fabric ply in the superposed arrangement is the one that is visible. A further noteworthy contribution of the present invention is the appreciation that stitch-pucker results in the first instance from needle thread tension during sewing, i.e., from a tension or drag that is exerted on this thread as it is carried through the fabric. This tension, it is further believed, manifests itself perhaps not in very stitch, but eventually after a series of stitches in a recurring needle thread loop between successive interengagements such as **42**, **44** which is too short in dimension to encompass the bulk of the fabric plies **12***a*, **28***a* therein without causing an inward pinch of the needle thread **46** into the visible surface of the sewn fabric. It is this inward pinch which results in stitch-pucked. With this understanding of the cause of stitch-pucker, it will be appreciated that given a fabric ply to be sewn that is stretchable to the extent specified, and by orienting the fabric stretch thereof in the direction of sewing, that the stretching of this fabric ply during sewing is effective to obviate stitch-pucker. This is because during sewing the individual stitches **30***a'*, **30***a''* are deposited in the fabric taut between successive needle holes **50** spaced apart a distance D in the stretched fabric and reduced to the lesser distance E when the fabric returns to its normal unstretched condition. Thus, the individual stitches or more particularly the threads **46**, **48** making up the same are

not under tension when spanning the lesser distance E between successive needle holes **50** in the relaxed or unstretched fabric. In the normal operation of sewing, the fabrics being sewn and located between the presser foot exerting a drag on one side, and the feed dogs imparting movement on the other side, are subjected to forces which have a tendency to stretch the fabrics in the direction of sewing until the presser foot is cleared and the stretched fabrics are permitted to relax or return to their normal dimension. Additionally, the stretching of the fabric during sewing in the direction of sewing opens or spreads the fibers of the fabric and there is therefore less drag exerted in the first instance on the needle thread **46** as it is carried by the needle through the fabric interstices during sewing, and also this stretching substantially reduces the amount of fiber cutting and distortion by the needle.

In FIGS. 4–6, it will therefore be appreciated that at the seam connection of the yoke **18** with the front panel **12** in which the stitching **20** is horizontally oriented, the fabric stretch A of the yoke **18** which overlies the front paned **12** along the seam **20** by being similarly horizontally oriented is thus adapted to promote or provide a smooth appearance to the seam **20**. On the other hand, the seam connecting the left front panel **12** to the left sleeve **28** is comprised for most of its length of the vertically oriented stitching **30** which dictates use of the front panel **12** in a position overlying the sleeve **28** along the connecting seam **30** so that the vertically oriented fabric stretch A of the front panel **12** is effective to obviate the formation of stitch-pucker in the needle thread during the sewing of this seam.

While the practice of the present invention involves little or no change in the actual operation of a sewing machine, to the extent that the uppermost or visible fabric ply of a superposed arrangement of fabric plies is required to have its stretch oriented in the direction of sewing, a radical departure is required in the customary manner of die-cutting or machine-cutting the usual garment parts for the shirt **10** when the garment's stretch capability in the filling direction is now commercially available. This may be best appreciated from FIGS. 3A and 3B in which there is illustrated a typical prior art layout of shirt parts (marked prior art), next to which there is illustrated a layout of the same parts according to the present invention. The latter layout is possibly subject to some variation to improve the yield from the fabric **52** although it is a currently preferred layout. As is generally understood, fabric **52** is stacked in layers on a cutting table and the various shapes of garment parts to be removed therefrom marked on the fabric **52** in an arrangement giving the most efficient yield. For present purposes, it is necessary only to note that as is exemplified by the prior art layout, the custom and practice is to orient the long dimension of the garment parts to the long dimension or warp direction of the fabric **52**. However, since stretch fabrics as are currently available, are stretchable by virtue of a stretch capability of the filling yarns of the fabrics, which filling yarns, as illustrated in the cross-hatching of FIG. 3B and designated **54** therein, run to the width or short dimension of the fabric **52**. Thus, the layout of the present invention in contrast to the prior art layout has the long dimension of the individual garment part oriented to the filling direction of the fabric **52**, even though this layout may require as much as one third of a yard more fabric per garment.

In the foregoing description, reference was made to sewing with a conventional sewing machine in the conventional and well understood operation of which a so-called needle thread and bobbin thread are interengaged to form the individual stitches of a seam or line of stitching. While the majority of sewing machines now in use employ a bobbin so that reference to bobbin thread is accurate in relation to the sewing machines, it is also known that there are sewing machines currently in use and being developed which eliminate the use of a bobbin per se, such as for example, a chain-stitch sewing machine. The seams or sewing produced by these sewing machines consist of one or more threads interengaged at spaced points along the fabric and with the thread between engagements extending along one side of the fabric. These seams or sewing, although not employing a bobbin thread, are nevertheless within the contemplation of the present invention. Accordingly, as used in the appended claims, the nomenclature for the threads will be referred to as top and bottom threads rather than as needle and bobbin threads which is not wholly accurate as to all types of sewing machines which can be employed for the present invention.

The present invention provides a highly useful method for producing puckerless seams. This problem, which has faced the industry for many years, can be solved in the simple manner taught by the present invention. The method is highly suited to existing commercial operations with no change in the existing conventional sewing machines now employed.

A latitude of modifications, change and substitution is intended in the foregoing disclosure and in some instances some features of the invention will be employed without a corresponding use of other features.

What is claimed is:

1. In the production of a cut-and-sewn garment from a plurality of cut garment parts including a yoke extending across the shoulders of a wearer, a pair of sleeves encircling the arms of a wearer, and a pair of front panels having a placket front extending vertically of the upper torso of a wear, said yoke, sleeve and front panels being sewn together with a stitched seam, an improved method for forming the seams interconnecting said garment parts so as to produce minimal stitch pucker, which improved method comprises:

(1) cutting said garment parts from a fabric having a relatively low elastic modulus and a recoverable stretch capability of at least 12% in at least one yarn direction of said fabric such direction of stretch of said garment parts is substantially in the direction of the long dimension of each of said garment parts,

(2) arranging at each of said seams at least two of said garment parts to be sewn to each other with an edge of one overlying the other and with the direction of stretch of at least the overlying garment part in the direction in which the seam is to be formed, and

(3) sewing said garment parts to stretch the overlying garment part between successive interengagements of sewing thread under low sewing thread tension so that upon the subsequent relaxation of said one overlying part said thread is relieved of tension.

2. The method of claim **1** wherein at least two of said garment parts are arranged with their directions of stretch in the direction in which the seam is to be formed.

3. The method of claim **1** wherein said yarn direction is the warp direction.

4. The method of claim **1** wherein said yarn direction is the filling direction.

5. The method of claim **1** wherein said stretch capability is in both the warp and filling directions.

6. The method of claim **4** wherein said fabric is a slack mercerized polyester/cotton batiste of about 65% polyester and about 35% cotton, and the said recoverable stretch capability is at least 15%.

7. The method of claim **4** wherein said fabric is a slack mercerized broadcloth.

8. The method of claim **1** wherein each of said fabrics is woven from core spun yarns containing spandex filaments.

9. The method of claim **1** wherein each of said fabrics is woven from texturalized yarn.

10. The method of claim **1** wherein said garment parts

are resin-impregnated fabrics which are cured prior to interconnecting said garment parts.

11. The method of claim **1** wherein said garment parts are resin-impregnated fabrics which are cured after interconnecting said garment parts.

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