Sept. 15, 1959 B. STEVENS, JR 2,903,869

METHOD OF KNITTING PILE FABRIC

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FIG. 2

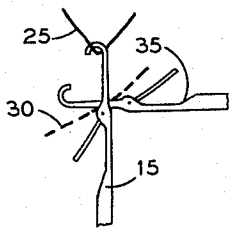


FIG. 3

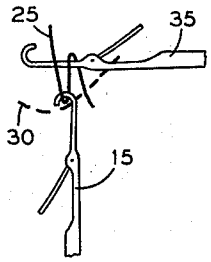


FIG. 4

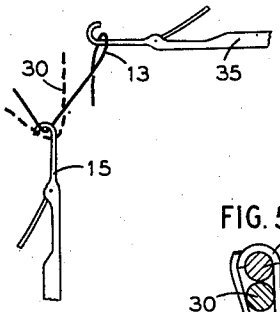


FIG. 5

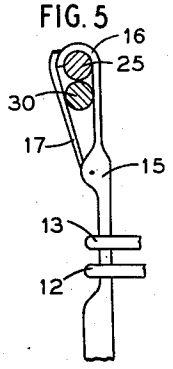


FIG. 1

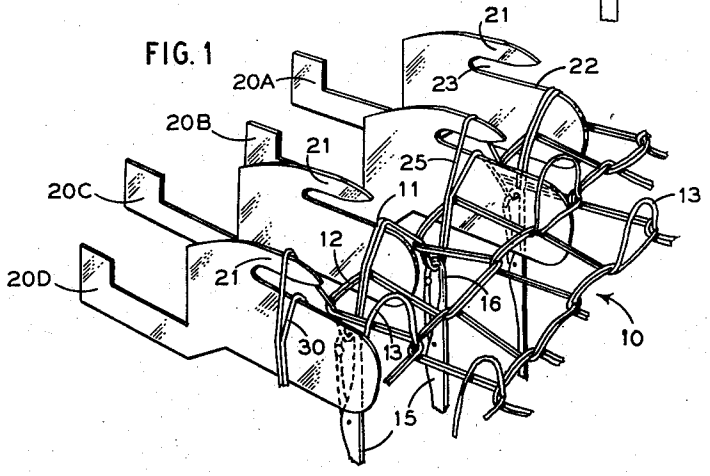


FIG. 9

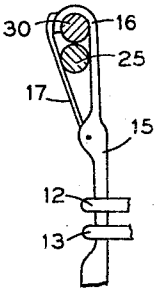


FIG. 7

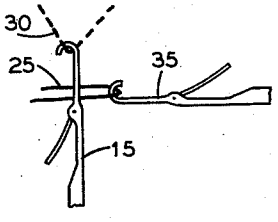


FIG. 8

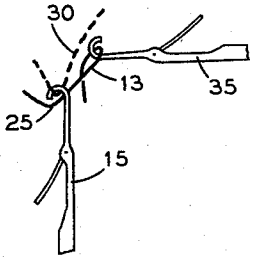
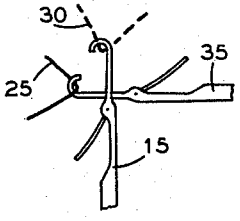


FIG. 6



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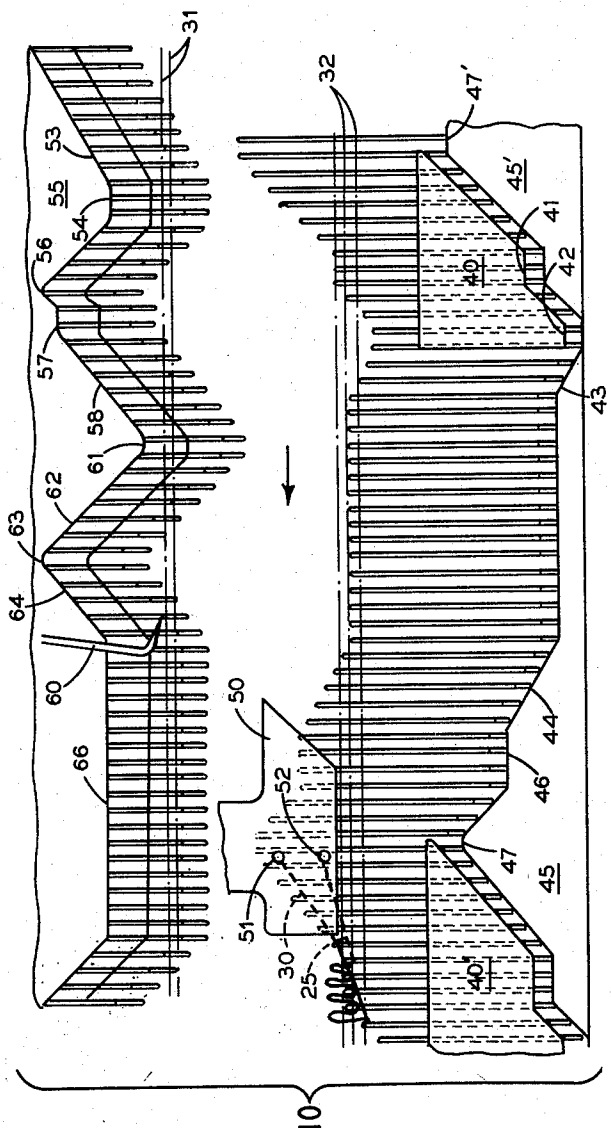


FIG. 10

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United States Patent Office 2,903,869 Patented Sept. 15, 1959

2,903,869

METHOD OF KNITTING PILE FABRIC

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Application June 11, 1956, Serial No. 590,581

9 Claims. (Cl. 66—92)

This invention relates to pile fabrics and a method of knitting the same, and, more particularly, to an improved knit pile fabric having a smooth jersey or back surface and to a method of knitting such improved fabric.

Pile fabrics, such as terry cloth, toweling etc. can be knit as a variation of plain jersey knit fabric, using two yarns. One yarn forms the pile loops, which may later be severed, if desired, and the other yarn forms the body of the fabric. In this case, the pile fabric is formed using latch cylinder needles cooperable with pile forming elements slidable in grooves contained in a dial mounted inside the needle circle.

One known way of knitting a pile fabric on a jersey fabric knitting machine is to use latch or spring beard cylinder needles cooperable with sinkers mounted in an outside dial, the needles and sinkers being cooperatively actuated by suitable cams which may have pattern wheels associated therewith. The sinkers are formed with noses and throats, and the needles draw the pile loop forming yarn down over the noses of the sinkers to form the pile loops. The stitch or body forming yarn is fed to the needles below the sinker noses and at the level of the sinker throats.

In another method, an inside dial is equipped with needles, and the cylinder needles draw the pile yarn down between the dial needles to form the loops, the stitch or body yarn being picked up by the cylinder needles below the level of the dial needles. In a variation of this method, the dial needles are replaced by blanks mounted in the inside dial, eliminating the need for latches to cast the pile loops off the dial needles and for means to subsequently open the dial needle latches.

The fabrics made by these two methods are identical with respect to stitch formation and the arrangement of the two yarns in the stitch. However, they frequently are characterized by a very rough, irregular, and unsightly back or jersey side. This is a result of the fact that each pile loop, after formation, must be freed from the loop forming dial means, such as the sinkers, needles, or blanks, before the new stitch is formed by a subsequent yarn feed.

During such subsequent yarn feed, the new stitch, composed of both pile loop yarn and stitch or body yarn, is pulled by the needle through the stitch formed during the prior feed. The stitch yarn normally has no slack, but the loop yarn does have a great deal of slack or looseness due to release of the loop from the dial element. The frictional effect of the needle and yarns of the new stitch being drawn through the previously formed stitch may pull some of the loop yarn slack through to the back side of the fabric in an irregular manner, thus causing the fabric back to have an unsightly appearance.

As stated, in both described methods, the hook of the cylinder needle first catches the loop yarn and later the stitch yarn. During the next yarn feeding operation, the loop and stitch yarns may change their relative positions on the needles, so that either the relatively tight stitch

yarn or the relatively loose loop yarn appears on the back of the fabric.

In accordance with the invention, a pile knit fabric having a smooth back or jersey surface is produced by reversing the positions of the loop and stitch yarns so that the cylinder needles catch the stitch yarn first and the loop or pile yarn subsequently.

In one method of effecting the invention, the dial is equipped with needles which draw long loops of the pile yarn through the cylinder needles after the latter have first caught the stitch yarn. During the subsequent feed, there is no tendency for the two yarns to shift their relative positions. The long loop yarn appears on the jersey side of the fabric in a larger and looser stitch covering the tighter stitch yarn, resulting in the jersey side having a soft surface and smooth appearance due to the lack of tension in the surface yarn.

For an understanding of the invention principles, reference is made to the following description of a typical embodiment thereof as illustrated in the accompanying drawing. In the drawing:

Fig. 1 is a somewhat diagrammatic perspective view illustrating the prior art knitting of pile fabric on a machine equipped with latch cylinder needles and sinkers mounted in an outside dial;

Figs. 2, 3 and 4 are diagrammatic elevation views illustrating successive steps of the prior art method of knitting pile fabric using cooperating cylinder and dial needles;

Fig. 5 is a partial elevation view of a cylinder needle of Figs. 2, 3 and 4, illustrating the relative positions of the pile and stitch yarns in the hook end of the needle;

Figs. 6, 7 and 8 are diagrammatic elevation views, respectively corresponding to Figs. 2, 3, and 4, illustrating successive steps of the invention method of knitting pile fabric; and

Fig. 9 is a view, similar to Fig. 5, illustrating the positions of the pile and stitch yarns in the needle when using the invention method;

Fig. 10 is a developed plane view of the dial needles and their cams in relation to a developed elevation view of the cylinder needles and their cams rotated into the plane of the dial needles and cams.

Referring to Fig. 1, a pile fabric **10** is illustrated as being knit using latch cylinder needles **15** and sinkers **20**. In this method of knitting pile fabric, needles **15** are successively elevated to the "knit" position, above upper noses **21** of sinkers **20**, to catch loop pile yarn **25** fed at the knit position or level. Needles **15** may be selectively raised as shown by the usual cam and jack-pattern wheel arrangements common in the art, or alternatively all cylinder needles may be raised. Similarly, sinkers **20** are operated by the usual sinker cams and associated jack-pattern wheels so that alternate sinkers **20B** and **20D** are projected further than intermediate sinkers **20A** and **20C**. However, if all needles are raised to take yarn, then all the sinkers will be projected in the same manner as sinkers **20B** and **20D**.

As loop pile yarn **25** is caught in the hooks **16** of needles **15**, it is pulled downwardly as the needles **15** are retracted toward the cast-off position to form loops over the lower noses or surfaces **22** of the alternate sinkers and over the upper noses of the intermediate sinkers as shown, or alternatively on the noses of all the sinkers. Stitch or body yarn **30** is fed to needles **15** at the level of the throats **23** of sinkers **20**, so that stitch yarn loops are drawn over surfaces **23**. It will be noted that the double yarn new stitches **11** are drawn through previously formed stitches **12** by needles **20**, the loops engaged with noses **22** forming pile loops **13** in fabric **10** as they slip off sinkers **20** when the latter are retracted.

Figs. 2 through 5 illustrate a known method of knitting

pile fabric using latch cylinder needles **15** cooperating with latch dial needles **35** operated by cams and jack-pattern wheels in a known manner. In this method, cylinder needles **15** are raised to the knit position to catch pile yarn **25** which is fed at this level. As pile yarn **25** is drawn down to the level of dial needles **35**, the pile yarn is caught by the dial needles to pull the pile loops **13** inwardly as the pile yarn is pulled down below needles **35** by needles **15**. Stitch yarn **30** is fed at the level of needles **35** and also pulled down by needles **15**. As the stitches and loops are cast off needles **15** and **35**, a pile fabric **10** is formed identical with that of Fig. 1.

It should be noted that in both the method of Fig. 1 and that of Fig. 2, pile yarn **25** is fed to needles **15** before stitch yarn **30** is fed thereto. Thus, pile yarn **25** is above stitch yarn **30** in hooks **16** of needles **15**, and the yarns may retain this position as they are drawn through previously formed stitches **12**, **13** which close latch **17** of needle **15**. Both of these methods, as previously mentioned, produce a rough, irregular and unsightly back surface on the pile fabric.

In accordance with the present invention, the relative feeding positions of the two yarns are reversed, so that stitch or body yarn **30** is caught first and pile yarn **25** caught subsequently. One method of effecting this is to use cooperating cylinder and dial needles, as used in the prior art method shown in Figs. 2–5, although the invention method can be practiced using cylinder needles cooperating with sinkers.

Figs. 6–10 illustrate the invention method as effected using cooperating cylinder and dial needles. Referring to these figures, stitch or body yarn **30** is fed to cylinder needles **15** at the knit level, while pile yarn **25** is fed to extended dial needles **35** at the level of these needles. Thus, stitch yarn **30** is caught first by needles **15** and engages the top of hooks **16**. As cylinder needles **15** pull stitch yarn **30** downwardly, dial needles **35** pull pile yarn **25** inwardly, so that hooks **16** of needles **15** catch pile yarn **25** at the level of needles **35**. Pile yarn **25** thus lies beneath stitch yarn **30** in hooks **16** as loops **13** are pulled down by needles **15** while yarn **25** is held by needles **35**. Dial needles **35** may be drawn in before needles **15** move down, if desired. Also, the fabric may be formed by the cylinder needles pulling the pile yarn over the dial needles, this amounting to an equivalent reversal of parts and their functions.

At the subsequent feed, there is no tendency for yarns **25** and **30** to shift their relative position. Loop yarn **25** appears on the back of the fabric as a longer and looser stitch covering the tighter stitch yarn **30**. The back has a soft surface, due to the lack of tension in the surface yarn, and has a very smooth appearance.

Fig. 10 illustrates the sequence of movement of cylinder needles **15** and dial needles **35** during one complete cycle. The needles are assumed to move from right to left, with lines **32** indicating the cylinder of movement of needles **15** and lines **31** indicating the plane of movement of needles **35**. The cam path for dial needles **35** is shown much closer to the line **32** of needles **15** than it would be in a practical machine.

At the extreme right of Fig. 10, cylinder needles **15** are shown in their clear position. As the needles move to the left, they are drawn down by stitch cam **40** to surface **41** of the latter. In this position, the latches of the cylinder needles are closed but the hooks are still well above the sinkers so that yarn will reeve freely through the closed hooks. Cam **40** then draws needles **15** down to knock over level **42** where the stitch is formed.

Needles **15** are then raised slightly by surface **43** of cam **45** to relieve the stitches, after which needles **15** ride up surface **44** of cam **45** to the tuck level **46** of this cam. The needles **15** remain at the tuck level for a short time after which they are raised to the clear or stitch level **47** of cam **45**. The needles **15** then encounter another stitch cam **40'** and the cycle is repeated.

A yarn guide **50** is shown near the left end of Fig. 10 and has eyelets **51**, **52** which may be located in vertical alignment in accordance with the invention, body yarn **30** being fed through upper eyelet **51** and loop yarn **25** through lower eyelet **52**.

Dial needles **35** are moved outwardly by surface **53** of cam **55** so that their hooks are beyond cylinder needle line **31** just after cylinder needles **15** pass the clearing surface **47'** of cam **45'**. After needles **35** pass along surface **54** of cam **55**, they are drawn inwardly taking loop yarn **25** in their hooks just before needles **15** reach cam surface **41**. Needles **35** continue inwardly to cam surface **56** at which time they have drawn sufficient pile or loop yarn **25**. Needles **35** preferably reach surface **56** before needles **15** start to draw the pile yarn through the old loops as needles **15** reach cast-off surface **42**, and dial needles **35** are preferably moved out slightly to surface **57** as needles **15** ride down to the cast-off position. This latter movement releases sufficient yarn to the cylinder needles **15** so that these may draw their stitches.

After leaving surface **57**, needles **35** are moved outwardly by surface **58** to the clear position at surface **61**, and are then retracted along surface **62** to the knock-off surface **63** where the needles cast-off the loop yarn from their hooks. The needles **35** are then moved out along cam surface **64** to the tuck position as they encounter surface **66**.

As needles **35** are moved toward the tuck position, their latches are opened by latch opener **60** before cylinder needles **15** are projected up between the dial needles.

While the invention has been illustrated and described as using latch cylinder needles, the method may be equally well performed using spring cylinder needles, and wherever the term "cylinder needle(s)" is used in the specification and claims it is to be understood as comprehending spring needles.

While a specific embodiment of the invention has been shown and described in detail to illustrate the application of the invention principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. A method of knitting pile fabric utilizing cylinder needles cooperable with movable dial needles, said method comprising, in each stitch forming sequence, feeding a body yarn to the hooks of the cylinder needles in the knit position; substantially simultaneously therewith, feeding a pile yarn to the dial needles, operating between the cylinder needles, at a level below the hooks of the cylinder needles in the knit position; drawing loops of pile yarn transversely between pairs of cylinder needles; subsequently catching the drawn pile yarn in the hooks of the cylinder needles below the body yarn therein while retaining the pile yarn loops in drawn position; drawing the body and pile yarn in the needle hooks through previously formed loops around the cylinder needles; and subsequently casting off the newly formed body yarn loops and the retained pile yarn loops.

2. A method of knitting pile fabric utilizing cylinder needles cooperable with movable dial needles operating between the cylinder needles, said method comprising, in each stitch forming sequence, feeding a body yarn to the hooks of the cylinder needles at a level above the dial needles; feeding a pile yarn to the dial needles while the hooks of the cylinder needles are above the dial needles; drawing a loop of pile yarn transversely between pairs of cylinder needles as the latter are moved toward a cast-off position; catching the pile yarn in the hooks of the cylinder needles below the body yarn therein during such movement toward the cast-off position; drawing the body and pile yarn caught in the hooks of the cylinder needles through previously formed loops around the cylinder needles; and subsequently casting

off the newly formed loops from the cylinder needles and the pile yarn loops from the dial needles.

3. A method of knitting pile fabric utilizing cylinder needles cooperable with movable dial needles operating between the cylinder needles, said method comprising, in each stitch forming sequence, feeding a body yarn to the hooks of the cylinder needles at a level above the dial needles; feeding a pile yarn to the dial needles while the hooks of the cylinder needles are above the dial needles; drawing an elongated loop of pile yarn transversely between pairs of cylinder needles as the latter are moved toward a cast-off position; catching the pile yarn in the hooks of the cylinder needles below the body yarn therein during such movement toward the cast-off position; drawing the body and pile yarn caught in the hooks of the cylinder needles through previously formed loops around the cylinder needles; and subsequently casting off the newly formed loops from the cylinder needles and the pile yarn loops from the dial needles.

4. A method of knitting pile fabric utilizing cylinder needles cooperable with movable dial needles operating between the cylinder needles, said method comprising, in each stitch forming sequence, feeding a body yarn to the hooks of the cylinder needles at a level above the dial needles; feeding a pile yarn to the dial needles while the hooks of the cylinder needles are above the dial needles; moving the dial needles to draw a loop of pile yarn transversely between pairs of cylinder needles as the latter are moved toward a cast-off position; catching the pile yarn in the hooks of the cylinder needles below the body yarn therein during such movement toward the cast-off position; drawing the body and pile yarn caught in the hooks of the cylinder needles through previously formed loops around the cylinder needles; and subsequently casting off the newly formed loops from the cylinder needles and the pile yarn loops from the dial needles.

5. A method of knitting pile fabric utilizing cylinder needles cooperable with movable dial needles operating between the cylinder needles, said method comprising, in each stitch forming sequence, feeding a body yarn to the hooks of the cylinder needles at a level above the dial needles; feeding a pile yarn to the dial needles while the hooks of the cylinder needles are above the dial needles; moving the dial needles to draw an elongated loop of pile yarn transversely between pairs of cylinder needles as the latter are moved toward a cast-off position; catching the pile yarn in the hooks of the cylinder needles below the body yarn therein during such movement toward the cast-off position; drawing the body and pile yarn caught in the hooks of the cylinder needles through previously formed loops around the cylinder needles; and subsequently casting off the newly formed loops from the cylinder needles and the pile yarn loops from the dial needles.

6. A method of knitting pile fabric utilizing cylinder needles cooperable with movable dial needles operating between the cylinder needles, said method comprising, in each stitch forming sequence, feeding a body yarn to the hooks of the cylinder needles in the knit position; projecting the dial needles between the cylinder needles in the knit position at a level below the needle hook; feeding a pile loop yarn to the projected dial needles; retracting the pile needles to draw a loop of pile yarn transversely between pairs of cylinder needles as the latter are moved toward a cast-off position; catching the pile yarn in the hooks of the cylinder needles below the body yarn therein during such movement toward the cast-off position; drawing the body and pile yarn caught in the hooks of the cylinder needles through previously

formed loops around the cylinder needles; and subsequently casting off the newly formed loops from the cylinder needles and the pile yarn loops from the dial needles.

7. A method of knitting pile fabric utilizing cylinder needles cooperable with movable dial needles operating between the cylinder needles, said method comprising, in each stitch forming sequence, feeding a body yarn to the hooks of the cylinder needles in the knit position; projecting the dial needles between the cylinder needles in the knit position at a level below the needle hook; feeding a pile loop yarn to the projected dial needles; retracting the dial needles to draw an elongated loop of pile yarn transversely between pairs of cylinder needles as the latter are moved toward a cast-off position; catching the pile yarn in the hooks of the cylinder needles below the body yarn therein during such movement toward the cast-off position; drawing the body and pile yarn caught in the hooks of the cylinder needles through previously formed loops around the cylinder needles; and subsequently casting off the newly formed loops from the cylinder needles and the pile yarn loops from the dial needles.

8. A method of knitting pile fabric utilizing cylinder needles cooperable with movable dial needles operating between the cylinder needles, said method comprising, in each stitch forming sequence, feeding a stitch yarn to the hooks of the cylinder needles in advance of feeding the pile yarn thereto; substantially simultaneously therewith, feeding a pile yarn to the dial needles, operating between the cylinder needles, at a level below the hooks of the cylinder needles in the knit position; drawing pile yarn loops between pairs of cylinder needles having the stitch yarn caught therein; subsequently catching the pile yarn in the hooks of the cylinder needles below the body yarn therein while retaining the pile yarn loops in drawn position; drawing the stitch and pile yarn loops through previously formed loops around the cylinder needles; and subsequently casting off the newly formed stitch yarn loops and the retained pile yarn loops.

9. A method of knitting pile fabric utilizing cylinder needles cooperable with movable dial needles operating between the cylinder needles, said method comprising, in each stitch forming sequence, feeding a stitch yarn to the hooks of the cylinder needles in advance of feeding the pile yarn thereto; substantially simultaneously therewith, feeding a pile yarn to the dial needles, operating between the cylinder needles, at a level below the hooks of the cylinder needles in the knit position; drawing elongated pile yarn loops between pairs of cylinder needles having the stitch yarn caught therein; subsequently catching the pile yarn in the hooks of the cylinder needles below the body yarn therein while retaining the pile yarn loops in drawn position; drawing the stitch and pile yarn loops through previously formed loops around the cylinder needles; and subsequently casting off the newly formed stitch yarn loops and the retained pile yarn loops.

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