April 6, 1965 B. D. GORDON ETAL 3,176,480

REAR PANEL FOR WOMEN'S KNITTED GARMENTS AND METHOD OF KNITTING SAME

Filed May 29, 1961 4 Sheets-Sheet 1

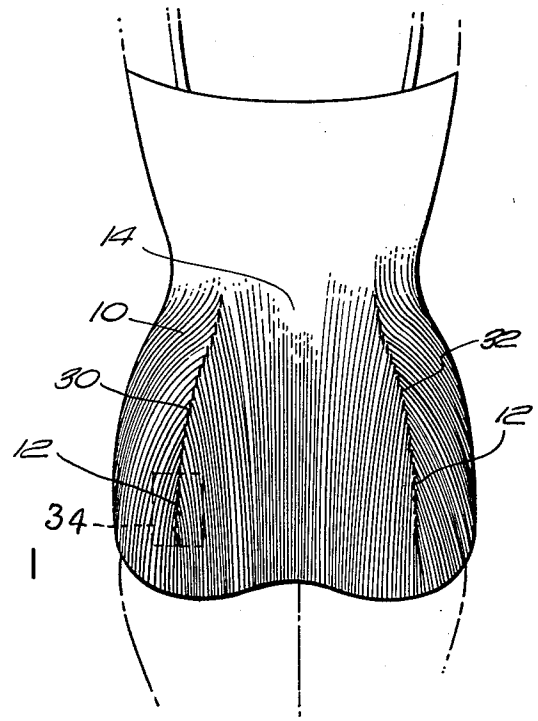


FIG. 1

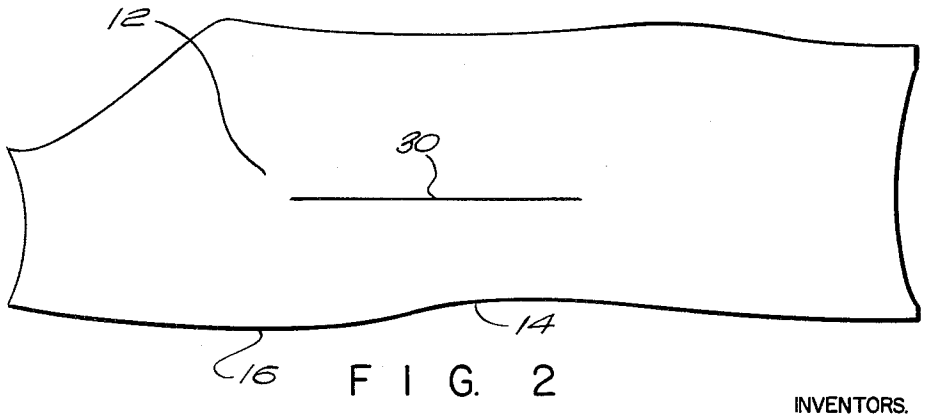


FIG. 2

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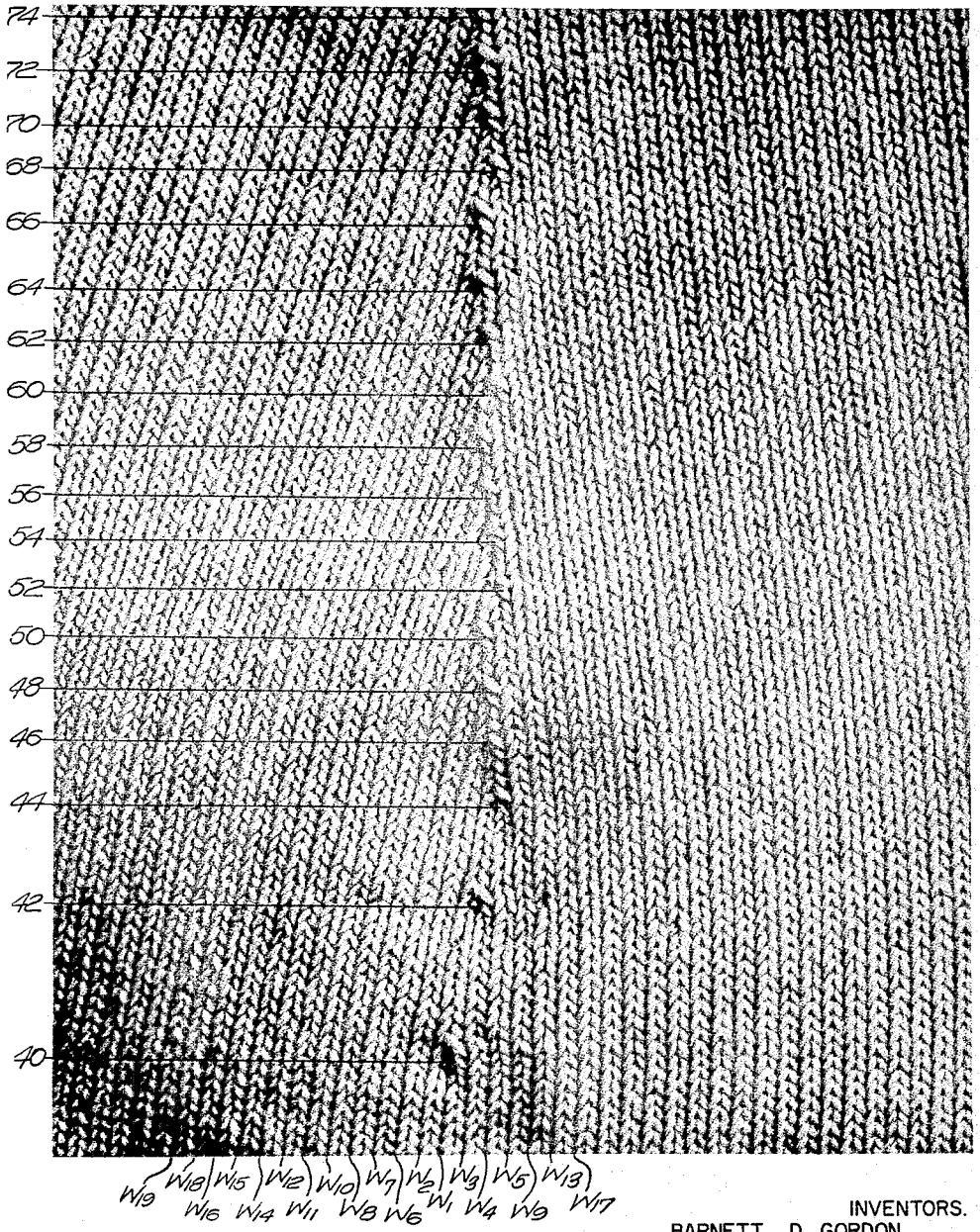


FIG. 3

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REAR PANEL FOR WOMEN'S KNITTED GARMENTS AND METHOD OF KNITTING SAME

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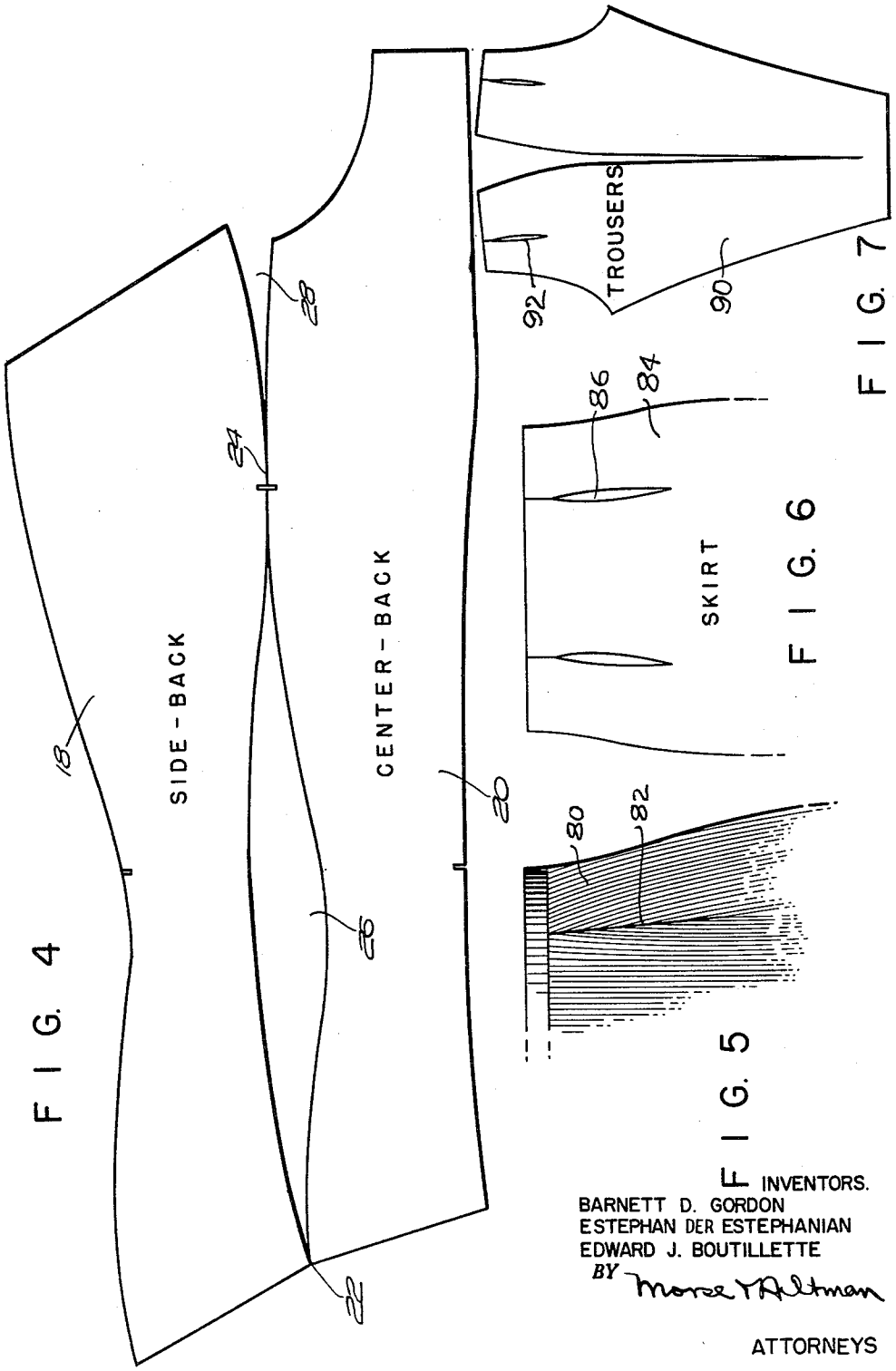


FIG. 4

FIG. 5

FIG. 6

FIG. 7

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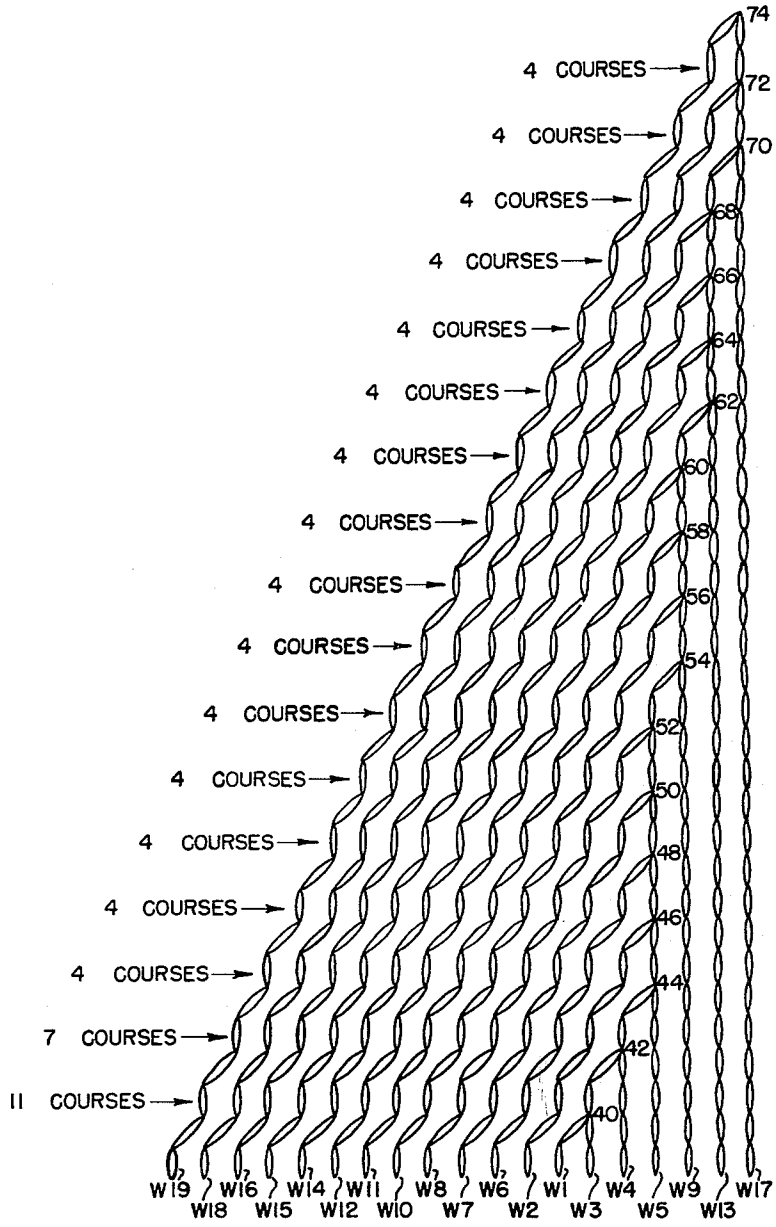


FIG. 8

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REAR PANEL FOR WOMEN'S KNITTED GARMENTS AND METHOD OF KNITTING SAME

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3 Claims. (Cl. 66—189)

This invention relates to a method of shaping parts for women's knitted garments in the process of knitting them. More particularly, the invention relates to a method of knitting a rear panel for a woman's swimsuit in such a way as to provide for a concave curvature at the mid portion and a convex curvature at the lower portion for a smooth fit on the small of the back and the buttocks, respectively. This is done, according to the invention, by first cutting out paper patterns which may comprise a number of pieces for a single part of a garment as, for example, the rear panel of a woman's swimsuit. Such pieces will have curved edges so that when laid flat and in contact, there will be gaps between the several pieces. These gaps provide a clue to the problem of arranging buttons on the pattern chain of a flat or fashioning knitting machine so that by shifting loops from some of the needles between the knitting of courses, the resulting fabric will be continuously knitted with no gaps but with the desired concave and convex shaping.

For a more complete understanding of the invention, reference may be had to the following description of the invention and to the drawings, of which:

FIGURE 1 is an elevational view of the rear panel of a woman's knitted swimsuit embodying the invention;

FIGURE 2 is an outline, on a larger scale, of the panel shown in FIGURE 1 folded double on its vertical median;

FIGURE 3 is a magnified photographic reproduction of a portion of the fabric indicated in FIGURE 1;

FIGURE 4 is an outline of two paper pattern pieces representing half of the swimsuit panel shown in FIGURE 1, but on a larger scale;

FIGURE 5 is a fragmentary elevational view of the upper portion of a skirt shaped by knitting instead of darts;

FIGURE 6 is an outline of the upper portion of a paper pattern for the skirt shown in FIGURE 5;

FIGURE 7 is an outline of a paper pattern for half a pair of trousers or slacks for women; and

FIGURE 8 is a diagrammatic illustration of the narrowing sequence of the fabric portion shown in FIGURE 3.

The rear elevation of a knitted swimsuit is indicated in FIGURE 1. A one-piece rear panel **10** is shown, this panel being joined to a front panel (not shown) by side seams (not shown). The rear panel **10** is three-dimensionally shaped with rounded bulges **12** to fit smoothly over the buttocks of the wearer and has a shallow depression **14** in its mid area to fit in the small of the back of the wearer. If the rear panel is folded double along its vertical median **16** while unattached to any other part, the outline of the doubled panel is somewhat as indicated in FIGURE 2. The bulges **12** are not illustrated in this figure, but the shallow hollow **14** at the small of the back is indicated by the concavity of the line of fold.

Ordinarily, a well-fitted back panel of a swimsuit or other form-fitting garment for women must have narrow pieces of the fabric cut out and the resulting edges stitched together. According to the present invention, the shaping of the rear panel is done by the knitting machine alone, two narrowing fingers being employed to shift loops of yarn on many of the needles as hereinafter described.

In order to obtain a proper form-fitting contour by knitting, a pattern is first laid out. Since the panel will be symmetrical with respect to the vertical median, the pattern can conveniently be laid out for half the panel. Such a pattern is shown in FIGURE 4 and consists of two pieces **18** and **20** representing the side and central portions, respectively of a rear half-panel. When properly shaped as shown, the mutually confronting edges of the parts **18** and **20** of the pattern curve in such a way as to touch at only two places **22** and **24**, leaving gaps **26** and **28** between the parts.

We have found that by merging wales along transfer lines such as are conventionally indicated at **30, 32** in FIGURE 1, when knitting a panel from bottom to top on a fashioning machine, a one-piece seamless rear panel can be knitted with the desired surface contours to fit the buttocks and the small of the back. For this purpose we employ two narrowing fingers each of which is equipped with enough narrowing points to take loops of yarns from knitting needles on the machine extending from any part of the transfer line **30** or the transfer line **32** to the adjacent selvage of the panel. When loops of yarn are taken from needles by points of the two narrowing fingers, the loops are shifted toward the center of the panel a distance of one needle-space, that is, the shifting movements of the narrowing fingers are toward each other. As hereinafter described, when the narrowing fingers have been moved toward each other to shift yarn loops, sometimes they at once move back again a needle space while at other times they remain in the positions reached in the shifting operation. Each such shifting of loops of yarn by the narrowing finger on the left results in the termination of one of the wales by merging it into the wale next to the right of it (when the narrowing finger is returned at once to its previous position after shifting loops of yarn) or into the wale next to the left of it (when the narrowing finger does not return to its previous position after transferring loops of yarn to the right). The transfer lines **30, 32** in FIGURE 1 merely indicate the approximate location of those lines and do not attempt to indicate the actual details of the merging wales. Such details are given in FIGURE 3 which is an enlarged photographic reproduction of an area of a swimsuit panel corresponding to the rectangle **34** indicated by broken lines in FIGURE 1. Approximately one quarter of the left transfer line **30** appears in FIGURE 3. Following is a detailed description, by way of example, of the transfer line partly illustrated in FIGURE 3, it being understood that the numbers given may vary for swimsuits of other sizes or when using a different yarn, and that corresponding operations take place to form the transfer line **32** in the right half of the panel. The knitting starts at the bottom of the panel and proceeds upward. The narrowing begins at **40** where wales W_1 and W_3 merge, this being done by means of a narrowing finger (not shown) which takes the yarn loops on the needles to the left of wale W_3 and shifts them one needle space to the right. Then eleven courses

are knitted during which the narrowing finger does not move. Subsequent operations are as follows, the narrowing finger sometimes remaining in place after a shift of yarn loops, and sometimes returning one needle space toward the left during the knitting of the courses following a shift of loops:

Wales merged:	The narrowing finger then—
3 and 4 at 42	Stays.
4 and 5 at 44	Returns.
2 and 5 at 46	Do.
6 and 5 at 48	Do.
7 and 5 at 50	Do.
8 and 5 at 52	Stays.
5 and 9 at 54	Returns.
10 and 9 at 56	Do.
11 and 9 at 58	Do.
12 and 9 at 60	Stays.
9 and 13 at 62	Returns.
14 and 13 at 64	Do.
15 and 13 at 66	Do.
16 and 13 at 68	Stays.
13 and 17 at 70	Returns.
18 and 17 at 72	Do.
19 and 17 at 74	Do.

The alternation of a loop-shifting operation followed by the knitting of four courses during which the narrowing finger either remains in place or more frequently returns a needle space toward the left continues until the upper end of the transfer line 30 is reached.

At the same time, the other narrowing finger is making the transfer line 32 to be a mirror image of the transfer line 30 so that the panel 10 is symmetrical with respect to its vertical center line. Since the narrowing fingers in making the transfer lines 30, 32 advance intermittently toward each other, the lines 30, 32 converge upwardly, the angle of convergence being approximately 12° in the panel illustrated in part in FIGURE 3.

It is to be understood that the foregoing description of the fabric shown in FIGURE 3 is by way of example only and that the sequence of yarn loop shifting operations and knitting of courses can be varied for different sizes of panels for swimsuits or other shaped garments for women. The narrowing operations along the transfer lines 30, 32 results in a fabric having a surface contour similar to that which would be obtained by cutting out four pieces of flexible fabric, two pieces being shaped like the pattern part 18 and two like the pattern part 20 shown in FIGURE 4 and stitching these pieces together along mutually adjacent side edges.

The application of narrowing in knitting on a fashioning machine may be used for shaping other garments for women. FIGURE 5 is a partial showing of a skirt 80 which is full at the hips but gathered at the waist, one of the transfer lines 82 indicating the termination of wales by merging being indicated conventionally, the length of the transfer lines and the frequency of the merging operations being estimated from a pattern 84 the upper portion of which is shown in FIGURE 6 with gaps 86 designed to provide proper shaping of the skirt over the hips. In like manner, a blank can be knitted on a fashioning machine to be made into slacks for women, transfer lines for the termination of wales being estimated from a pattern 90 having gaps 92 for shaping the slacks over the hips.

We claim:

1. A seamless knitted three-dimensional rear panel for a form-fitting garment for women having two transfer lines starting approximately at the centers of respective buttocks-covering areas and extending upward, each said transfer line indicating the locus of points of termination of individual wales resulting from narrowing operations in half of the panel during the knitting of the panel upward, said lines of transfer starting approximately at the centers of the respective buttocks-covering areas and converging upward at an angle of about 12°.

2. A seamless knitted three-dimensional rear panel for a form-fitting garment for women having two transfer lines starting approximately at the centers of respective buttocks-covering areas and extending upward, each said transfer line indicating the locus of points of termination of individual wales resulting from narrowing operations in half of the panel during the knitting of the panel upward, some of said wales terminating by merging outward into the next wale toward the nearest selvage, the other said wales terminating by merging inward into the next wale away from the nearest selvage, the inwardly merging wales and outwardly merging wales being in a ratio of about three to one.

3. A method of knitting a seamless three dimensional rear panel for a form fitting garment for women, which comprises straight knitting from the bottom of the panel to the center of the buttocks covering areas, shifting inward a distance of one needle space by means of narrowing fingers all the yarn loops on needles between the centers of the buttocks covering areas and the corresponding selvages, knitting several courses from selvage to selvage, shifting inward a distance of one needle space all the yarn loops on needles between the centers of the buttocks covering areas and the corresponding selvages, again knitting several courses, and continuing alternately shifting loops and knitting numbers of selvage-to-selvage courses to form two transfer lines extending several inches up from the buttocks covering areas, the numbers of the courses knitted between successive shifts of loops being varied, said narrowing fingers being returned after some of the loop shifting operations to the position occupied thereby just before the shift and being retained in position after each of the other loop shifting operations, the sequence of knitting and loop shifting operations employed in forming substantially the entire length of each said transfer line comprising several repetitions of the following cycle:

loops are shifted one needle space,
several courses are knitted during which the narrowing fingers remain stationary,
loops are shifted one needle space,
several courses are knitted during which the narrowing fingers return one needle space,
loops are shifted one needle space,
several courses are knitted during which the narrowing fingers return one needle space,
loops are shifted one needle space,
several courses are knitted during which the narrowing fingers return one needle space.

References Cited by the Examiner

UNITED STATES PATENTS

504,402	9/93	Pike	66—175
2,976,708	3/61	Gordon	66—176
2,977,783	4/61	Crawford	66—189

FOREIGN PATENTS

15,780	9/91	Great Britain.	

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