

The Manufacture of Fashioned Knit Goods

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PART I

It has always been the endeavor of the knitting industry to fashion products during the process of their manufacture. This explains why for certain purposes knitted wearing apparel is preferred to the woven articles, which are mostly tailored from piece goods.

The knitting industry offers many of its products "ready to wear." The articles are produced on the machines according to shape and size. The cutting of piece goods in the knitting industry is also an important line and requires special machines and apparatus as well as experienced help. It is not possible to finish knitted material on the ordinary domestic sewing machine and piece goods are not offered to, nor demanded by, the ultimate consumers.

The fashioned article is the product of one and the same factory from the yarn to the finished garment. The fashioning of the articles on the knitting machine reduces waste and gives close fitting, without bulky seams to destroy the shape and form of the body line. If knitted material for some reason or other shows any defects, the respective parts can be unravelled and the yarn can be used over again. Such merchandise is of good quality and generally correct in fit and appearance.

As stated before, besides the fashioned articles, cut articles from piece goods are extensively produced in the knitting industry. The manufacture of wearing apparel from piece goods (cut out from large pieces) according to certain patterns is more productive. Such articles, however, do not always compare favorably with the fashioned articles. Defective material cannot be unravelled on account of cut loops on the edge and must be considered as waste. The tailoring itself brings about considerably more waste than the manufacture of fashioned articles.

Methods of Fashioning

The fashioning of knitted products is ef-

fectured by different methods. Interesting working procedures are applied for which a number of remarkable and technically improved attachments are provided, on hand as well as on power knitting machines of all types. The construction of the machines proper and the attachments permits the widening and narrowing of the articles produced according to the type of the knitted fabric. The most important methods to effect the shaping or fashioning of a certain article on a machine are as follows:

1. Change from one loop form to another.
2. Loose and tight loop formation.
3. Change of direction of the loops with needle rack or special loop layers.
4. Widening of fabric:
 - a. By additional needles with selvage start.
 - b. Through gradual widening.
5. Narrowing by transferring stitches and reducing the number of needles in action.
6. Shaping through gussets.

A number of additional methods are well known but rarely applied in practical knitting.

The methods specified under 1-3 can be applied with advantage on merchandise produced on chain looms, provided that certain special conditions are lived up to. Special warps for fitted form are required. The machines must be supplied with the necessary reducing or shifting devices. The warp yarns are laid into the guide bars according to pattern.

Returning to the simplest method, it must be noted that on account of the peculiar tendency of the various loop forms, not only the shape of the goods is changed but there is a considerable influence on the type of pattern produced.

Change from one loop form to another: This method is quite often and preferably employed on two needle-bed knitting machines. However, there are a number of practical methods in existence in knitting mills, which readily prove that similar results can be ob-

tained on machines with only one needle bar. In this latter case it is quite necessary to thoroughly understand the particular interlocking of the loops in order to effect the desired widening or narrowing of the articles through correct yarn connections. It is assumed that specialists in both the hosiery and knitting industry are well acquainted with the double loop formation (tuck stitches) and their peculiar inclinations in comparison with other types of loops. Important is the tucking, which has the tendency to throw off adjacent loops, to enlarge the loops and thus increase the width of the fabric. This tendency is present not only in the well known cardigan and half-cardigan, but in the one-sided press cut fabric as well. In sharp contrast to the above are the simple and evenly worked out flat fabrics with their tightly pulled loops. Here the width of the fabric out of the machines is considerably reduced.

If widening of a certain fabric is desired, for instance in the tuck knit fabric by means of the tucking wheel, and for the parts to be narrowed the plain jersey stitch, a certain shape is effected by systematic shifting of such a tucking device and stitch change from design work to plain work. Such procedures are applied for the manufacture of skirts, infant goods, etc. Of more importance is such a shifting of the various loop groups on full-cardigan and rib frames. The well-known rib fabric with selvage start is in itself almost a fashioned fabric. The cuff stitch produces a fabric with much more elasticity than the cardigan and half-cardigan stitch. This is one of the most important peculiarities of this fabric and makes it especially adaptable for fashioned goods. Between the elastic rib fabric (1:1) with its proportioned shrinking of width on the machine and the wider full-cardigan fabric with very little elasticity, we have the half-cardigan or pearl stitch fabric. Various articles such as wearing apparel for sport, infant goods, as well as underwear, are easily fashioned on flat and circular machines by a practical combination of these stitches or loop forms.

The changes from one stitch to another are obtained automatically on hand and power ma-

chines through special setting of locks, cams and regulation devices, etc. These working methods have been generally adapted by the knit goods manufacturer and a number of ingenious devices have been invented, permitting automatic change from one stitch form to another.

A concrete example (to mention only one of a large variety) is the manufacture of vest and pullover sleeves. The individual parts are knitted connectively (Figure 1). The start

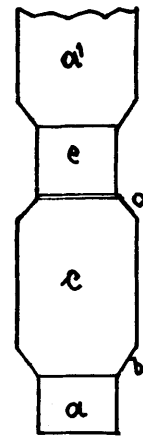


Figure 1

(a) comprises a certain number of rib or 2:2 courses. Passing at (b) to the wider part (c) the locks are changed to full-cardigan. As soon as the required length is obtained, the locks are again changed at (d) to the first position (a) 2:2, thus producing the narrow part (e). With this procedure a number of articles are fashioned on the machine without any particular effort. In order to obtain a nice looking fabric with this change from one narrow to the other wider part, or tight cuff stitch to the looser, full-cardigan, the intermediate use of half-cardigan stitch is advisable. The changeover is thus effected more gradually with a superior appearance of the fabric. The links/links or pearl stitch is also adaptable.

For the continuous working of connected parts of diverse articles, like sleeve parts, baby pants, legs of hosiery, etc., a separation or loose course is worked in. The rib setting (2:2) is preferred for cuffs and bottoms, where elasticity is required. Quite often only a section of a certain part is knitted with all

the needles, whereas the start and the finish are worked with a 2:2 needle setting; in other words, some of the needles are out of action. This is quite essential, due to the fact that the needles have to be arranged or grouped during the knitting. The idle needles, in this case every third needle, have to be freed of the loops and put out of action, and if again required, reinstated. This valuable method is only applicable, however, on machines with single, free movable needles, which are chiefly flat knitting machines and certain types of circular knitting machines.

Numerous inventions deal with devices to put needles automatically in and out of action, as well as the fixing of cast-off loops. The German patent No. 183,597, covers, for instance, a knitting machine with two different types of needles and assisting needles, as well as a special cam box. The main object of this machine is to avoid the opening of the loops and of drop stitches, while changing from 1:1 full needle cuff stitch to 2:2 rib (patent). For this purpose the inventor recommends a few protection or raveling courses, before starting the changeover from a full needle setting to 2:2 setting.

While working sleeve parts in rib stitch with separation yarn (Figure 1) the needles in the slots are arranged so that two needles with only one butt alternate with one needle with two butts, in order that the narrow elastic start at (a) and (e) can be worked with needles 2:2, and the widened upper sleeve portion (c) with all the needles. The sleeve parts (a, c and e, a¹) are worked in continuous strips with corresponding change to the various required stitch settings at (b & d).

Assuming at the upper part (c) of the sleeve (a-b-c) as finished at (d), there should follow through corresponding setting of the locks a few courses in tubular work, using every third, two-butt needle. During this time the remaining needles, grouped between, are inoperative. For this purpose the lock has to be adjustable to raise or lower certain cams. Then follows the so-called loose course, during which the single-butt needles are again put in operating position and take up the yarn for a continuation of the loop formation. How-

ever, at this moment, the two-butt needles are still in action, but in consequence of specially adjusted lock parts are only rising to the point where their loops slide down behind the latch, but do not catch the yarn. Thereupon a subsequent lock pulls these needles all the way down to put them entirely out of action, whereby the loops are cast-off. Beginning from the cast-off position (d) we now have the 2:2 rib fabric (e) and the next sleeve part can be started. It is advisable to work in at the change-over position (d) a separation yarn which later facilitates the separation of the connected sleeve parts. This practice is generally adhered to in knitting mills.

Start of New Article

The selvage start of the new article deserves special mention. To secure a smooth selvage edge, and to prevent raveling at (a) and (b), one of the two needle beds has to be racked over one needle, after the needles not required are out of action, in such a way that the yarn is alternately worked by the front and rear needles in similar rotation as if knitting with all the available needles. Only by doing so a good starting course is produced. Various methods have been employed for the shifting of the desired number of needles for fashioning work. On semi- and full-automatic knitting machines this is generally accomplished with a counter and pattern chain and corresponding buttons, or even with a Jacquard attachment. Since similar devices are required on automatic narrowing and widening machines, they will be more fully described in connection with those types of machine.

Loose and tight loop formation to obtain shape and form: This could be called a substitute for the narrowing and widening, mostly adapted for tubular work in both the hosiery and the knitting industry. In the hosiery line, the legs of both ladies' hose and men's socks are knitted in such a manner that the change from the upper leg part to the lower is made at the calf. If not done by means of the narrowing fingers at a very low speed, as in hand operation, quite complicated narrowing mechanisms are required. With the tighter or looser setting of the loop-forming devices the size of

the loops can be easily controlled, thus effecting similar results as with the narrowing and widening operation, and with a much simpler procedure. This is of great importance for the manufacturer of hosiery and knit goods, and particularly for the manufacturer of hosiery on circular knitting machines. Due to this fact, and the large production, the circular machine is widely used for the manufacture of hose.

In plain tubular work, the loose and tight stitch is regulated by setting the cylinder with all the needles higher or lower toward the cam ring. The same result is obtained on certain types of machines with an automatic adjustable knocking-over device. Modern circular knitting machines are provided with ingenious shifting devices with which the adjustment for different work or stitches is automatically controlled from a pattern drum or counting chain. The loose and tight stitch, however, is not the only way to give a fabric form and shape. In rib fabrics the so-called narrowing can be imitated by changing the length of the wales of the right and left loops, which also affects the width of the fabric. Such an imitation narrowing device mostly forms a part of circular rib frames, permitting gradual adjustment of the rib dial with the cylinder needles. In most cases the rib dial is set higher or lower to the cylinder needles. In other instances, a control chain with buttons of different size on a sprocket roller, acts on a special lever mechanism in connection with a block above the rib dial. This arrangement adjusts the rib dial gradually higher for a loose fabric and correspondingly lower for a tight fabric. The cylinder needles are thereby brought into a wider or closer position to the dial needles and the connections of the loops will be longer or shorter; in other words, a looser or tighter fabric is produced. It is quite essential that the needle loops are of the same size, whereas the different adjustment should only have an influence on the shaping or the position of the opposite loop wales, thus producing a wide (loose) or close (tight) tubular fabric.

The latest Jacquard circular machines are provided with similar adjusting devices, permitting a change at will of the rib dial and

lock setting device, mainly while working yarn of different sizes, which again requires a regulation of the tightness of the fabric.

Whenever such control attachments or devices are used in hosiery machines, it requires buttons of different sizes on the counter and narrowing chain, which on the other hand reduces the production. Different inventions cover improvements for permitting shifting of the rib dial by chain with buttons of equal size. Such a button on the chain brings a shifting rod into starting position. During the rotation of the machine a shifting lever of a shifting arrangement acts on this rod, whereby a spindle nut is gradually moved along the axle with the same result as above described, bringing the rib dial with the needles in the desired position. The shape of hosiery or sleeve parts is obtained absolutely automatically.

Shaping by change of direction of loops: This method is only applied on the rib work, or flat chain work with special yarn formation.

The rack stitch is applied especially on full- and half-cardigan fabrics and is particularly suitable to give form and shape to various articles. While previously mentioned methods all tend towards a certain shaping by means of narrowing or widening of the fabric, the rack stitch centers more in a lateral shifting of the loops, giving a certain direction to the entire piece of fabric. The continuation of a certain direction is obtained by racking of the same needle bed to pull all the loops of one side of the fabric alternately to one and then to the other, keeping the direction by following with knitting courses. In this way the desirable rack designs are produced.

Quite essential in the appearance of the goods is the action of the double loops or tuck

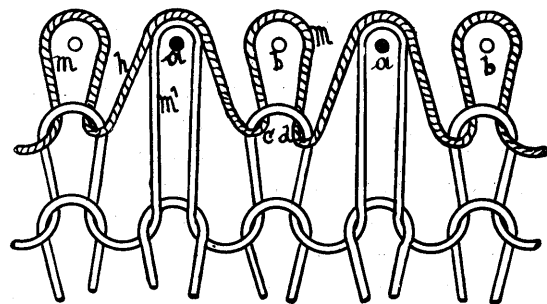


Figure 2

stitches. It is not the rack direction of one needle plate which is final for the loop direction, but rather the specific formation of the plain and tuck stitches. As a matter of fact a good rack design is only obtained when the one or the other side produces the so-called tuck stitches (h, Figure 2) whereas the opposite side should bring out the completely finished loops. Assuming that the front bed (a) and the rear bed (b) are set for full-cardigan, and that the front bed (a) is racked to the right after completion of one full course, we find according to Figure 3 that the loop parts

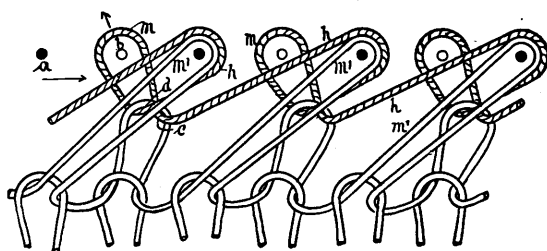


Figure 3

(h and m¹) while being pulled to the right nevertheless do not show any pattern effect in this position. The double loop (h-m¹) which was shifted during this operation does not appear as a design, therefore, and as such we have finished loop (m) which was pulled along in the same direction at the lower part at (c-d) and still suspends on the needle (b). This loop, however, shows on the face side of the fabric the reverse direction, since it is still held by its top loop on the needles. The double loop (h-m¹) is being formed into a finished loop only in the following course.

As illustrated in this example, the loops (m) are not directed to the right, but on the contrary to the left; in other words, in the opposite direction to the rack. The same result would be obtained by racking the rear needle bed (f. Figure 2) to the left instead of the front bed. This would indicate that it is immaterial which needle bed is racked, but rather on which needle bank during the racking operation the double loops (h-m¹) and the finished loops, respectively, are suspending. This is a rather peculiar characteristic of the loops which not only influences the design but the fashioning of the articles as well.

If, in the above specified example, after an additional full course the needle bed (a) is again racked back to the left, it would necessarily shift the finished loops once again to the left, since the tuck stitches (h) are alternately formed on the front and rear needle bank. The rear needle row (b) would then hold the tuck stitches or double loops and the front the finished loops. In both instances the finished loops on the front and rear were in fact turned to the left and the entire fabric has to be laid in this direction. If the racking in this manner is repeated after each course (one course to the right, the other to the left), for instance, eight times, all the 8 loops (1-8, Figure 4) still run in the same direction and the

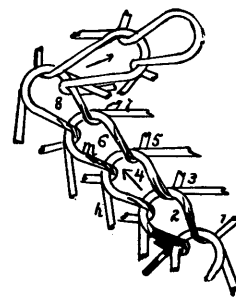


Figure 4

entire fabric would show the same formation. Of course the direction can be changed at will by interrupting the rack during one course. This would change not only the rack but the direction of the fabric as well. This peculiar tendency of the loops is of some advantage in the manufacture of infant's articles and sport caps. In alternating rack with straight fabric, the so-called

V-shape ($\bar{\nabla}$)

is produced, which is applied on shawls, collars, etc.

In chain fabrics the same result is obtained by forming the wales by means of blind layings. It is of importance that the yarns of the finished cast-off loops are all lying in the one or all in the other direction, however, over the same needles, in order that the loops keep a certain direction for a number of courses (Figure 4). Here, too, the change of direction

depends on the change of the double loops. The connections of adjacent loops are effected with blind layings. Such chain fabrics have the advantage of particular elasticity. A fashioned fabric similar to an elastic fabric is produced, and is especially adaptable for the millinery trade, hat bands, and racked rib fabrics, above described.

The tendency to fashion the fabric on chain looms is steadily gaining in popularity and is promoted by improved attachments and more up-to-date machinery.

The Widening of the Fabric

The widening of the fabric on the machine during the process of manufacture permits a much greater possibility for application than the previously mentioned methods. This working method can be applied on both jersey and rib fabrics. The most popular and most frequently practised method of widening is through adding needles at the edges.

The edges of the fabric, however, show stepped loops and long wales which should be covered in the finishing. Nevertheless this method is preferred to the widening with decker handles, which is less convenient, requires skilled labor, with complicated and improved machinery.

The widening by addition of needles: Since no special widening devices are required for this method, it is generally applied where conditions call for a minimum cost in installation and labor. This method of widening differs on machines with single adjustable needles and machines containing rigid set needle bars. It also depends whether the knitting calls for one or two needle banks. The working procedure is about alike on hand and power machines. It is only a question of the proper limitation of carrier travel and adding needles in action along the sides of the fabric.

On flat knitting machines with single movable needles the widening is mostly based upon the feeding-in of additional end needles, for which purpose there are in existence a variety of improvements known as widening devices.

On hosiery machines "Cotton" system and

Paget frames with rigid banks of needles, the widening is effected through corresponding shifting of the yarn carriers (limitation of carrier travel). After completion of one course, the carrier travel is limited to extend its way over one additional needle, thereby bringing the yarn in the next course within reach of an idle needle on one side of the fabric.

This procedure is illustrated in Figure 5. The width of the fabric (w) is assumed to be three loops I-II-III. After course I, the yarn carrier (F) with its yarn (f) is at the right at (a) and, before starting the next loop course II to (b), is correspondingly adjusted to bring its yarn around the idling needle (n) in order to form the wale as soon as the carrier travels from right to left. This can be repeated on the other side at (c) and (d) in order that the following course III produces a wale (h -I) on the idle left needle ($n-1$). With course III we would have already two additional needles in operation and the fabric has been widened by two loops (m & m^1).

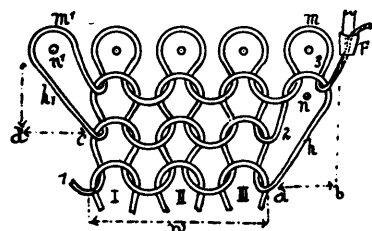


Figure 5

The yarn carrier travel which controls the "coulier" motion is automatically regulated with frictions controlled from the counting chain. On flat knitting machines with singly free moving needles and only one needle bed, this procedure, of course, is quite different. In addition to the proper shifting of the yarn carrier (F) Figure 5, the idling end-needles have to be pushed into operation. It is to be observed that the additional widening needle comes in operation on the side of the fabric where the yarn carrier acts on the "coulier" motion, or in knitting machines where the locks are ready to act on the needles.

(To be continued)