Stitches produced by varying the sequence of the needle loop intermeshing

9.1 Knitted stitches

Weft knitted stitches described so far have been composed entirely of knitted loops. A *knitted loop stitch* is produced when a needle receives a new loop and knocks-over the old loop that it held from the previous knitting cycle. The old loop then becomes a needle loop of normal configuration.

Other types of stitch may be produced on each of the four-needle arrangement base structures by varying the timing of the intermeshing sequence of the old and new loops. These stitches may be deliberately selected as part of the design of the weft knitted structure or they may be produced accidentally by a malfunction of the knitting action so that they occur as fabric faults. When these stitches are deliberately selected, a preponderance of knitted loop stitches is necessary within the structure in order to maintain its requisite physical properties.

The needles generally produce knitted loop stitches prior to the commencement, and at the termination, of these selected stitches, and there are usually certain needles that are knitting normally during the same cycles as those in which these stitches are produced.

Apart from the knitted loop stitch, the two most commonly-produced stitches are the *float stitch* and the *tuck stitch*. Each is produced with a *held loop* and shows its own particular loop most clearly on the reverse side of the stitch because the limbs of the held loop cover it from view on the face side.

9.2 The held loop

A *held loop* (Fig. 9.1) is an old loop that the needle has retained. It is not released and knocked-over until the next, or a later, yarn feed. A held loop can only be retained by a needle for a limited number of knitting cycles before it is cast-off. A new loop is then drawn through it, otherwise the tension on the yarn in the held loop becomes excessive even though there is a tendency to rob yarn from adjacent loops in the same course.

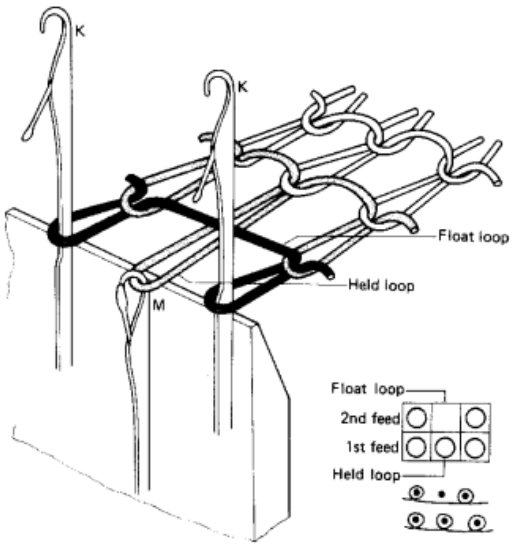

Fig. 9.1 Float stitch produced on a latch needle machine.

The limbs of the held loop are often elongated. They extend from its base, intermeshing in one course, to where its head is finally intermeshed a number of courses higher in the structure. Alongside it, in adjacent wales, there may be normally-knitted loops at each course.

A held loop may be incorporated into a held stitch without the production of tuck or miss stitches in either single- or double-faced structures.

In single-faced structures, it can only be produced on machines whose feeds or needles have a reciprocating action so that the yarn only passes across needles that are knitting, otherwise a float stitch would be produced. Held stitches of this type are used for producing three-dimensional shaping such as heel and toe pouches for footwear, held-loop shaping on flat machines, and designs in solid colour intarsia. Held stitches are produced in double-faced structures by holding loops on one bed whilst continuing to knit on the other, thus producing horizontal welt and cord effects.

9.3 The drop or press-off stitch

A *drop stitch fault* will result if a needle releases its old loop without receiving a new one. Sometimes this technique is used to achieve a press-off on all needles at the end of a garment-length sequence. A *drop stitch* or *press-off stitch* is used very occasionally in flat knitting to cause certain loops in a plain structure to be much larger than the rest. Knitting takes place on only one bed of needles and selected needles in the other bed pick up loops that are immediately pressed-off by not receiving yarn at the next feed.

The yarn from the pressed-off loops flows into the adjacent loops in the other bed, making them larger and giving the impression of a much coarser gauge. Drop stitch wales are sometimes used to provide a guide for the cutting operation. Generally, a secure structure is only produced when a needle retains its old loop if it does not receive a new loop.

Open-work 'crochet' type designs (also termed *drop-stitch*, *press-off*, or *latch-opener fabrics*) can be produced in single jersey by carefully pressing-off the loops of selected groups of needles, then recommencing knitting on the empty needles. Off-set yarn feeding is employed, the yarn feeders being collectively repositioned to feed the yarn from outside the needle-line across the front of the ascending needle hooks. The yarn itself brushes open the closed latches and does not damage the needles, unlike conventional steel point latch-openers.

An example produced on a E 28 *Monarch* machine has 4 feeds knitting plain with 1/30's cotton. Feeder 5 is knitted with a minimum stitch length and two ends of yarn to lock-in the following course. Feeder 6 is a slack course, knitted at half the normal tension and half the normal yarn count. It is jacquard-selected to produce a course of open-work pattern by pressing-off on these needles. The pick-up course is then knitted at high tension to avoid drop stitches and ladders at the edges of the pressed-off areas.

9.4 The float stitch

A *float stitch* or *welt stitch* (Fig. 9.1) is composed of a held loop, one or more float loops and knitted loops. It is produced when a needle (M) holding its old loop fails to receive the new yarn that passes, as a float loop, to the back of the needle and to the reverse side of the resultant stitch, joining together the two nearest needle loops knitted from it.

In Fig. 9.2, the float stitch shows the missed yarn floating freely on the reverse side of the held loop. (This is the technical back of single-jersey structures but is the inside of rib and interlock structures.) The float extends from the base of one knitted or tucked loop to the next, and is notated either as an empty square or as a by-passed point. It is assumed that the held loop extends into the courses above until a knitted loop is indicated in that wale.

A single float stitch has the appearance of a U-shape on the reverse of the stitch. Structures incorporating float stitches tend to exhibit faint horizontal lines. Float

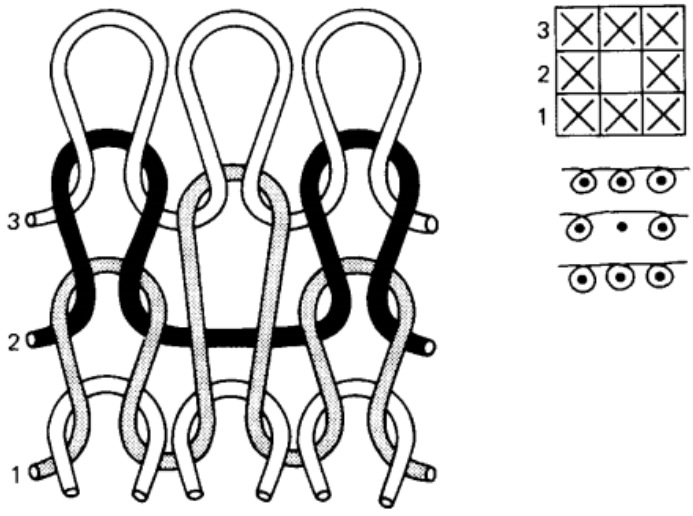

Fig. 9.2 Technical face of float stitch.

stitch fabrics are narrower than equivalent all-knit fabrics because the wales are drawn closer together by the floats, thus reducing width-wise elasticity and improving fabric stability.

Under normal take-down tension and with normal yarn extensibility, the maximum number of successive floats on one needle is four. Six adjacent needles are usually the maximum number for a continuous float because of reduced elasticity and problems of snagged threads, especially in continuous-filament yarns and with coarse machine gauges.

A floating thread is useful for hiding an unwanted coloured yarn behind the face loop of a selected colour when producing jacquard design in face loop stitches of different colours (adjacent needle floating in shown in Fig. 9.8, successive floating on the same needle in Fig. 9.7). The miss stitch can occur accidentally as a fault due to incorrectly set yarn feeders.

9.5 Float plating

Float plating (Fig. 9.3) produces an open-work mesh structure in single jersey and involves feeding two yarns in a plating relationship to needles having forward hooks. A thick yarn (A), for example 30 denier, is fed at a high level and is received only by needles selected to that height. A fine yarn (B), possibly 15 denier, is fed at a lower level and is received and knitted by every needle.

Two-course fishnet is the most popular structure, having a repeat of two wales and four courses deep. At the first two feeders, odd needles (O) knit only the thin yarn and even needles (E) knit plated loops. At the next two feeders the sequence is reversed.

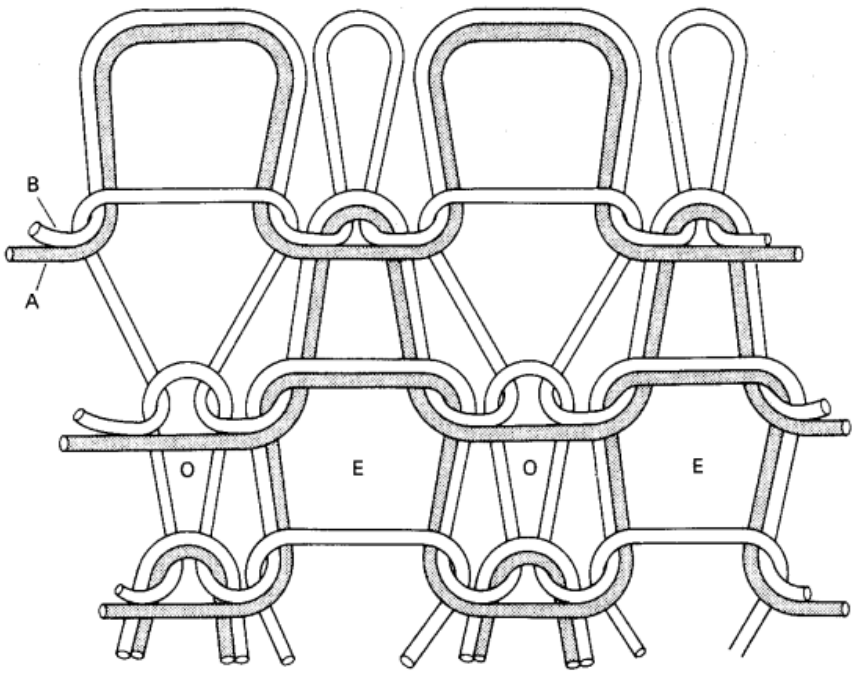

Fig. 9.3 Float plated fabric.

Knitting and missing of the thick yarn causes an expansion of alternate stitches. The two-course sequence may be extended to three or four courses and it is possible to plate the thick yarn on a needle selection basis. The structure has been used for ladder-resist shadow welts in stockings and for textured designs, as well as for underwear mesh structures on circular single-jersey machines [1] in gauges from E 14–24.

9.6 The tuck stitch

A *tuck stitch* is composed of a held loop, one or more tuck loops and knitted loops (Fig. 9.4). It is produced when a needle holding its loop (T) also receives the new loop, which becomes a tuck loop because it is not intermeshed through the old loop but is tucked in behind it on the reverse side of the stitch (Fig. 9.5). Its side limbs are therefore not restricted at their feet by the head of an old loop, so they can open outwards towards the two adjoining needle loops formed in the same course. The tuck loop thus assumes an inverted V or U-shaped configuration. The yarn passes from the sinker loops to the head that is intermeshed with the new loop of a course above it, so that the head of the tuck is on the reverse of the stitch.

The side limbs of tuck loops thus tend to show through onto the face between adjacent wales as they pass in front of sinker loops. Tuck stitch structures show a faint diagonal line effect on their surface.

In analysis, a tuck stitch is identified by the fact that its head is released as a hump shape immediately the needle loop above it is withdrawn. A knitted loop would be required to be separately withdrawn and a miss stitch would always be floating freely on the technical back.

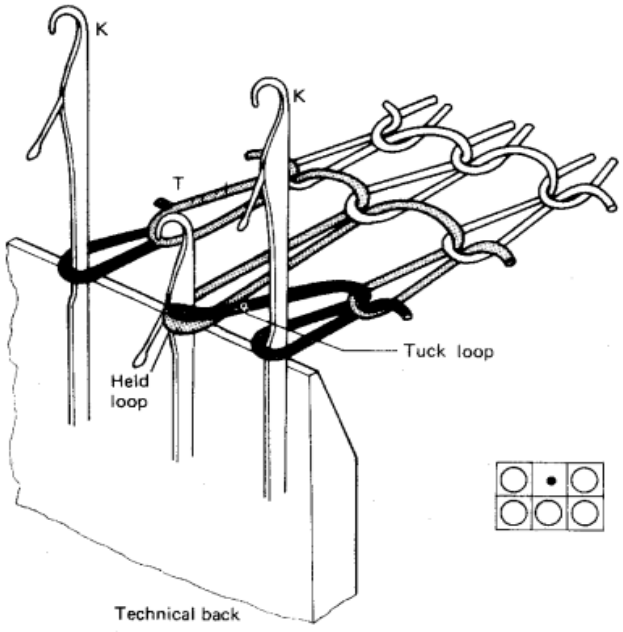

Fig. 9.4 Tuck stitch produced on a latch needle machine.

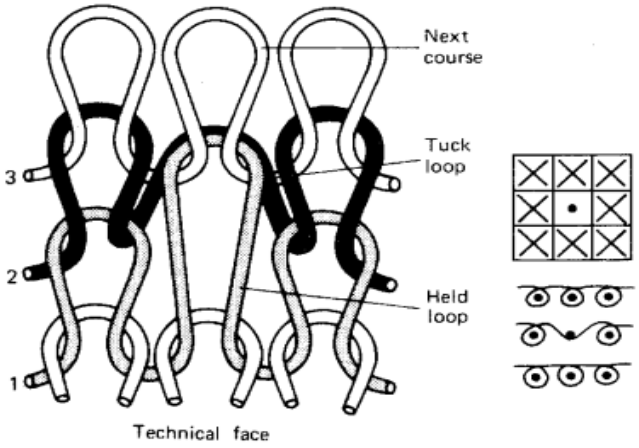

Fig. 9.5 Technical face of tuck stitch fabric.

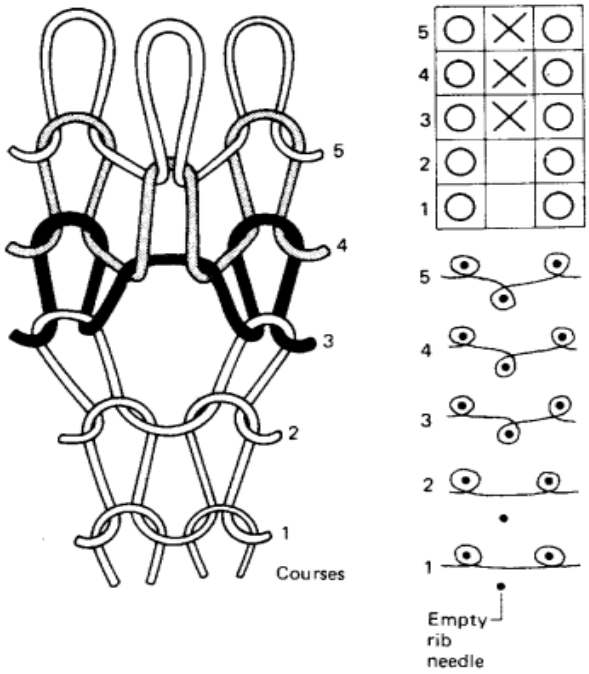

Fig. 9.6 Commencing knitting on an empty rib needle.

The tuck loop configuration can be produced by two different knitting sequences:

1 By commencing knitting on a previously empty needle (Fig. 9.6). As the needle was previously empty, there will be no loop in the wale to restrict the feet of the first loop to be knitted and, in fact, even the second loop tends to be wider than normal. The effect is clearly visible in the starting course of a welt. By introducing rib needles on a selective basis, an open-work pattern may be produced on a plain knit base.
2 By holding the old loop and then accumulating one or more new loops in the needle hook. Each new loop becomes a tuck loop as it and the held loop are knocked-over together at a later knitting cycle and a new loop is intermeshed

with them. This is the standard method of producing a tuck stitch in weft knitting (Fig. 9.4).

Successive tucks on the same needle are placed on top of each other at the back of the head of the held loop and each, in turn, assumes a straighter and more horizontal appearance and theoretically requires less yarn. Under normal conditions, up to four successive tucks can be accumulated before tension causes yarn rupture or needle damage. The limit is affected by machine design, needle hook size, yarn count, elasticity and fabric take-down tension (Fig. 9.7).

Each side of the head of a tuck loop is held by a sinker loop (S) from the course above (Fig. 9.9). When tucking occurs across two or more adjacent needles, the head of the tuck loop will float freely across between these two adjacent sinker loops, after which a sloping side limb will occur.

Dependent upon structural fineness, tucking over six adjacent needles is usually the maximum unit before snagging becomes a problem. (NB: Tucking across no more than two adjacent needles is generally the limit because the tuck is not secured at the middle wales when tucking across three or more needles.) For a greater number of adjacent needles, the accordion sequence (Section 10.4.3) where occasional tucks tie-in a floating thread, is preferred.

A tuck loop is notated either as a dot placed in a square or as a semi-circle over a point. A held loop is assumed to extend from the course below, up to the course where the next knitted loop is notated in that wale, as this is where it intermeshes.

Selective '*tucking in the hook*' (Fig. 9.10) is achieved on latch needle weft knit-

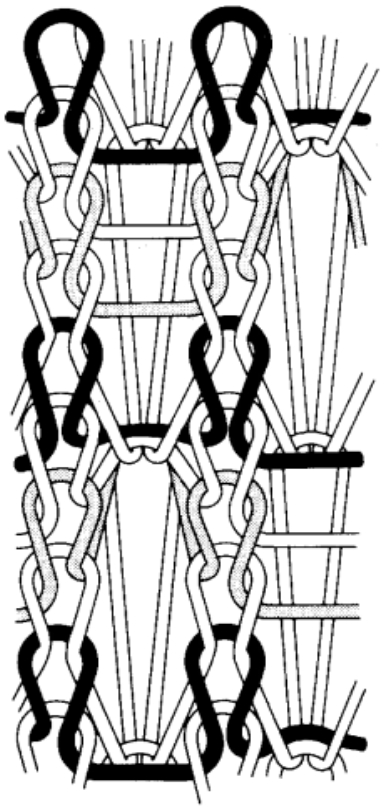

Fig. 9.7 Successive tucks and floats on the same rib needle.

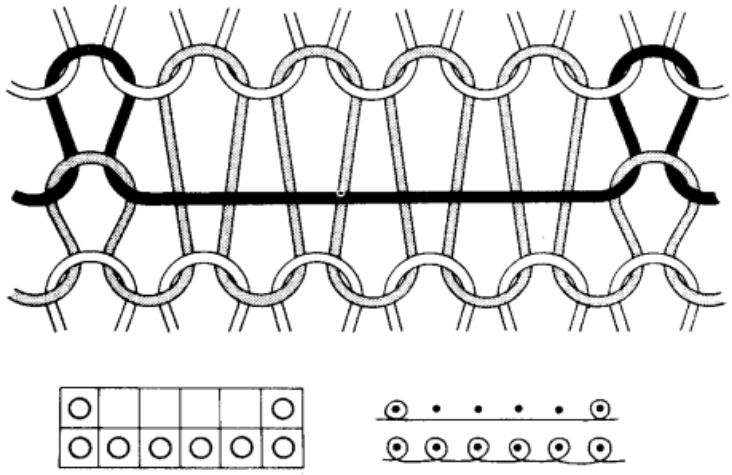

Fig. 9.8 Floating across four adjacent plain needles.

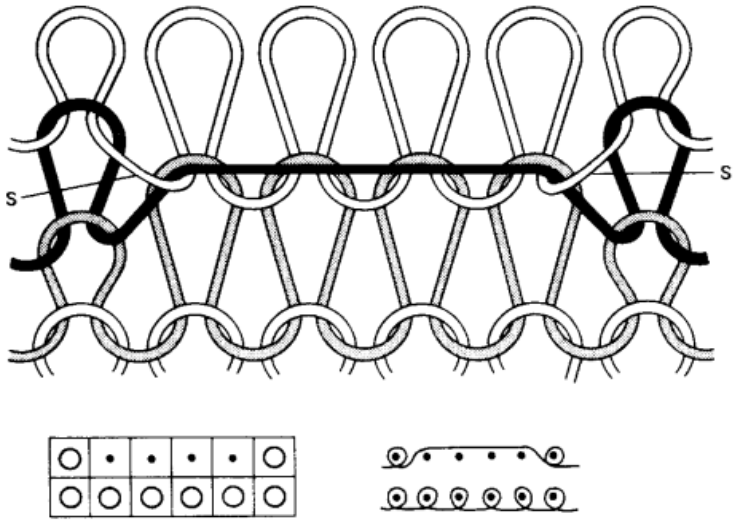

Fig. 9.9 Tucking over four adjacent plain needles.

ting machines by lifting the needle only half-way towards clearing height to tuck height. The old loop opens the latch but remains on the latch spoon and does not slide off onto the needle stem. It remains as a held loop in the needle hook where it is joined by the new loop, which becomes a tuck loop when the needle descends to knock-over.

The latch needle, because of its loop-controlled knitting action, is capable of being lifted to one of three stitch positions to produce either a *miss,* a *tuck* or a *knit stitch*; this is termed the *three step* or *three way technique* (Fig. 9.11).

On V-bed flat machines, raising cams, split into tuck and clearing height cams, are known as *cardigan cams*. They are not available on older machines so only collective '*tucking on the latch*' on all needles in one bed can be achieved. The stitch cam is raised so that the needles do not descend low enough to cast-off the held loops from the closed latches (Fig. 9.12). This is not a preferred technique because there

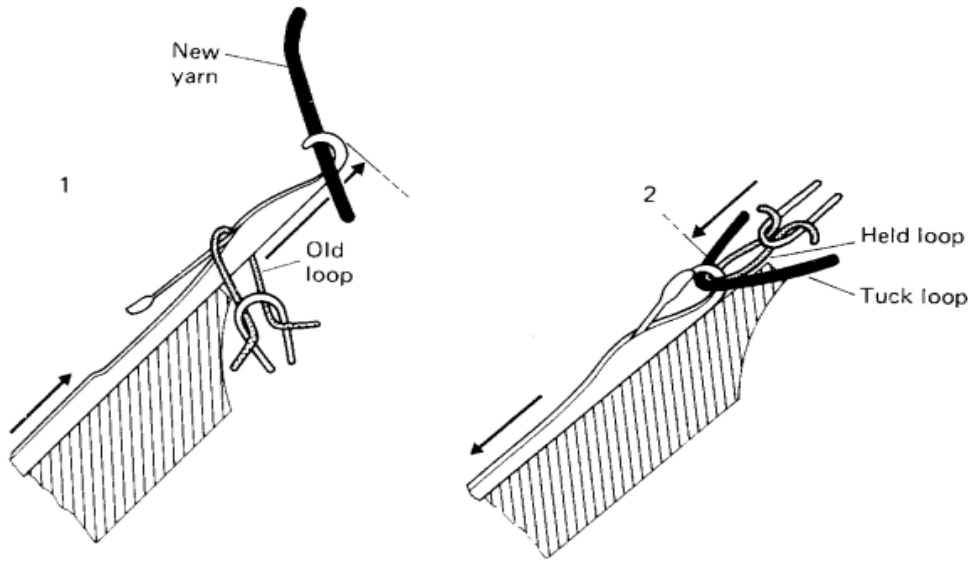

Fig. 9.10 Selective tucking in the hook.

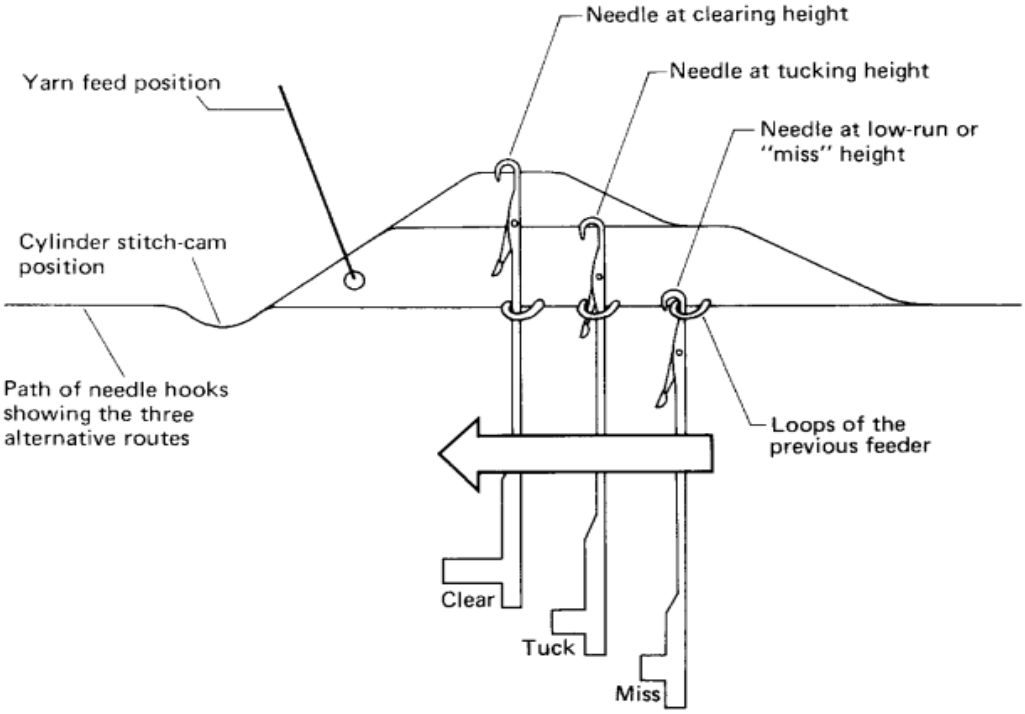

Fig. 9.11 Three step needle selection. The needles have been turned 90° in order to show the position of the latch in relationship with the loop of the previous feeder.

is no individual selection and there is the danger of the held loop slipping off and producing an intermeshed loop with the tuck, converting it into a knitted stitch.

The first tuck presser bearded needle frame was invented in Dublin in 1745. A bearded needle tucks when its beard is miss-pressed so that the old loop is not cast-off and remains as a held loop, inside the beard, with the newly-fed tuck loop.

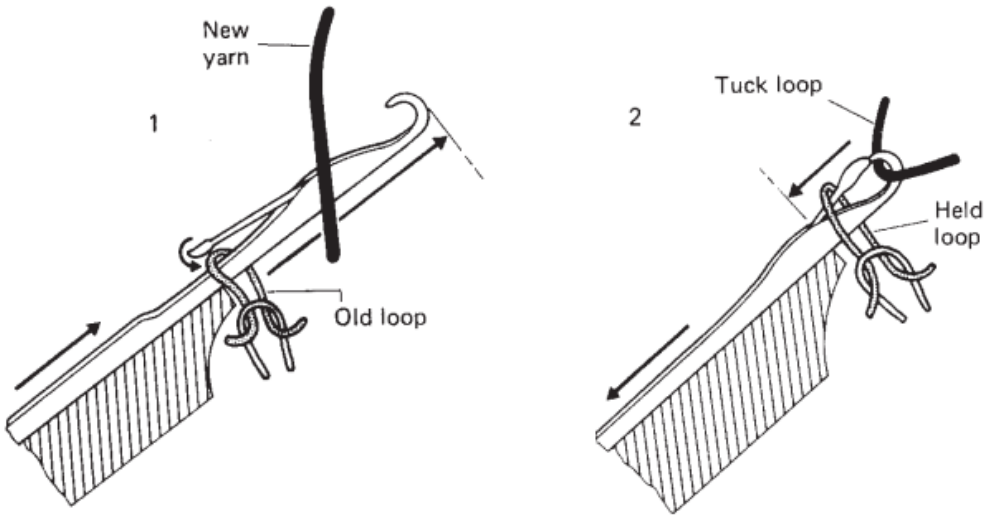

Fig. 9.12 Tucking on the latch.

Tucking for inlay may be achieved by deflecting certain needles during inlay feeding so that the yarn passes across the beards of the selected needles, forming a tuck instead of floating across their backs. Selective tucking requires cut-away pressing edges or individually controlled presser bits.

Tucking may occur accidentally as a result of stiff latches, imperfect pressing, imperfect knocking-over of old loops, or thick places in yarn.

Tuck loops reduce fabric length and length-wise elasticity because the higher yarn tension on the tuck and held loops causes them to rob yarn from adjacent knitted loops, making them smaller and providing greater stability and shape retention. Fabric width is increased because tuck loops pull the held loops downwards, causing them to spread outwards and make extra yarn available for width-wise extensibility. Fabric distortion and three-dimensional relief is caused by tuck stitch accumulation, displacement of wales, and by varying numbers of tuck and knitted stitches per wale.

Tuck stitches are employed in accordion fabrics to tie-in the long floats produced on the back of single-jersey knit/miss jacquard, thus reducing the problems of snagging that occur with filament yarns. The tuck stitch may also be employed to produce open-work effects, improve the surface texture, enable stitch-shaping, reinforce, join double-faced fabrics, improve ladder-resistance and produce mock fashion marks.