A MACHINE KNITTER'S GUIDE TO CREATING FABRICS

JACQUARD · LACE · INTARSIA · RIPPLE AND MORE

SUSANNA E. LEWIS
JULIA WEISSMAN

Lark Books
Asheville, North Carolina

Skechers EX1027
Skechers v Nike

Lark Books
50 College Street
Asheville, North Carolina

© 1986 Susanna Lewis and Julia Weissman
All rights reserved. No part of this book may be reproduced in any form or by any means without the permission of Lark Books.

10 9 8 7 6 5 4 3 2 1

Library of Congress Catalog Card Number: 85-82317

ISBN 0-937274-12-7

Printed in the United States of America

Art direction: Thom Boswell
Art production: Bernie Wolf
Typesetting: Eric Woro, Elaine Thompson
Photographic printing: Iris Photographics, Asheville
Jacket photograph: Richard Brown, Asheville
Printing and binding: Arcata Graphics Kingsport
Photography and illustrations by Susanna Lewis

The banner shown on the jacket and title page was designed and executed by Susanna Lewis. Detailed photographs of the patterns and instructions for knitting them are found on the following pages:

Title and authors' names: page 65, plated backing.

Chevron pattern: page 89, basic pin tuck in two-color jacquard.

Zigzag rib pattern: page 122, embossed racked rib on stockinette backing, with plating.

Star pattern: page 59, nopped face with 2x2 selection on backing.

Lightning bolt pattern: page 91, embossed pin tuck, jacquard Pattern 6.

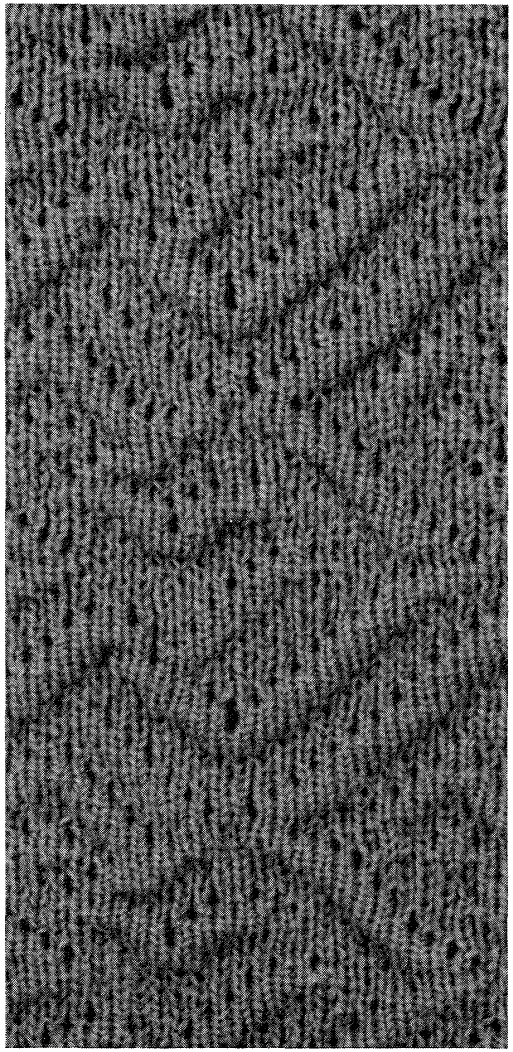
Airplane pattern: page 47, bird's-eye backing, jacquard Pattern 8.

Arrow border pattern: page 97, two-color raised blister.

While a great deal of effort has been spent in checking and testing of material in this book, the authors cannot accept responsibility for loss or damage to materials or equipment which result from errors in printing, misinterpretation by the reader, or faulty adjustment of the knitter's machine and accessories.

Skechers EX1027
Skechers v Nike

CHAPTER 1
How To Use the Material in This Book



There are several varieties of tables, charts, and diagrams used in this book. The gridded diagrams, needle set-ups, and tables are self explanatory. The stitch formation diagrams and cam charts are explained in this chapter as are the abbreviations and terms we use throughout the book. When in doubt, look it up!

ABBREVIATIONS

alt	alternate
BB	back bed
carr	carriage
CC	contrast color
CO	cast on
col	color
dec	decrease
DYG	double yarn guide unit (Superba)
EN	every needle
ER	every row
EON	every other needle
EOR	every other row
FB	front bed
FNR	full needle rib
HP	holding position
inc	increase
K carr	knit carriage (Brother/Knitking)
K	knit
L	left
L carr	lace carriage (Brother/Knitking)
MB	main bed
MC	main color
neg rev	negative reverser (Superba)
ndl	needle
ndl ret but	needle return button (Superba)
NWP	non-working position
P	purl
patt	pattern
patt pos	patterning position
prep	preparation row
pos	position
pos rev	positive reverser (Superba)
R	right
RC	row count (number of passes of carriage)
RP	resting position
SS	stitch size
st	stitch
var	variation
WP	working position
—	repeat the instruction between asterisks

GLOSSARY

Adjacent needles. Needles in WP next to each other and which knit in turn. In single bed work, they are adjacent on the same bed; in double bed knitting, they are across from each other on opposite beds.

All-over pattern. A repeated design or pattern extending across the length and width of the fabric.

Arrow keys. On both carriages of the Passap, these govern the automatic reversal of pushers in WP/RP. The L arrow key reverses the pushers when the carriages move left, the R key when they move right. Both keys together will reverse the pushers each row; the cancel key eliminates any reversal.

Automatic patterning. Pattern knitting predetermined by a punchcard, needle set-up, pusher positions, or cam settings. It does not involve manual manipulation of needles or cam changes.

Back bed (BB). On double bed machines, the needle bed farthest from the knitter, whether the main bed or second bed.

Background needles. See **Non-selected needles.**

Backing. The "wrong" side of a double bed fabric. It is usually that portion of the fabric knitted on the second bed or ribber.

Skechers EX1027
Skechers v Nike

Balanced and **unbalanced fabric.** In double bed work, if the number of knit rows between beds is the same, the fabric is balanced; if not, it is unbalanced. In single or double bed work, if the fabric structure at one part of the beds in relation to another part along the width is the same, it is balanced; if not, it is unbalanced.

Bias fabric. Selvedges are at an angle other than 90° to the cast-on and bound-off edges. The fabric stretches on the diagonal rather than vertically or horizontally.

Bind off. One of several methods for removing stitches from the needles and interlocking them to prevent unravelling of the finished edge. See **Cast off.**

Bird's-eye backing. One of two basic backings in rib jacquards. Alternate needles slip/knit every row to create the "bird's-eye" texture on the fabric face and reverse.

Blister jacquard. A double bed fabric in which either the design or background is separated from the backing and stands out in relief.

Bobbin knitting, bobbin weaving. See **Tapestry knitting, Tapestry weaving.**

Bobbles. See **Popcorns.**

Cables. Adjacent ribs two to five stitches wide which are crossed periodically to form raised, rope-like patterns.

Cams, cam settings. Metal or plastic tracks or pathways under the carriage through which butts of needles in WP travel as the carriage passes across the needle bed. Arrangement of the cams is governed by setting buttons or dials on top of the carriage to cause needles to move in and out of different positions for various kinds of knitting.

Carpet stitch. See **Pile knitting.**

Carriage (carr). A mechanism which moves back and forth on rails across the bed of the knitting machine. It houses the cams that engage the needle butts and determine their action. It has buttons, dials and levers to set cam positions and stitch size, and is equipped with a yarn feeder. On double bed machines, each bed has its own carriage; the two carriages are coupled during double bed knitting.

Cast off. An unfinished edge, i.e., stitches removed from the needles, usually at the end of knitting, without use of some method to prevent their unravelling. See **Bind off.**

Cast on (CO). The first one or two rows of knitting to place loops into the needles. There are several methods of casting on for both finished and unfinished edges.

Charting attachment. A device attached to the knitting machine to aid in shaping or patterning. A plastic or paper sheet on which the pattern is charted in graph or outline form is inserted into the attachment, which will rotate the sheet row by row as the knitting progresses.

Color changer (four color). An attachment that can hold four different ends of yarn and can exchange and feed them into the carriage during knitting.

Contrast color (CC). In two-color jacquard knitting it is usually the color which knits the design. When used with the double feeder, it is placed in the second feeder. See **Main color.**

Cross-bed transfer. Transfer of stitches from the needles of one bed to the needles of the opposite bed. This can be done manually with decker tools, or automatically with a cross-bed transfer carriage.

Cursor, cursor stops. On Superba, a small magnetic block attached to a belt on the back of the machine which in turn is connected to the scanner in the selection box. It travels with the main carriage to electronically transmit the pattern on the pattern card to the needles for selection in patterning. The cursor can be stopped at both left and right sides by the cursor stops, which can act as isolation cams if placed within the selvedges of the knitting.

Cut-and-sew. A shaping technique (for necklines, armholes, etc.) for fabrics too complex in stitch structure to shape on the machine. After the knitting is completed, the shape is outlined with sewing machine stitches and the fabric is cut along the outline.

Decker tools. Tools with eyeletted prongs used for transferring stitches. They are available with various numbers and arrangements of deckers.

Double bed. A knitting machine with two needle beds facing each other at about a 45° angle. Each bed has a carriage, and the two carriages are coupled to produce rib or double knit fabrics. Each bed may also be used as a single bed.

Double feed. Feeding two yarns, each from a separate feeder or feeding attachment, to the needles simultaneously. The position of the yarns is determined by the type of knitting and design of the machine being used. Double feed is used in jacquard, weaving, plating and intarsia.

Double jacquard. Another name for rib jacquard.

Double jersey. Another name for eight-lock.

Double knit. See **Rib fabric.**

Double rib. Another name for interlock rib.

Drop stitch fabric: A fabric with openings created by dropping selected stitches and allowing them to unravel.

Eight-lock. Double bed reversible fabric made by the interlock technique but in a wider needle selection. It can be a jacquard pattern, and when done in two colors, the pattern is also reversible.

Embossed fabric. Double bed relief fabric consisting of a single knit background with double knit rib, pile, or jacquard pattern. The background is in purl stitch while the pattern is often in Long Stitch to create a sharp contrast in texture.

European machines. For the sake of brevity, we use this term throughout the book when referring to the Passap Duomatic 80 and Superba S-48.

Eyelets: Small openings created by various techniques, generally for decorative purposes.

Face side. The side of the fabric facing the design or main bed during knitting. In stockinette, it would be the knit side.

Fairisle. Colored jacquard designs of small repeats traditional to Fair Isle knitting. The term is often used to include all colored jacquard designs knitted single or double bed.

Fisherman's rib and **half fisherman's rib.** A standard knit fabric also known as *cardigan* and *half cardigan,* and by other names. It is made on double bed by alternating rows of knit with rows of tuck. In full fisherman's rib, both beds alternate knit/tuck; in half fisherman's rib, only one bed will alternate knit/tuck while the other knits plain.

Skechers EX1027
Skechers v Nike

Float or **weft.** A strand of yarn which occurs on the reverse or purl side of a single bed fabric and crosses over one or more needles without being hooked onto a needle or knitted into the fabric.

Free move. Setting the cams on one or both carriages so they can be moved across needles in any position without disturbing them.

Front bed (FB). On a double bed machine, the needle bed closest to the knitter, whether the main bed or second bed.

Full needle rib (FNR). (1) A basic needle set-up for many double bed fabrics; all needles in the knitting area are placed in WP and the beds at half pitch. (2) The fabric resulting from the set-up as in (1). When knitted plain on both beds, it is a very elastic ribbed fabric. Unless otherwise stated, "FNR" in patterning directions means to set the carriages on both beds to knit.

Full pitch. On double bed machines, the two beds are set so their needles are exactly opposite. On Japanese machines, the pitch lever is set to P; on Passap, the racking handle is up; on Superba the intermediary lever is to the left.

Garter bar. A comb with eyeletted prongs which fit over needle hooks for easy removal and replacement of a row or group of stitches when knitting garter stitch, transfer patterns, cables, etc. Used with Japanese machines.

Garter stitch. A reversible pattern made by knitting and purling alternate rows. It is characterized by horizontal ridges on both sides of the fabric. On double bed machines it can be made by transferring stitches back and forth between beds on alternating rows; on single beds, by taking all stitches onto a garter bar, turning the knitting over and rehanging the stitches every row.

Gate posts. See **Sinker posts.**

Gauge. Stitch and **row.** The number of stitches and number of rows in a given unit of measurement, used as a basis for calculating stitches and rows necessary to knit a shape to a given size.

Grafting. A method of hand-joining the unfinished loops or edges of two pieces of knitting by using a needle and matching yarn to create an extra row of stitches between the two pieces, which makes an "invisible" join.

Graph or **chart.** A pattern drawn on plain or grid paper or plastic sheet. It can be run through the charting attachment to serve as a guide for knitting a garment shape or fabric pattern. It can also be a stitch-by-stitch guide for making a punchcard or knitting a complex pattern.

Grin-through. In a double knit fabric, the extent to which the stitches of one side of the fabric show through the other side.

Half Milano backing. A common method of knitting double bed jacquards or embossed fabrics. The main bed knits one row for every two rows knitted on the second bed, thus the backing has twice the number of rows as the face and causes the design stitches to stretch lengthwise. Also known as **Long Stitch.**

Half pitch. On double bed machines, the two beds are set so that the needles of one bed are exactly opposite the sinker posts of the other. On Japanese machines, the pitch lever is set to H; on Passap the racking handle is down; on Superba, the intermediary lever is to the right.

Holding position (HP). When needles are in holding position they will hold previously knitted stitches yet remain out of action while further knitting is occurring on other needles. This position is also an alternate method of making tuck stitches on all machines except Passap. See **Pull-up.**

Inlay. A technique in which an extra yarn is laid in among the knit stitches but is not knitted itself.

Intarsia. A fabric, usually jersey or stockinette, incorporating geometric shapes of at least two colors and knitted in such a way that each yarn knits its own shape without moving behind the fabric to another area, hence no floats are created.

Interlock rib. A basic double bed fabric knitted in FNR set-up. Both beds have an alternating 1x1 needle selection, knitted with a knit/slip cam setting. The fabric is very stable and semi-elastic, with a smooth texture on both faces. Interlock rib is often used on one bed only, as a backing (bird's-eye) or combined with stockinette (knit-weave).

Intermittent feed punchcard rotation. On Japanese machines and Superba, a punchcard row can be changed with every second pass of the carriage; i.e., the punchcard rotates every other row. Passap punchcards can rotate in this manner, and can also be set to rotate every four rows. See **Regular feed.**

Isolation cams. Small plastic cams, used when knitting with a punchcard, to interrupt the pattern across the bed where desired. They are used principally to isolate a motif in jersey or rib jacquard. On Passap, they are called *positioning pins;* on Brother/Knitking, *one point cams;* on Singer/Studio, *point cams.* On Superba, the cursor stops can function as isolation cams.

Jac 40. A hand-held punchcard reader. A punchcard is inserted into a slot and small "teeth" protrude through the punched holes. When the reader is positioned on the needle bed, these teeth select needles for patterning.

Jacquard, Joseph Marie. A French inventor who, in 1805, combined the work of other inventors to create a punchcard patterning device for weaving looms which automatically selected warp threads to be raised or lowered for pattern weaving. This made possible the rapid weaving of complex patterns.

Jacquard knitting. Design or "picture" knitting with two to four colors in each pattern row. The design is usually first charted in color on graph paper, then transferred to a punchcard; or it may be knitted by manually selecting the needles for each color in the design.

Jacquard punchcards. Cards punched especially for knitting from two to four colors into each pattern row. Some jacquard cards can also be used to knit one-color textured patterns.

Jersey. See **Stockinette.**

Japanese machines. We use this term throughout the book when referring to the Brother, Knitking, Singer, Studio, and other Japanese-made machines comparable to these.

Jersey jacquard fabric. A single bed fabric in stockinette, characterized by a knitted design of two to four, or more, colors per row. The reverse of the fabric is covered by floats.

Knit-in. Another name for jersey jacquard.

Skechers EX1027
Skechers v Nike

Knit/purl fabric. An embossed fabric in which the knit stitches of the pattern are made on one bed and the purl stitches on the other, to produce a jersey fabric with both knit and purl stitches on both faces.

Knit side. The face or smooth side of a stockinette fabric.

Knit stitch. (1) A completely formed stitch and the basic stitch of knitting. When the needle rises or extends to its fullest length, the previously formed stitch falls behind the latch. New yarn is then taken into the hook, and as the needle returns or descends, the old stitch forces the latch to close over the hook containing the new yarn. The old stitch passes off the needle, and the new yarn has formed a new stitch. (2) The smooth or face side of the stitch.

Knit-weave. A double bed fabric composed of alternating rows of either full needle rib or interlock rib, and stockinette.

Lace fabric. A fabric characterized by a predominance of open spaces. It can be knitted in a variety of techniques on both single and double bed.

Ladder. A vertical space in the knitting characterized by short horizontal floats which are created by dropping a stitch and allowing it to unravel, or by leaving a needle in non-working position. Several adjacent stitches can be laddered to create fringes or other decorative open spaces.

Latch up. To manually knit or "latch" the floats of a ladder with a crochet hook or latch tool. The stitches can be latched in knit or purl stitch, or with another yarn.

Lateral transfer. The transfer of stitches from needles of one bed to other needles on the same bed, using decker tools or a lateral transfer carriage.

"lili" buttons. Our acronym (pronounced "lily") for a pair of buttons, on the front bed carriage of Brother/Knitking and Superba, which will automatically select every other needle to patterning position in either or both directions. The selection always begins with the second needle the carriage encounters. There is also a lili setting on the Superba garter carriage (A) and the Passap U-80 (#2).

Lock. The German word for carriage, used by Passap.

Long Stitch. Another name for Half Milano, usually used in describing an embossed pattern.

Main bed (MB). The bed containing the punchcard pattern reader and device for automatic selection of needles for a pattern. On single bed machines, this is the only bed. See **Second bed.**

Main color (MC). In two-color jacquard knitting it is usually the color that knits the background stitches. When used with the double feeder, it is placed in the main feeder. See **Contrast color.**

Manual patterning. Pattern knitting involving at least some manual selection of needles, usually with the aid of a pattern ruler, Jac 40, or stitch transfer tools.

Mesh fabric. A fabric composed of evenly spaced holes or eyelets, framed by a minimum of knit stitches. It is the basis of all lace fabrics and can be made by a number of techniques.

Mock garter stitch. A non-reversible pattern that imitates the appearance of garter stitch on one face only. On double bed machines it can be made by two techniques: drop stitch and cross bed transfer. See Embossing chapter.

Mosaic knitting. A type of color knitting in which two (or sometimes more) colors alternate every two rows. Some stitches are slipped or tucked each pattern row in such a way that the design resembles a maze.

Motif. A design or pattern knitted into one or more selected areas of a fabric.

Needle. That element of the knitting machine which actually produces the stitch. The needles are lined up in slots parallel to one another across the width of the needle bed. Each needle can make one vertical column of stitches. The needle is composed of four parts: The *hook* holds the knit loop. The *latch* closes over the hook, allowing the previously knitted loop to slide off and a new loop to be formed. The *stem* is the length of the needle between the latch and the butt. The *butt* is a raised, rounded projection on the stem near the bottom end. It moves through the cam track in the carriage, which causes the needle to be raised and lowered.

Needle bed. A flat, rectangular assemblage of metal and plastic parts, approximately 45 inches long and 6 inches wide, with parallel slots or grooves along its length. Each slot holds one needle. The long edges are equipped with rails along which the carriage can move back and forth over the needles.

Needle rule. A standard format for setting up selvedge needles in double bed knitting. In FNR set-up, the first needle on the front bed is at the left, and the first needle on the back bed is at the right.

Needle selection. In pattern knitting, selected needles are moved into patterning position, either manually or by punched holes on a punchcard, to receive yarn from the feeder and make a plain knit stitch. Needles not selected remain in working position and act according to the cam setting. On some machines, needles can be selected for stitch transfer in the same manner.

Needle set-up. The arrangement of needles in working and non-working position at the start of knitting, after casting on.

Non-selected needles or background needles. In contrast to pattern or selected needles, these do not move out to patterning position and knit; instead they remain in WP and act according to the cam setting on the carriage. They correspond to the unpunched spaces on a punchcard.

Non-working position (NWP). (1) On all machines, needle butts are against lower rail of needle bed. Needles in this position remain out of action entirely. (2) On Passap, pushers within the blocking rail. Pushers in this position remain out of action entirely.

Nopps. Raised bumps or bobbles made by tucking for at least two rows (usually four to eight) on two needles separated by at least one needle knitting plain. The condensing of the fabric where the two needles are tucking causes the plain stitch(es) between to stand out in relief. Nopps can be made on single or double bed.

Partial knitting. Another name for short rows.

Pattern needles. See **Selected needles.**

Patterning position. The position of needle butts on the machine bed during pattern knitting. These needles will knit regardless of the cam setting.

Pattern repeat. The repetition of a design or pattern across the width and length of the fabric governed by the length and width of a pattern punched on a card or selected manually. Also, the repetition of a needle set-up coupled with the number of rows knit at various cam settings.

Skechers EX1027
Skechers v Nike

Pattern row. In jacquard punchcards, one pattern row is the number of punched rows on the card needed to complete one sequence of knitting. It is the same as one horizontal row on the original graphed design.

Pattern ruler. A hand-held plastic or metal strip with teeth on one or both long edges, used for manual selection of needles or pushers for patterning. Pattern rulers are available with various teeth combinations, some adjustable.

Pile knitting. A double bed relief fabric characterized by short loops held in place by the backing.

Pin tucks. Horizontal rolls or tubes in relief on the surface of the fabric. They are usually knitted double bed, but can also be knitted single bed by picking up stitches from several rows below and hanging them on needles to form the roll.

Plain knitting. All needles in working position knit with no slipping or tucking. May be done single or double bed.

Plating. A technique whereby two yarns are knit simultaneously in such a way that one yarn shows on the face of the fabric and the other on the reverse.

Popcorns or **Bobbles.** Isolated bumps or raised groups of stitches made by a variety of techniques. They are used decoratively in an embossed pattern.

Preparation row. In punchcard knitting, the pattern of a punched row on the card is set in the needle (or pusher) selector prior to the actual knitting of the row by making one pass of the needle selector past the card reader. (The needle selector is located in the carriage on Brother/Knitking and Singer/Studio and in the Deco on Passap.) This first pass to set the memory is called the preparation row. On Superba a preparation row is not needed.

Pull-up. On Japanese machines and Superba, another way of making a tuck stitch. The needles to form tucks are put in HP and a loop of yarn crosses over the needle stems with each pass of the carriage. It is particularly useful in combining tuck and slip stitches in the same row with knit stitches.

Punchcard reader. An attached or built-in device to hold the punchcard. When activated, it advances the card row by row, and, by means of plastic "feelers" that protrude through the punched holes, it reads the punched and unpunched spaces on each row of the card. A needle selector, built into or attached to the carriage, then passes across the feelers and selects needles to correspond with the arrangement of the feelers for each punched row.

Punch lace. Lace made by knitting in two colors, one of which is a transparent nylon thread which gives the illusion of spaces.

Purl loop. The horizontal loop on the reverse side of a knit stitch. When filling in empty needles during knitting, it is this loop that is picked up and hung on the adjacent empty needle. See **Sinker loop.**

Purl side. The reverse side of a stockinette fabric.

Purl stitch. The reverse side of a knit stitch.

Pushers. On Passap, these are metal jacks placed in channels underneath the needles on both beds. They are used for needle selection in patterning, for holding stitches, and for special kinds of knitting, such as half tubular. They can be manually placed in WP, NWP, or RP. On the front bed only, they can also be arranged automatically in WP and RP by a punchcard and the Deco. Punched holes on the card will cause corresponding pushers to move to working position. The arrow keys on both carriages can be used to automatically reverse the WP/RP arrangement of pushers.

Ravel cord. When a piece of knitting is begun with waste yarn, and before the main knitting is started, one row is knitted first with a ravel cord of smooth cotton or nylon. When knitting is completed, the waste yarn is separated from the main knitting simply by pulling out the ravel cord. It can also be used to hold stitches temporarily during knitting.

Regular feed punchcard rotation. On Japanese machines and Superba, a punchcard row can be changed with each pass of the carriage, i.e., the card rotates every row. Passap punchcards cannot rotate every row. See **Intermittent feed.**

Release stitch. Another name for drop stitch.

Relief fabric. A single or double bed fabric with portions of the fabric knitted so as to be raised from the rest of the fabric and create a three-dimensional texture.

Resting position (RP). On Passap, pushers are outside the blocking rail and placed against its top edge. Their respective needles act according to the cam setting on the carriage.

Reverse side of fabric. The side facing away from the main bed during knitting. In stockinette, the purl side. On double bed machines, the reverse is the side facing the second bed or ribber.

Reverser. On Superba, the second switch from the right on the selection box, which determines needle selection for patterning. The positive reverser (upper position) selects needles corresponding to blackened areas on the punchcard; the negative reverser (lower position) selects the non-blackened areas on the card.

Reversible fabrics. Double bed fabrics with the pattern showing on both sides, either in the same, or reversed, color sequence. The stitch texture also may be the same or reversed.

Ribber. See **Second bed.**

Rib, rib fabric. (1) So-called double knit fabric, made double bed, usually in FNR set-up, wherein knit stitches show on both sides of the fabric. (2) Double bed fabric characterized by vertical stripes of knit and purl stitches.

Rib jacquard fabric. A double bed fabric with a jacquard design on the fabric face, knitted in two to four colors per pattern row, with a backing which also contains all the colors. It can vary widely in structure and texture.

Ripple fabric. A double bed relief fabric characterized by a design or surface of pin tucks or nopps.

Row count (RC). In pattern directions, this term is often used to indicate the number of passes of the carriage in the repeating sequence: i.e. "RC2" instead of "knit 2 rows." This term is used because the carriage must sometimes make more than one pass to complete 1 row of knitting.

Row counter. A device attached to the machine to count passes of the carriage across the needle bed. A trip-cam on the carriage advances the numbers as it goes by the counter.

Second bed. On double bed machines, this bed is opposite the main bed (which contains the automatic patterning mechanism). Automatic patterning possi-

Skechers EX1027
Skechers v Nike

bilities on the second bed are less sophisticated, and in a double bed fabric it is generally used to knit the backing. On Japanese machines, this bed is called the ribber. See **Main bed.**

Selected needles or **Pattern needles.** Those needles selected manually or by punched holes on a punchcard to move into patterning position, receive the yarn from the carriage, and knit plain.

Selvedge. The side or vertical edges of the fabric as opposed to the cast-on or bound-off edges.

Set-up. The arrangement of needles in WP and NWP at the start of knitting, usually after casting on is completed.

Shadow lace. Another name for cross-bed transfer lace.

Shadowed reverse. Usually a double bed fabric wherein the design on the face of the fabric shows on the reverse, but in a different, less defined stitch structure. Often seen in rib jacquard fabrics. Needle selection for the pattern is required on the MB only.

Short rows. A technique for shaping fabric, and knitting intarsia, by knitting across only a portion of the needles holding stitches while non-knitting needles are placed in holding position. This will create more rows across one segment of the fabric than another, or will allow colored areas to be knitted separately.

Single bed. A knitting machine with one needle bed plus a carriage. It can produce jersey or stockinette fabrics of various types.

Single feed. A method of feeding one yarn at a time to the needles, in contrast to double feed, which feeds two yarns simultaneously.

Skip stitch. Another name for mosaic knitting.

Sinker loop. As the needles make knit stitches, the yarn passes from one needle to the next either in front of or around the sinkers. This element of the knit stitch is called the sinker loop. Sinker loops and purl loops together make very pronounced horizontal ridges on the reverse, or purl side, of the fabric. See **Purl loop.**

Sinkers or sinker posts. Along the top edge of the needle bed and in between the slots containing the needles are either small vertical metal posts or protrusions in the area between the slots. These are the sinkers (or sinker posts or gate posts). When the needles form loops, the yarn must travel around the sinkers from one needle to the next; this aids in the stitch formation and prevents stitches from becoming too tight on the needles.

Slip stitch. A missed stitch. A needle containing a stitch made on a previous row but which does not rise to knit a new stitch. The yarn will travel by it and make a float instead. Slip stitch is used in patterning where more than one color is used in a row, to make textured patterns of floats, and as one way of holding stitches for short rows.

Stitch size (SS). The relative size of a knit stitch in a given yarn, determined by the distance the needle descends to pull a new loop of yarn into its hook. This distance is adjustable and is governed by a calibrated dial on top of the carriage. See **Gauge.**

Stockinette or **jersey.** A single bed fabric knitted with needles in WP. The face shows a smooth texture of knit loops, while the reverse shows horizontal ridges created by the sinker and purl loops.

Striper backing. One of the two basic methods of knitting a backing in rib jacquards. All the needles on the second bed knit every row, creating horizontal stripes two rows high.

Tapestry or **bobbin knitting.** A manual method of knitting complex color patterns or intarsia in stockinette. Separate strands of yarn knit, each in their own color areas, across the fabric width.

Tapestry or **bobbin weaving.** Similar in concept to tapestry knitting. Separate ends of yarn for color changes are laid in manually where needed across the row, then the carriage with the main yarn is passed across to lay them into the knitted stitches. See **Inlay.**

Tension arm. An assemblage of spring wires and tension control discs mounted on the back of the machine. It carries the yarn from cone or ball to the feeder on the carriage, maintaining sufficient tension to produce even, loop-free knitting. Each arm holds one yarn. Tension can be adjusted according to the yarn used and type of knitting done.

Transfer, single and multiple. Transferring one stitch (single transfer) or several adjacent stitches (multiple transfer) to other needles, either laterally or cross-bed.

Transfer pattern. Any knitted pattern involving transfer or shifting of stitches from one needle to another, either laterally or cross-bed. May be done manually, or automatically with appropriate accessories.

Transfer tools, pronged or eyelet. See **Decker tools.**

Tubular knitting. Stockinette knitted on two beds in such a way that the yarn knits on alternate beds, always from the same direction, in a circular fashion. The resulting fabric will be a tube.

Tuck loop or **tuck stitch.** An incompletely formed stitch. The needle rises high enough for the hook to take new yarn, but not so high that the previous stitch falls behind the latch. When the needle descends, the previous stitch is still in the hook, together with a new loop of yarn. The loop is the tuck stitch, or, technically, the tuck loop. Several tuck loops can be collected in the same hook, over several rows. The combining of tuck stitches with knit stitches is one of the principal ways of making stitch patterns on the knitting machine.

Waste yarn. Yarn used either at the start or finish of knitting, or both, usually to produce an unfinished edge. This yarn will be removed later to leave an edge to be finished by hand or joined to the edge of another piece of knitting.

Weaving. An inlay technique for single bed knitting.

Weft, weft knit. In double bed knitting, a strand or float of yarn crossing over one or more needles on one or both beds without being hooked onto the needles or knitted into the fabric. It is usually enclosed within the rib stitches.

Working position (WP). (1) On all machines, the position of the needle butts on the machine bed that readies the needles for knitting. (2) On Passap, the pushers are placed halfway up their channels; their respective needles will then knit regardless of the cam setting.

Wrapping needles. A method of preventing eyelets and creating a solid join in short row and intarsia knitting. The first needle in holding position adjacent to the last needle which knitted is "wrapped" by placing the yarn in the hook or around the stem. If an eyelet is desired, the needle is not wrapped.

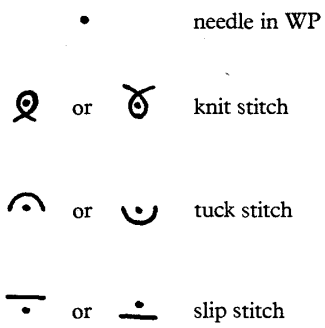
Yarn changer. See **Color changer.**

Skechers EX1027
Skechers v Nike

HOW TO READ THE STITCH FORMATION DIAGRAMS

These diagrams are placed as adjuncts to the text, cam charts and swatches to help you visualize and better understand the knitting of complex double bed fabric structures. Their purpose is to show as clearly as possible how one sequence of a particular fabric is knitted.

SYMBOLS USED IN STITCH FORMATION DIAGRAMS



Arrows indicate carriage direction; numbers indicate the knitting order of the rows in the sequence.

Pitch is indicated beside each diagram.

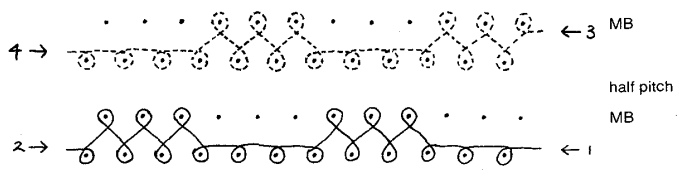
When two colors are represented, the solid line indicates color 1; the broken line indicates color 2.

Most of the diagrams are for double bed fabrics, hence there are two horizontal rows of dots per diagram to represent the needles of the two beds. The lines represent the yarn moving back and forth between the needles.

The main bed is always shown as the back bed and the second bed as the front bed, with carriages beginning each sequence from the right side. Every machine differs with respect to the MB and carriage starting side, but it shouldn't be difficult to reverse the two beds or the direction of the carriage to fit any particular machine.

The examples of jacquard patterning (on the MB) are shown in the diagrams as vertical stripes three needles wide; that is, the fabric *would* be striped if the sequence shown were knitted several times in succession. The diagrams are wide enough to show four stripes. If in two colors, they will be alternating stripes of dark and light; in one-color textured patterns, they will be stripes of knit stitches alternating with stripes of tuck or slip stitches.

Most fabrics require more than one diagram to show a complete sequence. They are always read from bottom to top, the way you actually knit. You must mentally superimpose them to visualize the complete structure.



Sample stitch formation diagram (for striper backing, described in the Jacquard chapter).

Skechers EX1027
Skechers v Nike

HOW TO READ THE CAM CHARTS

The left column lists the specific fabrics for which instructions are given in the adjacent text and photo captions. There is then a column for each machine. At the top, next to the machine name, is the usual starting position of the carriage for each pattern, determined by the placement of the color changer. Exceptions are noted in the individual boxes.

If a box is blank, or missing, the fabric cannot be made, or is too impractical to knit on that machine. Within each box the punchcard type is indicated in the upper right corner. For Superba and Japanese machines, card rotation also is noted here. Any special accessory needed is listed in the bottom left corner of the box.

Cam notations are written as follows: whatever is above the horizontal line refers to the back bed; whatever is below the line, the front bed. Any button, lever or setting not indicated should be in normal or neutral position according to the instruction book.

On the Japanese machines especially, some fabrics can be knitted by more than one method, or by switching directions of knit and tuck, for example. Don't be afraid to experiment!

Following are specific notations for the different machines.

	Passap carr R	Superba carr L	Brother/Knitking carr L	Singer/Studio carr L
Striper Backing **1 row pattern = 2 rows backing** **or** **2 rows pattern = 4 rows backing**	Type A N / BX ← Deco 4 RC2 ea col	Type A - Norwegian jacquard Type C1 - EOR o / ∧ RC2 ea col claw	Type B - ER Type C1 - EOR Type C2 - ER part ↔ / N N RC2 ea col	Type B - ER Type C1 - EOR Type C2 - ER △ slip △ / 1 1 RC2 ea col

Sample cam chart (striper backing is described in the Jacquard chapter).

Passap. If pushers on FB are in identical set-up on both beds, the notation will read WP/RP for both front and back beds. If they are set up opposite on each bed, it will read WP/RP for one of the beds, and RP/WP for the other. Assume that whenever the Deco is used, pushers on FB are either all in WP or all in RP, it doesn't matter which.

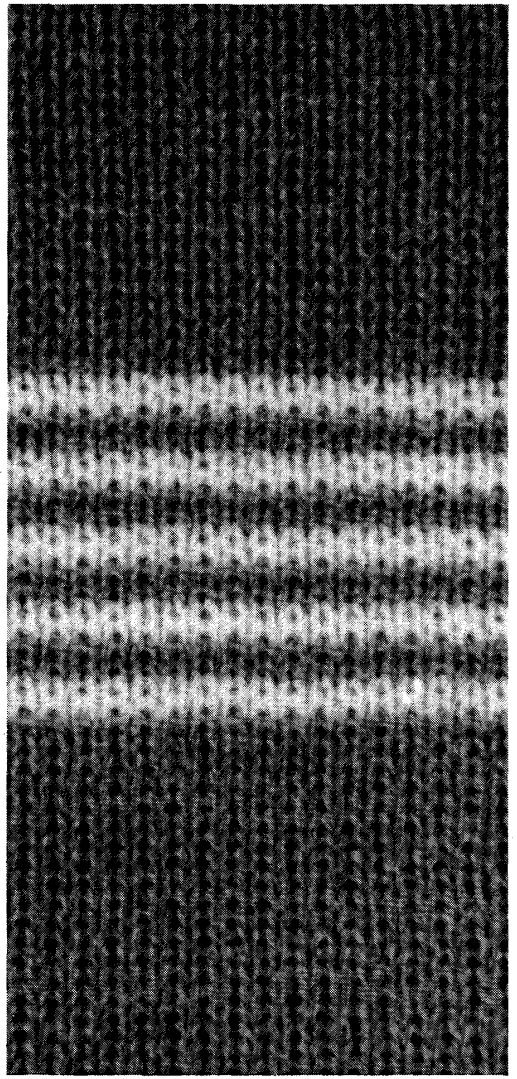
Superba. Arrows to indicate the position of the needle return buttons are the same for both beds. If they point upward, this means upper position; if they point downward, it means lower position. "No right cursor stop, cursor at right" means to lock the right stop at the end of the bed so it won't function, and place the cursor at the right side of the carriage where it remains throughout the pattern. The left cursor stop will be in position as usual. In all patterns, note carefully on which side the carriage begins. It is usually from the right, unless the Jac claw is used for two colors, when it usually starts from the left.

Brother/Knitking. Here a kind of shorthand is used to indicate cam settings, because the usual way of writing them takes too much space. The arrows for the main bed carriage indicate which direction(s) the carriage should tuck or slip. On the ribber carriage, the slip/tuck center button should always be in the slip position unless tuck is specified on the cam chart.

Singer/Studio. On the main bed, side levers back are indicated by a triangle, side levers forward by a circle. On the ribber carriage, the pick knob should always be in the slip position unless tuck is specified on the cam chart.

Skechers EX1027
Skechers v Nike

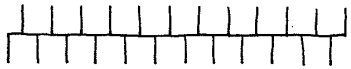
CHAPTER 2
The Basics



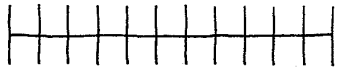
This section contains the general information pertaining to the needle beds and cam settings. Also included are instructions for the fabrics we consider to be so elementary that the directions for making them should be permanently etched into one's memory. Here, too, is the material for cross-referencing the carriage settings for your machine with those of another.

BED POSITIONS FOR DOUBLE BED KNITTING

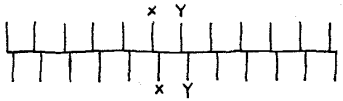
Before the needles are set up for double bed knitting, beds must be placed in one of three positions, which will determine the relationship of the front and back bed needles to each other. Of the bed positions shown in the next section, the two most common are "half pitch," where the needles alternate with each other; and "full pitch," where the needles are opposite each other. To maneuver the beds into one position or the other, there is a pitch lever adjacent to the racking handle on all machines except Passap, which uses the racking handle itself. A third position, "quarter pitch," is used by Passap and Superba when a cross-bed transfer carriage is employed for stitch transfer. Quarter pitch is midway between full and half pitch. Superba has a special lever for putting the beds in this position; on Passap the racking handle is turned to the 9 o'clock position.



Half pitch position. Needles between beds alternate with each other.



Full pitch position. Needles between beds are opposite each other.

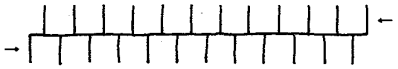


Quarter pitch position, the transfer position for Passap and Superba. Needles of the back bed are slightly to the left of corresponding needles on the front bed and will transfer to each other in either direction (pairs marked x *and* y*. If the front bed is racked one needle right to the next quarter pitch position, the front needle,* x*, and back needle,* y*, will transfer to each other.*

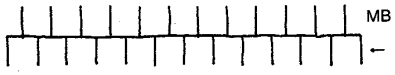
NEEDLE RULES FOR DOUBLE BED KNITTING

The term *needle rule* refers to the arrangement of the selvedge needles in double bed set-ups. The needle rule for the most common double bed set-up, full needle rib (FNR), is shown in most instruction manuals as the set-up below, with the first needle on the front bed at the left, and the first needle on the back bed at the right. This configuration follows in the most common rib set-ups as well.

In many fabrics, however, the needle rule acts only as a point of departure for configuring the selvedge needles in another way, in order to make neat selvedges in the fabric. A phrase commonly encountered in this book goes something like this: "Add an extra needle on the second bed to break the needle rule," resulting in the set-ups shown below.



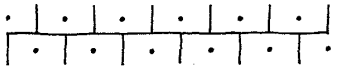
Normal set-up in full needle rib



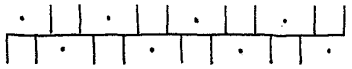
Extra needle on the second bed

Skechers EX1027
Skechers v Nike

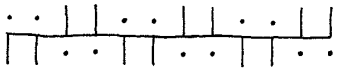
The needle rule also applies to other common rib set-ups, such as these.



Set-up for 1x1 rib, beds full pitch.



Set-up for 2x1 rib or 2x2 industrial rib, beds half pitch. Rack 1 needle left or right when casting on.



Set-up for 2x2 rib, beds full pitch. Rack 1½ needles when casting on.

	Passap	Superba	Brother/Knitking	Singer/Studio
Non-working position (NWP): no sts on ndls	ndls RP	o	A	A
Working position (WP): sts in hooks of ndls	ndls WP	1	B	B
Patterning position (patt pos) & bringing individual ndls from HP to WP: sts either on the latches or just behind the latches. Passap: sts in hooks	ndls WP and pushers WP	2	D	C
Holding position (HP): sts on stems of ndls. Passap: sts in hooks.	slip stitch cam settings only ndls WP and pushers RP or NWP	3	E	D

NEEDLE POSITIONS ON THE NEEDLE BEDS

Non-working position (NWP). Needles are pushed all the way down against the rail so that their butts are not fed into the carriage.

Working position (WP). Needles are pushed up to where the tops of the hooks are in even alignment with the sinker posts; butts will be fed into the lower cam track of the carriage. This is the normal position for plain, or stockinette, knitting, with the appropriate cam setting.

Patterning position (patt pos). For knit/slip or knit/tuck patterning on Superba and the Japanese machines, selected needles are pushed up either manually, or automatically by a punchcard, to where the spoons of the latches are in even alignment with the sinker posts. They will be fed into the upper cam track of the carriage and will always knit, no matter what the cam setting may be. The needles remaining in WP will be fed into the lower cam track and will slip or tuck according to the cam setting.

For knit/slip or knit/tuck patterning on Passap, pushers in WP cause corresponding needles always to knit, no matter what the cam setting may be. Pushers in RP or NWP (within the rail) cause corresponding needles to act according to the cam setting. Pusher selection may be either manual or by the Deco.

Holding position (HP). This position is for holding a group of stitches while another group is being knitted, for short rowing, and for tuck patterns on Superba and the Japanese machines (where it is used principally for combining knit/slip/tuck in the same pattern row).

On Superba and Japanese machines, needles are pushed up as far as possible so the butts are not fed into the upper cam track of the carriage. There are special buttons or levers on the carriage that act upon these needles, either to bring selected ones into HP (Superba only) or to knit them back into WP, all at the same time. To bring individual needles out of HP into WP, push the needle back to patt pos; the carriage will pick it up, knit it, and return it to WP.

For Passap, HP is possible only on slip stitch cam settings. In stockinette, pushers are placed in WP for the stitches to knit, RP for stitches to be held. Cams are set to BX for stockinette, or HX for tubular stockinette. If the pushers in WP and RP are already being used for patterning, as in jacquard knitting, then the stitches to be held must have their pushers in NWP. To hold stitches in a tuck pattern, the *needles* must be in NWP. When knitting a single bed tuck pattern, you can remove stitches from the needles with waste yarn or stitch holders, or transfer them to the opposite bed. With double bed patterns, knit the needles down to NWP with a ravel cord or waste yarn, holding the needle butts in place with masking tape.

Skechers EX1027
Skechers v Nike

CAM SETTINGS FOR BASIC KNITTING OPERATIONS

The chart illustrating the basic cam settings is largely self-explanatory. If you want to translate directions for another machine to your own, check which of its symbols for a certain action corresponds to the ones on your machine for the same action. The following describes what the various symbols represent:

The Singer/Studio ribber carriage and both Brother/Knitking carriages have separate cam keys for setting slip, tuck or knit in various combinations, either to left or right. The Singer/Studio MB carriage has one cam setting coupled with side levers for the action of the carriage in each direction with no pattern card in the reader. If the side levers are forward, on the circle symbol, the needles will act according to the cam setting. If they are back, on the triangle symbol, the needles will knit regardless of the cam setting. With a punchcard in the reader and the side levers on the circle symbol, all the needles will act according to the cam setting; if levers are on the triangle symbol, the card pattern will be knitted.

Superba has only one cam key for the action of the carriage in both directions. But it also has a tubular key, and on this setting the carriage always knits in the direction the arrow points, and it slips (or tucks, if the tuck key is also used) in the opposite direction. This helps you keep track of which bed knits first in a given direction.

Passap also has one cam setting for the action of the carriage in both directions, but it has several such settings for various combinations of knit/slip and knit/tuck.

For those of you who like the Passap pattern books, but use another kind of machine, the synopsis of each cam setting below will help translate Passap's directions to your machine. Keep in mind that on Passap both carriages have the same cam settings, both beds have pushers for selective patterning, and both have left and right arrow keys to reverse the pusher setting. Either one or both keys can be used; they will reverse the pusher setting in the direction the arrow points while the carriage is moving across the bed.

	Passap	Superba	Brother/Knitking	Singer/Studio
Knit	N / N	Λ / Λ	plain / N N	stockinette / 1 1
Slip	GX ; BX with pushers / GX BX	o / o	part/part / part/part	o slip o / o ← o
Tuck	AX with pushers / AX	⌒ / ⌒	tuck/tuck / part/tuck/part	o tuck o / o ∩ o
Tubular	CX ; HX & DX with pushers / CX HX DX	C / Ↄ	part ← / N part	o slip △ / 1 ← o
Fisherman's Rib	EX ; FX with pushers / EX FX	C⌒ / Ↄ⌒	tuck ← / N tuck part	o tuck △ / 1 ∩ o
Jersey Jacquard with double feed	GX / BX ← pushers WP/RP single feed only	↑□Λ↑ / o use double yarn guide	MC	knit-in
To keep ndls in HP while knitting on other ndls	pushers RP or NWP	needle return buttons center pos	HCL button H / HCL levers H H	Russel Levers I I / I I
To knit back all ndls in HP	pushers WP	needle return buttons lower pos	HCL button N / HCL levers N N	Russel Levers II II / II II

Note 1: All notations above horizontal line refer to back bed.
All notations below horizontal line refer to front bed.

Note 2: Back bed is main bed (MB) on Superba, Brother/Knitking, Singer/Studio.
Front bed is main bed (MB) on Passap.

PASSAP CAM SETTINGS

AX — Tuck in both directions. Pushers in NWP or RP will allow their needles to tuck, those in WP will cause their needles to knit.

BX — Slip both directions. Pushers in NWP or RP will allow their needles to slip, those in WP will cause their needles to knit.

CX — Tubular stockinette. No pushers necessary. Front bed knits right to left, back bed knits left to right.

DX — Tubular tuck. Pushers in NWP or RP will allow their needles to tuck, those in WP will cause their needles to knit. Front bed knits/tucks right to left, back bed knits/tucks left to right.

EX — Fisherman's rib both directions. No pushers necessary. Front bed knits right to left, tucks left to right. Back bed does the opposite.

FX — Fisherman's rib both directions. Pushers in NWP or RP allow their needles to knit fisherman's rib as with EX setting. Pushers in WP cause their needles to knit plain in both directions.

GX — Slip both directions. Pushers and needles in WP will *not* knit. This setting is for free move.

HX — Tubular slip. Pushers in NWP or RP will allow their needles to slip, those in WP will cause their needles to knit.

N — Knits all needles in WP regardless of pushers.

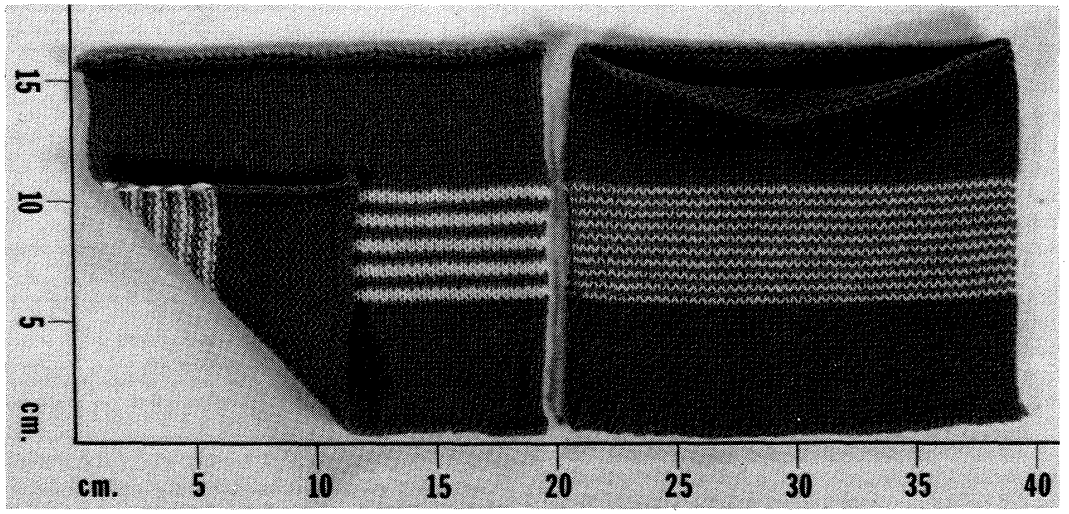
Skechers EX1027
Skechers v Nike

THE BASIC FABRICS AND THEIR STITCH SIZES

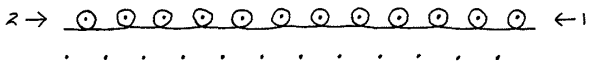
There are certain very basic fabric structures which can be knitted on any double bed knitting machine. It is important for every knitter to have a good understanding of how these fabrics are made on a particular machine, how the fabric is structured, and the qualities of the finished fabric. It also is important to understand technical factors such as the cam setting, relative stitch size, suitable yarn, adjustment of weight, and so on. It is upon these fabrics that a majority of the fabrics in this book are based. The ability to knit a good swatch of these basic ones is essential for success in knitting their variations and in designing and knitting more complex fabrics. Below is a brief synopsis of the six basic fabrics. Included for each is the approximate stitch size relative to the stockinette stitch size used for a given yarn, and a stitch formation diagram. The illustrated swatch of each fabric was knitted in FNR set-up. Each was knitted with the same yarn and the same number of stitches and rows, so you can see their relative proportions. The center stripes in the swatches were knitted RC2 each color in every case, to better illustrate the structure. In all cases, the direction of the carriages and setting of the cams can be reversed from those shown, if desired.

Stockinette, jersey, or **plain knitting.** Knit on one bed. All needles knit every row. The two sides of the fabric are not alike. During knitting, the knit side faces the needles, the purl side faces the opposite bed.

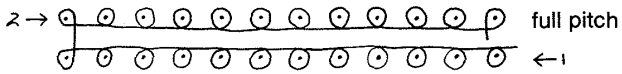
Tubular stockinette, or **circular knitting.** Knit on two beds, which alternate with each pass of the carriage. Each bed knits with the carriage passing from the same direction throughout, and the yarn travels in a circle. The fabric is stockinette, and since it is in a tube, both sides are alike. This swatch was knitted with the total row count doubled in order to achieve the same number of rows as the plain stockinette swatch. Stitch size on both beds is the same as for stockinette.



Left. Stockinette, jersey, or plain knitting.
Right. Tubular stockinette, or circular knitting.

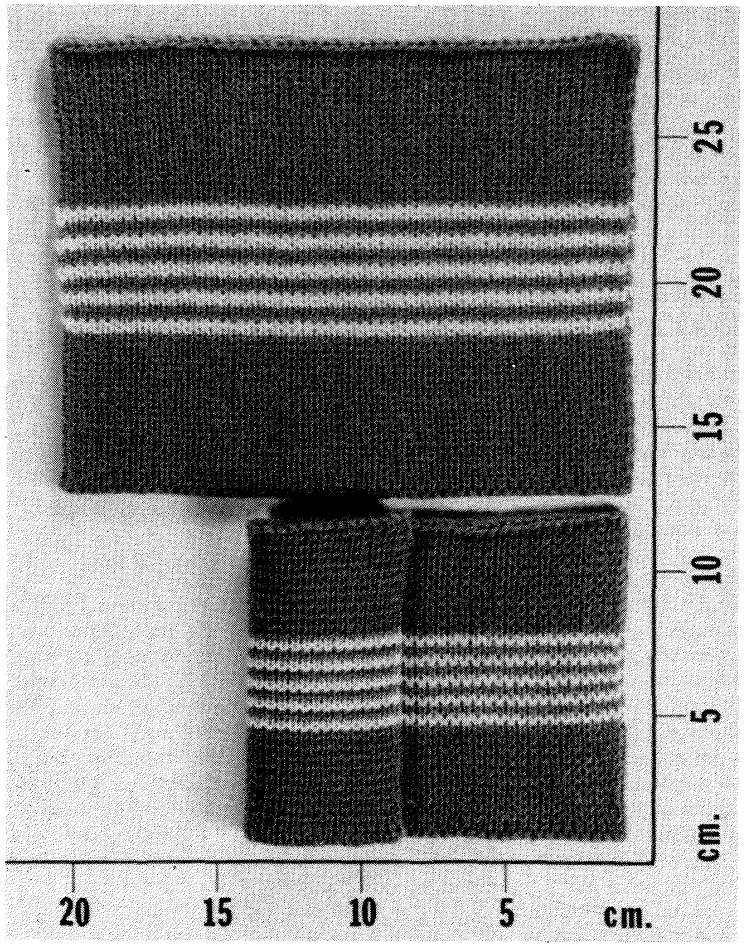


Stockinette.



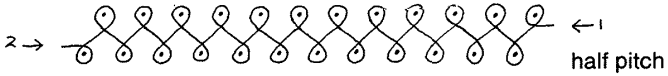
Tubular stockinette.

Skechers EX1027
Skechers v Nike



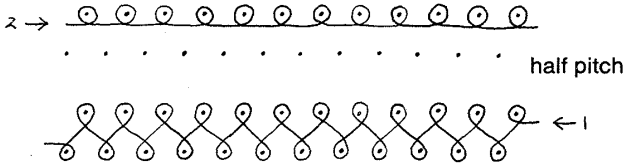
Top. Full needle rib, knit/knit, close rib, plain rib, or double rib.
Bottom. Long stitch, or half Milano.

Full needle rib, knit/knit, close rib, plain rib, or **double rib.** Knit on two beds, with all needles knitting in consecutive order every row. The two sides of the fabric are alike. The stitch and row gauges should be fairly close to those for stockinette. Stitch size on both beds is approximately 2 to 2.5 numbers smaller than for stockinette.



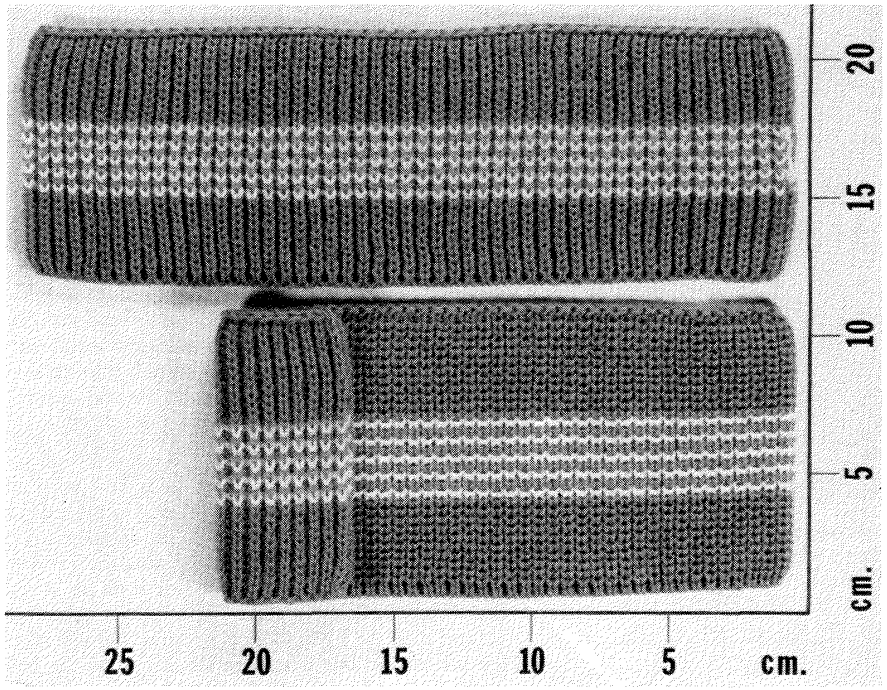
Full needle rib.

Long stitch, half Milano. Knit on two beds, with two rows of knitting required to complete one sequence. On the first row, both beds knit with all needles knitting in consecutive order. On the second row, one of the beds knits alone (in the diagram this is the back bed). In the finished fabric, since there will be twice the number of rows on one side as on the other, the two sides will not be alike. This swatch is somewhat shorter than the FNR swatch, because alternate rows are missing on one side. The stitch size on the bed which knits all rows (the back bed here) should be about 2 to 2.5 numbers smaller than for stockinette; for the bed which knits alternate rows only, about 1 to 1.5 numbers smaller than that of stockinette.



Long stitch.

Skechers EX1027
Skechers v Nike

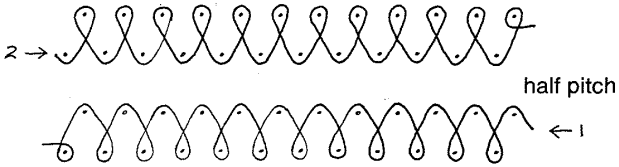


Top. Full fisherman's rib, or cardigan stitch.
Bottom. Half fisherman's rib, half cardigan, or English rib.

REMEMBER THESE POINTS WHEN CHOOSING STITCH SIZE

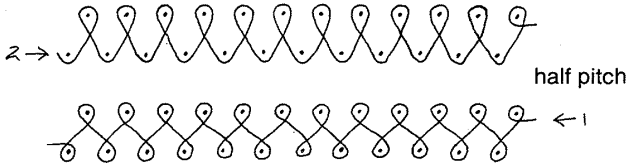
When knitting in tuck stitch on one or both beds, use a stitch size that is smaller than for stockinette or FNR. When knitting in slip stitch on one or both beds, choose a stitch size that is larger than that for stockinette or FNR. The choice will depend somewhat on the proportion of needles knitting and slipping or knitting and tucking. When knitting double bed, the stitch size can be different on the two beds.

Full fisherman's rib, cardigan stitch. Knit on two beds. On one bed, the back bed here, all needles tuck from right to left and knit from left to right. The front bed does the same, but in reverse. The two sides of the fabric are alike. Since a tuck loop is not a formed stitch and therefore does not add any length to the knitting, the fabric shortens about half, as compared to the same number of RCs in FNR. Note how the tuck loops push the ribs apart, making the fabric wider. The stitch size on both beds is about 3 numbers smaller than that of stockinette.



Full fisherman's rib.

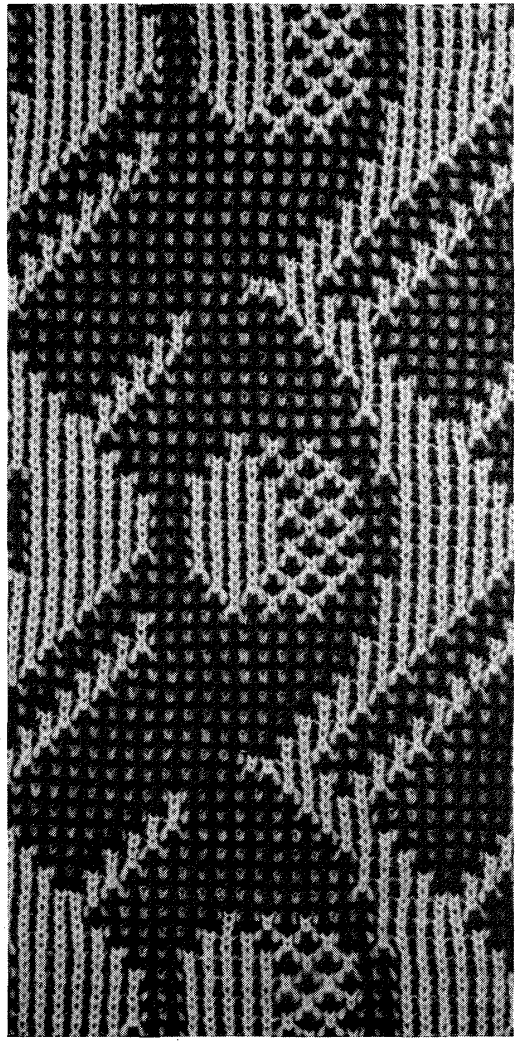
Half fisherman's rib, half cardigan, or **English rib.** Knitted on two beds. One bed, the back bed here, knits in both directions while the opposite bed knits and tucks as in full fisherman's rib. The two sides of the fabric are not alike. The side which knits in fisherman's rib looks like the fisherman's rib swatch, while the side which knits all rows has short, fat knit stitches, called *pearls* or *purls*. Because one bed is not forming tuck loops but is knitting all stitches, the fabric is slightly longer than the full fisherman's rib. The stitch size on both beds is about 2.5 to 3 numbers smaller than that of stockinette.



Half fisherman's rib.

Skechers EX1027
Skechers v Nike

CHAPTER 1
Jacquard Fabrics



Jacquard is one of the best known and most exciting kinds of machine knitting. Because it offers such enticing opportunity for experimentation with color and pattern, it can rapidly initiate the knitter into the art of creating original patterns and designs.

The principle underlying jacquard knitting came to machine knitting from traditional harness loom weaving. In 1805, in France, Joseph Marie Jacquard patented a loom attachment which incorporated a series of cards with holes punched in them. These cards mechanically selected warp threads for pattern weaving, which enormously speeded up the weaving of complex and intricate designs. Because his punched card principle has been applied to the selecting of needles for designing on knitting machines, the name Jacquard is as familiar to machine knitters as to weavers.

Theoretically, all punchcard knitting can be called jacquard, but to most machine knitters, the term implies a more or less flat fabric with a design having two to four (or more) colors per row. The design can be a "picture" or motif, an all-over pattern, or a combination of both. Today's electronic machines are the masters in their ability to separate, combine, lengthen, shorten, widen, narrow, and mirror jacquard patterns. Our concern here, however, is not with the design itself, but the fabric in which you choose to knit it.

Jacquard knitting in the instruction books is based on slip stitch, using one color for the background, the main color, and a contrast color for the design. The background stitches in each row are in the MC and the MC yarn slips behind the stitches saved for the design in that row; thus, if it is a jersey fabric, floats are formed. Meantime, the CC knits all the design stitches and slips behind the background stitches, forming more floats. The arrangement of the design and background stitches usually changes each pattern row, making a design in the knitting.

The best way to design a two-color jacquard pattern is to draw it on graph paper. Each square represents one stitch and either one or two knitted rows, depending on the pattern and the machine. The squares representing one color, usually that of the design, are filled in; those for the background color are left blank. In the simplest form of jacquard, the graphed design is transferred to a punchcard. The punched holes correspond to the filled squares and will cause the machine to knit one of the colors. The unpunched spaces correspond to the blank squares and will cause the machine to knit the other color. A full description of the types and designing of punchcards is found in Reference Chapter 4.

JERSEY JACQUARD

Jersey jacquard is also known as *fairisle, knit-in, slip-knit* and *skip-knit*. It is made single bed, by knitting and slipping the various colors in the manner described above. The face of the fabric is stockinette or jersey, with floats on the reverse. The method is described in all knitting machine instruction books, and is the same method hand knitters use. The most commonly used patterns are those which create short floats, such as the traditional Fair Isle and Shetland designs, and other patterns with small repeats or checked backgrounds. Patterns creating long floats make knitting difficult, are subject to snagging, and are usually more suitable for other types of jacquard knitting.

Jersey jacquard can be knitted by two methods on three of the machines in this book. Passap is the exception.

The Double feed method. This is a simple, quick and direct method of knitting a pattern with two colors per row, and is used on Superba, Brother/Knitking, and Singer/Studio. Both yarns are inserted into the feeder in separate slots. They knit simultaneously, one color knitting the needles selected for the design, and the other knitting the non-selected needles for the background.

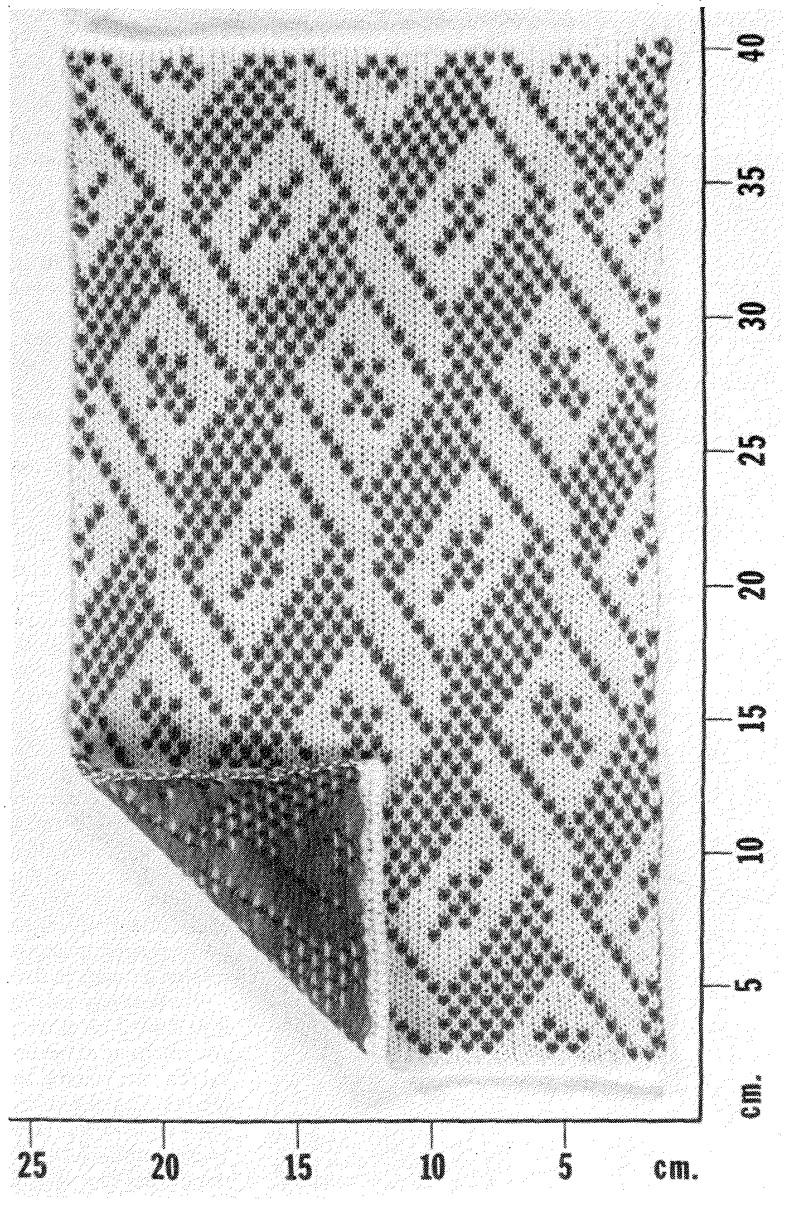
The Type A-1 or A-2 punchcard (illustrated in Reference Chapter 4) is used for this method. In card Type A-1, holes are punched for the design only; the background is left unpunched (with card Type A-2, it is just the reverse). Needles are selected by the punched holes to move to HP and knit the contrast color yarn in the second slot; the unselected needles will move to patterning position and knit the main color yarn in the main slot in the feeder. There is always a special cam setting on the carriage which causes the needles to move in this manner for the double feed system. If you wish to select the needles

Skechers EX1027
Skechers v Nike

manually for a pattern, move the needles for the design only (CC) to patt pos., then knit the row. The special cam setting will cause all the needles to knit their respective yarns, the same as with a punchcard.

The Single Feed Method. Passap also uses the Type A-1 or A-2 punchcard for knitting two colors per row, but uses the single feed system, with each color knitting in turn (MC, then CC). The arrow key on the carriage is used to switch the pusher selection for the design and background in each color. To select the pushers manually, start with all the pushers in RP, then move the ones to knit the design into WP. The cam settings and color changes are the same as with a punchcard.

Two colors per row also can be knitted by the single feed method on the Japanese machines with punchcards Type B and C. It is useful for knitting patterns with long floats, by incorporating needles on the ribber, and for knitting tubular jacquard with cams set for slip. Each color is knitted in turn. The B and C cards are designed so that holes are punched for needles that knit in a row; unpunched spaces cause needles to slip. In two-color work, two punched rows are required for each pattern row. All the background stitches are punched on one row and are knitted with MC; all the design stitches are punched on the next row and knitted with CC. All machines use the single feed method to knit patterns with three and four colors per row. Punchcard Type D is used, and the cams set to slip. The same principle used in punching the B and C cards applies to designs with three and four colors per row; each color in a pattern row must have its own punched row. A four-color changer is very useful for this kind of knitting.



Jersey jacquard fabric with 2 colors per patt row and 2 knitted rows per patt row. Example of a pattern with short floats. Design: jacquard Pattern 2.

Skechers EX1027
Skechers v Nike

	Passap carr R	Superba carr R	Brother/Knitking carr L	Singer/Studio carr L
Double Feed **MC - main feeder** **CC - second feeder**		Type A ↑ ⊔ ∧ ↑ DYG	Type A MC	Type A Knit-in
Single Feed **RC2 each color**	2 col - Type A 3, 4 col - Type D GX BX ← Deco 4 (2 col) BXo Deco 2 (3, 4 col)	2 col. { Type A - Norwegian jacquard / Type C1 - EOR 4 col - Type D - EOR o RC2 ea col claw	2 col. { Type B - ER / Type C - EOR 4 col - Type D - EOR part ↔ RC2 ea col	2 col. { Type B - ER / Type C - EOR 4 col - Type D - EOR △ slip △ RC2 ea col

Managing floats in jersey jacquard.

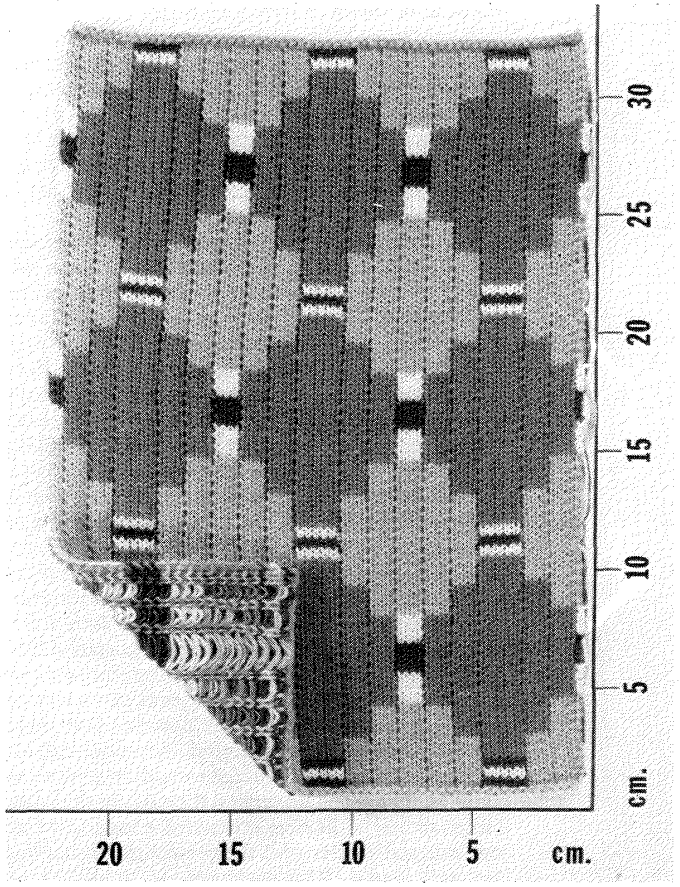
Nearly every basic machine knitting book includes discussion about the reverse side of a jersey jacquard fabric; managing long floats, and joining the edges of a motif to its background fabric. When knitting an isolated motif the edges of the motif must be attached to the main fabric on each pattern row, either by using a separate yarn or by wrapping the adjacent background needles with the motif yarn.

Another important matter is long floats. There are several methods for dealing with them; the one you choose will depend mostly on the arrangement of the floats on the fabric reverse. A vertical series of floats can be latched up, either during or after knitting, with the last one hung on a central needle or tacked in place with sewing thread. Or they can be gathered in groups and tied up with another yarn after knitting. An isolated long float can be lifted onto a central needle, immediately after it has been knitted, to tie it into the fabric. The treatment of long floats can be decorative, making the reverse of the fabric as beautiful and interesting as the face.

Another method for dealing with long floats requires a second bed and, except on Superba, the fabric must be knitted by the single feed method. With a few strategically placed needles in WP on the second bed, long floats can be "tied" automatically to the fabric by allowing these rib needles to knit once or twice each pattern row. The carriage on the second bed can be set for either knit or tubular (slip one direction, knit the other direction); the stitch size should be as small as possible. There will be vertical divisions in the fabric face as a result of the rib stitches on the backing, which can enhance the design if the needles on the backing are well placed. This technique is similar to rib jacquard, and is very useful when knitting three or four colors per row, or when knitting with heavy yarns in two colors, when regular rib jacquard would make the fabric too thick.

The photo on the next page is an example of jersey jacquard with isolated rib stitches as a backing.

Skechers EX1027
Skechers v Nike



Jersey jacquard fabric with single ndls spaced on second bed, knitting EOR, to prevent long floats on fabric reverse. These sts cause the face sts to divide into ribs. Design: jacquard Pattern 7.

	Passap carr R	Superba carr R	Brother/Knitking carr L	Singer/Studio carr L
	Type A single feed	Type A	Type B - ER Type C - EOR single feed	Type B - ER Type C - EOR single feed
Jersey Jacquard with Rib	CX, N, or HX ← BX ← Deco 4	↑ ⊔ ∧ ↑ ∧ or ↻ can also add ⊔ on FB DYG	part ↔ N N or N part	△ slip △ 1 1 or 1 ∠ o

TUBULAR JERSEY JACQUARD

Tubular knitting, which requires a second needle bed, is not often seen using jersey jacquard or other patterning. Yet seamless knitting *can* be done with either jacquard or textured patterning, and should be considered for items like socks, mittens, gloves, scarves, legwarmers, and ski hats, and we would like to delve into the subject a bit here.

In tubular stockinette knitting, when the carriages are moved in one direction, one bed knits; when moved in the opposite direction, the other bed takes up the yarn and knits. Therefore the yarn is travelling in a circle: each bed knits every other row and the carriage always passes on it from the same direction to knit that row.

The single feed system must be used to knit tubular jersey jacquard, with the appropriate punchcard Type for each machine. Since a minimum of two passes of the carriage is required to knit one pattern row on the main bed (one pass for each color), there will be twice the number of rows on the second bed if all the needles knit with each pass of the carriage. A very unbalanced tube will result unless the second bed is also knitting a pattern.

The photographs show three practical ways to knit tubular slip and tuck stitch patterns. The designs are in two-color jacquard and tucked mosaic patterns, because these present the most challenging problems in matching gauges between the two beds, controlling punchcards, and handling the number of color rows for each pattern row. Of course, other types of single bed fabric designs can be used as well.

Compared to stockinette, a tuck stitch fabric with the same number of stitches and rows tends to be shorter and wider. A slip stitch fabric will be shorter and narrower. How much, in either case, depends on the number of rows and stitches being slipped or tucked. A two-color mosaic tuck pattern shortens about a third, a jacquard about half. The width changes are less extreme, but still must be considered, especially when plain stockinette is the fabric chosen for the second bed.

COMBINING STOCKINETTE WITH PATTERNING IN TUBULAR KNIT

All machines except Passap must use either stockinette or manual patterning on the second bed. The

Skechers EX1027
Skechers v Nike

following are suggestions for dealing with the differences in gauge which occur when stockinette is knitted on the second bed and tuck or slip on the main bed. First, it is wise to use a yarn with good compressibility, which will compact or expand to suit the need.

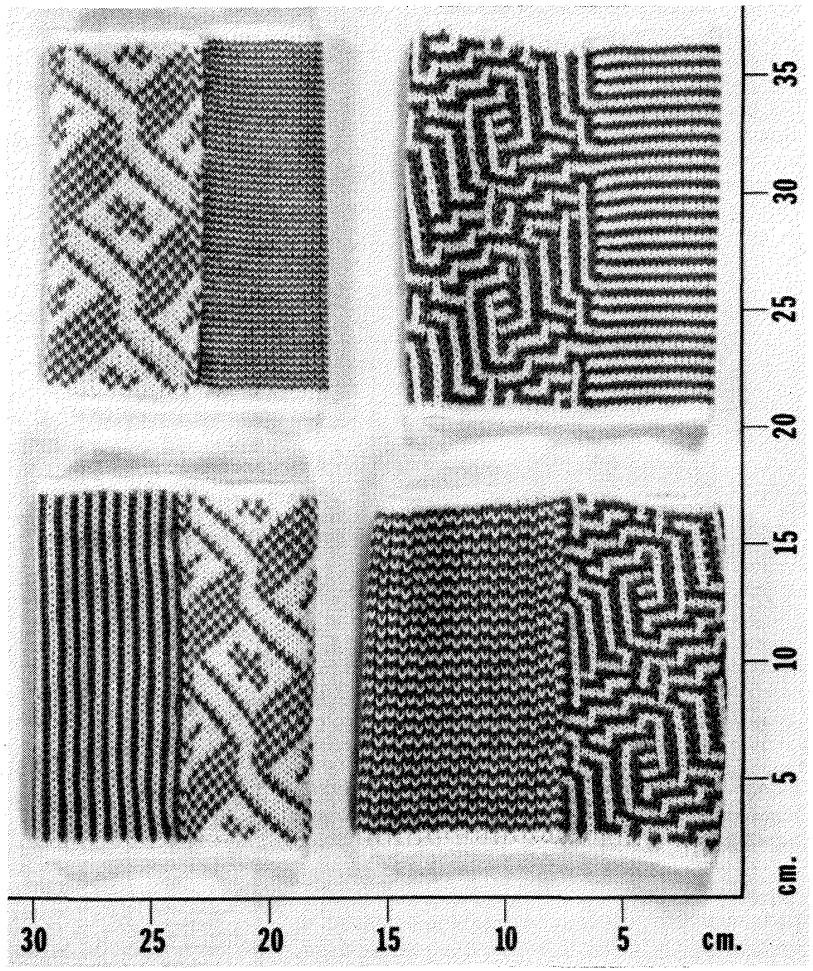
Control of the row gauge between the two beds. Use different stitch sizes on each bed. Assuming the gauge for the stitch size dial is the same on both beds, make the stitch size on the stockinette (second) bed as small as the yarn will take, and the slip or tuck stitch on the main bed as large as is appropriate for the pattern. The row gauge will even up quite nicely. The stockinette side will be very firm—ideal for palms of mittens or gloves, or the foot of a sock.

Control of the stitch gauge between the two beds. Use more or fewer needles on one bed than on the other. This technique is suitable only for small projects with narrow widths. Add or remove one needle at each end of one of the beds to equalize the width between the jacquard or tuck pattern and the stockinette. If the number of needles for the stockinette bed remains the same, then, for a slip stitch pattern, use two *more* needles, one added at each end, on the main bed. For tuck stitch, use two fewer needles, one removed from each end, on the main bed. Adding or removing more than two needles will result in floats between the two beds.

Block carefully. A small difference between the two sides of the fabric can be blocked out, particularly if you use yarns with good recovery.

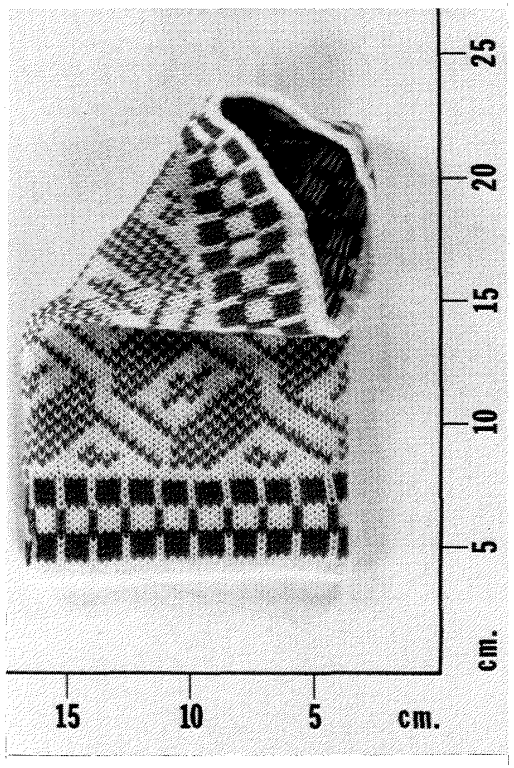
Take advantage of the characteristics of your stitch combinations. For example, a wider tuck stitch coupled with the narrower stockinette will, when blocked flat, result in a border of tuck stitches on each side of the stockinette. This can be a nice touch on the lining side of a scarf.

If there is a great difference between the number of needles on each bed, there will be floats between the two sides of the fabric. These can be an integral part of the design if latched up with another color yarn, or, if they are long enough, by latching them up in groups. Or, plan for very long floats, cut them to make fringes, and knot them at their bases, thus joining the two sides of the fabric.



Tubular jacquard and tucked mosaic patterns. Design: jacquard Pattern 2.
Top left: jacquard knitted on MB, stockinette with very small SS on second bed. Stockinette stripes are 1 row each color.
Top right: tuck mosaic knitted on MB, stockinette with very small SS on second bed. Stockinette stripes are 2 rows each color.
Bottom left: jacquard knitted on MB, 1x1 slip/knit on second bed. Identical SS on both beds.
Bottom right: tuck mosaic knitted on MB, 1x1 tuck/knit on second bed. Identical SS on both beds.

Skechers EX1027
Skechers v Nike



Tubular jacquard with identical pattern on both beds. Made with a Jac 40 and punchcard, both beds. Design: jacquard Pattern 2.

	Passap carr R	Superba carr R	Brother/Knitking carr L	Singer/Studio carr L
Tubular Stockinette no patterning	CX / CX	C / ↻	part ← / N part	o slip △ / 1 ← o
Tubular/Slip Stockinette MB - Jacquard 2nd bed-Stockinette 1 knit row per pattern row	Type A CX / HX ← Deco 4 RC2 ea col	Type C1 - EOR o / ↻ No R cursor stop. Cursor at carr R only. RC2 ea col See also Superba Specials. claw	Type C1 - EOR Type C2 - ER part ↔ / N part RC2 ea col Push back to B pos selected ndls EOR	Type C1 - EOR Type C2 - ER o slip △ / 1 ← o RC2 ea col
Tubular Tuck/ Stockinette MB - Mosaic 2nd bed-Stockinette 2 knit rows per pattern row	Type A1 RC2 CX / DX ← ; RC2 CX / DXo Deco 4 RC4 ea col	Type A1 stop card neg rev RC1 ⌒ / ↻ ; RC1 o / ↻ No R cursor stop. Cursor at carr R only. RC4 ea col Advance card to next patt row. claw	Type A2 - ER ← part/tuck → / N part RC4 ea col. Stop card before knitting row 1 ea col. Start card before knitting row 4 ea col. Push back selected ndls MB EOR	Type A2 - ER RC1 o tuck △ / 1 ← o ; RC1 o slip △ / 1 ← o RC4 ea col. Stop card before knitting row 1 ea col. Start card before knitting row 4 ea col
Tubular Slip/1x1 Slip MB - Jacquard 2nd bed-1x1 Slip/Knit 1 knit row per pattern row	Type A HX ← push. 1x1 WP/RP / HX ← Deco 4 RC2 ea col	Type A o / o No R cursor stop. Cursor at carr R only. RC2 ea col. On FB, select odd ndls col 1, even ndls col 2. claw	Type C1 - EOR TypeC2 - ER part ↔ / part ↔ RC2 ea col. Select odd ndls ribber col 1; even ndls col 2. Push back selected ndls MB EOR	Type C1 - EOR Type C2 - ER o slip △ / o ← o RC2 ea col. Select odd ndls. ribber col 1; even ndls col 2
Tubular Tuck/ 1x1 Tuck MB - Mosaic 2nd bed-1x1Tuck/Knit 2 knit rows per pattern row	Type A1 RC4 ea col RC2 DX ← / DX ← ; RC2 DX ← / DXo push 1x1 WP/RP / Deco 4	Type A1 neg rev stop card RC1 ⌒ / o ; RC1 o / o No R cursor stop. Cursor at carr R only. RC4 ea col. Select odd ndls, then even ndls FB EOR. Advance card to next patt row. claw	Type A2 - ER ← part/tuck → / tuck ↔ RC4 ea col. Select odd ndls, then even ndls on ribber EOR. Push back selected ndls MB EOR.	Type A2 - ER RC1 o tuck △ / o ⌒ o ; RC1 o slip △ / o ⌒ o RC4 ea col. Select odd ndls, then even ndls on ribber EOR.
Tubular Jersey Jacquard Jersey Jacquard both beds 1 knit row per pattern row	Type A HX ← Jac 40 / HX ← Deco 4 RC2 ea col. Insert Jac card right side up. Pushers RP, select to WP every RC4.	Type C1 - EOR Type C1 - Jac o / o No R cursor stop. Cursor at carr R only. RC2 ea col. On FB, select ndls with Jac to pos 2, EOR. claw	Type C1 - EOR Type C2 - ER Type C1 - Jac part ↔ / part ↔ RC2 ea col. On ribber, select ndls with Jac to D pos EOR. On MB, push back selected ndls EOR.	Type C1 - EOR Type C2 - ER Type C1 - Jac o slip △ / o ← o RC2 ea col. On ribber, select ndls with Jac to C pos EOR.

Skechers EX1027
Skechers v Nike

TECHNIQUES FOR TUBULAR PATTERNING

The swatches illustrated were knitted two repeats wide and two repeats high. Both the jacquard and the mosaic patterns use the same punchcard design, jacquard Pattern 2.

1. With an even number of needles in WP, the beds usually should be set at full pitch; for an odd number, at half pitch. This keeps the sinker loop passing between the beds the correct length and prevents a visible mark up the sides of the knitting. Sometimes, however, the reverse is better. It depends on yarn thickness and stitch size.

2. If the second bed is knitting stockinette, it will be easier to knit small stitches if extra weights are added.

3. The second bed may also knit a pattern, which will eliminate the concern of matching the gauges of the two sides of the fabric. Illustrated are 1x1 selections on the second bed, alternating for each color. On Passap, pushers can be set up 1x1 WP/RP. On other machines it will be necessary to select alternating groups manually with a pattern ruler, each row. The lili buttons on Brother/Knitking and Superba cannot be used for these fabrics. Cams and stitch size are the same on both beds, to keep the gauge the same on both beds. Of course, it is also possible to exaggerate a gauge difference in fabrics on the two beds, by knitting, for example, a tuck pattern on one bed and a slip on the other.

4. To make a tubular fabric with the same patterning all around, as for sock legs and ski hats, a punchcard in the reader may be coupled with an identical card in the Jac 40 for the second bed. A simple pattern can be knitted manually with a pattern ruler on both beds.

5. When knitting a jacquard or other slip stitch pattern coupled with selection on the second bed, be sure to hook each color yarn around the last needle opposite the color changer (if it is not knitting that needle) to ensure that both yarns are carried completely to the selvedge.

6. Mosaic patterns must be knitted with two rows of the same color, with the same needle selection (RC4 each color), to keep the horizontal parts of the design in proportion to the verticals. Jacquard patterns can be knitted with either one or two rows of the same color with the same needle selection (RC2 or 4 each color).

7. A special version of a tubular jacquard/stockinette combination can be made on Superba. The MB knits jacquard while the second bed plates the two yarns in stockinette. Stitch size is about the same for both beds. A sample swatch and cam settings are shown in the Superba Specials section of this chapter.

RIB JACQUARDS

Rib jacquards, also known as *double jacquard, fairisle, double fairisle and multicolored rib,* are made double bed. A backing is knitted on the second bed simultaneously with the design on the main bed. Floats on the reverse of jersey jacquards are knitted into the backing, producing a thicker, more stable, often reversible fabric.

For two colors per row, Type B and C cards are used on Japanese machines, and Type A cards on the European machines. Type D cards are used on all machines to knit 3 and 4 colors per row. The design itself can be knitted using the same technique and the same cam settings as for *single feed* jersey jacquard.

On the Superba only, rib jacquards can also be knitted with the double feed system to produce special fabrics. These will be discussed separately.

The design possibilities for rib jacquard fabrics are virtually limitless. Large designs, which would result in excessively long floats in jersey jacquard, can be knitted without concern. The interaction of stitches between the face and backing of the fabric can be varied in several ways to produce flat, ribbed, or relief textures. The techniques explained in this chapter are for flat and ribbed fabrics; relief fabrics are discussed elsewhere in the book. We hope the techniques introduced here will inspire you to design your own rib jacquard fabrics.

CHARACTERISTICS OF RIB JACQUARD FABRICS

1. Some techniques will cause a lengthwise and/or widthwise expansion of the design, while others will contract it.

2. Using a slip stitch cam setting on one or both beds produces a tighter fabric. Tucking on one or both beds produces a very stretchy fabric. Tucking on one bed while slipping on the other, or tucking and slipping on alternate rows, yields a fabric with properties of both slip and tuck.

3. The surface texture of both face and backing will vary with each technique, as it is a direct result of the interaction between the stitches of the two surfaces. If the number of colors per row is changed, the texture may also change, even with the same cam setting.

4. Some techniques produce a balanced fabric and others an unbalanced one, where a difference exists in the number of rows between the face and backing in each pattern row. This balance influences the thickness and stability of the fabric, which will be modified with each color added. Your choice of technique depends mainly on the number of colors per row, type of yarn, and degree of expansion or contraction you want in your design.

5. With any technique, using two colors per pattern row produces a lighter weight fabric than will three or four colors per pattern row, because each color added means extra yarn must be accommodated in the backing.

6. "Grin-through" is more apparent when three or four colors are used in each pattern row than with two colors. Some techniques produce more grin-through than others, so you have to consider whether it enhances or detracts from your design.

7. Many techniques will produce a more or less reversible fabric. Some fabrics will have the same design on both sides but in reverse colors; on many the design will be "shadowed" on the reverse. Other fabrics will have stripes, checks or a solid color on the reverse. In general, patterns with two colors per row produce reversible fabrics better than patterns with three or four colors per row.

8. Since the same needle selection must take place on both beds simultaneously, some reversible jacquard fabrics will need two identical cards and a Jac 40 on the second bed. Of course, the Jac 40 or pattern ruler can be used on both beds simultaneously instead.

9. In garments using rib jacquard patterns, shaping is best accomplished by increasing and decreasing stitches, since putting needles in holding position for shaping can cause knitting problems in some fabrics on some machines. Or, so that you can focus all your attention on the fabric itself, consider cut-and-sew construction, especially for necklines and other places requiring careful shaping.

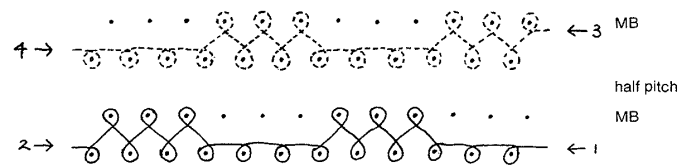
Skechers EX1027
Skechers v Nike

TWO-COLOR RIB JACQUARD FABRICS

All the swatches shown were knitted with the same yarn and have the same number of repeats—three wide and three in length. All the designs have the same size repeats. The scale beside each swatch shows the differences in swatch sizes produced by each technique. Some of these techniques are adapted to three and four colors and are presented at the end of the chapter.

Beds are set at half pitch throughout, except for knitting eight-lock fabrics. Adding one extra needle on the second bed (to break the needle rule) ensures a good selvedge for all the swatches.

	Passap carr R	Superba carr L	Brother/Knitking carr L	Singer/Studio carr L
Striper Backing **1 row pattern = 2 rows backing** **or** **2 rows pattern = 4 rows backing**	Type A N / BX ← Deco 4 RC2 ea col	Type A - Norwegian jacquard Type C1 - EOR o / ∧ RC2 ea col claw	Type B - ER Type C1 - EOR Type C2 - ER part ↔ / N N RC2 ea col	Type B - ER Type C1 - EOR Type C2 - ER △ slip △ / 1 1 RC2 ea col

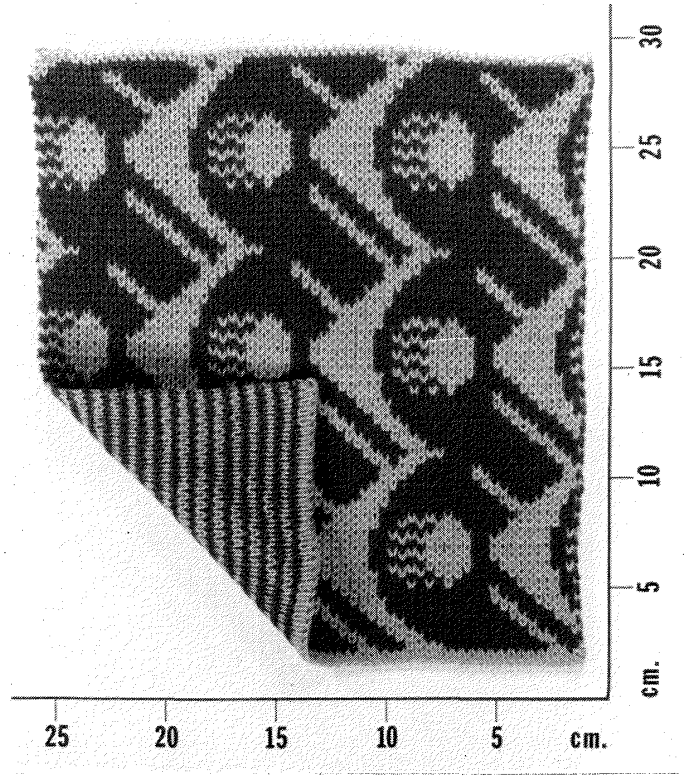


Striper backing.

THE BASIC RIB JACQUARD FABRICS

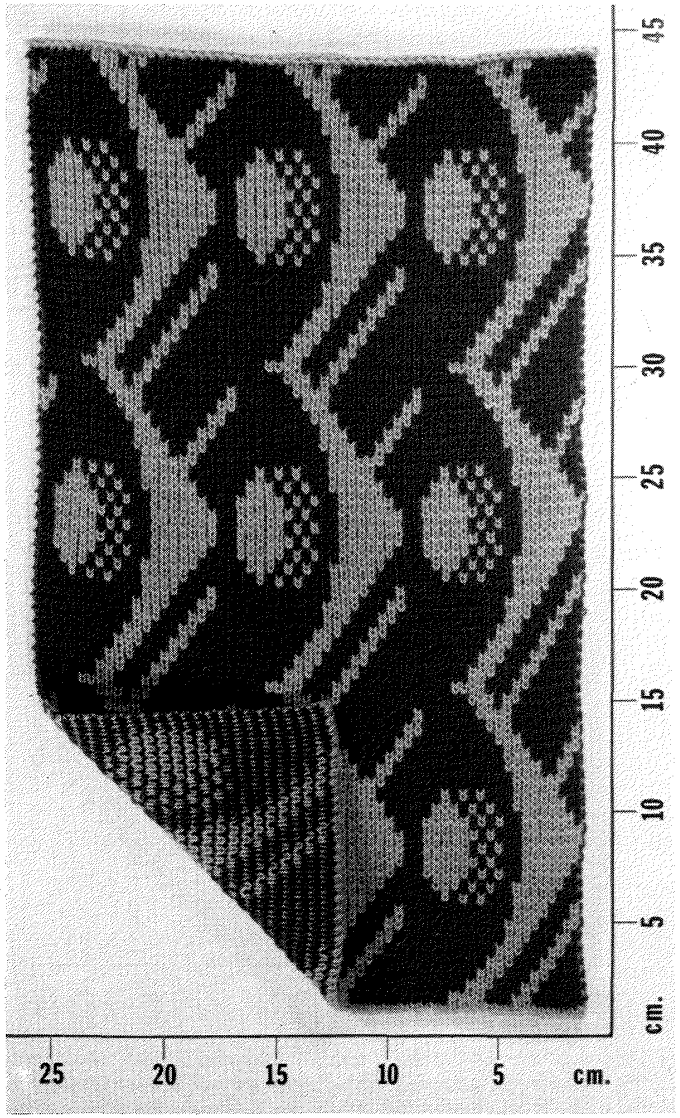
The most common and most versatile way to knit rib jacquard patterns is to use slip stitch on the main bed, and either slip/knit or plain knitting on the second bed. We shall begin with these two basic methods of knitting the backing, both of which are usually described in the instruction books for the machines or color changers. We use the names given these backings by the knitting industry. One is *striper backing,* which knits horizontal stripes on the backing and requires no needle selection on the second bed. The other is *bird's-eye backing,* which requires a 1x1 needle selection on the second bed and produces an all-over, tiny one-needle check. Except for a few of the reversible fabrics, all the backing variations we'll discuss are based on these two basic methods. They can be modified in several ways and can produce all sorts of interesting fabrics when combined with variations in knitting on the main bed.

Skechers EX1027
Skechers v Nike



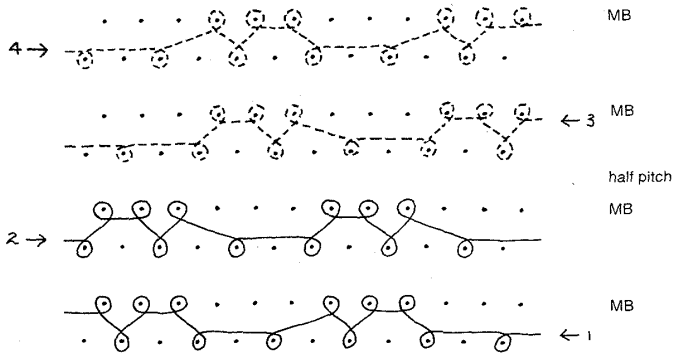
Striper backing. Design: jacquard Pattern 4. MB: knit/slip. Second bed: knit. All backing needles knit every row. The backing will appear as horizontal stripes, 2 rows each color. Stripes are even, as in the swatch above, when a Type B card is used. With Type A or C card, the design will be shadowed in the stripes (swatch at right). Stitches on the fabric face will be in perfect vertical alignment, which is characteristic of all jacquard fabrics with plain knitted backings. Fabric balance: 1 patt row = 2 backing rows; or 2 patt rows with same selection = 4 backing rows.

Variations (not shown). Striper can be varied by using punchcard Type B set to rotate EOR and knitting 4 rows each color. Backing stripes will be 4 rows each color, with each patt row knitted 2 rows alike.



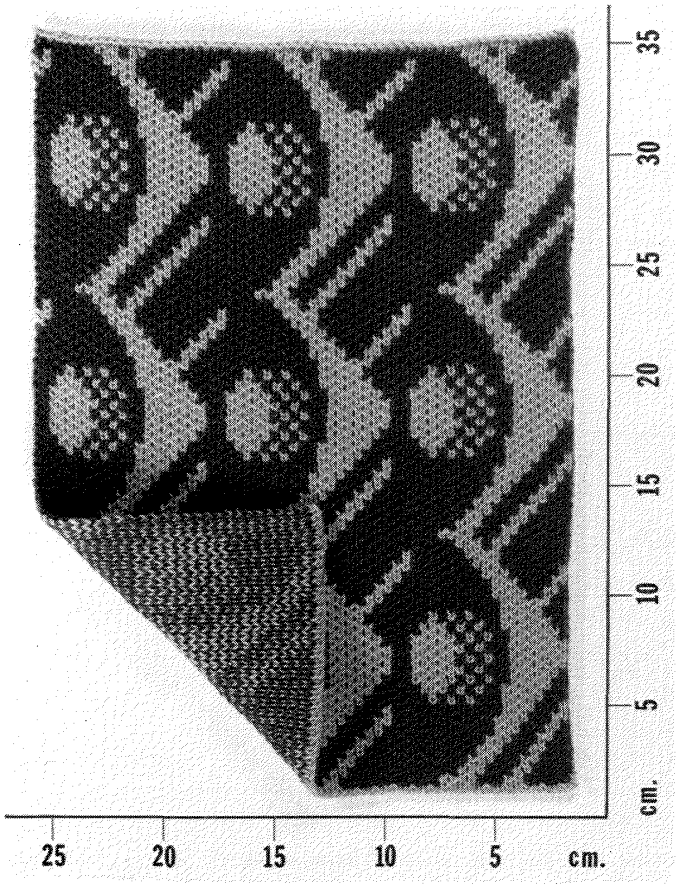
Skechers EX1027
Skechers v Nike

	Passap carr R	Superba carr L	Brother/Knitking carr L	Singer/Studio carr L
Bird's-eye Backing **2 rows pattern = 2 rows backing**	Type A BX ↔ push 1x1 WP/RP BX ← Deco 4 RC2 ea col	Type A - Norwegian jacquard Type C1 - EOR o lili o lili even # ndls FB RC2 ea col claw	Type B - ER Type C1 - EOR Type C2 - ER part ↔ lili part ↔ lili even # ndls ribber RC2 ea col	Type B - ER Type C1 - EOR Type C2 - ER △ slip △ o ← o RC2 ea col. Select odd ndls, then even ndls on ribber, ER.
Bird's-eye Backing Var; Vertical Stripe **2 rows pattern = 2 rows backing**	Type A BX ← push 1x1 WP/RP BX ← Deco 4 RC2 ea col	Type A - Norwegian jacquard Type C1 - EOR o o RC2 ea col. On FB, select odd ndls col 1; even ndls col 2. claw	Type B - ER Type C1 - EOR Type C2 - ER part ↔ part ↔ RC2 ea col. On ribber, select odd ndls col 1; even ndls col 2.	Type B - ER Type C1 - EOR Type C2 - ER △ slip △ o ← o RC2 ea col. On ribber, select odd ndls col 1; even ndls col 2.



Bird's-eye backing.

Skechers EX1027
Skechers v Nike

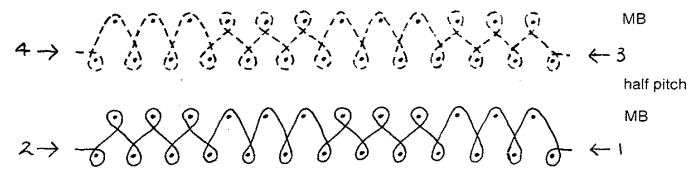


Bird's-eye backing. Design: jacquard Pattern 4. MB: knit/slip; second bed: knit/slip 1x1. Backing needles alternate knit/slip every row, to create a tiny checked appearance, or more typically, a scrambled appearance. Alternating needle selection on the backing causes stitches on the face to pull in an alternating diagonal direction creating the "bird's-eye" texture. A texture on the face created by diagonal pull of stitches is characteristic of all jacquard fabrics with needle selection on the backing. Fabric balance: 1 patt row = 1 backing row or 2 patt rows with same selection = 2 backing rows.

Variations. Design: jacquard Pattern 4. Bird's-eye can be varied by alternating the 1x1 backing selection EOR instead of ER to create vertical stripes, as in this swatch. It can also be knitted with 2x2 needle selection, alternating the selection every 4 rows to create a checked pattern. Note that the EOR selection causes the face to divide into ribs.

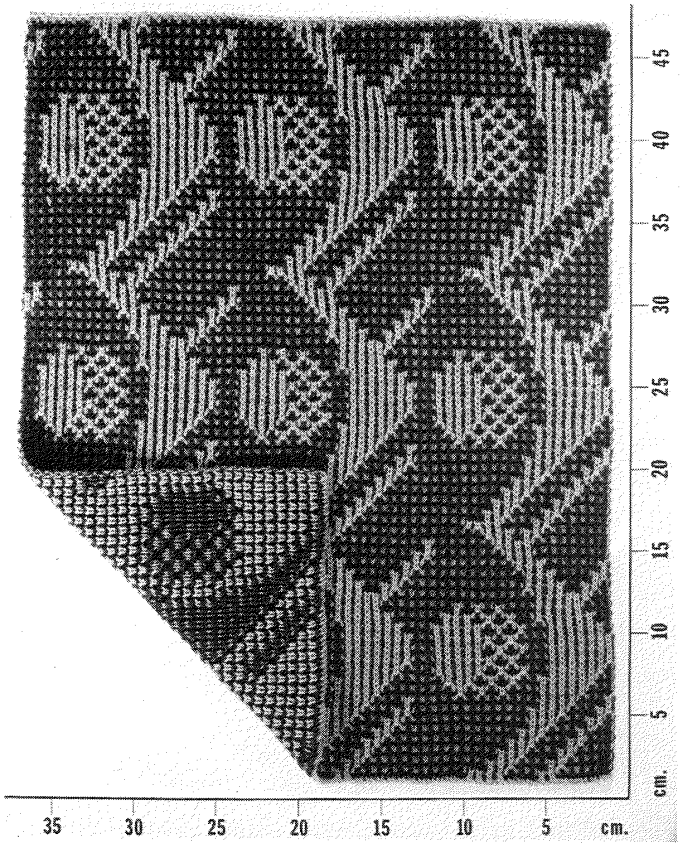
Skechers EX1027
Skechers v Nike

	Passap carr R	Superba carr L	Brother/Knitking carr L	Singer/Studio carr L
Basic Tuck Jacquard **2 rows pattern = 4 rows backing**	Type A N / AX ← Deco 4	Type A - Norwegian jacquard Type C1 - EOR ⌒ / ∧ RC2 ea col claw	Type B - ER Type C1 - EOR Type C2 - EOR tuck ↔ / N N RC2 ea col	Type B - ER Type C1 - EOR Type C2 - EOR △ tuck △ / 1 1 RC2 ea col
Basic Tuck Jacquard Var: Fisherman's Rib **2 rows pattern = 2 rows backing**	Type A AX ← WP or RP / AX ← Deco 4	Type C1 - EOR RC2 col 1 ⌒ / ⌒ ; RC2 col 2 ⌒ / ∧	Type C1 - EOR Type C2 - ER RC2 col 1 tuck ↔ / tuck ↔ ; RC2 col 2 tuck ↔ / N tuck N	Type C1 - EOR Type C2 - ER RC2 col 1 △ tuck △ / o ∩ o ; RC2 col 2 △ tuck △ / 1 ∩ 1



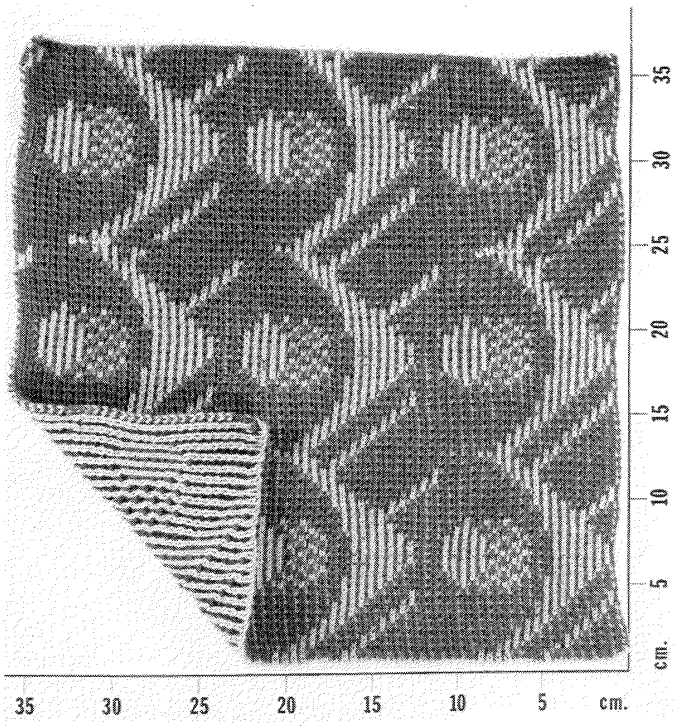
Basic tuck jacquard. Extra needle on backing bed.

Skechers EX1027
Skechers v Nike



Basic tuck jacquard. Design: jacquard Pattern 4. MB: knit/tuck. Second bed: knit. The fabric is knitted like basic striper backing, except the MB cam is set for tuck instead of slip. The backing will be nopped, with the nopps varying in size, depending on the design. The stitches on the face separate into vertical ribs, with each stitch outlined by the other color (grin-through). This is characteristic of all jacquard fabrics with tucking on the main bed. Note that the face stitches are in perfect vertical alignment, with no diagonal pull, because the backing is knitted plain. This fabric should be knitted with 2 knit rows per patt row, as there will be vertical condensing of the pattern. Fabric balance: 2 patt rows knitted with same selection = 4 backing rows.

Variations (not shown). Design: jacquard Pattern 4. Tucked jacquard can be made with smaller, smooth nopps on the backing by alternating a plain knitted row with a plain tucked row on the backing.



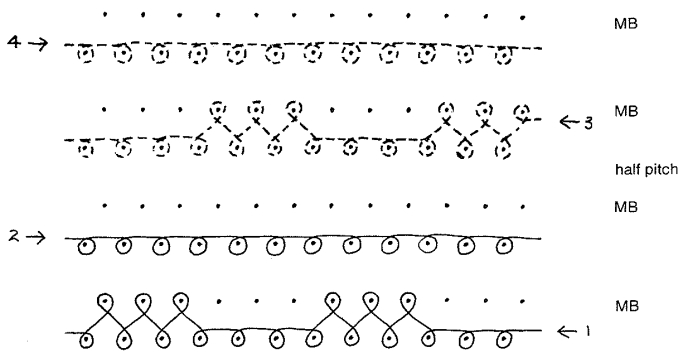
In the swatch above, if 2 plain knitted rows in col 1 are alternated with 2 plain tucked rows in col 2 on the backing, the design will knit in fisherman's rib while the background will be a flattened tuck rib. The backing will be solid, in col 1.

Skechers EX1027
Skechers v Nike

FABRICS WITH EXTRA BACKING ROWS

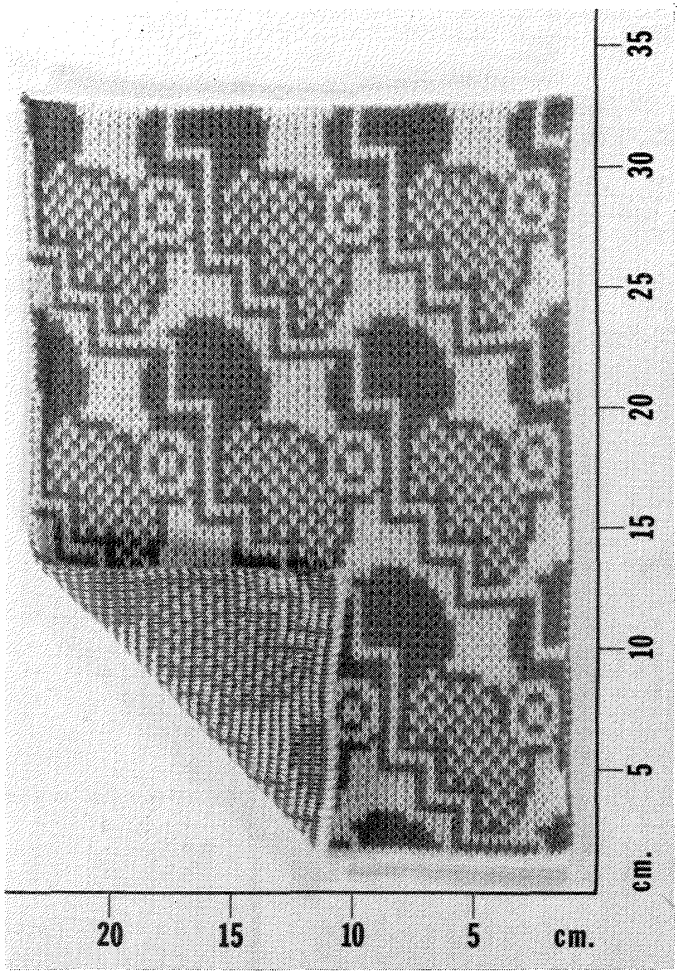
To add body to a fabric made with fine yarn, an extra row can be knitted every other row with each color on the second bed only. Both design and backing are knitted for the first row with color 1, then the second bed knits alone for the second row with color 1. These two rows are then repeated for the second color. Each pattern row on the face will be only one knitted row. When done in one color, this technique is known as *Long Stitch,* because the stitches on the fabric face are stretched lengthwise. It is often used for embossed designs.

	Passap carr R	**Superba** carr L	**Brother/Knitking** carr L	**Singer/Studio** carr L
Half Milano **1 row pattern = 4 rows backing**	Type A N / HX ← Deco 4 RC2 ea col	Type C1 - EOR o / ∧ No R cursor stop. Cursor at carr R only. RC2 ea col See also Superba Specials claw	Type C1 - EOR Type C2 - ER part ↔ / N N RC2 ea col. Push selected ndls to B pos MB EOR, or make a card as C with a blank row between each punched row.	Type C1 - EOR Type C2 - ER o slip △ / 1 1 RC2 ea col
Half Milano **Var: Tucked** **1 row pattern = 4 rows backing**	Type A N / DX ← Deco 4 RC2 ea col	Type C1 - EOR RC1 ⌒ / ∧ ; RC1 o / ∧ No R cursor stop. Cursor at carr R only. RC2 ea col. claw	Type C1 - EOR Type C2 - ER ← part/tuck → / N N RC2 ea col. Follow instruction for Half Milano.	Type C1 - EOR Type C2 - ER o tuck △ / 1 1 RC2 ea col

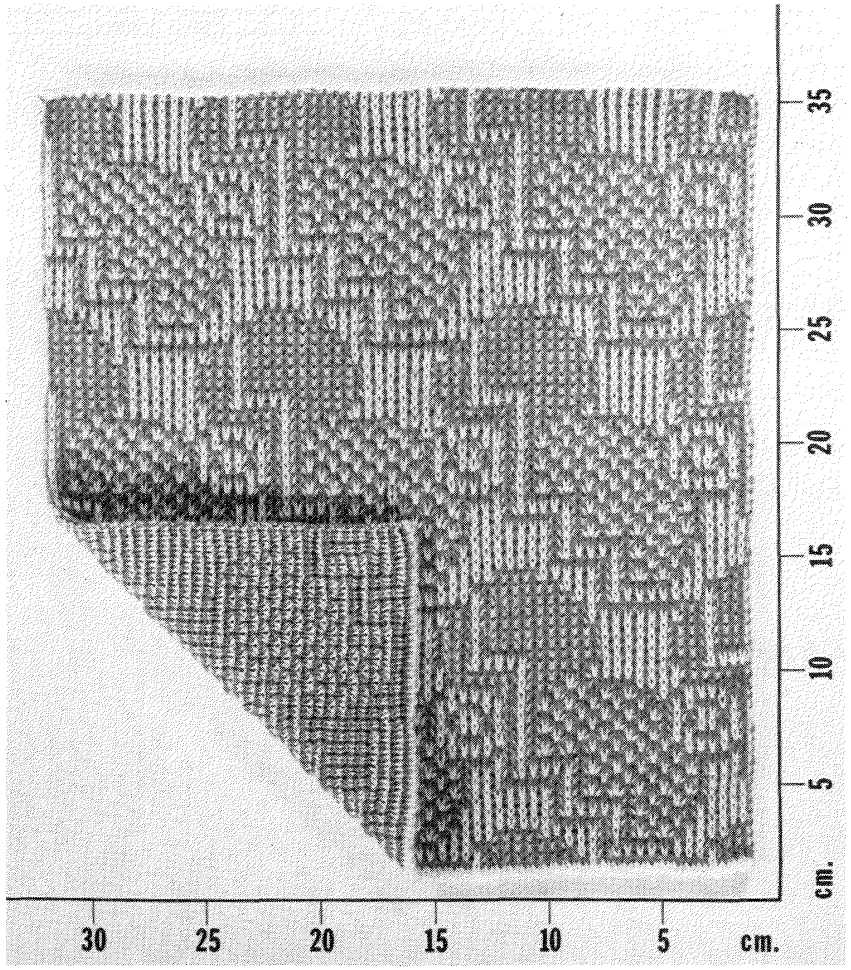


Half Milano.

Skechers EX1027
Skechers v Nike



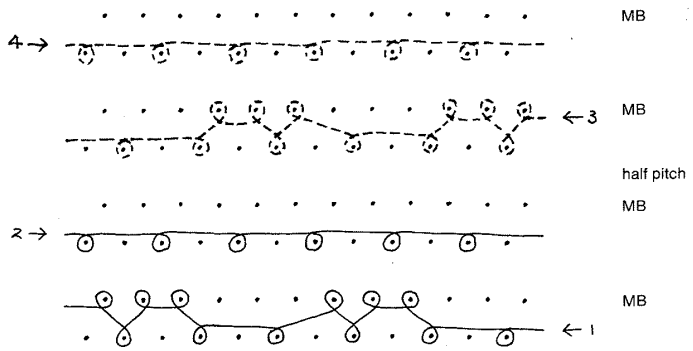
Half Milano. Design: jacquard Pattern 11. MB: knit/slip 1 row, slip all stitches 1 row. Second bed: knit all rows. The backing resembles striper backing, with 2 horizontal rows in each color, but its stitches will vary in size, causing the design in the face to be shadowed on the backing, as shown. Fabric balance: 1 patt row = 4 backing rows.



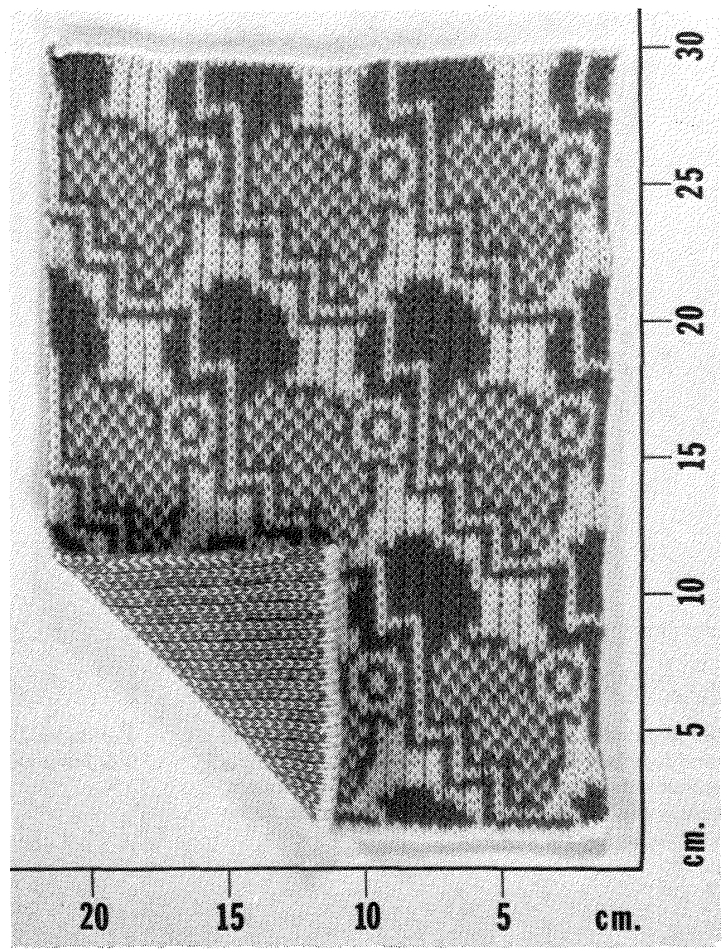
Variations. Design: jacquard Pattern 11. Half Milano can be knitted as knit/tuck on the MB. The fabric will be similar to basic tuck, but firmer.

Skechers EX1027
Skechers v Nike

	Passap carr R	Superba carr L	Brother/Knitking carr L	Singer/Studio carr L
Half Pique **1 row pattern = 2 rows backing**	Type A BX ↔ push 1x1 WP/RP HX ← Deco 4 *RC2 ea col*	Type C1 - EOR o lili o lili Even # ndls FB. No R cursor stop. Cursor at carr R only. RC2 ea col. claw	Type C1 - EOR Type C2 - ER part ↔ lili part ↔ lili RC2 ea col. Follow instructions for Half Milano. Even # ndls ribber.	Type C1 - EOR Type C2 - ER o slip △ o ← o RC2 ea col. On ribber, select odd ndls, then even ndls ER.



Half pique.



Half pique. Design: jacquard pattern 11. MB: knit/slip 1 row, slip all stitches 1 row. Second bed: knit/slip 1x1 all rows. Backing resembles bird's-eye but is closer to a tiny, perfect check. Face is divided into ribs, each 2 sts wide. Fabric balance: 1 patt row = 2 backing rows.

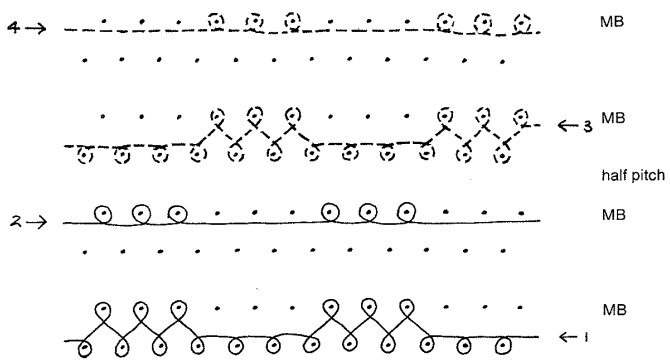
Variations: half pique. Design: jacquard Pattern 11. Vertical stripes will occur on the backing if 1x1 selection is alternated EOR instead of ER.

Skechers EX1027
Skechers v Nike

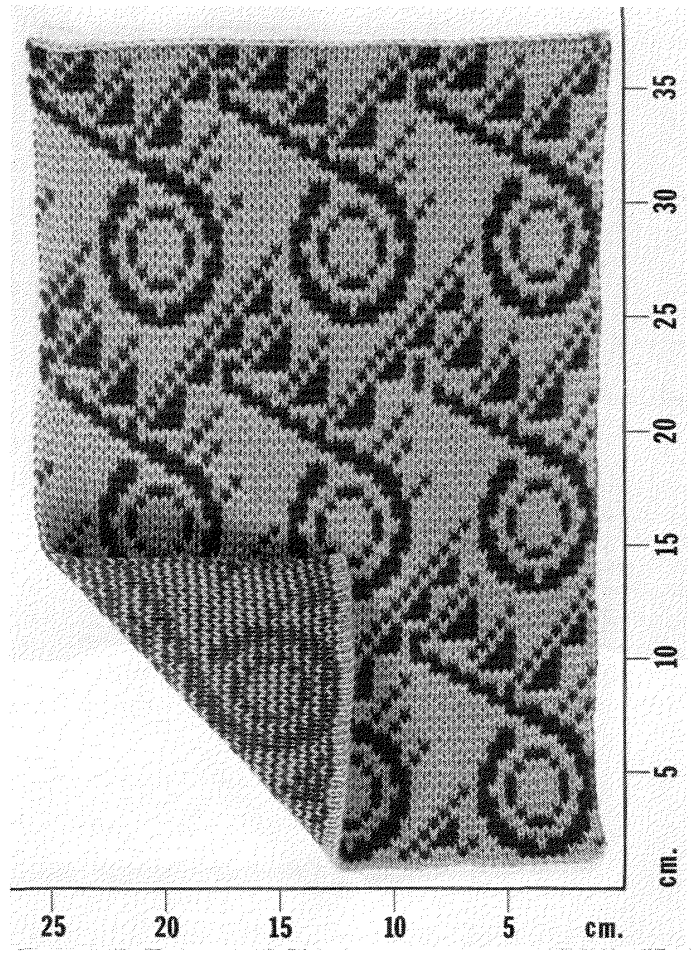
FABRICS WITH EXTRA PATTERN ROWS

Here we have the reverse of the above technique. One backing row is left out of the knitting every other row. This technique reduces the bulk created when heavier yarns are used for rib jacquard knitting. The fabric falls into the "weft knit" category, but is not a true weft knit fabric, since only *alternate* pattern rows have floats. In a true weft knit all the pattern rows have floats enclosed within the rib created by the backing. Because of the enclosed floats, weft knit fabrics have comparatively less stretch across the width.

	Passap carr R	Superba carr L	Brother/Knitking carr L	Singer/Studio carr L
Modified Weft Striper Backing **2 rows pattern = 2 rows backing**	Type A CX / BX ← Deco 4 RC2 ea col	Type C1 - EOR o / ↻ RC2 ea col See also Superba Specials claw	Type C1 - EOR Type C2 - ER part ↔ / part N RC2 ea col	Type C1 - EOR Type C2 - ER △ slip △ / o ← 1 RC2 ea col



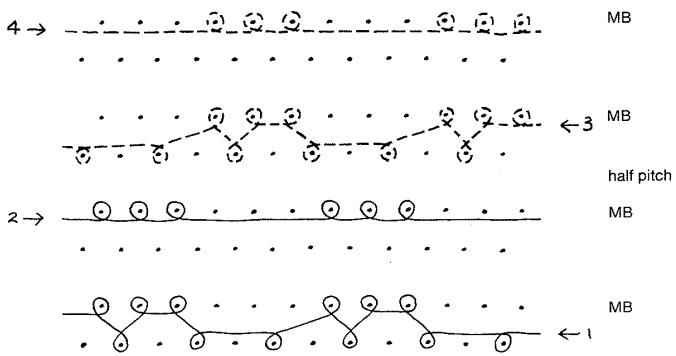
Modified weft with striper backing.



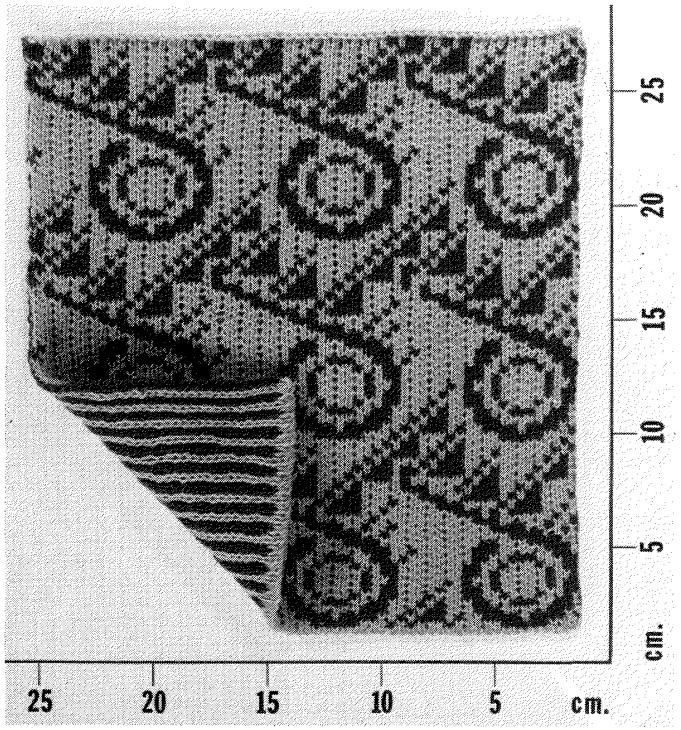
Modified weft with striper backing. Design: jacquard Pattern 12. MB: knit/slip all rows. Second bed: knit 1 row, slip all stitches 1 row. Horizontal stripes on the backing will have only 1 row of each color, as alternating backing rows are omitted. Fabric balance: 2 patt rows = 2 backing rows.

Skechers EX1027
Skechers v Nike

	Passap carr R	Superba carr L	Brother/Knitking carr L	Singer/Studio carr L
Modified Weft Vertical Stripe Backing **2 rows pattern = 1 row backing**	Type A HX ← push 1x1 WP/RP BX ← Deco 4 RC2 ea col	Type C1 - EOR o o RC2 ea col. On FB, select odd ndls, RC1; no selection, RC1; select even ndls, RC1; no selection, RC1. claw	Type C1 - EOR Type C2 - ER part ↔ part ↔ RC2 ea col. On ribber, select odd ndls, RC1; no selection, RC1; select even ndls, RC1; no selection, RC1.	Type C1 - EOR Type C2 - ER △ slip △ o ← o RC2 ea col. On ribber, select odd ndls, RC1; no selection, RC1; select even ndls, RC1; no selection, RC1.



Modified weft with vertically striped backing.



Modified weft with vertically striped backing. Design: jacquard Pattern 12. MB: knit/slip all rows. Second bed: 1x1 knit/slip 1 row, slip all stitches 1 row. Bird's-eye backing always becomes vertical stripes in this fabric, since alternating 1x1 selection knitted EOR causes the 2 colors to always knit on the same needles. Fabric balance: 2 patt rows = 1 row backing.

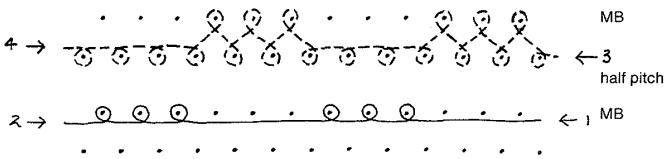
Variations (not shown). Vertically striped backing can be made knit/tuck instead of knit/slip. Texture of the face (ribs, 2 sts wide) remains unchanged, but the fabric is wider.

Skechers EX1027
Skechers v Nike

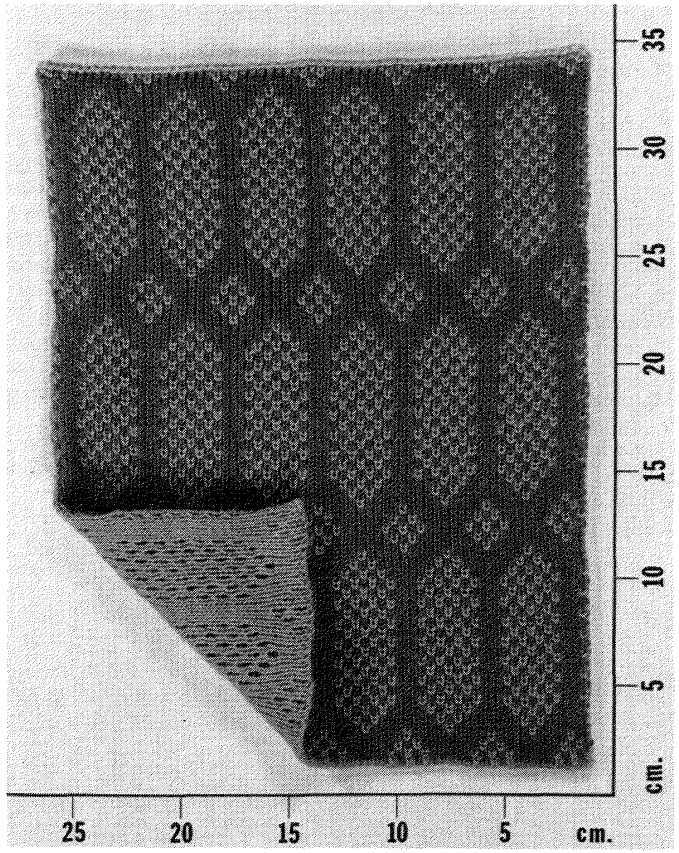
BLISTER FABRIC

Like the modified weft fabrics above, blister fabrics are weft knits with comparatively less stretch in the width. In a two-color blister fabric, color 1 knits selected needles on the main bed only, forming floats across the slipped needles. Color 2 knits both the second bed and the rest of the needles on the main bed. All color 1 floats will be enclosed within the rib of color 2. As a result, the pattern stitches on the main bed, in color 1, are separated from the backing, forming "blisters." The backing will be solid, in color 2.

	Passap carr R	Superba carr L	Brother/Knitking carr L	Singer/Studio carr L
Flat or Single Blister **2 rows pattern = 2 rows backing**	Type A BX ← push WP / BX ← Deco 4 RC2 ea col	Type C1 - EOR RC2 col 1 o ; / o RC2 col 2 o / ∧ claw See also Superba Specials	Type C1 - EOR Type C2 - ER RC2 col 1 part ↔ ; / part ↔ RC2 col 2 part ↔ / N N	Type C1 - EOR Type C2 - ER RC2 col 1 △ slip △ ; / o ← o RC2 col 2 △ slip △ / 1 ← 1



Flat or single blister. Extra needle on backing bed.



Flat or single blister. Design: jacquard Pattern 1. MB: knit/slip all rows. Second bed: slip all rows in col 1, knit all rows in col 2. In flat blister, 2 rows are knitted in each color on the MB so both design and background have the same number of rows. Notice that their stitch texture is different, as the blister color is in stockinette and the background color in rib. Fabric balance: 2 patt rows = 2 backing rows.

Variations: See the Blister Jacquard chapter for other ways to knit blister fabrics.

Skechers EX1027
Skechers v Nike

RIB JACQUARD IN TUCK/PLAIN AND TUCK/SLIP COMBINATIONS

Surprising effects can be achieved by combining tucking and slipping, either on alternate rows or on opposite beds. Only a few examples are given here. We expect that by now you have begun to realize the many possibilities of jacquard knitting and will want to create combinations of your own.

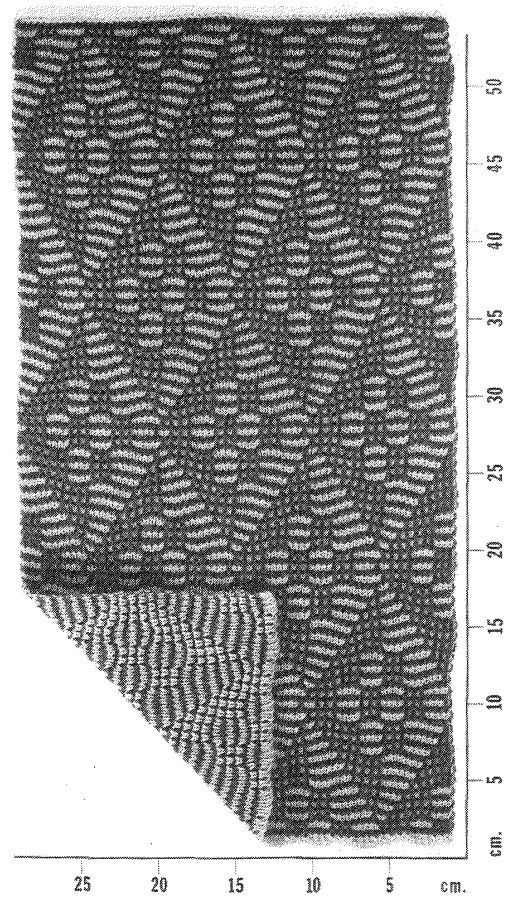
When you experiment, the following reminders about double bed tuck knitting should help you overcome obstacles that may occur:

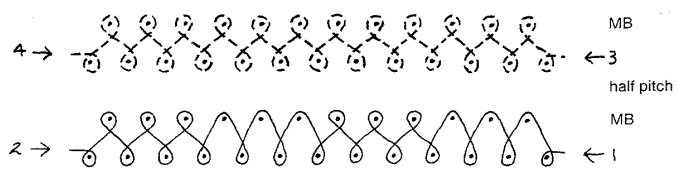
Tucking on the main bed should always be coupled with either all needles knitting or all needles tucking, or a combination of both, on the second bed. The cam must never be set for slip on the second bed. Since jacquard selection will cause some *adjacent* main bed needles to tuck, the needles opposite them on the second bed must either knit or tuck so the main bed needles that are tucking can retain their loops.

For the same reason, in cases where the main bed is slipping and the second bed tucking, every needle that tucks must have an adjacent needle knitting to hold the loops in place. Since the main bed is knitting and slipping in jacquard, the second bed must be in a 1x1 selection for tucking. This rule can be ignored occasionally if you use 2x1 or 2x2 selection on the second bed (two adjacent needles tucking alternating with one or two needles knitting). Make a careful adjustment in the SS and use extra weights.

	Passap carr R	Superba carr L	Brother/Knitking carr L	Singer/Studio carr L
Tuck/Plain Combination (Striped Tuck)	Type A RC2 col 1 N / AX ← or o ; RC2 col 2 N / N Deco 4	Type C1 - EOR or Type A - stop card; next patt row every RC4 RC2 col 1 ⌒ / ∧ ; RC2 col 2 ∧ / ∧ claw	Type C1 - EOR Type C2 - ER Type A - EOR RC2, stop - RC2 RC2 col 1 tuck ↔ / N N ; RC2 col 2 plain / N N	Type C1 - EOR Type C2 - ER Type A - EOR RC2, stop - RC2 RC2 col 1 △ tuck △ / 1 1 ; RC2 col 2 △ stock △ / 1 1

Tuck stitch and plain knitting in alternating colors (striped tuck). Design: jacquard Pattern 5. MB: knit/tuck col 1, knit all sts col 2. Second bed: knit all rows. In this jacquard fabric, col 1 knits the design in a knit/tuck needle selection, while col 2 knits all needles in plain rib. As there is no needle selection on the MB for col 2, these rows on the punchcard are skipped or knitted plain, without selection. On Japanese machines, punchcard Type A can be used. The design appears as a typical tuck jacquard, with vertical ribs in col 2 outlined by the tucks of col 1. The background, however, will be in horizontal stripes of both colors, 2 rows each color, to contrast with the vertical striping of the tucked design. Backing will be a combination of nopps and stripes.
Variation: See Embossed Nopps in the Ripple chapter for another fabric based on this same principle.

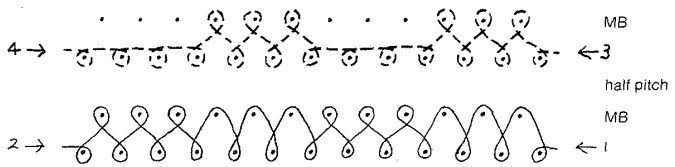




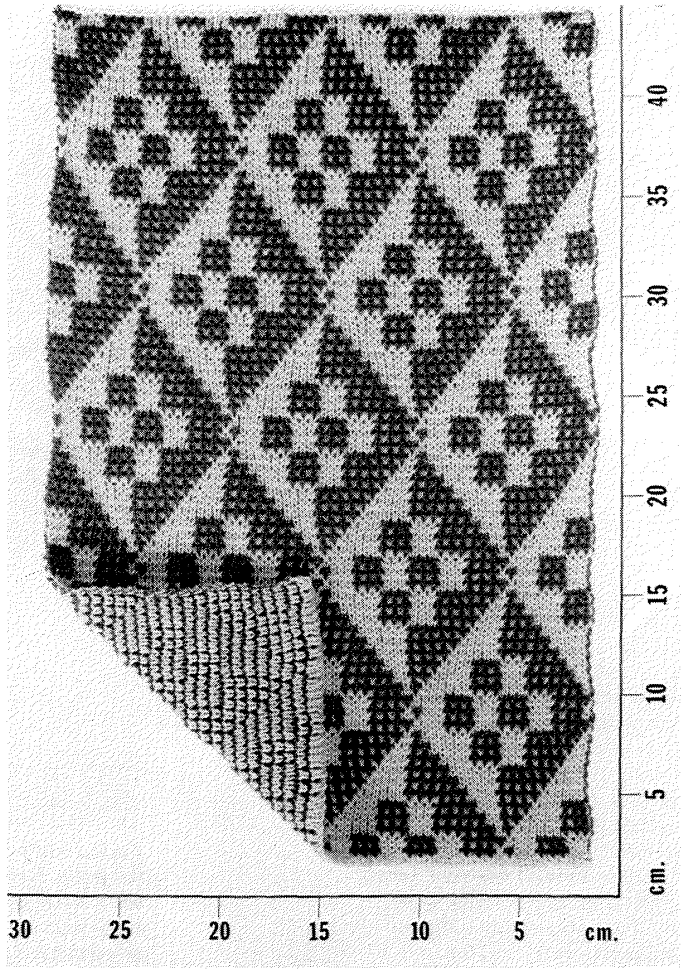
Tuck stitch and plain knitting in alternating colors (striped tuck). Extra needle on backing bed.

Skechers EX1027
Skechers v Nike

	Passap carr R	Superba carr L	Brother/Knitking carr L	Singer/Studio carr L
Tuck/Slip Combination	Type A RC2 col 1 N / AX ← ; RC2 col 2 N / BX ← Deco 4	Type C1 - EOR RC2 col 1 ⌒ / ∧ ; RC2 col 2 o / ∧ claw	Type C1 - EOR Type C2 - ER RC2 col 1 tuck ↔ / N N ; RC2 col 2 part ↔ / N N	Type C1 - EOR Type C2 - ER RC2 col 1 △ tuck △ / 1 1 ; RC2 col 2 △ slip △ / 1 1



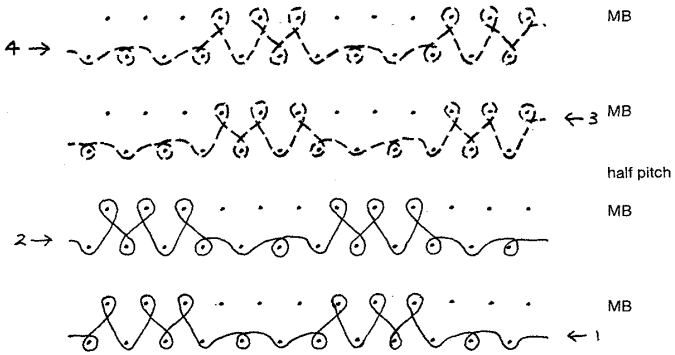
Tuck stitch and slip stitch in alternating colors. Extra needle on backing bed.



Tuck stitch and slip stitch in alternating colors. Design: jacquard Pattern 5. MB: knit/tuck col 1, knit/slip col 2. Second bed: knit all rows. The appearance and texture of this fabric are much like the striped tuck fabric, except the horizontal stripes are eliminated on the background of the design. Needle selection for MB occurs with both colors, with cams set for slip with one color and tuck for the other color. Either slip or tuck can be knitted first.

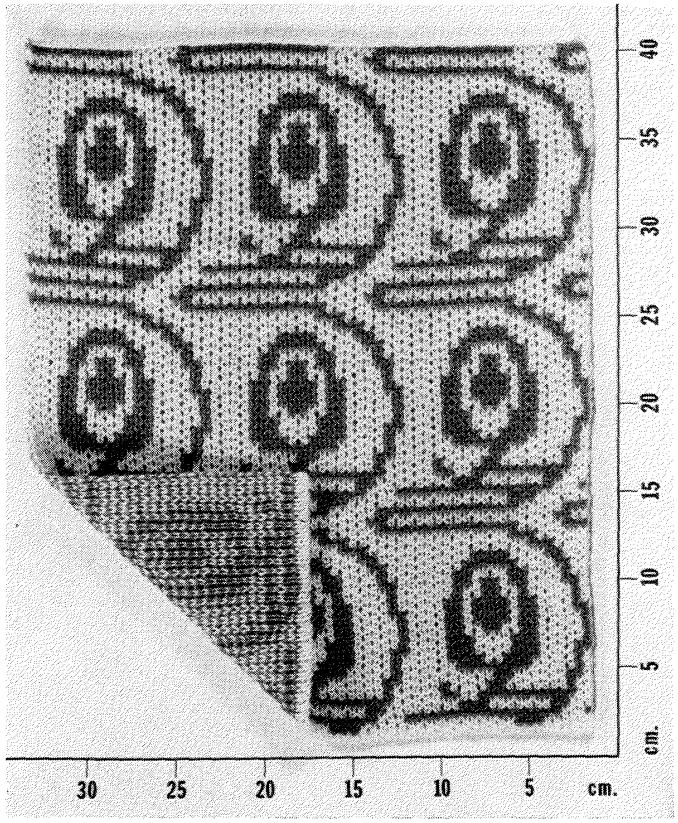
Skechers EX1027
Skechers v Nike

	Passap carr R	Superba carr L	Brother/Knitking carr L	Singer/Studio carr L
Tucked Bird's-eye	Type A AX ↔ push 1x1 WP/RP BX ← Deco 4 RC2 ea col	Type A - Norwegian jacquard Type C1 - EOR o lili ⌒ lili RC2 ea col, Even # ndls FB. claw See also Superba Specials	Type B - ER Type C1 - EOR Type C2 - ER part ↔ lili tuck ↔ lili RC2 ea col. Even # ndls ribber.	Type B - ER Type C1 - EOR Type C2 - ER △ slip △ o ⌒ o RC2 ea col. On ribber, select odd ndls, then even ndls, ER.



Slip stitch and tuck stitch on opposite beds (tucked bird's-eye).

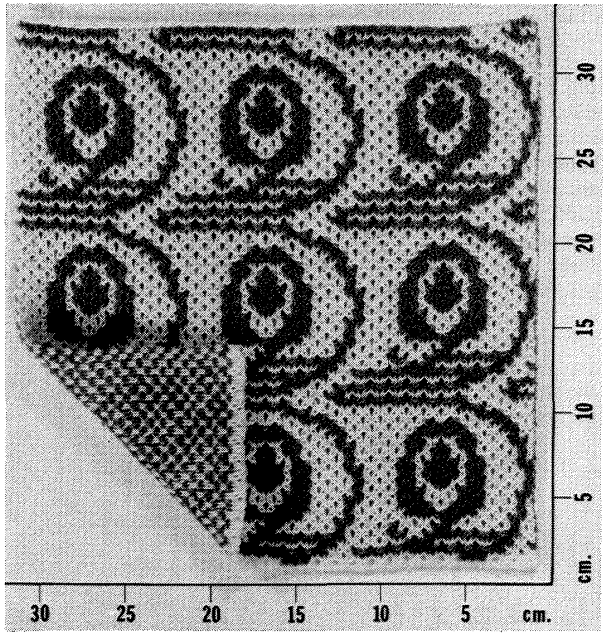
The swatches on these two pages were made with slip stitch on MB and tuck stitch on second bed. Design: jacquard Pattern 10. MB: knit/slip. Second bed: knit/tuck 1x1, 2x1, etc. All fabrics in this group require needle selection on second bed—1x1, 2x2, 1x2—all of which will cause stitches on the MB to divide into various kinds of ribs. The MB knits with a knit/slip cam setting for all fabrics in this group. By using a knit/tuck cam setting on the second bed, a variety of textured ribs can be designed on the face, from wide, straight ribs to narrow, wavy ribs, to nopps. Many will have textured backings as well. Remember, the finer the yarn, the more tuck loops each backing needle can hold.



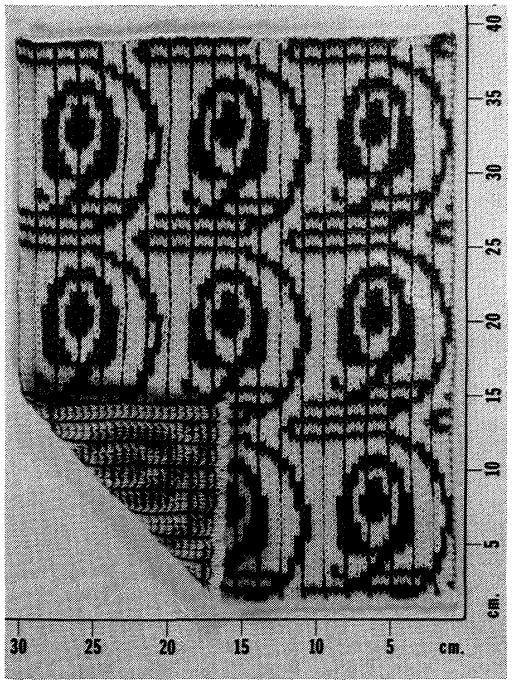
Tucked bird's-eye. Design: jacquard Pattern 10. This is the basic fabric in this group. It resembles regular bird's-eye backing, but the fabric is wider and has a softer texture. Backing needles alternate in 1x1 knit/tuck selection every row; the face is made knit/slip as in regular bird's-eye. The best proportion is 2 knitted rows per patt row.

Skechers EX1027
Skechers v Nike

Variations. Design: jacquard Pattern 10. MB: knit/slip. Second bed: knit/tuck 1x1, 2x2, 2x1. All variations are made on the second bed only, by changing needle selection and number of rows knitted with each selection before alternating. The best proportion is 2 knitted rows per patt row.

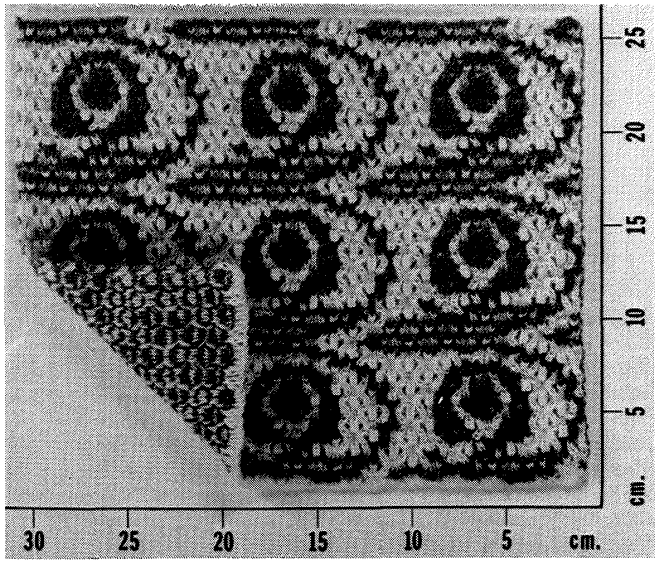


Checked backing with 1x1 needle selection alternating every 4 rows. The face is a wavy rib. Design: jacquard Pattern 10.



Ribbed fabric face created by 2x1 selection (2 knit, 1 tuck) on backing. Design: jacquard Pattern 10. Selection does not alternate, but is maintained throughout. On every 4th row (the last row of col 2) the cam on the second bed is set for plain knitting to knit off the loops.

Nopped fabric face created by 2x2 selection on backing, with 8 consecutive rows each selection. Design: jacquard Pattern 10.

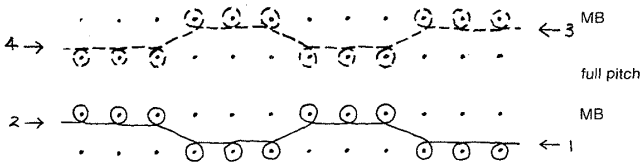


Skechers EX1027
Skechers v Nike

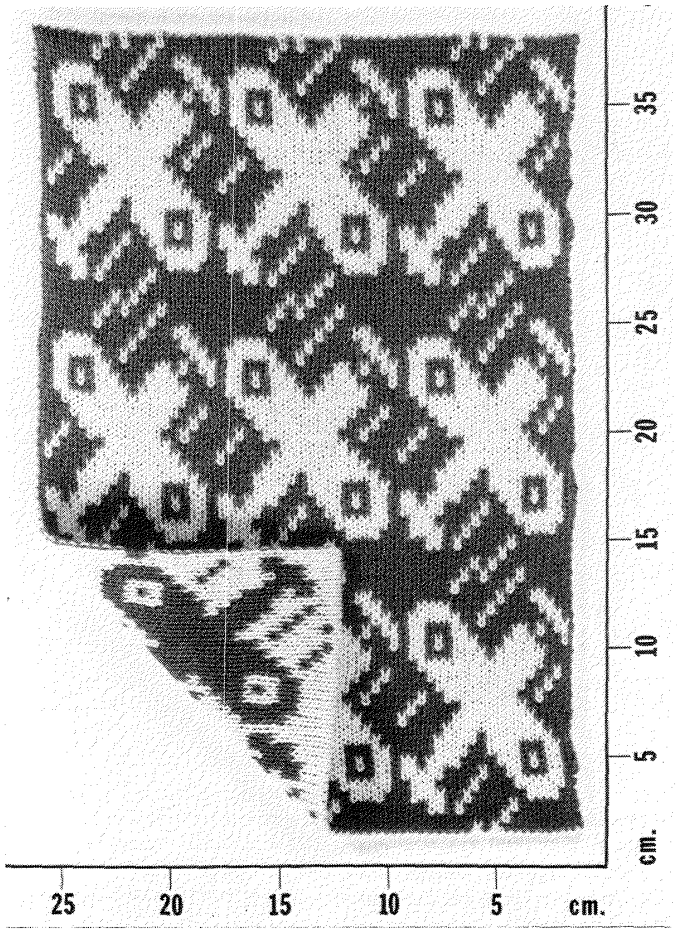
REVERSIBLE JACQUARD FABRICS

To make a jacquard fabric with two "right" sides and with the design back to back, the same needle selection for the jacquard pattern must occur on both beds simultaneously. The punchcard in the pattern reader will select the needles for the main bed as usual, and a Jac 40, pattern ruler, or manual selection can be used to select needles for the same pattern on the second bed. Or, you can use one card and a Jac for both beds. When a knit/slip cam setting is used, it is possible to knit both faces of the fabric with the design and background colors exactly the same or exactly reversed. With a knit/tuck setting, the colors must always be reversed, although the fabric texture can be the same or reversed. In all cases, the stitch and row gauges on both beds must be the same.

	Passap carr R	Superba carr L	Brother/Knitking carr L	Singer/Studio carr L
Eightlock (Double Jersey)	Type A BX ← Jac / BX ← Deco 4 RC2 ea col. Back bed: pushers in WP, select with Jac to RP every RC4.	Type C1 - EOR Type C1 - Jac o / o RC2 ea col. On FB, move all ndls to pos 2, select with Jac to pos 1 ER, rotate card EOR. claw	Type C1 - EOR Type C2 - ER Type C1 - Jac part ↔ / part ↔ RC2 ea col. Ribber: move all ndls to D pos, select with Jac to B pos, ER, with rotation EOR.	Type C1 - EOR Type C2 - ER Type C1 - Jac △ slip △ / o ← o RC2 ea col. Ribber: move all ndls to C pos, select with Jac to B pos ER, with rotation EOR.



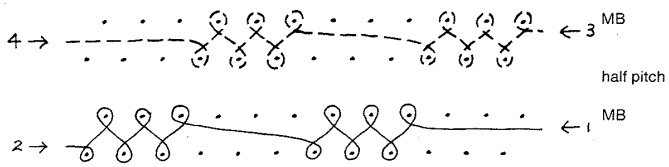
Eight-lock or double jersey.



Eight-lock or double jersey. Design: jacquard Pattern 8. Both beds: knit/slip. Colors are reversed on each face. Opposite needles are selected on each bed. This fabric is really two jersey jacquard fabrics, one knitted on each bed, interlocked only at the points where the design/background colors change. There are no floats within the fabric. Col 1 knits the design on one bed and the background on the other bed at the same time, while col 2 knits just the reverse. To accomplish this reversal, design needles are selected on one bed along with the background needles for the same pattern row on the other bed to knit with col 1, then the selection is exactly reversed for col 2. Beds are set at full pitch. You'll find more on eight-lock in Chapter 5.

Skechers EX1027
Skechers v Nike

	Passap carr R	Superba carr L	Brother/Knitking carr L	Singer/Studio carr L
Reversible Weft	Type A BX ← Jac / BX ← Deco 4 RC2 ea col. Back bed: pushers in RP, select with Jac to WP every RC4.	Type C1 - EOR Type C1 - Jac o / o RC2 ea col. On FB, select ndls with Jac to pos 2 ER, rotate card EOR. claw	Type C1 - EOR Type C2 - ER Type C1 - Jac part ↔ / part ↔ RC2 ea col. Ribber: select ndls with Jac to D pos ER, with rotation EOR.	Type C1 - EOR Type C2 - ER Type C1 - Jac △ slip △ / o ← o RC2 ea col. Ribber: select ndls with Jac to C pos ER, with rotation EOR.

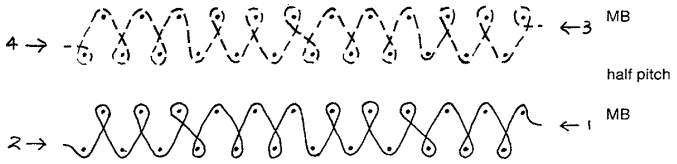


Reversible weft.

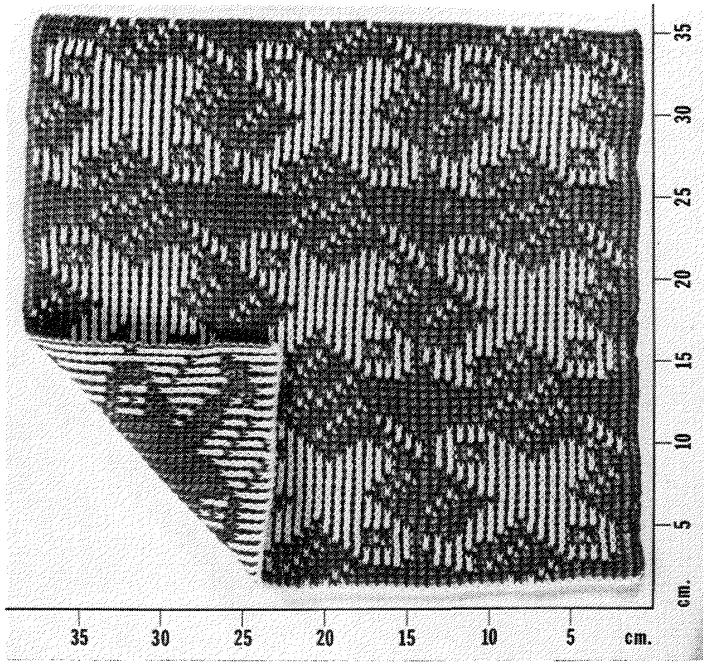
Reversible weft. Design: jacquard Pattern 8. Both beds: knit/slip. Colors the same on each face; same needles are selected on both beds. Since the same needles are selected on both beds for both design and background colors, both sides of the fabric will be exactly alike; there will be no color reversal. Each color will have floats, enclosed by the knit stitches of the opposite color. As with all weft knit fabrics, this one has less stretch across the width. Note the method of needle selection used here is exactly the opposite that used in eight-lock. Beds are set at half pitch. Put an extra needle in WP on one bed on the side opposite the color changer and hook the weft yarn around it each time the carriage passes it, to carry the weft completely across the fabric.

Skechers EX1027
Skechers v Nike

	Passap carr R	Superba carr L	Brother/Knitking carr L	Singer/Studio carr L
Reversible Tuck	Type A AX ← Jac / AX ← Deco 4 Knit same as Eightlock	Type C1 - EOR Type C1 - Jac Knit same as Eightlock claw	Type C1 - EOR Type C2 - ER Type C1 - Jac tuck ↔ / tuck ↔ Knit same as Eightlock	Type C1 - EOR Type C2 - ER Type C1 - Jac △ tuck △ / o ∩ o Knit same as Eightlock



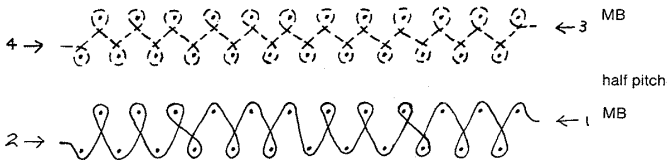
Reversible tuck.



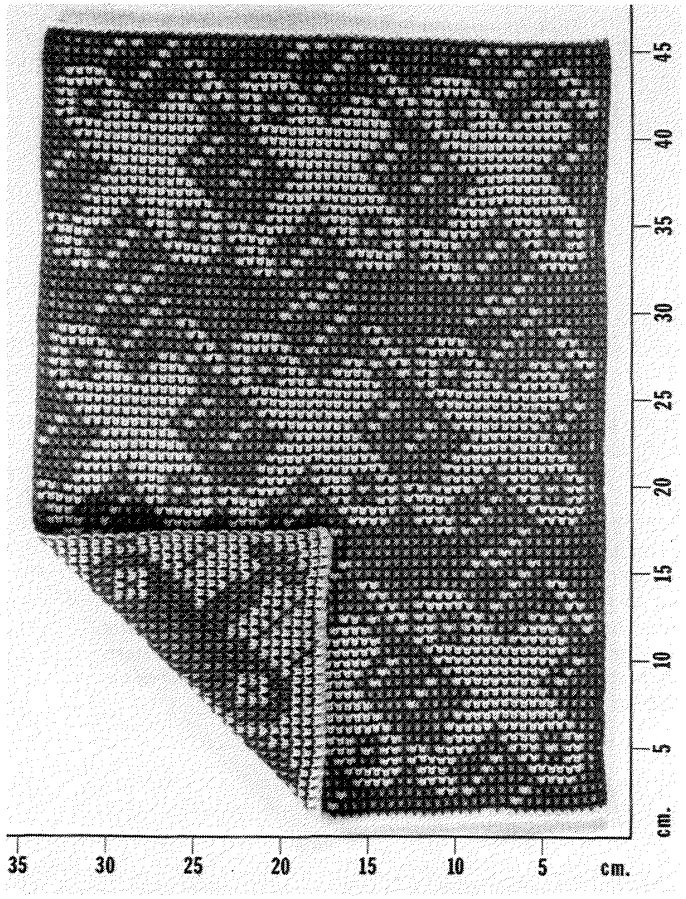
Reversible tuck. Design: jacquard Pattern 8. Both beds: knit/tuck. Colors reversed each face. Opposite needles selected on each bed. This fabric has the appearance and texture of basic tuck on both sides of the fabric, with colors reversed. The technique is the same as for eight-lock, but with beds at half pitch and cams set to tuck.

Skechers EX1027
Skechers v Nike

	Passap carr R	Superba carr L	Brother/Knitking carr L	Singer/Studio carr L
Reversible Striped Tuck	Type A RC2 col 1 AX ← or o ; / AX ← or o RC2 col 2 N Jac / N Deco 4 RC2 ea col. Back bed: pushers in WP, select with Jac to RP every RC4.	Type C1 - EOR Type C1 - Jac or Type A - stop card; next patt row every RC4 Type A - Jac RC2 col 1 ⌒ ; / ⌒ RC2 col 2 ∧ / ∧ FB: move all ndls to pos 2, select with Jac to pos 1, ER, with col 1 only. claw	Type C1 - EOR Type C2 - ER Type A - EOR RC2, stop RC2 Type A - Jac RC2 col 1 tuck ↔ ; / tuck ↔ RC2 col 2 plain / N tuck N Ribber: move all ndls to D pos, select with Jac to B pos, ER, with col 1 only.	Type C1 - EOR Type C2 - ER Type A - EOR RC2, stop RC2 Type A - Jac RC2 col 1 △ tuck △ ; / o ⌒ o RC2 col 2 △ stock △ / 1 ⌒ 1 Ribber: move all ndls to C pos, select with Jac to B pos, ER, with col 1 only.



Reversible striped tuck.

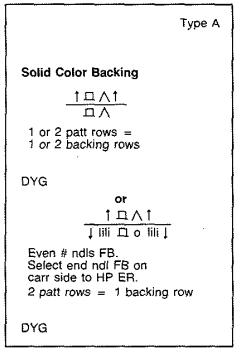


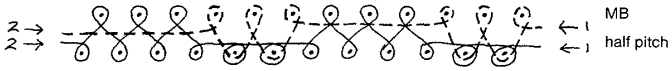
Reversible striped tuck. Design: jacquard Pattern 8. Both beds: knit/tuck, col 1; knit all sts col 2. Colors and stitch texture reversed each face. Opposite needles selected each bed. The technique for striped tuck can be used here for a fabric with both color and texture reversal, but without stripes. Needle selection occurs only with col 1—the design needles on one bed and background needles for the same pattern row on the other bed. Col 2 knits plain across all needles. The result is a nopped design against a vertically ribbed background on one side of the fabric, and a vertically ribbed design against a nopped background on the other side, with colors reversed as well.

Skechers EX1027
Skechers v Nike

SUPERBA SPECIALS: RIB JACQUARD MADE WITH DOUBLE YARN FEED

Superba machines can make all the fabrics described above, and also have the capability of using the double feed method, with the second yarn guide unit, to knit two-color jacquard fabrics. Because the backing is constructed in a different way, these fabrics are unique to Superba. There are two basic kinds of backings: plated and solid color. Techniques for making them are described below.

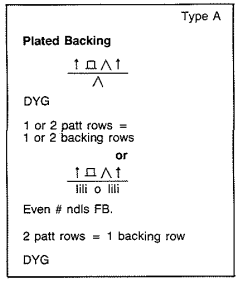


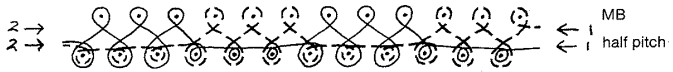


Solid color backing, for Superba only.

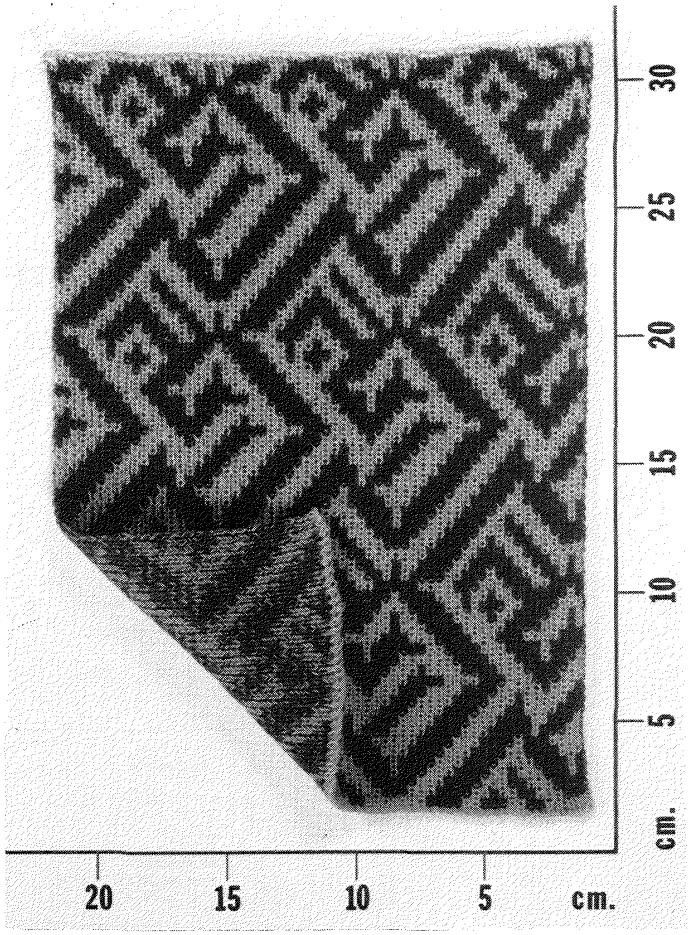
Solid color backing. Design: jacquard Pattern 3. The cam setting for the MB carr is the usual jacquard setting. When the jacquard key on the front carriage is used, col 1 in the main feeder will knit its own stitches on the MB and all the needles on the backing. Col 2, in the double yarn guide, is carried as a weft behind col 1 stitches on the MB. At the same time, it knits its own stitches on the MB and tucks on the backing needles behind the stitches it is knitting on the MB. This fabric construction causes col 2 stitches to puff out in slight relief on the face. The backing may be knitted with all needles knitting every row; fabric balance: 1 patt row = 1 backing row. The backing may be knitted with 1x1 selection on the backing; fabric balance: 2 patt rows = 1 backing row for a bird's-eye texture with slightly more relief on the face. This fabric is not recommended for patterns with long floats, as they tend to get caught in the backing needles during knitting. It knits best with heavier yarns. To ensure that both yarns are carried completely to each selvedge, set the needle return buttons on the front carriage to the lower position, and select the end ndl on the carr side to HP at the start of each row.

Skechers EX1027
Skechers v Nike



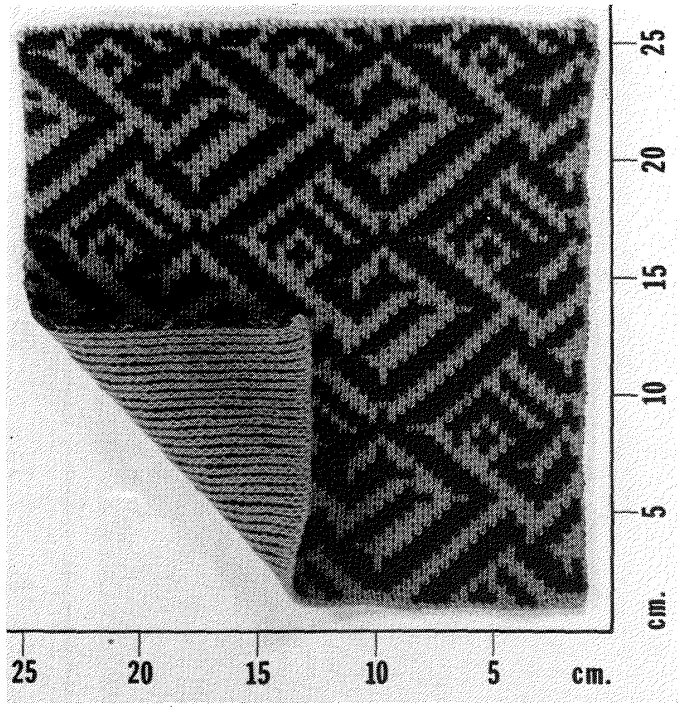


Plated backing, for Superba only.



Plated backing. Design: jacquard Pattern 3. The cam setting for the MB carr is the usual jacquard setting. The jacquard key on the front carriage is not *used. There are no wefts in this backing and the face of the fabric is smooth. Both colors knit together in a plating relationship on the backing needles on the front bed. The design on the face will be shadowed on the backing, and the SS on the backing must be large enough to accommodate both yarns. It may be knitted with all needles knitting every row on the backing, or with 1x1 selection, which will cause the face to divide slightly into vertical ribs. The fabric balance is the same as for the solid color backing. This backing must be made with finer yarns only. Both solid and plated backings can be knitted easily with either 1 or 2 knit rows per pattern row.*

Skechers EX1027
Skechers v Nike



Modified weft.

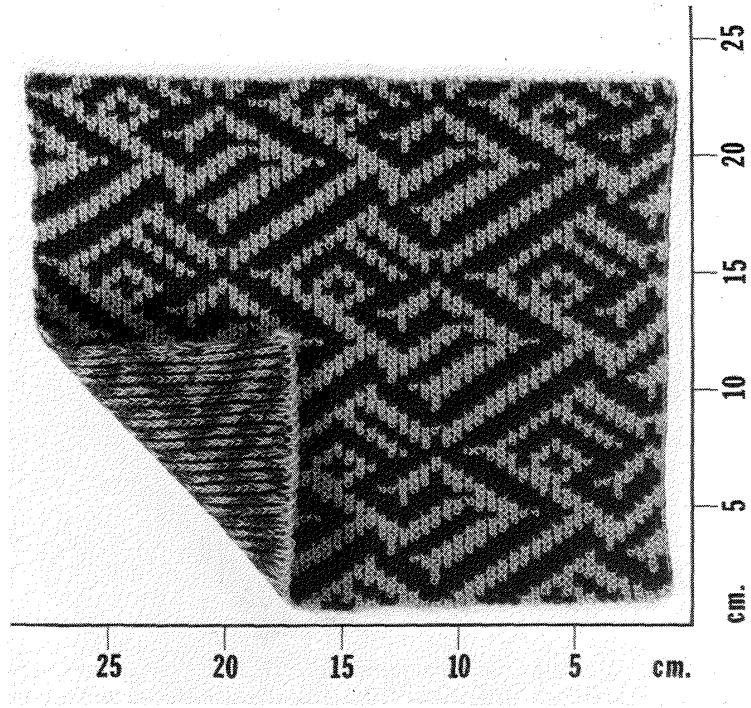
Type A

Modified Weft

Select end ndl FB on carr side to HP every row.

2 patt rows = 1 backing row

DYG



Tucked bird's-eye.

Type A

Tucked Birds-eye

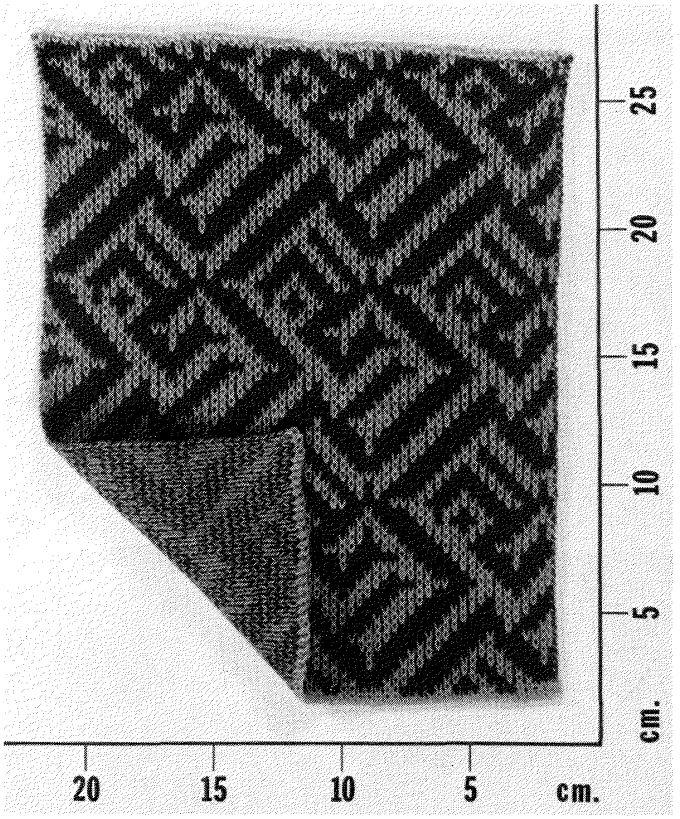
Even no ndls FB.

2 patt rows = 1 backing row

DYG

The photos on these two pages show variations for both solid color and plated backing. The usual cam setting on the MB can be varied with the tubular setting, and, coupled with the use or non-use of the right cursor stop, other fabrics similar to those already discussed can be invented. The tubular setting may be used on the second bed, incorporated into either a plated or solid backing, and the tuck setting may also be used on the second bed with 1x1 selection.

Skechers EX1027
Skechers v Nike



Half Milano.

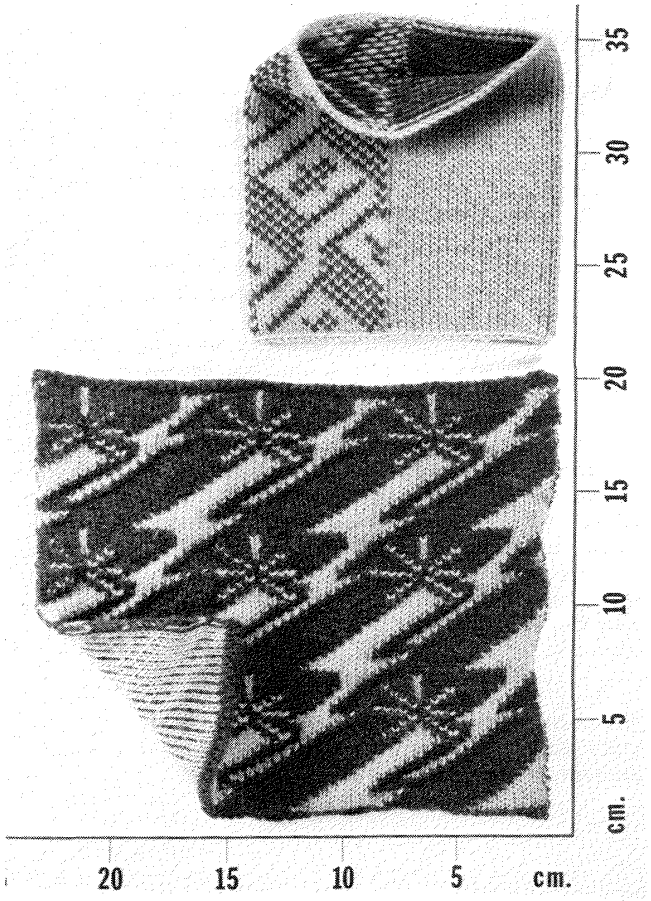
Type A

Half Milano

↑⊓⊂↑
Λ

No right cursor stop, cursor at carr R. Start carr L.
1 patt row = 2 backing rows

DYG



Top: tubular jersey jacquard. Bottom: blister jacquard.

Type A EOR	Type A EOR neg rev
Tubular Jersey Jacquard	**Blister Jacquard**
Tubular Jacquard/plated stockinette	
↑⊓⊂↑ / ↻ No R cursor stop. Cursor at carr R.	↑⊓⊂↑ / ↓⊓↻↓ Select end ndl FB on carr side to HP ER.
DYG	DYG

Skechers EX1027
Skechers v Nike

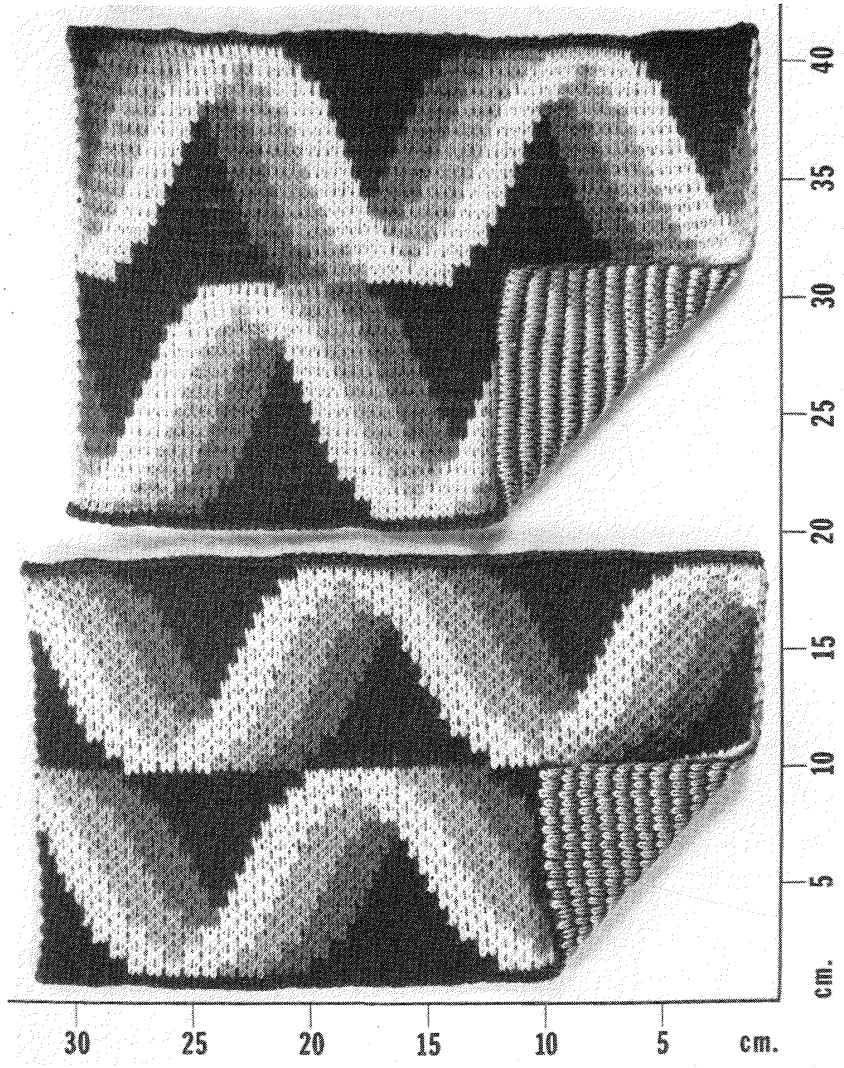
RIB JACQUARD KNITTING WITH THREE AND FOUR COLORS PER ROW

All the techniques in this chapter can be used to some extent with patterns having three or four colors per row. Keep in mind that for every additional color there will be more rows in the backing, which results in extra bulk and a thicker, tighter fabric. Some techniques, such as those for bird's-eye, flat blister and modified weft, are suitable for reducing bulk, while others, like those for basic tuck, striper, Half Milano and slip/tuck combinations, make use of the extra bulk to create heavily textured backings.

Fine yarn should be used to knit three and four colors with the tuck setting on the main bed, because some needles will have to collect up to eight or more loops before knitting off. In three- and four-color work, basic tuck and Half Milano are less suitable for the Japanese machines than modified weft and bird's-eye because they lack strippers to push the extra stitches down, but striper backing knits easily and makes a texture similar to Half Milano.

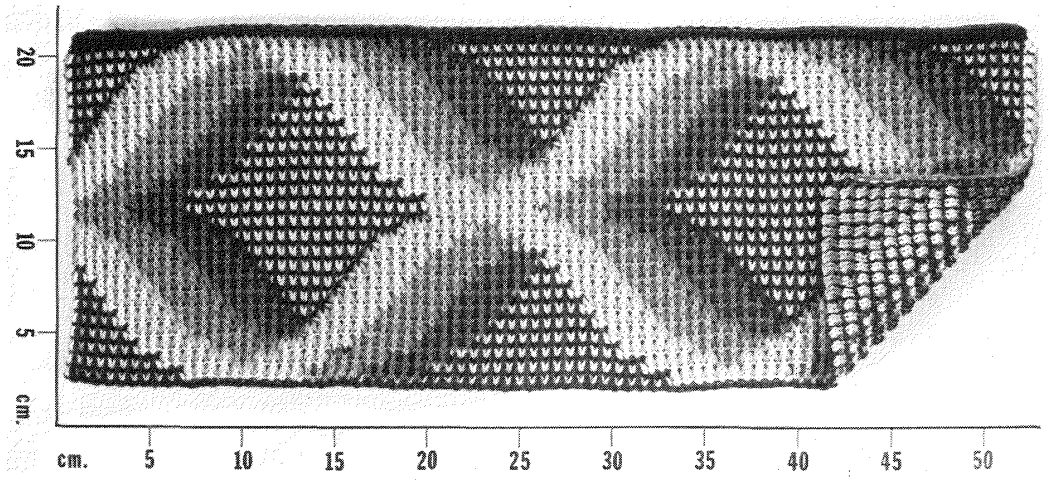
The techniques used for the swatches below are the same as their counterparts knitted in two colors. They were knitted with a Type D card set to rotate every other row.

On these three pages are examples of three-color and four-color jacquard, knitted with jacquard Patterns 13 and 14.

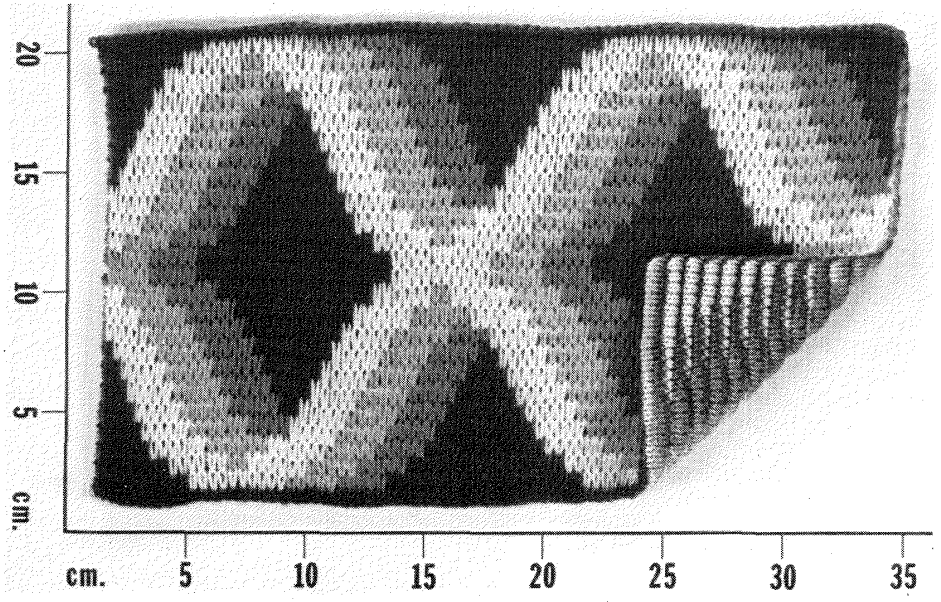


Four colors per pattern row. Design: jacquard Pattern 14. Top: striper backing. Card turned backwards for 2nd repeat. Bottom: bird's-eye backing.

Skechers EX1027
Skechers v Nike

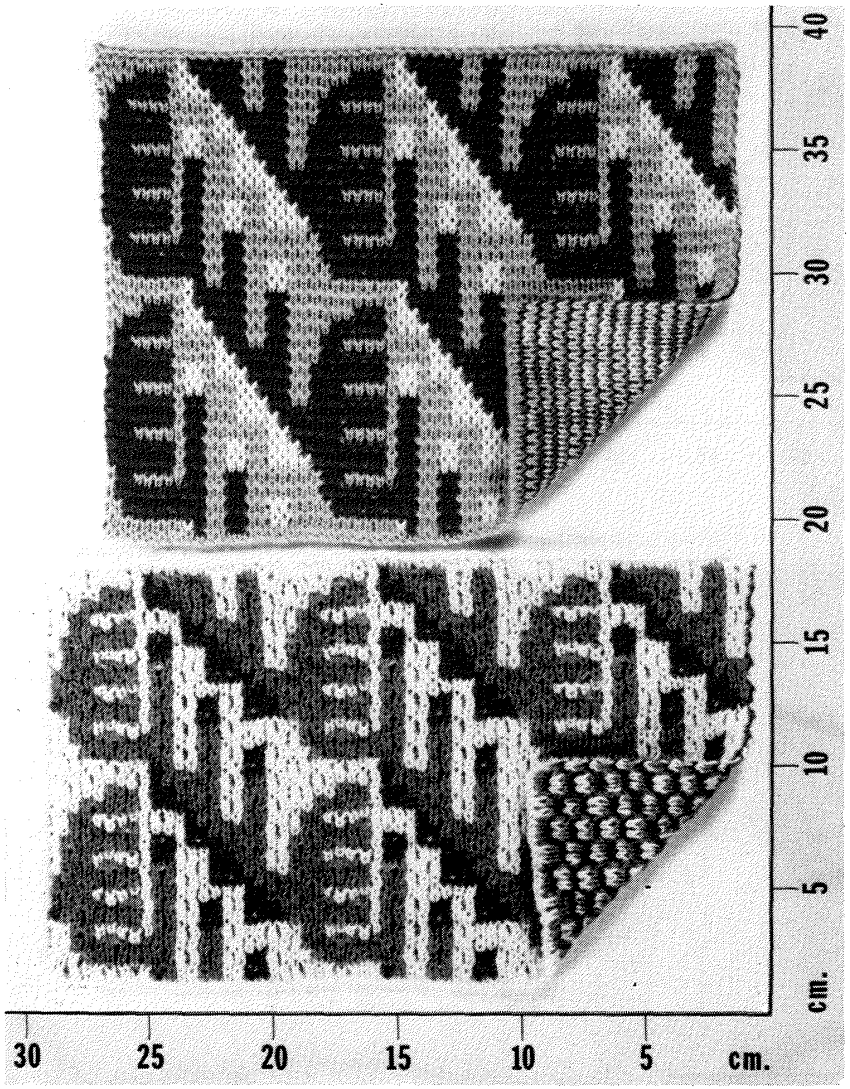


Basic tuck. Card turned upside down for 2nd repeat. Design: jacquard Pattern 14.



Half Milano. Card turned upside down for 2nd repeat.
Design: jacquard Pattern 14.

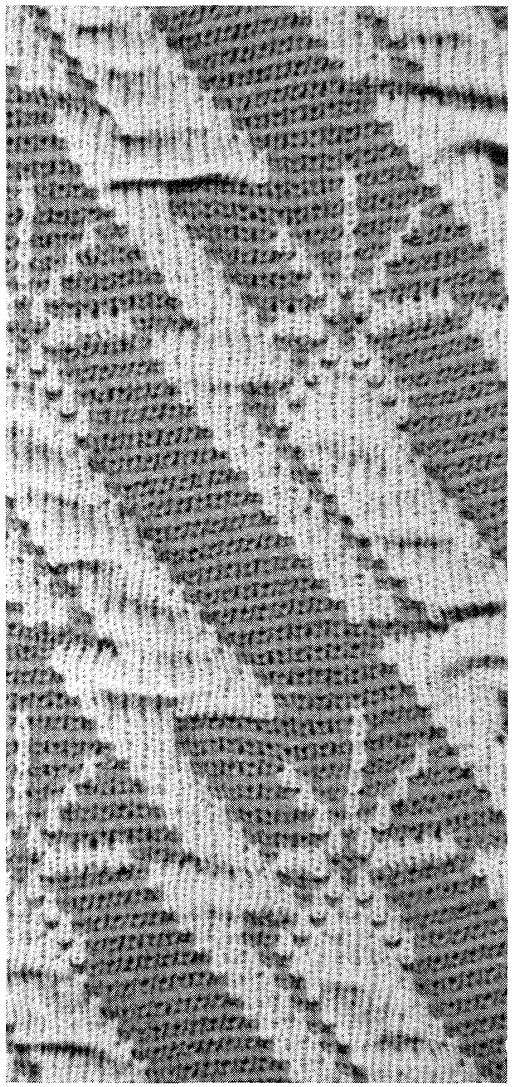
Skechers EX1027
Skechers v Nike



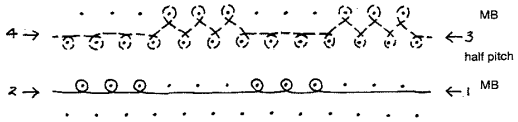
Three colors per pattern row. Design: jacquard Pattern 13. Top: modified weft with striper backing. Bottom: MB slip/knit; second bed tuck/knit 2x2 backing. Knit 6 rows with same 2x2 selection, then alternate.

Skechers EX1027
Skechers v Nike

CHAPTER 4
Blister Jacquard



If ripple fabrics intrigue you, then you will certainly be fascinated with blister fabric. Blister is a double bed jacquard technique. As its name implies, it is a fabric with design areas that separate from the backing and puff up from it like blisters. The blisters are in stockinette, knitted in color 1 on the main bed only. There will be wefts, or floats, from one blistered area to the next across the background stitches, which are knitted in color 2. These background stitches on the main bed and the backing stitches on the second bed are knitted together in full needle rib in color 2, which at the same time encloses the wefts from color 1. The area on the backing behind the blister is also stockinette stitches. Therefore the face of the fabric will show the blistered design in color 1 on a flat background of color 2; the reverse of the fabric will be solid in color 2.



Rows 1 and 2: design needles knit the blister in color 1 (solid line). Rows 3 and 4: background and backing needles knit in color 2 (broken line), enclosing wefts from the blister color.

Blister is similar in many ways to two-color embossed pin tuck, described in Chapter 3. The principal difference is that in blister, the background stitches (color 2) on the main bed require needle selection rather than being knitted plain across the width of the fabric. Blister fabric shares characteristics with all weft knit fabrics: there is little stretch across the width, and its texture is firm and comparatively thick.

VARIATIONS IN BLISTER

There are several ways to knit blister fabric, depending on the effect you want. You can use up to four colors per row. The design can be blistered on a flat rib background, as described above, or you can have a blistered background with a flat design in rib. The extent of blistering is variable: the blister can be perfectly flat if knitted with the same number of rows for both rib and blister, or it can be very bubbled if several blister rows are knitted for each rib row.

The backing, although flat and in a solid color, will shadow the design on the face. The backing behind the blister is in stockinette, hence these stitches are comparatively smaller; the rest of the stitches, knitted in rib, are comparatively larger. The fabric face also can be knitted flat, allowing the blister to appear in the stockinette of the backing instead. It will be a raised blister in one color.

Punchcards for rib jacquard can be used to knit blister jacquard: Type A for European machines and Type C for Japanese machines. Two cam settings are usually involved, one for the blister rows and one for the rib rows. Also, to knit a raised blister, the card must be stopped on the blister rows so the extra rows can be knitted with the same needle selection. Cards punched for two colors per row can be used to knit in two colors, or, for raised blister, in one color. Jacquard cards punched for three or four colors per row are quite successful with one or two colors for the blisters and the other one or two for the rib. The backing will be horizontally striped in the colors used for the rib rows.

TECHNIQUES FOR KNITTING BLISTER FABRICS

No matter which machine you use, there are a few points to remember in order to knit blister fabrics successfully.

1. Choose a *simple* pattern that has large enough design areas to show off the blister.
2. Plan the design so there are as many, or more, blister needles knitting in each row as rib needles. This will help prevent long wefts between groups of blister needles, which sometimes cause difficulty in knitting the blister rows. Long wefts can also be controlled by selecting a few needles on the backing between groups of blister needles to knit the wefts in a spotted or striped pattern during knitting of the blister rows. This effect is illustrated in the swatch photographs.
3. The stitch size on the bed knitting the blister should be from one-half to one size larger than on the bed making the backing. This makes the stockinette or blister stitches puff out more and also enables the rib stitches to better cover the wefts for less grin-through.

Skechers EX1027
Skechers v Nike

4. Extra weights are helpful, particularly in patterns with several rows of blister for each rib row.

5. The backing can be knitted either in full needle rib, with all backing needles knitting every row, or in bird's-eye backing, with alternate needles knitting/slipping on alternate rows. Bird's-eye will condense or shorten the fabric vertically, and will make a tighter backing and fuller blister. Full needle rib will elongate the design and allow more grin-through from the wefts, which can add a subtle textural quality to the design.

6. Two rows of full needle rib alternated with two rows of blister will result in flat blisters. Two rows of bird's-eye backing alternated with two rows of blister makes a slightly raised blister because there is one less row on the backing than on the face in every pattern row. The more blister rows added per rib row, the more pronounced the blister. The fabric also becomes thicker because of all the extra wefts.

7. In a raised blister fabric, the blister rows within each pattern row are knitted first, then the rib rows. In a flat blister, either blister or rib rows can be knitted first.

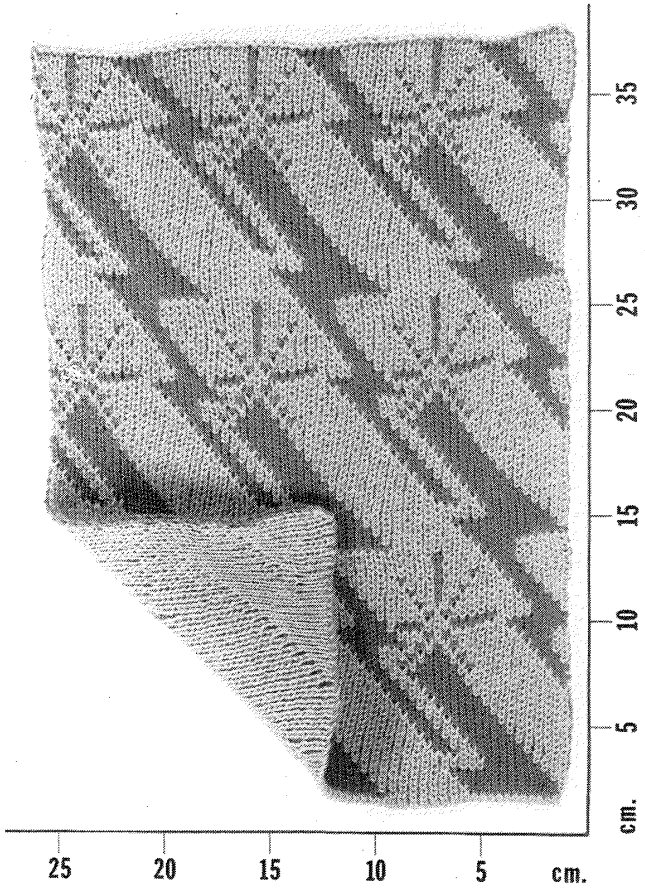
8. Motifs are very effective knitted in blister. Remember to hook the blister yarn around the last selvedge needle on the side opposite the color changer, each time the carriage is on that side, so the weft is carried completely across the fabric. Otherwise only one side of the background around the motif will enclose a weft, and the fabric will become unbalanced. It may also be necessary to do this with certain all-over patterns which have a large background or rib area next to the selvedges. An extra needle on the second bed can accommodate the wrapped yarn.

9. If you want blisters in more than one color, as in a fabric with three or four colors per row, there will be a weft yarn in each blister color enclosed within each rib row. The fabric will be thicker and firmer across the width, and will have more grin-through between rib stitches. If the pattern is simple, this results in a rich, mosaic-like background.

10. Superba machines can do a special version of blister using the double feed system for jacquard. Make the stitch size on the front bed about one number smaller than that on the back bed to make the blister more pronounced. For cam settings and swatch, see Superba Specials in Chapter 1.

	Passap carr R	Superba carr L	Brother/Knitking carr L	Singer/Studio carr L
Flat or Single Blister **either blister or rib rows can be knit first**	Type A BX ← push RP or WP, + 1 at L opp / BX ← Deco 4 RC2 ea col	Type A stop card RC2 col 1, neg rev o ; / o RC2 col 2, pos rev o / Λ hook blister yarn around last ndl EOR advance card manually See also Rib Jacquard Superba Spec. claw	Type C1 - EOR Type C2 - ER RC2 col 1 part ↔ ; / part ↔ RC2 col 2 part ↔ / N N hook blister yarn around last ndl EOR	Type C1 - EOR Type C2 - ER RC2 col 1 △ slip △ ; / o ← o RC2 col 2 △ slip △ / 1 ← 1 hook blister yarn around last ndl EOR

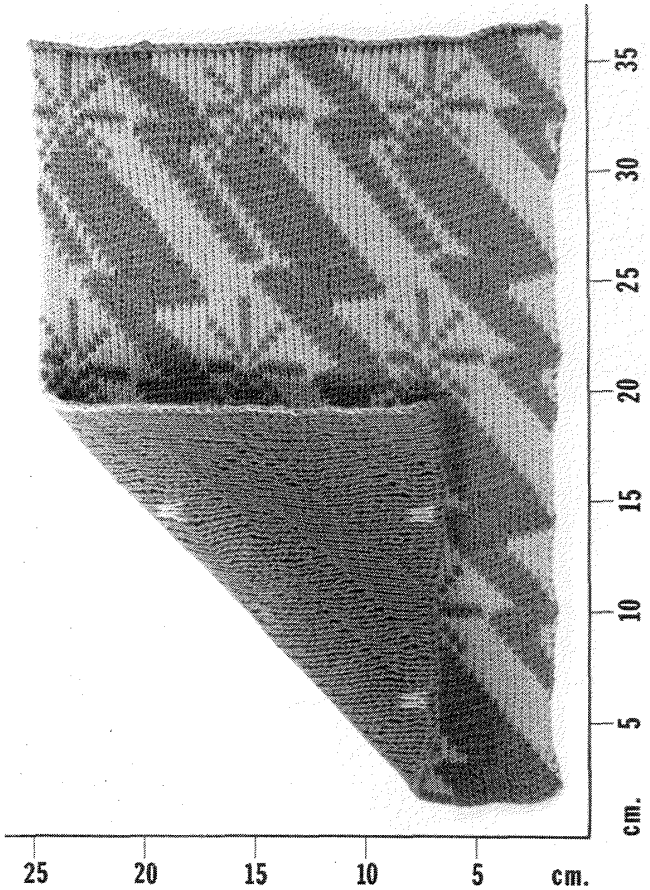
Flat blister knitted with jacquard Pattern 6. No needle selection on backing, RC2 each color. Two blister rows = 2 rib rows. Blister design, rib background.

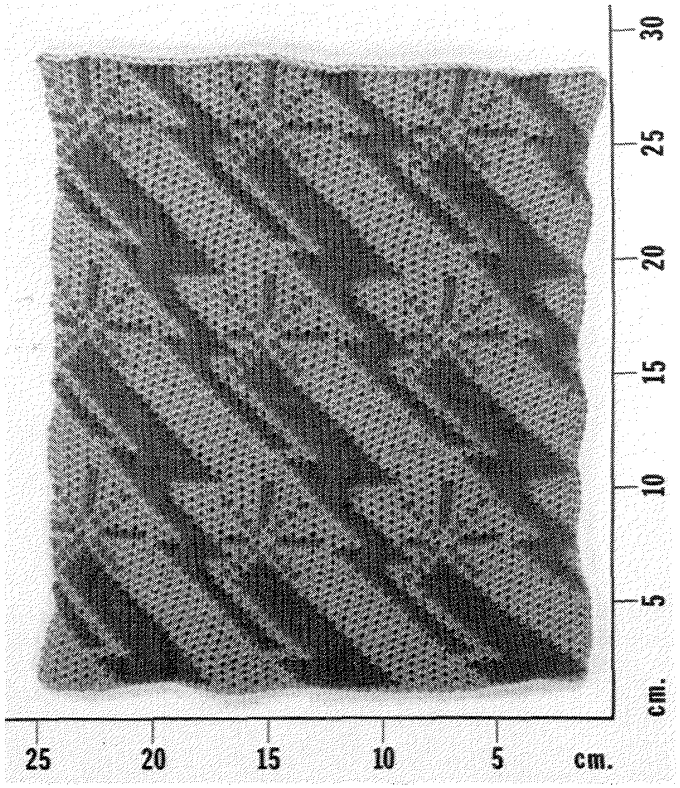


Skechers EX1027
Skechers v Nike

Flat blister knitted with jacquard Pattern 6. Two needles were selected on backing to knit the blister color for six rows, to control the long wefts at midway point of each lightning bolt. Blister background, rib design.

	Passap carr R	Superba carr L	Brother/Knitking carr L	Singer/Studio carr L
Flat Blister Var: Birds-eye Backing	Type A RC2 col 1 GX ↔ push 1x1 WP/RP ; / BX ← Deco 4 hook yarn around last ndl at L RC2 col 2 BX ↔ / BX ←	Type A stop card RC2 col 1, pos rev o ; / o hook yarn around last ndl at L RC2 col 2, neg rev o / lili o lili use even # ndls FB advance card manually claw	Type C1 - EOR Type C2 - ER RC2 col 1 part ↔ ; / part ↔ hook yarn around last ndl at R RC2 col 2 part ↔ / lili part ↔ lili use even # ndls ribber	Type C1 - EOR Type C2 - ER RC2 col 1 △ slip △ ; / o ← o hook yarn around last ndl at R RC2 col 2 △ slip △ / o ← o select odd ndls, then even ndls ER



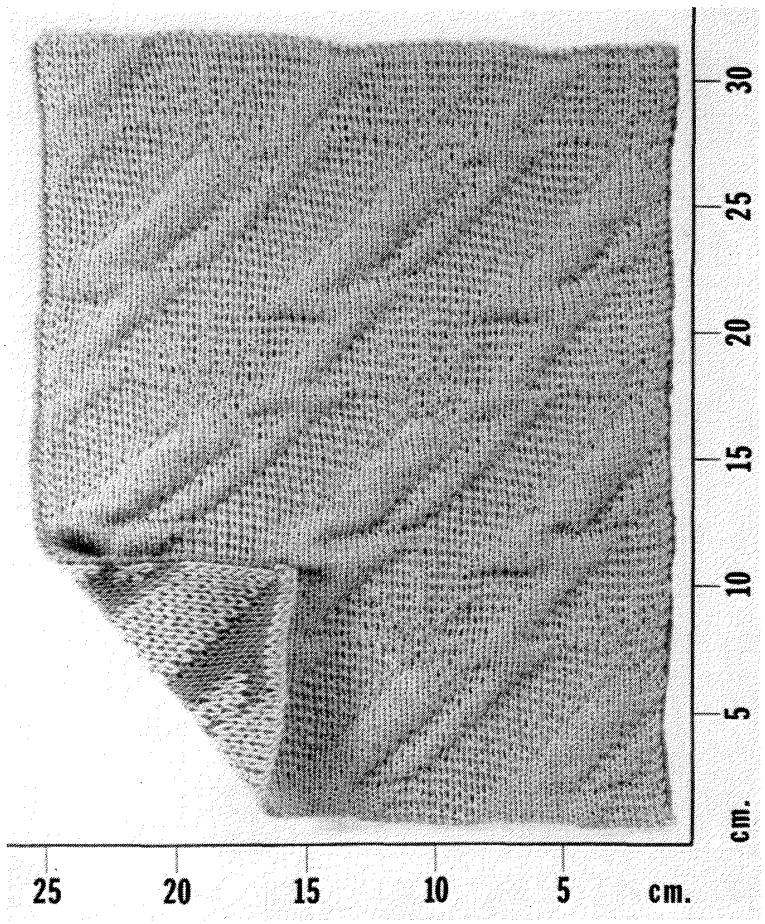


Flat blister knitted with jacquard Pattern 6. Made with bird's-eye backing on rib rows, RC2 each color, which causes the blisters to be slightly raised. Background has characteristic bird's-eye texture. Two blister/background rows = 1 backing row. Blister design, rib background.

Skechers EX1027
Skechers v Nike

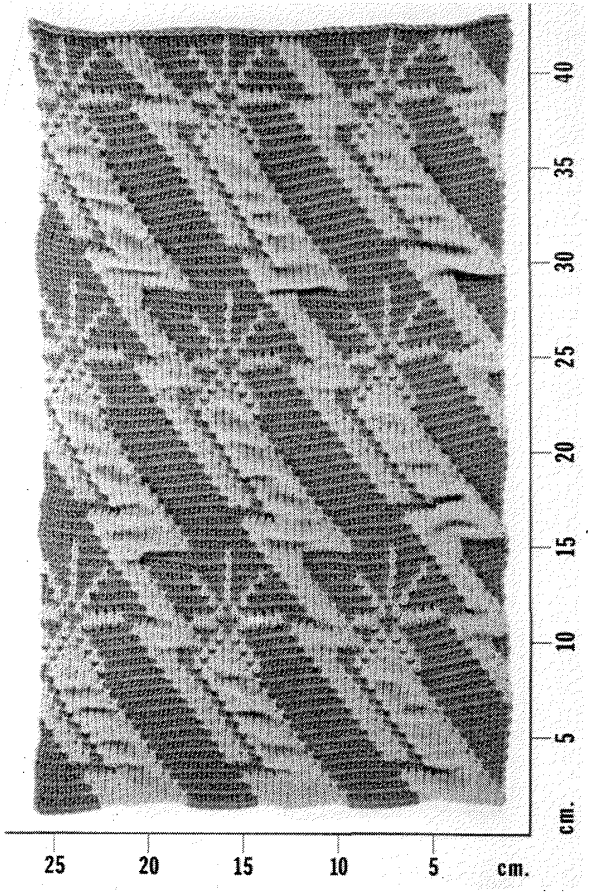
	Passap carr R	Superba carr L	Brother/Knitking carr L	Singer/Studio carr L
Flat Blister Var: Blistered Backing	Type A BX ← push WP + 1 ea end RP / HX ← Deco 4 RC2 ea col	Type A *stop card* RC2 col 1, pos rev C / o RC2 col 2, neg rev C / ∧ No R cursor stop. Cursor at carr R throughout. *Advance card manually.* claw	Type C1 - EOR *Type C2 - ER* RC2 col 1 part ↔ ; / part ↔ RC2 col 2 part ↔ / N N push back selected ndls MB EOR, both colors.	Type C1 - EOR *Type C2 - ER* RC2 col 1 o slip △ ; / o ← o RC2 col 2 o slip △ / 1 ← 1

Raised blister on backing, using jacquard Pattern 6. Fewer rows are knitted on the face than on the backing, causing the stockinette areas of the backing to be raised in a blister. One blister/background row = 2 backing rows. Blister design, rib background.

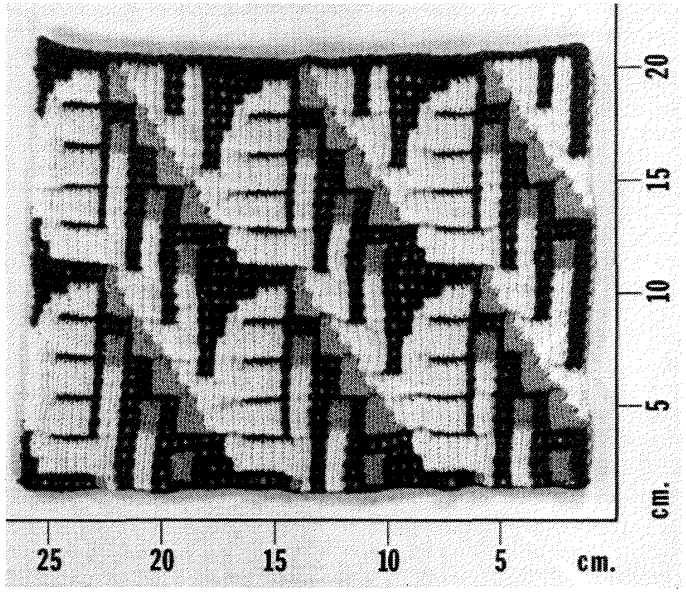


Skechers EX1027
Skechers v Nike

	Passap carr R	Superba carr L	Brother/Knitking carr L	Singer/Studio carr L
Raised Blister 2 color	Type A RC4 or more col 1 BXo 1 push ea end WP ; BXo Deco 2, uncoupled RC2 col 2 N BX ←	Type A stop card RC4 or more col 1, pos rev; o o hook yarn around last ndl ea end RC2, col 2 neg rev o Λ advance card manually claw	Type C1 - EOR stop card RC4 or more col 1 part ↔ ; part ↔ hook yarn around last ndl ea end start card RC2 col 2 part ↔ N N	Type C1 - EOR stop card RC4 or more col 1 △ slip △ ; o ← o hook yarn around last ndl ea end start card RC2 col 2 △ slip △ 1 ← 1



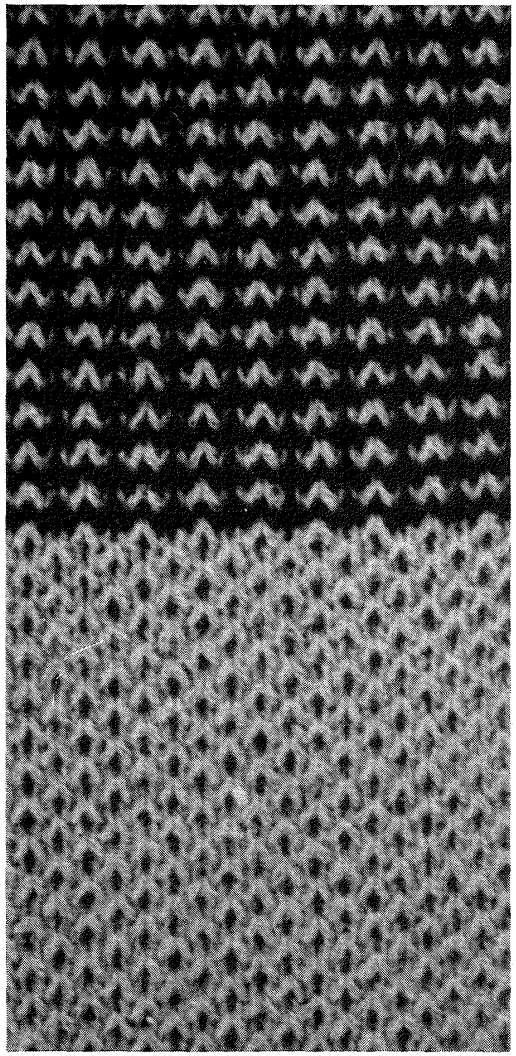
Raised blister on fabric face, using jacquard Pattern 6. Four blister rows knitted with same needle selection (card stopped), followed by 2 rib rows with second color. Blister design, rib background.



Raised blister in 3 colors using jacquard Pattern 13 (card Type D). Colors 1 and 2 are knitted 4 rows each with card stopped for blister, then 2 rows knitted in rib with color 3 for the background/backing. Blister design, rib background.

Skechers EX1027
Skechers v Nike

CHAPTER 6
Knit-weave Fabrics



Knit-weave, or knit-woven, is a term used in industrial knitting. In spite of its name, this fabric does not contain weaving elements or even look woven. Nor is it one of the inlay fabrics, often called by this name, which are described in Chapter 11. It is, rather, a run-resistant flat double bed fabric. Like weft knitting and weaving, knit-weave is so named because it has much the same firmness, smoothness and comparative lack of stretch as loom-woven cloth, yet it retains the suppleness of knitted textiles.

The knit-weave structure is characterized by one or two rows in rib alternated with one or two rows of single bed or tubular stockinette. The rib or "warp" rows are the "knit" part of knit-weave, the stockinette rows are the "weave" or "weft" rows. (In traditional weaving, the warp yarns run lengthwise on the loom and the weft threads weave crosswise.) The stitches on the stockinette rows, smaller than the rib stitches knitted at the same stitch size, force the fabric to contract crosswise *and* lengthwise, making it firm and smooth.

Knit-weave fabrics are especially good for coats, suits, skirts, pants and upholstery because they drape well and withstand stretching. Knit-weaves are particularly effective in very fine yarns because, although compact, the fabric is still light in weight. Moreover, this is a perfect cut-and-sew fabric. It doesn't curl at the edges, stretch, or run when cut. It won't catch in the sewing machine, or do any of those things which make you cringe at trying cut-and-sew construction. If you like to tailor, it is an ideal fabric. Many knit-weaves are identical on both faces, and all of them can be varied to suit your needs or fancy.

Quite a few knit-weaves can be made without needle selection on either bed; others require a 1x1 selection on both beds. A basic 1x1 punchcard can be used on the main bed for some fabrics, with rows of holes taped over if necessary. If selection is required on both beds, the punchcard can be coupled with selection by a 1x1 pattern ruler, or the lili buttons on Superba and Brother/Knitking. The cam charts give only manual selection for these fabrics on Superba and the Japanese machines; you can decide for yourself how to make a more automatic selection on your machine.

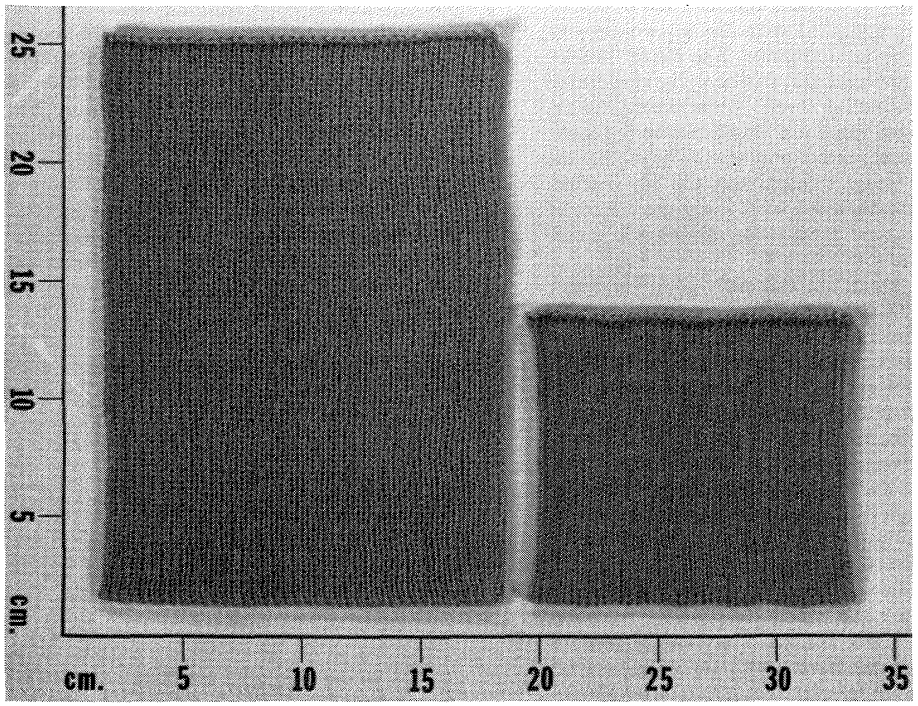
THE THREE BASIC KNIT-WEAVES

The photos illustrate swatches of these fabrics, knitted in one and two colors, to show the texture and to help you visualize the structure. The names we use for these fabrics are those used in the knitting industry, but we have also mentioned the other commonly used names.

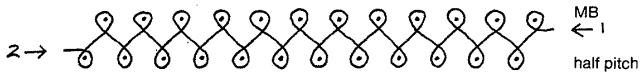
The three basic types of knit-weave fabric which will be discussed below are classified according to the method by which the rib rows are knitted. These include full needle rib, interlock rib, and combinations of the two. All the swatches shown in the photographs are knitted 40 stitches wide and to RC96, so you can see the gauge differences in the various fabrics. The stitch size should be a little large for the rib stitches, so the stockinette stitches will then be fairly tight. In the fabrics knitted in two colors, the colors are changed every two rows, even in three- or five-row sequences. In the knitting directions, the slash indicates that the rows alternate: for example, "one row rib / one round tubular" means rib rows alternate with tubular rows.

Skechers EX1027
Skechers v Nike

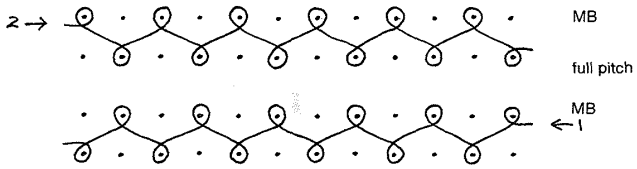
	Passap carr R	Superba carr R	Brother/Knitking carr L	Singer/Studio carr L
Full Needle Rib	N / N	∧ / ∧	plain / N N	stock / 1 1
Interlock Rib	BX ↔ / BX ↔ push 1x1 WP/RP / push 1x1 RP/WP	o / o (a) Select odd ndls / even ndls RC1; (b) Select even ndls / odd ndls RC1 Repeat (a & b)	part ↔ / part ↔ (a) Select odd ndls / even ndls RC1; (b) Select even ndls / odd ndls RC1 Repeat (a & b)	o slip o / o ← o (a) Select odd ndls / even ndls RC1; (b) Select even ndls / odd ndls RC1 Repeat (a & b)



Basic knit-weave fabrics.
Left. Full needle rib. RC1 makes one complete row of rib; all needles knit in consecutive order with each pass of the carriage.
Right. Interlock rib. RC2 makes one complete row of rib; alternate needles on both beds knit with each pass of the carriage. Both swatches have the same number of stitches and row counts; both were knitted with the same stitch size.



Full needle rib.



Interlock rib.

Skechers EX1027
Skechers v Nike

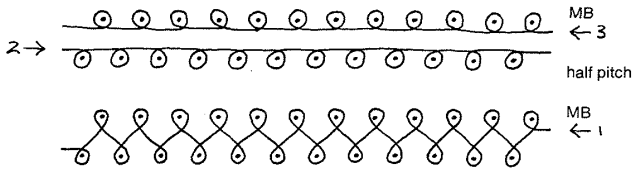
FULL NEEDLE RIB

All machines can knit these fabrics easily because, with the exception of triple knit rib, no needle selection is required on either bed. These fabrics are less compact than those in the other two groups. Beds are always set at half pitch to knit these.

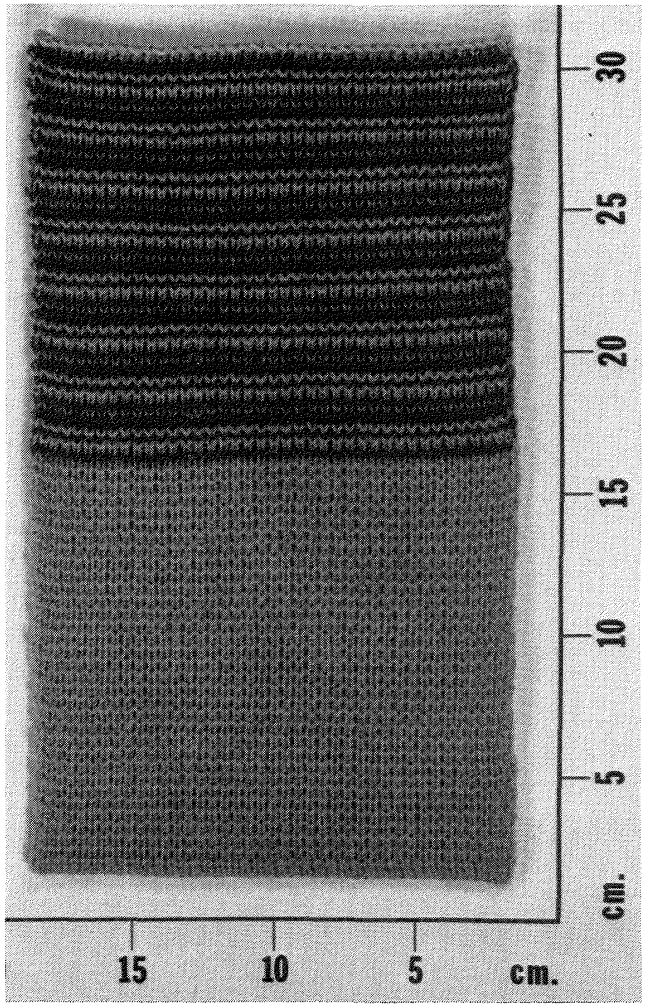
	Passap carr R	Superba carr R	Brother/Knitking carr L	Singer/Studio carr L
Milano Rib	RC1 N/N ; RC2 CX/CX	RC1 Λ/Λ ; RC2 C/O	RC1 plain/N N ; RC2 part ←/N part	RC1 o stock △/1 ← 1 ; RC2 o slip △/1 ← o

Milano Rib or Italian Stitch

One row rib / one round tubular = one repeat (RC3). Both sides of the fabric are identical, although when 2 colors are used, the color rows shift slightly between the face and reverse.



Milano rib.



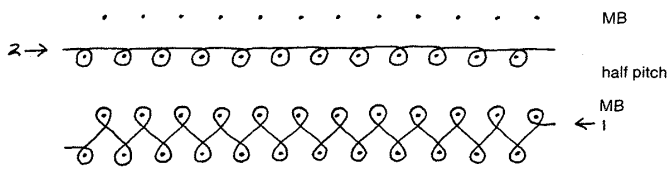
Milano rib.

Skechers EX1027
Skechers v Nike

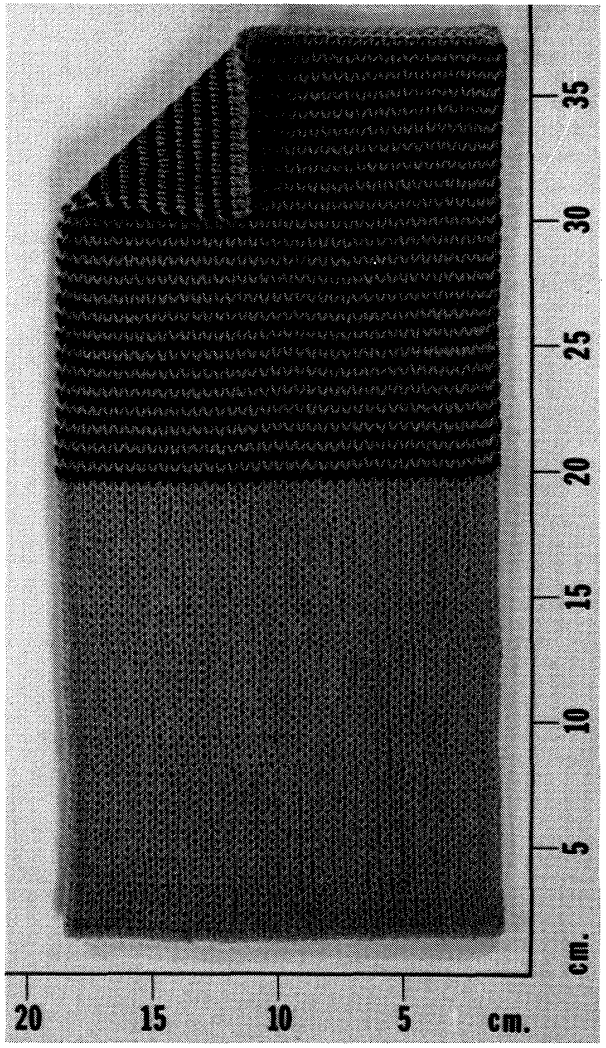
Half Milano or Long Stitch

One row rib / one single bed row (RC2) which is always on the same bed for each repeat. The two sides are not identical. This fabric is often used for embossed patterns; the extra (stockinette) row on the backing side stretches and flattens the stitches lengthwise for the embossed pattern on the opposite bed, making the pattern contrast sharply with the backing. If this fabric tends to curl during knitting, make the SS on the MB one-third to one-half number larger.

	Passap carr R	Superba carr R	Brother/Knitking carr L	Singer/Studio carr L
Half Milano	N / CX	C / Λ	part ← / N N	o slip Δ / 1 1



Half Milano.



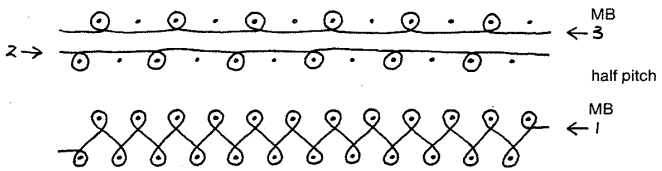
Half Milano.

Skechers EX1027
Skechers v Nike

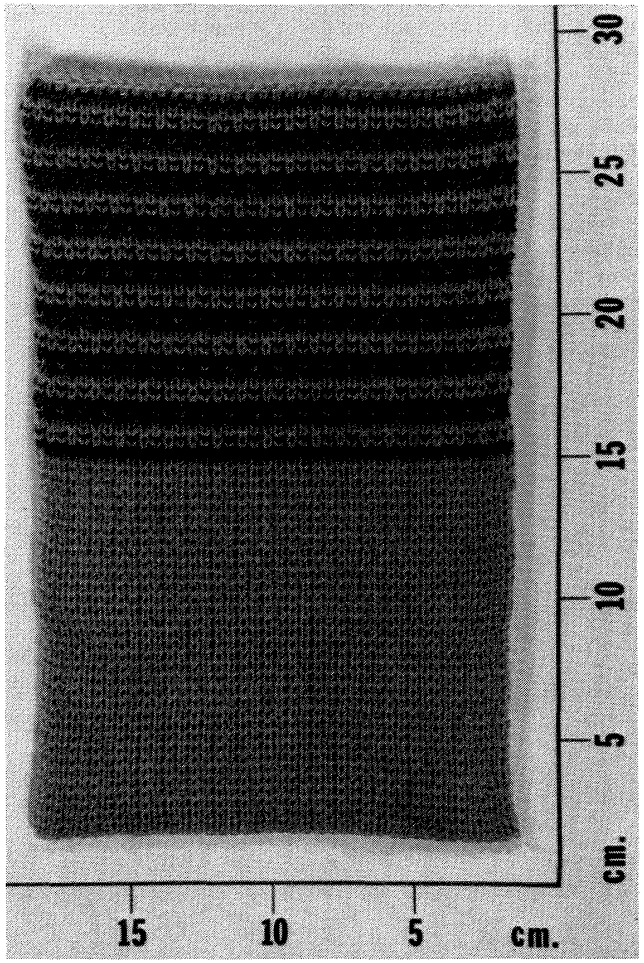
Triple Knit Rib

One row rib / one round tubular with alternate needles knitting and slipping (RC3). The same needles knit or slip in each tubular round throughout. Both sides of the fabric are identical, although in two-color work the color rows shift slightly between the face and the reverse.

	Passap carr R	Superba carr R	Brother/Knitking carr L	Singer/Studio carr L
Triple Knit Rib	RC1 N / N ; RC2 HXo / HXo push 1x1 WP/RP / push 1x1 WP/RP	RC1 ∧ / ∧ ; RC2 o / o Select odd ndls, each bed, on all tubular rows.	RC1 plain / N N ; RC2 part ↔ / part ↔ Select odd ndls, each bed, on all tubular rows.	RC1 o stock o / 1 ← 1 ; RC2 o slip o / o ← o Select odd ndls, each bed, on all tubular rows.



Triple knit rib.



Triple knit rib.

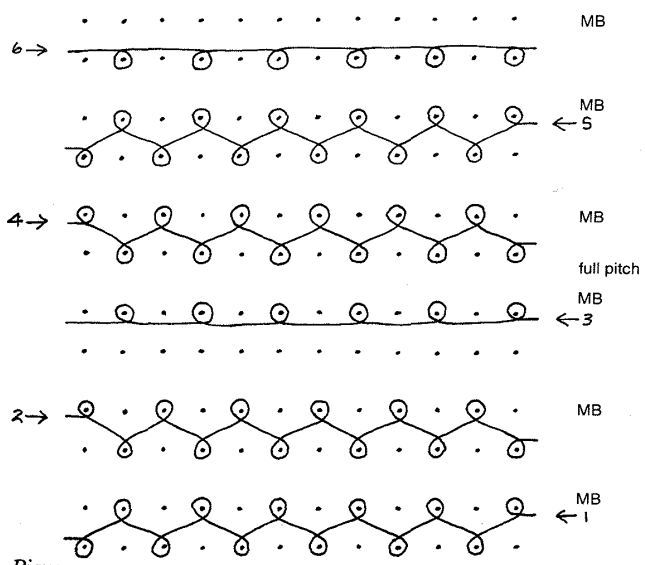
Skechers EX1027
Skechers v Nike

INTERLOCK RIB

These fabrics are more compact than those in the other two groups. They require 1x1 needle selection on both beds. Beds are usually set at full pitch. On Passap, needles are selected by arranging alternate pushers WP/RP on both beds. On Superba and Brother/Knitking, needles are selected by lili buttons on the front carriage, and by a 1x1 punchcard on the back bed. On Singer/Studio, the 1x1 pattern ruler is used on the ribber, and a 1x1 punchcard for the main bed. Coordinate selection between beds so needles alternate, rather than clash! The "a" and "b" in the cam charts refer to the a and b sequences in the Interlock Rib cam chart on the second page of this chapter. For an introduction to interlock fabrics, see Chapter 5.

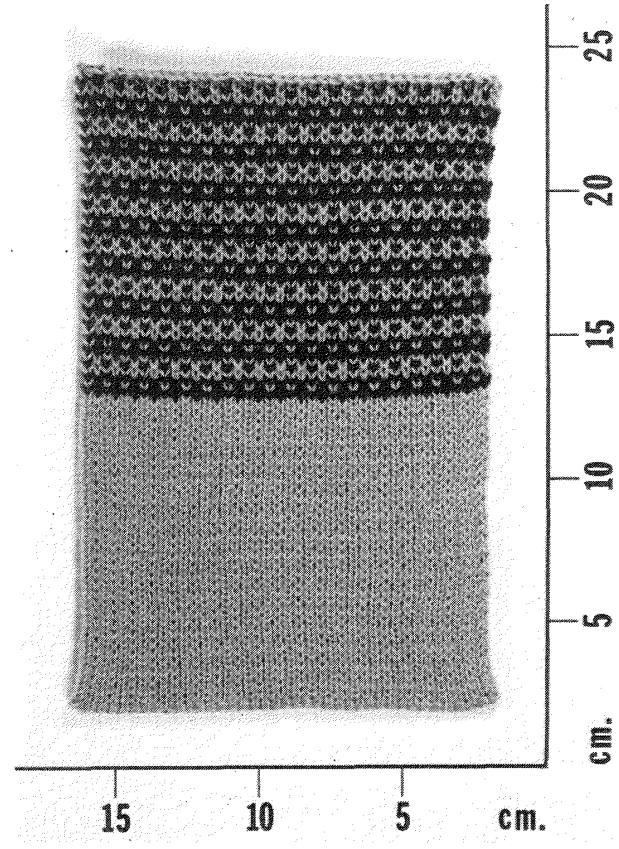
Pique

One row rib / one single bed row with alternate needles knitting and slipping (RC3). The single bed rows will alternate beds for each repeat, which means one complete repeat = RC6. Both sides of the fabric are identical, although when 2 colors are used, the color rows shift slightly between the faces.



Pique.

	Passap carr R	Superba carr R	Brother/Knitking carr L	Singer/Studio carr L
Pique	RC2 BX ↔ / BX ↔ ; RC1 BX ↔ / GX ↔ ; RC2 BX ↔ / BX ↔ ; RC1 GX ↔ / BX ↔ push 1x1 WP/RP / push 1x1 RP/WP	o / o RC2 Interlock Rib (a & b); RC1 select odd ndls MB; RC2 Interlock Rib (b & a); RC1 select odd ndls FB.	part ↔ / part ↔ RC2 Interlock Rib (a & b); RC1 select odd ndls MB; RC2 Interlock Rib (b & a); RC1 select odd ndls ribber.	o slip o / o ← o RC2 Interlock Rib (a & b); RC1 select odd ndls MB; RC2 Interlock Rib (b & a); RC1 select odd ndls ribber.



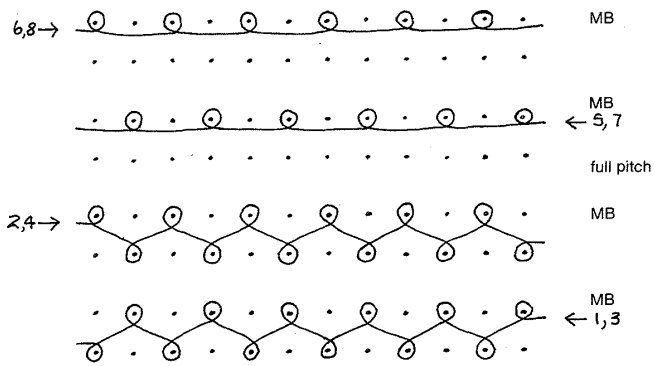
Pique.

Skechers EX1027
Skechers v Nike

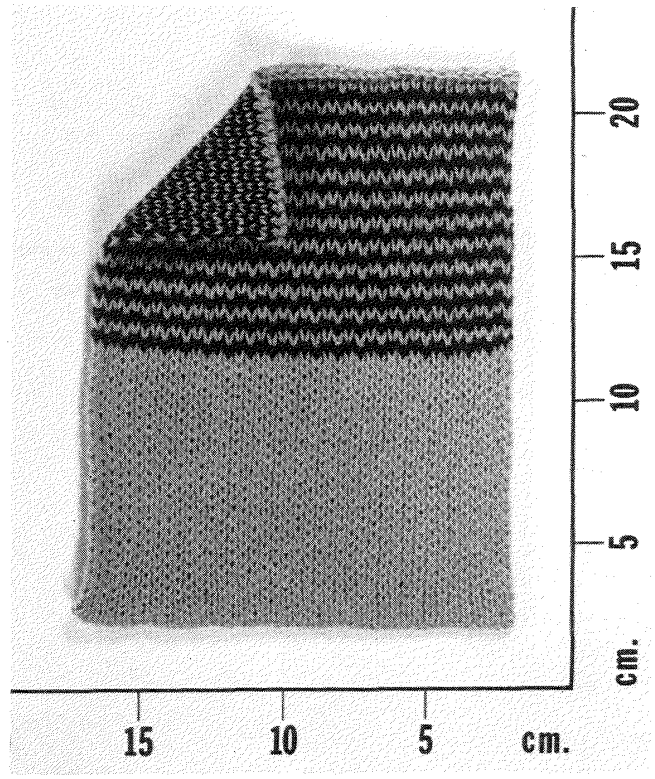
Bourrelet

Two rows rib (RC4) / four rows single bed with alternate needles knitting and slipping (RC8). The single bed rows are always on the same bed. The two sides of the fabric are not identical. In both pique and bourrelet, the stitches of single bed rows continue the alternating knit / slip sequence from the rib row.

	Passap carr R	Superba carr R	Brother/Knitking carr L	Singer/Studio carr L
Bourrelet	RC4 BX ↔ / BX ↔ ; RC4 BX ↔ / GX ↔ push 1x1 WP/RP / push 1x1 RP/WP	o / o RC4 Interlock Rib (a & b; a & b); RC4 select odd, then even ndls ER, MB only.	part ↔ / part ↔ RC4 Interlock Rib (a & b; a & b); RC4 select odd, then even ndls ER, MB only.	o slip o / o ← o RC4 Interlock Rib (a & b; a & b); RC4 select odd, then even ndls ER, MB only.



Bourrelet.



Bourrelet.

Skechers EX1027
Skechers v Nike

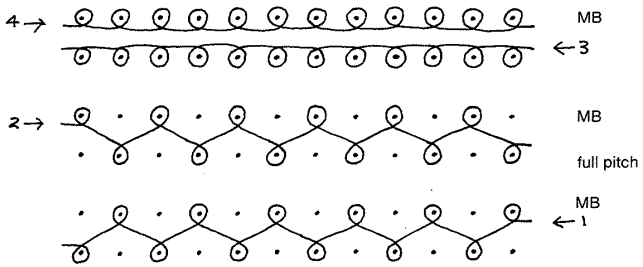
Ponte di Roma

One row rib / one round tubular with all needles knitting (RC4). Beds at full pitch. Both sides are identical.

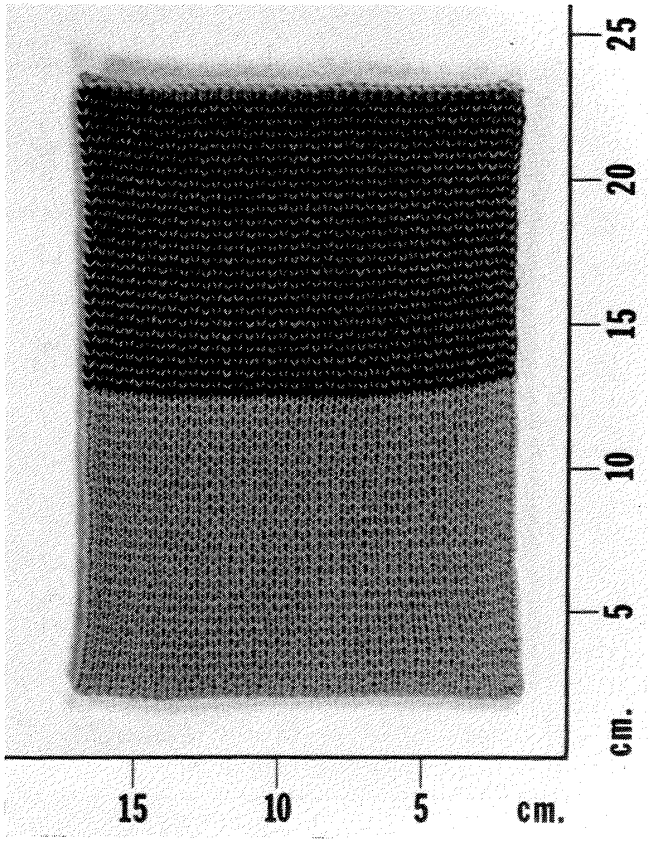
Evermonte

This fabric is made exactly like Ponte di Roma, but with beds at half pitch. It is slightly looser and the ribs tend to group together in pairs.

	Passap carr R	Superba carr R	Brother/Knitking carr L	Singer/Studio carr L
Ponte di Roma Evermonte	RC2 BX ↔ / BX ↔ ; RC2 CX ↔ / CX ↔ push 1x1 WP/RP / push 1x1 RP/WP	RC2 Interlock Rib (a & b) o / o ; RC2 C / ↻	RC2 Interlock Rib (a & b) part ↔ / part ↔ ; RC2 part ← / N part	RC2 Interlock Rib (a & b) o slip o / o ← o ; RC2 o slip △ / 1 ← o



Ponte di Roma.



Ponte di Roma.

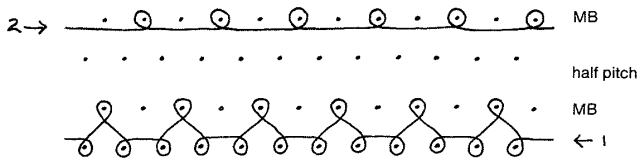
Skechers EX1027
Skechers v Nike

COMBINATION RIB

These fabrics are a combination of interlock rib and full needle rib. One bed knits full rib, the other knits interlock rib. Needle selection is on the interlock bed only. All machines can knit these fabrics easily. For Singer/Studio, use a 1x1 punchcard for interlock needle selection on the MB. For Passap, use pushers in 1x1 WP/RP. On Superba and Brother/Knitking, use the lili buttons on the front carriage.

RC2 makes one complete repeat, which is one rib row and one single bed row combined. All needles on the front bed and even needles on the back bed knit the first row (the rib row); odd needles on the back bed knit the second row (the single bed row), with slip stitch across the needles already knitted.

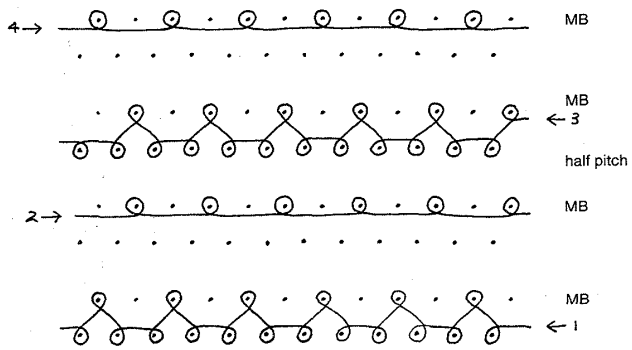
	Passap carr R	Superba carr R	Brother/Knitking carr L	Singer/Studio carr L
French Pique	BX → push 1x1 WP/RP / CX	o / ↻ On MB only: Select odd ndls, RC1; *select even ndls, RC1;* select even ndls, RC1; select odd ndls, RC1.	part ↔ / part N On MB only: Select odd ndls, RC1; *select even ndls, RC1;* select even ndls, RC1; select odd ndls, RC1.	o slip o / o ← 1 On MB only: Select odd ndls, RC1; *select even ndls, RC1;* select even ndls, RC1; select odd ndls, RC1.



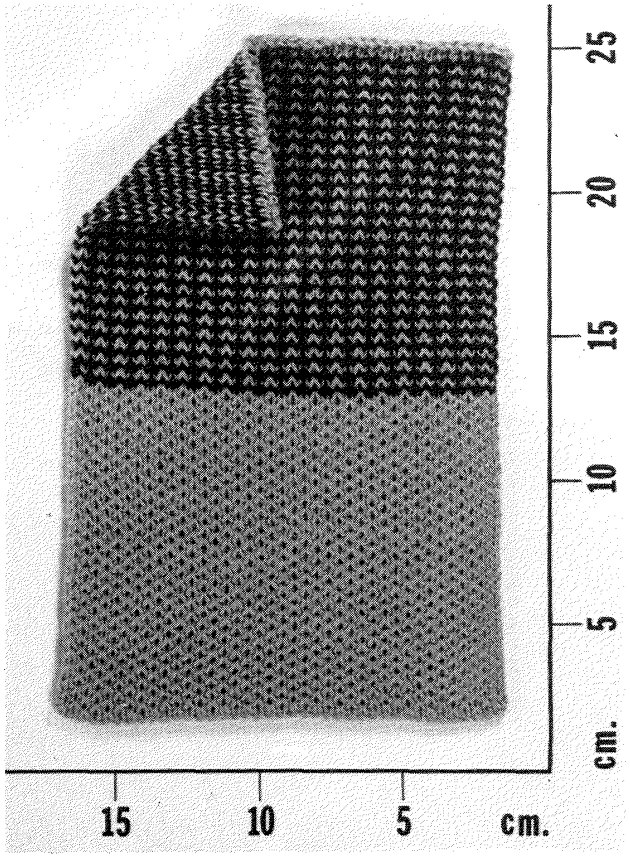
Combination rib.

French Pique or Bird's-eye Twill

One row rib / one row single bed (RC2), on which the needles knitting are those which *slipped* on the rib row. In the next repeat, the needles which have just knitted the single bed row will knit again on the next rib row, so that 2 rib and single bed rows (RC4) are necessary to complete one full repeat. The two sides of the fabric are not identical. When knitted in two colors, there will be horizontal stripes on the reverse.



French pique.



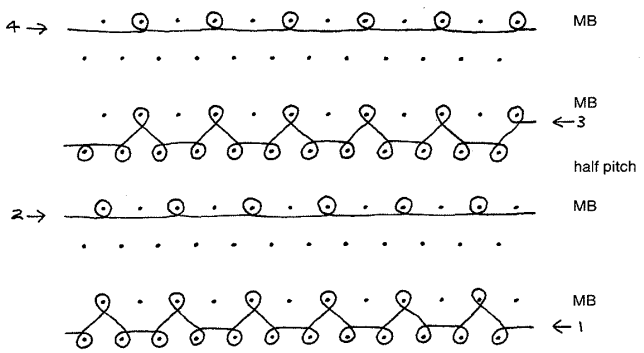
French pique.

Skechers EX1027
Skechers v Nike

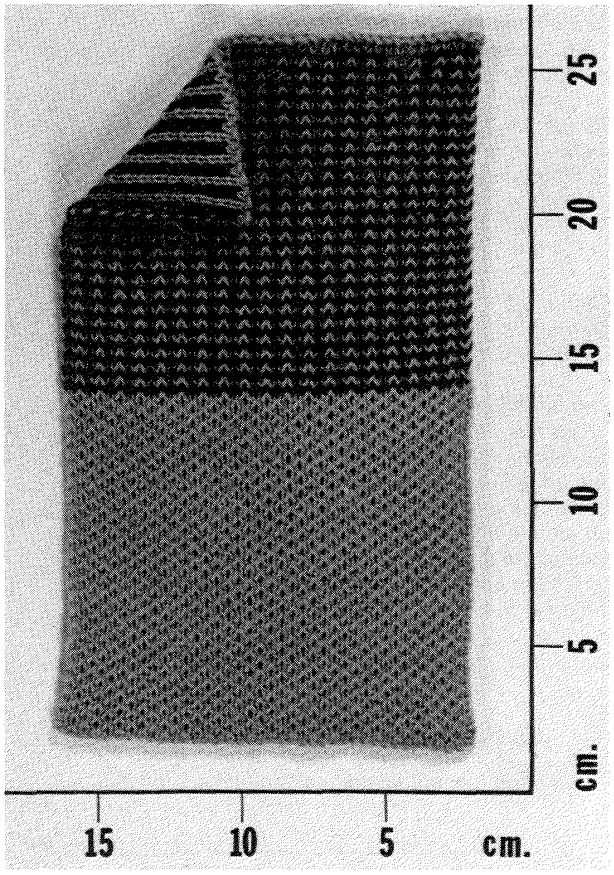
Swiss Pique or Overknit

One row rib / one row single bed (RC2) on which the needles knitting are the same ones which *knitted* on the rib row—exactly the opposite of the French pique method. In the next rib / single bed rows the needles which now knit are the ones which slipped in the previous repeat. Therefore, two rib / single bed rows (RC4) are necessary to complete one full repeat, as in French pique. The face of this fabric looks like French pique, both in one and two colors, but it is a little narrower. When two colors are used, there will be vertical stripes on the reverse.

	Passap carr R	Superba carr R	Brother/Knitking carr L	Singer/Studio carr L
Swiss Pique	BX ← push 1x1 WP/RP / CX	o / ↻ On MB only: Select odd ndls, RC1; select odd ndls, RC1; select even ndls, RC1; select even ndls, RC1.	part ↔ / part N On MB only: Select odd ndls, RC1; select odd ndls, RC1; select even ndls, RC1; select even ndls, RC1.	o slip o / o ← 1 On MB only: Select odd ndls, RC1; select odd ndls, RC1; select even ndls, RC1; select even ndls, RC1.



Swiss pique.



Swiss pique.

Skechers EX1027
Skechers v Nike

VARIATIONS

The variations are included to encourage you to experiment. Note that, except for color changes, most variations will loosen the fabric structure to some degree. You will be able to see the extent of this difference in your own swatches. If you experiment, choose the basic fabric which is easiest to do on your machine, then systematically put it through a series of changes such as those suggested below. Try not to change the basic alternating sequence of rib/stockinette rows, although you may want to alternate the needle selection differently, or change it to have all needles knitting to avoid an otherwise bothersome cam change or needle selection.

Some experiments will produce unexpected results, both good and bad; some will work with one kind of yarn but not with another. Here are some changes you might try:

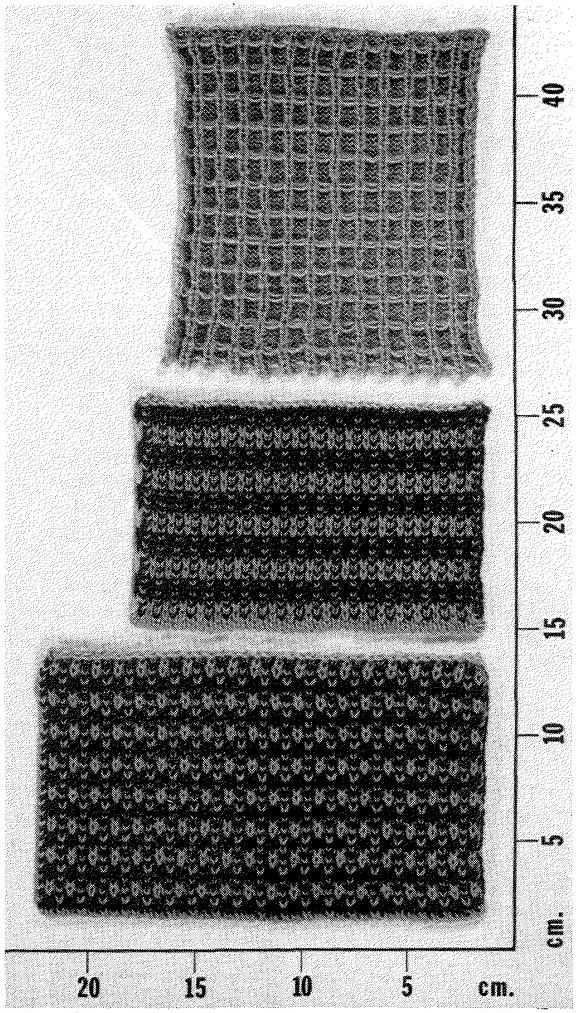
1. Use two or three colors, or two or three different types of yarn, changing every RC2 or RC4. Or alternate two rows of color 1 with 4 rows color 2.
2. Put a few needles on one bed into NWP.
3. Change one or both cams from slip to tuck.
4. On single bed rows, try a 1x1 knit/slip setting on rows where all needles knit, knitting two rows in knit/slip to one plain row.
5. Try racking, especially with a tuck cam setting.
6. When knitting fabrics based on interlock rib, try a 2x1 or 2x2 needle selection instead of 1x1.

The following photos illustrate a few variations to show what can happen with even one or two changes.

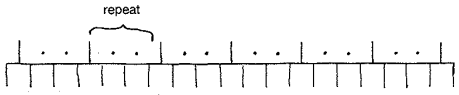
Milano waffle. One color. On one of the beds, two needles out of three are in NWP to make vertical ribs. Cams are set the same but the knitting sequence is doubled. RC4 full needle rib / RC4 tubular.

Milano Rib variation. Rib row is the same as for Milano rib (RC1). Tubular row is knitted twice (RC4) with alternating 1x1 needle selection, knit/slip, on both beds. RC2 each color.

Tucked pique. Knitted exactly like the basic pique swatch in 2 colors, but with cams set for tuck. Be sure that one cam is changed to slip or free move for the single bed rows, otherwise the needles on the opposite bed will all take tuck loops. Set beds at half pitch.



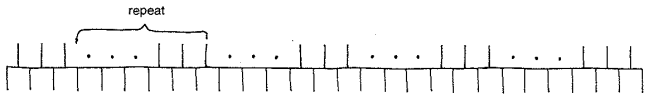
Top. Milano waffle.
Center. Milano rib variation.
Bottom. Tucked pique.



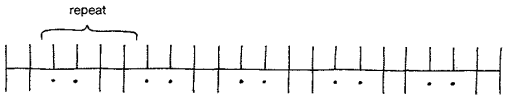
Milano waffle.

Skechers EX1027
Skechers v Nike

Half Milano with tucked Long Stitch. The second bed knits the same as Milano rib. The MB (knitting the Long Stitch) has some needles in NWP for an embossed rib. These rib needles tuck one row, then slip one row, with color 1 while the second bed knits both rows. Then the rib needles knit one row, then slip one row, with color 2 while the second bed knits both rows.

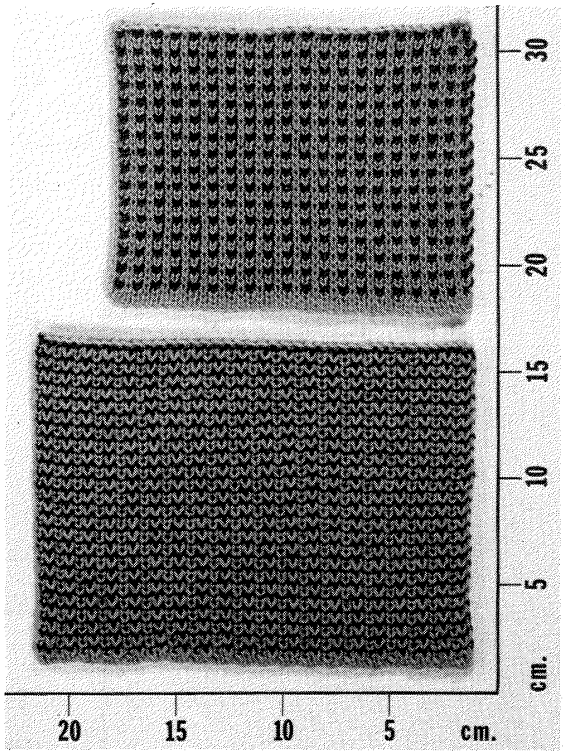


Windowpane bourrelet. The needle set-up on the second bed (with single bed rows) remains the same as in basic bourrelet. The needle set-up on the MB is *2 ndls in WP, 2 ndls in NWP.* Repeat. Beds are at full pitch. Needle selection on both beds is in the same alternating sequence as for basic bourrelet, and cam settings are the same. Knit RC6, col 1, with first half of the knitting sequence; RC6, col 2, with second half of the knitting sequence.

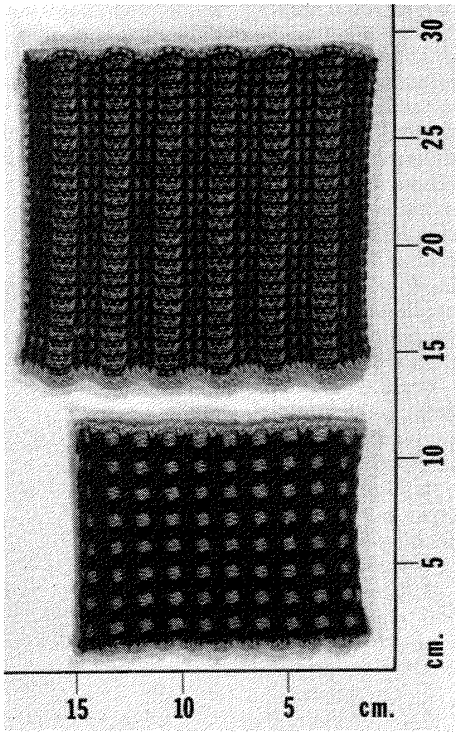


Triple knit rib variation. This is the same fabric as the basic triple knit rib, with more rows added to even out the color repeat. Two rows are knitted in rib (RC2) with col 1, and two rounds knitted in tubular (RC4) with col 2.

Evermonte with Fisherman's Rib. This one is knitted as the basic Evermonte in two colors, except for the cam settings on the two rib rows. Row 1 is plain knit on one bed and knit/tuck on the other. Row 2 reverses the cam settings (col 1). The tubular row is the same (col 2).



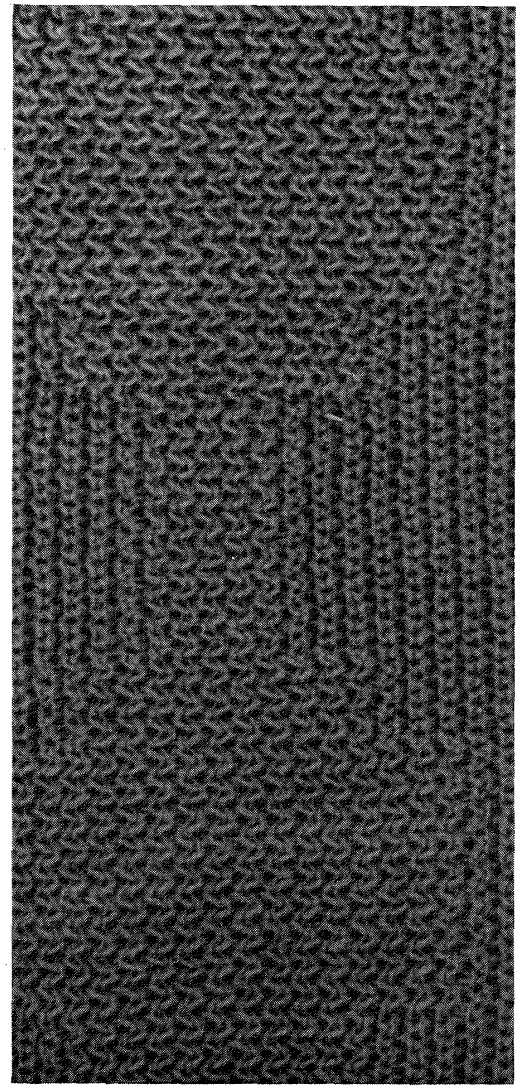
Top: Triple knit rib variation.
Bottom: Evermonte with fisherman's rib.



Top. Half Milano with tucked long stitch.
Bottom. Windowpane bourrelet.

Skechers EX1027
Skechers v Nike

CHAPTER 13
The Principles of Racking



We've already talked about racking as a patterning aid in lace, embossing, plating, jacquard and ripple knitting. Now we want to discuss its underlying principles and eliminate, we hope, the confusion which for many knitters surrounds racking and racked fabrics, particularly those fabrics based on full and half fisherman's rib.

Racking is a double bed technique whereby one bed is moved laterally by means of a racking handle located under the front bed at the left side. When stitches are knitted on both beds, as in full needle rib, this sideways movement causes the stitches opposite each other on the two beds to be displaced in their consecutive order of knitting, and to be pulled or slanted diagonally between the beds. Because the needles will then have a new consecutive order of knitting, this slant can be permanently fixed into the fabric if a new row of stitches is knitted while the beds are in the racked position. The beds can then be racked again, either in the same or the opposite direction, to slant the next row of stitches. When the fabric comes off the machine, the effect of the racking can be seen in the diagonal, rather than the normal, vertical alignment of the stitches.

Our discussion of racking will be limited to plain and patterned fabrics with all-over designs knitted in full and half fisherman's rib. Though they can also be done in plain knitting on both beds, tuck rows added to plain knitting on one or both beds dramatizes the effect of racking and greatly extends the range of design variations. Adding tuck rows also will condense the fabric vertically, separate the stitches horizontally, and thus emphasize the whole effect of racking in the pattern.

The swatches illustrating the basic principles of racking are knitted both in full and half fisherman's rib. To show some patterning possibilities, other swatches have more tuck rows added to these two basic fabrics, or have needles left out of work, or use tuck/knit combinations on the same bed.

There are four principles to observe when designing racked fabrics, especially those incorporating tuck stitches. Once you understand the principles, and have practice in making the swatches, you should be able to control the effects of racking and create your own fabrics and patterns. The same principles apply to all machines, no matter which bed is the main bed and which bed does the racking. The stitch formation diagrams will help you see how to apply these principles.

THE BASIC PRINCIPLES OF RACKING

1. Racking usually occurs after a *tuck row* on one of the beds has been knitted. In half fisherman's rib, where the main bed alternates knit and tuck rows and the second bed always knits, racking usually occurs after the main bed tucks, every two rows. In full fisherman's rib, where both beds alternate knit and tuck rows, racking can occur after every row, since one or the other bed is always tucking; or it can occur after two rows.

2. The effect of racking—the slanting of the stitches—will show on the fabric face knitted on the bed *opposite* the tuck row which was racked in principle 1 above. In half fisherman's rib, racked every two rows, the slanted stitches will appear in the plain knit stitches of the second bed. In full fisherman's rib, if racking occurs after every row, the slanted stitches will appear on both sides of the fabric. If racking occurs after every two rows, the slanted stitches will appear on only one side of the fabric, which would be the side opposite the tuck row that was racked, as in half fisherman's rib.

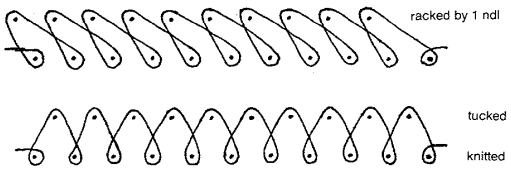
3. The direction in which the stitches slant will depend on which bed does the racking and whether the racking bed has just knitted or just tucked. If it has just knitted, and the opposite bed has tucked, the knit stitches on this bed will slant in the direction in which the bed was racked. If the racking bed has just tucked, and the opposite bed has knitted, the knit stitches of the opposite bed will slant in the opposite direction to that in which the bed was just racked.

In the half fisherman's rib swatch knitted on Passap (shown in the first photo), the back bed was racked one needle to the left, then one needle to the right, with two rows knitted between rackings. Racking was done only after the front bed tucked, to create the all-over zigzag effect.

In full fisherman's rib, if racking occurs every two rows, the zigzag racked effect will show on one face only, as in the center swatch of the first photo. If you want it to show on both faces, as in the bottom swatch, then rack twice in succession in the *same* direction,

Skechers EX1027
Skechers v Nike

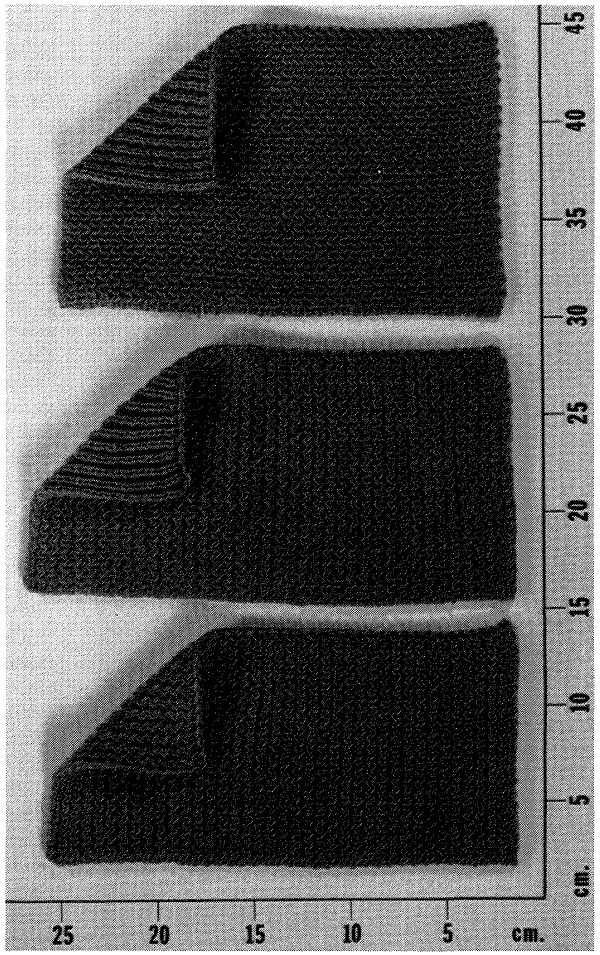
with 1 row between rackings (for example, twice to the left, then twice to the right), since the first and third rackings will affect one bed only, and the second and fourth rackings will affect only the other bed. This is also true in the horizontal herringbone pattern; if you rack one needle left, then one needle right with one row between rackings, the stitches on both faces of the fabric will slant in the same direction, and create a bias fabric. To change the direction of the bias, knit one row without racking after it, to put the carriage on the opposite side and so break the sequence. Then start again with the racking sequence.



The diagram illustrates the first three basic principles of racking.
Set-up: FNR.
Principle 1. Racking occurs after a tuck row has been knitted on one of the beds.
Principle 2. The effect of the racking will show in the knitted stitches of the front bed.
Principle 3. The stitches on the front bed will lean to the right.

	Passap carr R	Superba carr L	Brother/Knitking carr L	Singer/Studio carr L
Basic setting: Full Fisherman's Rib	EX/EX R-L: tuck/knit ; L-R: knit/tuck	↻⌒/↺⌒ L-R: knit/tuck ; R-L: tuck/knit	← tuck/N tuck L-R: knit/tuck ; R-L tuck/knit	o tuck △/1 ∩ o L-R: knit/tuck ; R-L: tuck/knit
Basic setting: Half Fisherman's Rib	N/EX or EX/N	↻⌒/∧ or ∧/↺⌒	← tuck/N N or plain/N tuck	o tuck △/1 1 or o stock o/1 ∩ o
Racking direction	back bed racks 1st rack is to L	front bed racks 1st rack is to R	front bed racks 1st rack is to R	front bed racks 1st rack is to R

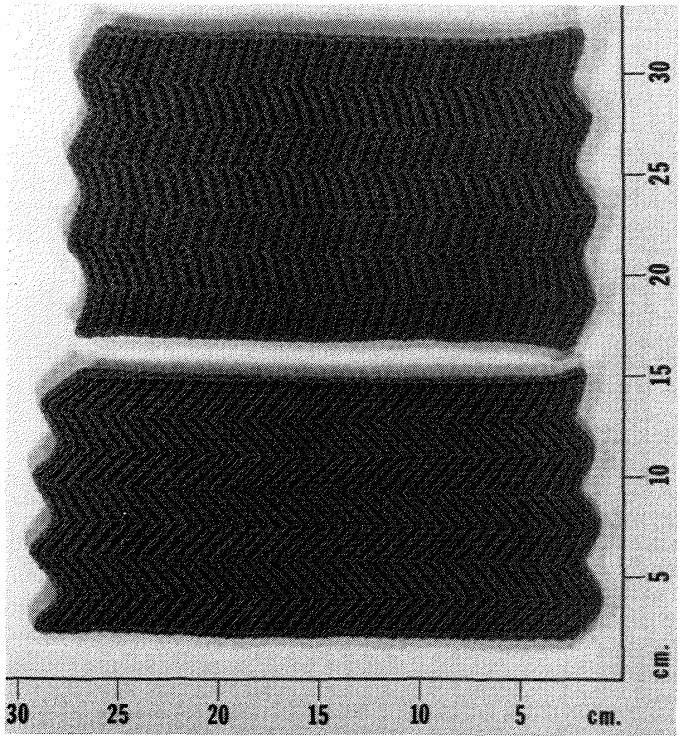
Note: racking sequence for each fabric is given in the caption for the swatch photo.



Unless otherwise noted, the set-up for all swatches in this chapter is FNR. "Rack one space" means to make the first rack by one needle either left or right, depending on your machine. "Rack one space back again" means to rack in the opposite direction. See the cam chart.

Plain racked fabrics with straight selvedges. These swatches illustrate basic principles 1 and 2.
*Top. Half fisherman's rib. The racking shows on one face. *Knit 2 rows, rack 1 space. Knit 2 rows, rack 1 space back again.* For another effect, reverse the cam settings between beds.*
*Center. Full fisherman's rib. The racking shows on one face. *Knit 2 rows, rack 1 space. Knit 2 rows, rack 1 space back again.* If you wish to make the racked effect show on the opposite face while on the machine: knit 1 row, rack 1 space. *Knit 2 rows, rack 1 space back again, knit 2 rows, rack 1 space.* End with knit 1 row, rack 1 space back again.*
*Bottom. Full fisherman's rib. The racking shows on both faces. *Knit 1 row, rack 1 space. Knit 1 row, rack another space in the same direction. Knit 1 row, rack 1 space back again; knit 1 row, rack another space back again in the same direction.* Try this in half fisherman's rib, too.*

Skechers EX1027
Skechers v Nike

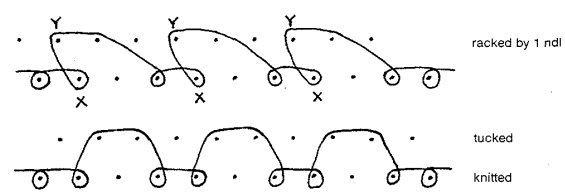


Fabrics with horizontal bias and zigzag side selvedges, illustrating basic principle 3. Horizontal herringbone pattern. The knitting instructions below are for both fabrics.
Top. Half fisherman's rib.
Bottom. Full fisherman's rib.
**Knit 1 row, rack 1 space; knit 1 row, rack 1 space back again.* Continue to RC12. Do not rack after RC12. *Knit 1 row, rack 1 space back again; knit 1 row, rack 1 space.* Continue to RC24. Do not rack after RC24. Start again from the beginning. This makes one full herringbone repeat. Omitting the racks after RC12 and RC24 breaks the sequence and starts the bias in the opposite direction.*

PATTERNING

There are two ways to create patterns with straight and slanted stitches on the same face of the fabric. Needles can be left out of work in such a way that those remaining will vary in their consecutive order when racked. Or punchcards or pushers can be used to select needles for knit and tuck on the same bed simultaneously. The photos illustrate how the same pattern can result from either method. Once you understand how these two methods work, you can create an endless variety of racked patterns, using either method alone or the two together.

4. For a given knit stitch to show the slanted effect of racking, it must, when racked, cross all the way behind or in front of a needle on the opposite bed which will knit on the next row, to change the consecutive knitting order of the needles. If the racked stitch crosses a space where a needle is in NWP, or where a needle will tuck, rather than knit, on the next row, the given knit stitch will be straight instead of slanted, since the consecutive order will not change. In other words, it doesn't matter whether the given knit stitch will knit or tuck on the next row, but it does matter whether the stitch crossing behind it will knit or tuck on the next row. This is because a tuck stitch is not a stitch, but a loop. It slips and slides behind a knit stitch and therefore is not capable of fixing the racked effect into the fabric.

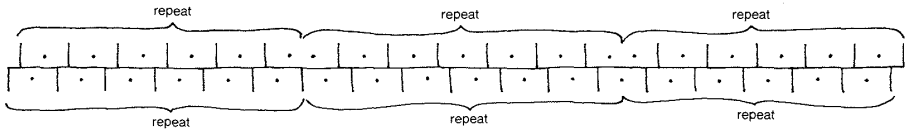


The diagram illustrates the fourth basic principle of racking. Set-up: 2x1 rib (plain dots are needles in NWP).
Principle 4. Each stitch marked x *on the front bed will show the effect of racking, since an occupied needle (marked* y*), which will knit on the next row, has crossed behind it, thus changing the consecutive knitting order of the needles. The other stitches on the front bed will remain straight.*

Skechers EX1027
Skechers v Nike

	Passap carr R	Superba carr L	Brother/Knitking carr L	Singer/Studio carr L
Check in Half Fisherman's Rib with ndl selection MB	N / AX ↔ *push 6x6 WP/RP*	6x6 card - ER	6x6 card - ER tuck ↔ / N N	6x6 card - ER △ tuck △ / 1 1
Check in Full Fisherman's Rib with ndl selection both beds	AX ↔ push 6x6 RP/WP / AX ↔ push 6x6 WP/RP	6x6 card - ER On 2nd bed, select ndls with 6x6 patt ruler ER, so that selected ndls will face tuck ndls on MB.	6x6 card - ER tuck ↔ / tuck ↔ On 2nd bed, select ndls with 6x6 patt ruler ER, so that selected ndls will face tuck ndls on MB.	6x6 card - ER △ tuck △ / o ∩ o On 2nd bed, select ndls with 6x6 patt ruler ER, so that selected ndls will face tuck ndls on MB.

Note: racking sequence for each fabric is given in the caption for the swatch photo.



Set-up for the bottom swatch in the photo at right. Two sets of brackets make a complete repeat consisting of one plain check and one patterned check.

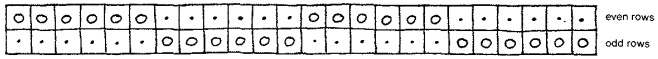
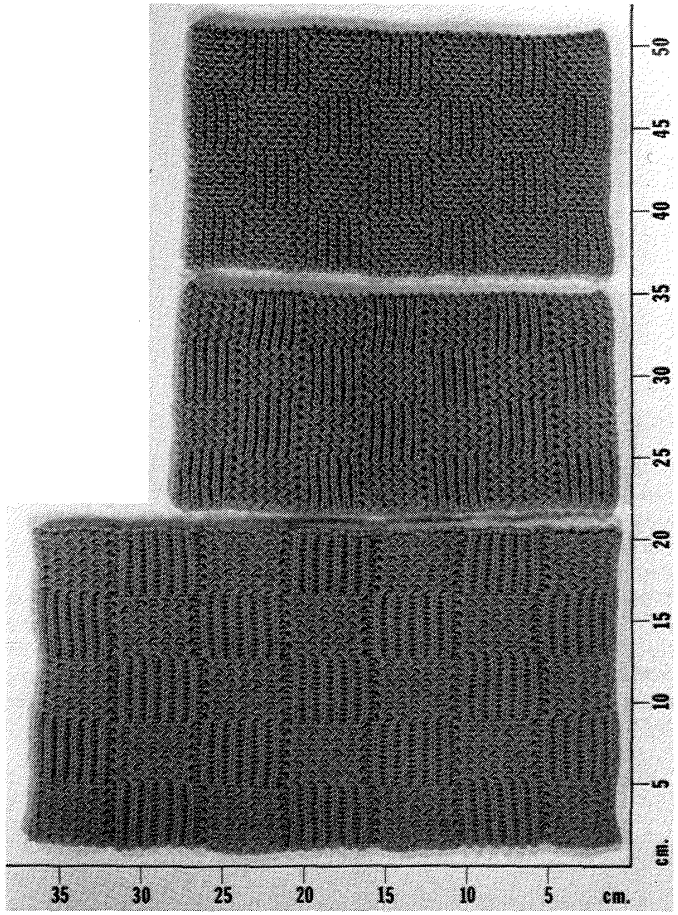


Diagram of 6x6 punchcard for Superba and the Japanese machines, to be used with the racking patterns on this and the following pages. Repeat: 2 rows, 12 stitches.



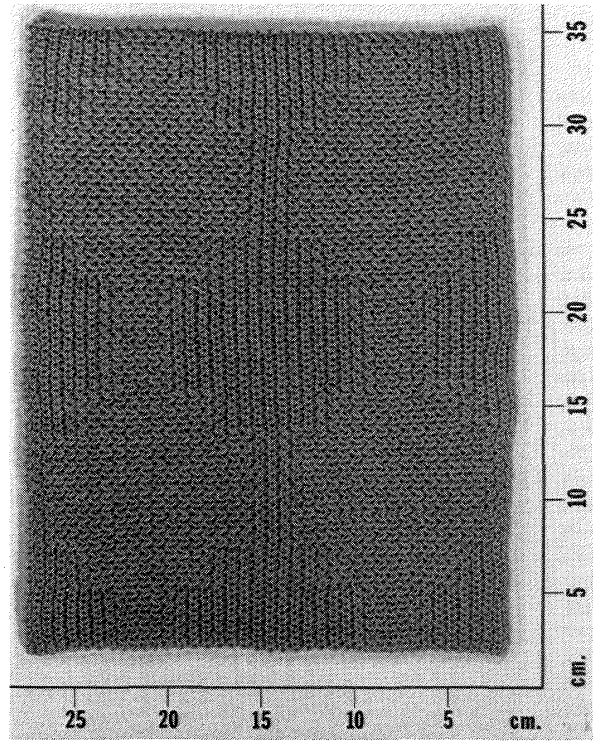
Checkerboard pattern, illustrating basic principle 4.
*Top. Half fisherman's rib, made in FNR set-up with 6x6 selection on MB only. The racked pattern shows on the opposite face. *Knit 2 rows, rack 1 space; knit 2 rows, rack 1 space back again.* Repeat for 20 rows, ending with final "rack back again." Knit 1 row without racking. Start the 21-row sequence again. For each sequence, the carriage starts from the opposite side. See cam chart and punchcard diagram. The punchcard rotates continuously and the cam setting remains the same throughout.*
Center. Full fisherman's rib, made FNR with ndl selection on both beds. The racked pattern is reversible. The knitting directions are the same as for half fisherman's rib. See the cam chart for settings.
*Bottom. Full fisherman's rib, made in 1x1 set-up (half-pitch) with both carriages set for fisherman's rib. No needle selection. The racked pattern shows on one face only—the back bed. *Knit 2 rows, rack 1 space; knit 2 rows, rack 1 space back again.* Continue to RC24, ending with final "rack back again." Repeat the sequence, but start racking in the opposite direction: the same direction as the last rack of the prior sequence.*

Skechers EX1027
Skechers v Nike

*Half fisherman's rib, jacquard Pattern 7. Needle selection on the MB only; the racked effect shows on the opposite bed. *Knit 2 rows, rack 1 space; knit 2 rows, rack 1 space back again.* Each pattern row is knitted RC4.*

	Passap carr R	Superba carr L	Brother/Knitking carr L	Singer/Studio carr L
Vertical Herringbone 1 color Half Fisherman's Rib	N / AX ↔ push 6x6 WP/RP	6x6 card - ER ⌒ / ∧	6x6 card - ER tuck ↔ / N N	6x6 card - ER △ tuck △ / 1 1
Vertical Herringbone 2 colors Half Fisherman's Rib RC2 each color	N / AX ← push 6x6 WP/RP	6x6 card - EOR ⌒ / ∧	6x6 card - EOR tuck ↔ / N N	6x6 card - EOR △ tuck △ / 1 1

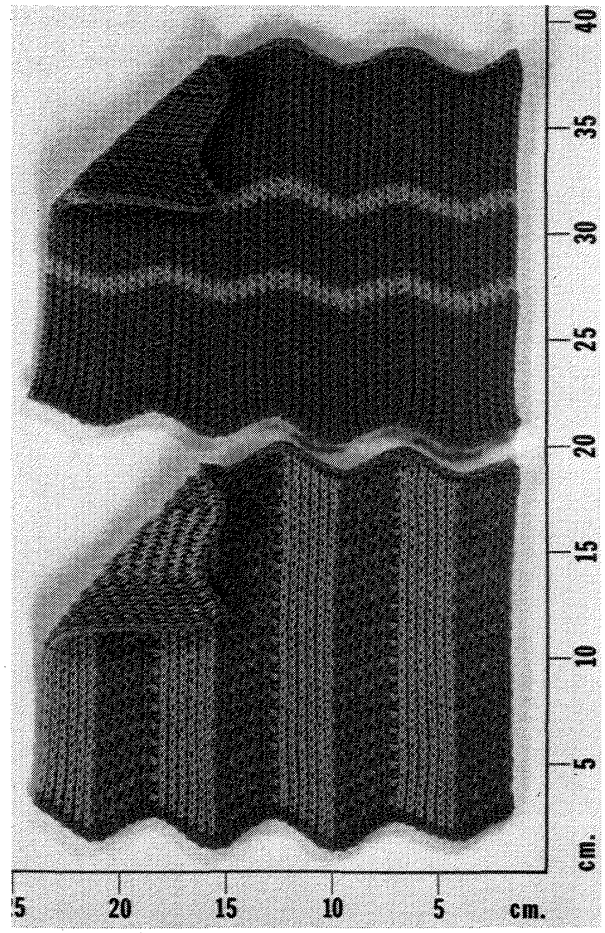
Note: racking sequence for each fabric is given in the caption for the swatch photo.



Note: racking sequence for each fabric is given in the caption for the swatch photo.

	Passap carr R	Superba carr L
Jacquard Pattern with punchcard - Half Fisherman's Rib	Type A N / AX ↔ Deco 4	Type A - stop card change patt rows every RC4 ⌒ / ∧ RC 1 pos rev, RC1 neg rev

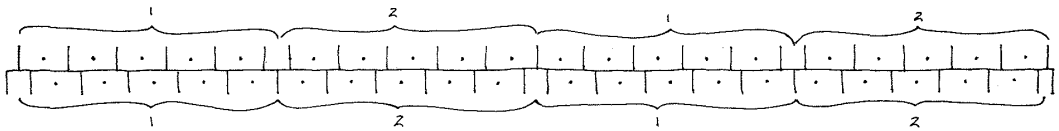
Vertical herringbone pattern with top and bottom selvedges zigzagged, illustrating basic principle 4.
*Top. Half fisherman's rib, in one color or in horizontal stripes, made in FNR set-up with ndl selection on the MB only. *Knit 1 row, rack 1 space, knit 1 row, rack 1 space back again.* Repeat. Look at the cam chart for settings.*
*Bottom. Half fisherman's rib in two-color vertical stripe, made in FNR set-up with ndl selection on the MB only. *Knit 2 rows with col 1, rack 1 space. Knit 2 rows with col 2, rack 1 space back again.* Repeat. See the cam chart for settings.*



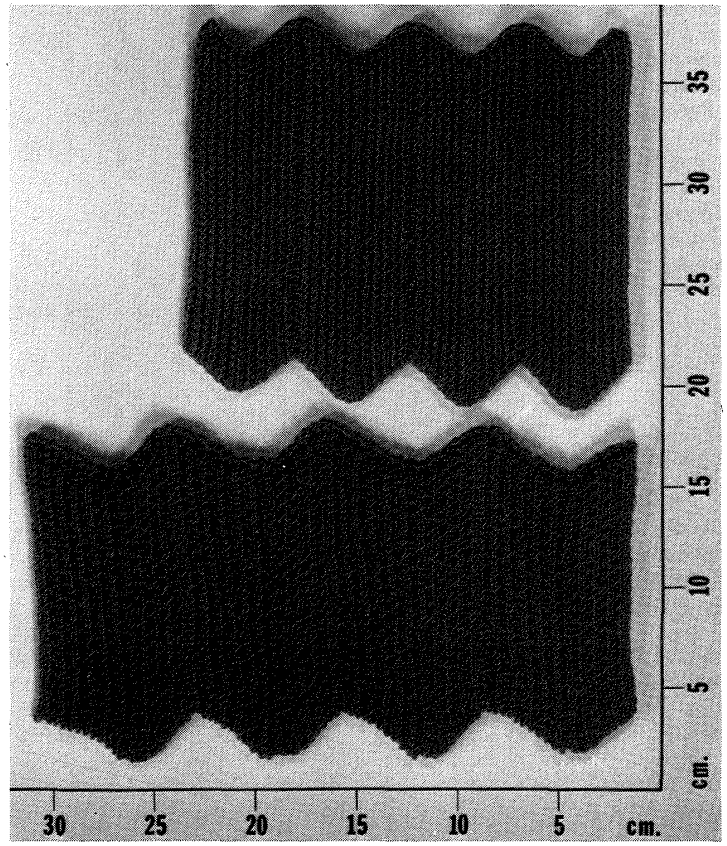
Skechers EX1027
Skechers v Nike

	Passap carr R	Superba carr L	Brother/Knitking carr L	Singer/Studio carr L
Vertical Herringbone 1 color Full Fisherman's Rib	AX ↔ push 6x6 RP/WP AX ↔ push 6x6 WP/RP	6x6 card - ER ∩ ∩ On 2nd bed, select ndls with 6x6 patt ruler ER, so that selected ndls will face tuck ndls on MB.	6x6 card - ER tuck ↔ tuck ↔ On 2nd bed, select ndls with 6x6 patt ruler ER, so that selected ndls will face tuck ndls on MB.	6x6 card - ER △ tuck △ o ∩ o On 2nd bed, select ndls with 6x6 patt ruler ER, so that selected ndls will face tuck ndls on MB.

Note: racking sequence for each fabric is given in the caption for the swatch photo.



Set-up for the bottom swatch in the photo below. Numbers 1 and 2 together make one repeat.



*Top. Full fisherman's rib in one color, made in FNR set-up with ndl selection on both beds. *Knit 1 row, rack 1 space; knit 1 row, rack 1 space back again.* Refer to cam chart for settings.*

*Bottom. Full fisherman's rib in one color, made in 1x1 set-up in half pitch. No ndl selection on either bed; both carriages set for fisherman's rib. Both faces of the fabric are identical. Unlike the other patterns, this one has three racking positions: left, center, right; or right, center, left, depending on your machine. The center position is the starting set-up. *Knit 1 row, rack one space; knit 1 row, rack back to center; knit 1 row, rack in same direction again; knit 1 row, rack back to center.* Repeat.*

HINTS FOR KNITTING RACKED PATTERNS

For most knitters, the bane of racking is the hypnotic effect of knitting sequence after sequence. One's attention seems to lapse just when it is needed to keep the knit/rack sequence in proper order. Then there are interruptions and other distractions, like a ringing telephone. To keep track of what you are doing, try the following:

1. Make a diagram of the needle set-up at the beginning of the pattern. Most racking sequences move out of, then back into, the starting set-up.
2. If you can't remember whether or not you just racked, or in which direction you racked, look at the slant of the stitches. If they are pulled diagonally, racking has occurred. If they appear in the normal zigzag pattern, racking hasn't occurred. Most machines have an arrow on the racking scale, showing the direction of the last rack.
3. Make note of the number of rows in a sequence, and of its multiples. Then during knitting, if you forget how many rows there are to the end of a sequence, you can figure it out from the row counter.

OTHER TECHNIQUES FOR KNITTING RACKED PATTERNS

1. The usual needle rule for the starting set-up in a racked pattern is the same as the normal needle rule for all double bed knitting. On Passap, the first rack is generally to the left (the back bed racks). On other machines, the first rack is generally to the right (the front bed racks), so the racked position is exactly opposite the usual needle rule for all machines.
2. Beds are always at half pitch.
3. Use a stitch size slightly larger than usual, to accommodate the stretch during racking.
4. Check the racked position of the beds before setting up the needles. They should usually be centered.
5. Rack beds in a backward sequence when ripping out rows.
6. When setting up, first go through the racking sequence with empty needles, and add extra needles where necessary for selvedges. A tuck loop at the end of a row on an exposed selvedge needle will always drop at the start of the next row, so an adjacent needle must be knitting on the opposite bed to "guard" it. This must be watched when increasing and decreasing as well.

Skechers EX1027
Skechers v Nike