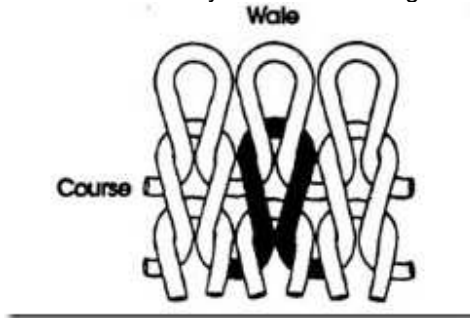


# Fundamentals of Knitting

To form a fabric by the intermeshing of loops of yarn.

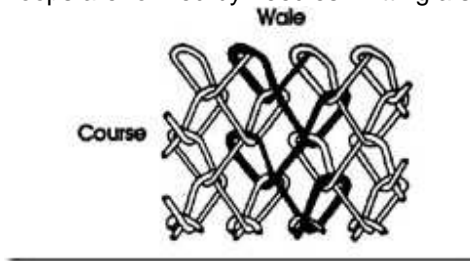


## Weft Knitting

Loops are formed by needles knitting the yarn across the width of the fabric. Each weft thread is fed at right angles to the direction of fabric formation.

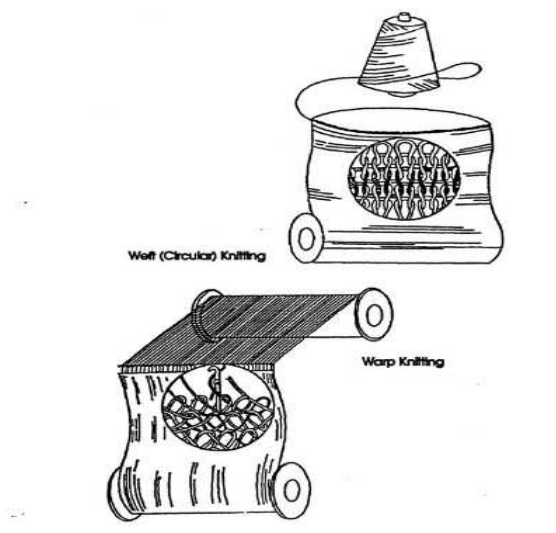
## Warp Knitting

Loops are formed by needles knitting a series of warp yarns fed parallel to the direction of fabric formation.



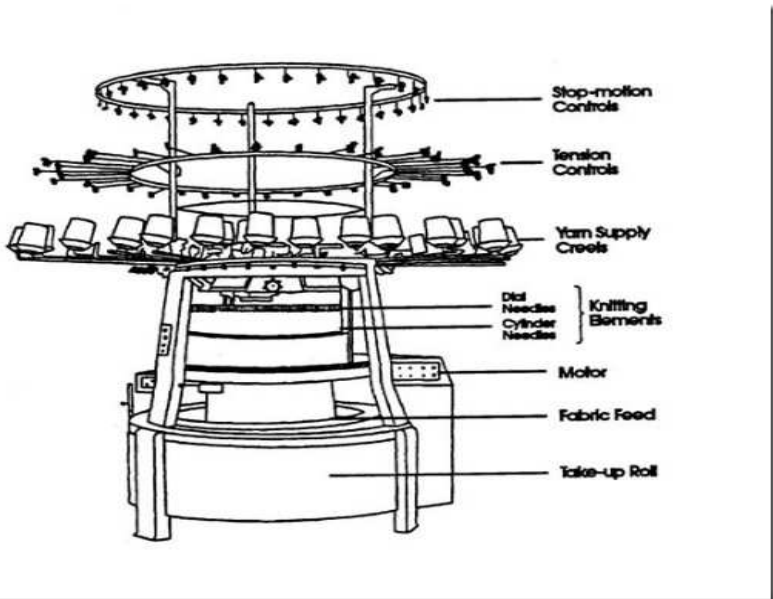
In warp knitting all needles knit simultaneously for all yarns, while in weft knitting the needles knit in sequence for each yarn.

**Figure 9-1 Weft (Circular) Knitting And Warp Knitting**



- Consumer Acceptance
- Comfortable
- Pliable
- High extensibility
- Easy care properties
- Inexpensive

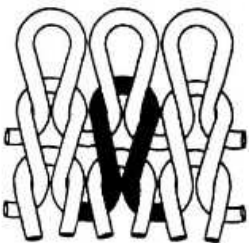
Apparel, home fashion, industrial  
 Productivity And Lead Time  
 Faster than woven  
 Shorter lead time, quick response Small lots  
 Body sizes, Full fashion  
 Use Of Fibers And Yarns  
 All fibers All yarns Low tensions/stress allow loop formation or entrapment  
 Capital Investment  
 Low initial cost  
 No expensive yarn preparation  
 Small area of floor space required  
 Few auxiliary machines needed for operation  
**Figure 9-2 Weft Knitting**



**Basic Weft Knitting Terminology**

Course  
 Wale  
 Course Count  
 Wale Count Knit Loop Face Loop Back Loop Stitch  
 Tuck Loop Float Loop Yield  
 Course Length Cut or Gauge Gaiting Timing  
 Dial Height Back Loop  
 Stitch  
 Tuck Loop Float Loop Yield

**Figure 9-3 Jersey Knit**



**Figure 9-4 1x1 Rib**



Figure 9-5 The Latch Needle

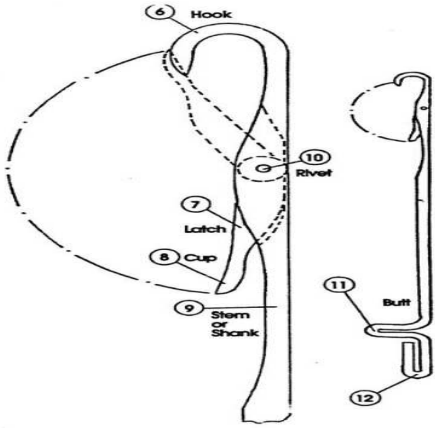


Figure 9-6 Needle Cylinder

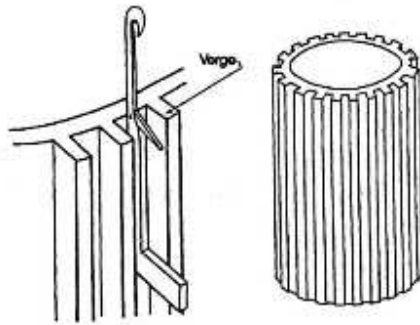


Figure 9-7 Latch Needle Activation

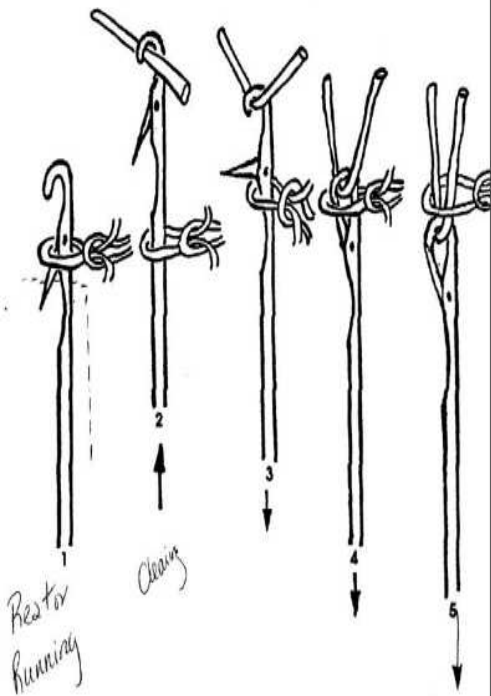


Figure 9-8 Typical Cam System Of Single Jersey

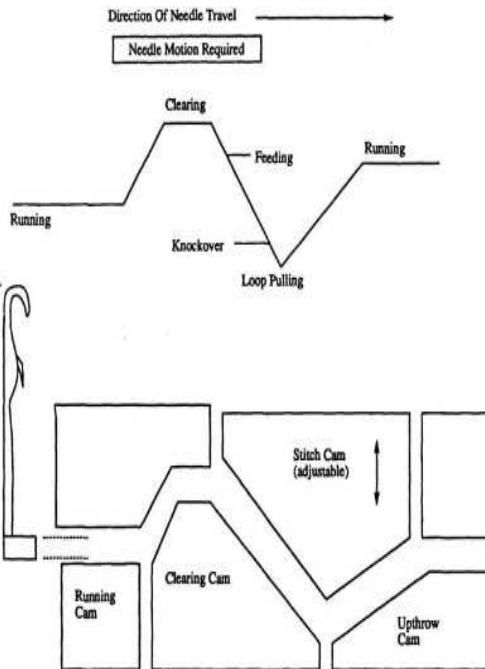


Figure 9-9

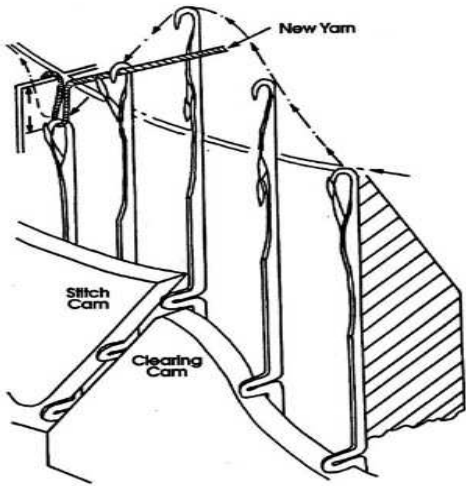


Figure 9-10

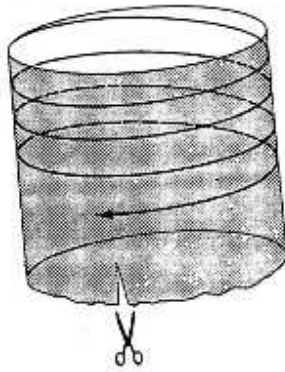


Figure 9-11 Latch Needles And Web Holding Sinkers

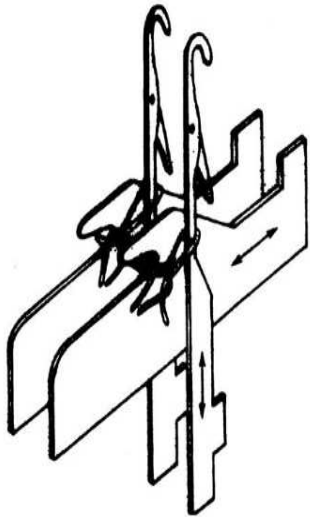


Figure 9-12 Movements Of Latch Needles And Web Holding Sinkers

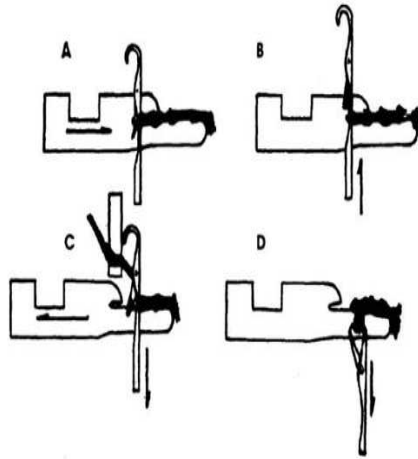


Figure 9-13 Diagrams of Three Types of Loops

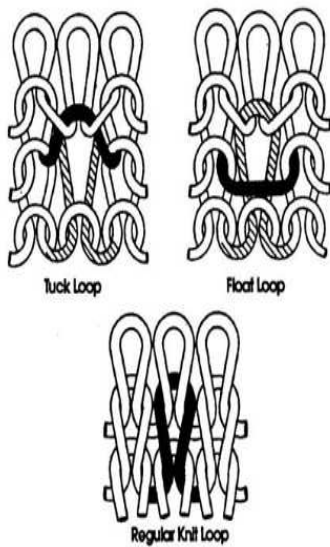


Figure 9-14 Technical Face and Rear of Tuck Stitch



### Basic Weft and Warp Knitting Terminology

- A. Course - the row of loops or stitches running across the width of a fabric corresponding to filling of a woven fabric.
- B. Wale - in knit fabrics, a column of loops running lengthwise the fabric.
- C. Course Count.- the number of courses in a knit fabric per unit length measure. For example: courses per inch.
- D. Wale Count - the number of wales in a knit fabric per unit length. For example: wales per inch.
- E. Knit Loop.- a stitch in a fabric Where the yarn is formed into a loop shape by the knitting elements. Knitting meshes or interlocks these loops to form a fabric.
- F. Face Loop - a knitted loop formed on the cylinder needles on a knitted machine.
- G. Back Loop - a knitted loop formed on the dial needles on a knitted machine.
- H. Stitch - in knitting, a stitch is the loop geometry of a particular pattern repeat. . It may be in the form of a knitted, a tuck or a float loop.
- I. Tuck Loop.- a knitted stitch when a needle receives a new yarn without losing its old loop.
- J. Float Loop - a knitted stitch when a needle holds its old loop and does not receive a new yarn. It connects two loops on the same course but not in adjacent wales. Also called a miss-loop.
- K. Yield - the amount of fabric delivered off a knitting machine in terms of its weight per unit length or area, or the number of linear units delivered per unit weight. For example, ounces per yard, or ounces per square yard or yards per pound. •
- L. Course Length - the amount of yarn used in forming all the knit-loops in one course of a knitted fabric. Also called run-in.
- M. Cut or Gauge - the number of needles per inch in the circumference of the cylinder or dial of a knitting machine.
- N. Gaiting - the spacing of the needles in the dial and the cylinder in relation to each other on rib and interlock machines. In rib knitting, the needles of the cylinder are between the needles of the dial. In interlock gaiting, the needles of the cylinder are directly opposed to the needles in the dial (opposed to each other).
- O. Timing - the order the needles in the dial and cylinder go through the knitting cycle in relationship to one another. The cylinder needles that correspond to dial needles may go through the knitting cycle before or after the dial needles.
- P. Dial Height the distance between the bottom edge of the dial section on a knitting machine at its perimeter from The corresponding upper edge of the cylinder at its perimeter.
- A. Tricot - a type of warp knitting in which spring bearded needles are normally used to make fine fabrics with usually one to three warps are used.**
- B. Raschel - a type of warp knitting in which plain and jacquard fabrics can be made. Raschel fabrics are normally coarser than other types Of warp knits, :but a wide range of fabrics can be made. Raschel machines may have one or two sets of needles and up to thirty guide bars.**
- C. Gauge - the number of needles per linear inch of the needle bar. For most warp knits that refers to a one linear inch, but can be for two.**
- D.. Guide Bar - a mechanism on a warp knitting machine which directs warp yarns to the knitting needles, and their movement is controlled so that patterns can be knit.**
- E. Needle Bar - a flat metal plate with slots (tricks) cut into it at regular intervals into which needles slide during the**

knitting process.,

F. Runner Length - in warp knitting the number of inches of yarn needed to knit one rack of fabric.

G. Rack - a warp knitting measure of 480 courses. Tricot fabric quality is judged by the number of inches per rack.

H. Inch Quality - a measure of quality of warp knit fabric, the number of inches of fabric per rack.

I. Full Set - a term that indicates that all guide eyes in a guide bar each have a yarn from the warp.

j. Part Set - a term that indicates that all guide eyes in a guide bar do not have a yarn from the warp.

K. Positive Feed - when the yarn is metered off the warp beam by a metering device.

L. Negative feed - when the yarn is pulled off the warp beam by the knitting action of the needles during the loop forming step.

M. Pattern Wheel - a cylinder or wheel upon which a pattern chain is placed which has links of different heights so as to move the guide bars throughout its pattern.

Figure 9-15 Tuck Stitch Formation

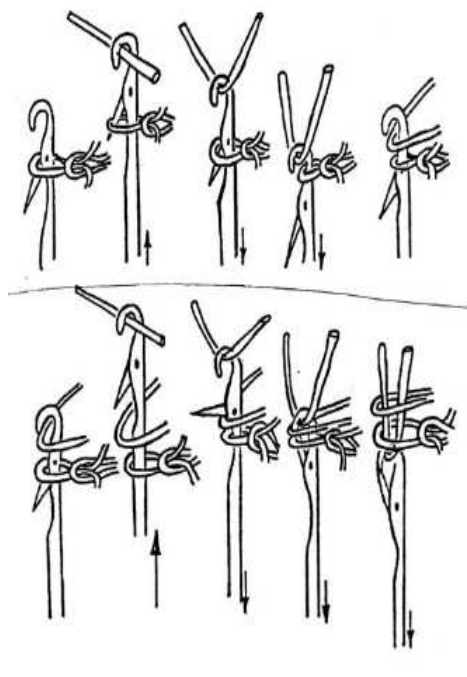
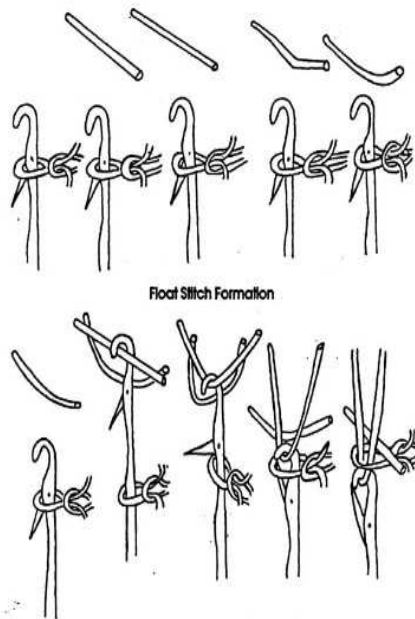


Figure 9-16 Float Stitch Formation



Effects Of Tucks And Floats On Knitted Fabrics

**Tuck Loop**

- Makes the fabric wider
- Makes the fabric thicker
- Makes the fabric slightly less extensible

**Float Loop**

- Makes the fabric narrower
- Makes the fabric thinner
- Makes the fabric much less extensible

Figure 9-17 Cylinder and Dial

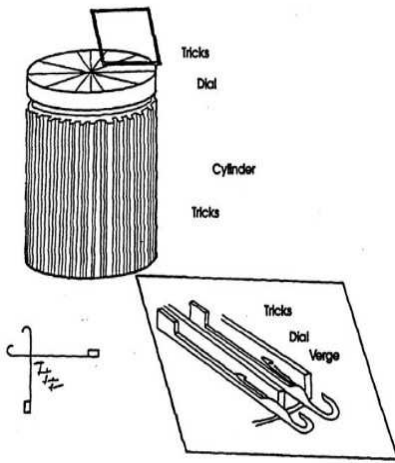
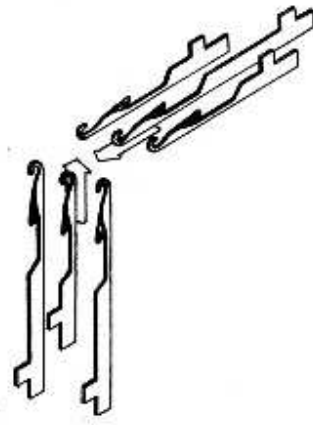


Figure 9-18 1 x 1 Rib



Figure 9-19 Rib Gaiting



**Weft Knitting Notation**

**Verbal**

1 x 1 Rib - Fabric made with face loops and back loops alternating in same course but not same wale. Made on dial and cylinder machine with rib gaiting.

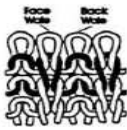
**Symbolic**

1 x 1 Rib

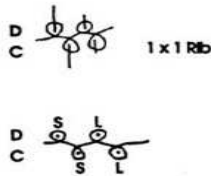


	Fd. 1
Dial	L K
	S K
Cyl.	S K
	L K

**Graphic**



**Diagrammatic**



**2 x 2 Rib**

**Machine Requirements**

A rib machine.

Only one came race and one type of needle for the cylinder dial. Rib gaiting

Needle Setout

Needles not knitting must be removed from the machine Needle Selection

All at every feed

Fabric Properties

A one feed repeat.

Same appearance on both sides. Good crosswise extensibility.

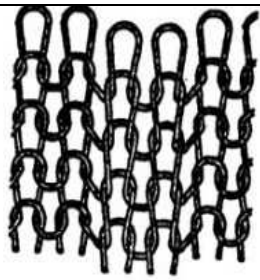
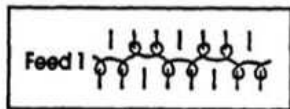


Figure 9-20 Interlock

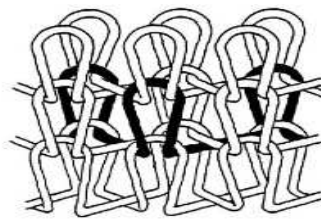


Figure 9-21

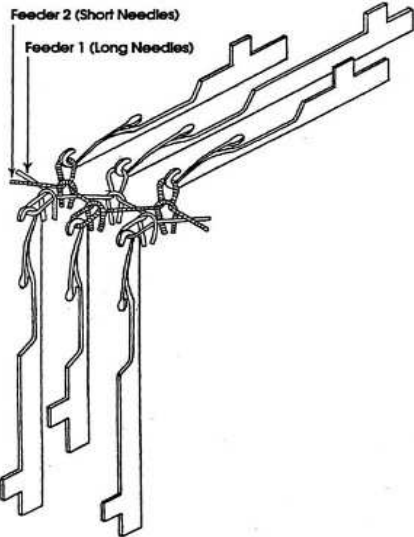
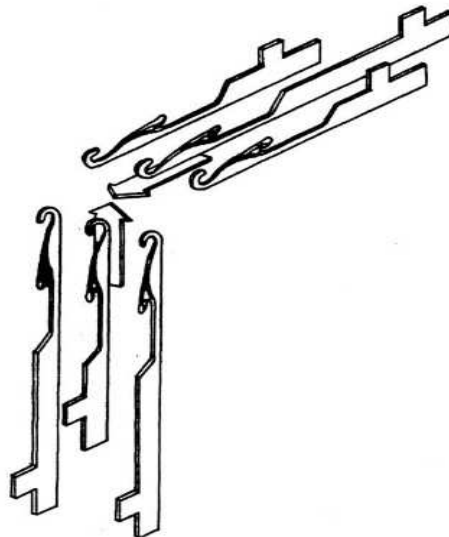


Figure 9-22 Interlock Gaiting



**Interlock**

**Machine Requirements**

An interlock or eightlock machine.

Long and short needles in both the cylinder and dial. Interlock gaiting and usually delayed timing.

**Needle Setout**

Needles alternately arranged long and short in the cylinder and dial. Needle Selection

Dial Needles Cylinder Needles

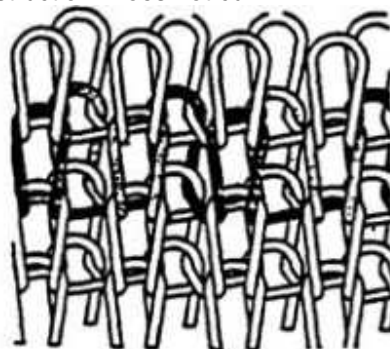
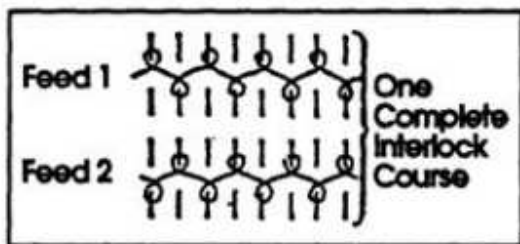
Knit short Knit short

Knit long Knit long

**Fabric Properties**

A two feed repeat.

Same appearance on both sides. Tight and stable construction. Does not curl.



**Ponte Di Roma**

**Machine Requirements**

An eightlock machine.



Long and short needles in both the cylinder and dial. Interlock gaiting (Rib gaiting can also be used) and usually delayed timing.

Needle Setout

Needles alternately arranged long and short in the cylinder and dial. Needle Selection

Dial Needles Cylinder Needles,

Knit short Knit short

Knit long Knit long

Miss all Knit all

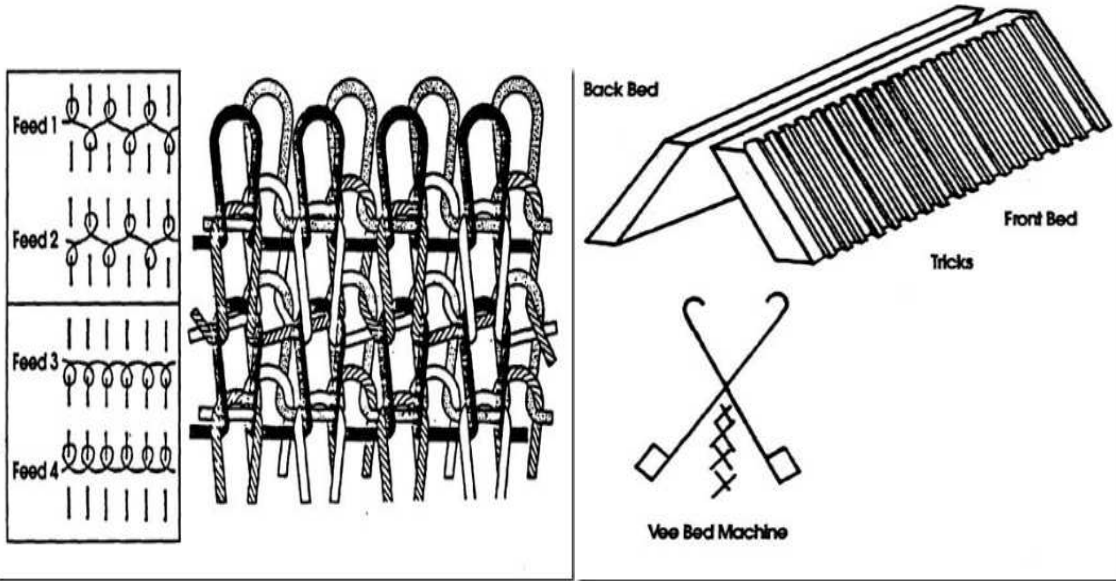
Knit all Miss all

Fabric Properties

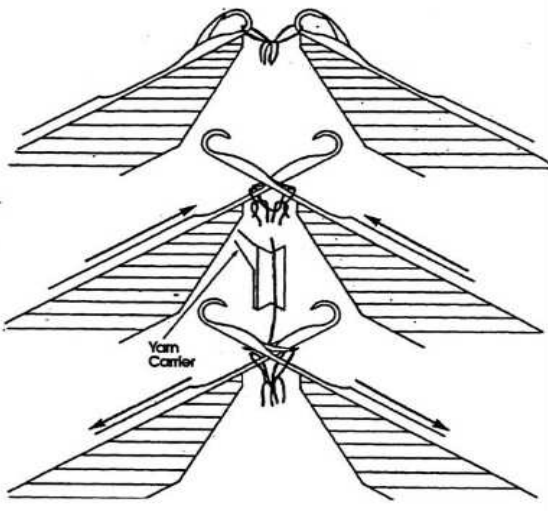
A four feed repeat.

Same appearance on both sides. Tight and stable construction. Does not curl.

**Figure 9-23**



**Figure 9-24 'V Bed Rib'**



Properties Of Weft Knits

Stretch and recovery Wrinkle Recovery Thickness

Air Permeability

Shrinkage

Snagging

Pilling  
Curling

Figure 9-25 Warp Knitting

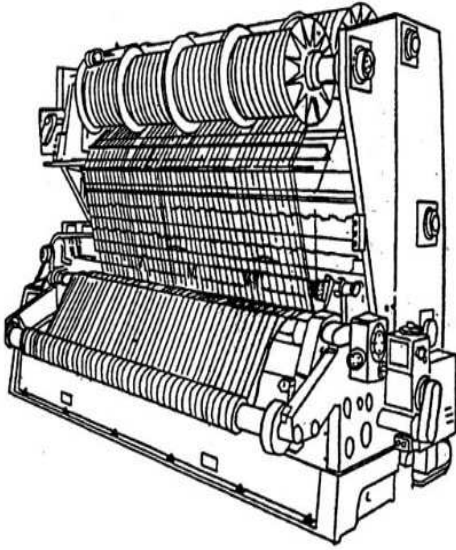
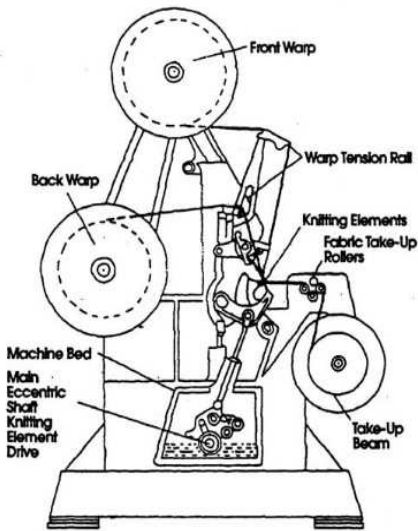


Figure 9-26 Diagram Of A Typical Tricot Machine: The Front Is At Right



### Warp Knitting

L Basic Warp Terminology

A. Tricot

B. Rachel

C. Gauge

D. Guide Bar

E. Needle Bar

F. Runner Length

G. Rack

H. Inch Quality

I. Full Set

J. Part Set

K. Positive Feed

L. Negative Feed M. Pattern Wheel

**II. Basic Warp Knit Actions**

- A. Spring Beard Needle
- B. Latch Needle
- C. Compound Needle

**III. Design Variables**

- A. Yarn Characteristics
- B. Threading
- C. Underlap Length and Position
- D. Number of Bars
- E. Fabric Enhancement

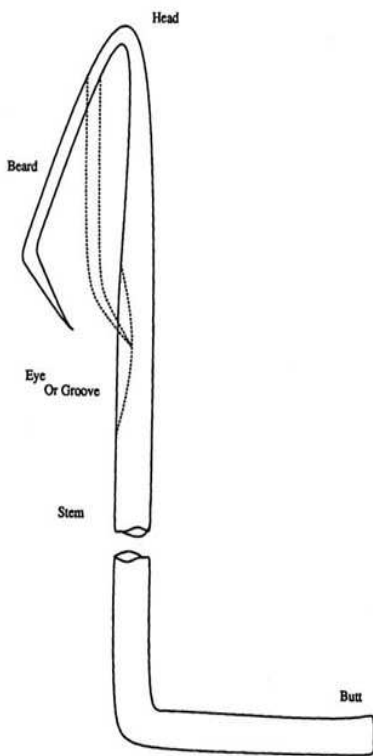
**IV. Fabric Classifications**

- A. One Bar
- B. Two Bar
- C. Three Bar
- D. Multiple Bar

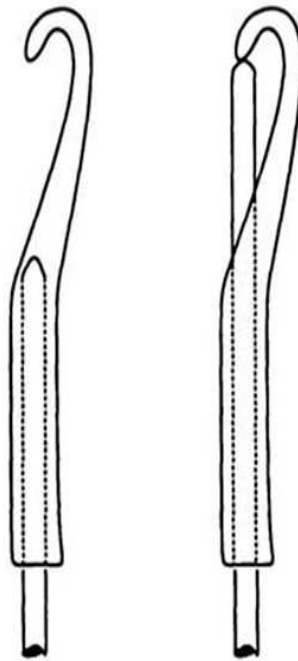
**V. Warp Knitted Fabric Notation**

- A. Verbal
- B. Graphic
- C. Numerical
- D. Diagrammatic

**Figure 9-27 The Bearded Needle**



**Figure 9-28 Compound Needle**



**Comparison Of Latch Needle and Spring Beard Needle**

- |              |                            |
|--------------|----------------------------|
| Latch Needle | Spring Beard Needle,       |
| Latched      | Not latched                |
| Self-closing | To be closed               |
| Forms loop   | Requires help to form loop |
| Expensive    | Cheaper                    |
| Coarser      | Finer                      |

Low needles per inch More needles per inch

Figure 9-29 Lapping Movements

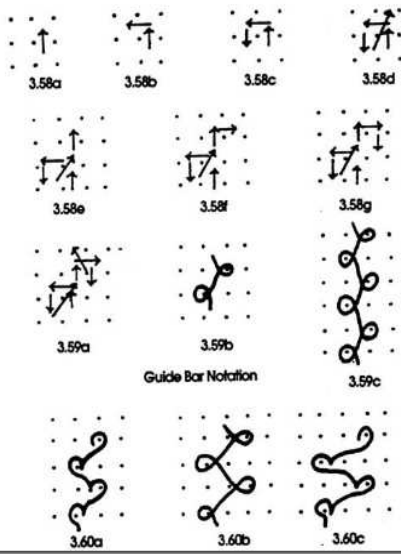


Figure 9-30 Tricot Machine Kniffling Action

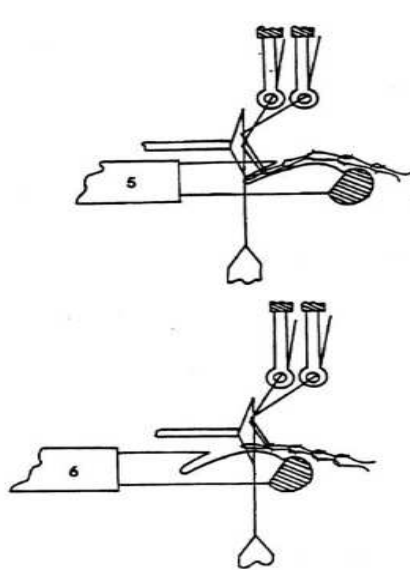
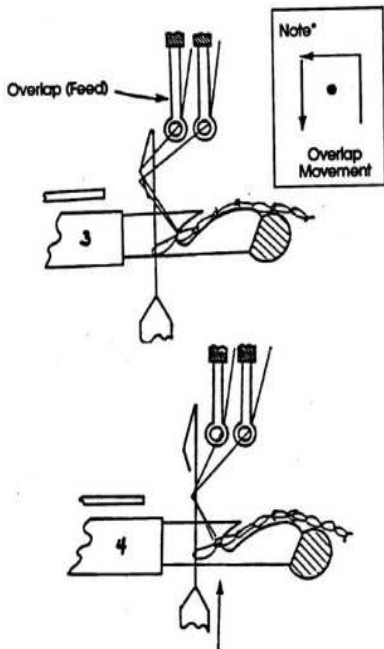
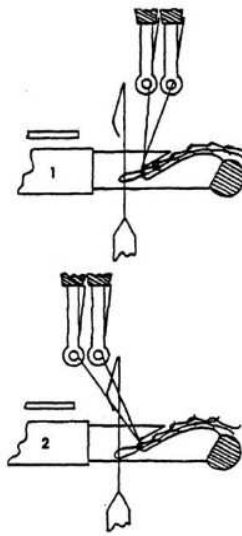


Figure 9-31 Half Tricot Structure

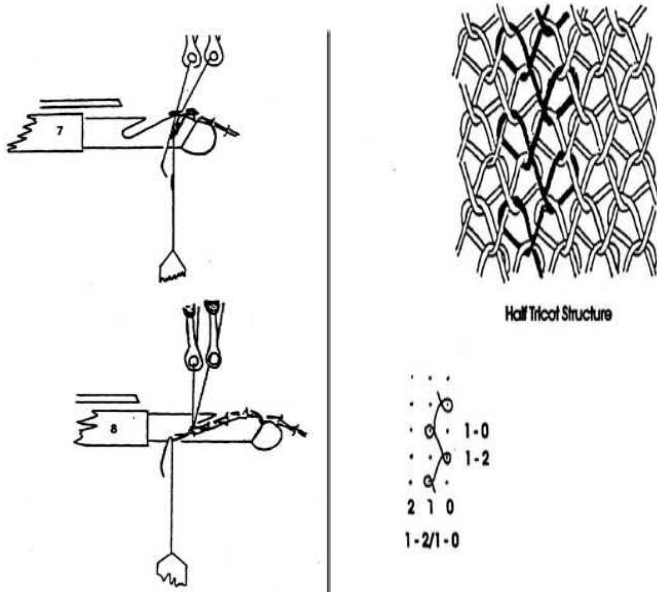
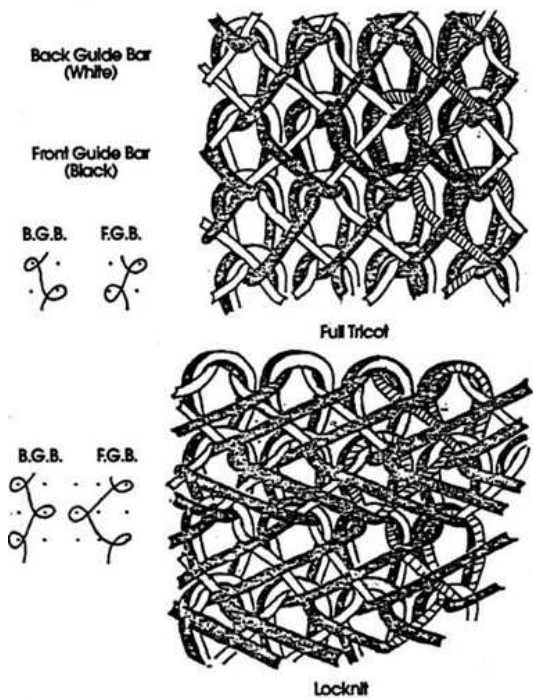


Figure 9-32 Two Bar Fabrics



Standard Two Bar Fabrics  
 Tricot Jersey (Full Tricot)  
 Front Bar 1-2/1-0/  
 Back Bar 1-0/1-2/  
 Locknit  
 Front Bar 2-3/1-0/  
 Back Bar 1-0/1-2/  
 Reverse Locknit  
 Front Bar 1-2/1-0/  
 Back Bar 1-0/2-3/

Loop Raised  
 Front Bar 1-0/3-4/  
 Back Bar 1-0/2-3/  
 Sharkskin  
 Front Bar 1-0/1-2/  
 Back Bar 3-4/1-0/  
 Satin  
 Front Bar 3-4/1-0/  
 Back Bar 1-0/1-2/  
 OR  
 Front Bar 4-5/1-0/  
 Back Bar 1-0/1-2/  
 Queenscord  
 Front Bar 1-0/0-1/  
 Back Bar 3-4/1-0/  
 OR  
 Front Bar 1-0/0-1/  
 Back Bar 4-5/1-0/

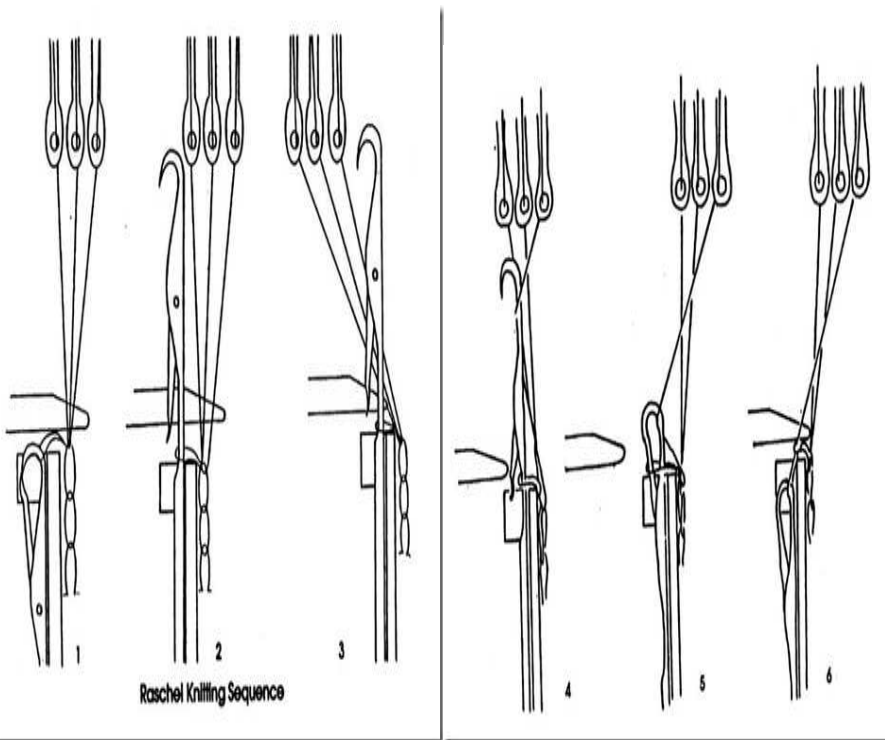


Diagram of a Simple Raschel Crochet Knit

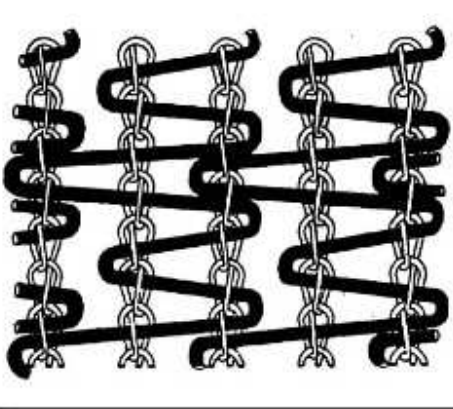
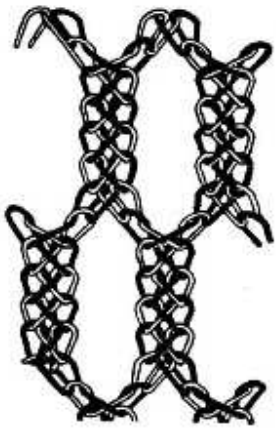
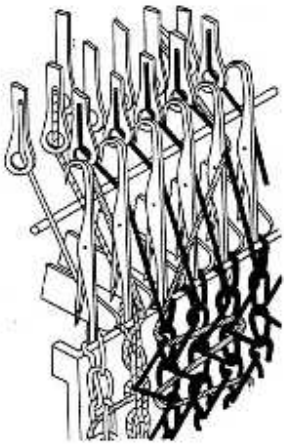


Figure 9-33 Diagram Of A Knitted Net



**Figure 9-34 Diagram Showing Laying In Yarn to Form Designs: Some guide bars are left empty.**



#### Characteristics Of Warp Knit Fabrics

- Extremely versatile in pattern effects with yarn Rigid to elastic
- Cannot be raveled
- Good air and water permeability
- Good crease resistance
- Good drapability
- Good dimensional stability
- Good Strength