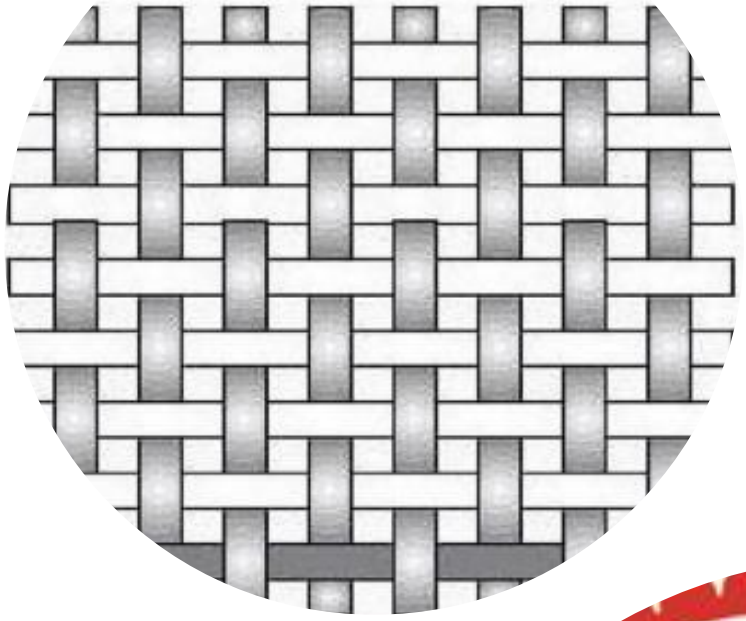
Fabric Manufacturing I (TXL231)



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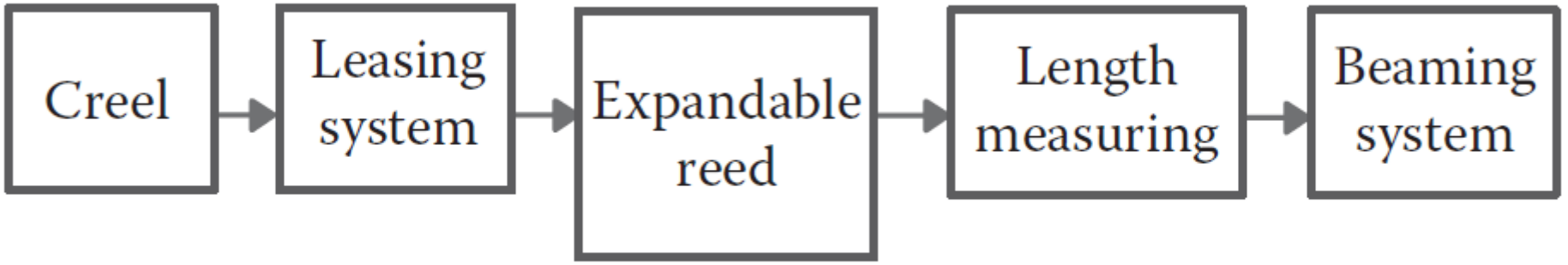
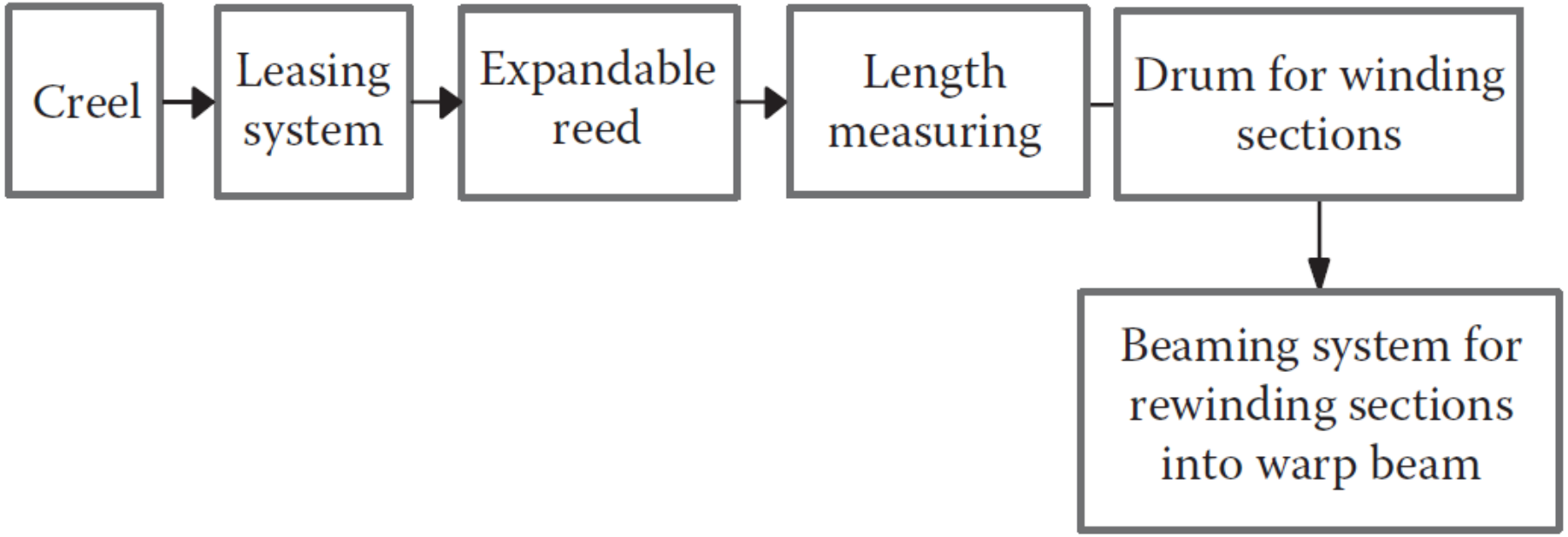
Warping: Steps

Beam Warping



Sectional Warping

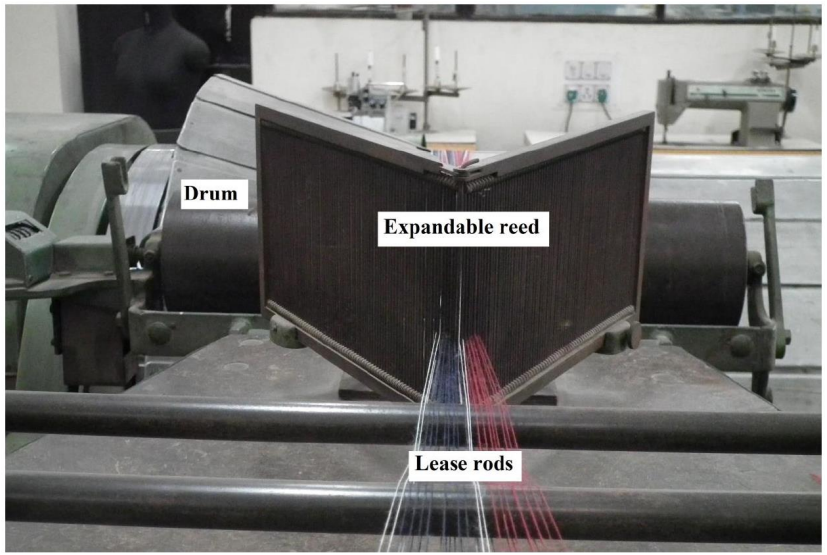


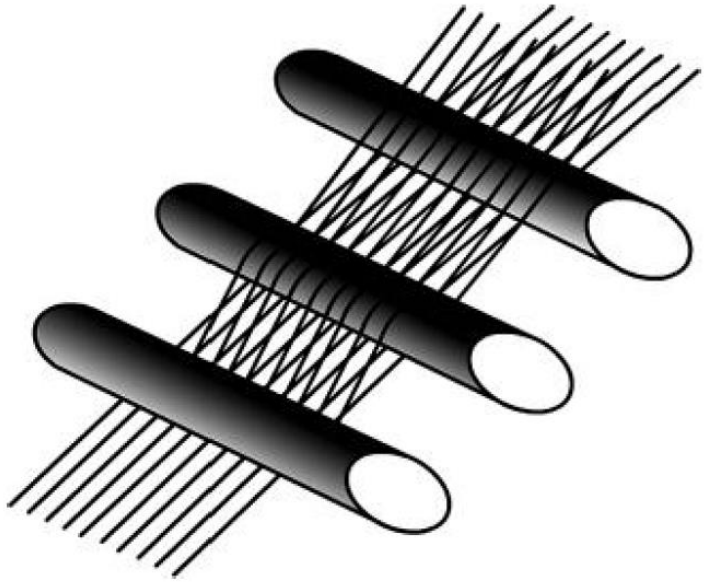
Warping: Creels

- Single end creel
- Magazine creel
- Traveling or multiple package creel

Warping: Leasing system

Leasing is a method of segregating yarns from neighboring ones and maintaining their location in a warp sheet

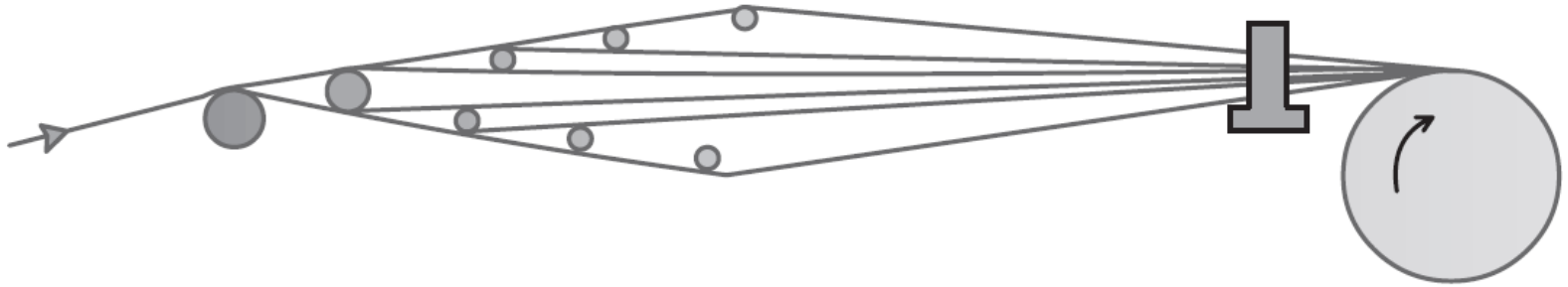




- Simple end-and-end leasing involves splitting a warp sheet into two layers of odd- and even-numbered ends
- A rod inserted between these two layers would show either the odd-numbered or the even-numbered yarns passing above the band or rod
- To create a neat crossover line, another rod or band is subsequently introduced between the two layers with the order reversed

Warping: Leasing system

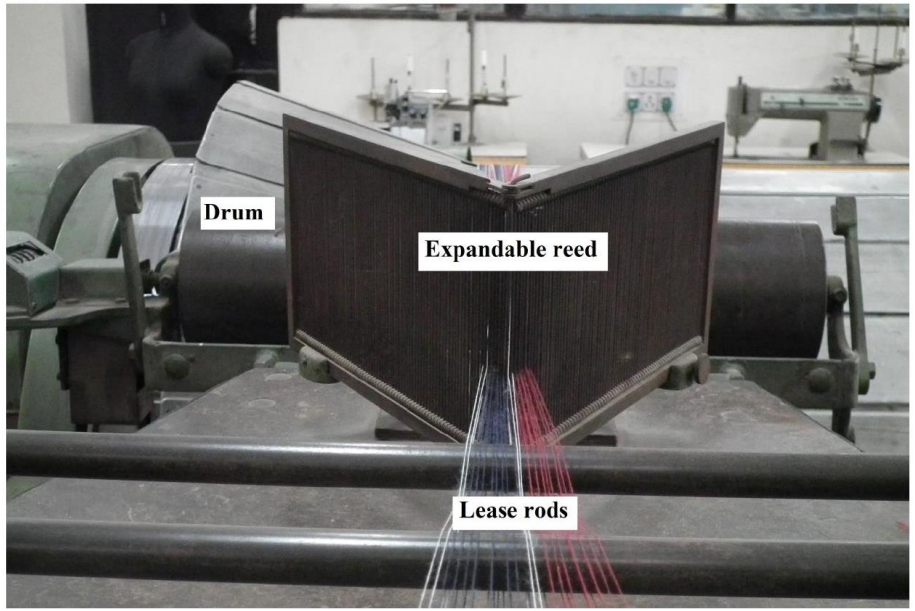
- A sized warp sheet is completely encased in size film and cannot be used in the subsequent process unless yarns are individualized
- To avoid any stress concentration of sized yarns, multiple leasing is resorted to in which the warp, depending on the closeness of yarns in the sheet, is split into multiple layers, say six or eight or 10



In case the warp needs no sizing, then a multiple leasing is not required, and end-and-end leasing would suffice

Warping: Expandable Reed and Length Measurement

A warp sheet from a creel converges into the expandable reed through the dents of which warp yarns pass. As the reed wires can be moved either closer to or away from each other, the distance between dents can be adjusted to the desired value of yarn spacing in the warp sheet



The two limbs of V shaped expandable reed can be expanded or collapsed as per the required spacing of ends

- The length of warp sheet in a beam is crucial from the point of minimizing wastage
- In its simplest form, the moving warp sheet is taken around a freely mounted roller whose angular displacement can be translated both into yarn speed and yarn length by a suitable electronic counting system

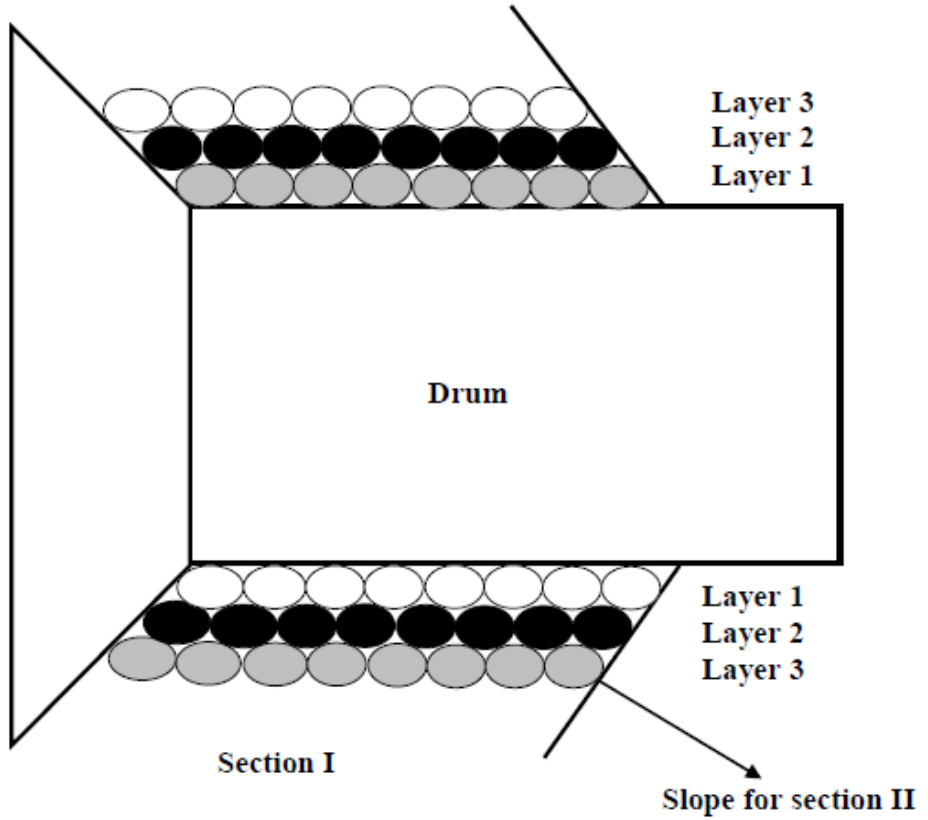
Warping: Sectional warping

- The drum on a sectional warping machine is a hollow cylinder with a conical flange on one end. The leading edge of a section of warp sheet is hooked on the drum surface at an appropriate location, and then, as the drum rotates, the section starts getting wrapped on the drum surface.

- Sectional warping is preferred over beam warping for multi-coloured warp. Here the entire width of the warping drum is not developed simultaneously. It is developed section by section.

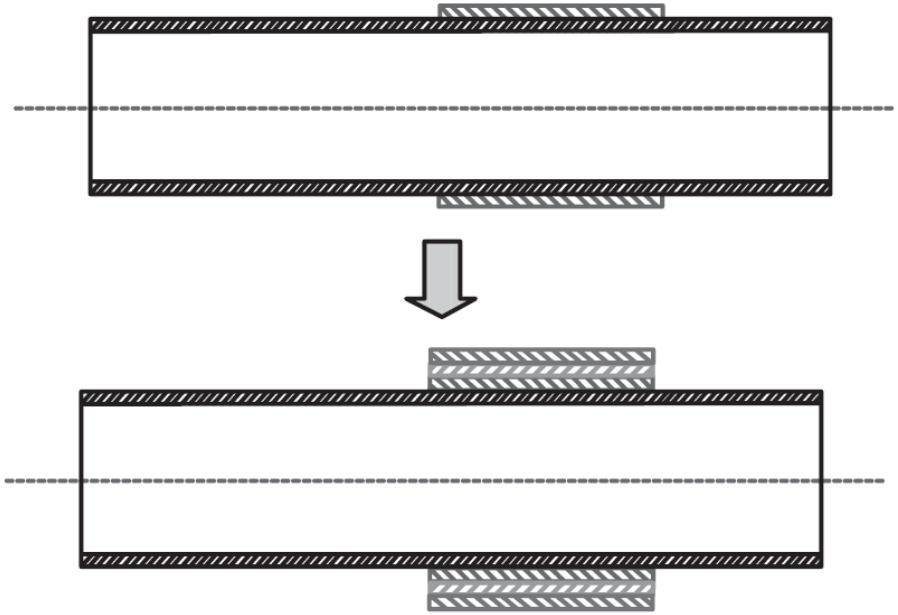
- only one section is built at a time, a support is needed at one side of the drum. This is provided by making one side of the drum inclined.

  Fixed angle
  Variable angle (7^o, 9^o, 11^o etc.)

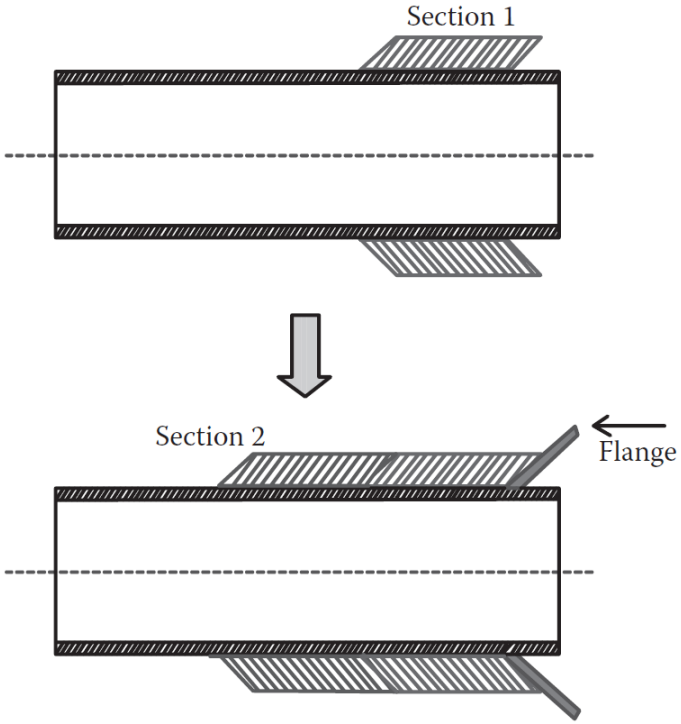


Warping: Sectional warping

- If the layers of a section were allowed to be wrapped on the same location ofnthe drum, then, after a while, the sectional view of warp sheet would appear like a rectangle, and the two edges of the warp sheet would tend to collapse in the absence of any lateral support



- Every section is given a lateral shift or a traverse during the winding process such that the cross-section of warp sheet wound on the drum appears like a parallelogram instead of a rectangle



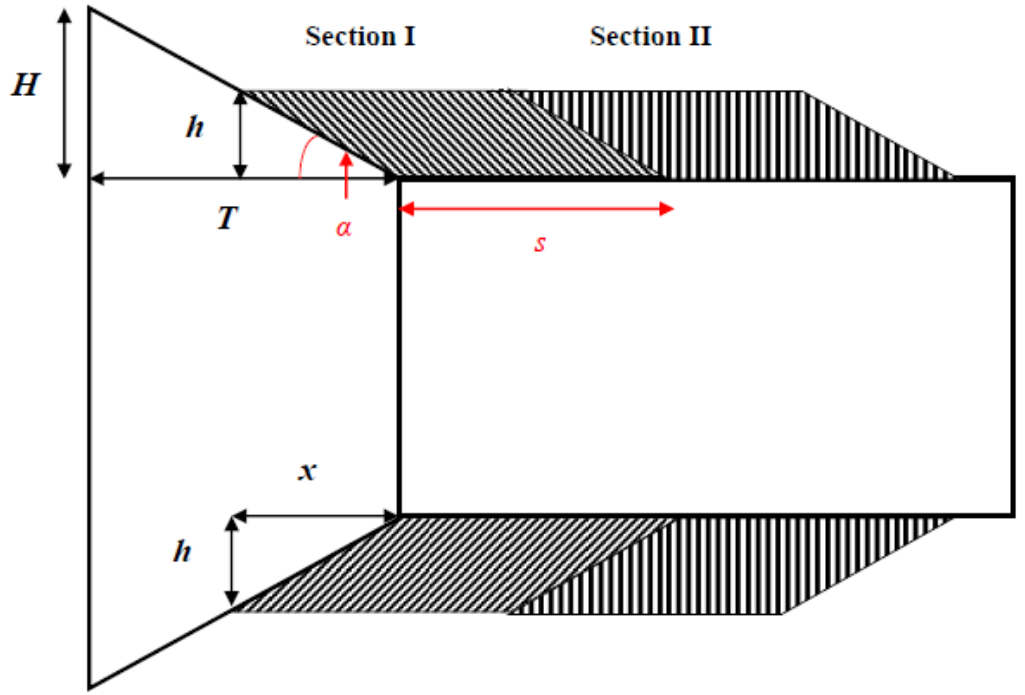
Warping: Sectional warping

- As the process continues, the thickness (or height) of the section gradually increases. When requisite length has been wound in a section, next section is started by shifting the expandable reed assembly by suitable distance

If α is the angle of inclination, x is the traverse given to the section and h is the height of the section then

$$\frac{h}{x} = \frac{H}{T} = \tan\alpha$$

$$\text{So, } x = \frac{h}{\tan\alpha}$$



For drum with fixed angle, if the yarn is coarser then one layer of the warp ribbon will result in higher increase in thickness (Δh) and thus to match the inclination, the traverse speed (Δx) should be higher

Warping: Sectional warping

- The resultant yarn sheet is then is governed by thickness of yarn and yarn spacing as well as tension applied to a section during winding. Higher yarn thickness, lower yarn spacing, and lower yarn tension result in a higher value of yarn sheet thickness for the same length wound

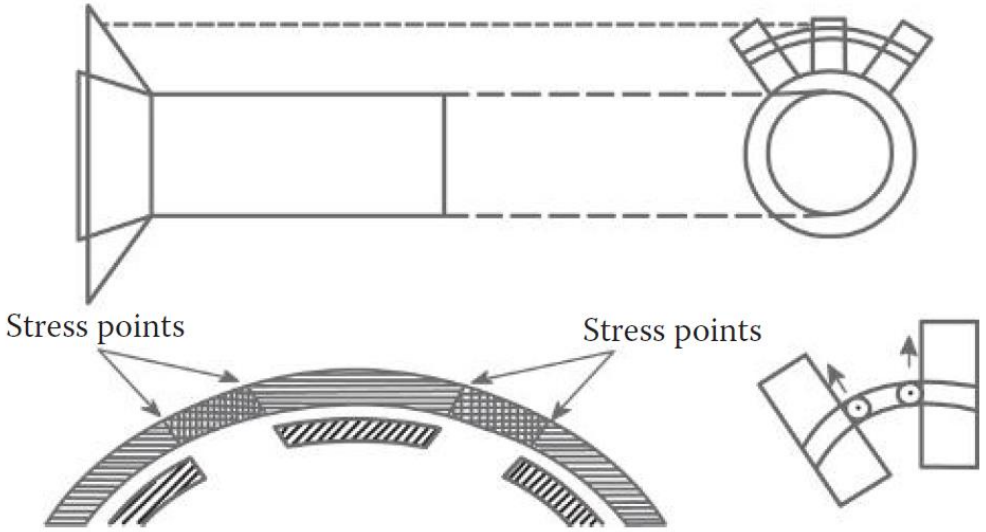
- For fixed angle drums, only one variable i.e. traverse speed is to be adjusted while with variable angle drums both traverse and the angle of inclination can be varied

- For drums with variable angle, the angle is changed by changing the inclination of metal plates which are supported at the end of the drum. When the angle is increased, larger gaps are created between the neighboring metal plates. Therefore, the yarn will remain unsupported at the gaps between two metal plates (**But what does it lead to??**)

Warping: Sectional warping

- In the variable conicity drums, plates hinged at one end on the drum body are arranged along the circumference of the drum. By raising the free ends of the plates simultaneously away from the drum by an equal amount, the conical surface is created.

- As one moves away from the hinge of the plates toward their tips, the gaps between the edges of neighboring plates keep on increasing.



These two factors result in stress concentration on yarn segments due to difference in length between yarns wound on the flange and those on the main body of the drum at the corresponding diameters

Warping: Some prevalent question

- Can we define the interdependence of among the distance between the creel, the speed of winding, and the braking torque that can be applied on the drum?

When yarn breaks during the winding process, the drum has to be brought to a stop within less than one revolution as otherwise the broken end would get embedded in the subsequent layer. Reversing the drum for finding out the broken end in the absence of any accumulating system would create entanglements among yarns and, hence, is not feasible. Thus, the larger the winding drum and the higher its speed, the more efficient the braking system has to be. Although a higher distance between the creel and the winding drum would ease the situation, it would also mean a higher space requirement

- Where should we use a fixed conicity drum?

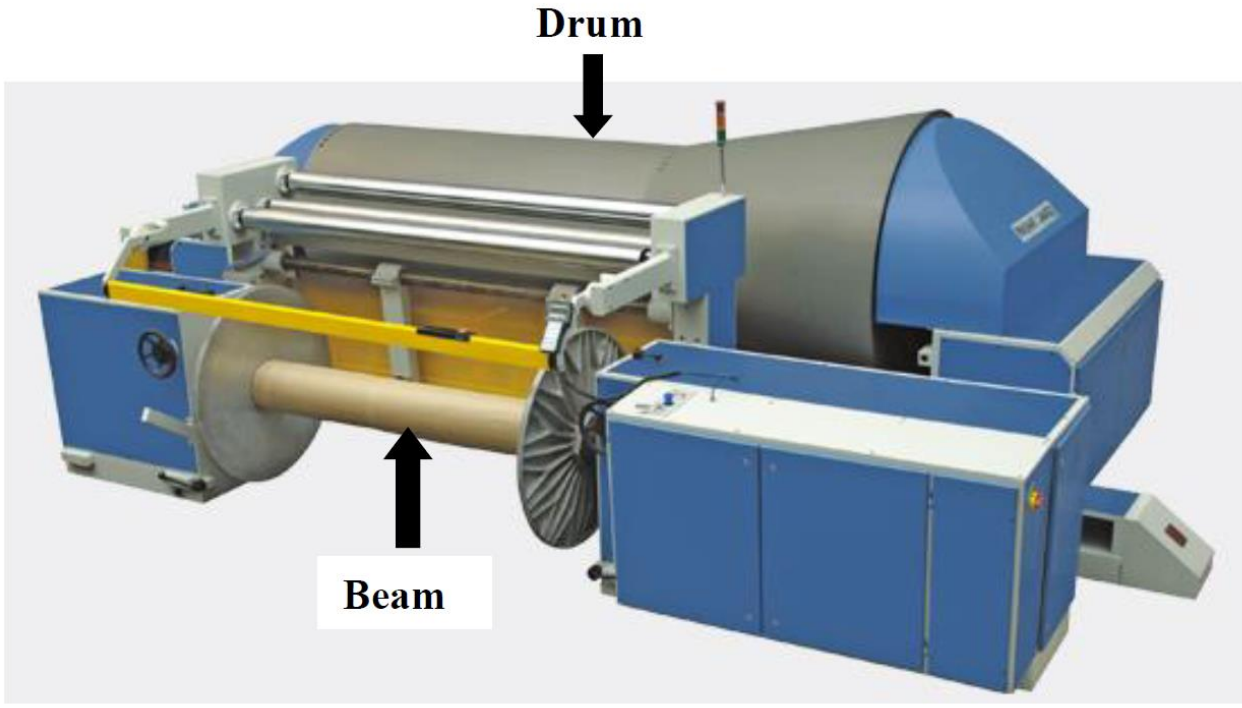
Drums with fixed conicity are preferred for winding delicate yarns, that is, yarns with low modulus and high extensibility

Warping: Beaming Systems

- In the indirect system of beaming, the ends of sections wound on a drum are collected in a sheet form and then wrapped onto a flanged barrel
- The barrel is given a spindle drive, and the resultant tension created in the warp sheet rotates the winding drum, unwinding all the sections wound on the drum simultaneously.
- The beaming operation is carried out at a fairly low speed of around 300 m/min
- Proper density of the resultant warp beam is regulated with the help of press rolls, and the angular velocity of the beam is gradually reduced with a build up of diameter

- In a direct-beaming system, a reasonably small number of yarns, varying, for example, between 250 and 500, is pulled out of the creel and wound on a flanged barrel

- The beaming speed can be in excess of 1000 m/min



Warping: Differences

Beam warping	**Sectional warping**
Used for high volume production	Used for small volume and customised production (stripes and specialised yarns)
One step process	Two step process
High creel capacity is required	Low creel capacity is sufficient
Comparatively less expensive	Comparatively more expensive
Beaming speed is high	Beaming speed is low
More common	Less common

Sizing: Objectives

The objective of warp sizing is to improve the weaveability of yarns by applying a uniform coating on the yarn surface so that protruding hairs are laid on the yarn surface

Benefits of Sizing

- ❖ It prevents the warp yarn breakage due to abrasion with neighboring yarns or with back rest, heald eye and reed.
- ❖ It improves the yarn strength by 10 to 20%, although it is not the primary objective of sizing process.

Characteristics of Sized Yarn

- ✓ Higher strength
- ✓ Lower elongation
- ✓ Higher bending rigidity
- ✓ Higher abrasion resistance
- ✓ Lower hairiness
- ✓ Lower frictional resistance

Sizing materials

- ❑ Starch
- ❑ PVA

Basic definitions

$$\text{Size concentration (\%)} = \frac{\text{Oven dry mass of size materials}}{\text{Mass of size paste}} \times 100 = \frac{S}{P} \times 100$$

$$\text{Size add on(\%)} = \frac{\text{Oven dry mass of size materials}}{\text{Oven dry mass of unsized yarns}} \times 100 = \frac{S}{Y} \times 100$$

$$\text{Wet Pick up} = \frac{\text{Mass of size paste}}{\text{Oven dry mass of unzized yarns}} = \frac{P}{Y}$$

$$= \left(\frac{S}{Y} \times 100\right) \times \left(\frac{P}{S} \times \frac{1}{100}\right)$$

$$= \frac{\text{Add on (\%)}}{\text{Concentration (\%)}}$$