I. KNOW ABOUT TEXTILE WEAVING INDUSTRY:

The Indian Textile weaving Industry is highly fragmented and decentralised. The weaving of fabric is carried out in four major sectors, viz. Handloom Sector, Powerloom Sector, Mill Sector and Hosiery Sector. The total production of cloth from all the sectors put together is 49,577 Million Sq. Meters in the financial 2005-06.

Production of cloth in different sectors may be seen at ***Table 2.3*** **of "*Hand Book on Power Loom*"(HBPL) in this website.**

The Powerloom sector contributes about 62% of the total production, whereas production of mill sector is just about 3%, while Hosiery sector production at 21% is continuously increasing, indicating higher growth potential.

Major Powerloom Weaving clusters in the Country and its Products Profile may be seen in ***Table 2.4*** **of the HBPL in this website**.

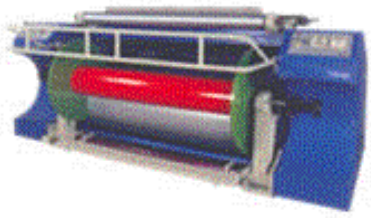
Installed loom in India V/s World capacity and Weaving Capacity of different countries may be seen in ***Table 1.2*** **of the HBPL in this website**.

II. WEAVING :

1. Weaving is an interlacement of warp ends (vertical) and weft yarn (Horizontal). The process of weaving of cloth is carried out in three stages.

1. Warp Preparation or warping.

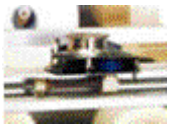
. warping Machine



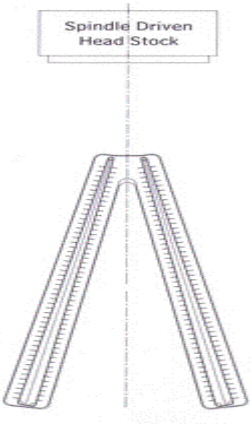
Creel

Stop Motion

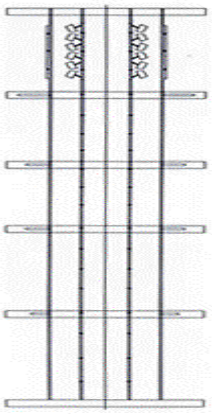
Centralised Tension Control



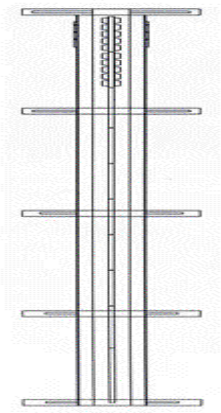
Different types of Creel Drawings



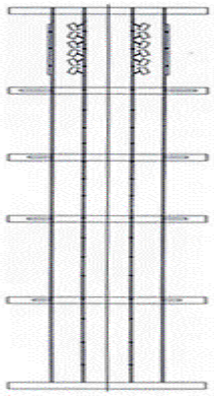
Revolving
V-Creel VC



Swivel Frame
Creel SF



Truck Creel TC



Magazine
Creel MC

Warping is the first process of assembling individual ends into a sheet. The yarn to be warped from cone or cheese (package) are placed / fixed, in an orderly manner, on a frame called “creel” with tensioning and stop motion devices so as to ensure proper unwinding of yarn with uniform tension from packages placed on the creel. The yarn drawn from the creel is then passed through set of lease rods and dents of wires to ensure all the warp yarn are parallel to each other of uniform tension and do not have cross ends and such sheet of number of ends are then wound on to a beam called “warpers beam” or ‘weavers beam’. The process is called warping and the machine used is “warper”. The number of threads per beam and length of the warp beam depends on the density of ends required per inch and width and length of the fabric to be woven. Proper preparation of warp is very important for reducing breakages on loom, to weave defect free fabric and to achieve higher weaving efficiency in the loom shed. To achieve this it is necessary to ensure the following:

- Top quality warp yarn and good yarn package.
- All the threads to be would with equal tension.
- Precise creel alignment.
- Reliable creel-stop motions and efficient brake.
- Minimize wobbling of warping beams.
- Even build up of yarn from one side to the other of warper beam.
- Drop wires / guides should be free from burrs.
- For wider width looms, wider width warping machines are preferred.

There are three ways to prepare weavers beam for weaving.

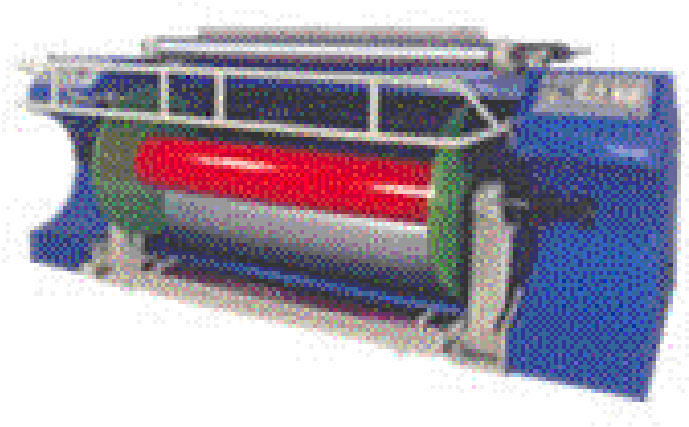
(i) Direct warper.

Warping Machine - Drum Drive

Direct warper, as the name suggests the Warp beam is prepared directly from the supply package either at one stage, if the number of ends / beam required can be accommodated in the creel or in two stages - first ”warper beam” and then “weavers beam” by using number of “warper beam” to prepare “weavers beam” of required density of warp ends. Direct warper is used for manufacture of coarse fabrics, multi-layer fabrics and industrial fabrics where the yarn is having more than 2 ply with high tensile strength which can withstand stress and strain during weaving. Generally, such yarn do not require sizing.

For weaving medium, fine and very fine fabric of medium to high density fabrics using single and two ply yarn, it is necessary to adopt two stage process for warp preparation:-

In first stage, warper beams of required number of ends is prepared on warping machine.



Hydraulic Drum Driven type Warping Machine.

(ii) Warping machine or warper is similar to Direct warping machine with higher creeling capacity and it is a high speed warping machine with stop motions and tensioning device to ensure uniform warp tension. The number of ends per beam and number of such warper beam for preparing weavers beam depend again on the density of ends and width of the fabric required to be woven. As the warp yarn is to withstand stress and strain during weaving operation and also to ensure lower warp breakage, high loom efficiency and to produce defect free longer length fabrics to meet the customer requirement, the yarn is required to be treated or applied with starch uniformly to enhance the tensile strength of the yarn and also to ensure smooth passage of ends through drop pins, heald wires, Reed dents without rupturing the yarn for quality woven fabrics. This process of application of starch is called sizing.

(iv) Sectional Warping

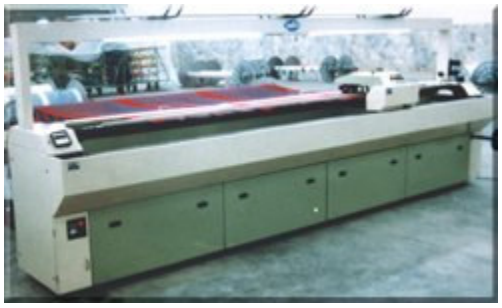
For weaving, suiting, shirting (stripes, checks or designs using coloured yarn either single or plied yarn) warping is done section by section with required numbers of ends per section, as per the design pattern. The number of sections per beam depends on number of ends per inch and width of the fabric. The process of preparation of warp section by section is called sectional warping. The machine used is sectional warper.

High Speed Sectional warping machine

The weavers' beams on sectional warper may be prepared directly, for ply / folded yarns, which may not require sizing. For single or two ply yarns of fine and very fine yarns which require sizing, the warp beam of sectional warping is sized on sizing machine and wound on 'weavers beam' which is ready for further process.

(v) Warp Leasing-in process:-

One of the most important stages in the preparation of warps for weaving is the insertion of the lease. This process establishes the warp ends in the sequence prescribed by the warper or beamer. It is especially important to have the correct sequence in densely set of patterned warps, as well as in warps containing fine yarns, such as synthetics, filament or worsted yarns. By using warp Leasing-In machine the preparatory process in weaving will become highly rationalized, all type of sized warps can be automatically and correctly leased at a high speed. Leasing each and every warp end means arresting them in their original position, and not allowing them to migrate.



Fully Automatic Warp Leasing-in Machine

It Helps;

- Even tensioning to each warp over the entire width.
- Reduction in fluffiness in the warps.
- Reduces end breakages during weaving.
- Frequent loom stoppage is reduced.
- Improves the quality of woven products.
- Rationalizing the preparatory process.
- Fully Automatic. The machine can be left alone during operation.

After warp leasing in process and denting, the weavers beam is ready for gaiting onto the loom.

(vi) Warp Tying machine: It is required for tying the warpends of already running sorts on the loom. The quick changing of run out beam with new warp beam of the same sort on the loom is carried out with Warp Tying Machine with minimum of time contributes a lot to the loom efficiency and low stoppage rates of the high performance loom

Fully Automatic Warp Tying m/c

Warp Dressing Frame

The working range of latest tying machine is practically unlimited it can tie any material with or without lease may it be cotton, spun, worsted, filament, P.V. or woolen from finest to coarsest with high efficiency at low labour cost. Easy adaptability to different tying methods at any time.

(iii) **Sizing**:

The object of sizing is to 'prepare' the warp which can withstand the stresses and strains during the weaving operation, may be, on a handloom or a powerloom or a modern shuttleless weaving machine. In other words, the purpose of sizing is to import 'weavability' to the sheet of warp yarn by application of starch and other sizing ingredients so as to serve the specific purpose of protecting the warp against breakage for only a limited time interval until the warp sheet is converted into cloth.

Sizing Machine for CONTINUOUS ZERO TWIST FILAMENT YERN

Sizing machine for cotton and blended Yarn

2. **Weft preparation for shuttle loom**

The weft yarn required for shuttle loom is to be wound on pirn using a winding machine called pirn-winding machine. The pirn winding is carried out either on circular pirn winding machine (for ordinary plain looms) and for semi auto and auto looms on parallel pirn winders.

For shuttleless looms the weft yarn is taken directly from the supply package either in cone or cheese form. The weft yarn used in high speed shuttleless looms required to be wound on winders with auto yarn clearers and air splicers. In shuttleless loom weaving the pirn winding process is eliminated.

3. Weaving :-

It is carried out on a machine called Loom. The looms are broadly divided into two groups.

(i)Handlooms

(ii)Powerlooms

The weaving on handloom is carried out manually. The shedding, picking and beating(primary motions) to weave the fabric are carried out manually. No power is used.

The weaving on powerloom is carried out using power.The primary motions are carried out mechanically with power.The powerlooms is broadly classified into two group

(a)Shuttle looms

(b)Shuttleless Looms

(a) Shuttle Loom:- There are different types of shuttle looms which are categorized based on the features and extent of automation.

(i) Plain Loom:-It is a simple loom to weave a fabric having only simple primary motions, negative let-off and take-up motion. The picking of weft may be either through over-pick or under-pick mechanism. The under-picking mechanism is smooth, less noise and "shuttle flying" chances is less when compared to over-picking mechanism. The loom with over-pick mechanism is called over-pick loom and one with under-pick mechanism is called under-pick loom. Under-pick looms are preferable for running quality fabrics in the decentralised powerloom sector

Overpick Plain loom

Underpick Plain Loom

(ii) Semi-Automatic Loom:-It is an improved version of plain loom. with additional features such as wrap-stop motion, weft-stop motion, negative/ positive let-off motion and positive take-up motion called secondary motions. This type of looms are generally underpick loom.

Semi-auto Loom

Pick-n-Pick Loom

Terry-Towel Loom

(iii) Automatic Loom:- It is a loom with further improvement on semi-automatic loom to include change of pirn or shuttle automatically so as to enable insertion of pick continuously without stoppage of loom, as in the case of plain or semi-automatic loom.This improvement enhances loom efficiency and quality of the fabric automatically

Automatic Pirn change loom

Automatic shuttle change loom

The plain loom and semi-automatic loom speed varies from 100-120 picks per minute on 60 inches width loom and its productivity varies from 30 to 45 meters per day on three shift working.In automatic looms the speed varies from 160-210 picks per minute and its productivity ranges from 55 to 80 meters per day on three shift working depending on quality.

(b) Shuttleless Loom:

The fundamental principles of weaving namely SHEDDING i.e. dividing thelongitudinal threads called 'Warp' into two sheets. PICKING i.e. insertion of transverse thread called 'Weft' into the space created by the division of warp sheets and BEATING i.e. pulling the inserted wefts one after the other to form cloth. There is no change in these principle whether it is Handloom, Powerloom, Autoloom or Shuttleless loom technology.

Shuttleless looms have been developed to overcome one inherent problem created by the picking mechanism on conventional Fly shuttle loom and make use of entirely different methods of weft insertion to achieve higher level of pick insertion rate thereby increasing productivity and automising the entire primary, secondary and auxilary motions operations controlled through micro processor with very minimal intervention of weaver to achieve higher levels of loom running efficiently and better quality of fabric.

Shuttleless looms are generally of wider widths enabling the simultaneous weaving of two or more width; upto 400 / 420 cms in the case of Airjet and Rapier and upto 540 cms in case of Projectile Loom. The weft insertion rate achieved are 1500, 1450, 2850 and 2500 mtrs/minute for Projectile, Rapier, Airjet and Waterjet weaving machines respectively.

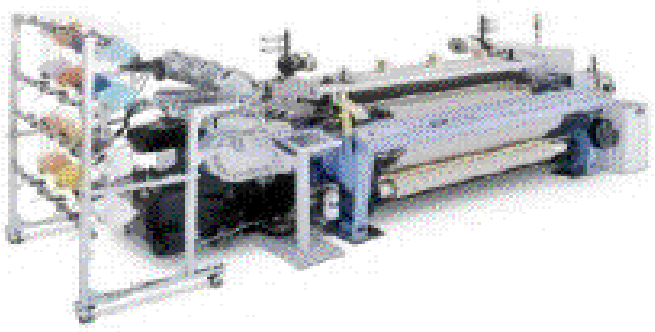
For common features and various mechanisms of Shuttleless Weaving, please refer to Chapter-6 Modern loom of Handbook on Powerloom in this website.

(i) Projectile Weaving Machine :-

* Projectile loom is suitable for weaving wider width grey fabrics with minimum number of sorts. Cotton, woollen, synthetic or blended fabrics can be woven.
* For weaving Double width suiting or triple width shirting with design upto 8 colours weft selection.
* For weaving quality Furnishing, upholstery and Towellings.

* For weaving industrial fabrics like glass fabrics, Geo textile etc upto 540 cms width.

(ii) Rapier Weaving Machine :-



Sulzer Textil G6500-Rapier Loom

The Rapier weaving technology is versatile to manufacture any variety of fabric either grey or coloured fabric. The Rapiers used may be rigid or flexible to take the weft from one end to the other direct from the supply package.

* Rapier looms are suitable for weaving small orders with any number of sorts, Cotton, synthetic or blended fabric can be woven.
* Suitable to weave unlimited weft pattern
* Loom can have upto 12 colour selection of weft.
* Furnishings, upholstery fabrics with fancy weft yarn can also be woven.

iii) Airjet Weaving Machine :-

In airjet weaving machine, weft thread is carried from one end to the other end of warp sheet using air pressure with the help of Air Jet Nozzles. The air passage is through the profile reed having integrated tunnel or by separate guide brought into the warp shed. No mechanical device is needed to direct the filling thread or weft yarn. Relax nozzles are

fixed in front of the reed at regular intervals and thread passes along the reed tunnel subject to air pressure.

* Airjet looms are suitable for weaving Grey fabric of high to very high volumes in single sorts.
* Frequent changes of sorts is not advisable as the graduated reed used is very expensive. Any sort change should take into consideration of cost of Reed, Air consumption etc into account.
- High speeds and lower operating costs are favourable factors that make the technology ideally suited for large batch production of superior quality fabrics.
- High quality, high tensile strength warp & weft yarn and best sized warp yarn essential for achieving high weaving efficiency and best fabric quality.

iv) <u>Water-jet Weaving Machine</u>

Toyata Water Jet Loom (LW 600):

Water jet nozzles are used to propel the weft yarn from one side to other side. must be erosion proof. These loom have the advantage of high rate of weft insertion of 2500 mtr/minute but the main limitation is that it is suitable only for hydrophobic yarn like nylon, polyester, glass etc. Water used for weft insertion must have specified degree of hardness. After weaving the fabric is to be dried.

(v) Multiphase weaving machine

The multi-phase weaving technology is a totally new weaving system for top-quality standard fabrics. It weaves fabrics type substantially faster than any conventional high-speed weaving machine and shuttleless weaving machine.

The multi-phase weaving machine is the reinvention of weaving compared to single-phase weaving machines. The multi-phase weaving technology leads to the following advantages:

- three - to fourfold productivity with simple standard fabrics
- lower specific energy consumption
- smaller footprint
- low dynamic building load – lower building costs
- lower air treatment cost and less dust in the air, thanks to air conditioning of working zone and integrated dust extraction
- easier operation
- far lower noise level
- process costs 20 to 30 percent lower, depending on location
- reduced personnel requirement.