A **loom** is a device used to weave **cloth** and tapestry. The basic purpose of any **loom** is to hold the warp threads under tension to facilitate the interweaving of the weft threads. The precise shape of the **loom** and its mechanics may vary, but the basic function is the same

Definition Of Loom

Loom is a machine or device which is used to produce woven fabric by interlacement of warp and weft yarn. Ginning, opening, cleaning, carding, combing, drawing, spinning, winding, warping, sizing, beaming are the process prior to weaving. All these process converge on loom.

Classification Of Loom

a) Hand loom.
b) Powerloom.

Handloom refers to wooden frames of different types which are used by skilled artisans to weave **fabrics** usually from natural fibers like Cotton, Silk, Wool, Jute etc. ..

Hand Loom

1. Primitive or power loom.
2. Pit loom.
    i. Through shuttle loom.
    ii. Fly shuttle loom.
3. Frame loom:
    i. Through shuttle.
    ii. Fly shuttle.
4. Chittranjan loom.
5. Hattersleyloom.

Power Loom

A powerloom is a type of mechanically powered loom driven by a steam engine or electric power used to weave cloth.

1. Conventional power loom:
   i. Simple.
   ii. Automatic.
2. Modern loom:
   i. Jet loom.
   ii. Rapier loom.
   iii. Multiphase loom.

Jet loom:

a. Air jet loom.
b. Water jet loom.

Rapier loom:

a. Single.
b. Double.

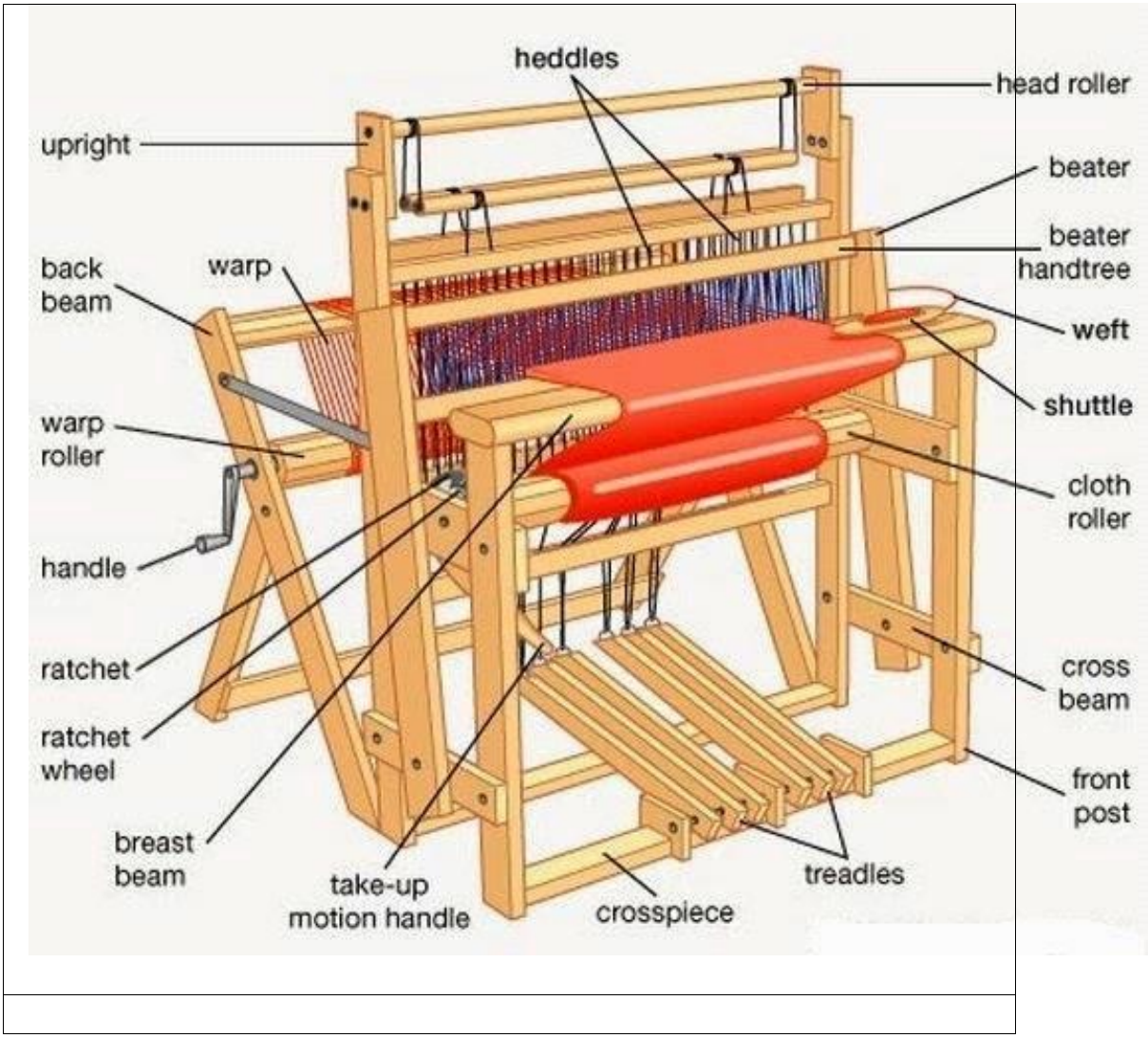
Multiphase loom:

a. Plain.
b. Circular.

Basic Parts of a Loom

Clothes are second basic need of human being. people make clothes by using a method which interlacing the different types of yarns together. This process is popularly known as 'weaving'. Textile weaving is as old as our civilization. Weaving is practised all over the globe. Looms are the most well known word to the people in terms of weaving. The main function of the loom is to weave clothes. For enhancing the working capabilities, the size and shape of the looms may vary but the basic structure of all types of looms are same. There are many available in this era. Some of them are:

- Back strap loom
- Warp weighted loom
- Draw loom
- Handloom
- Haute lisse loom
- Power loom etc.



Basic Parts of a Loom

Basic Parts of a Loom

Heald Shaft-This part is related to the shedding mechanism. In textile weaving industry, heald shaft is produced by using metal such as aluminium or wood. It carries a number of heald wires through which the ends of the warp sheet pass. The heald shafts are also termed as 'heald staves' or 'healdframes'. The total no. of heald shafts varies according to the warp repeat of the weave. It is decided by the drafting plan of a weave during weaving.

Functions of Heald Shaft in Weaving:

- Heald shaft helps in weaving shed formation.
- It also maintains the sequence or order of the warp threads.
- Heald shaft determines the warp thread density in a fabric, i.e. the numbers of heald wires per inch determine the warp thread density per inch.
- It apprehends the order of lowering or lifting the necessary no. of healds for a pick. It

  helps in forming the design or pattern in a fabric.
- Heald shaft is useful in identifying broken warp threads in weaving.

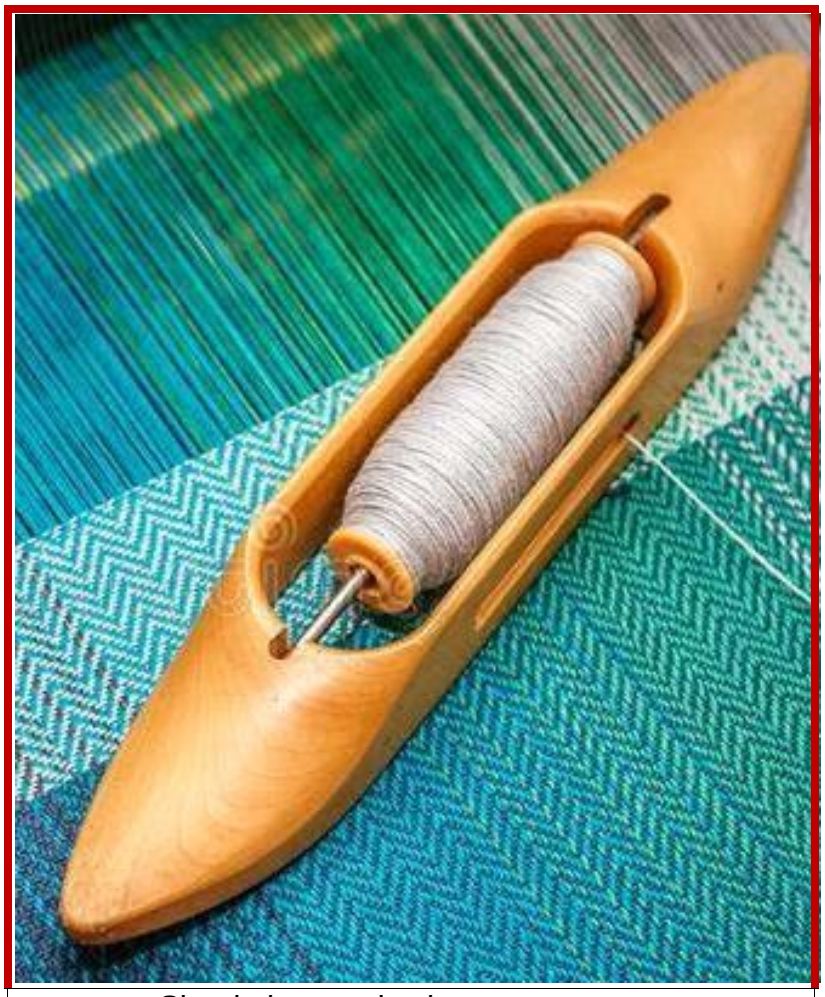
Sley of Lay: It is made of wood and consists of the sley race board or sley race, reed cap and metal swords carried at either ends. The sley mechanism swings to and fro.

Functions of Sley of Lay:

- Sley is responsible for pushing the last pick of weft to the fell of the cloth by means ofthe beat up motion during.
- When moving towards the fell of the cloth the sley moves faster and moves slower when moving backwards. This unequal movement is termed as 'eccentricity of the sley'.

- In order to perform the beat up and also to give sufficient time for passage of shuttle to pass through the warp shed sley is needed in weaving.

Shuttle: In textile weaving, shuttle is a weft carrier and helps in interlacement of the weft with thewarp threads to form fabric.



Shuttle in weaving loom

Functions of Shuttle:

- The shuttle is made of wood which passes from one end of the loom to the other.

- Shuttle travels along the wooden sley race and passes between the top and bottomlayers of the warp sheet.
- After passing through the warp shed, shuttle enters a shuttle box fitted at either ends of the loom. It should be noted here that, a shuttle normally weighs about 0.45kgs.

Functions of Shuttle Box:

Shuttle box is the housing for the shuttle and is made of wood. It has a picker and a spindle. It may also accommodate the picker without spindle. The top and side of the shuttle box unto the sley race are open. The shuttle dwells inside the box for the intermediate period between two successive picks.

- **Reed:**

Reed is a metallic comb which is fixed to the sley with a reed cap. In textile, shuttle is made of a no. of wires and the gap between wires is termed as dents. The count of the reed is decided by the no. of dents in two inches. There are different types of reed in textile weaving such as ordinary reed, expanding reed, gauze reed, V reed etc.

REED

Functions of Reed:

- Reed pushes the lastly laid pick of weft to the cloth fell.
- It determines the fineness of the cloth in conjunction with the healds.
- Reed acts as a guide to the shuttle which passes from one end of the loom to the other.
- It helps to maintain the position of the warp threads.

- Reed determines the openness or closeness of the fabric.

- **Picker:**

  Picker is a piece made either of synthetic material or leather. Picker may be placed on a grooves or spindle in the shuttle box. Picker is used to drive the shuttle from one box to another. While entering the box it also sustains the force of the shuttle.

- **Warp Beam:**

  Warp beam is also known as the weaver's beam. It is fixed at the back of the loom. The warp sheet is wounded on to the warp beam. The length of warp in the beam may be more than a thousand meters.

Functions of Back Beam:

Back Beam is also known as the back rest. It is placed above the weaver's beam. Back Beam may be of the floating or fixed type. The back rest merely acts as a guide to the warp sheet coming from the weaver's beam in the first case. Back beam acts both as a sensor and as a guide for sensing the warp tension in the second case.

- **Breast Beam:**

Breast beam is also termed as the front rest. At the front of the loom, it is placed above the cloth roller and acts as a guide for the cloth being wound on to the cloth roller. It maintains proper tension to facilitate weaving.

- **Cloth Beam:**

Cloth beam is also called as the cloth roller. The woven fabric is wounded on to this roller. Cloth beam roller is placed below the front rest. It is also termed as the cloth roller.

The **woven fabric** is wounded on to this roller. This roller is placed below the front rest.

WEAVING PROCESS

As defined earlier, the weaving process requires interlacing of warp and weft yarns at right angle to each other. In order to interlace these yarns, basic mechanism involves primary and secondary motions. The primary motion includes shedding, picking, and beat-up, whereas the secondary motions are warp let-off and cloth take-up.

Primary Motions:

The motions that are compulsory for weaving process are called primary motions. Weaving will not happen if any of these motions are not completed. These motions include

- Shedding
- Picking
- beat-up.

- **Shedding:**

This is a process of raising and lowering warp yarns by harnesses to make an opening for the filling (weft) yarn to pass through. In shedding motion, warp threads are divided into two layers. The top layer is called top shed line, and the bottom layer is called bottom shed line. The raised and lowered form of warp yarns is called shed, and there are three types of shedding motions available for different types of fabrics, namely tappet shedding, dobby shedding, and jacquard shedding. The shedding is achieved by means of treadles, dobby, or jacquard. The treadles are used in handlooms, operated by the weaver's feet, and in power looms, operated by shedding tappets. The dobby and jacquard are either mechanically controlled or electrically controlled shedding systems. Healds are used in tappet and dobby shedding systems, whereas jacquard controls the warp threads individually for producing sheds by means of hooks, needles, harness cord, and knives. A simple shedding motion controlled by harness is shown in Figure-3. On the basis of shed geometry, the shedding is broadly divided into two classes: closed shedding and open shedding.

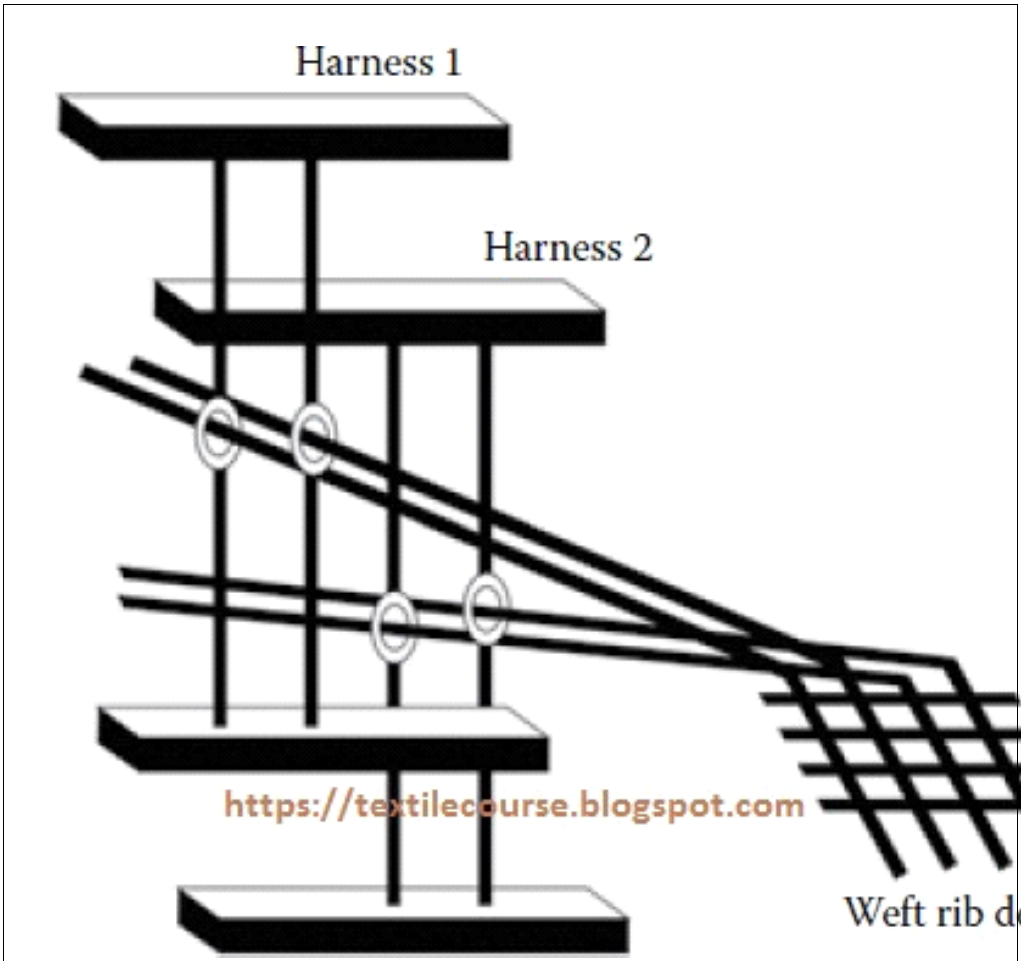


Figure-3: Shedding motion

Closed shedding:

The closed shedding system employs all of the warp yarn levels after the insertion of each pick. The level is made either at bottom/top or at the centre of shed line. The type of closed shed where the level of warp yarns is made at bottom/top shed line is called bottom closed shed or top closed shed depending on the position of levelling. This kind of shed is produced by giving motion only to threads that are to form the upper shed line. Similarly, the type of shed where warp yarns are made level at the centre shed line is called centre closed shed. In centre closed shed, the warp yarns required to make the top shed line are

made to move upward, whereas the warp yarns required to make the bottom shed line are made to move downward. Afterward, all the warp yarns meet at the centre shed line. The schematic diagrams of bottom closed shed and centre closed shed are shown in Figure-4. The advantage of bottom closed shed is to achieve high cover factor at the cost of high power consumption and wear and tear of weaving parts. The bottom/top closed shed is not suitable for high-speed weaving due to larger time required for changing the shed. The high-speed weaving can be achieved by centre closed shed due to less strain in warp yarns as compared to bottom/top closed shed. The power consumption and wear and tear are also less in center closed shed as compared to bottom/top closed shed.

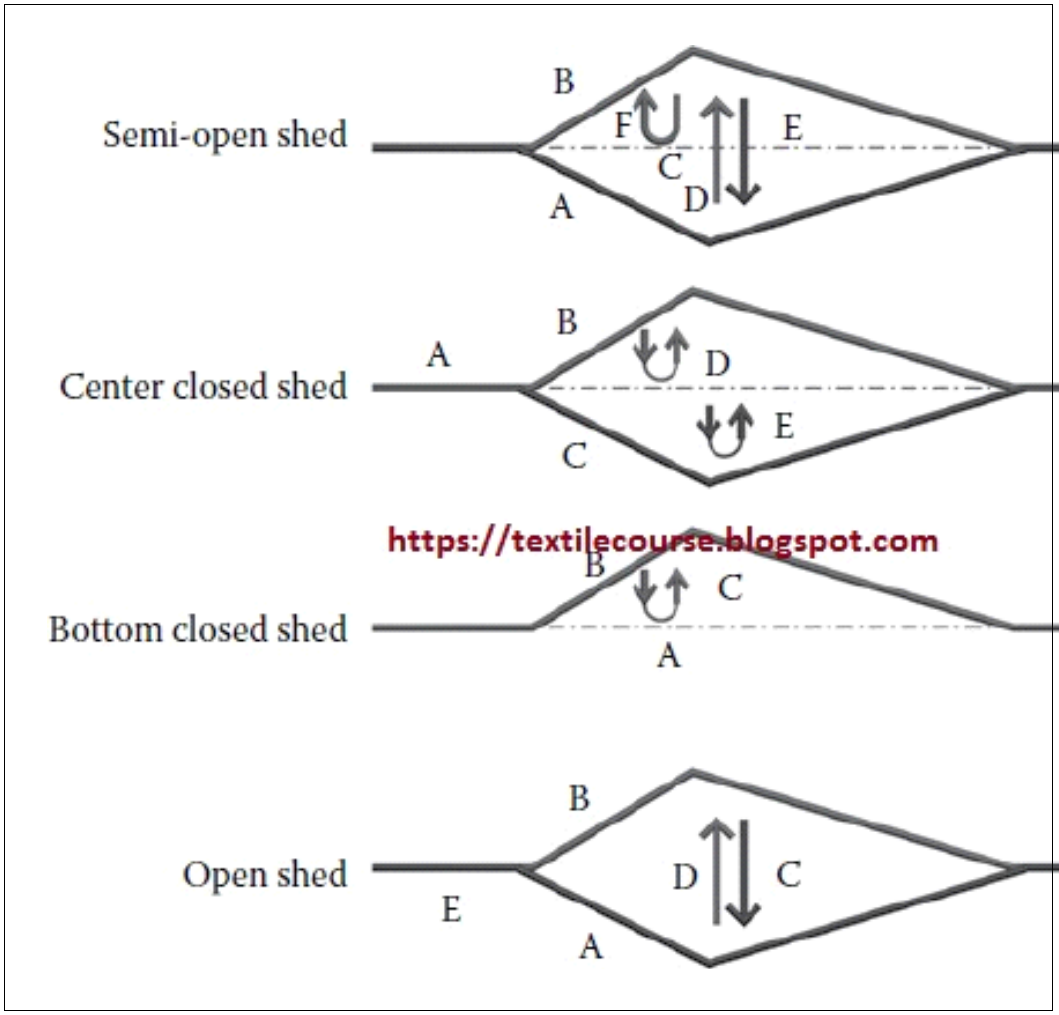


Figure-4: Semi-open, centre closed, bottom closed, and open shed.

Open shedding:

In open shedding, the warp is only moved when a pattern requires a change of position. There are two methods of producing open shedding, that is, open shedding and semi-open shedding. In semi-open shedding, as shown in Figure-4, the stationary bottom line is retained, but warp yarns of the top shed line is either lowered to the bottom at one movement or raised to the top. The remaining warp yarns move down. This is formed under both open and closed principles and is being used by double-lift dobby and Jacquard shedding system.

In open type of shedding, as shown in Figure-4, the warp threads form two stationary lines, one at the top and the other at the bottom. After inserting a pick, threads are moved from one fixed line to the other. So, one line of thread is lowered from the top to the bottom, and the other line was raised from the bottom to the top simultaneously. Open shedding is performed using ordinary tappets.

- **Picking:**

The insertion of weft yarn through shed is called picking. Mostly, the weaving machines are categorized based on their picking systems. There are two major types of available picking systems, namely shuttle and shuttle less picking. Shuttle picking is further categorized into two main systems, that is, under picking and over picking. In under picking, the picking sticks moves under the shuttle box, whereas in over picking, the picking stick moves over the shuttle box.

In shuttle less picking system, the picking is carried out with the help of various picking media such as **projectile**, rapier, air, and water. Shuttle less picking system has an advantage of high speed over shuttle picking system. A number of weft (filling) selections are made available on weaving loom to select the desired weft depending on the count and colour of weft yarn. A weft, being inserted through a shed, is shown in Figure-5.

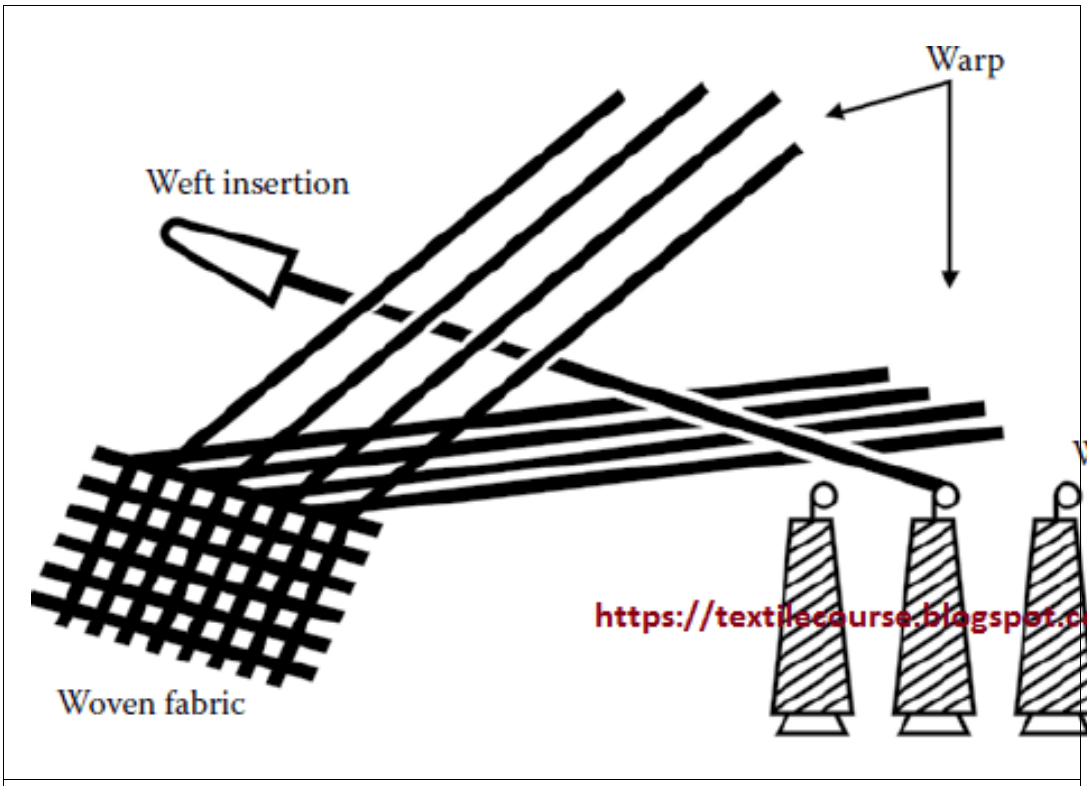


Figure-5:
Picking

- **Beat-Up:**

The filling insertion system cannot fit the weft at an acute angle of shed opening, which is done with the help of beat-up motion. The fitting of newly inserted pick to the fell of cloth is called beat-up. The fell of cloth is an imaginary line which shows the point of cloth woven. The beat-up

is performed with the help of a device called reed. The reed acts like a comb made of metal stripes. A typical reed is shown in Figure-6.

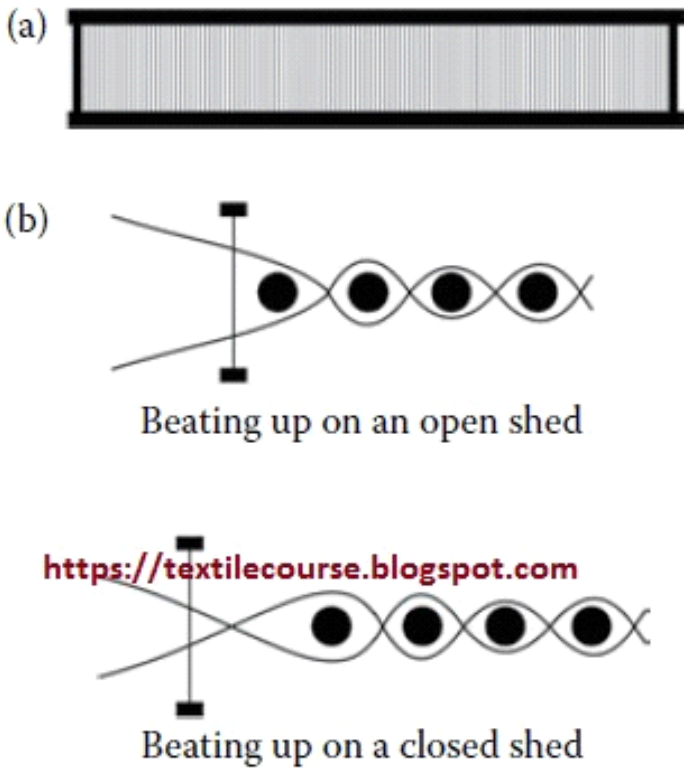


Figure-6: (a) A reed used for beat-up, (b) beat-up for an open and closed shed.

Secondary Motions:

The weaving motions required to make the weaving process continuous are called secondarymotions. These motions include

- warp let-off motion
- cloth take-up motions

- **Warp let-off motion:**

As the fabric is produced, it is required to let off the warp yarn for continuous weaving. The delivery of warp yarn at required speed is called warp let-off motion. The warp yarns are delivered in the form of

sheet from weaver beam installed at the back of loom. The let-off motion has been controlled by dead weight called lingos, but nowadays the speed of this motion is controlled using load cell and servo motor. An electrically controlled warp let-off motion is shown in Figure-7. As the cloth is woven, the warp yarns exert a tension on whip roller. The whip roller moves forward toward the front side of loom and does an amount of work against the force of spring. The work done in terms of displacement is measured by a sensor, which gives signal to control panel. The control panel sends instruction to servo motor to adjust the speed in order to let off the warp sheet.

- **Cloth take-up:**

The woven cloth needs to be wound on a specific package after it has been beaten up. The winding of woven cloth is called take-up. The cloth is wound on a roller, which is placed on the front side of loom, called the take-up roller. The take-up motion defines the pick density of woven cloth. It is important to note here that take-up of cloth is always less than the length of warp sheet due to warp shrinkage. Modern cloth take-up systems are electrically controlled by servomotor as shown in Figure-8. The take-up roller is connected to servo motors via pairs of worm and worm wheel. The take-up system is equipped with electrical sensor to control the surface speed of take-up roller to provide the required number of picks per unit length.

Auxiliary Motions:

These mechanisms are useful to produce defect-free woven fabric production. Weaving machine is the complex machine. It is difficult to monitor all the points like yarn breaks, finish of weft yarn, etc. Without these tertiary motions, the process will continue, but it is

quite impossible to make a defect-free cloth. Hundreds of yarns are running in a loom, so it is quite impossible to monitor all the yarns separately. It may cause the faulty production.

Warp stop motion:

Warp stop motion stops the loom at the event of warp yarn breakage. The motion helps to remove the faults which are expected to be produced due to warp yarn breakage. All the warp yarns are required to pass through an individual special inclined shape wire, which is called dropper. The length of dropper ranges from 120 to 180 mm, while the width of dropper is usually found as 11 mm. In the event of warp breakage, the dropper wire falls on dropper rod. The dropper rod is composed of positive and negative terminals. After the falling of dropper wire, the electrical circuit of the dropper rod is completed. The completion of electrical circuit sends the instruction to servo motor to stop via control panel.

Weft stop motion:

Weft stop motion has been used to stop the loom at the event of weft breakage. In modern looms, mainly two types of weft stop motions are used, namely piezoelectric electronic weft stop sensor and optical sensors. The optical type of weft stop sensors is shown in Figure-7. The piezoelectronic weft stop sensor is designed for rapier and projectile looms, whereas the optical sensors are made especially for air-jet looms. The piezoelectronic sensor is made of smart materials, which works on the principle that vibration produces electric charges. The electric charges produced are used to send the signal to stop loom. Under normal running of loom, the electric charges are produced with low amplitude due to less vibration; however, when the weft yarn is broken, a jerk is produced which results in high amplitude of electric

charges. These high-amplitude electric charges are used to stop the loom. On the other hand, the optical sensor detects the light emitted by a light source. In air-jet looms, optical weft stop motion sensor serves two purposes, that is, stops the loom if weft yarn is broken and stops the loom if weft yarn has been moved too forward. The sensors are classified as Weft Feeler 1 and Weft Feeler 2. Weft Feeler 1 senses the absence of weft yarn and stops the loom, whereas Weft Feeler 2 senses the presence of yarn and stops the loom.

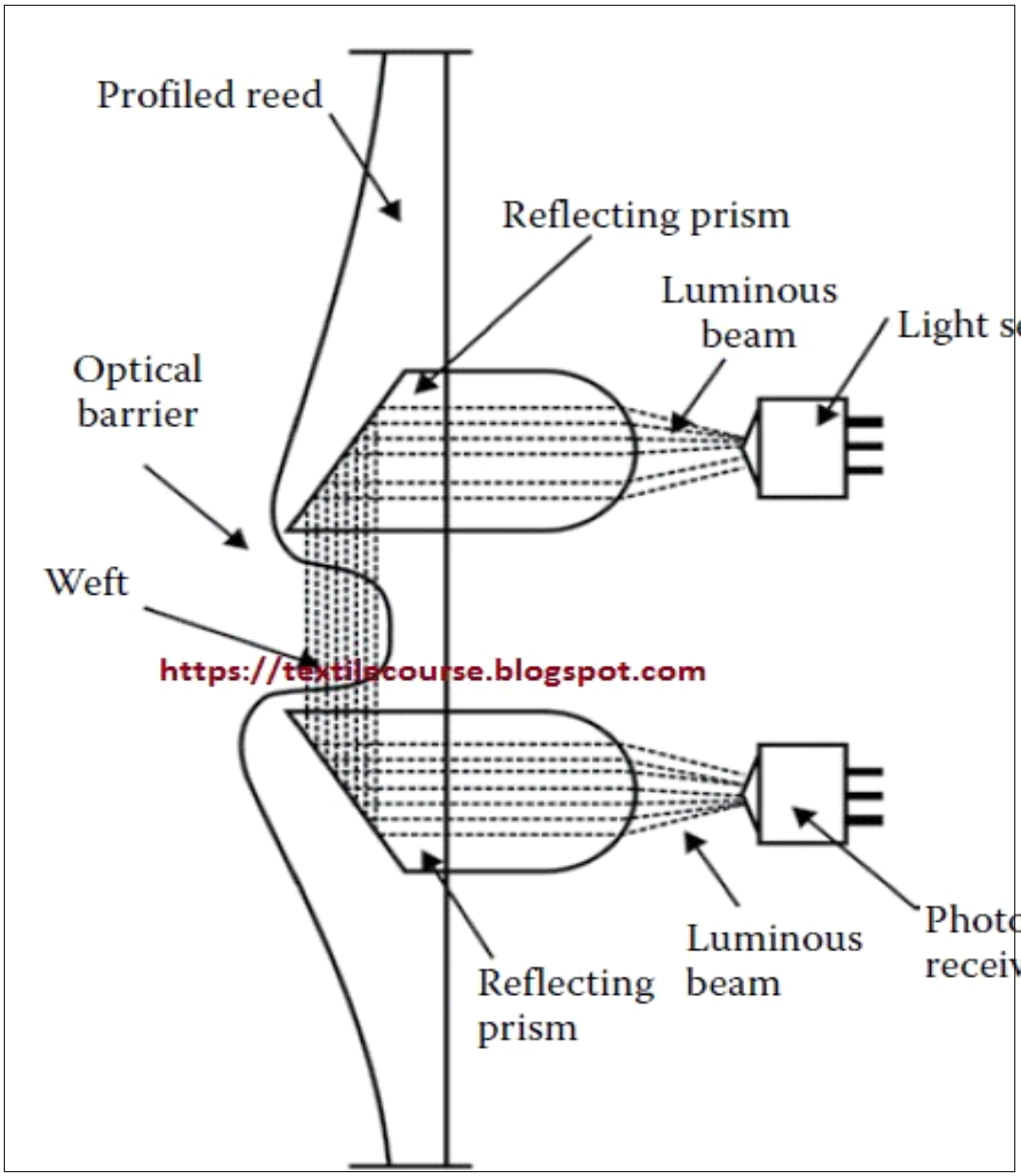
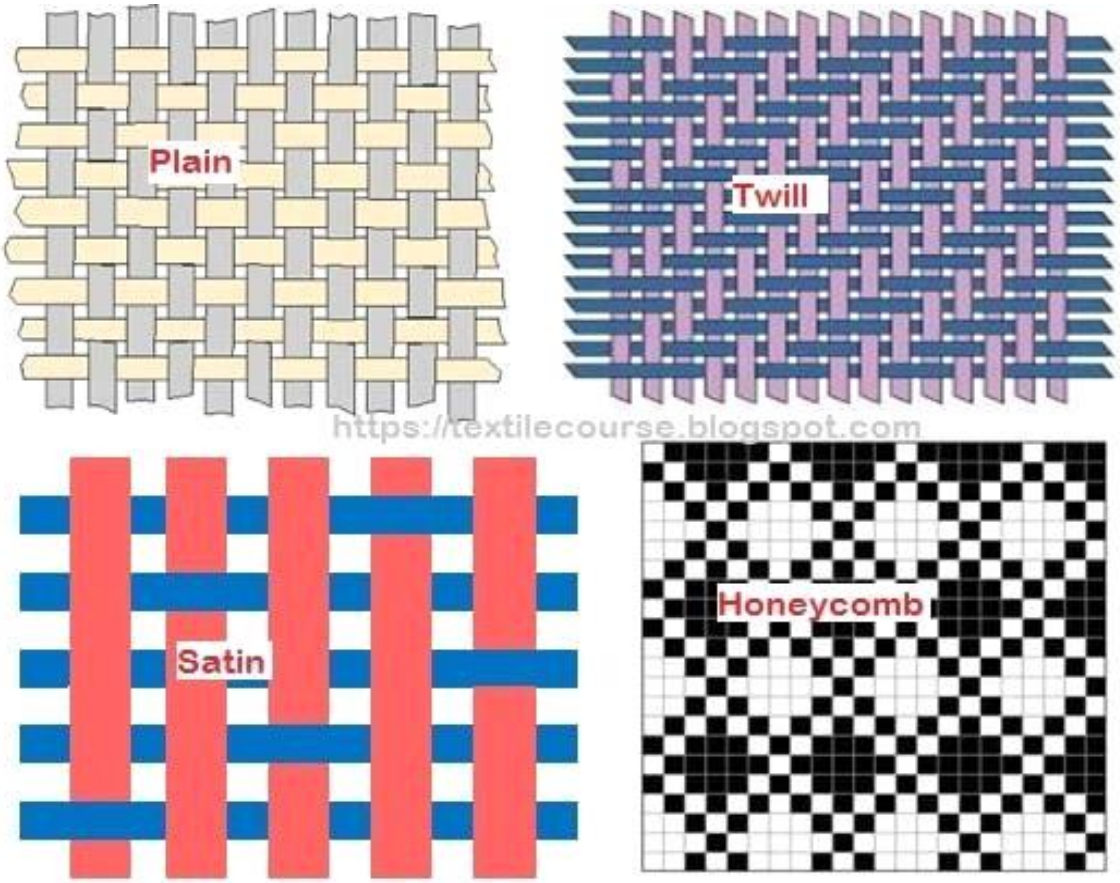


Figure-7 : Optical weft stop sensor.

Other auxiliary motions are warp tension compensation motion, weft tension control motion, auto pick finding motion, weft mixing motion, weft holding, tucking and trimming motion, warp protector motion, weft replenishment motion, and temple motion.

Basic Weaves

Weave is the interlacing pattern warp and weft yarns, in order to produce a **woven fabric**. Weave structures is the design by which fabric is produced. Fabric are manufactured in wide varieties and design. The great variety of weaves found in the textiles of today are modifications of a few fundamental weaves invented in the earliest times. The basic weaves are plain, twill, and satin. All the others are derivatives of these basic weaves or their combination. In this article I will discuss about different types of basic weaves structures and their names.



Different Types Of Weaves and Their Names:

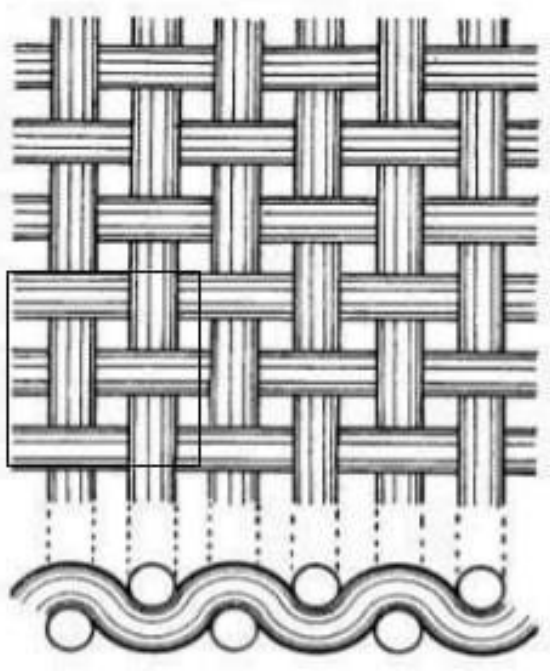
- Plain Weave
- Twill Weave
- Satin/Sateen
- Honey Comb Weave

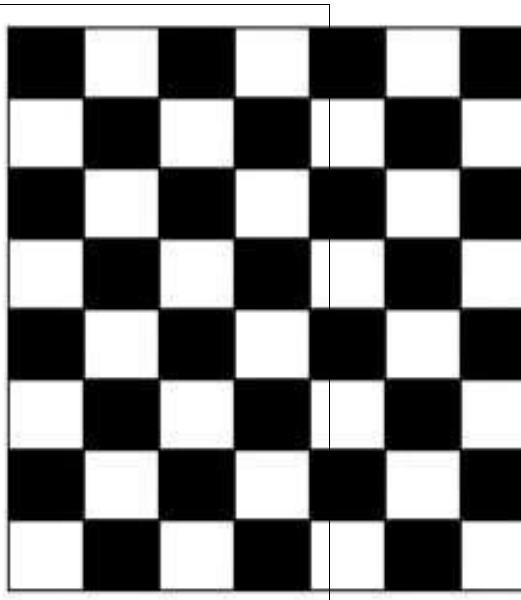
- Huck a Back Weave
- Crepe Weave
- Bedford Cord Weave
- Welts and Pique
- Mock Leno Weave

All types of basic weaves are descried briefly.

Plain Weave:

Plain is the simplest weave, in which warp and weft threads interlace in alternate manner (as shown in Figure-2), giving maximum number of interlacements. This maximum interlacement imparts firmness and stability to the structure. In trade, the special names like broadcloth, taffeta, shantung, poplin, calico, tabby, and alpaca are applied to plain weave. At least two ends and two picks are required to weave its basic unit. A minimum of two heald
frames are required for this weave, but more than two (multiple of basic weave) heald frames can be used to weave this construction. It is used in cambric, muslin, blanket, canvas, dhothi, saree, shirting, suiting, etc.





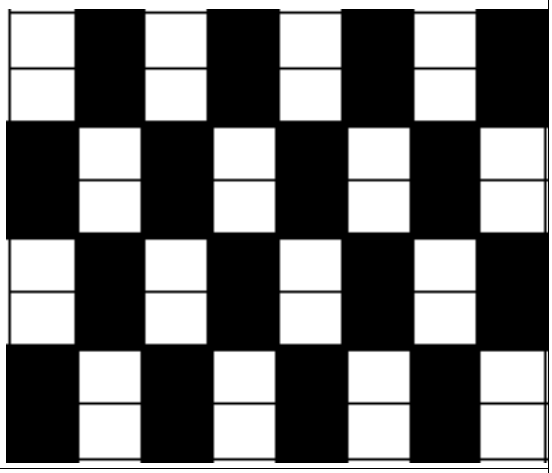
Plain weave
structure

Plain weaves are basically three types. They are:

- Warp Rib
- Weft Rib
- Matt Weave

Warp ribs are a modified form of plain weave. It has 1/1 interlacements in the filling direction, which differs from the simple plain weaves. This modified interlacement results in the formation of cords, ridges, or texture across the warp direction of the fabric. These cords or ridges are formed due to the grouping of the filling yarns. The repeat of warp rib is always on two warp yarns. The first warp yarn follows the formula, while the second warp yarn is in the opposite direction of the first one. It requires two heald frames at least, but multiple of these can also be employed. The number of weft yarns in a repeat unit of this weave is equal to the sum of the digits in formula of warp rib. For example, 2/2

warp rib requires 2 warp yarns and 4 weft yarns. Design of the above-stated warp rib is shown in Figure-3. Warp rib isalso known as ottoman.



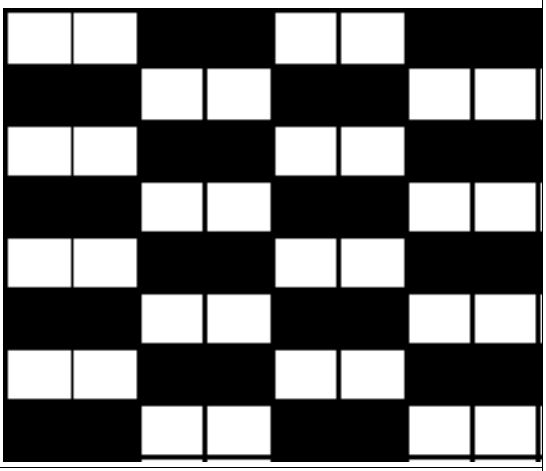
Warp rib (2/2).

Warp rib are two types:

- Regular Warp Rib
- Irregular Warp Rib

Weft rib:

Weft ribs are another modified form of plain weaves. It has 1/1 interlacements in the warp direction, which differs from the simple plain weaves. This modified interlacement results in the formation of cords, ridges, or texture across the weft direction of the fabric. These cords or ridges are formed due to the grouping of the warp yarns. The repeat of weft rib is always on two weft yarns. The first weft yarn follows the formula, while the second weft yarn is in the opposite direction of the first one. It requires two heald frames at least, but multiple of these can also be employed. The number of warp yarns in a repeat unit of this weave is equal to the sum of the digits in formula of warp rib. For example, 2/2 weft rib requires 2
weft **yarns** and 4 warp yarns. Design of the above-stated warp rib is shown in Figure-4. Weftrib is also known as half panama.



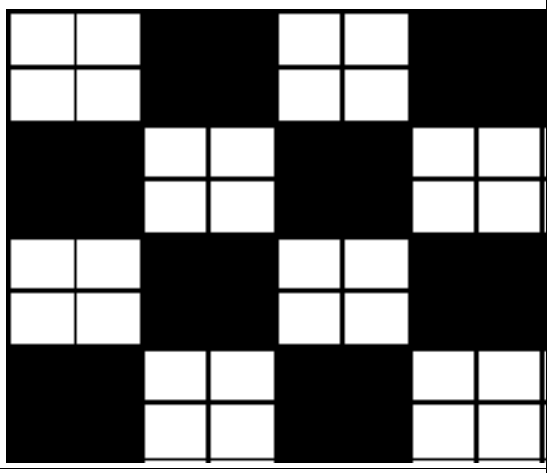
Weft rib (2/2).

Weft rib is two types:

- Regular Weft Rib
- Irregular Weft Rib

Matt weave:

This type of weave is constructed by extending the plain weave in warp and weft directions at the same time so that two or more threads work alike in both directions. In this weave, the same size of squares appear on both sides of the fabric showing the same number of warp and weft yarns on front and back of the fabric. Matt weave is also commercially known as basket, hopsack, or full panama. This weave requires a minimum of two heald frames. Design of the 2/2 matt weave is shown in Figure-5. The matt weaves can be extended further to give more prominence but restricted due to loose structure and modified in several ways. In matt weave, the warp ends that work alike tends to twist around each other. To avoid this **twisting of the yarns**, warp ends that work alike are drawn from different slits of the reed.



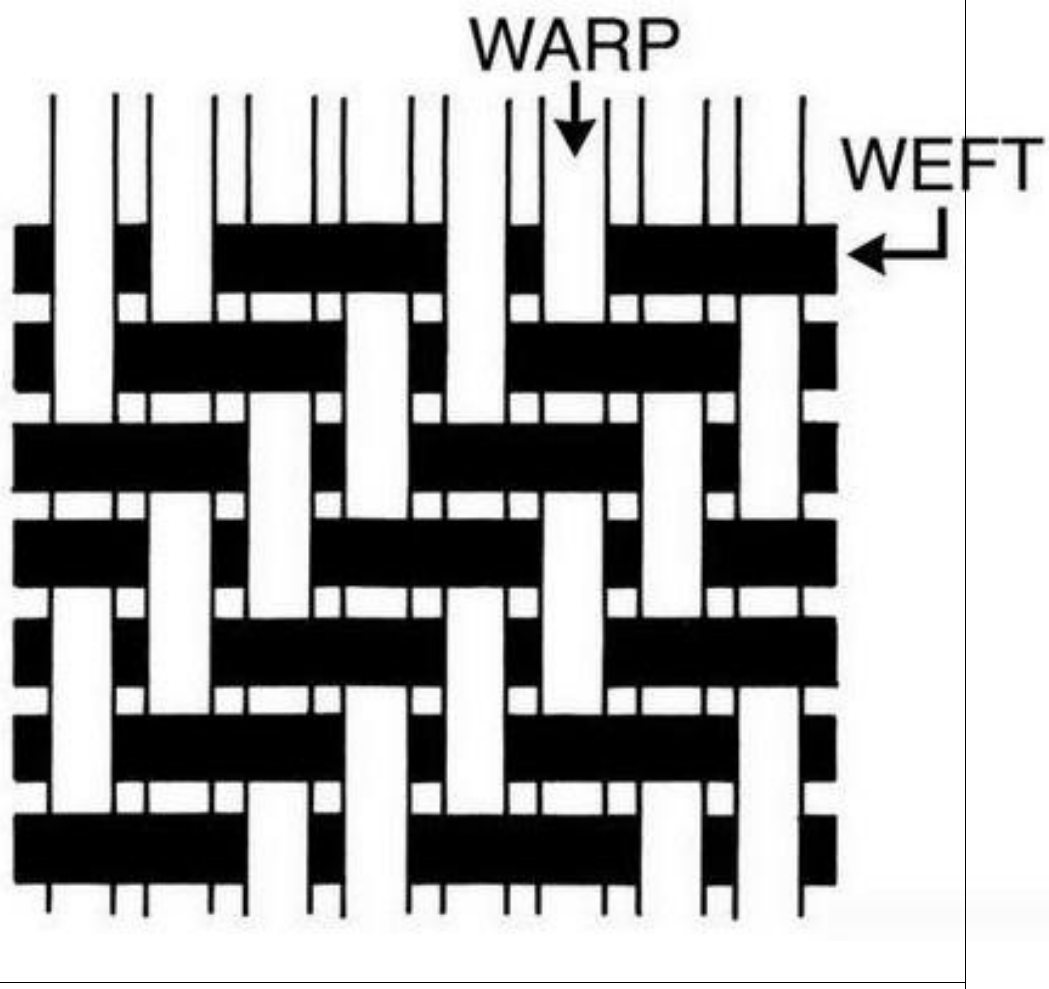
Matt weave (2/2).

Matt weave are three types:

- Regular Matt Weave
- Irregular Matt Weave
- Fancy Matt Weave

Twill Weave:

Twill weave is another basic weave which is well known for its diagonal line formation in the fabric due to its interlacing pattern. This weave and its derivatives are used for the ornamental purposes. Twill has closer setting of yarns due to less interlacement imparting greater weight and good drape as compared to the plain weave. In simple twill, the outward and upward movement of the interlacing pattern is always one that imparts a diagonal line to this design. The direction of the propagation of twill line classifies twill into right-hand or left-hand twill. Twill weaves find a wide range of application such as drill cloth, khakhi uniforms, **denim** **cloth**, blankets, shirtings, hangings and soft furnishings

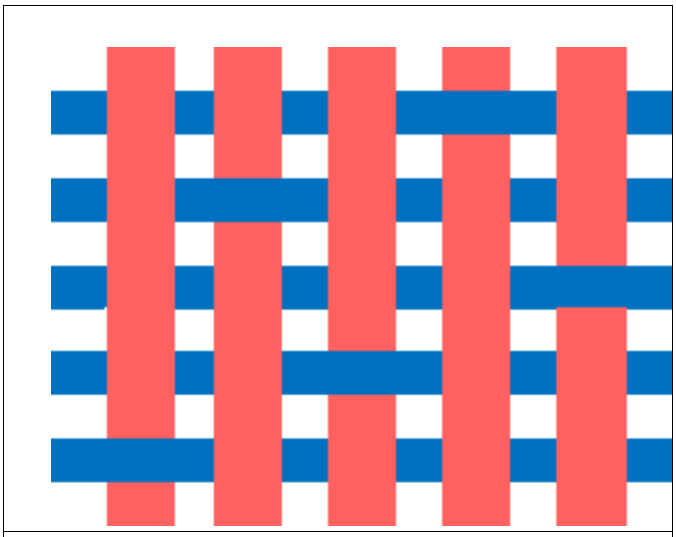


Twill weave

Satin/Sateen:

Satin/sateen is a basic weave that does not have any regular pattern like twill. The surface of the fabric is either warp or weft faced. Satin is warp faced, which means that all the surface of the fabric will show the warp threads except for the one thread interlacement with other series of yarn. If it is weft faced, then it will be known as sateen, which means that fabric surface will show the weft threads mostly. The unique in this weave is the single interlacement of

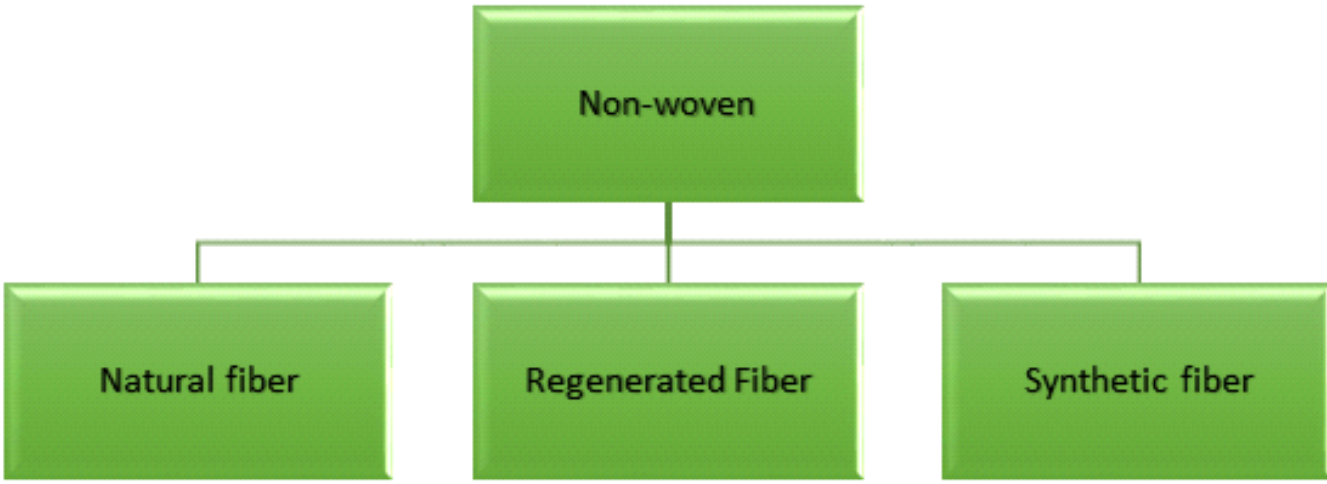
warp thread and weft thread in a single repeating unit. These weaves have the least interlacement points among the basic weaves. Due to this reason, it gives the surface of fabric more luster and smoothness. Along with these properties, more close packing of the threads is possible, which gives the maximum achievable cover factor in this weave. With this weave it is possible to use a cotton warp and silk filling, having most of the silk appear on the surface of the fabric.



Satin weave

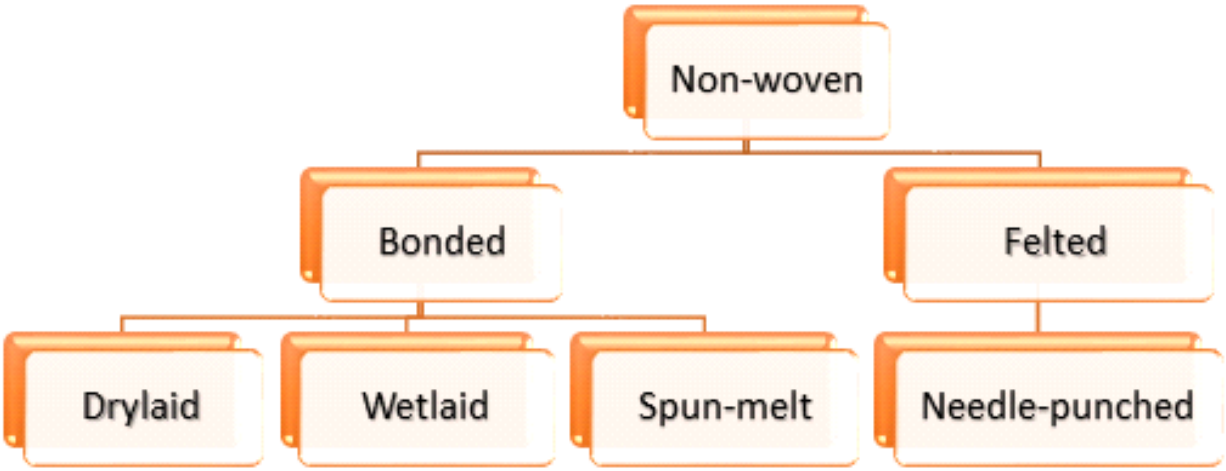
NONWOVEN FABRICS

Nonwoven fabric is a fabric-like material made from staple fibre **(short) and long fibres (continuous long), bonded together by chemical, mechanical, heat or solvent treatment. The term is used in the textile manufacturing industry to denote fabrics, such as** felt**, which are neither woven nor knitted.**



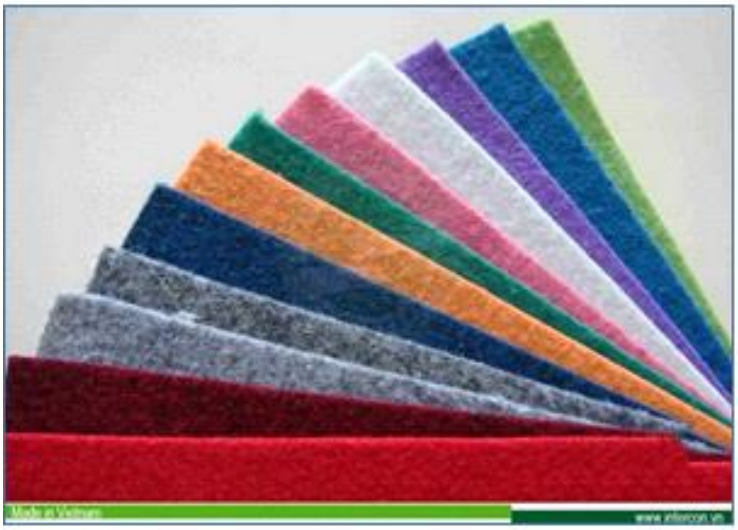
Felting

Felting**, in my words, is the** process **of producing a textile or fabric by combining and compressing the loose fibers, wool or hair.**



According to ASTM, felt is a structured build-up from the interlocking of fibers by a suitable combination of mechanical work, chemical action, moisture and heat without spinning, weaving, or knitting.

Other Felted Fabric Cotton felt, jute felt, Flax Felt, Synthetic Fiber Felt fabric.



Colored Felted Fabric (Synthetic Fiber).

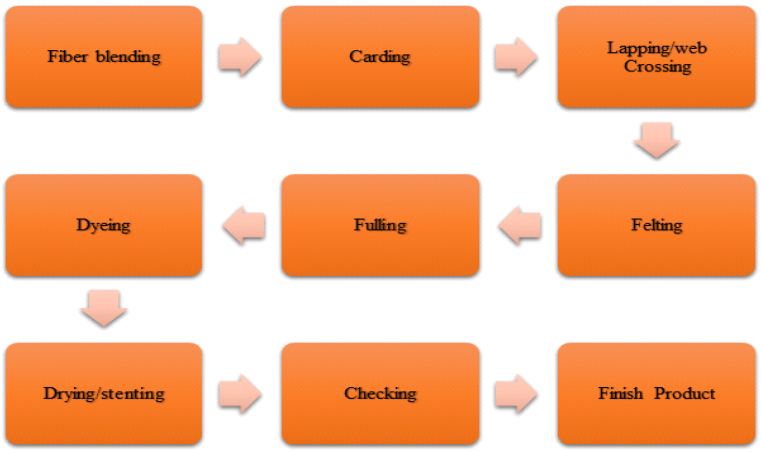
Manufacturing process: Felt is manufactured either manually or by machine. Machine-made felt manufacturing is described in the following. Fiber is

subjected to two consecutive carding operations and the two carding operations make the fibers parallel and of even thickness in the form of a fine web.

Recycle cotton Felted Fabric (Geo-Textile, Insulator)

Several layers of web are built up until a sufficient amount of weight or thickness has accumulated. The mass or batt (layer of web) is then cut and the edges trimmed to the desired width. The batts are usually about 37m long, 150-230 cm width and their weights vary from 8-23 kg.

The batts are evenly sprinkled with warm water, pass over a steam box to warm the fabrics thoroughly and then press between two rollers.



The manufacturing process of non-woven fabric

The top roller rests on the batt and with an oscillating motion exerts the pressure that combined with moisture and heat produces the final felting action. Then they are allowed to draining and cooling off for about 24 hours.

Application

Geo-Textiles: (Road construction, rail line Construction, River Bank Construction)

Mattress, foam, floor cover, composite.

BONDED FABRIC

Bonded non-woven fabric:

Nonwoven web formation methods are classified according to the form of raw materials chosen for the specific application. Staple fiber and filaments are used to fabricate nonwoven webs.

Bonded Non-woven techniques are:

- Dry-laid
- Wet-laid
- Polymer-melt/ spun-melt

Dry-laid web formation: Dry-laid web formation is one of the old techniques and is very similar to the felting process. For the production of dry-laid web, carding machines and web lappers are used to layer the fibrous batt. The fibrous web layers are subsequently felted using heat, moisture, and agitation. These materials may be of natural or synthetic polymer composition and can be processed alone or in blends. Carded webs are produced from either short-staple fiber (20–60 mm) or long-staple fiber (50–150 mm).

The dry-laid web formation technique, such as fiber preparation, blending, carding, and garnering are innovations of the textile industry. These processes prepare staple fibers, blend them, and layer the fiber batt in a dry state. In dry-laid web formation, the fibers are collected into a web form by parallel lapping, cross-lapping, or aerodynamic (air-

laid) lap forming and then bonded by means of mechanical needles, hydro-entanglement, chemical adhesives, and thermal bonding methods.

Raw material: Cotton fiber, synthetic Fiber, Viscose fiber, Short cotton fiber.

Application of dry-laid

- Diapers
- Baby wipes
- Feminine Napkins
- Tampons
- Adult Incontinence Products
- Medical textile

Wet-laid web formation: Wet-laid forming, which can be regarded as being analogous to conventional papermaking processes but with use of chopped synthetic or staple fibers, continues to draw attention as an advantageous way to prepare advanced nonwoven textile products. The wet-laid web forming system is designed to fabricate short fibers dispersed in liquid, which are subsequently layered. The wet-laid method is specifically suitable for the large scale production of disposable products, such as tea bags, aprons, gloves, napkins, and surgical gauze.
Raw Material: A wide range of natural, wood pulp, mineral, synthetic and man-made fibers of varying lengths can be used such as glass, polyester, polyamide, and regenerated fiber.

Applications: Filter paper, Tea Bag Fabric, Napkin, Surgical gauze.

Spun-melt non-woven fabric: Spun-melt is a generic term describing the manufacturing of nonwoven webs directly from thermoplastic polymers. It encompasses 2 processes,

- Spun-bond Non-woven
- Melt-Blown Non-woven

Spun-laid (bonded) Non-woven: Polymer granules are extruded into filaments through so called spinnerets. The continuous filaments are stretched and quenched before

being deposited on conveyor belt to form a uniform web. The spun-laid process results into nonwovens with an increased strength compared to carding, due to the attenuation of the filaments. The downside is that the choice of raw materials is more restricted. Co-extrusion of two components leads to bico fibers, either adding more properties to the web or allowing air-through bonding. Please note that the word spunbond is reserved for thermo bonded spun-laid.

Raw material: PP (polypropylene), Pet, Nylon, PE, Polyester. (Synthetic Thermoplastic Resin).

Manufacturing Process:

Application: Packaging (Shopping Bag), PPE for medical,

Melt-blown non-woven: Meltblown, like spun-laid, starts with extruding a low viscosity polymer. But instead of quenching the filaments when they leave the spinneret, the filaments are being attenuated by hot air streams, keeping the filaments in a partially molten state. This leads to much thinner filaments, with low tensile strength. The filaments hit a belt or a conveyor belt where they form a web.



Figure 10: River-bank, road and railway construction.

Raw material: Polypropylene (PP), polyamide (PA), Polyester, Polyethylene (PE).

Some of the processed polymers are:

- Polypropylene is the most used polymer for melt-blown technology.
- Polypropylene is easy to process and makes good web.

- Polyethylene is more difficult to melt-blow into fine fibrous webs than is polypropylene.
- Polyethylene is difficult to draw because of its melt elasticity.
- PBT processes easily and produces very soft, fine-fibered webs.
- Nylon 6 is easy to process and makes good webs.
- Nylon 11 melt-blows well into webs that have very unusual leather-like feel.
- Polycarbonate produces very soft-fiber webs.
- Polystyrene produces an extremely soft, fluffy material with essentially no shot defect

Manufacturing process: The melt-blown technology is based on a melt blowing process, where, usually, a thermoplastic fiber-forming polymer is extruded through a linear die containing several hundred small orifices. Convergent streams of hot air rapidly attenuated extruded polymer streams to form extremely fine fiber (1-5 micro-meter). The attenuated fibers subsequently blown by high viscosity air onto a collector conveyor, thus forming a fine fibered self-bonded non-woven fabric.
Applications: Filter paper, N95 mask (as filter fabric), PP Gown, surgical mask, Napkin, Teabag fabric, water filter.

- Face Mask
- Package
- Teabag
- Silica gel bag
- Sanitary materials
- Warm filling material
- Filtering material
- Diapers and sanitary pads

Mask

N95 mask: An N95 respirator is a respiratory protective device designed to achieve a very close facial fit and very efficient filtration of airborne particles.

The ‘N95’ designation means that when subjected to careful testing, the respirator blocks at least 95 percent of very small (0.3 micron) test particles. If properly fitted, the filtration capabilities of N95 respirators exceed those of face masks. However, even a properly fitted N95 respirator does not completely eliminate the risk of illness or death. Surgical N95 Respirators are commonly used in healthcare settings and are a subset of N95 Filtering.

Manufacturing Technology: 5-layer Fabric.

Surgical mask: A surgical mask is a loose-fitting, disposable device that creates a physical barrier between the mouth and nose of the wearer and potential contaminants in the immediate environment. These are often referred to as face masks, although not all face masks are regulated as surgical masks.

- It is tested for fluid resistance, filtration efficiency (particulate filtration efficiency and bacterial filtration efficiency).
- It should not be shared or reused.

Braiding

Braiding consists of three or more yarns mechanically intertwined in such a manner that no two yarns are twisted around one another. The braids are continuous, which enables the load to be evenly distributed throughout the structure. These fibers are coiled into a helix, similar to wire in a spring.

Tubular braid features continuous seamless fibers from end to end of a part. The braided fibers are manufactured in the form of sleeves, wide fabrics or flat tapes. The

sleeves have the 'Chinese finger-trap'-effect so that it conforms to the shape it is reinforcing.

Benefits of Braided Fibers

The following are the key benefits of braided fibers:

- Generally, when a structure is exposed to elevated fatigue cycles, micro-cracks tend to occur through the matrix of unidirectional prepreg laid-up structures. The micro-cracking can, however, be stopped at the intersections of the reinforcing yarns, thus enabling this material to be easily adapted for use in the aerospace industry.
- The efficient distribution of load in a braided structure enhances its impact resistance.
- Braids improve interlaminar shear properties when combined together with other braids. Interlaminar adhesion in braided structures enables the layers to move together, which helps to prevent cracks.
- As braids are woven on a bias, they provide very efficient reinforcement for parts that are subjected to torsional loads.
- Braids can be easily and repeatedly expanded to fit over molding tools or cores. They can accommodate straight, uniform cross-section forms as well as non-linear, irregular cross-section components.
- Braids can be designed with high level of flame resistance, abrasion resistance, flexibility and expandability.

Applications

Braids are used in many industrial applications. Some of the common applications are listed below:

- As fan blade containment in commercial aircrafts
- For energy-absorbing crash structures in Formula One racing cars

- As reinforcement for aircraft propellers and stator vanes in jet engines
- For building light weight frames and structures such as trusses
- For use in precise manufacture of composite parts
- Ideal reinforcement for drive shafts and torque transfer components, such as flanged hubs
- For products with changing geometries like prosthetics and hockey sticks.

Crocheting

Crochet is a **process** of creating fabric by interlocking loops of yarn, threads, or strands of other materials using a **crochet** hook. **Crochet** is slightly different from that of knitting. **Crochet** completes stitches and then proceeds to the next one while knitting have many stitches open at a time.

ADVANTAGES

- Easy to learn
- Easier to recover from mistakes due to fewer live stitches
- Cost-effective in terms of investing in materials
- Portable
- Inexpensive way of making clothing and accessories
- Several health benefits such as stress relief, toning of eyes and muscles in the fingers, staves off Alzheimer's

DISADVANTAGES

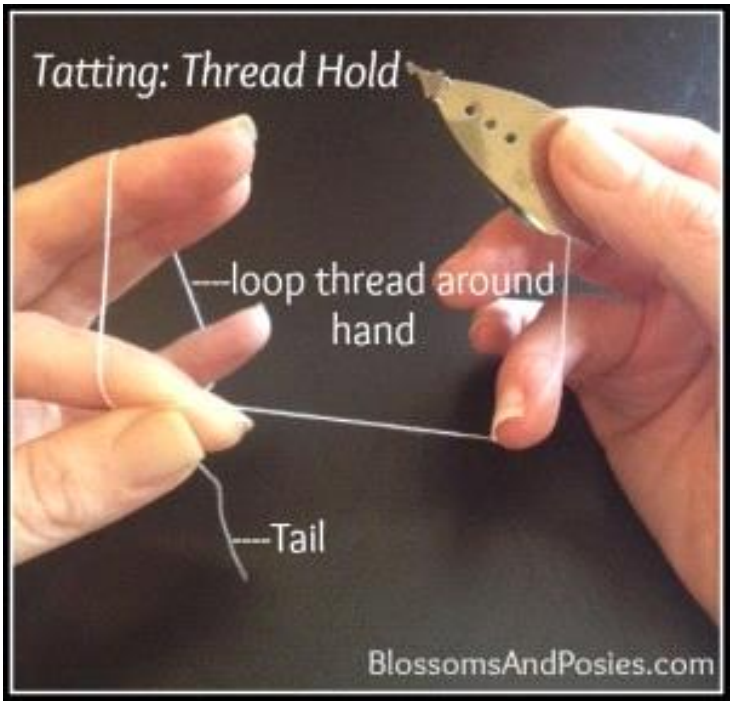
- Limited stitches and patterns
- Thicker stitches that can lead to bulkier garments
- Colourwork might not come out very neatly
- Does not have a wide market

Tatting

Tatting is an old-fashioned decorative art that probably originated in the early 1800's in Europe. Tatting is lacework that's made using fine thread and a small, oval shaped handheld shuttle.

First, thread is wound onto the shuttle. A right handed tatter would hold the shuttle in their right hand. This would be their "working hand."

The long tail of the shuttle thread is then looped around the left hand and the working hand then weaves the shuttle thread back and forth through the loop, which is actually called a "ring."



Essentially, tatting is knot-making

Each tatted stitch is composed of two parts. When combined, the two parts make one knot that sits on top of the loop. Many stitches are tatted alongside each other on the same loop, or ring. The key is that each knot must slide along the ring so that when the

ring thread is pulled tight it forms a closed ring of tatted stitches. In tatting, if a stitch isn't formed properly the ring won't close. (Remember that tatting is knot work, so the mistake must be unknotted or "picked out", or the work must be begun again.)

A chain stitch can also be created (using an additional ball of thread – see photo below.) **Tatting is easily recognized in that it consists of rings and chains.**