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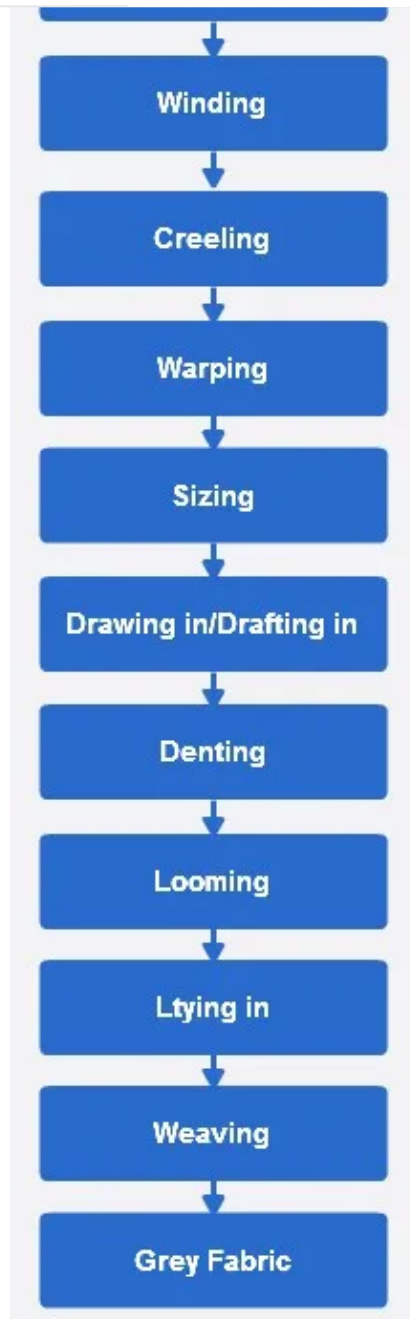


Figure 1: Flowchart of weaving

Fabric can be woven on a small hand loom or a huge computerized loom. Either way, the basic

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into place at the front of the loom by a beater or reed. As the shuttle comes back through to the original side, another harness goes up. As these up-and-down and back-and-forth motions continue, the finished fabric rolls onto the cloth beam at the front of the loom.

Wet Wipes Making Machine

High-speed, computerized looms can produce over 100 yards of fabric per hour. Instead of a shuttle, these looms use a stream of water or an air jet to carry the weft yarn across the shed at very high speeds. The yarn travels as fast as 200 miles per hour. The harnesses and beaters on these looms move faster than the eye can follow.

In practice, the weaving machines are named after their weft insertion systems. Mainly, there are two main weft insertion systems, namely shuttle weft insertion and shuttleless weft insertion systems. Shuttle weft insertion is performed on shuttle looms, which have been used for centuries to make woven fabrics. In this type of loom, a shuttle, which carries the weft yarn wound on a quill, is transported from one side to the other and back. In the mid-twentieth century, shuttleless weft insertion started to emerge. According to the principle of weft insertion, weaving looms can be divided into shuttle looms, **projectile loom**, **rapier loom**, and **air-jet loom**. Today, the shuttle looms have become obsolete and are not manufactured anymore except for some very special niche

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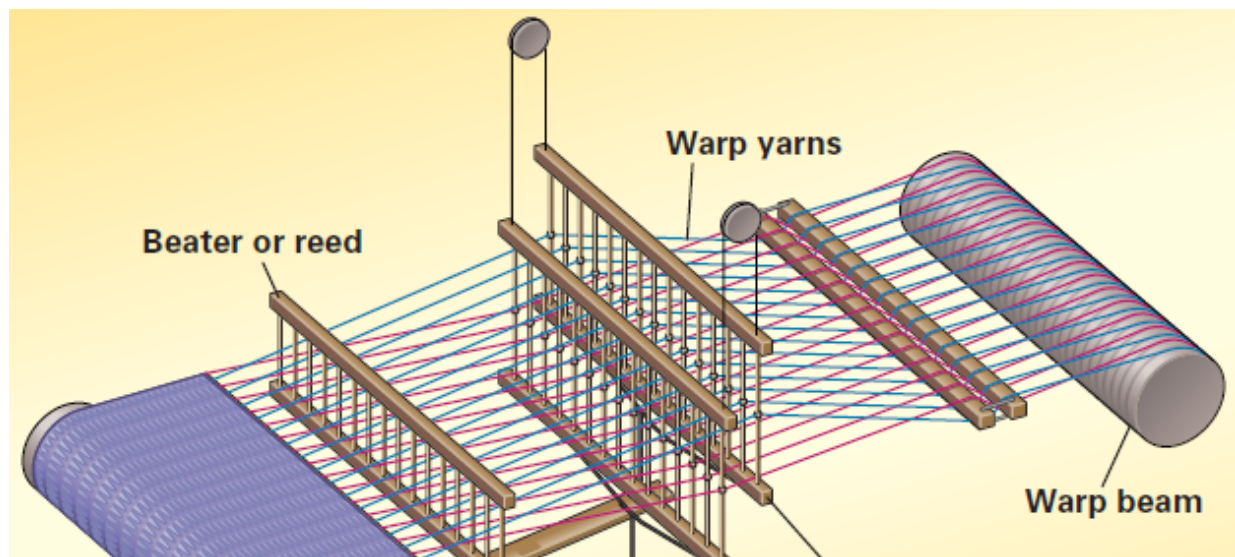


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Basic Weaving Mechanism:

The conversion of warp sheet into fabric by interlacing with weft yarn requires the basic mechanism to be carried out on loom in a specific order. In order to interlace these yarns, basic weaving mechanism involves primary motions, secondary motions and and stop motions. The primary motion includes shedding, picking, and beat-up, whereas the secondary motions are warp let-off and cloth take-up.



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happen if any of these motions are not completed. These motions include shedding, picking, and beat-up. The primary weaving motions are shown in Figure 3.

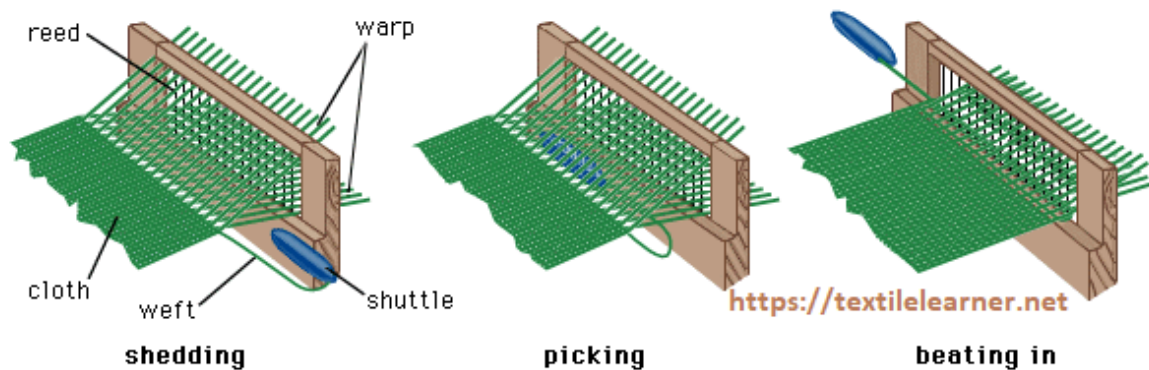


Figure 3: Primary weaving motions. (a) Shedding (b) Picking and (c) Beat-up

Shedding:

Shedding, one of the three primary motions in weaving, is aimed at splitting threads in the warp line into two groups, namely the top (or the upper) shed line and the bottom (or the lower) 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

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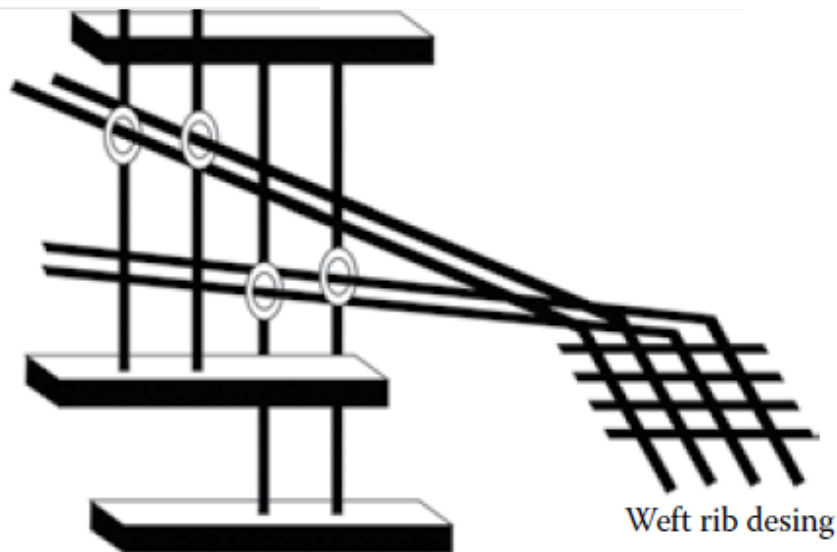


Figure 4: Shedding motion

a) 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 center 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 leveling. 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 center shed line is called center closed shed. In center 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 center shed line. The schematic diagrams of bottom closed shed and center closed shed are shown in Figure 5. 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 center 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

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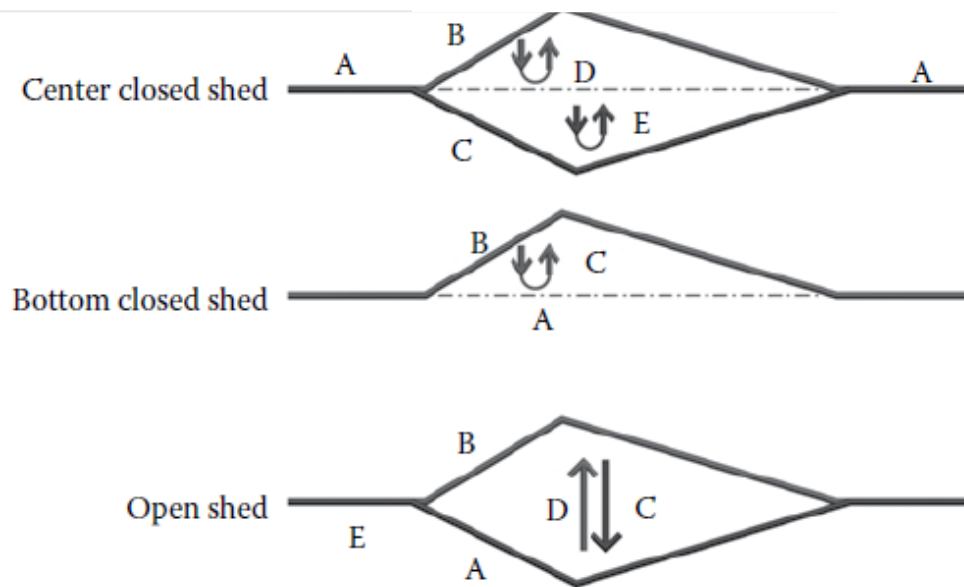


Figure 5: Types of shed

b) 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 5, 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 5, 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.

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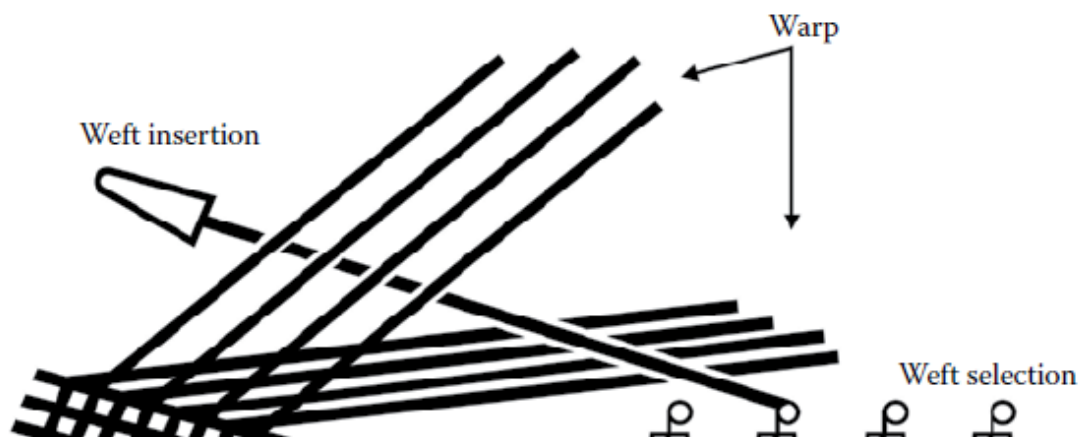
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Picking:

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 shuttleless picking. Shuttle picking is further categorized into two main systems, that is, underpicking and overpicking. In underpicking, the picking stick moves under the shuttle box, whereas in overpicking, the picking stick moves over the shuttle box.

In shuttleless picking system, the picking is carried out with the help of various picking media such as projectile, rapier, air, and water. Shuttleless 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 color of weft yarn. A weft, being inserted through a shed, is shown in Figure 6.



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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 7.

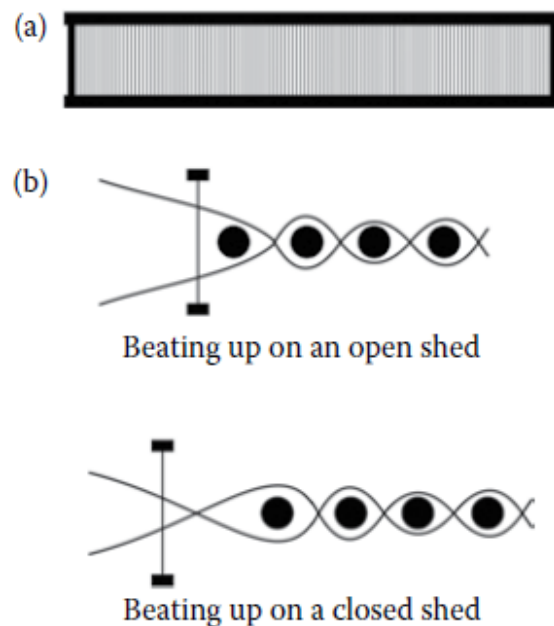


Figure 7: (a) A reed used for beat-up, (b) beat-up for an open and closed shed.

Secondary Motions:

The weaving motions required to make the weaving process continuous are called secondary motions. These motions include warp let-off motion and 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

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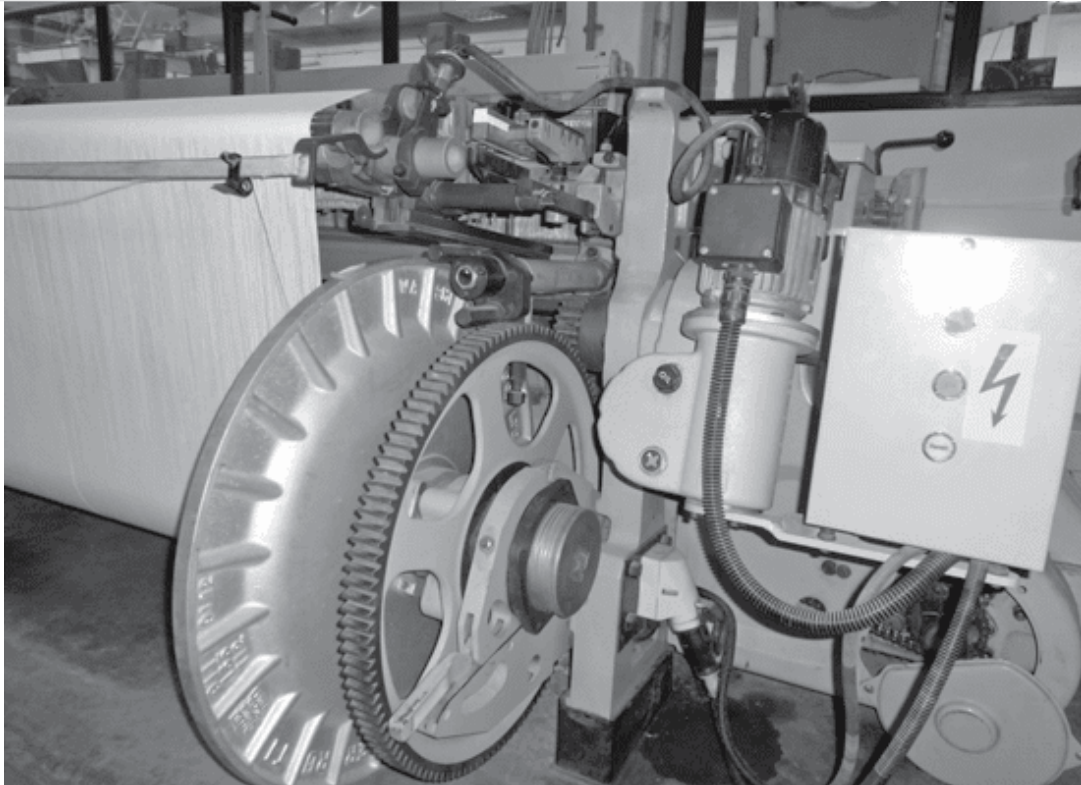


Figure 8: Let-off mechanism on loom.

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 9. 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.

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Figure 9: Take-up mechanism on loom.

Auxiliary Motions / Stop Motions:

The auxiliary motions / mechanisms are useful but not absolutely essential. This is why they are called the auxiliary mechanism of weaving. Stop motions are used in the interest of quality and productivity; stopping the loom immediately in case of some problem. 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:

The warp stop motion will stop the loom in case any warp yarn breaks, avoiding excessive damage to the warp threads. 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

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Weft stop motion:

Weft stop motion will come into action at the event of weft breakage or exhaustion of yarn in the weft package and stop the loom. 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 10. 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.

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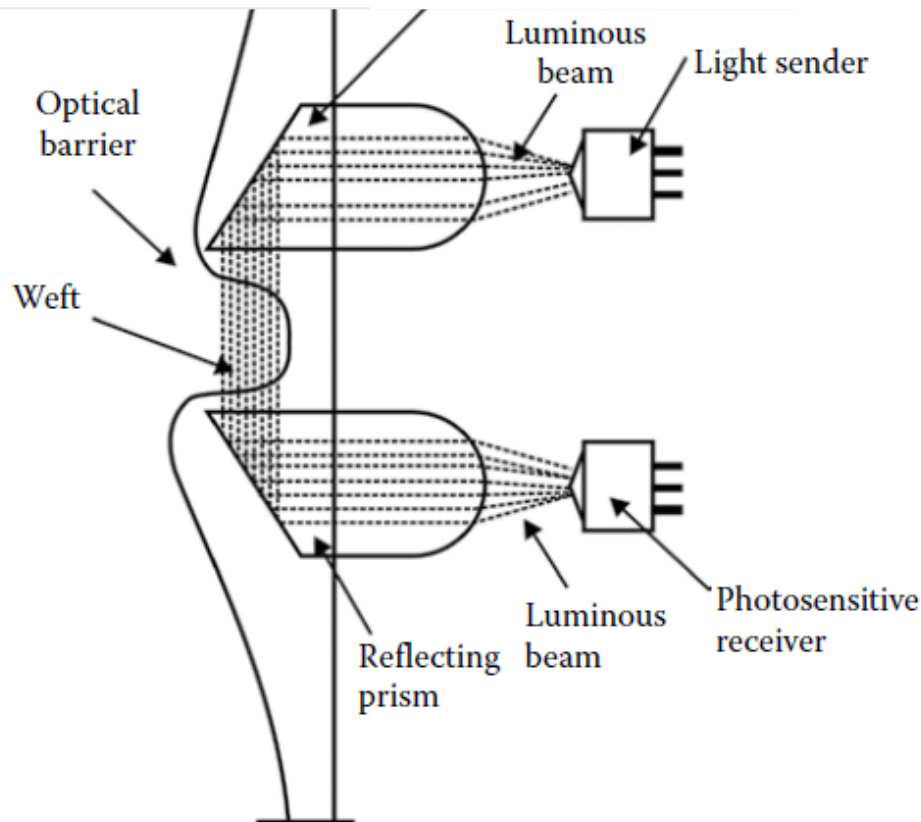


Figure 10: Optical weft stop sensor

Temples:

The function of the temples to grip, the cloth and hold it at the same width warp in the reed, before it is taken up

Brake:

The object of the warp stop motion is to stop the loom immediately when a warp thread breaks during the weaving process.

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 and weft replenishment motion

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5. Handbook on Fabric Manufacturing: Grey Fabrics: Preparation, Weaving to Marketing by B. Purushothama
6. Clothing: Fashion, Fabrics and Construction, Fifth Edition by Jeanette Weber
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