LECTURE NOTE

SUB: FABRIC MANUFACTURE - II

BRANCH: - TEXTILE ENGG.

SEMESTER: 4TH

GOVERNMENT POLYTECHNIC, BHADRAK

PREPARED BY: PUJA MEHER (Guest Faculty)

Th.3.
Fabric Manufacture-II

Name of the Course: Diploma in Textile Technology /Engineering			
Course Code:	TH-3	Semester:	4th
Total Period:	60	Examination:	3hours
Theory Periods:	4P/Week	Internal Assessment:	20
Maximum Marks:	100	End Semester Examination	80

A. Rationale :

A knowledge about the different processes like Secondary, auxiliary, Multiple Box , dobby, Jacquard and shuttle-less loom are essential for the students to understand the operations in the weaving processes. Hence they must be taught to the students to enhance their knowledge and skill in the setting and operation of the preparatory machines, to perform necessary weaving calculations and also fundamental concept of mechanism for formation of fabric.

B. Objective : After completion of this subject the students will able to

1. Develop concepts on conventional & non conventional weaving processes.
3. Understand the Auxiliary mechanism in looms, Working of the Dobby & Jacquards & Automatic looms for plain and ornamental fabrics.

C. Topic wise distribution of periods		
Sl. No	**Topics**	**Period**
01	Secondary and Auxiliary motion	14
02	Multiple Box Motion	06
03	Dobby & Jacquard shedding	20
04	Modern developments in auto loom	10
05	Shuttle –less Looms	10
Total:		**60**

D. Course Contents:

1. Secondary and Auxiliary motion

1.1 Explain take up & Classify take up motion.

1.2 Discuss Negative and positive take up motions.
1.3 Explain let off & Classify let off motion.
1.4 Discuss Negative and positive let off mechanism.
1.5 Explain Warp protecting motion.
1.6 Discuss weft stop motion
1.7 Discuss Break Mechanism.
1.8 Discuss Timings and settings of these motions.

2. Multiple Box Motion

2.1 Explain drop Box mechanism,.
2.2 Explain pick & pick looms.
2.3 Brief idea on card saving devices.

3. Dobby & Jacquard shedding

3.1 Explain working principles of dobbies like Keighly , cam, paper and electronically controlled Dobby.
3.2 Discuss pegging for dobby (Right & left hand) loom.
3.3 Explain principles of Jacquard weaving & Classify Jacquards.
3.4 Explain working single lift double lift single cylinder Jacquards.
3.5 Discuss double lift double cylinder Jacquards.
3.6 Discuss Jacquard building and harness ties & Casting out of Jacquard.
3.7 Brief idea on Electronic Jacquard.

4. Modern developments in auto loom

4.1 Explain weft feeler mechanism.
4.2 Discuss 3 try weft fork mechanisms.
4.3 Discuss Automatic warp stop motion.
4.4 Explain Shuttle protector.
4.5 Discuss Automatic cop changing motion.
4.6 Discuss fabric defects, its causes and remedies.

5. Shuttle –less Looms

5.1 Classify & Explain unconventional looms.
5.2 Discuss Limitation of shuttle looms& State the advantages of shuttle-less looms over shuttle Looms.
5.3 Explain the preparation of raw materials for unconventional looms.
5.4 Classify & explain briefly on different types of weft insertion processes in shuttle-less looms like- Rapier, Gripper, Fluid jet etc.

Objective and motions of loom :

Objective of loom

1. The main objective of loom is to produce fabric.
2. Interlacement of warp and weft is carried out on a loom.
3. Different motions are carried out in the loom to produce the fabric.
4. The objective of loom is to make fabric without any damage.
5. Take up and let off motion are carried out in the loom.
6. The purpose of loom is to hold the warp yarns so that weaving can take place properly.
7. Loom gives the facility to produce the desired design on any fabric.

Different motions of a loom

There are three motions of a loom which are as follows

1. Primary motions

2. Secondary motions

3. Auxiliary motions

SECONDARY MOTION

The loom motions which help to weave a fabric continuously are called secondary loom motions. The fabric can be woven without these motions too, but you can't keep the weaving process continue without secondary motions. There are following two secondary motions required to make continuous weaving process.

These motions are next in importance to the primary motions. For continuous weaving these secondary motions are necessary. So these motions are call as secondary motions.

There are two secondary motions

1. Take-up motion

2. Let-off motion

Objectives of secondary motions

1. To provide facility for take up and let off motion.
2. It releases the warp from the back beam.
3. To take up the women cloth pick by pick.

Types of Take – up motion

1. Positive Take-up motion
2. Negative take-up motion

Positive take-up motion:

The take-up motion is said to be positive when it is not operated manually and the cloth is taken up pick by pick automatically during weaving by the help of train of wheels. Example: 5- wheel and 7- wheel take up motion

Negative take- up motion

The take-up motion is said to be negative when it is operated manually as in handloom without the help of any mechanical motion.

Types of positive take-up motion:

1. Intermittent take-up motion
2. Continuous take-up motion

Intermittent take-up motion:

In this type of motion a pawl and ratchet wheel drive is use to drive the take up roller.

Continuous take-up motion:

In this type of motion a worm and worm wheel drive is used to drive the take up roller. This motion is continuous and cloth is drawn forward and wound on to the cloth roller by frictional contact with the take- up roller.

Take up motion

In this motion the cloth roller take up the fabric pick by pick as weaving take place. In this motion 5 wheels and 7 wheels are use.

It is of two types

1. 5- wheel take up motion

2. 7- wheel take up motion

FIVE WHEEL TAKE - UP MOTION (A SECONDARY LOOM MOTION)

Take up motion is a secondary loom motion. The take-up motion helps to perform continuous weaving of fabric. When the fabric is woven on the loom during weaving, it is pulled (drawn) regularly according to picks per inch in the fabric. This fabric pulling (drawing) process continues during loom operation. This drawn cloth is wound on the cloth beam or cloth roller).

In shuttle loom, intermittent take up motion is used. Actually, there are two kinds of take-up motions used in the loom.

1- Intermittent take-up motion
2 - Continues take-up motion.

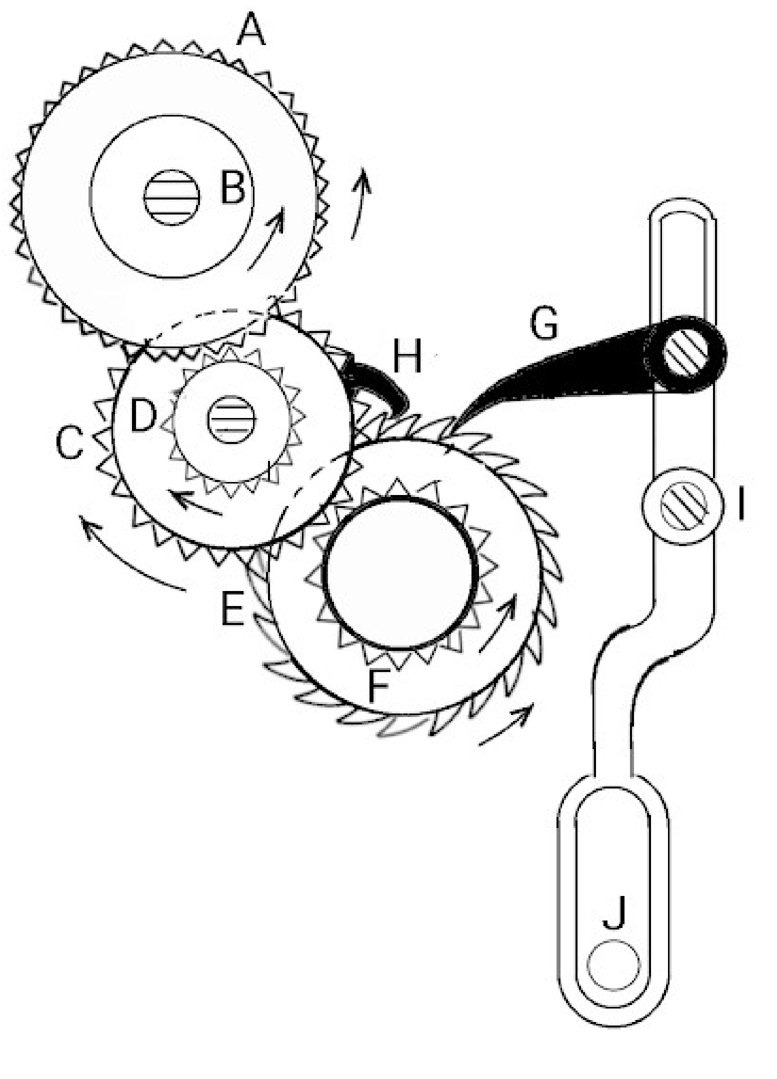
Intermittent take-up motion

In this kind of mechanism, the emery roller does not rotate continuously. When the last inserted pick gets beaten by reed, the take-up roller draws the fabric in a forwarding direction and winds in on the cloth beam. The fabric pulling (drawing) takes place intermittently.

There are two types of mechanisms used in shuttle loom:

1 - Five wheel take-up motion
2 - Seven wheel take-up motion

1 - **Five wheels take up motion:**



Five wheel take - up motion:

PARTS OF 5 WHEELS

I - fulcrum
G - Pushing pawl
E - Ratchet wheel
F - Change pinion
A - Beam wheel
B - Pin roller or take-up roller or emery roller
H - Catcher
C - Stud wheel
D - Stud pinion
J - Finger

Five wheels take-up motion is an intermittent take up motion. A train of five gears is used in this five wheel take-up motion mechanism. This mechanism receives the motion through slay sword by a connecting rod. One end of connecting rod gets connected to the sley sword with the help of a stud. This end of connecting rod gets free to rotate in both directions. The other end of this connecting rod is fulcrum med in the bottom of the finger 'J'.

When the crank is rotated, it imparts rocking motion to the sley sword. The connecting rod is connected to the sley sword from one side. When the slay starts to move from front dead centre to back dead centre, the slay starts to push the connecting rod fulcrum med with it.

When connecting rod travels toward the back dead centre, it pushes the finger 'J' fulcrum med with the other end.

The connecting rod pushes the finger 'J'. Since the finger 'J' is fulcrummed at point 'I', so that finger makes the angular movement at fulcrum 'I'. The direction of this angular movement of the finger changes with the slay sword position.

The pushing pawl 'G' is mounted in the upper slot of the finger 'j'. This pushing pawl is mounted with the help of a stud. This pawl can move freely on this stud.

As the finger goes toward the back dead centre, the pushing pawl imparts the angular motion to ratchet wheel 'E'. The ratchet wheel starts to move now.

This ratchet wheel is mounted on the shaft. The ratchet wheel 'E' rotates with a shaft. A change pinion 'F' is also fastened on this shaft. The change pinion 'F' and ratchet wheel 'E' rotate together in the same direction as shown in the above figure.

A catch 'H' (pulling pawl) is also fitted over the ratchet wheel. This catch prevents reverse motion of the ratchet wheel when the finger goes back toward the back dead centre.

Change pinion imparts motion to stud wheel 'C' fastened on a shaft. This shaft is rotated with a stud wheel. Another stud pinion 'D' is also fastened with this shaft. The stud wheel and stud pinion rotate together.

The stud pinion is geared with beam wheel 'A' fastened with a take-up roller shaft. The stud pinion imparts motion to the beam wheel. When this beam wheel rotates, it revolves the take-up roller 'B' together.

The take-up roller rotates in an anti-clockwise direction. Since the fabric passes over this take-up roller so that it pulls (draws) the fabric in a forwarding direction.

SEVEN WHEEL TAKE UP MOTION (A SECONDARY LOOM MOTION)

Seven wheel take-up motion:

In this take-up mechanism, a train of seven wheels is used. Seven wheels take-up motion is an intermittent take up motion. This mechanism receives motion from the sley sword. When the crankshaft rotates, the slay sword receives to and fro motion from the crankshaft.

A connecting rod is used to connect the finger and slay the sword. One end of the connecting rod is fitted with slay sword with the help of a bush and nut. The connecting rod can move freely at the connecting point.

The other end of the connecting rod is connected with the finger at point L with the same mechanism as slay sword joint.

The finger L is fulcrum med at the near bottom slot at point K.

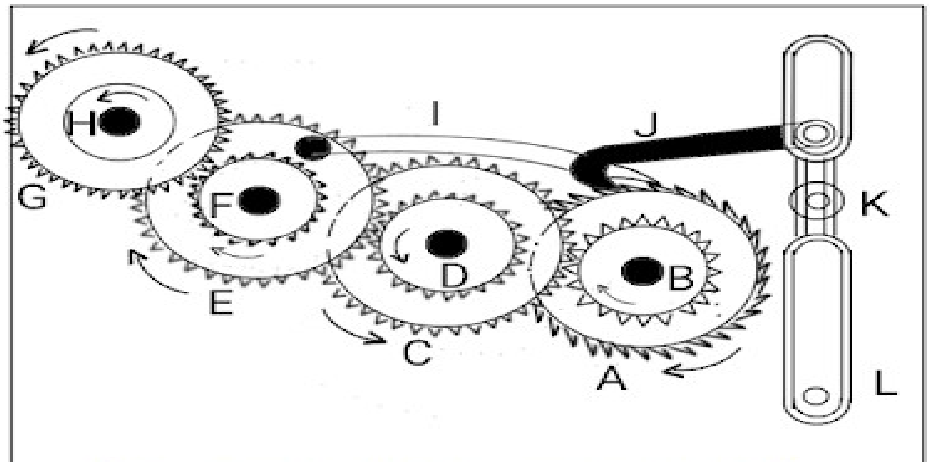
When slay sword goes toward the front dead centre position, the pulling pawl freely mounted in the top slot of the finger pulls the teeth of ratchet wheel A.

This ratchet wheel is mounted on a shaft. Another standard wheel B gets mounted on this shaft.

When pulling pawl J pulls the teeth of the ratchet wheel, the standard wheel B also rotates with the ratchet wheel.

A Pushing pawl I is also used to prevent backward rotation of the ratchet wheel.

The standard wheel B transfers angular motion to change wheel C fastened on the shaft. A change pinion D is also fastened with this shaft.
The change wheel C and change pinion D rotates in the same direction together.
The change pinion D imparts angular motion to the compound wheel E fastened on a shaft. A compound pinion F is also fastened on this shaft. The compound wheel and compound pinion rotate in the same direction.
The compound pinion transfers angular motion to the take-up roller wheel mounted on the take-up roller shaft.
The take-up roller rotates with the take-up roller wheel in the same direction.
When the cloth roller rotates, it draws the fabric to be produced.
In this mechanism, you can change one or two-wheel as you need.



Seven wheel take - up motion

A- Ratchet wheel
B - standard wheel
C - Change wheel
D - Change pinion
E - Compound wheel
F - Compound pinion
G - Take up roller wheel
H - Take up roller
I - Pushing pawl
J - Pulling pawl
K - Finger fulcrum
L - finger

Theory: The function of the take up the motion is to draw a fabric to the cloth roller regularly as it is woven. Texture of a fabric largely depends upon the number of ends and picks per inch, that contribution to the uniform texture of the fabric.

Objective:I) To learn about the take up mechanism.
II) To learn about gearing of that mechanism and calculate PPI.

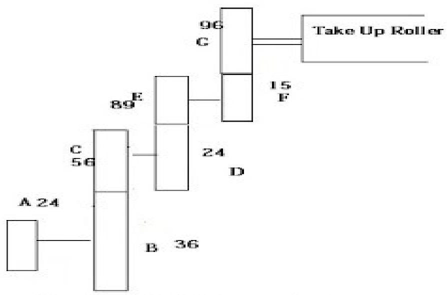


Fig: Seven wheel take up mechanism

Related Machine Parts:

- Sley Sword.
- Finger
- Take up lever
- Pawl
- Returning Clutch
- Ratchet Wheel
- Standard Pinion
- Change Wheel
- Change Pinion
- Compound Wheel
- Compound Pinion
- Take Up Wheel
- Take Up Roller

Construction of the mechanism:
A) In this mechanism take up lever connect both sley sword ad ratchet wheel . For beat up the ratchet wheel move due to push by the pawl
B) Ratchet wheel connected with standard wheel.
C) Standard wheel connected with change wheel and change wheel attach with change pinion by shaft.
D) Change pinion transmit motion to compound wheel which is connected with compound pinion by shaft.
E) Compound pinion transfer motion to take up wheel which connected with take up roller.

Working Principle:
1) The pawl move with sley sword which push the ratchet wheel for every beat up.
2) Ratchet wheel transfer motion to standard wheel.

3) Change wheel received motion from standard wheel, it transfer motion to change pinion.
4) Change pinion sent motion to compound wheel so compound pinion is also rotate.
5) Compound pinion transfer motion to take up wheel so take up roller received motion.

Calculation:
Circumference of take up roller is 15.8"
IF it rotate one time the no. of picks
= 1 X (96/15) X (89/24) X (56/36) X 24
= 886
PPI = 886 / 15.8 = 56
Loom Constant = { 1 X (96/15) X (89/24) X (1 / 36) X 24 } / Circumference of take up roller
= 1

PPI = Loom constant X No. of Change wheel pinion Teeth
= 1 X 56
= 56

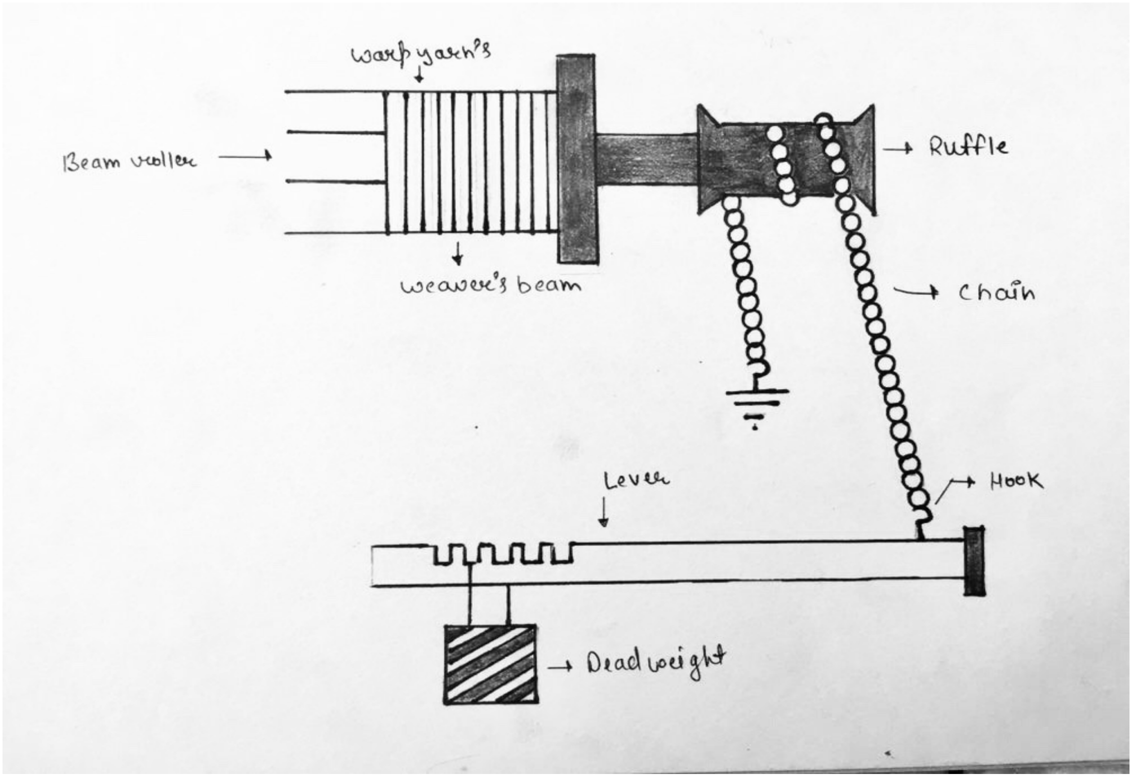
Result : Picks per inch = 56

Comparison between Five-wheel and Seven-Wheel Take-up Motion

S. No.	Five-Wheel take-up motion	Seven-wheel take-up motion
1.	It consists of five wheels	It consists of seven wheels..
2.	Practical dividend is 2030.	Practical dividend is 1.
3.	Only the change wheel is changed to get the required picks per inch.	Both the standard wheel and the change wheel are changed to get the required picks per inch.
4.	The calculation to get the required picksper inch is slightly complicated.	the calculation is quite easy i.e. the number of teeth on the change wheel will directly give the picks per inch.
5.	It is not easy to get a fractional number of picks per inch using this motion.	It is easy to get a fractional number of picks per inch in this motion.

LET-OFF MECHANISMS

The let off motion is the secondary motion of weaving which is used to release the warp yarns from the weavers beam so that weaving can take place. It is a mechanism which provides the facility to let off the warp yarn from the beam.



2. Objects of Let-of Motion:

- To maintain the necessary tension in the warp sheet through its consumption in weaving from the full beam stage to the empty beam stage.
- To regulate the amount of warp yarn delivered by the warp beam during weaving.
- To influence the number of picks per inch in a fabric, this being subsidiary to the take-up motion.

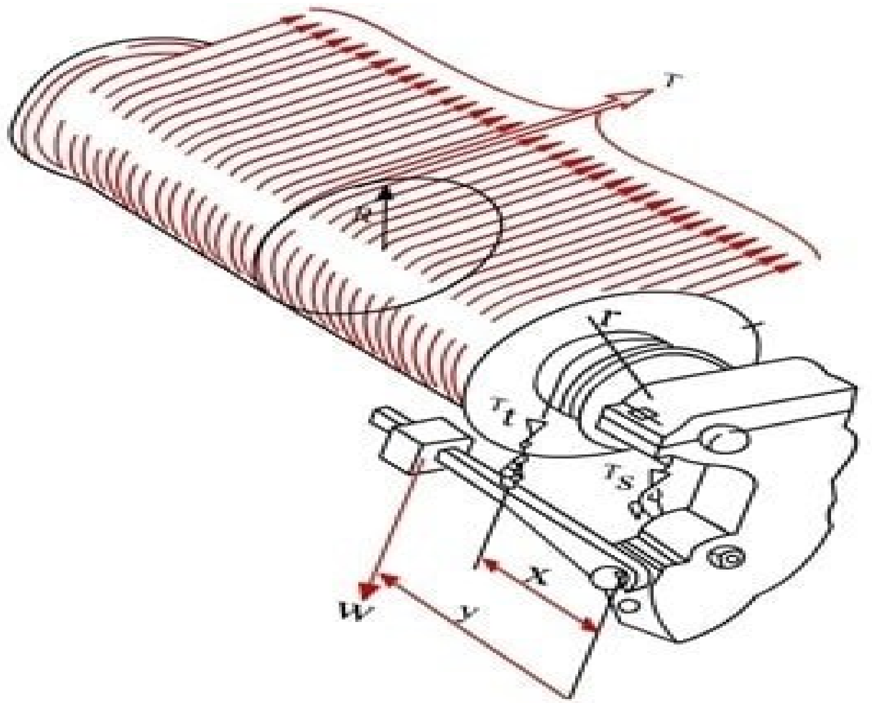
3**. Types of Let-off Motion:**

There are two types of let-off motion. These are:

- Negative let-off motion
- Positive let-off motion.

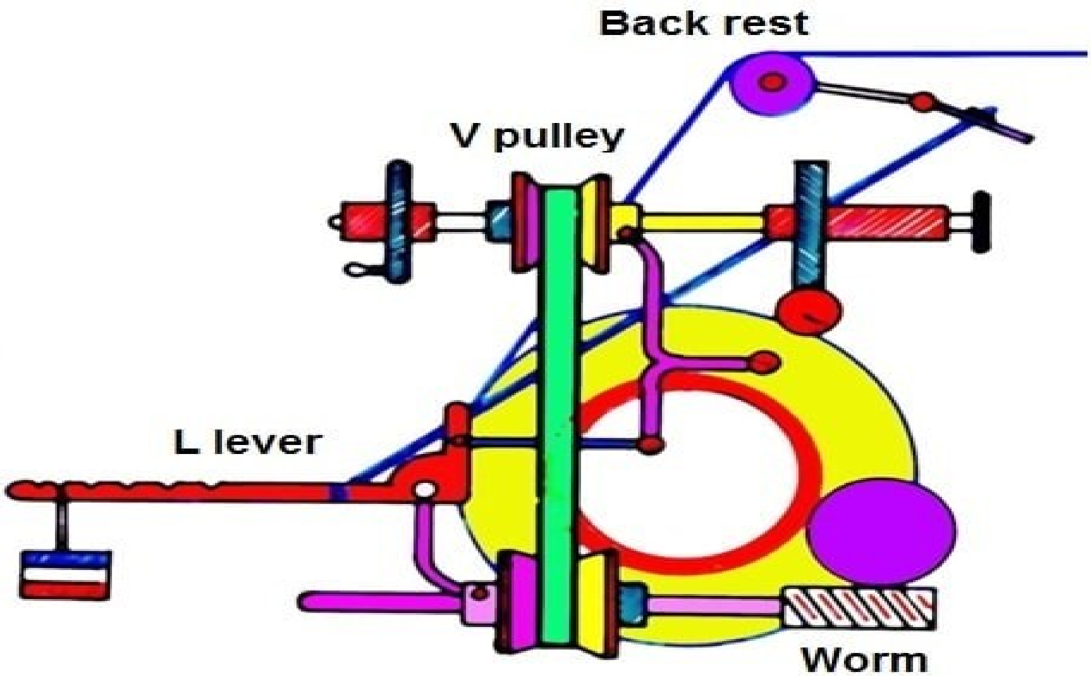
Negative let-off motion:

In the negative let-off motion, the warp beam is not driven positively. The beam is driven by the dragging of the cloth and the warp sheet by the take-up motion. The warp tension and delivery of warp are controlled by using a weight-and-lever system. However, this system does not give uniform delivery and adequate control over warp tension.



Positive let-off motion:

In the positive ¯let-off motion, the warp beam is positively driven through a gear drive. Only in this let-off motion, warp tension and delivery of warp are controlled uniformaly from the full beam stage to the empty beam stage during the weaving process.

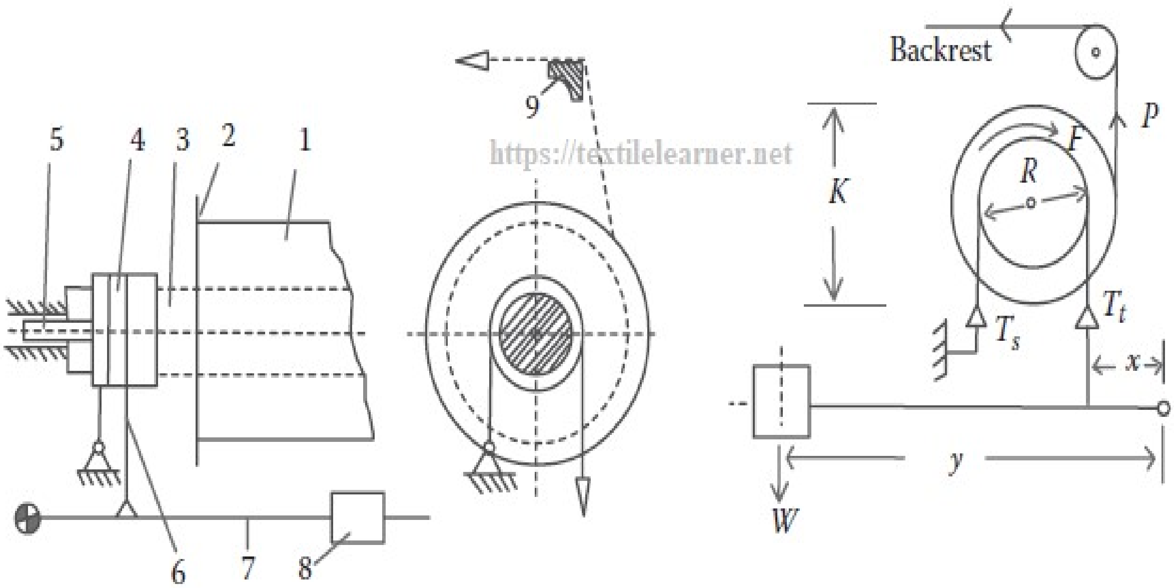


3. Negative Let-off Motion:

Negative let-off motions are generally the following:

Brake let-off motion
Frictional let-off motion and
Rope or chain, lever and weight let-off motion.

Negative Let-off Mechanism



5. Construction & Working:

Figure shows the right-side view of the negative let-off motion. A weaver's Beam A has a beam barrel B and flanges C at its ends. Only one flange is shown in the a figure. The other flange is at the left-hand side of the beam. The distance between the two flanges can be adjusted to suit the required width of the warp sheet. Next to the 6flange is ruffle K, over which a chain D is wound. The warp beam is held in a horizontal, position by two beam brackets, which are connected to the side frame of the loom. One Pend of the chain is connected to the loom rail at L and other end is wound about 11/2 to rounds on the ruffle and is connected to a hood E. The hook E is connected to a long lever F by means of a pin J resting in one of the notches in the lever F. The lever F is fulcrumed at H. A weight G hangs on the lever. The beam flanges vary from 12 inches to 18 inches in diameter. A similar arrangement is provided on the other side of the warp beam.

6. Working:

The let-off motion works by the pulling action of the take-up motion. As the cloth roller rotates, it pulls the warp sheet from the weavers beam. When the loom is in operation, the diameter of the weaver's beam is gradually reduced. If the weight on the lever is kept at a fixed position, the tension on the warp sheet can increase considerably. This causes shuttle-trap, variation in picks per inch and warp breakages. To maintain uniform tension and avoid the above defects, the following ways can be adopted:

Decreasing the amount of weight on the lever
Altering the position of the weight on the lever
Changing the position of the pin on the lever
Increasing or decreasing the number of turns of chain around the ruffle.

The second method is usually adopted to reduce tension in the warp sheet as the diameter of the warp beam decreases. The other two methods are practically impossible. Whenever the weight is moved towards the fulcrum of the lever, warp tension is reduced. The weaver does this. Shifting of weights on the levers should be done simultaneously on both sides of the beam, or else irregular tension will develop in the warp sheet. Since the weaver move s the dead weights manually, the tension on the warp may not be regulated evenly. The let-off motion is a negative let-off motion as it comes into operation as a result of the take-up motion.

Automatic let-off motions are available that work on three different principles as listed below.

a. Automatic negative let-off
b. Automatic semi - positive let-off
c. Automatic fully positive let-off

Automatic negative let-off:
These let-off motions work on the principle of the conventional negative let- off motion - but with some modifications. In the automatic version, the rotation of the beam for the purpose of let-off is effected by the pull of the warp itself, but the shifting of dead weights is completely eliminated.

Advantages:
A negative let-off motion is simple in construction and cheap.
It is useful for light and medium weight fabric.

It facilitates the weaving of tender warp.

Defects:

Tension in the warp cannot be kept uniform since the weights are moved manually.

Due to irregular tension in the warp sheet, shuttle-trap, variation in picks per inch and warp yarn breakages may occur.

c. There is difficulty in regulating the tension in the warp sheet during start up.

b. Automatic semi-positive let-off:

In the semi-positive let-off motion, the weaver's beam is rotated positively. But the amount of rotation of the beam is controlled by warp tension itself. This is done in such a way that an increase in warp tension increases the let-off and a decrease in warp tension decreases it. The warp tension is thus always maintained at the same level.

c. Automatic fully positive let-off:

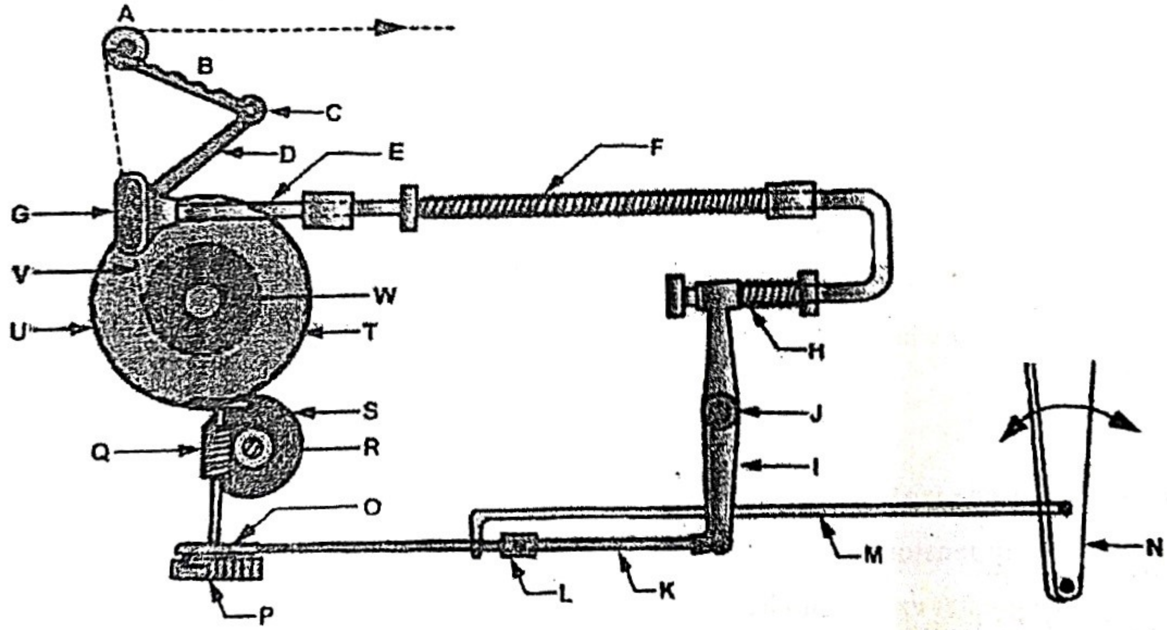
In this positive let off motion, the beam is rotated positively by means of a gearing arrangement for the purpose of letting off the warp. This type of let-off motion requires precision wound beams and greater uniformity in yarn count. The let-off motion is set to deliver a definite amount of warp for every pick, as determined by the speed of take-up or the number of picks per inch. It is very difficult to get a completely positive type of let-off motion in a loom.

7. Advantages of positive let-off motions:

The automatic let-off motion relieves the weaver of the manual work of adjusting the weights, as in the ordinary let-off motion.

It controls the warp tension more scientifically and precisely.

Variations in the width of the cloth and the number of picks per inch, and the increase in warp breaks due to abnormal increase in warp tension are some defects found in the traditional let-off motion. These defects are much less prevalent in the automatic type of let-off motion.



A - Sensitive back rest
B - Arm
C - Shaft
D - Arm
E - Spring-loaded lrver
F - Spring
G - Collar
H - Small spring

I - Pendulum lever
J - Fulcrum
K - Pawl lever
L - Stop
M - Draw hook
N - sley sword
O - Pawl
P - Ratchet wheel

Q - Worm
R - Worm wheel
S - Beam pinion
T - Beam wheel
U - Weaver's beam flage
V - Warp sheet
W - Weavr's beam

Bartlett let-off motion

8. Basic Requirements of Positive Let-off Motion:

It should maintain uniform warp tension from full beam stage to empty beam stage during weaving.

It should be capable of turning the beam at a rate at which the length of warp between the weaver's beam and the fell of the cloth should be constant for every loom cycle.

It should maintain the tension and the constant length of warp without any other further adjustment after initial setting up is made at the full beam stage.

AUXILIARY MOTIONS

To get high productivity and good quality of fabric, additional mechanisms, called auxiliary mechanisms, are added to a plain power loom. The auxiliary mechanisms are useful but not absolutely essential. That is why they are called the auxiliary mechanisms.

- **Warp protector mechanism:** The warp protector mechanism will stop the loom if the shuttle gets strapped between the top and bottom layers of the shed. It thus prevents excessive damage to the warp threads, reed wires and shuttle.
- **Weft stop motion:** The object of the weft stop motion is to stop the loom when a weft thread breaks or gets exhausted. This motion helps to avoid cracks in a fabric.
- **Temples:** The function of the temples is to grip the cloth and hold it at the same width as the warp in the reed, before it is taken up.
- **Brake:** The brake stops the loom immediately whenever required. The weaver uses it to stop the loom to repair broken ends and picks.
- **Warp stop motion:** The object of the warp stop motion is to stop the loom immediately when a warp thread breaks during the weaving process.

Auxiliary Functions

In addition to the five basic motions of a loom there are many other mechanisms on weaving machines to accomplish other functions. These include:

- A drop wire assembly, one wire for warp yarn, to stop the machine when a warp end is slack or broken
- A tension sensing and compensating whip roll assembly to maintain tension in warp sheet
- A mechanism to stop the machine when a filling yarn breaks
- Automatic pick finding device reduces machine downtimes in case of filling yarn breakages
- Filling feeders to control tension on each pick
- Pick mixers to blend alternate picks from two or more packages
- Filling selection mechanism for feeding multi-type filling patterns
- Filling selvage devices such as trimmers, tuckers, holders and special weave harnesses for selvage warp ends

Warps Protector Motion

To protect the warp yarn/reed/shuttle inward illustration of trapping the shuttle inward the shed is the constituent of warp protector motion. The shuttle failure or the shuttle trap within the warp shed may crusade many broken ends during the frontwards motion of the sley. In guild to preclude this from occurring a device is necessary to halt the loom whenever the shuttle fails to ambit the shuttle box.

Types of Warps Protector Motion

Warp protector are 2 types

- Loose reed warps protector
- Fast reed warp protector

Loose reed motion (warp protector motion)

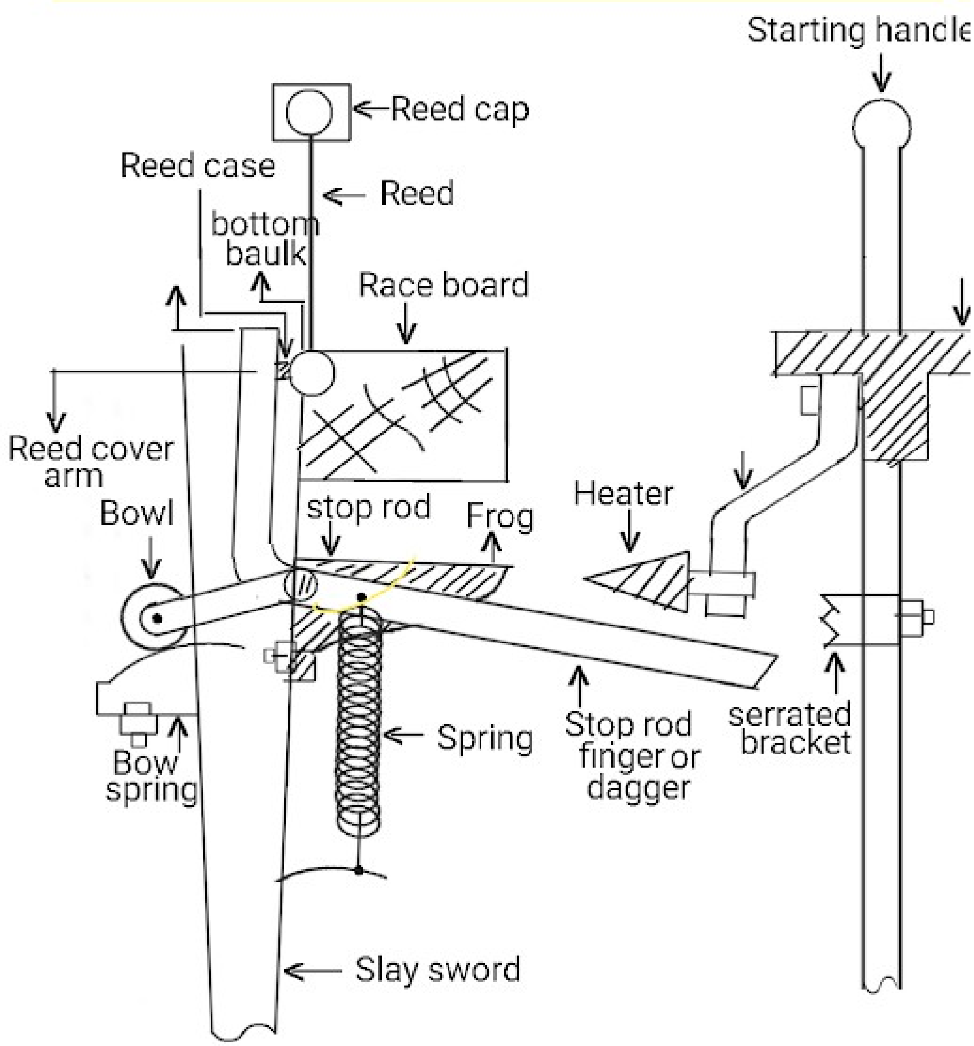
Objective of loose reed motion:

When a shuttle loom works, there is always a chance to trape the shuttle in the shed. Since the reed performs beating motion, the shuttle gets beaten by the reed in case of shuttle trapped situation. the beating of the shuttle after trapping is a very serious problem during weaving. Multiple warp breakages get occurred in this situation. The shuttle and reed may be damaged. The loose reed motion mechanism prevents multiple warp breakages, damage to the reed and shuttle.
In this way, we can say that the main objective of the loose reed motion mechanism is to prevent the multiple breakages of warp and damage of shuttle and reed.

Structure of loose reed motion:

Reed is mounted in the reed case and reed cap. The reed cover arm helps to hold the reed firmly. This reed cover arm looks in L shape. It gets fulcrummed near the joint of the dagger or stop rod finger. An anti-friction bowl is also connected with a stop rod. The anti-friction bowl presses the bow spring in normal running condition. A spiral spring is also connected with the stop rod. A frog is attached to the stop rod. A heater is mounted on the starting handle in such a way that that frog passes under it in normal running condition. A serrated bracket is mounted on the starting handle. The dagger does not push this serrated bracket in normal working.

Loose reed motion (a warp protector motion)



Working principle of loose reed motion:

The reed is gripped in between the reed cap and reed case firmly by the reed cover arm. When the shuttle travels from one shuttle box to another shuttle box, it exerts pressure on the reed. The tension of the bow spring helps to keep the reed in the reed case firmly. This bow spring does generate the pressure equal to that pressure that gets applied to the reed during the beating. Therefore a spiral spring mounted on the stop rod helps to hold the reed firmly in case of beating motion.

In normal running conditions, the frog gets passed under the heater and the dagger does not push the serrated bracket.

When the shuttle gets failed to reach to opposite shuttle box, the shuttle either flys from the shed or gets trapped into the shed.

We know very well that reed beats every inserted pick after pick insertion. The reed beats the shuttle in case of shuttle trapping. This trapped shuttle beating causes multiple warp breakages and damage of shuttle and reed.

As the shuttle gets trapped in the shed, the loose reed motion mechanism comes into play immediately. The pressure getting applied on the reed during beating motion gets increased in case of shuttle trapping.

This increased beating pressure transfers to the reed cover arm. The bottom baulk of the reed comes out of the reed case. And reed does strike to the trapped shuttle hardly. the warp, red, and shuttle remain safe.

Since the reed cover arm gets fulcrum med at its fulcrum point, the reed cover arm receives a partial angular motion.

The reed cover arm is connected to the stop rod so that the stop rod lifts up. The frog comes over the heater. The heater increases the lift of the frog. The dagger mounted on the stop rod comes in front of the serrated bracket and pushes it. In this way, the starting handle gets disengaged and the loom gets stopped immediately.

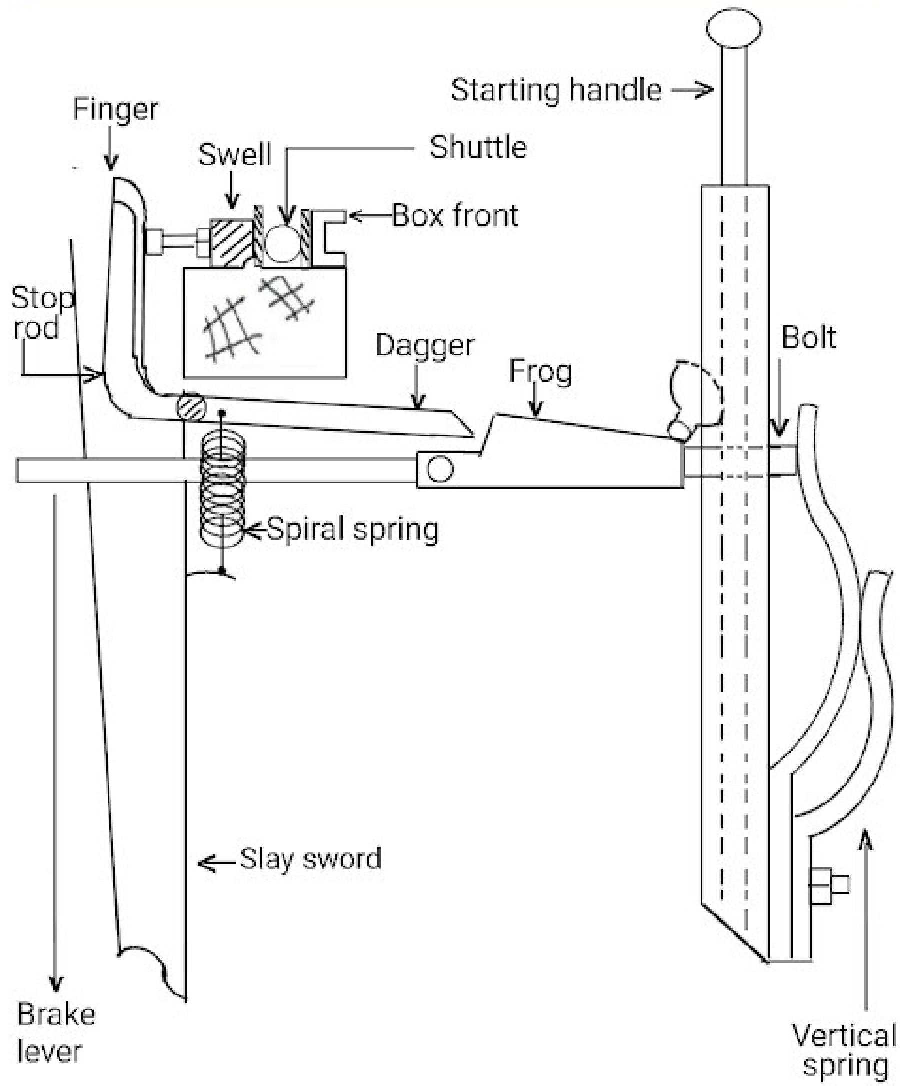
Fast reed motion (warp protector motion)

This is an auxiliary loom motion. The fast reed motion is mostly used on that loom which is used to weave heavier weight fabric. The loom having loose reed warp protector motion doesn't get able to weave heavyweight fabric so that fast reed motion is used in place of loose reed motion in the loom which is getting used to weave heavier weight fabrics. the fast reed motion mechanism stops the loom immediately before beating of pick by reed in case of failure of the shuttle to reach in the shuttle box.

Structure of fast reed motion mechanism:

This mechanism is totally different from loose reed motion. a stop rod is mounted on the loom. This stop rod runs under the sley. Two fingers are mounted on this stop rod. One finger is fitted at each side of the shuttle box. Each finger presses against the swell mounted in the shuttle box. Two daggers also get mounted on the same stop rod. One dagger is fitted at each side of the shuttle box. The dagger are mounted in such a way that they face the frog. This frog gets mounted on the sidewall of the loom. This sliding frog carries a brake lever. The front end of the brake lever touches the adjustable bolt which knocks off the starting handle in case of shuttle trapping. The rear end of the brake lever is connected to the brake assembly. A spiral spring is connected with the dagger. The sliding dagger touches two vertical springs.

Fast reed motion (warp protector motion)



Working principle of fast reed motion mechanism:

When the shuttle travels from one shuttle box to another shuttle box during weft insertion, the swell mounted in each shuttle box feels the presence of a shuttle in the box. The spiral spring mounted on the dagger constantly applies pressure on the finer. The finger presses the swell mounted in the shuttle box. When the shuttle reaches the box, it presses to the swell. As the swell gets pressed by the shuttle, the finger receives partial rotator motion. Since one end of this finger is connected with the dagger so the dagger lifts up. Now this dagger passes over the frog without touching it. Thus the sliding frog doesn't receive any kind of movement and the starting handle position remains unchanged. The loom gets to continue to run.

Now suppose that loom is running continuously. If the shuttle gets failed to reach the shuttle box due to any reason, the swell mounted in the shuttle box doesn't get pressed by the shuttle. Since the finger receives the partial rotatory motion through swell and it helps to lift up to the dagger so that the dagger remains in front of the sliding frog. Now the dagger pushes to the sliding frog. The sliding frog pushes to the starting handle knocks of through adjustable bolt mounted on the starting handle. The rear end of the brake lever connected to the brake assembly actuates the loom brake immediately. The loom is stopped without completing the beating motion. Since the loom stops suddenly, a heavy jerk gets applied to the different loom parts. This jerk is absorbed by two vertical springs mounted behind the sliding frog.

Comparison of fast-reed and loose-reed motions

No	Loose-reed mechanism	Fast-reed mechanism
1.	This mechanism acts on the loose reed priniple.	This mechanism acts due to the swell in the box.
2.	The reed is firm or rigid only at the front and back centre	The reed is always firm or rigid
3.	When loose reed acts, the loom comes to stop only after one or two revolutions.	Loom stops immediately at the top centre itselt.
4.	It is not suitable for heavy fabric.	It is suitable for all types of fabrics particularly for cavas fabric.
5.	When the loom stops, there is a little vibration of the parts.	When the loom stops, there is a greater vibration of the parts.
6.	Wear and tear of the moving parts is low.	Wear and tear of the moving parts is relatively more.

Weft stop motion

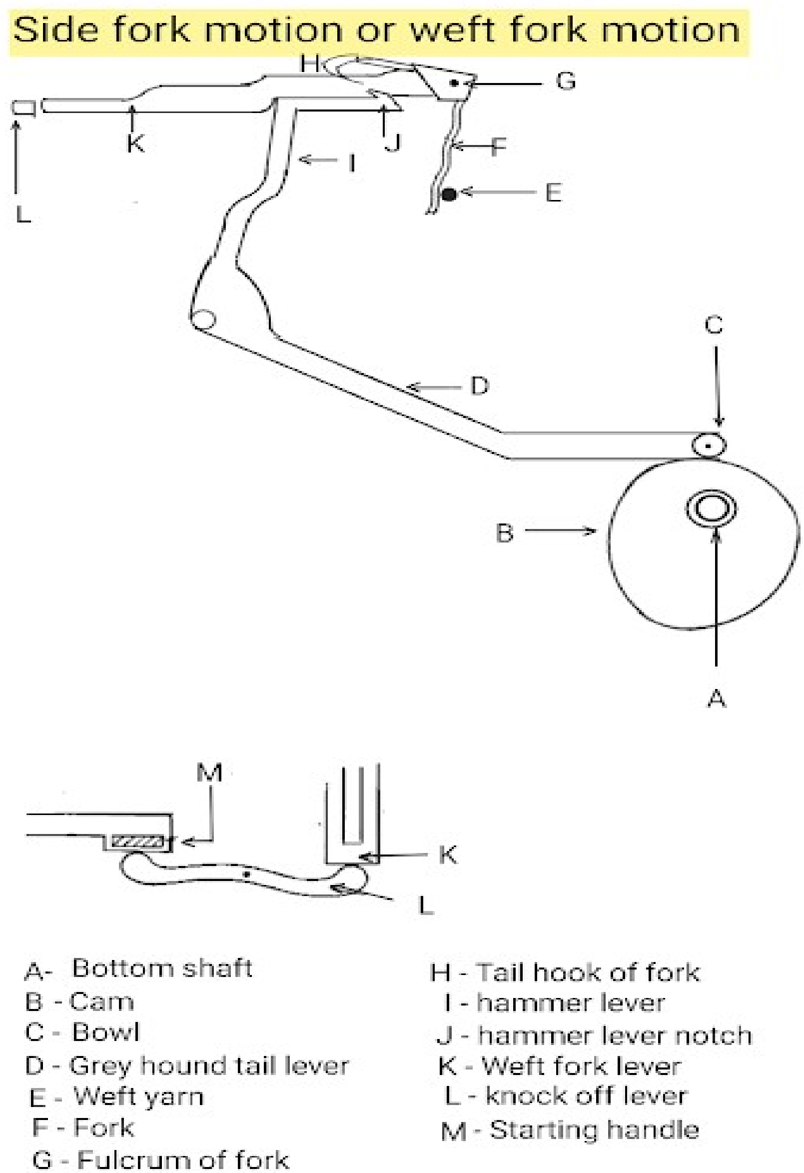
- This stop motion enables the loom to immediately stop after a weft is broken or weft running out.
- There are two types of weft stop motions on a conventional weaving machine.
  - Side weft fork motion
  - Centre weft fork motion

Side fork motion l Weft fork motion l Weft break stop motion l Auxiliary loom motion

The side fork motion is an auxiliary loom motion. The main objective of side fork motion is to stop the machine immediately in case of weft insertion failure during weaving. The side fork motion is mounted at the starting handle side of the loom. Since this mechanism gets mounted at the one side of the loom so that this mechanism is called side fork motion. This side fork motion helps to improve both quality and productivity.

Side weft fork motion toque the presence of weft inwards every 2 picks. It is situated at the side of the reed. It is used for producing medium in addition to heavy fabric. Basically, it is used inwards modern automatic loom.

The basic regulation of the side weft fork lays inwards the fork in addition to grate. H5N1 metallic grate is placed betwixt to terminate of the reed in addition to the shuttle box oral fissure on the starting grip side equally shown inwards the figure. H5N1 weft fork made of calorie-free metallic which has 3 prongs bent at correct angles is situated inwards forepart of the grate



WORKING

A grid is mounted between one end of the reed and the mouth of the shuttle box. The race board has a grove just opposite the prongs of the fork. the prongs of the fork get operated in this grove of the race board. This grid gets parallel to sley and in front of the prongs of fork F. The fork F is fulcrummed at fulcrum point G. The fork is mounted on the weft fork lever K. The fork has prongs at one end and a tail hook H at another end. This fork is made of lightweight material. The weight of the tail hook side is greater than the side of the prongs. Normally, the tail hook H of the fork F rests on the hammer lever notch J just because of the higher weight of the tail hook H. The knock-off lever L is mounted just behind the weft fork lever K. The other end of the knock-off lever gets touched to starting handle M. A cam B is mounted on the bottom shaft A of the loom. The greyhound tail lever D and the hammer lever I are connected to each other and they are fulcrummed at the joint of both levers. A bowl C is mounted at the end of the greyhound tail lever D. Bowl C touches cam B.

When the bottom shaft rotates, the cam B mounted on the bottom shaft also rotates with the bottom shaft. The cam imparts up and down movement to the bowl mounted at the end of the greyhound tail lever. Since the greyhound tail lever and hammer lever are connected to each other and get fulcrummed at the joint of both levers so that the cam imparts to and fro motion to the hammer lever.

The side weft fork motion performs its work when the sley moves to the front dead centre position. The prongs of the fork push the weft yarn present in the shed in a normal running position of the loom. When prongs of fork strike the weft yarn, the tail hook of the forklifts up and the loom gets to continue to running position. The cam makes one round when the crankshaft makes two rounds.

If the weft yarn gets absent due to any reason during loom working, the tail hook of the fork falls down on the hammer lever. Since the hammer lever makes a to and fro motion, the hammer lever notch carries the weft fork lever with it. The weft fork lever pushes the knock-off lever in this situation. The knock-off lever strikes the starting handle and the starting handle gets disengaged. In this way, the loom is stopped in a weft break situation.

Center weft fork motion, structure and working principle

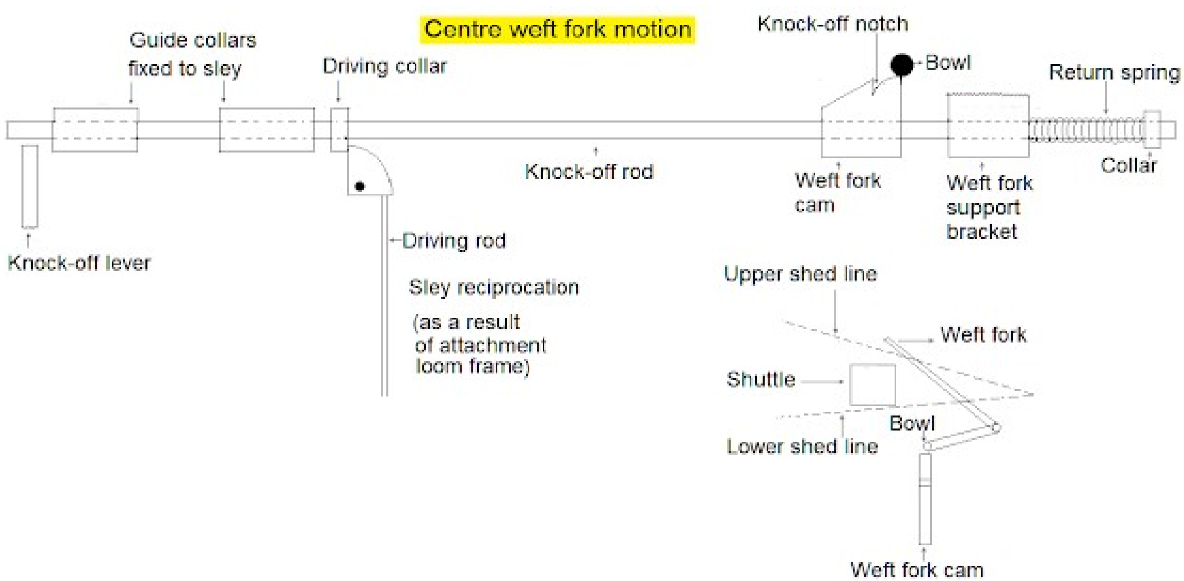
Objective of center weft fork motion:

Weft fork motion stops the loom when the pick gets absent in the warp shed. If this motion is mounted at one side of the loom, then this motion performs its work at every alternative pick. There is always a possibility of missing two picks in the fabric and these missing picks create either dense mark or crack during restarting of the loom.

The center weft fork motion is mounted at either middle of the race board or nearly the middle of the race board. This mechanism stops the loom immediately if the weft breakage occurs mechanism doesn't wait for the next round of loom. Thus this mechanism helps to improve the quality of the fabric.

Structure of center weft fork motion:

A slot is cut at either middle or near the middle of the race board. The prongs of the weft fork fall in this cut-out slot on the race board. The weft fork with prongs gets fulcrum med at the weft fork support bracket. This weft fork support bracket is attached to the front of the sley. A return spring is mounted at the one end of the knock-off rod as shown in the figure. A weft fork cam is mounted on the knock-off rod near the weft fork support bracket. This weft fork cam touches the bowl mounted on the weft fork. The driving collar is mounted on the knock-off rod. The driving collar is connected with the driving rod. There are two guide collars fixed on the sley. The one end of the knock-off rod passes through these two fixed guide collars. A knock-off lever is mounted near the outer guide collar under the end of the knock-off rod.



Working principle of center weft fork motion.

The movement of sley is used to reciprocate the weft fork cam by having the knock-off rod fixed to a point on the loom frame which is often attached to the inside of the loom frame near its base. When the sley makes a reciprocating motion, the distance from the fulcrum varies. this distance variation in the fulcrum causes the knock-off rod to be driven to the left direction as shown in the figure. The returning of the knock-off rod is achieved by return spring.

As the weft fork cam moves in the left direction, the bowl of the fork rides up the weft fork cam surface and the prongs of the fork lift up. Now the shuttle travels from one shuttle box to another shuttle box.
When the fork is supported by weft yarn, the bowl is carried over the knock-off notch, and the knock-off rod makes complete movement toward the right side. In this situation, the left side of the knock-off rod doesn't protrude and it does not strike the knock-off lever. Thus loom gets continues to run.
If weft yarn gets absent in the shed the prongs of the weft fork fall in the cut out of the sley and the bowl gets trapped in the knock-off notch and limits the distance that the knock-off rod can move to the right. A small length of knock-off rod is now protruding from the left side of the guide collar. As sley moves toward the beating position, the protruding portion of the knock-off rod strikes with a projection from the starting handle and knocks off the loom. The loom is stopped before beating position.

S.No	Side weft-fork motion	Centre weft-fork motion
1.	This motion is fitted on one side of the loom	This is fitted almost at the centre of the loom
2.	It can be brought into action only once for every two picks.	It acts for every pick.
3.	It is suitable for cotton fabric	It is suitable for silk, rayon, nylon, polyester and fine quality fabric.
4.	As the fork feels the picks at the side of the loom, it is not suitable for pick-at-will loom having multiple boxes at both the ends of the loom.	As the fork feels each pick at the centre, it is suitable for all types of looms.
5.	There is a risk of getting broken picks.	It reduces the risk of broken picks.

Warp break stop motion:

The warp stop motion is an auxiliary loom motion. The main objective of a warp stop motion is to stop the loom immediately when an end breakage occurs during the loom operation. The warp break stop motion plays a very important role to improve the quality of the fabric and the productivity of the loom. If an end breakage occurs and the loom gets continued to run, the broken end coming from the warp beam gets accumulated behind the eye of the heald wire. This yarn deposition causes multiple end breakages and this multiple ends breakage takes a

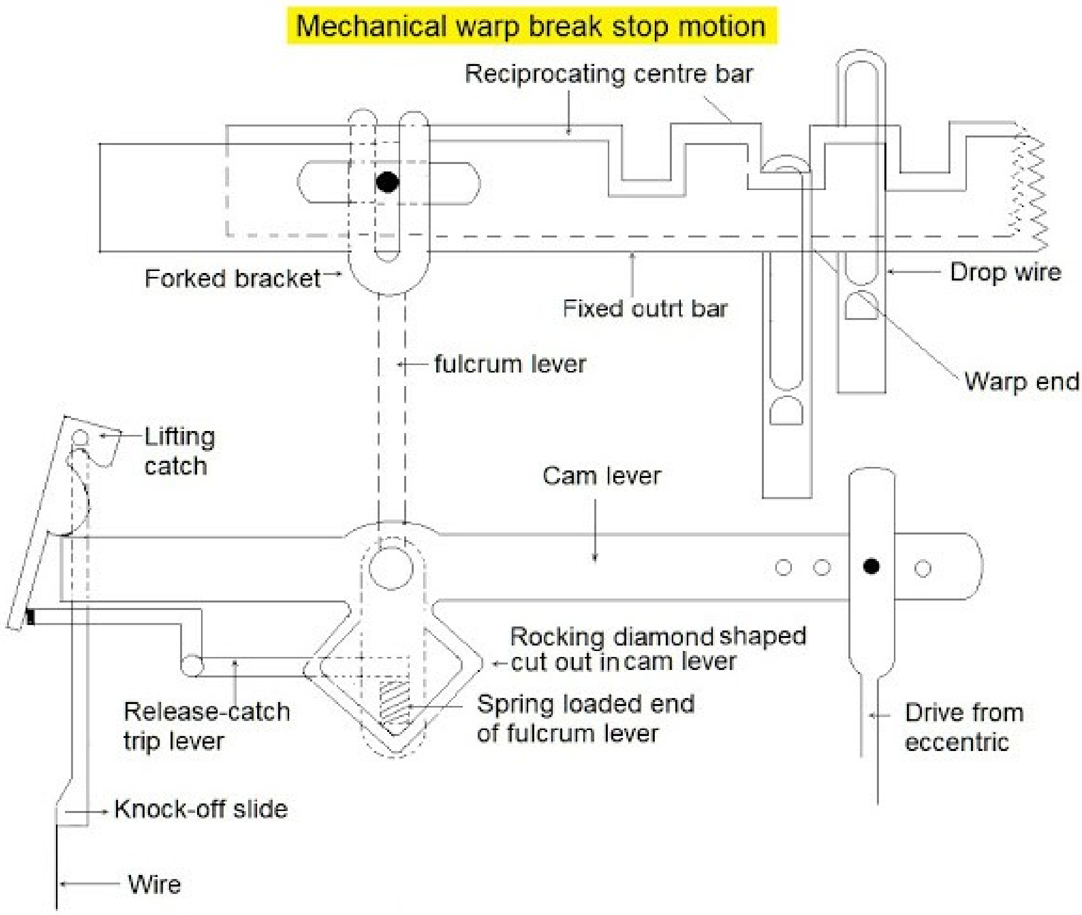
long time to redraw these broken ends. Thus loom efficiency gets decreased.
When the loom gets continues to run in case of end breakage, the fabric getting produced becomes defective. Thus the quality of the fabric gets affected. The warp break stop motion helps to increase productivity and improve the quality of the fabric getting woven on the loom.

Types of warp break stop motions:

The types of warp break stop motions are given below:
1 - Mechanical warp break stop motion
2 - Electrical warp break stop motion
3 - Electronic warp break stop motion

Structure of mechanical warp breaks stop motion

This mechanism consists of a reciprocating bar, oscillating device knock-off device, and drop wire.
The complete reciprocating bar made of three components. The fixed outer bar consists of two plates.
The reciprocating bar slides between these two plates of fixed outer bar. The top edge of the outer bar and reciprocating bar gets castillated.
In order to ensure that the drop wire will fall into the lowest cut-out point of both bars, it is necessary for the reciprocating bar to be slightly higher than the two fixed outer bars.
The number of castillated bars depends upon the number of ends per inch used in the warp beam. 4 - 8 castillated bars are normally used.
The one end of each castillated bar gets connected with the drive mechanism through a pin.
The castillated bars pass through the slot in the drop wire. The reciprocating bar is connected with the forked bracket.
This forked bracket is attached with a fulcrum lever. This fulcrum lever held in the bottom of the rocking diamond-shaped cut out of the cam lever.
The lower end of the fulcrum lever gets spring-loaded. The one end of the release trip lever rests upon the spring-loaded lever.
The release catch trip lever gets fulcrum med as shown in the below figure.
The other end of the release catch trip lever rests in front of the lower end of the lifting catch.
The oscillating mechanism is connected to the crankshaft through the sprocket wheel and chain.
The one end of the cam lever is connected to the eccentric.



Working principle of mechanical warp stop motion:

The cam lever and eccentric are connected through the connecting rod. When the eccentric rotates, it imparts oscillating motion to the cam lever.

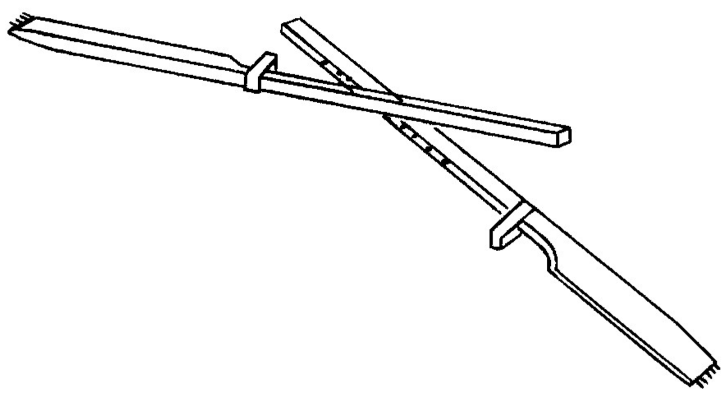
The fulcrum lever is connected to the cam lever in the middle. A forked bracket is attached at the top of the fulcrum lever.
When the cam lever oscillates, the forked bracket also oscillates. Since the one end of the reciprocating bar is connected with a forked bracket so that the reciprocating bar also makes back and forth movement.
When the loom operates, the drop wire rests upon the warp end due to warp tension.
Enough the clearance between the top edge of the reciprocating bar and the slot of drop wire.
This clearance makes a free passage for back and forth movement of the reciprocating bar between two fixed outer bars.
The position of the release catch trip lever doesn't change in this situation and the loom gets continues to run.
When the end breakage occurs, the drop wire falls immediately in the cut-out of the reciprocating bar.
The drop wire creates a hurdle in the back and forth motion of the reciprocating bar.
The spring-loaded end of the fulcrum lever rises in this situation because it cannot be rock side-wise.
The release catch trip lever also rises. Now the outside end of this lever falls and allows the lifting catch to slip over the outside end of the cam lever.
As this end of cam lever rises, it raises the lifting catch, and thus the knock off lever slides and through a wire further catch attached to sley at the front end of the loom is raised into line with a projection of the starting handle unit for the loom to be knocked off.

Temple:

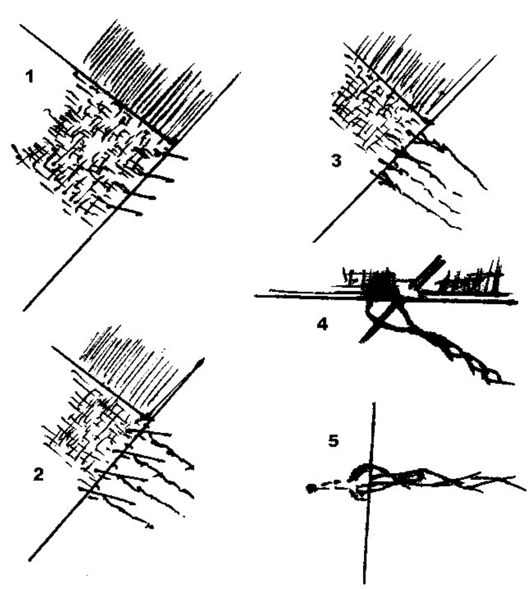
- Owing to the interlacement of warp and the weft, the fabric contract in width.

- The temple is a device used to maintain uniform width of fabric during weaving.
- The width of fabric in loom is lesser than the width of the warp on the reed.
- The temple prevents undue contraction of cloth, by keeping the cloth with proper tension.
- It also prevents the damage to the reed by the selvedge ends.

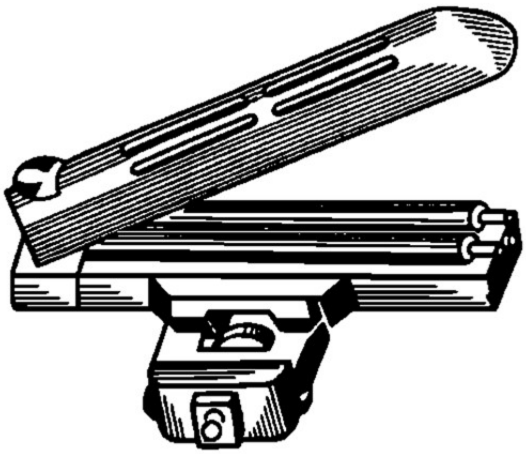
The following are types of Temple:



1. Flat wooden temple used on handloom for all count of textures.

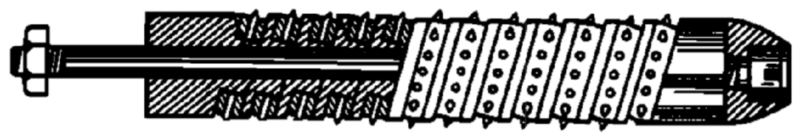


2. Walking temple used for heavily wefted fabric such as lunges, hand kerchiefs etc.



3. Roller temple - used in power loom for weaving fine and medium varieties

4. Ring temple - used in power loom for weaving finer verities of Cotton, silk, polyester.



MULTIPLE BOX MOTION

Multiple box motion is necessary on a conventional shuttle loom, when weft pattern is to be introduced across the fabric

Weft patterning may be necessary for weaving yarns of different color, count, twist or material

Each variation in the weft requires an individual shuttle and there must be always one empty shuttle box in the system

Use of multiple boxes reduces the speed of the loom by 10% as compared to shuttle plain loom

Types of box motion

- Circular box motion
- Drop box motion
- Cowburn or Eccle's Dropbox motion
- Knowle's Drop box motion
- Pick at will box motion

Circular box system

Circular box units consist of six compartments for six individual shuttles revolve on a spindle

Examples include hattersley and whites circular box motions

The presence of over pick stick causes difficulty of applying automatic weft replenishment device on an automatic loom

Drop box units operate on a rising and falling principle

A loom with a two box unit at one side and a single box at the other side of the loom is generally described as a 2x1 box loom

One of the limitation is that only one box movement is possible to move from the box in use to either of the adjacent boxes only, which limits 3 colors in sequence

The size of the shuttle compartment is fixed and therefore any adjustment for worn out shuttle is difficult

2 x 1 box loom can insert two different wefts

4 x 1 box loom can introduce up to four different wefts

In box motion with multiple boxes on one side necessitates insertion of picks of same weft in multiples of two

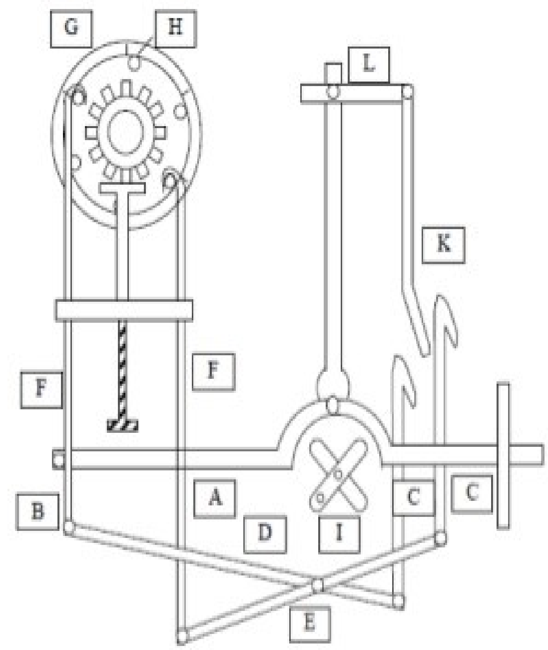
2 x 1 box motion also known as weft mixing motion is used for introducing same weft material of continuous filament after every second pick from two shuttle with an object of minimizing possibility of weft bars in the fabric

4 x 1 drop box motion on the loom is the most common type for weft patterning to give a greater scope in cloth designing

Examples of 2 x1 box motions are ruti weft mixing, northrop two-box motions

Examples of 4 x 1 box motion include Diggles chain, knowles chain, whitesmith, Eccles, cowburn and pecks, ruti and Zang four box motions

Illustrate the working principle of 6 × 1 circular box motion



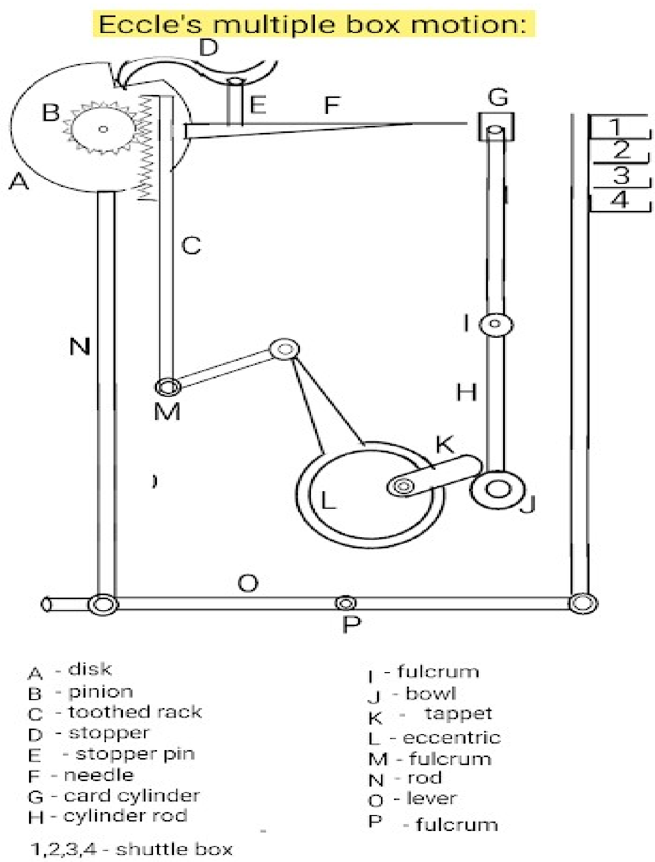
A= Lifting lever; F=Draw Hook, K=Elbow lever
B=Pivot; G= Shuttle box cyclic L=Feeler lever
C=Lifting hook, H=pegged disc I=Cam
D=Bottom lever E=Fulcrum,

Eccle's drop box motion l Multiple box motion l Weft colours changing motion

Eccle'smultiple box motion:

The main objective of multiple box motion is to change colour of weft yarn as per fabric weft pattern. It is mounted at each side of the loom. If a fabric having more than one colour or count in the weft yarn, the multiple box motion gets compulsory in the loom.
The eccle's dropbox motion is positive multiple box motion. A pattern cylinder is used to select the shuttle box. 4 shuttle boxes are used in this type of dropbox motion at one side of the machine.

Structure of eccle's dropbox motion:

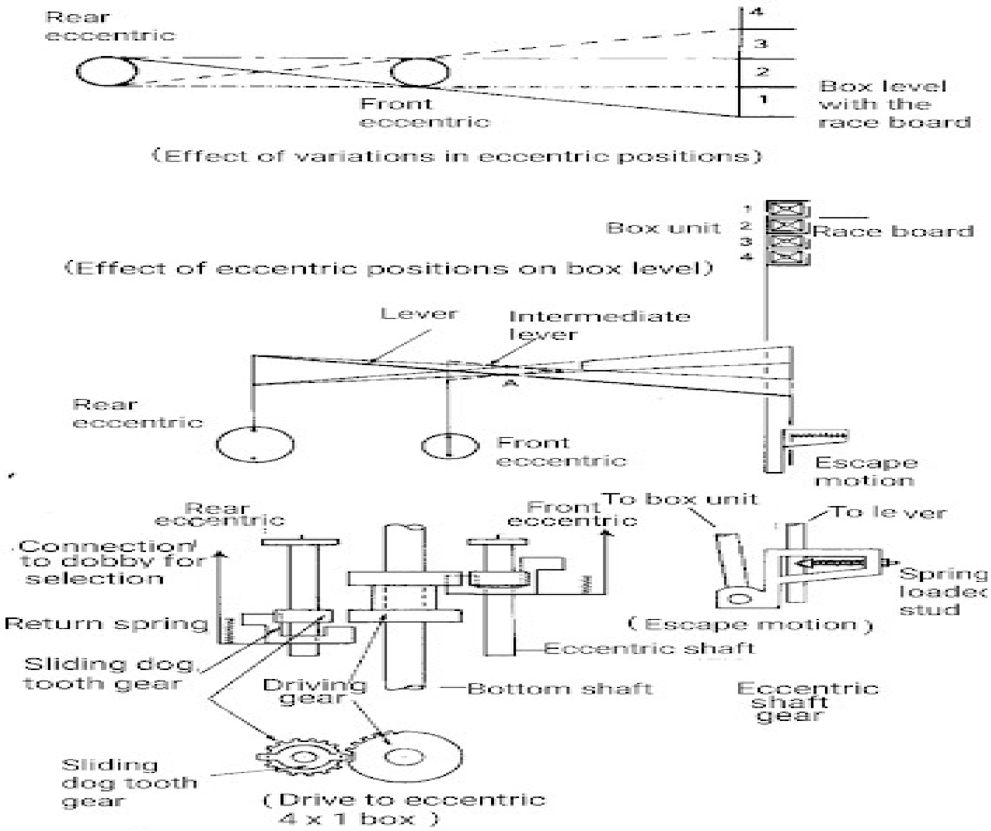


A disc A is used in this mechanism. A pinion B is also fastened on the disc shaft. A toothed rack C is connected to the teeth of pinion B. The bottom part of the toothed rack is fulcrummed at point M. An eccentric disc L is mounted on the bottom shaft of the loom. The one end of rod N comes down and gets connected to the one end of lever O. The lever O is fulcrummed at point P. The other end of the lever is connected to the shuttle box lever. Rack C makes up and down movement when eccentric L rotates. The card cylinder G rotates by tappet K. A pattern chan is mounted over the card cylinder. The tappet K is mounted on the bottom shaft of the loom. Stopper(catch) is used to prevent unnecessary movement of disc A . Needle F rests in front of card cylinder. Four shuttle boxes are mounted on the top of the shuttle box shaft.

Working principle of eccle's drop box motion:

Since the eccentric is fastened on the bottom shaft so that eccentric L rotates with the bottom shaft in the same direction. The eccentric transfer motion to the toothed rack C. Card cylinder receives motion through a tappet K and bowl J.

Pattern chan is mounted on the card cylinder. The cylinder pushes the needle. If there is a hole in the pattern cylinder, the needle F gets entered into the hole of the pattern chain. The teeth of rack C are disengaged from pinion B. Disc A remains stationary and stopper (catch) D lockes the unnecessary movement of the disc. Thus the position of the shuttle box remains unchanged. When the blank portion of the pattern chain comes in front of needle F, the blank portion of the pattern chain pushes the needle against the rack. The teeth of the toothed rack get engaged with pinion B. Since the toothed rack receives the up and down motion through the eccentric L, so that disc A makes a half turn. Now the shuttle box position gets changed. In this way, the eccle's dropbox motion works.
at February 22, 2021 No comments:
Email ThisBlogThis!Share to TwitterShare to FacebookShare to Pinterest
Knowele's drop box motion (a multiple box motion) , Structure and working
Knowele's drop box motion:
Structure of Knowle's drop box motion:
This mechanism receives motion from the bottom shaft. Two driving gears fastened on the bottom shaft. These driving gears have half teeth on their periphery. The direction of the teeth of driving gears just opposite to each other. There are two eccentric shafts used in this drop box motion. Each eccentric shaft gets mounted at both sides of the bottom shaft. The eccentrics are mounted on their respective eccentric shafts as shown in the figure. A sliding dog tooth gear is mounted on each eccentric shaft opposite the driving gear. The engaging and disengaging of sliding dog tooth gears are controlled by sliding dog tooths. The sliding dog tooth gets operated by a selection mechanism through an independent pattern chain and cylinder or dobby. The eccentrics are connected with a box unit lever through intermediate levers. A spring-loaded stud is used to prevent the damage of the shuttle or shuttle box in case of incorrect settings or mishappening.



Working principle of knowele's drop box motion:

The driving gear is mounted on the bottom shaft. Since it is fastened on the bottom shaft so that it rotates with the bottom shaft. The sliding dog tooth gear is mounted on the eccentric shaft in such a way that the teeth of the sliding dog tooth gears do not touch the teeth of the driving gears in normal condition. The sliding dog tooth is attached with sliding dog tooth gear. As the sliding dog tooth receives the motion from the selection mechanism, it pushes the sliding dog tooth gear toward the driving gear. The continuously rotating drive gear gets engaged with the teeth of the sliding dog tooth gear. This sliding dog tooth gear rotates for half revolution because the driving gear has half teeth on its periphery. Now the sliding dog tooth gear's teeth get disengaged again. The position of sliding dog tooth gear gets unchanged till the weft pattern does not demand the change in the box position. Since the sliding dog tooth gear is mounted on the eccentric shaft so that the eccentric also rotates for the half-round. This motion is transferred to the box unit lever through an intermediate lever. Thus the position of the shuttle box gets changed.

The spring-loaded stud remains engaged with a cut out on the box unit support shaft to drive the boxes up and down. If the shuttle is projecting from the box so that full movement of the box unit is not possible. In this situation, the catch will be forced out of the cut-out that the drive mechanism will make it a full movement but box unit movement will be limited and damage avoided.

The initial position of the rear eccentric with connection is the up position and the initial position of the front eccentric is a down position.
When the rear eccentric is in the up position and the front eccentric is in the down position, then the first (top box) box gets leveled with the race board.
If rear and front both the eccentrics go in their up positions, then the second shuttle box gets leveled with the race board.
If rear and front both eccentric come in the down position, the third shuttle box gets leveled with race board.
If the rear eccentric is in the down position and the front eccentric is in the up position then the fourth box gets leveled with the race board.

Pick-at-will

A loom having multiple box units at both sides with 2 x 2 or usually 4 x 4 can be used as pick and pick system or pick-at-will system
The insertion of a single pick or any possible number of times from the either end of the loom to introduce any number of picks, whether odd or even number, from the same shuttle is known as pick-at-will
The picking tappet has two noses positioned diametrically opposite and therefore picking may occur from either side of the loom or from the same side for two, three or four consecutive picks
However when box units are individually controlled for pick and pick working, it is possible to use up to seven shuttles with different wefts
The 4 x1 drop box motion introduced by cowburn and peck in 1889 works on the principle of double crank and two discs
The discs are free to turn on a stud
The outer disc carries a fixed stud, which gives a movement of one box
A crank is loosely mounted on the stud which gives movement of two boxes and its pin passes though the slot of inner disc
The lifting rod passes down from the crank to the fulcrummed bottom lever through a spring loaded lifting rod
To the other end of the bottom lever is fixed a box rod which is also spring loaded and at its end it carries four drop boxes
The disc is turned by its rack attached to a cradle which rocks through an inclined rod by the action of crank on the bottom shaft
A cam fixed on the bottom shaft brings the card cylinder against needles by giving stroke to the bowl and fulcrummed bowl rod
The card cylinder turns by L-lever operated from a stud on the cradle engaging with the star wheel
A blank(closed card) in the pattern card pushes the needle against the rack, which causes the dice to make a half turn
Each disc when not in action is loaded by a flat spring that brings a catch into the uppermost notch
Pattern cards

When a hole(open card) on the pattern card is against a needle, the rack is clear of the disc pinion and the disc is locked. So a change in the box does not take place
A blank card(closed card) pushes the needle to engage the rack with the pinion during its descending movement
The stud disc movement gives one revolution
A slotted disc gives two-box movement
For three box movements, both the discs should be rotated
Card saving device
A central hole is provided in the flat steel cards of the pattern chain
When it is blank(closed card), a third rack engages with a pinion to rotate a secondary card barrel of wooden lags
A bar which rests on these lags give lateral movement to the L-shaped lever either to give clockwise movement of the pattern cylinder or to stop it from turning
Another star wheel is used to give an anticlockwise movement
Wooden lags are of three types
Flat
Medium and
Raised
The flat lags are used to give a forward movement
The last one (raised lags) for reversing of the pattern barrel
The middle one (medium lags) to stop its movement

DOBBY SHEDDING MECHANISM

The dobby is a shedding device placed on the top of a loom in order to produce a figured pattern by using a larger number of healds than the capacity of a tappet. In fancy weaving, the dobby is used to produce small figures by means of warp threads and healds, whereas the jacquard is used to produce very huge and elaborate figures by means of warp threads and hooks, needles and harness cord.
Dobby is also known as a "witch" or "wizard ".This is a compact, electronically guided shedding motion and capable of having up to 28 shafts, More complex versatile shedding motion. A dobby loom therefore, can have up to 28 shafts, and much greater weave repeat is possible.

Scope of Dobby Shedding Mechanism

The scope of dobby is limited between the uses of tappets and jacquards.
When the no of heal shafts to be controlled on the picks to the repeat of a design is beyond the range of a shedding tappet, but at the same time to be economically produced by a jacquard the dobby mechanism is used
The no of Heal shafts in a Dobby: - Tappet-14
Dobby-Theoretically: 48 Practical (Wool & Allied): 36
Practical (Cotton & allied): Maximum (At least 12 heal shafts are used)
In this case the healds are all operated by jacks and levers occupy less space as compared to tappet shedding mechanism.
The Dobby Shedding Mechanism gives a good T scope for weaving designs repeating a large no. of picks and ends. It is easy to change the pattern, whenever a new design is required to be woven.

Advantages & Disadvantage of DobbyShedding

Advantages

In this loom many numbers of healds can be used for weave a figured fabrics.
Particularly 12-24 healds can be used in a cotton industry to weave fabrics.
In which fabrics are not possible to weave in tappet shedding loom and jacquard loom for increasing the production cost, to weave this kind of fabrics dobby are used extensively.

Disadvantage

Disadvantages of dobby shedding mechanism comparatively cost is high than tappet loom and less productivity than tappet loom. Speed is less. The adjustment of dwell is complicated.
Maintenance cost is so high.

Classification of Dobby

1. According to lift - (a). Single lift
(b).double lift
2. According to figure capacity (no. of heal shafts) - 48's, 36’s, 24’s, 20’s, 16’s, 12’s
According to position - (a) Vertical
(b)Horizontal
According to driving of heal shaft - (a) Positive (b) Negative
According to shed - (a) Bottom close shed
(b)Centre close shed (c) Semi opened shed (d) Open shed
According to no. of jack lever - (a) Single jack lever
(b) Double jack lever
Broadly dobby shedding can be classified as - (a) Ordinary dobby (i.e. single jack lever)
(b)Special dobby (i.e. double jack lever, 48's
Dobby)
Positive & Negative Dobby Positive

Principles of positive dobby -: In this type of shed lifting and lowering of the heal frame both is possible lifting is occurred by means of jack & lever, and lowering is occurred by means of spring under tension.

Construction and working principle-: Positive dobby shedding is the combination of three cylinders, jack lever, spring and a shaft. Between the three cylinders a shaft is fulcrum is one side the upper cylinder moves as the anti clockwise and lower cylinder moves as the clockwise direction. The main cylinder when get motion from the shaft when it found peg or pattern plan then the cylinder attached with the upper half toothed disc. So that the heal frames is up & down when the pattern cylinder doesn't found peg then the main cylinder attached with the lower half toothed disc and the spring retains the heal frame to the downward direction.

Negative
In the negative shedding the heal frames are operated by the jack & lever. The levers are connected with the knife and knifes are attached, with the driving rod by means of connecting needles. A pattern is used here
According to the weave plan, when the teeth of chain is come to contact of the chain drum then whole the arrangement moves together and lowering of the heal frame is occurred by the spring.

Working Principle-:

The lowering of the heal frame is happen here by spring or jack-lever. When the pattern cylinder doesn't find peg on the pattern drum when then baulk lever and jack lever bring the heal frame in downward direction, therefore the lowering of the heal frame is occurred by means of spring tension.

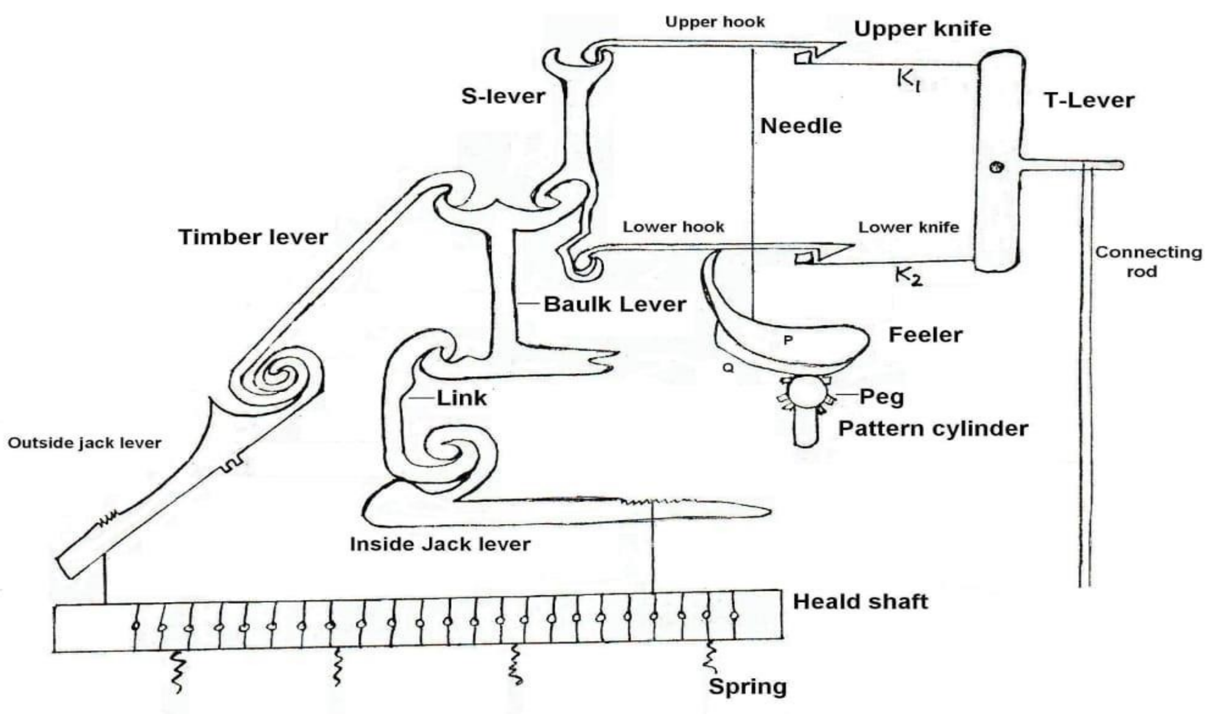
Single lift & double lift Dobby Single Lift Dobby-:
The dobby in which each hook controls a single heald forming a bottom closed shed and the beat-up is done in a closed shed is called single lift dobby.
-Single lift dobby is driven from the crankshaft.
-It is relatively simple in construction.
-This is now rarely used in weaving silk and rayon.
-Slow speed.
-High power consumption.
-Heavy wear & tear.
-High strain on warp.

Double Lift-:

The dobby in which two hooks control a single heald forming an open shed and the weft is beaten up in a crossed shed is called double lift.
-It is driven from the bottom shaft of the loom.
-High speed.
-Less wears & tear.

Negative Hook and Knife Dobby (Climax)-:
Two knives k1 and k2 are connected with T-lever, in which is driven by the dobby driving shaft which in turn get motion from bottom shaft.
The upper hook and lower hook get movement by upper knife and lower knife. The two ends of S-lever.
The S-lever is joined with baulk lever at its upper end. Outside jack lever joined with the baulk lever by timber lever and inside jack lever joined with baulk lever by link rod. Two ends of heal shaft joined with the outside and inside jack lever.
Two feeler P & Q are use to activate two hooks P feeler is directly connected with the lower hooks & Q Feeler is joined with upper hook by a needle. The two feelers are fulcrum at a point.
There is a pattern cylinder below the feelers. There is a peg chain in pattern cylinder and it's made according to fabric design

Main Parts of Dobby Shedding:
Bottom shaft
L-lever
Upright shaft
T-lever
Upper draw knife
Lower draw knife
Upper hook
Lower hook
S-lever
Bulk lever
Thumb lever
Jack lever
Heal shaft
Returning spring
Motor
Crank shaft **17.**Pattern cylinder **18.**Pattern chain Design.
Negative Hook and Knife Dobby (Climax)-



Working Principle

When the connecting rod is move up and down, T-lever gives outward & inward movement.

According to the fabric design, when a peg came in contact with the feeler. Then the right portion of feeler is raised and the left portion being lowered. As hooks are supported with feeler hooks are lowered. When the left and of feeler Q is lowered, then upper hook cam in with upper knife. In this safe, when connecting rod moves down, the upper portion of T-lever is joined with S-lever moves to the rights. As outside and inside jack lever joined with timber lever & link the lever moves up at the same time. Thus the heal shaft raised up.

Similarly, when the left end of feeler P is lowered then lower hook came in contact with lower knife. In this state, when connecting rod moves up and the bottom portion of T-lever moves to the right side.

As a result bottom portion of S-lever moves to the right & the same process occurs i.e. top portion of the baulk lever moves to the right, then jack levers are moved up at the same time.

Hence the heal shafts are again raised.

Thus a heald shaft is alternately raised by the upper knife & lower knife. The shaft will therefore be lowered with the help of return spring and will remain down for next.

JACQUARD SHEDDING MECHANSIM

What is Jacquard?

A jacquard shedding device ‘used in weaving designs that are beyond the scope of dobby shedding. In practice, jacquards are mainly used for large and intricate figured designs with several hundred or even several thousands of ends working in different fashion and repeating upon a similar number of picks. Types of Jacquard: Jacquard machines used at the present time are numerous and varied. However, they may be broadly divided in to two groups; Ordinary and special. Ordinary Jacquard may be further classified on the basis of the type of the shed formation achieved

1) Bottom closed shed type with single lift, single cylinder.
2) Centre closed shed type.
3) Semi open shed type like double lift, single cylinder on double lift, double cylinder.
4) Open shed type Special Jacquards are modifications of the ordinary ones.

These are designed to increase the figuring capacity of the jacquard or to weave special types of fabrics. Some of the special jacquards are listed below:

1) Cross border jacquard
2) Leno jacquard
3) Scale harness or banister jacquard
4) Pressure harness jacquard
5) Twilling jacquard
6) Inverted hook jacquard
7) Jacquard with working comber board
8) Fine pitch jacquard

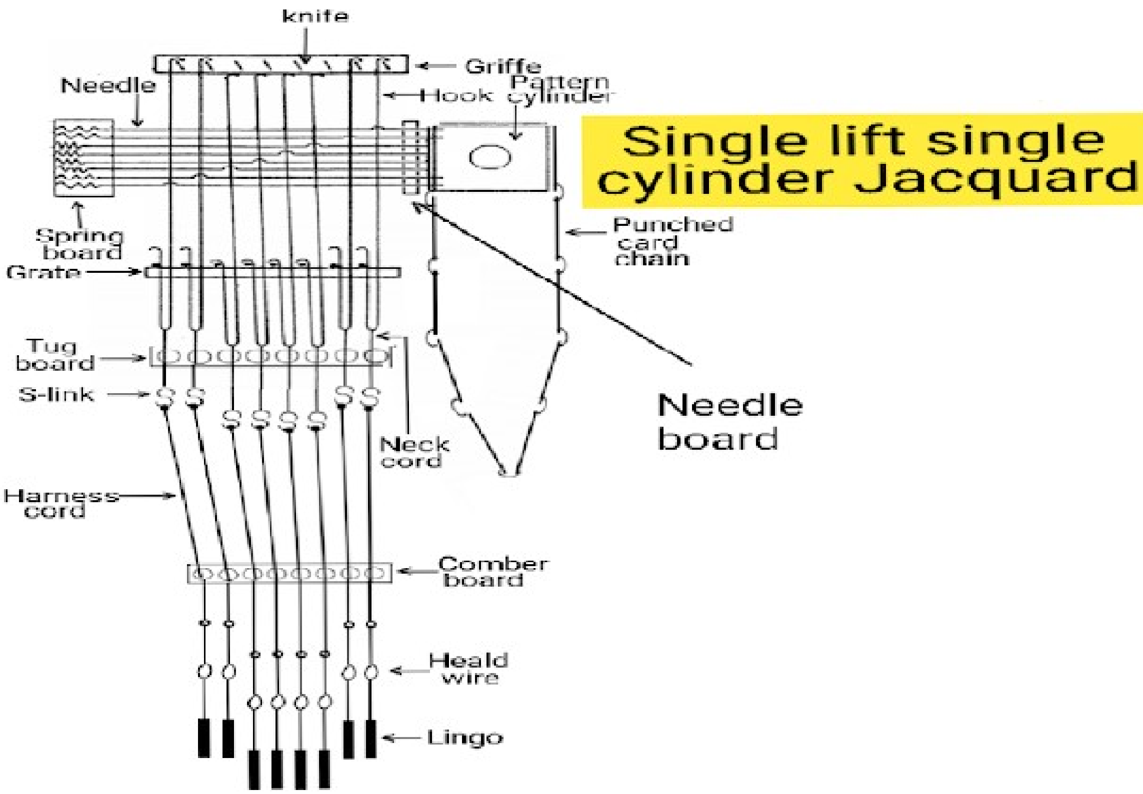
Single-lift and single-cylinder Jacquard shedding mechanism:

Objective of Jacquard shedding:

- The weave or design is created in the woven fabric by a shedding mechanism.
- If a loom is equipped with a tappet shedding mechanism then the - lifting plan of the heald shaft gets fixed.
- The number of picks and ends per repeat gets limited in the tappet shedding mechanism. These limitations don't allow us to create bigger motifs.
- If the loom is equipped with dobby shedding, the weaving of small geometrical motifs is possible because the dobby mechanism has the capability to operate up to 28 heald shafts in different lifting modes.
- The weave or design having a large number of picks per repeat can be woven on a dobby loom.
- If the design repeat has more number of ends per repeat than the number of jack levers present in the dobby then we can not produce this kind of larger design.
- The jacquard shedding has the capability to operate a large number of ends in different lifting modes.
- We can produce the larger floral, ornamental, and geometrical woven designs by using jacquard shedding.
- The lifting of the individual end gets controlled in jacquard.

Structure of single lift and single cylinder jacquard:

- The knives are mounted on the griffe. The griffe makes up and down movements.
- The lower end of hooks rests upon the grate.
- A needle is engaged with each hook through the eye of a needle.
- The front end of the needle passes through the hole of the needle board.
- A pressure spring is fitted at the rear end of the needle. The - pressure spring always pushes the needle toward the cylinder.
- The pattern cylinder is mounted in front of the needle board. A star wheel is mounted at one side of the pattern cylinder.
- The punched card chain is mounted over the pattern cylinder.
- The lower end of each hook is connected with the upper end of the neck cord.
- Now the neck cord passes through the holes of the tug board mounted just under the hooks.
- An s-link gets connected at the lower end of the neck cord.
- The s-link is connected with the upper end of the harness cord. This harness cord passes through the hole of the comber board mounted on the loom.
- The lower end of the harness cord is connected with the upper end of the heald wire. The lower end of the heald wire gets connected with the lingo.
- The jacquard receives rotatory motion through a crank-shaft. the sprocket wheels and chain are used for motion transfer.



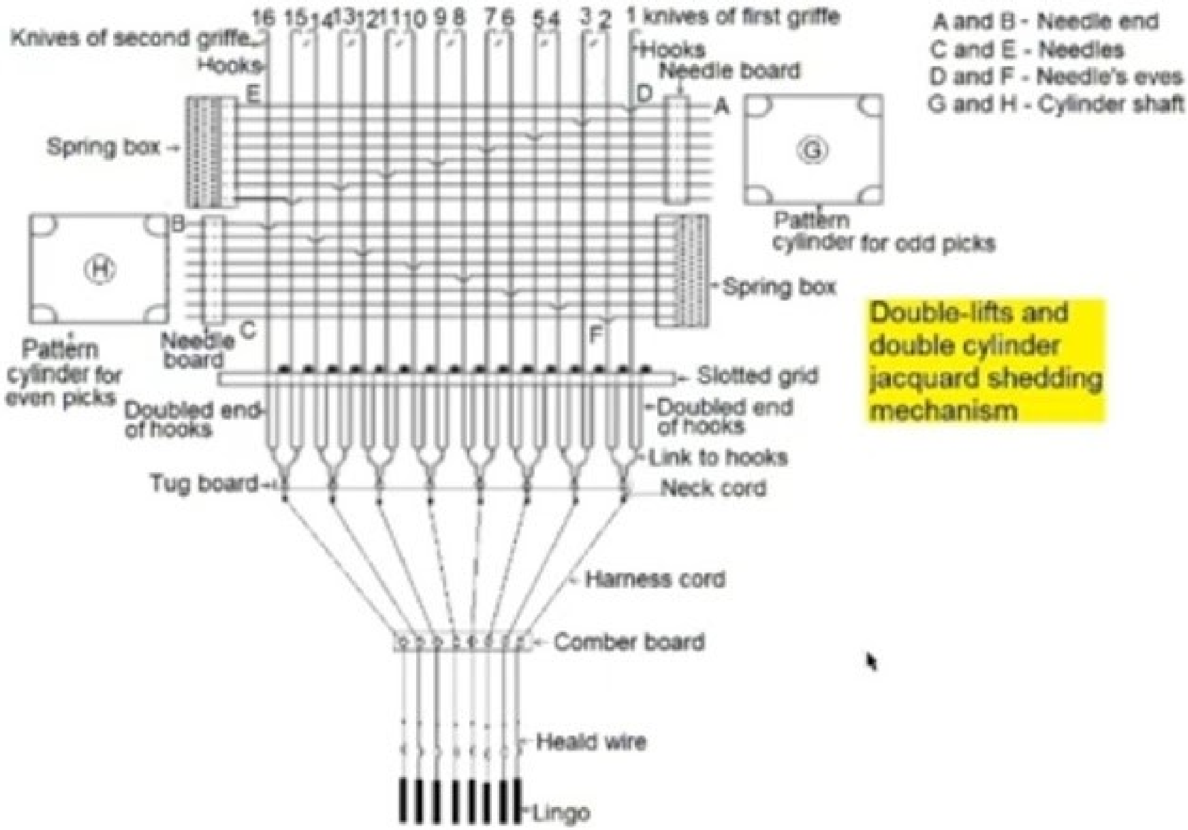
Working principle of single-lift and single-cylinder jacquard:

-The jacquard shaft receives motion through sprocket wheels mounted on the crank-shaft.
- The crank-shaft and jacquard shafts are connected through a sprocket wheel chain.
- The eccentric cams are used to provide upward and downward movement to the griffe.
- The griffe make one cycle of up and down movement when the crank-shaft completes one revolution.
- The knife mounted on the griffe comes slightly down in comparison to the upper end of a hook. This position is also called the selection position.
- Tow the punched card mounted over the pattern cylinder pushes the front end of the needle.
- The blank portion of the card deflects the hook away from the knife.
- If there is a hole in the card, the needle gets entered into the hole of the perforated cylinder and the needle does not deflect the hook away from the knife.
- In this situation, the hook rests just over the knife. Thus the hooks get engaged with a knife.
- Now the lifting griffe carry the engaged hook in the upward direction.
- The lingo (deadweight) attached with the lower end of the heald wire brings the heald wire in the downward position.

Double-lifts and double-cylinders jacquard shedding mechanism:

Structure of double-lifts and double-cylinders jacquard shedding mechanism:

There are two griffes used in this jacquard shedding mechanism. Eight knives are mounted on the first griffe and eight knives are mounted on the second griffe. The first griffe carries upward the odd number hooks and the second griffe carries even number hooks in the upward direction. In this jacquard shedding mechanism, two kinds of hooks are used. The upper ends of odd number hooks get inclined toward the pattern cylinder getting used for the selection of odd number hooks and the upper ends of even number hooks get inclined toward the pattern cylinder getting used for the selection of even number hooks. The number of hooks used in this mechanism is just double the figuring capacity of the jacquard. 800 hooks are used for 400 figuring capacity jacquard. Two sets of needles are used to control the hook selection in this jacquard. Needles E control the selection of odd number hooks while needles C control the selection of even number hooks. The front end A and B of each needle pass through the holes of respective needle boards. The spring boxes are mounted just behind the rear ends of the needles E and C. The pressure springs mounted at the rear end of each needle tend to push the needle toward the respective pattern cylinders. Two pattern cylinders are mounted in front of the needle boards. One pattern cylinder performs a selection of hooks for odd number picks and another pattern cylinder performs a selection of hooks for even number picks. One hook of an odd number and one hook of an even number get paired through the link. The doubled end of each hook rests upon the slotted grid. The upper end of the neck cord is connected with the pairing link. This neck cord passes through the hole of the tug board then the lower end of the neck cord gets connected with the upper end of the harness cord. Now the harness cord passes through the hole of the comber board. The lower end of this harness cord is connected to the upper end of the heald wire. A lingo is connected with the lower end of the heald wire.



Double-lifts and double cylinder jacquard shedding mechanism

Working principle of double-lift and double-cylinders jacquard mechanism:

This mechanism receives rotatory motion through the bottom shaft. One sprocket wheel is mounted on the bottom shaft while another sprocket wheel of the same number of teeth is mounted on the jacquard shaft. These sprocket wheels are connected to each other through an endless chain. The griffes receive the reciprocating motion through the eccentric cams mounted on the jacquard. When the first griffe reaches the top dead centre of the jacquard, the second griffe reaches the bottom dead centre of the jacquard. When the jacquard shaft rotates, both griffes cross to each other. When the griffe reaches the bottom dead centre position, it comes slightly down in comparison to the upper inclined end of the hook. Now the pattern cylinder pushes the front end of the needle. If there is a hole punched in the card, the front end of the needle gets entered into the hole of the perforated pattern cylinder and that hook gets engaged with a knife. If there is a blank portion in the design card, the needle gets pushed toward the spring box and the hook gets disengaged from the knife. When the griffe starts to travel from the bottom dead centre position to the top dead centre position, it carries the engaged hooks in the upward direction. The second griffe reaches at the bottom dead centre position now. The other pattern cylinder pushes the front end of the needle and hooks are selected. When the second griffe travels upward, it carries engaged hooks with it. The right-hand side pattern cylinder performs the selection of odd number picks while the left-hand side cylinder performs the selection of even number picks.

Since the upper end of the heald wire gets connected to hooks pairing link through the neck cord and harness cord so that the neck cord and harness cord lift the heald wire in an upward direction. The lingo brings the hook in a downward position. Two separate pattern chains are prepared in this jacquard. A chain of odd number picks is mounted on the right-side pattern cylinder while another chain of even number picks is mounted on the left side of the pattern cylinder. The number of picks in both chains should be equal.

Cross Border Jacquard:

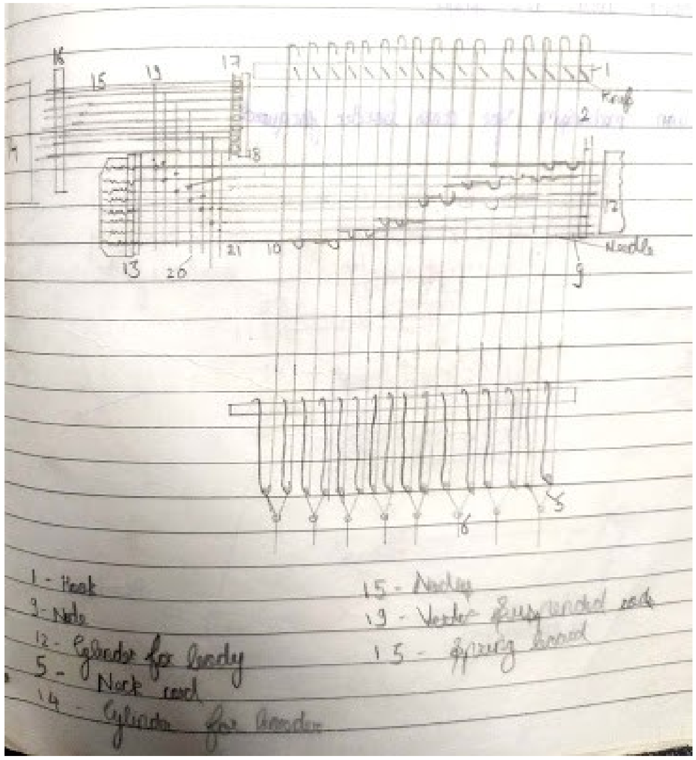


Fig- Cross Border Jacquard

<u>Need of Cross Border Jacquard:-</u>

When weaving the fabrics like Terry towels, chaddars, sarees, tapestries, we need border along the four sides of the fabric. To achieve we need a set of paper cards which will produce the border design. can be achieved by cross-border Jacquard. It is DLSC jacket with extra cylinder for border cards.

<u>Working of Cross Border Jacquard:-</u>

It has two cylinders which are work alternately. It is DLSC mechanism when the body cylinder work, Jacquard works in conventional way as DLSC. When the cross border design is needed, body cylinder is taken out of function and border cylinder is put in use. The border cylinder has short needle which are spring loaded. To each needle there is a one suspended rod which is attached to the main needle controlling hook but the suspended rod is fulcrum in the middle. So when border cylinder works if there is a hole the main needle is pushed to engage hook and knife, when there is a blank the hook will miss engagement with the knife.

Coarse and Fine Pitch Jacquard:

Find pitch jacquards are originated in France. They are compact and extensively used for weaving design repeating on large number of shed like silk. The main fine pitch machine are are Vincenzi and verdol.

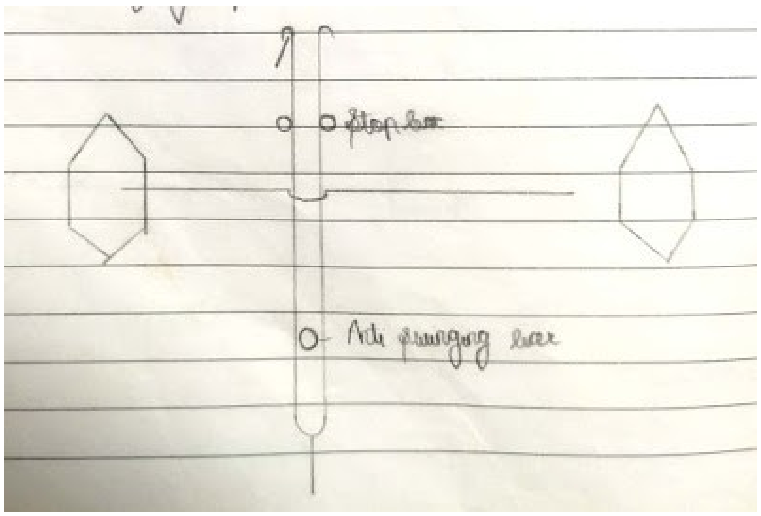
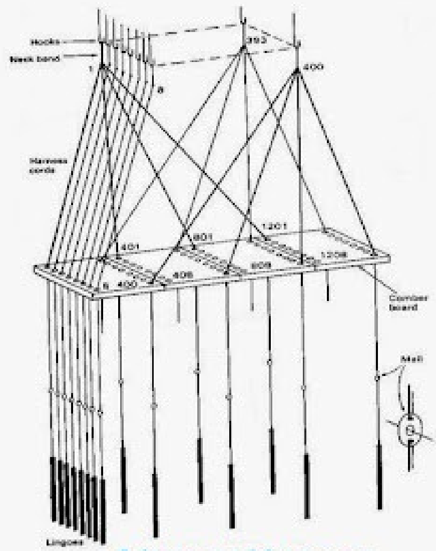


Fig- Vincenzi Jacquard

Vincenzi Jacquard has each of 40 needle per square inch as agains 14 in coarse pitch. Standard size of the machine are in multiple of 440 hooks arrange with 16 needles per short row and common sizes are 440, 880, 1326, 17260 and 2640 hooks. It is DLDC producing semi-open shed. It has got 'U' type of hook having self spring action and thus use of spring in the needle board is avoided the pattern cylinder is hexagonal. There is two sets of knives.

Harness Mounting

The jacquard harness is the system of cords, healds and lingoes that transmit the movement of the hooks to the individual warp threads. A simple form of harness is represented in the fig. below:



A jacquard harness

There are two main types of harness ties.
1. Norwich system.
2. London system.

Norwich system
When jacquard mechanism is mounted with the parallel of the loom is called Norwich Jacquard. In this jacquard the long rows of needles are parallel to the comber board & at the right angle to the warp. The cords will be at the front or at the back or at both front & back of the loom.

London system
When the jacquard mechanism is mounted at one end of the loom and at 90˚ angle of the loom is known as London Jacquard. In this system the jacquard is turned through a right angle the cords stay at the side of the loom.

The both tie systems are divided into the following four types.
1. Single tie-up.
2. Repeating tie-up.
3. Pointed tie-up.
4. Mixed tie-up.

Single tie-up: (For asymmetric design)

In this system only one harness cord is attached to one neck cord. There are must be as many hooks as there are threads in the width of the fabric. If the design is required to be woven 400 ends there are 400 hooks in the jacquard.
No. of neck cord = No. of harness cord = No. of warp in a repeat

Scope
This tie is used to produce a fabric containing only one repeat across the width of the fabric.

Repeating tie-up
This is the most common design tie used for both Norwich and London harness ties. In this tie there must be as many harness cards tied to each neck cord as there are 4 repeats in the full width of the fabric. If there are 4 repeats of the pattern then there will be 4 harness cords tied with each neck cord.
No. of neck cord = No. of jacquard

Scope
This type of tie is used to produce a fabric having more than one repeat across the width of the fabric.

Pointed tie-up: (Single repeat)
This tie up is widely used where pointed draft is used and for symmetrical design if turned over its center line. Suppose a design has 800 ends. Then it is divided in to two groups i.e. 400 ends in each group. So there are required 400 ends in each group. So there are required 400 Neck cords. In this system two harnesses is attached with one neck cord.

Scope
This tie up is used to produce symmetrical design which turned over its center line.

Mixed tie-up
In this tie up a large number of harness cord is used. A great skill is required of designer because the design required a greater capacity of the jacquard that has been actually used.

Scope
This tie is used if a large repeat pattern is to be produced with the existing capacity of the jacquard.

a) Number of ends and picks (or cards) in one repeat of the design.
b) Number of ends per inch in the reed.
c) Suitable capacity of jacquard and set of harness to produce the design exactly in the size.
D) Counts of design paper.
a) The repeat is 4.8 cm in width and 6 cm in length. The number of ends in the repeat—50x4.8= 240 The number of picks in the repeat--- 38x6= 228
b) Number of ends per cm in the reed--- 50-8%= 46
c) A suitable standard capacity of jacquard in an 8-row 304-tie which will require to be cast out: 304-240= 64 hooks The set of the harness requires to be finer than the set of the warp, because 304 harness cords have to occupy the same width in the comber board as 240 ends in the reed , and the proportion is therefore: 240 ends:304 hooks:: 50 ends per cm: 63 harness cords per cm 26

Card Cutting:

The purpose of the jacquard weaving is to produce designs that are too expensive to be woven with tappets or dobbies. Any design that can be painted can be woven on loom with jacquard. Card cutting is an important work for a weaver working on handloom jacquard. At present card cutting can be done through some external agency to save the time and to increase the production. Even though the weaver should have some basic knowledge about card cutting and card lacing which is discussed as below. First a design is drawn on a plain paper and then repeated a sufficient number of times vertically and horizontally to see the overall and general effect of the repeating pattern. The design is then transferred and enlarged on a suitable graph paper. The vertical lines on the graph will show the warps and the horizontal lines will show the picks. The design is enlarged on the graph paper with exact number of ends and picks as it will appear on the fabric. Before starting the card cutting it is necessary to divide the graph paper by heavy vertical lines into a number of hooks in a short row. The design paper is guide to the card cutter. In case of a 8 hook in the short row of the jacquard, the design paper should be marked with heavy lines after every 8 small squares horizontally. This is essential because the working of all the hooks in each row is read at a time for punching a card. Thus, in a 400-machine with 8 hooks in each short row, 50 operations are required to transfer the working of 400 ends from the graph paper to the pattern card. In ordinary jacquard each card represents only one pick of the design. Thus, if a repeat is completes on 300 picks then it is essential to cut 300 cards. Card cutting machine: The most common type of manually operated card cutting machine is known as Piano card cutting machine. A figure of card cutting machine is shown below with different views.

Card Lacing:

The next operation after the cards are cut is the lacing of the cards to form an endless card chain. The card lacing is usually done by hand in case of handloom weaving.

Hand lacing:

A wooden lacing frame consisting of two long narrow supports for the cards is used to place about 30 to 50 cards at a time for lacing. The wooden lacing frame is studded with small metal or wooden pegs representing the pegs of the cylinder of the jacquard. The cards are placed in the serial order in the frame. A needle, threaded with a lacing twine, is used to lace the cards. The manner in which the cards are laced is shown in figure below. It is clear from the figure that the lacing cords are crossing between two consecutive holes and also between two consecutive cards.

Weft Replenishment/refill

Feeler:

Feelers play an important role in Automation. Weft replenishment is done by a mechanism making contact with the pirn by a probing action to detect if yarn was present or not. The action of probing is given by feelers mechanisms. The principle behind any feeler action is that. Once every two picks, the presence of yarn on the stem of the pirn about 4 cm from the pirn butt is investigated. If yarn is present, the feeder will allow the loom to continue running normally but if there is no yarn at this point, then the feeder will activate the start of a change mechanism. On a single shuttle automatic loom the feeler is mounted at the left –hand side of the loom whereas the automatic –change mechanism is normally at the right –side.

Functions of feeler:

- To check the presence or absence of yarn for weft insertion.
- To activate the change mechanism for change or replacement.

Classification of feeler:

- Mechanical feeler.
- Side –sweep mechanical feeler.
- Depth mechanical feeler.
- Diameter gauge mechanical feeler.
- Penetration gauge mechanical feeler.
- Electrical feeler.
- Two prong electrical feeler.
- Photoelectric /photo –cell feeler.
- Sensor.
- Electro mechanical feeler.

Above all mechanical and Electrical feeler is most commonly used.

Shuttle Skewering: Enter the pirn into the shuttle.

Mechanical Feeler

Side-sweep mechanical feeler

This mechanism has two parts.
Changing mechanism part

Feeler part.

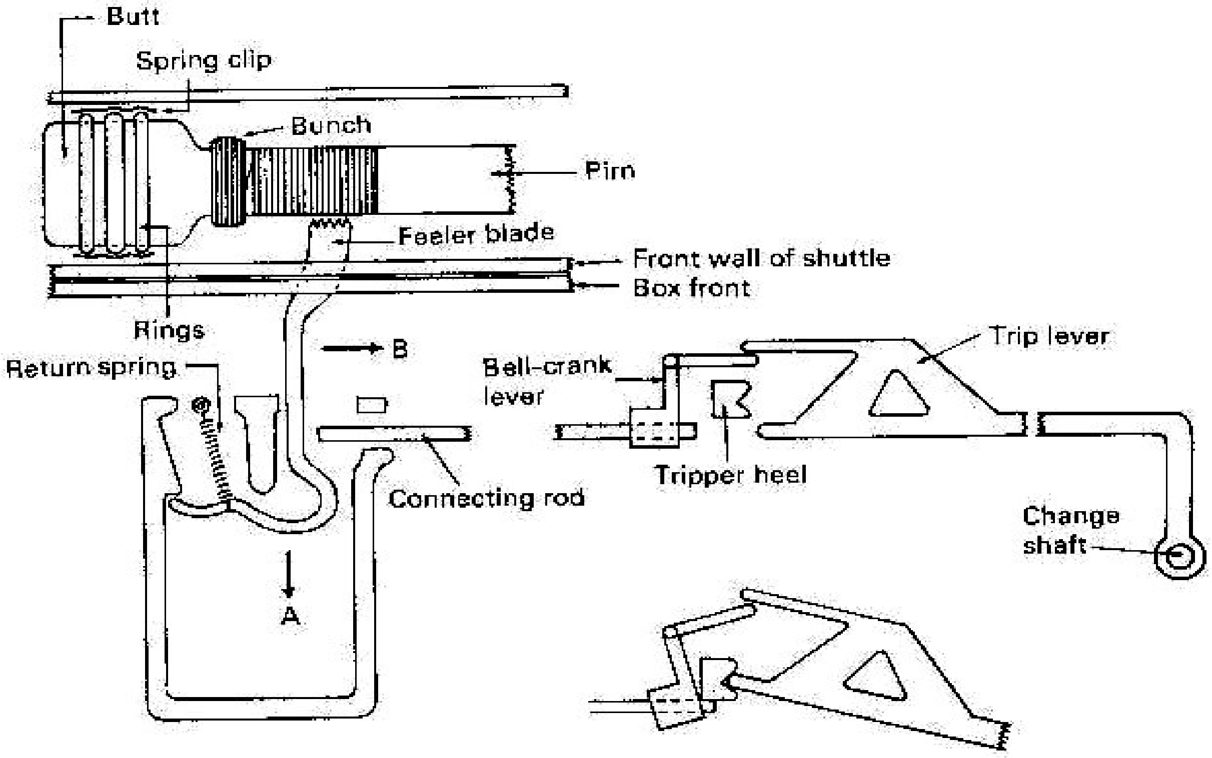


Fig. A side-sweep feeler

This mechanism is also known as the "midget feeler". The feeler blade makes contact with yarn on the pirn when the loom is nearing its most forward position by penetrating holes in the shuttle –box front and the shuttle wall. It will be pushed in the direction of arrow A. (fig: a), because the serrations in the tip of the blade will have become embedded in the yarn. As the sley recedes the blade will be returned to its original position by the spring. When yarn is being withdrawn from the bunch the feeler blade will slide to the right as indicated the arrow B on the smooth polished surface of the pirn as the sley is at the forward position. This will cause the connecting rod to push the bell – crank lever whose upper arm will then raise the trip lever. The tripper heel, which is attached to, and therefore oscillates with the weft fork hammer, will now push the lower arm of the trip lever and thus cause a sufficient rotation of the change shaft which therefore activates the changing mechanism. The feeler blade is returned to its normal position by its spring.

Changing mechanism Part

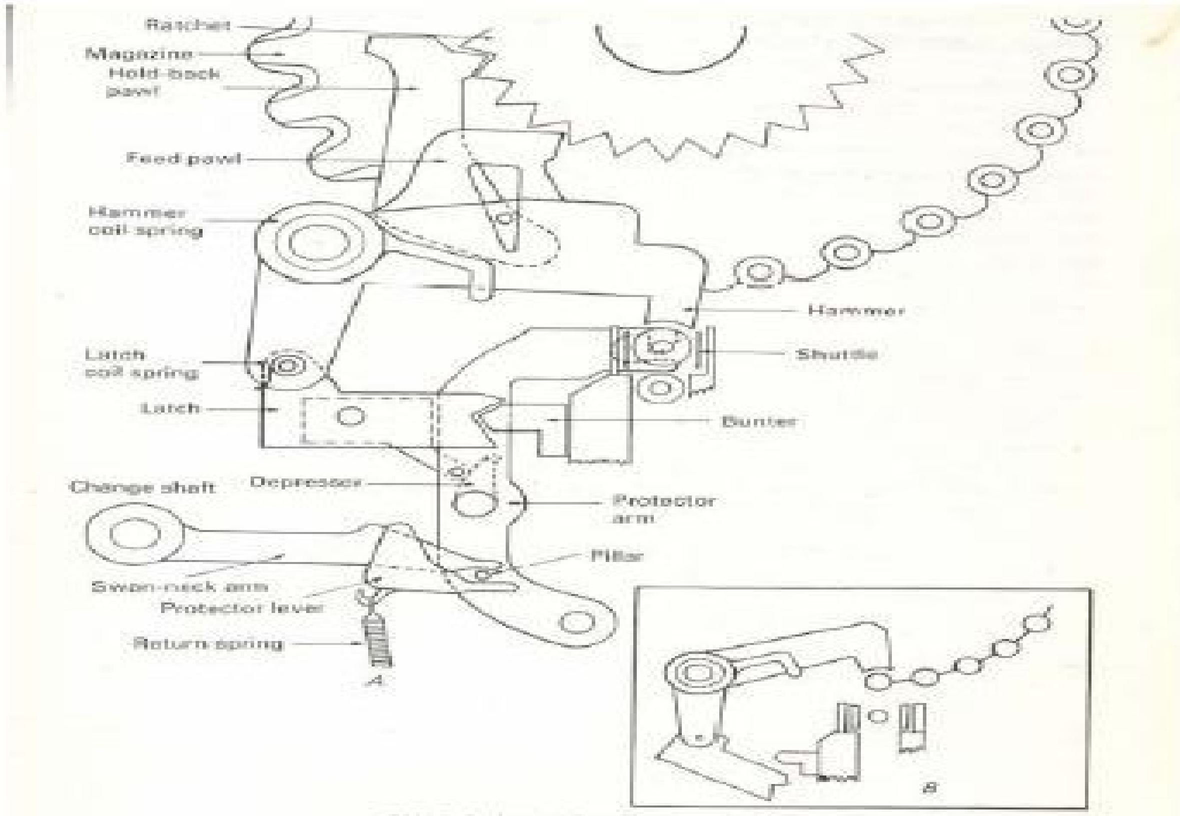


Fig. 9.6 A bobbin-change mechanism

Differences of Drop box and Circular box mechanism:

The difference of Drop box and Circular box motion are illustrated below:

Drop box motion	Circular box motion
1. In drop box shuttle boxes are arranged as a box on another box.	1. In circular box, shuttle boxes are arranged around a circle.
2. It is used on both under pick and over pick loom.	2. It is used only over pick loom.
3. It is widely used in industry.	3. It is not widely used.
4. It gets motion from bottom shaft through eccentric.	4. It gets motion from bottom shaft through cam.
5. Any kind of yarn can be used.	5. Usually cotton worsted yarn is used.
6. Generally it is used to produce heavy fabric.	6. Generally it is used to produce light fabric.
7. It is possible to change the shape of shuttle box.	7. There is no possibility.

wheel M. As the hammer is depressed for the transfer of the new pirn into the shuttle, it lowers the feed pawl L so that the catch slips into the next tooth of the ratchet wheel. As soon as the transfer of the pirn has taken place, the receding sley breaks the contact between the bunter and the latch and enables the hammer to move up to its original position due to the pressure of the hammer coil spring S, and in doing it pushes the feed pawl L upwards aided by a spring underneath the pawl, and turns the ratchet wheel M one tooth bringing the next full pirn in the battery right below the hammer for the subsequent transfer.

Defects/Faults Of Woven Fabric With Their Causes And Remedies

Warp Way Defects
The warp way defects are:
Crack between stripes

A crack seen along the length of the fabric between the stripes woven with different weaves.

Causes
Differences in warp release due to uneven beam surface.
Differences in crimp relationship of ends grouped in separate dents in the reed and in weaves.

Remedies
Avoid uneven build of beam surface by proper system of denting at the sizing machine.
Ensure that denting at weaving is such that ends of the two weaves are not separated by a reed dent.

Double end
More than one end working in a heald eye without the adjacent end missing.

Causes
Sticky ends on weavers beam
Wrong drawing-in of ends through heald eyes.

Remedies
Take precautionary measures during sizing.
Bring the defect to the notice of the drawing-in operator.
Instruct weavers and supervisors to periodically check fabric to remove double ends.

Floats
Defect in a woven fabric where warp and weft threads do not interlace as desired.

Causes
Broken end getting entangled with the adjacent warp ends. The breaks between reed and healds are more prone to form floats, especially when the warp loses its elasticity due to over stretching or over-backing during sizing.
Knots with long tail ends leading to entanglement of ends.
Fluff with long tail ends leading to entanglement of ends.
Fluff or foreign matter trapped in the shed.
Broken heald unable to lift or lower the thread.
Lighter type of warp stop motion pins used on the loom.

Remedies

Attend to broken ends without delay on looms equipped with warp stop motion; ensure proper functioning of the same.
Avoid long tail ends in knots in weaving preparatory and weaving.
Ensure cleanliness of loom.
Take maximum possible care while blowing the looms.
Use screens to avoid fluff flying to adjacent looms.
Inspect the healds for wear before putting on a new beam.
Ensure proper selection of drop pins.

Misdraws
Incorrect positions of ends in the fabric causing considerable damage in fabrics with woven design or stripes.

Causes
Faulty drawing-in of beam.
Faulty drawing-in of broken ends by the weaver.

Remedies
Bring the defect to the notice of the drawing-in operator.
Ensure periodic inspection of the fabric on loom by the supervisory stuff.

Missing end
Void caused by a missing warp thread in the fabric.

Causes
Failure of weaver in attending to warp breaks immediately.
Warp stop motion not acting properly.

Remedies
Missing the incidence of lappers during sizing.
Use spare ends on loom as a substitute for the missing ends.
Instruct the weaver to attend to warp breaks immediately.
Discourage the weaver's habit of waiting for the broken end on the beam to advance sufficiently for knotting.
Inspect the drop pins while putting on a new beam and weed out the defective ones.
Check the warp stop motion assembly.

Reedy fabric
Fine cracks appearing across the fabric between groups of warp ends, matching with the pattern of denting in the reed.

Causes

Excessive warp tension.
Late shed timing leading to lack of proper tension at beat-up.
Insufficient toughing of shade.

Remedies
Adjust the warp tension.
Resort to early shed timing.
Raise the back-rest 12-24 mm above the front-rest level.

Stitches
Individual warp thread floating over a group of weft threads. Defect is more prominent in synthetic blended warps due to static electricity generation and hairiness of these yarns.

Causes
Soft sized beam.
Inadequate amount of antistatic agent in the size recipe.
Improper tensioning of warp.

Remedies
Ensure proper sizing.
Ensure proper size recipe.
Prefer slightly higher tension on warp.
If necessary, introduce lease rods between the healds and the drop pins.

Thick end
A warp end having diameter larger than normal.

Causes
Excessive count variation.
Accidental mixed-up of counts in winding and warping.
Piecing up of broken end with a wrong thread during weaving.

Remedies
Avoid it.
Conduct frequent checks to avoid mix-up of counts.
Inspect the thrums provided on the loom.

Warp streaks
Stripes running in warp way direction characterized by apparent differences in shade from the adjoining portions, arising mainly as a result of variation in the amount of light transmitted and reflected from groups of threads.

Causes

Short, medium and long-term variations in warp and/or uneven spacing of dents in the reed. Coarser count and closer spacing of ends appear lighter while finer count and wider spacing appear darker in shade than the normal portion of the finished fabric.

Mix-up of yarns of different luster, count or blend proportion.

Faulty drawing-in ends, e.g. double ends, missing ends etc.

Variations in package and beam dyeing.

Remedies

Improve the quality of warp since normal control exercised on count variation proves inadequate to prevent streakiness.

Check the condition of reed.

Use all metal reeds which give better results compared to pitch-bound reeds.

Ensure early shed timing and lower warp tension to help lessen the prominence of streaks in the fabric.

Adopt good materials handling system with proper storage and identification of materials to avoid mix-up of yarns.

Bring the defect to the notice of operators.

Take care to match the shade when mixing a freshly dyed lot with the old stock, especially in the case of synthetic and blend materials.

Weft Way Defects

The weft way defects are as follow:

Broken pattern

Restricted to fabric woven with patterns on drop box looms. It occurs either when the sequence of weft colors to be put is disturbed or when the width of color band is affected.

Causes

Improper adjustment of pattern cards or lattices.

Weaver neglecting to adjust the pattern chain before restarting the loom after mending a break or a crack.

Inserting pick in a wrong shed after mending a weft break.

Remedies

Check and adjust the pattern cards or lattices at the start of beam.

Make the weaver’s quality conscious.

Resort to pick finding prior to restarting the loom.

Broken pick

Weft is inserted only for a portion of a pick.

Causes
Weft break or weft exhaustion on ordinary looms.
Weft break or improper size of bunch on auto-pirns.
Improper functioning of weft fork.
Weft change effected through weft fork mechanism on automatic looms.

Remedies
Check the shuttle for loose fitting of pirn or roughness of surfaces as these cause more weft breaks.
Check also the shuttle boxes for settings and surface condition to prevent cutting of weft.
Check the shuttle and shuttle boxes.
Ensure proper size of bunch on auto-pirns.
Maintain the weft-fork mechanism in good working condition.
Resort to pirn change by weft feeler mechanism.
Resort also to pick finding before restarting the loom.

Cut weft
A defect generally randomly distributed over the fabric, not clearly visible in the grey stage, but becomes pronounced in the finished fabric.

Causes
Improper condition or quality of emery roller covering.
Viscose yarn from old lot or of lower strength is used.

Remedies
Check the emery roller covering.
Ensure proper check on the quality of blended yarn.

Double pick
Two or more picks inserted in the same shed where only one is desired.

Causes
Failure of the weaver to find out the correct shed when restarting an ordinary loom.
Pirn change when affected by weft fork on automatic loom.

Remedies
Resort to pick finding while restarting.
Effect the pirn change with weft feeler mechanism.

Gout
Foreign matters like lint or waste or pieces of harness strapping and leather accessories woven into the fabric.

Causes
Indiscriminate throwing of waste by weavers.
Foreign matter getting into the shed during weaving.

Remedies
Ensure cleanliness of machines and surroundings in the loom shed.
Keep frequent check on harness strappings and leather accessories for undue wear and replace them, if necessary.

Sloughing off
Thick bunches of yarn are woven into the fabric in the weft direction due to slipping off of coils of yarn from the pirn during weaving.

Causes
Improper package characteristics.
Softly wound pirns.
Harsh picking and/or poor shuttle checking.
Poor humidity conditions during the storage of pirns.

Remedies
Employ correct package characteristics in pirn winding.
Ensure proper yarn tension during pirn winding in the case of rewound weft and in spinning in the case of direct weft.
Check the picking and checking mechanisms.
Condition the weft before putting it on loom.

Slub
An abnormally thick place in the yarn finally appearing in the fabric.

Causes
Undrafted portion in the yarn.

Remedies
Minimize the incidence of slubs during spinning.
Clear the yarns effectively during winding.

Snarl
It is a short length of yarn, mostly weft, which has spontaneously doubled back on itself. The snarling tendency is latent in highly twisted yarns. In some

fabrics, the snarls are found to be randomly spread over the width of the fabric, while in some other cases, they are restricted to a region at a fixed distance from one of the selvedges.

Causes

Highly twisted weft.
Low weft tension.
Shuttle rebounding either due to harsh picking or poor checking.
Centre weft fork not set right.

Remedies

Condition the weft prior to weaving by steam conditioning, CMC conditioning or gumming.
Provide suitable drag in the shuttle.
Ensure smooth picking and adequate checking of shuttle in the boxes.
Check the setting of centre weft fork.

Starting marks

A thick or thin place is produced in the fabric due to variation in pick density while starting the loom.

Causes

Weaver letting back the fell of the fabric too close to the reed by faulty adjustment of take-up motion.
Faulty functioning of anti-crack motion.

Remedies

Instruct the weavers about the correct procedure.
Ensure correct functioning of the motion.

Cracks

A higher pick density than the normal is referred to as starting mark while a lower pick density is referred to as crack.

Causes

Improper letting back of the fell of the fabric.
Improper lifting of the dead weights on let-off motion while adjusting the warp tension.
Faulty functioning of anti-crack and weft fork mechanisms.
Snagging of warp due to the shed being kept open for exceptionally long periods.

Remedies

Undrafted portion in the yarn.
Guide the weavers about the right adjustment.
Set the mechanisms properly.
Stop the looms at healds leveled position so as to ensure minimum of warp tension during the stoppages.

Thick and thin places
Weft bars differing in appearance and repeating several times along the fabric.

Causes
Irregular let-off.
Faulty take-up.

Remedies
Set the let-off and/or take-up motion properly.

Weft bars
Weft way bands which are clearly distinguished from the rest of the portion of the fabric. The bars may be restricted for a particular length of fabric or may repeat at fixed intervals.

Causes
Periodic count variation in the weft yarn arising out of roller eccentricity or mechanical defects in the spinning preparatory processes.
Mixing of weft of – different counts, different twist levels, different directions of doubling twist and different brightness levels especially in filaments.
Mixing of spun blended yarns produced from synthetic fibres of different merge numbers.
Manufacturing defect in filaments like variation in denier.

Remedies
Ascertain and rectify the source of periodic count variation.
Take due care to avoid mix-up of weft during pirn winding and/or weaving.
Resort to segregation of packages in weft preparation.
Conduct a dyeing trial on a few pieces before taking up bulk dyeing.

Weft floating on one side
Causes
Shedding either uneven or tilted on one side when connecting band is broken.
Too weak a picking force from one end leading to passage of shuttle after the shed is crossed.

Remedies

Correct the shedding.
Correct the picking force.

Wrong pick density

Causes
Wrong pick wheel fixed in the take-up mechanism due to carelessness of line jobber.
Coarser of finer weft used by mistake.

Remedies
Ensure strict supervision on pick density at the start of a beam.
Take precautionary measures.

Other Fabric Defects
The other fabric defects are:

Hole or tear in fabric
A defective portion in the fabric marked by distortion or cutting of warp and weft.

Causes
Mechanical faults in loom.
Weavers tapping the fabric with the shuttle tip or pirn on the front rest when inserting a new pirn.
Carelessness of the weaver in removing gout.
Holes form during the finishing processes due to the presence of foreign matter.

Remedies
Rectify the mechanical faults.
Make the weaver quality conscious.
Take precautions in weaving to avoid incidence of woven foreign matter.

Smash
A damaged spot in the fabric with many broken ends and floating picks due to shuttle being trapped in the shed.

Causes
Incorrect timing of shedding and picking.
Improper starting of loom.
Too weak or too harsh checking of shuttle.
Improper working of loose reed and knock-off mechanisms.

Remedies
Tune the loom properly.
Tune the checking mechanism.
Tune the mechanisms properly.

An introduction about shuttleless weaving (a non conventional weft insertion system)

The weft insertion in the shuttle less loom is carried out without using the shuttle. Since the pirn winding process does not occur in the shuttle less weaving method so that the manufacturing cost is reduced. The loom revolutions per minute are also increased comprehensively. The weft insertion in these looms is carried out from one side. The yarn package is directly used in weft yarn so that the loom stoppage time due to weft package change is reduced many times in comparison to the shuttle loom. The multicolor weft fabric is woven effectively. Eight colours in the weft may be used successfully without any problem in the rapier loom. Four colors in weft can be used successfully in the projectile looms and air-jet looms. There is no selvedge wastage in the projectile loom. The selvedge waste occurs in the jet looms and rapier loom. Since the weft insertion is carried out from one side of the loom so that ordinary selvedge does not form in shuttleless weaving. Leno selvedge, tuck-in selvedge, and melt selvedge are formed in shuttleless weaving.
The shuttleless loom can be classified into the below categories according to the weft insertion mechanism used in the shuttleless loom:

1 - Projectile loom
2 - Rapier loom
3 - Air jet loom
4 - Water jet loom

Projectile loom:

The weft insertion is carried out in a projectile loom with the help of a projectile. The small gripper is fitted in the projectile. the weft yarn package is mounted on the weft creel. The weft yarn first passes through the weft accumulator. This weft accumulator ensures the continuous supply of weft yarn at regular tension. The weft accumulator neutralises the effect of irregular yarn tension to be created due to a change in the package size. The weft yarn passes through the yarn tensioner. Now weft yarn passes through the compensator which brings the weft back as required. The weft yarn next passes through the filling sensor. Finally, weft yarn passes through the weft selection finger.

The projectile is projected from picking a side to receiving side with the help of picking shoe which hits the projectile hardly. The projectile travels in between the projectile guide. The number of projectiles depends upon the reed space used on the loom. When the projectile reaches the receiving side, the micro procedure controlled projectile brake breaks the momentum of it. Since the projectile gets crossed the required mark during its journey so that the compensator brings it in its correct position. Now the gripper grips the tail of weft yarn. The projectile falls on the conveyor chain which has projections at regular interval. The projectiles circulate from receiving side to the picking side with the help of a conveyor chain. The difference between the two projections in the conveyor chain is kept 10 inches.
The projectile lifter brings the projectile in front of the picking shoe. The projectile opener opens the gripers jaws. When the tail of weft yarn enters between the gripper jaws the opener comes out and the projectile gripper holds the weft yarn firmly. Now the picking shoe hits the projectile and sends it from the picking side to receiving side. A release opener now opens the jaws of the gripper and weft yarn gets released. this insertion cycle gets repeated continuously.

Projectile Weaving Machine or Loom:

Projectile weaving machine is a shuttleless loom method for filling yarn insertion using a small metal device resembling a bullet in appearance with a clamp for gripping the yarn at one end, which is then propelled into and through the shed. Among the **different types of modern looms**, projectile loom is one of them

Figure-1: Projectile weaving machine

The unique principle of projectile filling insertion allows the insertion of practically any yarn: cotton, wool, mono- and multifilament yarns, polypropylene ribbon, and even hard fibers like jute and linen. resulting in a wide variety of fabrics, from simple staple goods through superior fashion cloth and from wide heavy **industrial fabrics** to complex jacquard cloths.

Main Parts of Projectile Weaving Machine:

Major parts of projectile loom are given below:

Torsion bar A: As shown in figure-2 it has splinted ends as seen in the fig one end is secured firmly at the clamping flange with provision for adjusting twisting angle. The twisting length of the torsion is 721 mm. It is diameter is 15, 17 or 19 mm depending upon the model. Larger the diameter higher the initial projectile speed. The angular twisting of torsion bar at commencement of picking is 28-30O.

Picking shaft B: The free end of the torsion bar is linked with the picking shaft through spines.

Picking lever C: The picking lever is clamped on the picking shaft.

Picking shoe D: The picking lever carries the picking shoe at its top end.

Picking shaft lever E: It is a rigid part of the picking shaft.

Toggle plates F: The toggle plates center at o carry a roller G and connected to the picking shaft lever E through a link H. They are covered at the bottom.

Picking cam I: It is mounted on a shaft J and rotated by bevel wheels K once every pick. It rotates in the direction of the arrow shown in figure-2. It carries a roller R after the nose part.

Oil break L: The shock of the picking is taken by the oil break.

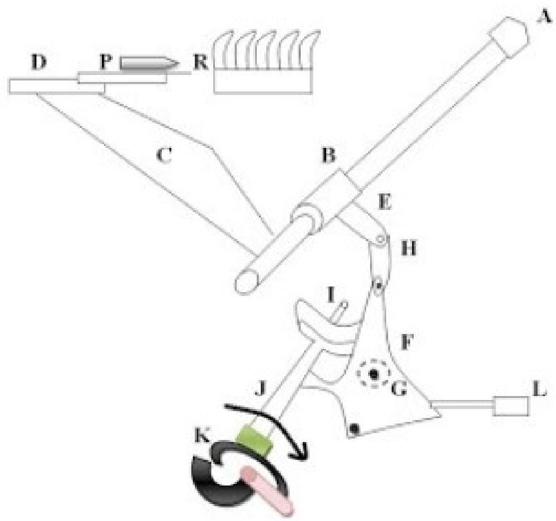


Figure-2: Picking mechanism on
Projectile weaving machine.

Where,

A=Torsion bar,
B=Picking shaft,
C=Picking lever,
D=Picking shoe,
E=Picking shaft lever,
F=Toggle plate,
G=Antifriction bowl,
H=Link,
I=Picking cam,
J=Shaft,
K=Bevel wheels,
L=Oil brake,
P=Projectile,
R=Projectile guide.

Working Principle of Projectile Weaving Machine:

Weft is withdrawn from the package through a tension device, weft tensioner, shuttle feeder, scissor, and weft end gripper. The picking arm has released the projectile which is shown in the guide teeth at the mid-shed position. At the receiving side the weft end gripper is positioned to grip the weft after reception. The shuttle break is shown in its operating position with the shuttle returner ready to push the projectile to the release and tucking position. Illustrates the torsion bar picking system of the machine. Strain energy is developed in the bar and released in such a way as to transfer the maximum possible strain energy to the projectile before it separates from the picker shoe.

The torsion bar (A) has its splined ends rigidly constrained in an adjustable housing with provision for adjusting the maximum angle of twist and projectile initial velocity. The other end of the torsion rod is splined into the picking lever (C) which carries the picking shoe (D) at its extremity. The projectile (P) is illustrated in the shuttle lifter with the projectile spring opener. The bevel wheel (K) rotates the picking cam shaft (J) which carries the picking cam (I). The picking shaft lever (E) is rigidly connected to the torsion bar and through a short linkage to the toggle plate (F) center at anti friction bowl (G). The action of the cam is for the small roller to bear against the toggle rotate it anti clockwise about anti friction bowl (G), thus withdrawing the picking shoe to its rearmost position. In this position the center of the toggle arrangement is in line and the torsion bar is twisted to its predetermined angle.

The nose of the **picking** cam then bears against the roller carried between the toggle plates and moves the central pivot of the toggle system off line center, thus permitting the strain energy in the rod to be transmitted instantaneously to the projectile. The projectile separates from the shoe after 6.4 cm travel in 0.007 s as a velocity of about 24.4 m/s after being subjected to a maximum acceleration of about 6700 m/s^2 at a point 1.5 cm inboard of the rest position. The residual energy in the picking system, some 62% of the whole is absorbed in the hydrolic buffer the body and plunger of which are shown at (L).

Developments of Projectile Weaving Machine:

1. Color selection

1 X 1, 2, 4 and 6 colors can be used in weft direction.

The system is freely programmable and operated by servo controller.

No limitations on feeder position shifting.

2. Electronic weft breaker

This device keeps a uniform tension on weft.

The braking force and the braking duration are programmable.

Programme can be given for each pick.

The device is driven by stepper motor.

Pre-acceleration to weft yarn is given by compressed air, which relieves extra tension in weft while inserting.

K3 Synthetic projectile can be used for weaving of delicate yarns.

The number of heald shafts operable by cam motion is extended to 14.

Speed has been increased up to 1400 mpm (470 rpm) due to improvement in many related mechanisms.

LED display at signal pole for machine speed, projectile arrival time, angle of machine stop, etc., which helps in monitoring of process.

Automatic weft brake repair motion enables shifting of feed package to a reserved one in the event of weft break between package and accumulator, no stopping of machine which increases the machine efficiency.

Advantages of Projectile Weaving Machine:

The projectile weaving machines offer the following advantages:
Low power consumption
Reduced waste of filling material due to unique clean, tucked-in selvages
Quick warp and style change
Mechanical and operational reliability and ease of use
Low spare parts requirement and easy maintenance
Long machine life
Rapier loom:

This is the most versatile loom. It has a very wide weft count range. You can insert from very coarse to very fine yarn without making a big change. The weft yarn package is mounted on the creel. The weft yarn passes through the weft accumulator first. The weft accumulator ensures continuous yarn supply at regular yarn tension. Now the weft yarn passes through the filling tensioned, weft sensor, and the yarn guide. The weft sensor keeps continuous watch on the weft movement. If weft yarn gets failed to reach the destination, the weft sensor stops the loom immediately. Finally, the weft yarn passes through the eye of the weft selector finger.

The weft insertion is carried out by grippers fitted on the ribbons made of Teflon and carbon fabrics. These. ribbons make a reciprocating motion with the help of sprocket wheels and drive gears. When the weft insertion cycle begins, both the grippers start to move toward the sley centre. The receiving gripper starts to moves first. The weft selection finger falls down over the rapier guide. Now the insert gripper holds the weft yarn between the gripping jaws. The weft cutter cuts the weft yarn now. The receiving gripper arrives first and rests in the dwell period. When the insert gripper travels toward the sley centre and the yarn gripped by the insert gripper crosses the hook of receiving gripper, the receiving gripper begins to move outside of the shed. The insert gripper also moves back after the dwell period. The weft transfer takes place in the centre of the shed. When the receiving gripper comes out of the shed, the gripper opener releases the weft yarn near the fabric selvedge. This cycle is repeated continuously.

Rapier weft insertion system l Types of rapier looms l Weft yarn passage and working principle of rapier weft insertion system

Rapier loom weft insertion system:

This is the most versatile. It has a very wide weft count range. You can insert from very coarse to very fine yarn without making a big change. The journey of weft yarn gets constantly controlled throughout the picking motion. The fabric width can be adjusted within the machine's specification limit. The rapier looms are widely used in the textile industry. The number of weft colours ranges between 8 to 16.

Classification of rapier looms:

A rapier loom can be categorized into the below classes according to the weft insertion mechanism used.

Single rapier loom:

That rapier loom in which only one rapier gets used to insert the the weft yarn in the shed is called the single rapier loom. The traveled distance of the rapier gets equal to the reed space used in the loom. This kind of loom works at a very low speed. The warp yarn exerts high pressure on the rapier.

Double rapier loom:

That rapier loom in which the weft insertion in the shed is carried out with the help of two rapiers, This type of loom is known as the double rapier loom. Each rapier travels a half distance of the reed space used in the loom. Double rapier loom runs at very high speed. The pressure of the warp yarn on the rapiers gets reduced up to a maximum extent.

Flexible rapier looms:

In this kind of loom, the grippers are mounted on the flexible ribbon or tape made of Teflon and carbon fabric. Since the length of the ribbon is almost equal to the reed space used in the double rapier loom and almost half of each ribbon length enters into the shed during weft insertion so that the remaining half-length of the ribbon goes back inside the hollow rapier guide when the rapier reaches to the outer dead center position. This remaining length is that length that doesn't enter into the shed during weft insertion. This task gets possible due to the flexibility of the rapier ribbon. Due to the use of flexible rapier ribbons, this kind of loom is called a flexible rapier loom. This loom can run at higher rpm than rigid rapier looms. This kind of looms occupies less space too.

Rigid rapier looms:

If the grippers are mounted on the rigid rapier racks in any rapier loom, it is known as a rigid rapier loom. The rigid rapier runs at a slower speed than the flexible rapier loom. The rigid rapier loom occupies more space than the flexible rapier loom.

Negative weft transfer rapier loom:

If the weft yarn gets entered between the gripping jaws of rapier grippers with the help of weft tension and an extra mechanism is not used to open and close the gripping jaws of each gripper during the weft transfer cycle, this kind of weft transfer is called negative weft transfer. If the loom has negative weft transfer during weft insertion, that loom is called a negative weft transfer rapier loom.

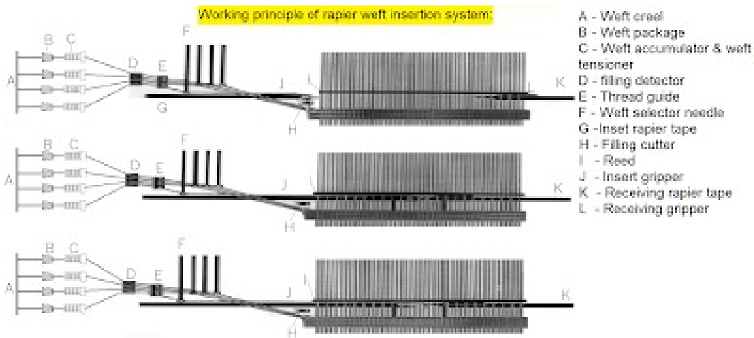
Positive weft transfer rapier loom:

If the gripping jaws of each rapier get opened and closed with the help of an extra mechanism throughout the complete cycle of weft transfer, this kind of weft insertion is known as positive weft transfer. The loom equipped with positive weft transfer is called a positive weft transfer rapier loom.

Passage of weft yarn in the rapier loom:

The weft package is mounted on the weft creel. The number of weft packages is used according to the number of colours in weft yarn getting used. The yarn passes first from the thread guide and weft tensioner mounted on the weft creel. Next, the weft yarn passes through the weft accumulator. This weft accumulator ensures continuous yarn supply at a constant tension. When the weft package reaches to near the exhaustion position, the yarn tension gets increased to maximum. The weft accumulator neutralizes this effect and keeps the weft tension constant throughout the package. The weft tensioner mounted on the weft creel prevents the overlapping of adjacent yarn coils on the accumulator. The number of weft accumulators used gets equal to the number of colours getting used in the weft yarn.

Now the yarn passes through the filling detector. The filling detector consists of either a single weft sensing channel or multi weft sensing channels. The filling detector monitors the complete journey of the weft from one side to another side. If weft insertion gets either failed or felt short in length, it stops the loom immediately. The yarn next passes through the thread guide which helps to keep the weft yarns separate. It also prevents entangling the different weft yarns together. The thread guide consists of many ceramic eyes in it.
Finally, weft yarn passes through the eye of the weft selector needle. The weft selector needle gets selected according to the weft sequence feed in the control computer.



Working principle of rapier weft insertion system:
The weft yarn gets held in the catch selvedge. Ten to twenty ends are used to make this catch selvedge. The ends are wrapped either on a separate reel or a catch selvedge creel is used in which required small yarn packages are mounted. A plain weave is always used in the catch selvedge. A catch plate mounted on the temple bracket very close to the end of the reed prevents the weft yarn from going toward the reed.
When the reed beats the last inserted pick, a fresh weft insertion cycle begins. First of all, the weft selector needle falls, and the weft yarn comes in front of the insert gripper. The weft yarn falls on the rapier guide and touches it.
The rapier starts traveling toward the sley center and the receiving rapier also starts to travel toward the sley center. The receiving rapier starts to move first. When the gripper passes under the weft yarn, the yarn gets entered into the slot of the insert gripper. The gripping pressure of the gripper is adjusted in such a way that it allows entering the weft yarn between the upper and lower gripping jaws of the insert gripper. An approproate weft yarn tension is also achieved by adjusting the yarn tensioner. The weft yarn should be at least reached the middle of the gripping jaws. There should be no yarn slippage between the gripping jaws of the insert rapier. When the insert gripper begins to enter the shed, the filling cutter cuts the weft yarn. A weft yarn support guide is mounted at the one end of the rapier guide near the entry point of the insert rapier. This yarn guide makes a required clearance between the reed and weft yarn. it also prevents reed damage.
Both the rapier travels toward the sley center. The receiving rapier reaches first at the sley center and rests there indwell period. The receiving rapier gets ready to receive the weft yarn from the insert gripper and it waits there. Now the insert rapier reaches the sley center and the yarn gripped in the insert gripper cross the tip of the hook receiving gripper. The three mm clearance between the tip of the hook of receiving gripper and weft yarn is ensured during setting. As the insert gripper comes in the dwell period, the receiving gripper starts to travel toward

the fabric selvedge. The hook of receiving gripper pulls the weft yarn from the insert gripper. Since the receiving gripper has little more gripping pressure than the insert gripper so that yarn gets entered between the gripping jaws of receiving gripper. The insert gripper also starts to travel toward the fabric selvedge after passing its dwell period. The receiving gripper comes out of the shed first. A gripper opener fitted at the rapier guide opens the gripping jaws and releases the weft yarn outside of the catch selvedge. A suction nozzle sucks the tail of the weft yarn inside it and helps to keep it tight. The catch selvedge ends cross to each other at the same time and holds the weft yarn firmly. The insert rapier also comes out of the shed during this period. Now the weft yarn is beaten by reed and catch plate hold again the weft yarn. This cycle is repeated continuously.

Air-jet loom:

The air jet loom is a very high-speed loom. The weft insertion is carried out with the help of compressed air. The weft yarn travels from one selvedge to another selvedge through the reed profile guide The weft yarn package is mounted on the weft creel. First of all, the weft yarn passes through the weft pre-winder. The main objective of the pre-winder is to ensure continuous weft supply at constant tension and to release accurate pick length for weft insertion. A magnetic brake is used to control the required pick length accurately. This yarn brake is controlled electronically. The required number of yarn coils is fed in the control computer. The weft yarn enters into the main air jet nozzle and rests there. The relay nozzles are mounted on the sley at a definite interval of distance. The number of relay nozzles depends upon the reed space used in the loom. The main nozzle and relay nozzles are connected to a compressed airline through flexible pipes. The operation of the main nozzle and relay nozzles get controlled electronically through a control computer. The opening and closing of the nozzles are carried out with the help of magnetic valves. air regulator valves regulate air pressure in the loom. A filling detector is mounted at the end of the profile reed opposite side of the main nozzle. A weft stretch nozzle is also mounted near the filling detector. A filling cutter is mounted on the filling insertion side close to the end of the reed.

Working Principle of Air Jet Loom

Air jet weaving machines were invented in Czechoslovakia and later refined by the Swiss, Dutch, and Japanese were designed to retain the tension less aspect of the picking action of the water jet while eliminating the problems caused by the use of water.

The yarn is pulled from the supply package at a constant speed, which is regulated by the rollers, located with the measuring disk just in front of the yarn package. The measuring disk removes a length of yarn appropriate to the width of the fabric being woven. A clamp holds the yarn in an insertion storage area, where an auxiliary air nozzle forms it into the shape of a hairpin.

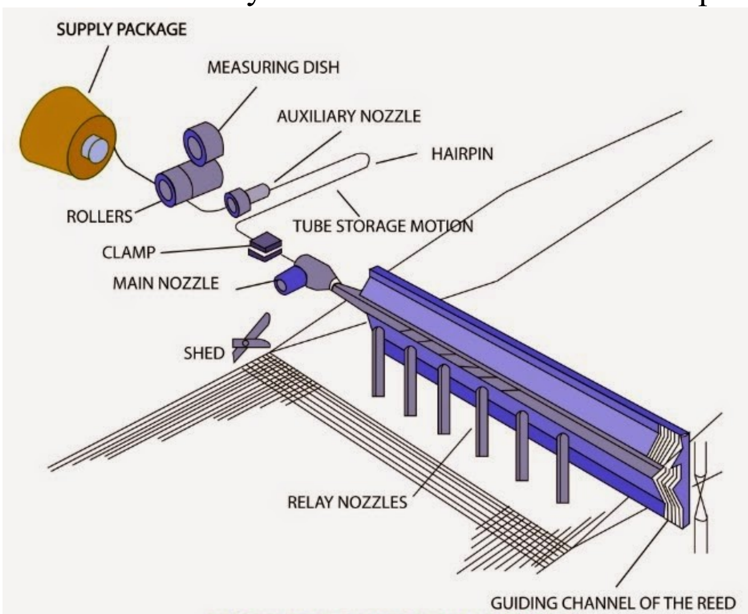


FIG: OPERATION PRINCIPLE OF THE AIR JET LOOM

The main nozzle begins blowing air so that the yarn is set in motion as soon as clamp opens. The hairpin shape is stretched out as the yarn is blown into the guiding channel of the reed with the shed open. The yarn is carried through the shed by the air currents emitted by the relay nozzles along the channel. The initial propulsive force is provided by a main nozzle. Electronically controlled relay nozzles provide additional booster jets to carry the yarn across the shed. The maximum effective width for air-jet weaving machines is about 355 cm. At the end of the each insertion cycle the clamp closes; the yarn is beaten in, and then cut, after the shed is closed. Again some selvage-forming device is required to provide stability to the edges of the fabric.

These weaving machines use a jet of air to propel the weft yarn through the shed at rates of up to 600 ppm. Date from manufacturers indicate that air-jet looms operate at speed up to 2200 meters of pick inserted per minute. They can weave multicolored yarns to make plaids and are available with both dobby and jacquard patterning mechanism.

Air jet weaving is more popular because the machines cost less to purchase, install, operate, and maintain than rapier or projectile weaving machines, and the air jet can be used on a broader variety of yarns than a water jet.

When the reed begins to move from the front dead centre to the back dead centre position, the filling cutter cuts the last inserted pick at 0 - 10 degree. when the shed gets almost opened, the air supply in the main nozzle gets opened. The compressed air carries the weft yarn from one selvedge to another selvedge. The main nozzle can not inset the weft yarn alone. The relay nozzles activate one by one according to the program and help to accelerate the weft insertion. When the yarn reaches near the selvedge opposite of the insertion side, it is detected by a filling detector. If the yarn is short or too long than required, it stops the loom immediately. The weft stretch nozzle sucks the tail end of the weft outside of the shed. This cycle is repeated continuously. The fabric quality of the air-jet loom is better than the projectile loom and rapier loom.

Water jet loom:

The water pressure is used to insert the weft yarn into the shed in the water jet loom. This loom also has high productivity. Low moisture content yarns can be woven on the water jet loom. The water jet nozzle is used to insert the weft yarn. A high-pressure water pump generates high water pressure. The water jet nozzle gets connected with the high-pressure water pump. The opening and closing of water pressure in the water jet nozzle are carried out with the help of a microprocessor-controlled magnetic valve. The pressure regulator valve regulates the water pressure in the water jet nozzle. A filling detector is mounted at the end of the reed opposite side of the water jet nozzle. A stretch nozzle is also mounted near the filling detector. A filling cutter is mounted near the end of the reed at the picking side. Weft pre-winder ensures the continuous weft yarn supply at regular yarn tension. The pre-winder also regulates the required pick length. The weft yarn rests inside the water jet nozzle.

When the sley starts to move toward the back dead centre position, the filling cutter cuts the last inserted pick. When the shed gets almost opened, the water jet nozzle controlled by the magnetic valve is opened. The very fine stream of water emerges from the jet of the nozzle. This water stream carries the weft yarn with it. The filling detector feels the weft yarn. If the weft insertion gets failed or gets short of the required length, the filling detector stops the loom immediately. The stretch nozzle sucks the end of inserted weft simultaneously. This cycle is repeated continuously.

Water-jet loom weft insertion system:

The weft insertion is carried out into the shed from one selvedge to another selvedge with the help of a high pressure water stream. The water is fed to the fine jet nozzle through a high pressure water pump. A fine stream of water emerges from the jet. It carries the weft yarn with it. The water jet loom is mainly suitable for those fabrics which are woven with hydrophobic material in character. The mono and multi filament yarns are mostly used on water jet looms because these yarns have very low moisture content. Water jet loom consumes low energy. The productivity of the loom is very high. The noise level of water jet loom is too low. It requires very low maintenance in comparison to any other looms. This loom is suitable for light and medium weight fabrics.

Weft yarn passage of water jet loom weft insertion system:

The structure of water jet loom is much similar to air jet loom. The weft yarn passage of water jet loom is given below:

The weft yarn package is mounted on the weft creel. First of all, the weft yarn gets passed through the weft accumulator.

Next, the weft yarn passes through the weft guide.

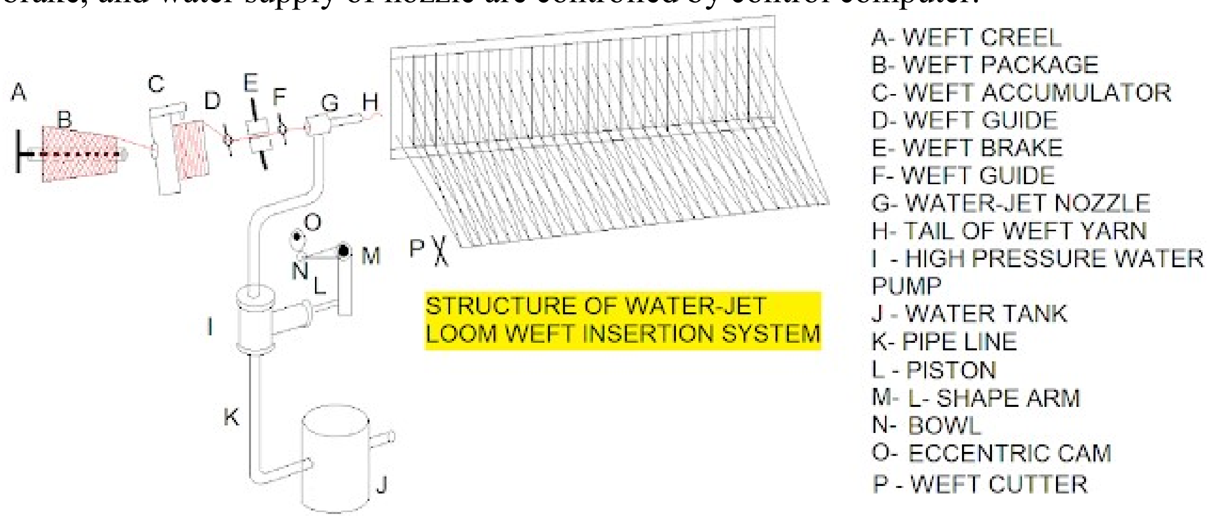
Now this weft yarn passes between the two plates of the weft brake.

The weft yarn further passes through another weft guide.

Finally, the weft yarn passes through the water-jet nozzle and rests there. You can see clearly in the below picture.

Function of various parts of water jet loom:

The weft package is mounted on the package holder of the weft creel. One thread guide is mounted in the creel for each package holder. The number of weft package holders depends upon the number of weft colours getting used in the fabric to be woven. There are balloon separators also used to prevent the striking of two adjacent weft yarns. The weft yarn passes through the weft accumulator in next. There are three objectives of weft accumulator in the water-jet loom. The weft accumulator ensures the regular weft yarn supply during weft insertion at constant yarn tension. The weft accumulator neutralises the tension variation effect when the weft yarn package reaches the exhaustion situation. Secondly, it controls the required pick length according to the reed space used in the loom. First of all, the perimeter of the accumulator is calculated precisely then number of weft coils required per pick is calculated. The number of weft coils should always be a whole number. If number of coils per picks is not a whole number, the diameter of the accumulator drum is adjusted and the number of coils per pick is calculated. The drum diameter adjustment continues till the achievement of number of coils per picks as a whole number. Third objective of the weft accumulator is to stop the machine immediately when the weft yarn package gets exhausted. The unnecessary pick finding time gets saved by this bobbin brake stop motion. The weft yarn now passes through the ceramic thread guide. This thread guide keeps the weft yarn in its proper place and prevents to entangled of two adjacent weft yarns to each others. Now, the weft yarn passes through the weft brake. This weft brake imparts the required tension to the weft yarn when needed. Next, the weft yarn further passes through another weft guide. Finally, the weft yarn passes through the water-jet nozzle and rests there. The water jet nozzle is mounted on the sley in picking side very close and adjacent to the reed. This water jet nozzle is connected to the high pressure water supply through the pipe line. The high pressure water pump is used to feed the water in the nozzle at very high pressure. The water pump consists of cylinder and piston. This water pump is connected to the water tank through pipe line. The vertical arm of L- shape lever is connected to the piston and an antifriction bowl is mounted at the end of the horizontal arm of L-shape lever. This anti friction bowl touches the eccentric cam. When the cam rotates, the piston attached with vertical arm of L- shape lever makes a reciprocating motion. Water is sucked from water tank by pump and is fed it to the water jet nozzle. The nozzle opening and closing gets controlled by magnetic valves. The opening and closing timings are entered into control computer. The opening and closing of the electromagnetic valve, weft brake, and water supply of nozzle are controlled by control computer.



weft insertion cycle of water jet loom:

A new weft insertion cycle of water jet loom begins after beating motion. As the reed beats the last inserted pick, the weft cutter(mechanical cutter or thermal cutter) cuts the weft yarn very close to the selvedge. Now reed begins to move toward the back dead centre position. After angular movement of few degrees of reed shaft, the sley enters into dwell period. Now, the pin of electromagnetic valve mounted on the accumulator lifts up and the accumulator gets ready for weft unwinding. The weft brake also releases the weft yarn tension at the same time. A high pressure water supply of the nozzle gets begun now. When the valve of water jet nozzle opens, a fine water stream emerges from the nozzle. Since the tail of weft yarn rests inside the water jet nozzle so that a emerging fine water stream carries the weft yarn with it into the shed from one selvedge to another selvedge. The electromagnetic valve of accumulator gets closed and the pin drops on he accumulator drum after insertion of complete pick length. The weft brake is also closed at the same time. The catch selvedge ends hold the weft yarn properly. Now reed begins to move toward the front dead centre position and beats the yarn finally. The weft cutter cuts the weft yarn and the selvedge cutter trims the weft yarn at right hand side. This cycle gets repeated continuously.