through a reed G, which holds the yarns at uniform spacing and is also responsible for beating-up the weft yarn I into the fell of the cloth. After the weft is beaten up, the warp yarns interchange positions in the shed and thereby cause interlacing to be achieved. At this point, cloth is formed and is held firmly by temples J to assist in the formation of a uniform cloth. The cloth H then passes over a front rest K, around an emery roller or take-up roller L and a guide roller M and is finally wound on to a cloth roller N.

## 1.4 Motion of Heald Shafts, Shuttle and Sley

In a plain power loom the heald shafts, shuttle and sley are operated by mechanisms that are set in motion by a motor through a crankshaft and a bottom shaft. The heald shafts move up and down by the shedding mechanism. The motion is obtained from the bottom shaft or counter shaft that carries the tappets. So the warp sheet is divided into two layers and it forms a shed.

The shuttle is pushed into the warp shed by a picker that gets activated by a picking mechanism. Normally the shuttle is kept in a shuttle box. When the shuttle is pushed, it reaches the opposite box. The arrival of the shuttle in the opposite box is confirmed by shuttle checking devices. The picking mechanism is set in motion by the bottom shaft.

The crankshaft operates the sley through the crank and crank arms. The sley gets a to-and-fro motion. As the sley reciprocates, the reed, which is fixed to the sley, also gets a to-and-fro motion. The reed thus beats up the weft into the fell of the cloth.

## 1.5 Warp and Cloth Control

After beating up the weft into the fell of the cloth, a take-up motion draws the cloth forward and winds it on to a cloth roller. At the same time the warp is delivered from the weaver's beam by a let-off motion.

These two motions are operated simultaneously and at a constant rate. i.e. the rate of cloth take-up is so set as to be equal to the rate of warp let-off. The take-up motion is operated through a sley stud and gear mechanism. The let-off motion operates by the pulling action of the cloth.

The two temple pieces located at the selvedges of the cloth control the cloth width.

## 1.6 Stop Motions

To ensure good productivity and quality of cloth, the following stop motions are used: The warp protector mechanism protects the warp from breakages during shuttle trap and stops the loom immediately.

The weft stop motion stops the loom if a weft thread breaks or the weft yarn gets exhausted, and thereby prevents the formation of weftway cracks in the fabric. The brake stops the loom instantaneously at any desired moment. The warp stop motion stops the loom when a warp thread breaks during weaving.

## 1.7 Methods of Driving a Plain Power Loom

Power looms are driven by the following types of drives:

a) Individual drive

b) Group drive

### 1.7.1 Individual Drive

In this method, each power loom is driven by an individual motor. The power required to drive a plain power loom is 0.75HP.

Figure 1.2 shows a simple driving arrangement commonly found in mills. A single motor is used to drive the loom. Motor A, via motor pulley B and loom pulley or fast-and -loose pulley C and D, drives the top shaft or crank shaft E. A crank shaft gear wheel F and a bottom shaft gear wheel G drive the bottom shaft H.

By means of a starting handle, a belt fork can be used to change the position of the belt on the fast-and-loose pulley arrangement. When the belt is on the loose pulley D the pulley will rotate but the crank shaft will not rotate. Therefore the machine can be stopped. By moving the belt to the fast pulley C the loom can be started or stopped at any time.

In the latest looms, a motor with an electro-magnetic clutch drive is used. This is more reliable and stops the loom instantaneously by a push-button control system.

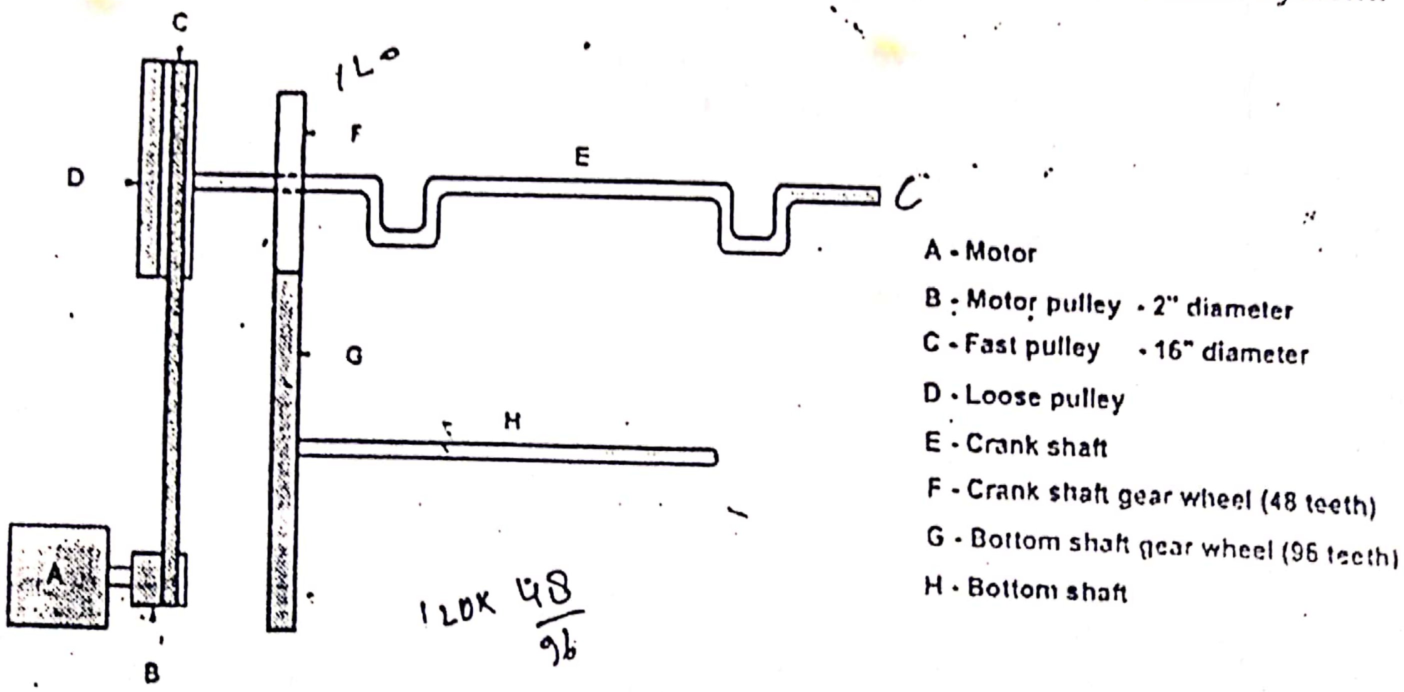


Figure 1.2 Individual drive in a loom

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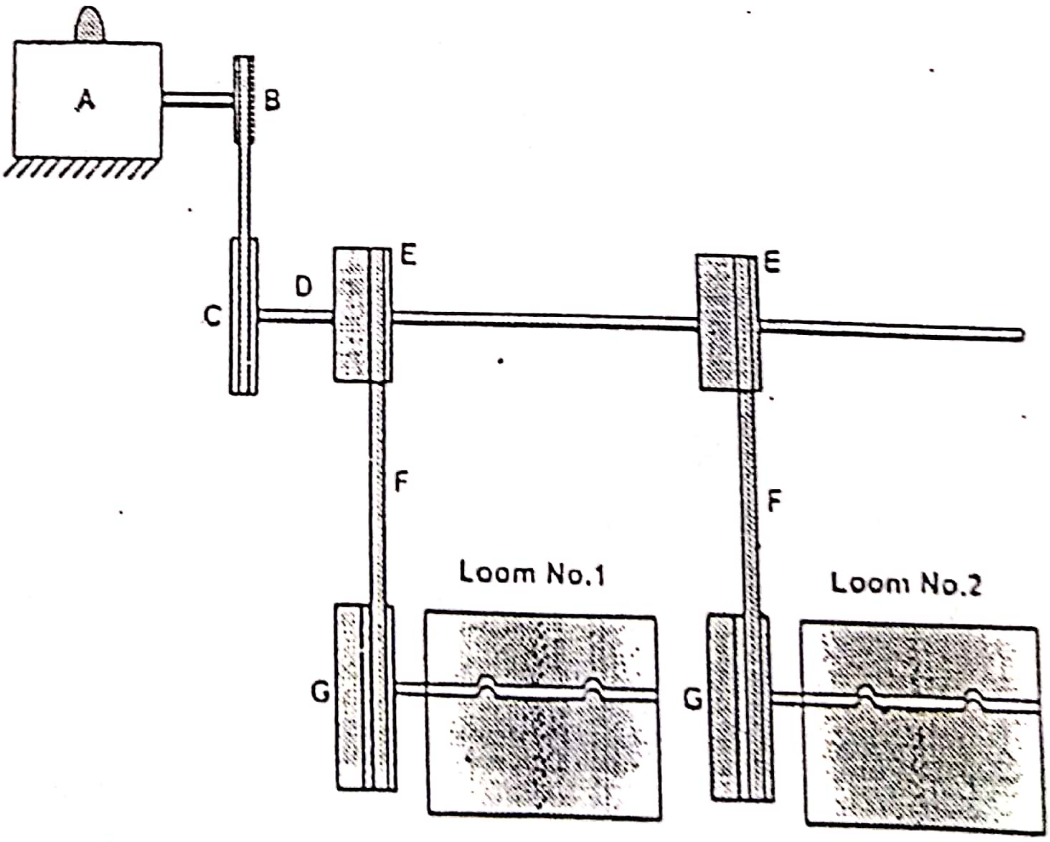
### 1.7.3 Advantages and Disadvantages of Different Loom Drives

#### Individual drive

The advantages of individual drive are listed below:

1. In case the motor of any particular loom fails, that loom alone will stop running, while all the other looms keep running.
2. Power losses in individual loom drive are much less than the losses in a group drive system. There is therefore a considerable saving in power.
3. The life of the transmission belt is comparatively greater in individual drive.
4. In the individual drive system, there will be a clear view of all the looms in the shed. Due to the absence of overhead shafts and moving belts, the lighting in the shed will be brighter and more uniform.
5. The possibility of accidents is considerably minimised in the individual drive system as each loom and its drive is compactly arranged, without any inter-loom connection.
6. The shed plan and layout of looms is neat and easy.




A - Common motor
B - Motor pulley
C - Overhead shaft driving pulley.
D - Overhead shaft or main shaft
E - Main shaft pulleys
F - Belts
G - Fast- and- loose pulleys

Figure 1.3 Group drive in a loom shed

The disadvantages of individual drive are:

1. Initial cost is high.
2. High maintenance cost.

Advantages of group drive:

1. Initial cost is low.
2. Maintenance cost is low.

Disadvantages of group drive:

1. Higher power consumption.
2. One motor drives a number of looms. So, if it fails, all the looms it drives are affected. This results in poor loom-shed efficiency.
3. There are greater chances of accidents due to the overhead and other inter-loom connections.
4. The large number of pulleys and belts in the loom shed will reduce the effective amount of light in the loom shed.
5. The layout for a group-drive system is complicated and presents a clumsy overall appearance.

## 1.6 Classification of Weaving Machines

Looms are classified mainly into handlooms and power looms. The power looms are classified further into the following categories.

a) Non-automatic power looms

These looms have only the basic mechanisms, viz. primary, secondary and some auxilliary mechanisms. The following are examples of non-automatic power looms.

1. Tappet looms
2. Dobby looms
3. Jacquard looms
4. Drop-box looms
5. Terry looms.

b) Automatic looms or conventional automatic looms

To get high productivity and good quality of fabric, additional mechanisms are added to ordinary non-automatic power looms. These looms are becoming popular because of their advantages of versatility and relative cheapness.

Examples: 1. Pirn changing automatic loom

2. Shuttle changing automatic loom.

**c) Shuttleless looms or unconventional looms**

In the non-automatic and automatic looms, shuttles are used for inserting the weft yarns. In these shuttle-looms, preparation of weft yarn and the weft insertion mechanism itself limit the loom production and fabric quality; they are also prone to mechanical problems in propelling the shuttle. Hence loom manufacturers have developed looms with various innovative and alternative means of weft insertion.

These modern looms are known as **"shuttleless looms"** and some examples of the looms are:

1. Air-jet loom
2. Water-jet loom
3. Projectile loom
4. Rapier loom
5. Needle loom
6. Various other methods include rectilinear multiphase looms.

**d) Circular looms**

These looms achieve higher weft insertion rates because more than one shuttle is delivered at a time. In these looms, the shuttles move simultaneously in a circular path and tubular fabrics are produced.

### 1.9 A Method for Indicating Loom Timing

In a loom, all the mechanisms must be set at correct timings in relation to each other. We therefore need a simple and unambiguous method for identifying and stating these timings.

The loom overlooker or jobber often adjusts the loom settings. This is generally done by keeping the reed or sley at a particular distance, as measured by a steel rule or a gauge, from a fixed mark on the loom frame. This is convenient for practical purposes but not for studying the principles of weaving.

To study and set the mechanisms, it is better to state their timings in terms of the angular positions of the crank shaft which activates both the sley and the reed.

This can be done conveniently by means of a circle, the radius of which is equal to the length of crank, and in which the centre represents the centre of the crank shaft. The circle is known as crank circle or timing circle. Figure 1.4 shows a timing circle. The circle is graduated in the direction of rotation of the crank and is divided into four

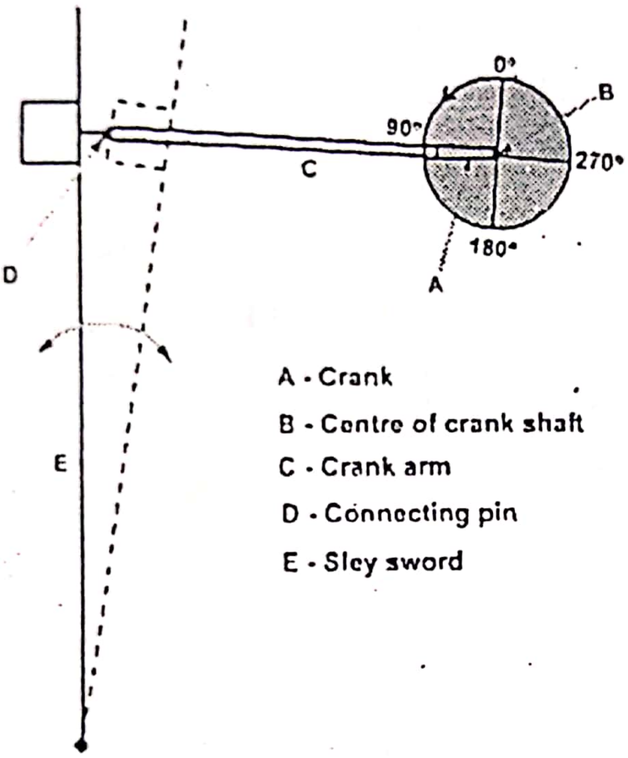



Figure 1.4 Method for indicating loom timing

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quarters; the terms top, front, bottom and back centres are used to correspond to the 0°, 90°, 180° and 270° positions of the circle. Also, in these timings the crank positions correspond to the top, front, bottom and back respectively.

By stating the crank position in terms of degrees, the mechanisms like shedding, picking, etc. can be set and studied without any difficulty. The timings are graduated on a wheel fixed to the crank shaft in degrees and a fixed pointer enables settings to be made in relation to the angular position of the crank shaft.

~~1. Open shed~~ Closed shed

There are two types of closed shed.

1. Centre-closed shed
2. Bottom-closedshed.

2.9.1 Open Shed

The shed is always in the open position in this type of shed.

(i) Fully-open shed

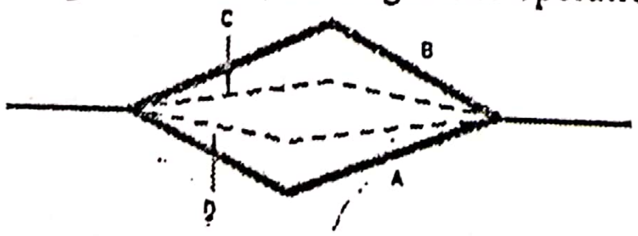
In this type of shed, the warp threads form two stationary lines, one at the top and the other at the bottom. After inserting a pick, changes are made by carrying threads from one fixed line to the other, so some threads are lowered from the top line and some threads are raised from the bottom line. During this change, the raising and lowering of threads occur simultaneously. Therefore the shed is formed in a minimum period of time. As the falling threads help the rising threads to move, strain upon the warp yarn is low. Figure 2.22 shows a fully-open shed. In the figure, A and B are the stationary bottom and top lines respectively. The arrows C and D show the movements of the falling and rising threads respectively. Full lines show that the shed is always in an open position only. So this shed is known as fully-open shed.

Merits

1. Rising threads help to move lowering threads.
2. Strain upon the warp is low, so it requires a minimum period of time to form a shed.
3. The loom can run at a high speed.
4. Power consumption is low.
5. Wear and tear of the loom parts is low.

Demerits

1. This type of shedding is troublesome to weavers because the two fixed lines make it more difficult to repair broken ends. Therefore a levelling mechanism is added to all looms using this type of shedding mechanism. While repairing broken ends, this levelling mechanism is brought into operation.




A - Bottom line of warp

B - Top line of warp

C - Movement of falling threads

D - Movement of rising threads

2. As the shed is always open, breakages may results especially when the yarn is weak.
3. When many heald shafts are used, the strain on the warp yarns in the back heald shafts is increased and hence warp breakages may occur.

Uses

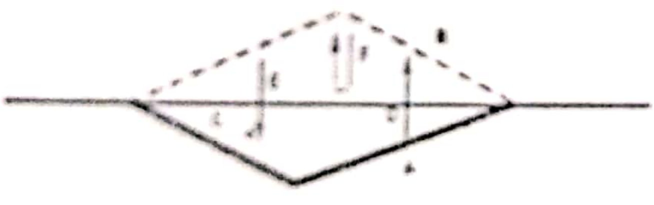
This type of shed is used in

1. Plain loom for producing twill and satin weaves and
2. In double-lift dobby and in double-lift jacquards.

(II) Semi-open shed

This is formed under both closed and open principles. In this shed, a stationary bottom line is retained. The top line is a movable one. After inserting a pick, the top line moves towards the bottom line. When the threads are moving down, some of the threads which are to form once again at the top line are arrested midway and are then carried to the top line. The remaining threads move down. Similarly the threads which are to be at the top line also move up and are carried to the top line. Figure 2.23 shows a semi-open shed. In the figure, A is the bottom stationary line. B is the top line. Arrow D, shows the movement of rising threads from the bottom to the top line. Arrow E shows the movement of threads going directly down to the bottom line. Arrow F, shows the movement of the arrested threads at the midway position C. From the midpoint C these threads are carried to the top line.

The full lines indicate the positions of shed lines after inserting a pick. They are in a semi-open state. So this type of shed is known as semi-open shed.



A - Bottom line of warp

B - Top line of warp

C - Point where some of the downward movement of threads is arrested

D - Movement of rising threads

E - Movement of falling threads

F - Movement of arrested threads

Figure 2.23 Semi-open shed

In the CD-ROM, watch Animation No. WFP-12.10

Merits

1. In a semi-open shed, the strain upon the warp is low.
2. It requires minimum time to form a shed.
3. The loom can run at a high speed.

4. Power consumption is low.

5. Wear and tear of the loom parts is low.

**Demerits**

1. This shedding is troublesome to weavers because the two fixed lines make it more difficult to repair broken ends. Therefore a levelling mechanism is added to all the looms using this type of shedding motion. While repairing broken ends, this levelling mechanism is used.

2. As the shed is always open, breakages may result, especially when the yarn is weak.

3. When many heald shafts are used, the strain on the warp yarn at the back heald shafts is increased and hence warp breakages may occur.

4. In a fully-open shed, the strain on the rising and falling threads is equally distributed. But in a semi-open shed, since some of the threads are coming from the bottom line and some threads are arrested midway and again carried to the top, the strain is not equally distributed.

**Uses**

Many double-lift dobbies and double-lift jacquards form semi-open sheds.

### 2.9.2 Closed Shed

This type of shed closes after every pick is inserted. So all the warp threads come to the same level after each pick is inserted.

**(i) Centre-closed shed**

In this type of shed, warp threads move in an upward and downward direction from a centre line. The threads which are to form the top line move upwards and the threads which are to form the bottom line move to bottom line. After inserting a pick both the lines meet at the centre-line.

Figure 2.24 shows a centre-closedshed. A is the centre-line. B and C are the top and bottom lines respectively. D and E are the arrows showing the movements of the rising and falling threads respectively.

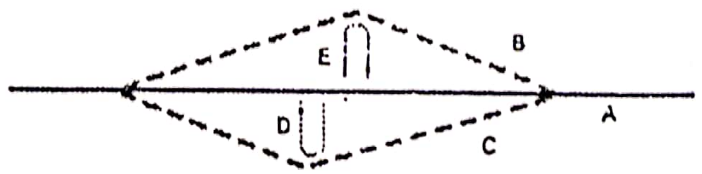



Figure 2.24 Centre-closed shed

In the CD-ROM, watch Animation No. WFP-12.11

Merits

1. A rising thread is partially balanced by a falling thread.
2. The machine can run at high speed.
3. Power consumption and wear and tear of the loom parts are low.

Demerits

1. Since every thread is moved to form each shed, strain on the warp is more than that for the open shed.
2. An unsteady movement of threads is caused by the warp threads being in constant motion.

Uses

Centre-shed dobbies, centre-shed jacquards and handlooms form centre-closed sheds.

(ii) Bottom-closed shed

This kind of shed is formed by giving motion to only those threads that form the top line. Under this condition, after inserting a pick, all the warp yarns come to the bottom line. Figure 2.25 shows a bottom- closed shed. A represents the bottom stationary line, B the top line and C is the arrow showing the movement of threads.

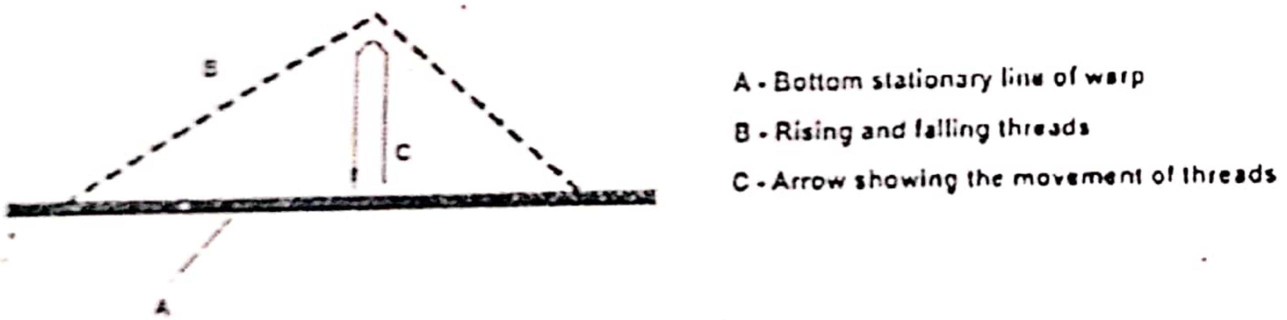



Figure 2.25 Bottom-closed shed

In the CD-ROM, watch Animation No. WFP-12.12

Merit

The alternate tightening and slackening of threads produces a cloth with good cover.

Demerits

1. It takes a long time to produce a shed since it is necessary to move the threads a space equal to twice the depth moved in other types of sheds.
2. It is unsuitable for high loom speed.
3. Strain on the warp is high.
4. Wear and tear of the loom parts is high.
5. Power consumption of the loom is high.

4. Power consumption is low.

5. Wear and tear of the loom parts is low.

**Demerits**

1. This shedding is troublesome to weavers because the two fixed lines make it more difficult to repair broken ends. Therefore a levelling mechanism is added to all the looms using this type of shedding motion. While repairing broken ends, this levelling mechanism is used.

2. As the shed is always open, breakages may result, especially when the yarn is weak.

3. When many heald shafts are used, the strain on the warp yarn at the back heald shafts is increased and hence warp breakages may occur.

4. In a fully-open shed, the strain on the rising and falling threads is equally distributed. But in a semi-open shed, since some of the threads are coming from the bottom line and some threads are arrested midway and again carried to the top, the strain is not equally distributed.

**Uses**

Many double-lift dobbies and double-lift jacquards form semi-open sheds.

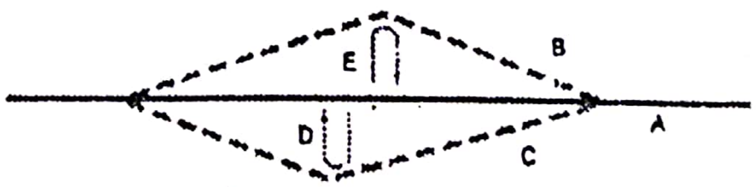
### 2.9.2 Closed Shed

This type of shed closes after every pick is inserted. So all the warp threads come to the same level after each pick is inserted.

**(i) Centre-closed shed**

In this type of shed, warp threads move in an upward and downward direction from a centre line. The threads which are to form the top line move upwards and the threads which are to form the bottom line move to bottom line. After inserting a pick both the lines meet at the centre-line.

Figure 2.24 shows a centre-closedshed. A is the centre-line. B and C are the top and bottom lines respectively. D and E are the arrows showing the movements of the rising and falling threads respectively.




A - Closed warp line
B - Top line of open shed
C - Bottom line of open shed
D - Movement of rising threads
E - Movement of falling threads

Figure 2.24 Centre-closed shed

In the CD-ROM, watch Animation No. WFP-12.11

Merits

1. A rising thread is partially balanced by a falling thread.
2. The machine can run at high speed.
3. Power consumption and wear and tear of the loom parts are low.

Demerits

1. Since every thread is moved to form each shed, strain on the warp is more than that for the open shed.
2. An unsteady movement of threads is caused by the warp threads being in constant motion.

Uses

Centre-shed dobbies, centre-shed jacquards and handlooms form centre-closed sheds.

(ii) Bottom-closed shed

This kind of shed is formed by giving motion to only those threads that form the top line. Under this condition, after inserting a pick, all the warp yarns come to the bottom line. Figure 2.25 shows a bottom- closed shed. A represents the bottom stationary line, B the top line and C is the arrow showing the movement of threads.

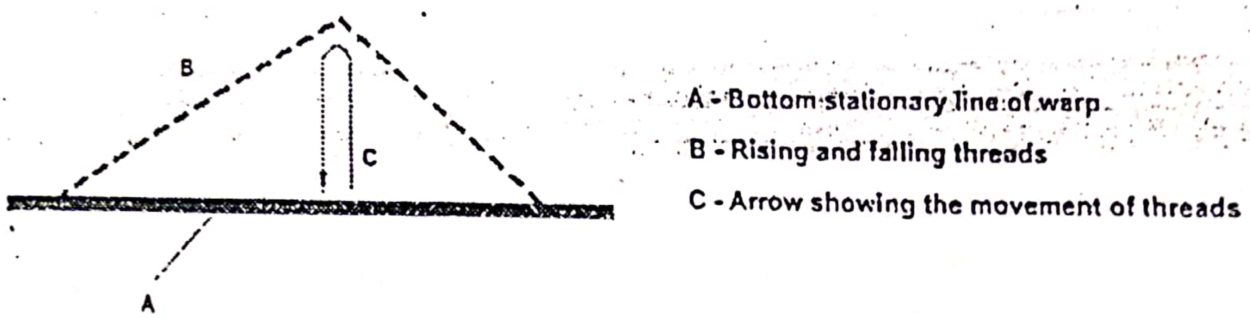



Figure 2.25 Bottom-closed shed

In the CD-ROM, watch Animation No.WFP-12.12

Merit

The alternate tightening and slackening of threads produces a cloth with good cover.

Demerits

1. It takes a long time to produce a shed since it is necessary to move the threads a space equal to twice the depth moved in other types of sheds.
2. It is unsuitable for high loom speed.
3. Strain on the warp is high.
4. Wear and tear of the loom parts is high.
5. Power consumption of the loom is high.