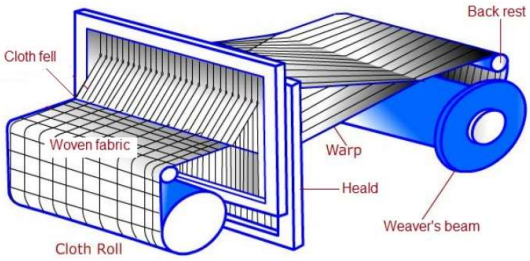
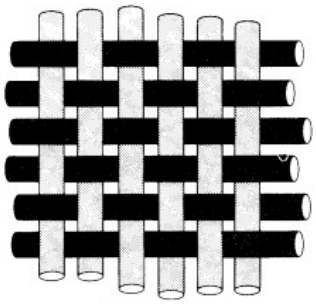
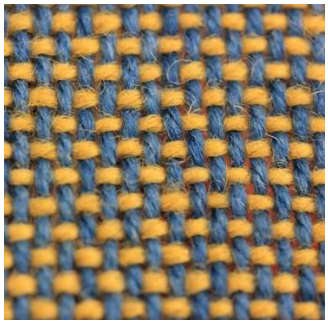
WEAVING

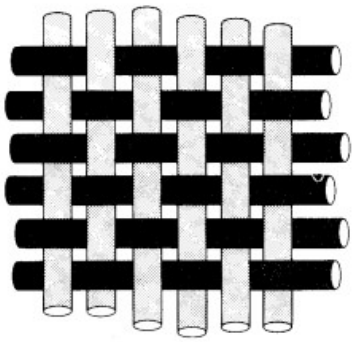


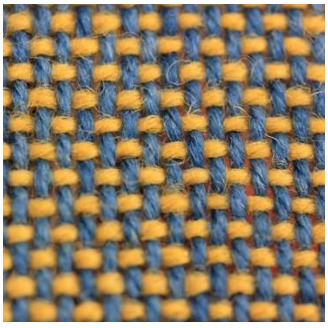




WEAVING

Weaving is the most popular method of fabric manufacturing and is generally done by **interlacing** two orthogonal sets of yarns – **warp** (or end) and **weft** (or pick) – in a regular and recurring pattern.





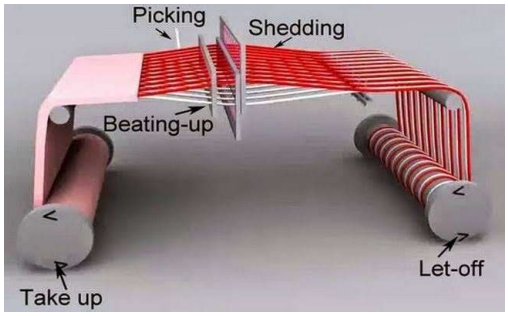
Commonly in shirts, trousers, denim, curtains, bedsheets, etc

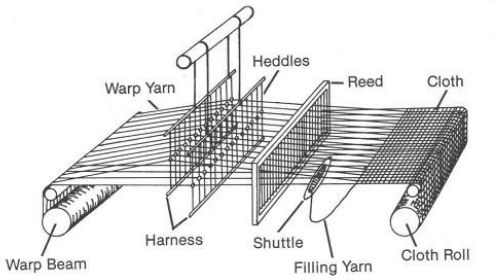
Weaving mechanism

Primary motions
1. Shedding
2. Picking
3. Beat up

Secondary motions
1. Take up
2. Let off

Auxiliary motions
1. Warp stop
2. Weft stop
3. Warp protector

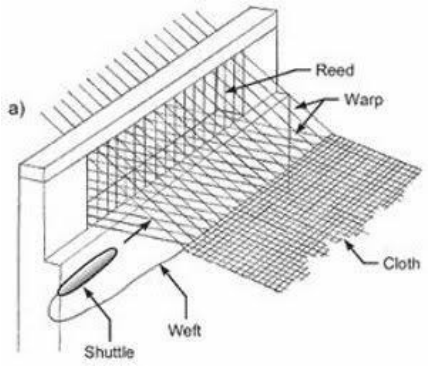


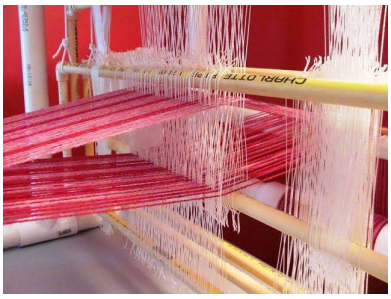


Weaving: Shedding

Shedding

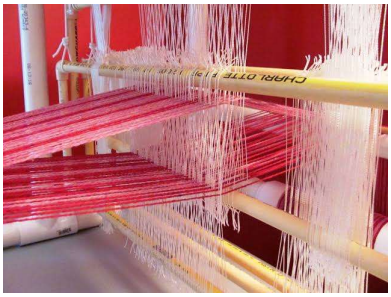
Shedding is the process by which the warp sheet is **divided into two groups** so that a clear passage is created for the weft yarn to pass through it.



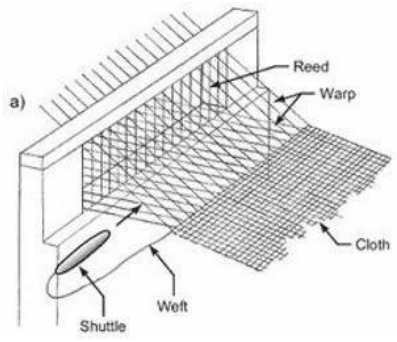


Shedding

One group of yarns either moves in the upward direction or stays in the up position, thus forming the top shed line.



Another group of yarns either moves in the downward direction or stays in the down position, thus forming the bottom shed line.

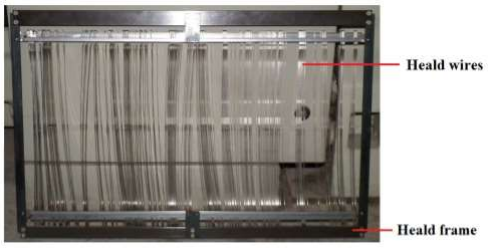


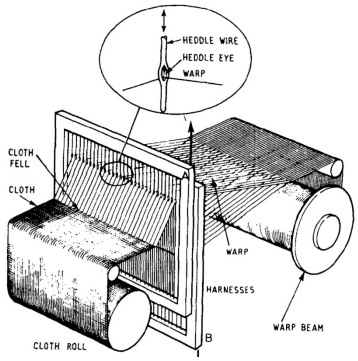
Shedding

Warp yarns are not controlled individually during the shedding operation (except Jacquard shedding)

Healds are used to control a large number of warp yarns.

The **heald frame** carries a large number of metallic wires known as **heald wires**.



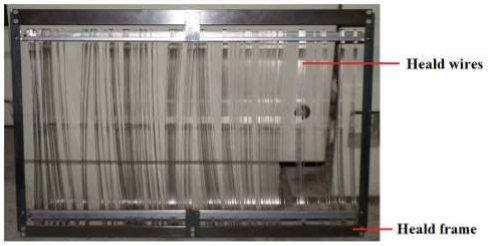


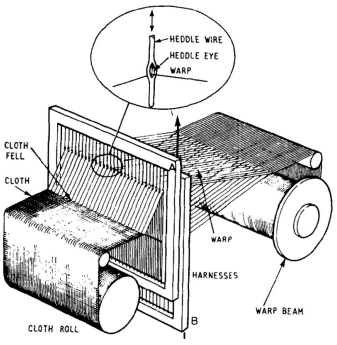
Shedding

Each heald wire has a hole, called **heald eye,** at the middle of its length.

The warp yarn actually passes through the heald eye.

Therefore, as the heald moves, all the warp yarns which are controlled by that heald also move.





Shedding

The upward and downward movements of healds are controlled either by cam or by dobby shedding mechanisms and associated heald reversing mechanism.

The movement of the healds is not continuous.

After reaching the topmost or lowest positions, the healds, in general, remain stationary for some duration. This known as 'dwell'.

In general, the shed changes after every pick, that is the insertion of weft.

Transmission of motions in loom

The revolution per minute (r.p.m.) of the crank shaft is equal with the loom speed (number of picks inserted per minute or picks/minute).

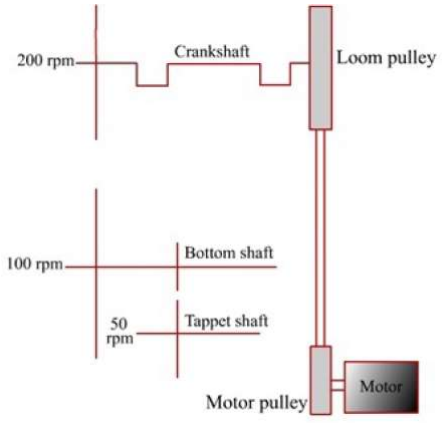


Figure 6.1: Transmission of motions in loom

Transmission of motions in loom

The primary motions, their frequency and controlling loom shaft for plain weave and 3×1 twill weave are given.

Table 6.1: Frequency of primary motions and controlling shaft for Plain weave

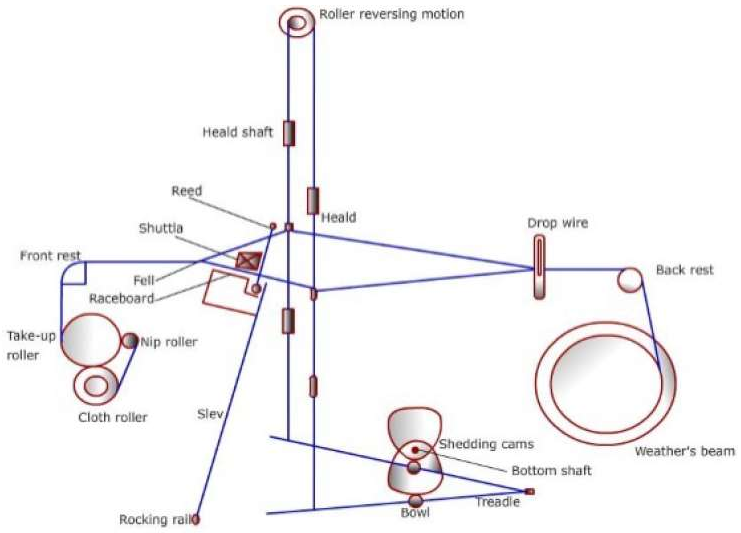
Operation cycle	Frequency of operation	Loom shaft
Shedding	Once/2 pick	Bottom
Picking	Once/2 pick	Bottom
Beat-up	Once/ pick	Crank

Table 6.2: Frequency of primary motions and controlling shaft for 3×1 twill weave

Operation cycle	Frequency of operation	Loom shaft
Shedding	Once/4 pick	Cam/tappet
Picking	Once/2 pick	Bottom
Beat-up	Once/ pick	Crank

Cam Shedding Systems

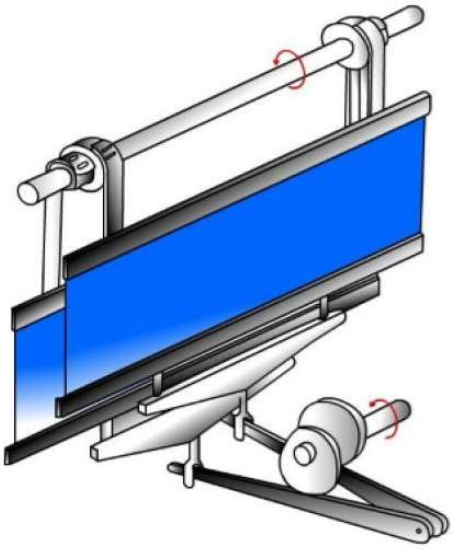
Two shedding cams controlling two healds through the treadle levers.



Cam Shedding Systems

➢For plain woven fabrics, two shedding cams are positioned at 180° phase difference.

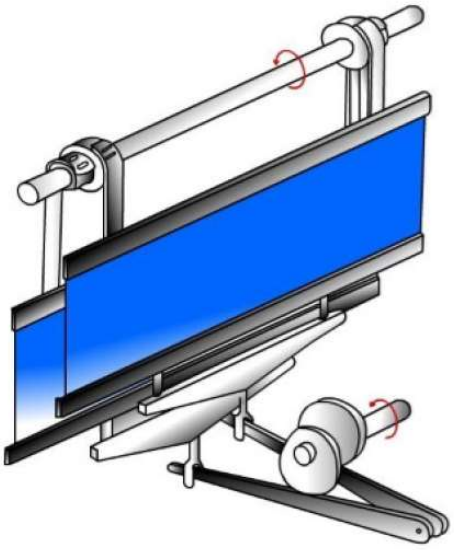
➢Therefore, when one cam pushes the treadle bowl in the downward direction, the other cam accommodate the upward movement of the other treadle bowl.



Cam Shedding Systems:Negative cams

➢Negative cams can control only the one part (50%) of the movement of the healds (downward movement).

➢The upward movement is ensured by the roller or spring reversing mechanism.



Cam Shedding Systems:Positive cams

Positive cams control the upward and downward movement of the healds.

Grooved cams **or** matched cams are generally used as positive cams

Positive Cam Shedding

Two types of system are available which ensures controlled lifting and lowering of healds.

i. Grooved cam

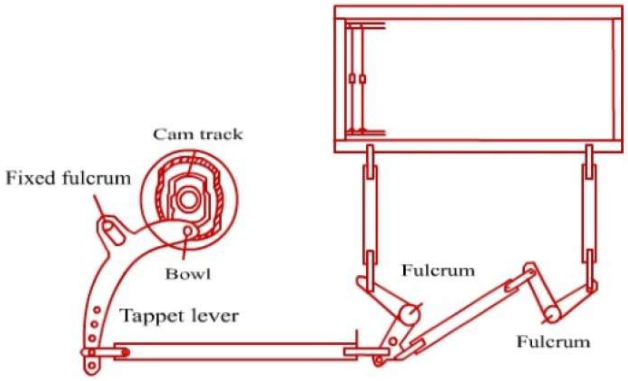
ii. Matched cam

No heald reversing motion is required

Grooved cam

When the cam rotates, the bowl moves upwards and downwards and this movement is translated into sidewise movement of lower end of tappet lever.

The heald is also raised and lowered by using levers and link systems.

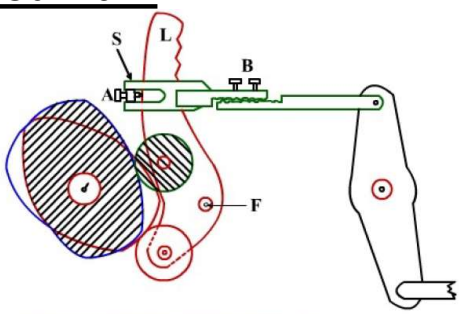


Matched Cam

When the shaded follower is touching the minimum radius of the corresponding cam, the un-shaded follower is touching the maximum radius of the corresponding cam.

This will cause the lifting of the heald through the connections.

The situation will be reversed when the cam shaft will rotate by 90°.



Design of Shedding Cams

The shedding cam has to be designed in accordance with the interlacement pattern (plain, twill, satin etc).

The design of the shedding cam influences following things:

✓Dwell time of shed

✓Movement pattern of heald during rise and fall

Types of Heald Movement

Depending on the types of heald movement, sheds can be classified under four categories.

i. Bottom closed shed

ii. Semi open shed

iii. Centre closed shed

iv. Open shed

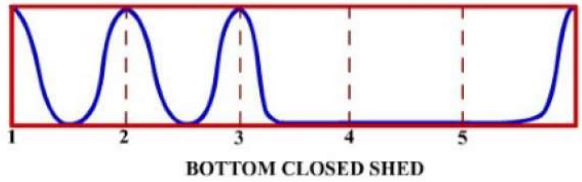
Bottom Closed Shed

All ends come to their lowest position after every pick to close the shed.

Even if the end is supposed to be in up position in two consecutive picks, the end will come to the bottom position

Unnecessary movements and thus wasted energy.

Example: Single lift jacquard produces bottom closed shed.



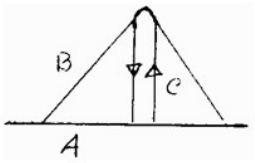


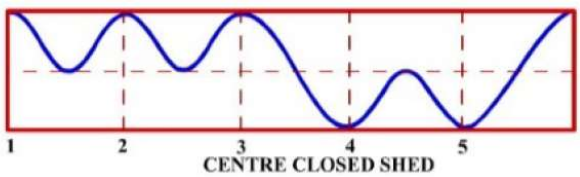
Figure. Heald movement pattern for 3 up 2 down twill

Centre Closed Shed

Shed closes at the centre (warp line) after every pick.

If the end has to be in up (or down) position in two consecutive picks, it will come to the middle position of shed depth between the two picks.

The amount of wasted movement is relatively low than bottom closed shed



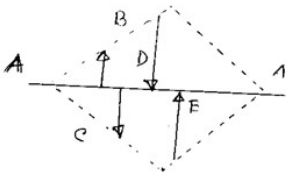


Figure. Heald movement pattern for 3 up 2 down twill

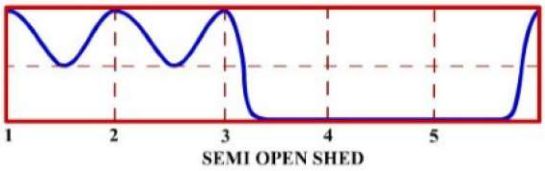
Semi Open Shed

All ends come to their middle level position (warp line) after every pick to close the shed.

However, if one end has to be in down position in two consecutive picks, it does not move at all between picks.

Lower wasted movement

Example: Double acting jacquard produces semi open shed.



SEMI OPEN SHED

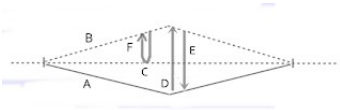


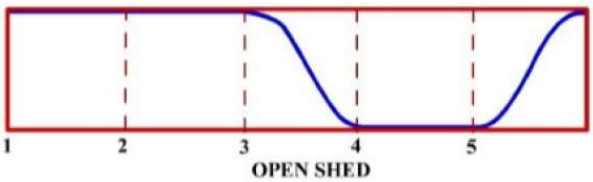
Figure. Heald movement pattern for 3 up 2 down twill

Open Shed

Ideal kind of shed and it minimises the wasted movements of the ends (or healds).

If the end has to be in up or down position in two consecutive picks, then it remains stationary between two picks.

Example: Keighley dobby



OPEN SHED

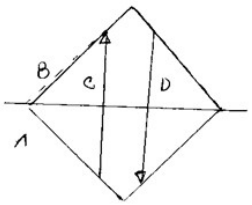


Figure. Heald movement pattern for 3 up 2 down twill

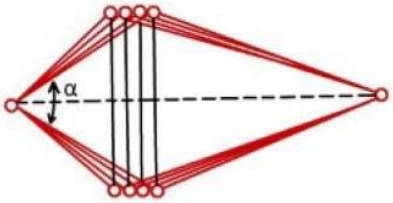
Indistinct (unclear) Shed

➢If the extent of vertical movement of the healds during shedding is same then indistinct or unclear shed is produced

➢Position of the top shed line is different for different healds.

➢Shuttle get lower amount of space through which it has to travel.

➢So, the possibility of abrasion and collision between shuttle and shed line is higher.



Indistinct shed

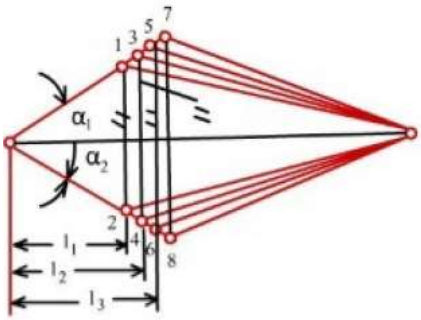
Distinct (clear) Shed

➢Position of top shed line at front part of shed is same irrespective of healds.

➢This type of shed formed when extent of vertical movement of healds during shedding is changed.

➢The first heald nearer to cloth fell, has minimum vertical movement and last heald has maximum vertical movement.

➢The shuttle gets more space to travel



Distinct shed