Advance Weaving Technology

Unit-1 Basic understanding of shuttle less approach in weaving machine

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Subject Name : Advance Weaving Technology

Plan of Lecture

Lecture no.	Title
1	**Unit-1 Basic understanding of shuttle less approach in weaving machine**
2	Limitation of shuttle weaving machines
3	Principle of shuttle less weaving machine operation
4	Classification of shuttle less weaving machine
5	Comparative study of various systems of weft insertion
6	Attributes of shuttle less weaving machine
7	Brain storming session for unit 1

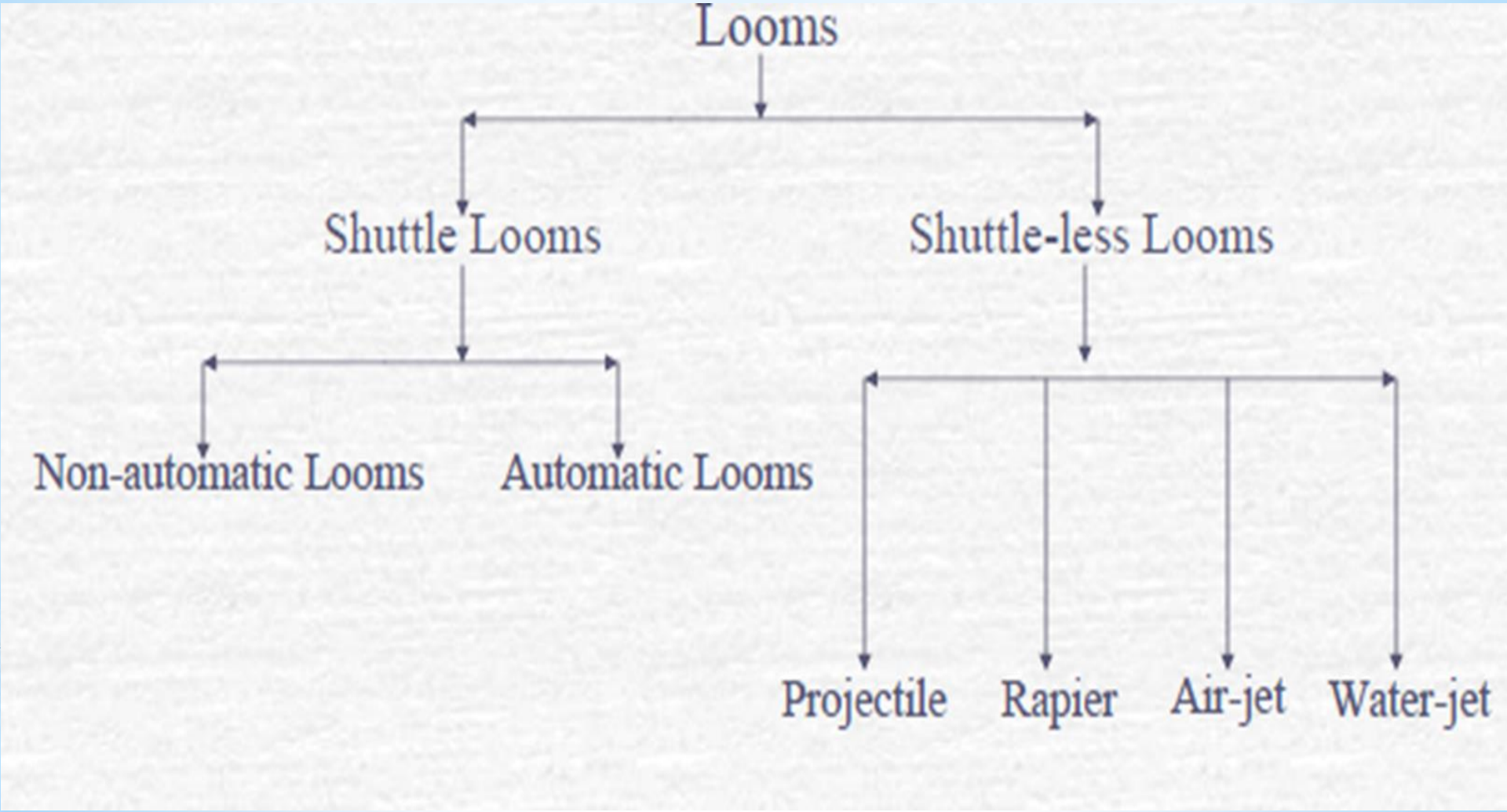
Looms

Loom is machine or device which is used to produce woven fabric. It is the central point of whole process of fabric production.

The basic purpose of any loom is to hold the warp threads under tension to facilitate the interlacement of the weft threads. The precise shape of the loom and its mechanics may vary, but the basic function is the same.

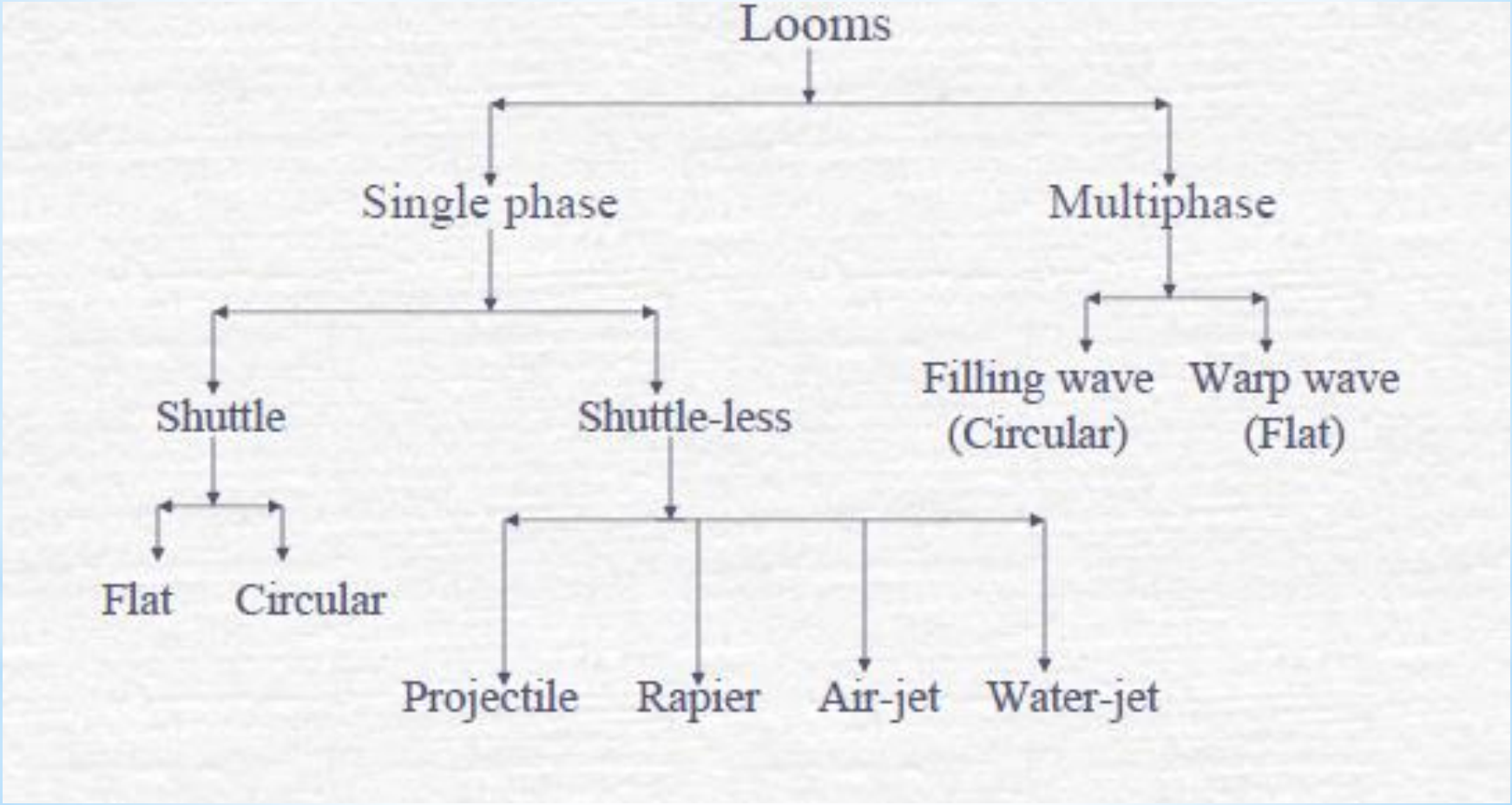
Classification of looms

(Based on weft insertion system)

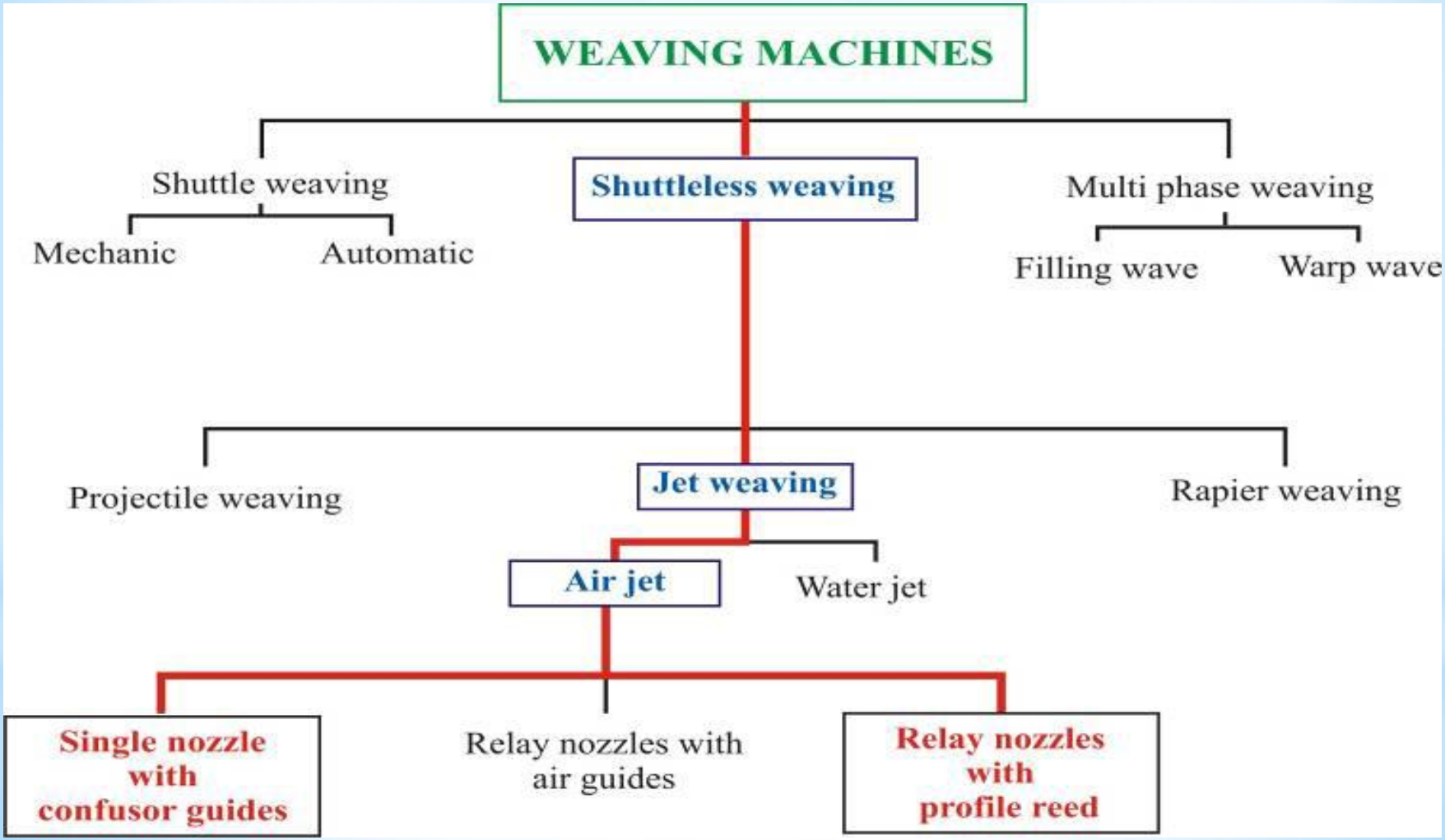


Classification

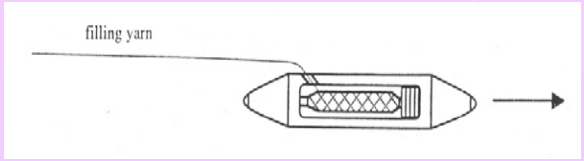
(Based on number of phases)



Classification of looms

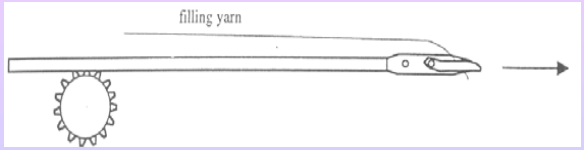


Weft Insertion Systems in Looms

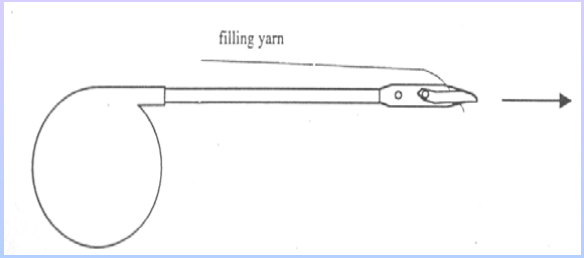


Shuttle

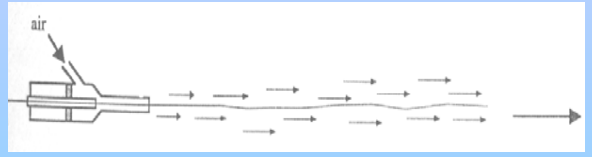
Projectile



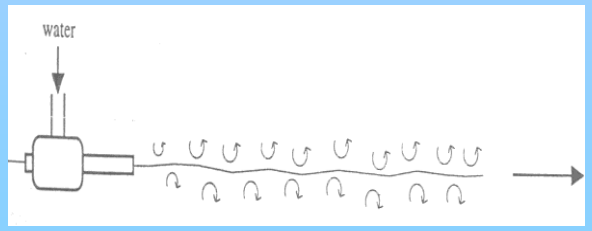
Rigid rapier



Flexible rapier



Air-jet



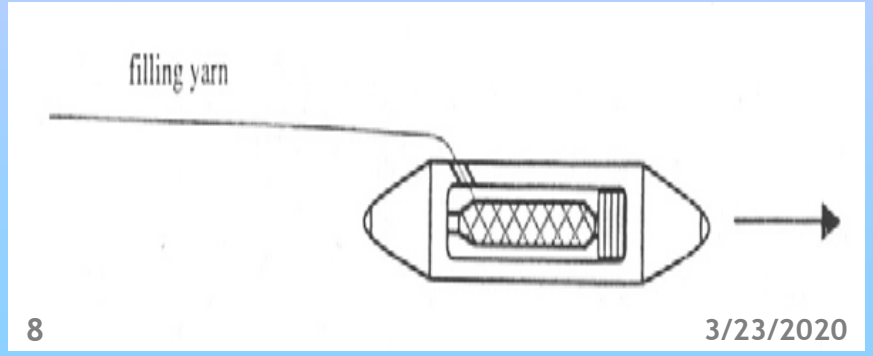
Water-jet

Shuttle Looms

The shuttle loom is the oldest type of weaving loom which uses a shuttle which contains a bobbin of filling yarn that appears through a hole situated in the side.

A conventional shuttle performs three functions;

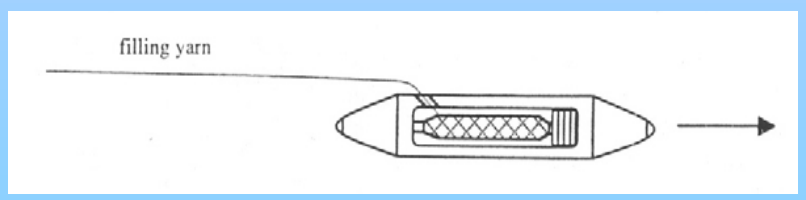
- it stores a certain length of weft within its hollow in the form of a pirn,
- transports this package across a warp shed
- permits the desired length of pick to be unwound smoothly from the pirn stationed within its hollow.



Shuttle Looms

Picking mechanisms of the shuttle loom have two inherent disadvantages, which prevent them from achieving higher rates of weft insertion.

- In the first instance, they insert weft during only a fraction of the pick cycle.
- The rate of weft insertion is limited by the mechanical problems and the extent of the dynamic forces involved in picking and checking. These problems have in many instances been responsible for the extensive efforts that have been put into developing alternative methods of weft insertion.



Disadvantages of Shuttle Looms

- A large shuttle mass of about 450g (for cotton weft yarn) is employed for transporting a pick of weft which is about 0.2 g/m on the average, leading to a considerable waste of energy High energy consumption
- Unguided free flight of shuttle can lead to shuttle fly, abrasive damage of reed and shuttle as also uncontrolled weft tension
- Mass of shuttle with full pirn and with near empty pirn can differ by about 10%. As a result the nature of shuttle flight varies in a periodic manner which in turn affects weft tension profile and therefore properties of the resultant fabric.

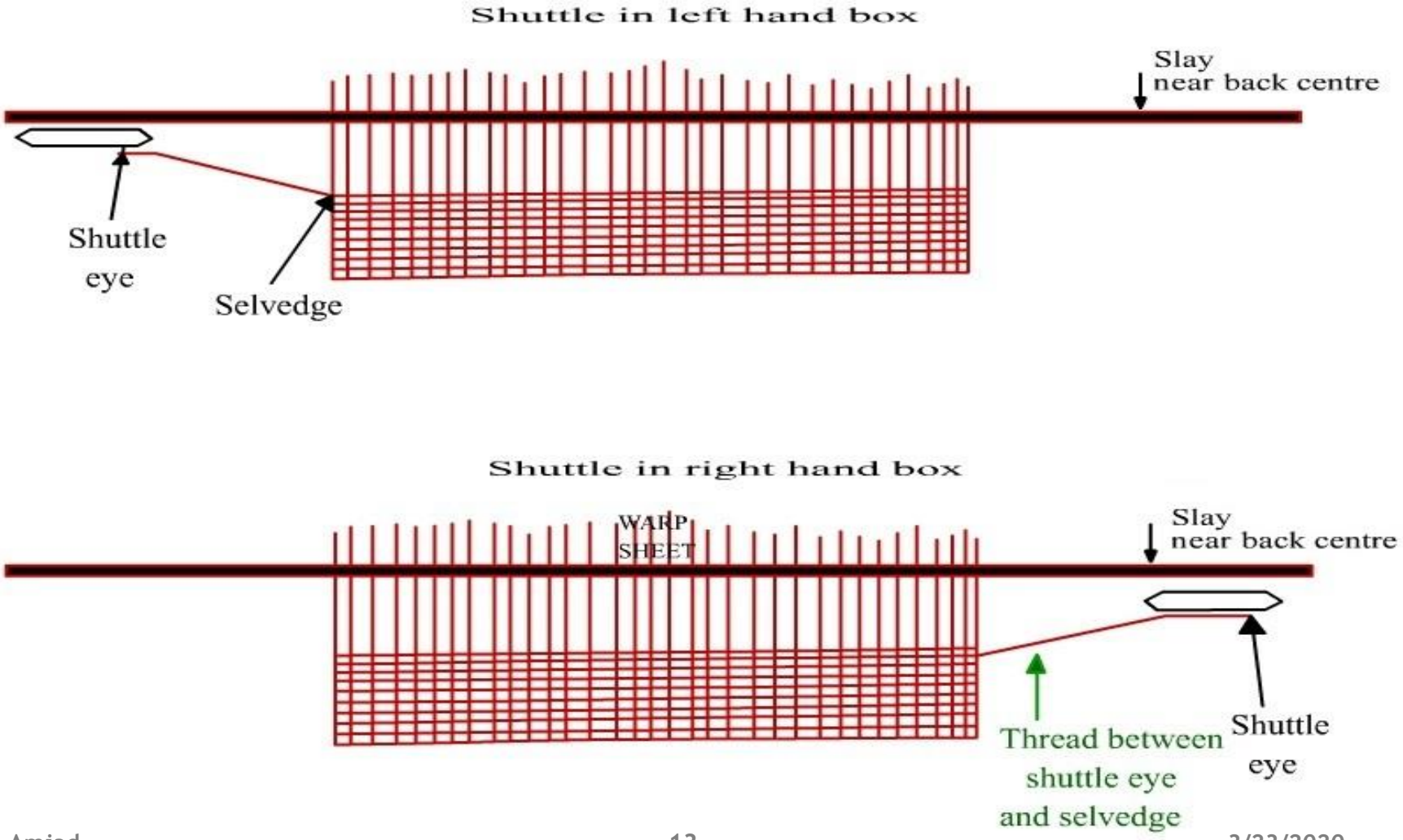
Disadvantages of Shuttle Looms

- Noise emanating from weft insertion systems employing a conventional shuttle can be as high as 110dB
- Shuttle is made of an assembly of various elements which may come apart over a period of time due to multiple and severe impactual cyclic loads. Moreover the major component of shuttle is good wood which is becoming scarce by the day.
- More defects in fabric
- Limited space within shuttle limits pirn size which leads to frequent pirn changing. This is a source of additional workload and frequent defects. A plain loom stops running when a pirn is exhausted. Leads to More downtime

Disadvantages of Shuttle Looms

- While a shuttle is in state of rest within a shuttle box, the weft thread that it carries in the pirn extends from the instantaneous unwinding point on the pirn body, passing through the shuttle eye and ending up at the fabric selvedge.
- It is observed from Fig. from next slide that due to asymmetric location of shuttle eye on the shuttle body, length of this thread segment is higher when the shuttle is in the right hand box than when it is in the other. Thus as the shuttle is accelerated from its state of rest in a shuttle box, the weft thread initially falls slack and remains in such a condition till the shuttle has travelled a fair distance into the shed to have completely taken up this slack. Evidently the distance that the shuttle has to travel before the weft thread can become taut again is higher in alternate picks than in the intervening ones.
- More maintenance cost/time, more man power requirement
- More wastage, More vibration of machine parts

Disadvantages of Shuttle Looms



Concept of Shuttle-less weaving

- Power consumed by shuttle during its acceleration phase is proportional to the product of its mass and (loom rpm)3,
- A lowering of shuttle mass can be translated into higher loom speed and hence higher loom productivity.
- Moreover smooth passage of a large shuttle through the confined space within a warp shed and over a large reed width demands a high sweep as also high eccentricity of sley, factors that adversely affect loom speed.
- Hence a reduction in mass and dimensions of shuttle provides an efficient route to raising loom productivity.

Concept of Shuttle-less weaving

- Mass of a conventional shuttle can be reduced by reducing its dimensions and by opting for a lighter and stronger material.
- The first option would aggravate problems related to pirn changing while the second solution has not found any commercial acceptance. An elegant solution to this vexing issue is found in the unconventional, i.e. the so called Shuttleless weft insertion systems.

Objective to develop Shuttle-less weaving

- To eliminate the heavy weight weft carrier.
- To eliminate unnecessary to & fro movement.
- To eliminate the movement of entire weft package.
- To minimize power consumption in picking.
- To improve quality of woven fabric.
- To improve productivity.

Approach of Shuttle-less weaving

1. **Reduction in mass and size of carrier**

- The weft carrier can be drastically reduced in mass and size leading to reduced consumption of energy per pick. Alternately supplying same power to carrier as to one with higher mass enables the lighter carrier to travel a longer distance. This translates into higher reed width of loom for equivalent picking power.
- A reduction in carrier size automatically leads to reduction in shed depth and sweep of sley. Reduction in shed depth suppresses amplitude of dynamic load on warp threads and permits a higher frequency of shed change while reduction in sweep of sley promotes higher frequency of sley oscillation. Higher frequencies of shed change and sley oscillation mean a higher loom rpm.
- Conclusion is, a loom employing unconventional principle of weft insertion can be run at higher speed with a wider reed. This effectively translates into a higher weft insertion rate and hence higher productivity.

Approach of Shuttle-less weaving

2. Weft supply system out from loom frame

- Being stationed outside the oscillating sley, weft supply package remains visible and accessible while weaving continues. Such a scenario permits intervention of suitable control systems for switching weft supply from an exhausted to a full cone. This literally guarantees inexhaustible weft supply, contributing to higher loom efficiency. Moreover intervention of suitable control systems operating from within the weft supply zone ensures controlled tension in inserted picks.

3. Continuous and effective control of weft tension

- Unwinding of weft from a pirn stored within the hollow of a conventional shuttle during a picking cycle is governed by the location of shuttle at any instant of time. As a result, tension in an inserted pick of weft varies from one segment to the other in an uncontrolled manner. The nonconventional weft insertion systems permit a continuous and effective control of weft tension, a superior fabric quality.

Advantages of Shuttle-less weaving

- The problems of shuttle loom are the weft yarns are placed inside the shuttle. The shuttle is big and heavy and the machine speed is low and noisy to operate. In addition, a new pirn must be inserted to the empty shuttle for continue operation.
- Shuttleless looms eliminate these problems by placing the cone of yarn at the side of the loom.
- Shuttleless weave 2 to 4 times as much as conventional looms per unit time.
- The cost of pirn winding is eliminated.
- Strain upon the warp threads is reduced due to smaller depth of shed.
- Heavy cost of repairs and replenishment of worn out parts is reduced.
- The physical and mental strain upon the weaver is reduced.

Advantages of Shuttle-less weaving

- There is no risk of shuttle fly out owing to the absence of conventional shuttle and packing being positive.
- Quality of the fabric gets enhanced because of a positive control over the weaving process.
- Higher production per loom.
- Speed is not the only criterion for the selection of shuttleless looms. Efficiency is also an important criterion. Efficiency advantage of 10-15% due to shuttle changes, Un weaving of damages, reduced time for warp changes can be obtained from shuttle less looms. 5% higher efficiency would provide an additional profit of Rs. 1/- per meter.

Commercially Shuttle-less weaving

Commercially successful shuttleless weft insertion systems can be categorized with respect to the nature of carrier and its flight through warp shed.

- A carrier may either be solid or fluid
- Its flight may be positively controlled, partially guided or absolutely

THANK YOU