

## Secondary motion: -

- ✓ These mechanisms are needed for a continuous weaving operation. They cause the material to move forward on the weaving machine.
- ✓ It is essential operation in order to have continuous weaving Process.

It includes:

(i) **Warp let-off:** Delivering the warp to the fabric formation zone at the required rate and a suitable constant tension by unwinding it from the weavers beam

**Let off:** Releasing the warp sheet from the weaver's beam in a controlled manner with uniform tension and speed.

- ✓ The let-off motion delivers the warp to the weaving area at the required rate and at constant tension by unwinding it from the weaver's beam. The secondary motions are carried out simultaneously. The speed of the servo motor is transmitted to warp beam gear via reduction gear, thus driving beam.
- ✓ The function of let-off is to feed the warp sheet at the required rate to the cloth formation zone and keep constant warp tension from the start to the end.
- ✓ Warp tension assists beat-up (pick spacing), to form clear shed, and to avoid entanglement among warp ends.
- ✓ If the tension of the warp is high, it increase the end breakage rate and decreases warp crimp/ increases weft crimp which results instable crimp condition and leads to contraction the width of the fabric; whereas, if the warp tension is low, improper shed opening (entanglement of warps) and beat-up will occur which also results loose fabric structure.

**Warp let-off motion can be classified as:**

1. **Negative let-off** in which withdraw the warp sheets against frictional force and the system is adjusted manually.
2. **Semi-positive let-off** in which the rate of withdrawal depends on some sensing mechanisms for warp tension i.e. if feeding warp is required, warp tension will be increased but difficult to get feed of warp on every pick.
3. **Positive let-off** in which constant warp tension throughout the weavers beam and exact amount of warp feed on every pick.

**Beam driving mechanism:** the movement of the back roller as it senses changes in the length of warp between the fell and the beam to be converted into changes in the rate of rotation of the beam so as to restore the warp length to its original value.

**The choice of let-off motion depends on the type of fabric woven.**

- With heavier fabrics, warp tension is more critical and, therefore the deadweight type of let-off appears preferable because it keeps warp tension constant at the expense of the cloth fell position.

- With lighter fabrics, the cloth fell position is more critical and the break type let-off appears preferable, since it keeps the cloth fell position more constant in return for a fall in a warp tension.
- **Warp beam:** This is also known as the weaver's beam. It is fixed at the back of the loom. The warp sheet is wound on to this beam. The length of warp in the beam may be more than a thousand meters.
- **Back rest (back beam):** It is placed above the weaver's beam. To control the warp yarn tensions that properly feeding in the weaving area.

**Backrest:**

1. Floating- for guidance
2. Fixed- for guidance & sense tension of warp

When the tension of warp increases, the backrest deflect as a result warp beam take more yarn (cloth take-up increases)

- **Guide roller:** to support the warp sheet

(ii) **Cloth take-up:** Moving the fabric from the fabric formation zone at the constant rate and winding the fabric on a cloth roller

Take up: Winding of the woven fabric onto the cloth beam.

Done with Wheel take up/Positive take up motion.

- ✓ The function of the take-up motion is to withdraw the fabric from the weaving area at a constant rate that will give either uniform pick-spacing or uniform density of weft and wound onto the cloth roller.
- ✓ The take-up motion controls the rate at which the cloth is drawn forward, and its function may be to secure either uniform pick-spacing or uniform density of weft (i.e. the same bulk or weight per unit length of weft every along the cloth).
- ✓ In most cases, uniform pick spacing is the objectives of positive take-up motion. Uniformity of pick spacing is important in most cloths, and especially in those made from uniform yarns because the more uniform the yarns, the more likely are variations in pick-spacing to produce visible faults in the fabric.
- ✓ Weft yarns are very irregular (e.g. some woollen yarns) and if the cloth is to be heavily milled and raised, it may be preferable to try to achieve uniform weft density. In this case negative take-up motion can be used because yarn irregularities tend to mask variations in pick-spacing.
- ✓ Neither objective will be achieved if the warp tension is allowed to vary. It is the function of the let-off motion to control the warp tension, so to achieve they required result and hence both the take-up and the let-off motions must be functioning correctly.
- ✓ When the reed comes forward, it will stretch the cloth at the fell. This will result in severe rubbing of the ends near the selvages by the wires of the reed. Weaving cannot proceed under these conditions. We therefore use temples to keep the cloth near the fell stretched to reed width, or as near to it as possible. With efficient templing, we have the condition shown in Fig. C and D as the reed moves to and fro. Contraction at the fell is prevented, and rubbing of the ends near the selvages is greatly reduced. The picks are now under

high tension until they are clear of the temples, and the weft crimp near the fell is very low.

- ✓ In weaving fabrics with the normal range of weft cover factors, such as are necessary to produce a firm cloth, the required pick-spacing cannot be achieved unless the reed exerts some substantial pressure on the fell at beat-up. This is called the beat-up force. Now, the reed can exert pressure on the fell only if the fell offers resistance to displacement. This is called the weaving resistance. The beat-up force and weaving resistance are equal and opposite.
- ✓ If the displacement of the cloth fell by the reed at beat-up is sufficiently large, the cloth tension at beat-up will be reduced to zero, and the cloth will be momentarily quite slack which is known as **Bumping condition**. It is easily recognized by the noise the cloth makes and detected by placing the fingers on the cloth near the fell. This can be controlled by increasing the basic warp tension, and hence the basic cloth tension, so that the cloth can sustain a larger displacement of the fell without becoming sack.

**There are three main sources of variations in picking-spacing:**

- a. Take-up motions
- b. Let-off motion; and
- c. Loom stoppages

Any variation in the rate of take-up must cause of a change in cloth-fell position and therefore a change in pick-spacing and mainly due to mechanical imperfections, such as eccentric or eccentrically mounted rollers or gear wheels, and from worn or incorrectly shaped teeth.

Take-up can be classified as:

|                  |   |                       |
|------------------|---|-----------------------|
| Negative take-up | ⇒ | Constant weft density |
| Positive take-up | ⇒ | Uniform pick-spacing  |

### **1. Negative take-up motion**

The negative take-up is controlled by warp tension and its applications are very much limited. The weights are raised as the slay moves towards the back of the loom and remain suspended out of contact with the lever as the slay moves forward.

- At beat-up, the weights are therefore floating since they are not heavy enough to turn the ratchet wheel.
- As the reed displaces the cloth fell, the cloth tension falls, and the weights are now able to turn the ratchet wheel by an amount that will depend on the thickness of the pick being beaten-up.

### **2. Positive take-up motion**

The cloth is drawn forward by frictional contact with the emery covered take up roller is positively driven through a number of gear wheels at a uniform spacing.

Positive take-up motions can be classified as in the following way:

1. **Continuous** (worm and- worm-wheel drive), indirect which is common in wollen and worsted weaving but is much less popular in weaving cotton and continuous-filament yarns.
2. **Intermittent** (pawl-and-ratchet-wheel drive) which can be use:
  - a) **Indirect system:** in which the cloth being wound up onto a separate roller.
  - b) **Direct system:** in which the cloth may be wound directly onto the driven roller. Here the rate of rotation of the driven roller has to be reduced progressively as the cloth builds up so as to maintain a constant linear rate of take-up and therefore relatively uncommon.

### Investigation on the nature of positive take-up

All types of positive take-up motion make use of spur gears and also sometimes of a worm and worm wheel. If any wheel in the train of gearing is eccentric or eccentrically mounted, or if the teeth are worn or badly designed, periodic variations in pick-spacing will result.

The factors which determine whether the periodic variations are likely to produce serious faults in the fabric are:

- The type of yarns and the fabric being woven
- The severity of the mechanical fault, and
- The wavelength of the faults in the fabric.

### The seven wheel positive take-up motion

Train of gears is used in the take-up motion to reduce the speed of the take up roller. However, if these gears have faulty in design, eccentricity and damaged teeth, it leads to periodic variation in pick spacing. A periodic variation in picks spacing in fabric results a defect known as 'barre'.

- In a conventional power loom, the way to obtain a desired pick-spacing is to make the rate of the cloth take-up per pick equal to the pick-spacing by suitable adjustment of the take-up motion. During normal weaving, the amount of fabric woven is increased by a length equal to the desired pick-spacing at beat-up, and the function of the take-up motion is to take-up this length so as to ensure that the cloth fell stays in the same position.

Thus the function of the take-up motion is to maintain a constant cloth fell distance when pick-spacing is correct, and to cause a change in the cloth fell when the pick-spacing is incorrect.

- ✓ **Cloth take-up roller:** - to withdraw the woven fabric from the weaving area.
- ✓ **Spreading roller:** - to press the fabric with the take-up roller to get proper fabric tension.
- ✓ **Cloth wind up roller:** - To withdraw the fabric from the weaving area at a constant rate that will give either uniform pick-spacing or uniform density of weft and wound onto the cloth roller.
- ✓ **Changeable gears:** - to arrange the required density of the fabric by changing the gears.
- ✓ **Front rest:** guide the warp