

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 box **reduces** the speed of the loom by **10%** as compared to shuttle plain loom

- Some of **the common fabrics** produced on looms by using **multiple box motions** are

- Weft striped
- Check
- Extra weft figured effects
- Crepe
- Georgette
- Double cloth
- Pique and certain varieties of towels, napkins and handkerchiefs

Classification of multiple box motions

- Multiple box changing motions can be classified into **two main system** as
 - **Circular box system**
 - **Drop box system**
 - Boxes on **one side**
 - Boxes on **both sides**
 - Box motion can be **negative or positive** type, the most common being **negative** type

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

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 through 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