2.4 Drawing In

The sized warp sheet is wound on to a beam called as the weaver's beam. It has the required number of ends and the yarns have adequate strength to bear the tensions of weaving process on loom. This beam is either used for drawing in or knotting / tying, depending on the requirement (Fig. 7).

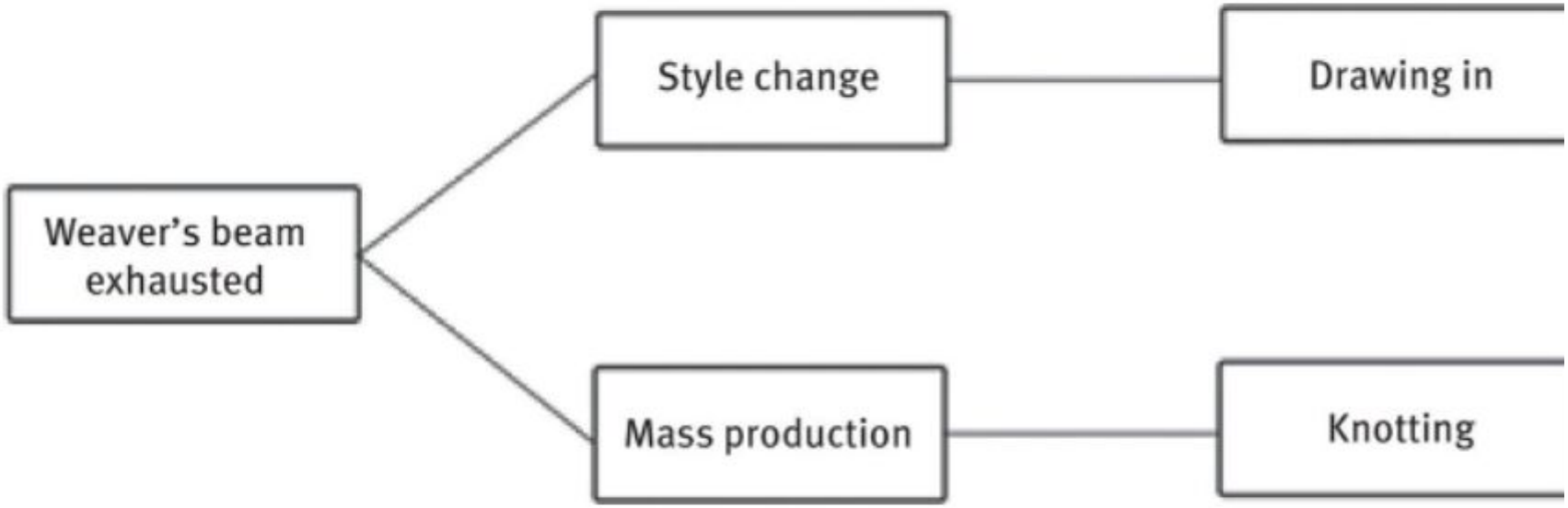

Fig. 7

Drawing in / knotting procedure.

Style change involves the production of a new fabric style, while mass production means to continue the weaving of same fabric style just replacing the empty beam with a full beam of same type. Drawing in is the process of entering the individual yarn of warp sheet through dropper, heald eye and the reed dent (Fig. 8). The yarns can be threaded wither manually or by using automatic machines.

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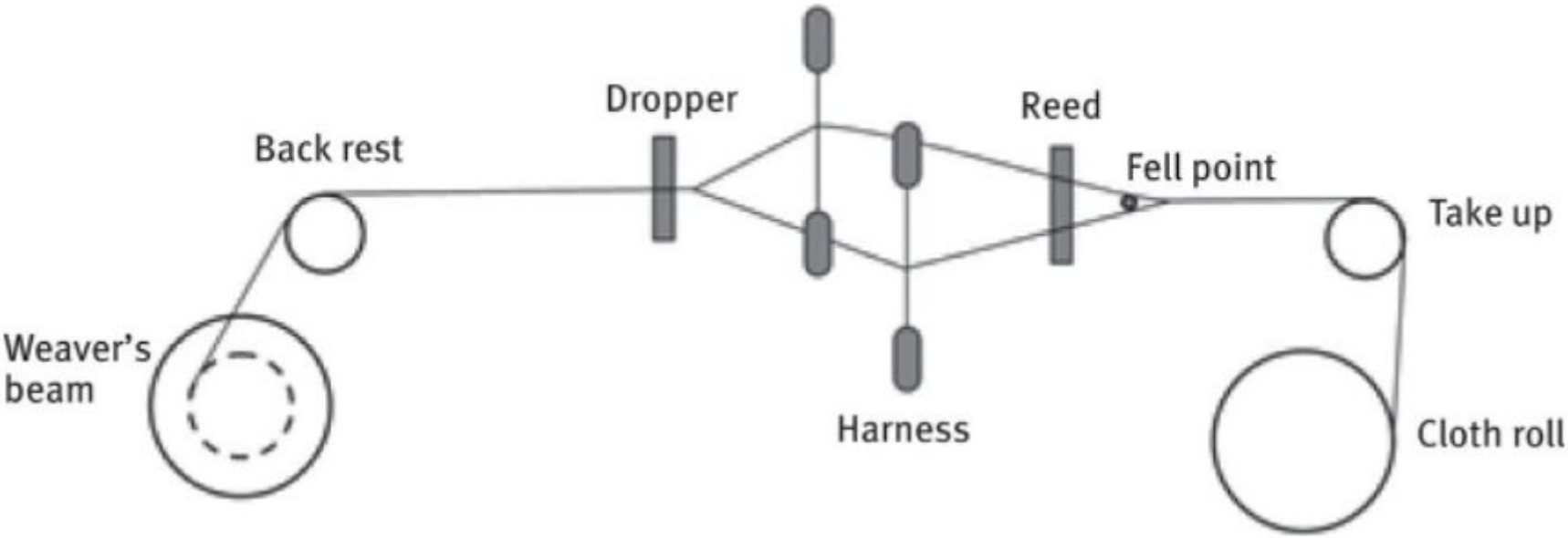


Fig. 8

Drawing in schematic and yarn path.

The yarn is now fully prepared for conversion into the fabric, which takes place at the loom. The weaver's beam is gaited on the loom, while weft yarn is provided at right angle either from cone or bobbin depending on the picking media.

3 Weaving Mechanisms

The conversion of warp sheet into fabric by interlacing with weft yarn requires the basic operations to be carried out on loom in a specific order. It involves the primary motions, secondary motions and the stop motions [5].

3.1 Primary Motions

The primary loom motions include the following three operations:

Shedding: the separation of the warp sheet into two layers to form a tunnel known as the shed

Picking: insertion of weft yarn, across the warp sheet width, through the shed

Beat-up: pushing the newly inserted length of weft (pick) to the fell of cloth. These operations occur in a given sequence and their precise timing in relation to one another is of extreme importance.

3.2 Secondary Motions

The secondary motions facilitate the weaving of fabric in a continuous way [6]. These include:

Let off: this motion provides warp sheet to the weaving area at the required rate and under constant tension by unwinding it from weaver's beam

These motions are used in the interest of quality and productivity; stopping the loom immediately in case of some problem. The warp stop motion will stop the loom in case any warp yarn breaks, avoiding excessive damage to the warp threads. Similarly weft stop motion will come into action in the absence of weft yarn, and stop the loom.

4 Types of Shedding Mechanism

There are three most common types of shedding mechanisms, namely Tappet, Dobby and Jacquard shedding [7]. Tappet and dobby systems control heald frames while jacquard provides control of individual warp yarn.

4.1 Tappet Shedding

This system is also termed as cam shedding. The cam is an eccentric disc mounted on the bottom shaft, rotating to lower or lift the heald frame. It is relatively simple and inexpensive system handling up to 14 heald frames [8]. But this system has very limited design possibilities and pick repeat, producing simple weaves.

4.2 Dobby Shedding

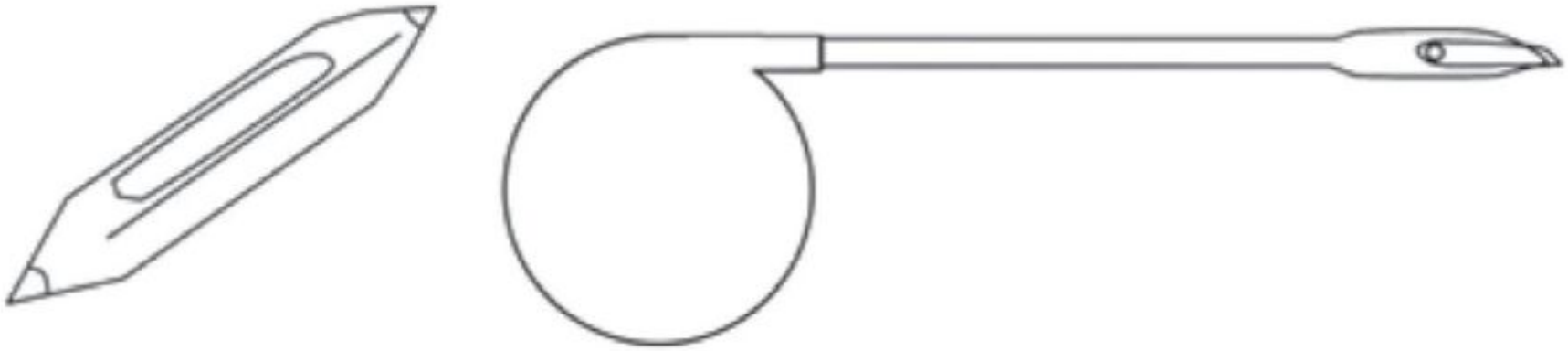
It is a relatively complex shedding system and can control up to 30 heald frames. The pick repeat to dobby system is provided by peg chain, punched papers, plastic pattern cards or computer programming, and is virtually unlimited. This system offers more design possibilities as compared to tappet shedding.

4.3 Jacquard Shedding

The jacquard shedding provides unlimited patterning possibilities. The working principle is relatively simple but involves more number of parts that make it a complex machine. Versatility of jacquard shedding is due to control over individual warp yarn. The jacquard shedding system can be either mechanical or electronic.

5 Types of Picking Mechanism

Picking involves the insertion of the weft yarn through shed across the width of warp sheet. The picking mechanism is mainly a function of the picking media, used for the insertion of weft (Fig. 9). The picking media vary greatly on the basis weft velocity and the insertion rate; and are classified into shuttle and shuttle-less picking.



5.1 Shuttle Picking

It is the oldest technique of weft insertion on loom. The picking media is a wooden shuttle that traverses back and forth across the loom width. A pirn or quill having yarn wound on it is placed inside the shuttle. As the shuttle moves across, the yarn is unwound and placed in the shed. A picking stick on each side of loom helps to accelerate the shuttle by striking it. Shuttle travels on the race board, above lower portion of the warp sheet. The shuttle picking takes place from both the sides of loom.

5.2 Projectile Picking

Introduced first time by Sulzer in 1952, this machine uses a small metallic projectile along with gripper to throw the wet yarn across the loom width. The energy required for propulsion of projectile into the shed is provided by twist in the torsion rod. The projectile glides through guide teeth in the shed. It had low power consumption, versatility of yarns and a higher weft insertion rate as compared to the shuttle picking system.

5.3 Rapier Picking

This picking system uses a rigid or flexible element called rapier for the insertion of weft yarn across the shed. There are two major variations in the rapier picking; single rapier and double rapier. In case of single rapier picking system, the rapier head grips the weft and carries it across the shed to receiving end. The rapier has to return empty to insert the new weft. The double rapier picking makes use of two rapiers [9]. One rapier (giver) takes yarn to the centre of machine and transfers it to the other rapier (taker), which

The water jet picking involves the insertion of weft yarn by highly pressurized water. This pressurized wate takes the form of a coherent jet due to the surface tension viscosity of water. The flow of water has three phases: acceleration inside pump, jet outlet from nozzle and flow into the shed. The amount of water used for the insertion of one pick is less than 2 cm^3. This system is mostly preferred for the synthetic yarns.

5.5 Air Jet Picking

In air jet picking system, the weft is inserted into the shed by the use of compressed air. The yarn is taken from the supply package / cone and wound on to the feeder before insertion to avoid tension variations. The weft is then passed through the main nozzle which provides initial acceleration to the yarn. The auxiliary nozzles are present at specific distance along the width to assist in weft insertion. A special type of reed, called profiled reed is used for air jet picking. The channel in the reed guides the yarn across the shed and avoids entanglement with warp. It has an extremely high weft insertion rate.

6 Weave Design

The woven fabric is produced by interlacement of warp and weft, and this interlacement pattern is called weave design of the fabric [10]. The three basic weave designs are plain, twill and satin.

6.1 Plain

The simplest interlacing pattern for warp and weft threads is over one and under one as shown in Fig. 10. The weave design resulting from this interlacement pattern is termed as plain or 1 / 1 weave. The 1 / 1 interlacement of yarns develops more crimp and fabric produced has a tighter structure. The plain weave is produced using only two heald frames. The variations of plain weave include warp rib, weft rib and matt or basket weave.

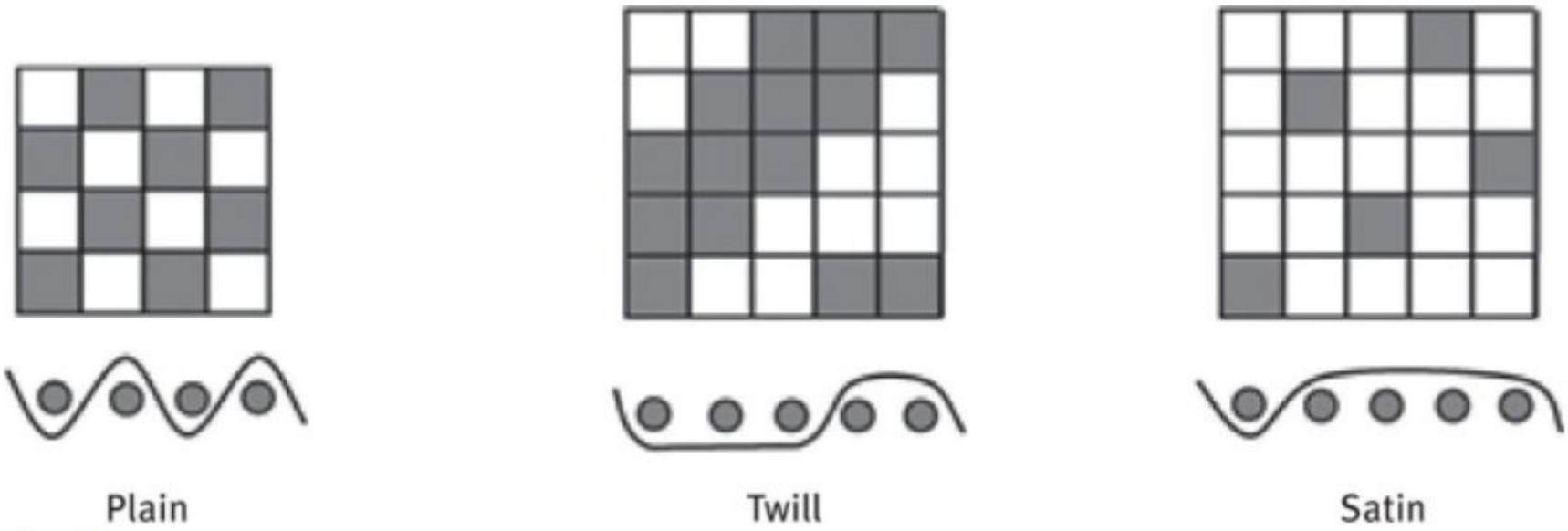


Fig. 10