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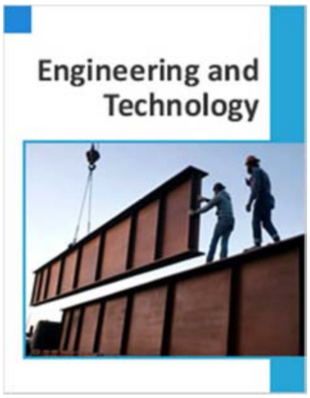


# Exploration of the Advancement in Warp & Weft Stop Motion: Primitive to Electronic System

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## Abstract

The primary function of a stop motion is to put off the loom when there is a thread breakage of warp or weft. Stop motions are obligatory for a weaving machine in order to weave a faultless fabric. Two Types of stop motions available; they are warp stop and weft stop. These stop motions are part of Auxiliary or Tertiary Motion of a loom. The main purpose of this paper is to find out the inadequacies of all stop motions and consequent development of newer version. Nonetheless, in this paper all types of motions and their comparative study is provided which will help upcoming explorer.

## 1. Introduction

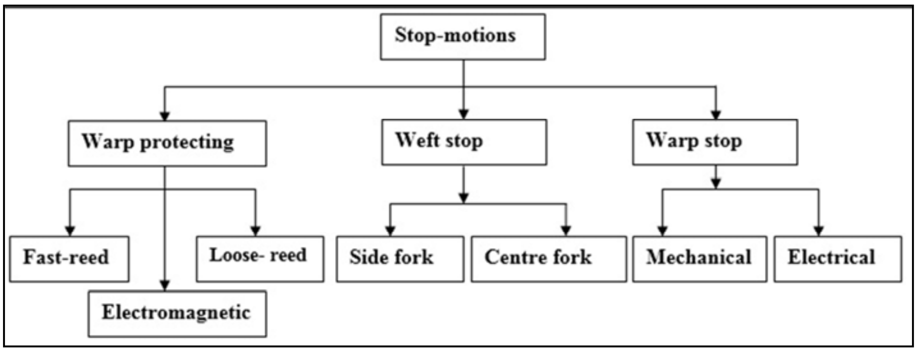



***Figure 1.*** *Types of Stop Motion [1].*

## 2. Literature Appraisal

### 2.1. Weft Stop Motion

This stop motion enables the loom to immediately stop after a weft is broken or weft running out. The weft stop motion controls the correct insertion of the weft into the shed that is whether the weft has broken or be too short to reach the opposite end of the shed (short weft). [2]

There are two types of weft stop motions on a conventional weaving machine.

- Side weft fork motion
- Centre weft fork motion [3]

### 2.1.1. Side Weft Fork Motion

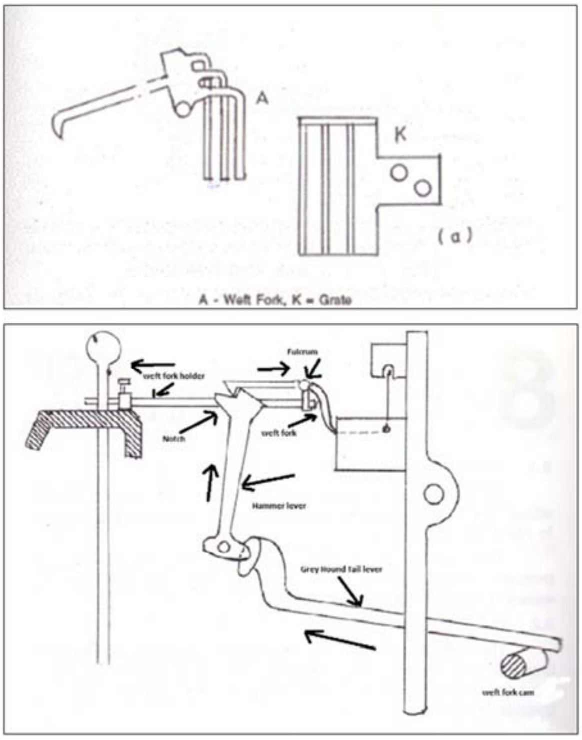



***Figure 2.*** *Side Weft Fork Motion.*

### (i) Working Principle

- The fork and grate form the basic units of side weft fork motion
- The metal grate is located between the end of the reed and the shuttle-box mouth on the starting handle side
- A weft fork which is bent at right angles is situated in front of the grate
- The tail end of the fork is slightly heavier than the forked end
- The weft fork is held by a fork holder at front and in turn the fork holder is connected to the knock-off lever which is in contact with the starting handle
- The hammer lever is connected to a greyhound tail lever at the bottom end of which is resting on a weft fork cam fixed to the bottom shaft.
- During the rotation of bottom shaft the cam raises the greyhound tail lever on every two picks and causes the hammer lever to rock towards the loom front
- The wooden race board has a channel opposite to the weft fork so that when the sley comes forward to beat up position the weft fork prongs will remain below the race-board level until it is touched by a weft thread lying across the channel.
- In the case where the weft thread is not broken or missing, the thread pushes the weft fork prongs, thus lifting the hooked tail clear of the hammer lever.
- At the same time the rotation of the cam makes the hammer lever move towards the front rest.
- In case the weft is absent either through breaking or running out, the weft fork remains horizontal and the prongs pass freely through the bars of the grate
- The hook tail of the fork is caught in the notch of the hammer lever and this lever movers towards the front rest along with its holder resulting in the weft fork lever pressing against the starting handle through the knock off lever

### (ii) Shortcomings

Since this mechanism is situated only at the starting handle side of the loom, the stopping is affected only when the shuttle reaches the starting handle side. This will result in missing a maximum of two picks when the weft breaks or exhausts as soon as the shuttle leaves the starting handle side.

In case such a device is to be provided on both sides of the sley the cost factor and the complicated knocking off arrangement has to be thought of [4].

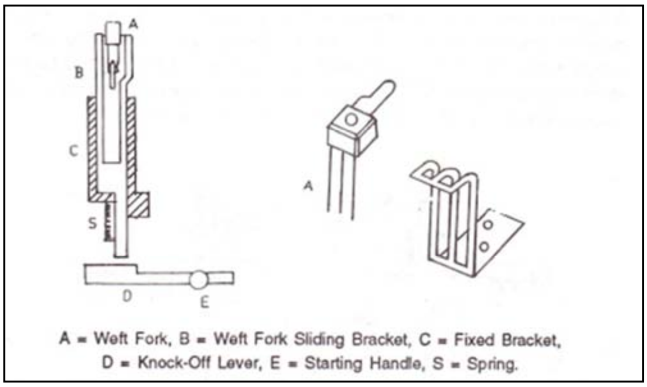



***Figure 3.*** *Weft Fork Acts Directly upon the staring Handle.*

### 2.1.2. Centre Weft-Fork Motion

Where,
A= Weft fork, B= Lever
C= Connecting rod, D= Knock off arm
E= Cam, F= Projecting stand
G= Knock off lever, J= Flat spring

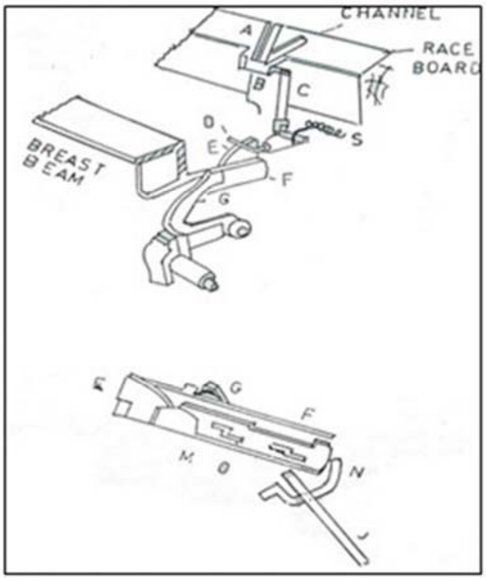



***Figure 4.*** *Centre Weft Fork Motion [5].*

### (i) Salient Features of the Motion

i. This motion is designed to feel the weft thread every pick and stop the loom in case the weft thread breaks or runs out
ii. The loom is brought to a stop before the beat-up action takes place
iii. It is not always compulsory that the shuttle should always in the starting handle side box for effecting the loom stop
iv. This device is useful for looms weaving pick and pick colored wefts
v. This stop motion helps to weave faultless cloth free from pick finding marks or broken picks
vi. Centre weft fork is suitable for weaving fabrics made from filament yarns. eg, polyester, nylon and yarns made out of other delicate fibers

### (ii) Working Principle

a) A channel is cut in the race board, at or near the centre depending upon the length of the weft from the shuttle eye to the fork
b) The weft fork with prongs is fulcrummed on a bracket fixed to the front of the sley
c) When the sley moves towards the back centre, the fork tilts upwards through the warp far enough to allow the shuttle to pass underneath and the weft is laid under the fork.
d) During the forward movement of the sley the fork drops downwards upon the weft and is held from moving further down in the channel by the grid effect of the warp threads belonging to the bottom shed, supporting the weft thread against the light pressure of the fork
e) In this condition the weft fork holds the knock-off arm away from the knock-off lever
f) The fork is pulled out of the shed just before the reed reaches the fell of the cloth for the beat up of the weft
g) If however, if there is no weft underneath the fork as the sley moves forward, the fork drops into the channel in the sley and the knock off arm D is moved into contact with the knock of lever G thus stopping the loom

### (iii) Problems Associated With Centre Weft Fork Motion

- Weft curls in the middle of the cloth.

*Causes*

- The prongs of the fork press the weft through the bottom shed
- Early or strong picking
- Irregular loom speed
- Loom stopping constantly although weft has not broken because of slack warp, slack weft, fibrous or hairy warps

## 2.2. Weft Control at Modern Loom

In the case of rapier and projectile weaving machines, the mostly used device is provided with piezoelectric crystals. These crystals have a double quality: if an electric charge passes through them, they vibrate, or vice versa if they are made vibrate, they produce a light electric charge. This second property is used for the weft insertion control. This device, if it detects a correctly inserted weft, produces a light electric charge. As this signal is too weak, it is first amplified and then controlled against a sample signal: if the signal corresponds, nothing happens.


***Figure 5.*** *Piezoelectric Electronic Weft Stop [2].*

Otherwise, the absence of the charge is interpreted as a broken weft and the weaving machine stops. At this point the automatic pick finding device enters into action and brings the machine back to the shed where the fault occurred. In this connection you must consider that, although the stop signal is given quite quickly, a certain technical time for stopping the loom is required. During this time, although the weft presenting device is standing, the loom moves forward with some strokes which are compensated recovering tension and space through the reverse running of the evener rollers. In the case of fluid jet machines, it is preferable not to hinder the weft fly, therefore optical sensors are used which do not touch the weft. As already mentioned, in the case of the air jet machines (at the moment only for them) there is a device which permits to restore automatically the broken weft and to start the loom. This mechanism permits to go on weaving if the problem takes place inside the shed. However, if defects take place in the pre-winding drum or between this and the cone, it is appropriate to have on board the machine the device which permits to select automatically the cone being processed. This system enables to bypass the pre-winding drum which has problems and to select a reserve drum which is standing until that moment. The machine does not need long stops and the operator can intervene easily to remedy the problem. Should the same fault take place again on the new pre-winding drum, this will be excluded in favor of the first drum. The optical sensors are primarily infrared photocells suited to detect the presence of the thread or the quantity of thread accumulated in a prefixed zone. An example of these devices is the sensor for weft control on air jet weaving machines, which is briefly described in the following.

This device, which is designed to control the correct weft insertion into the shed of an air jet loom, has the task of stopping the machine in case of incorrect insertion. The sensor is placed on the shaped reed at the desired height in the zone of weft arrival; it reads the presence of the thread when its front free end arrives in the sensor's measuring range and crosses it.

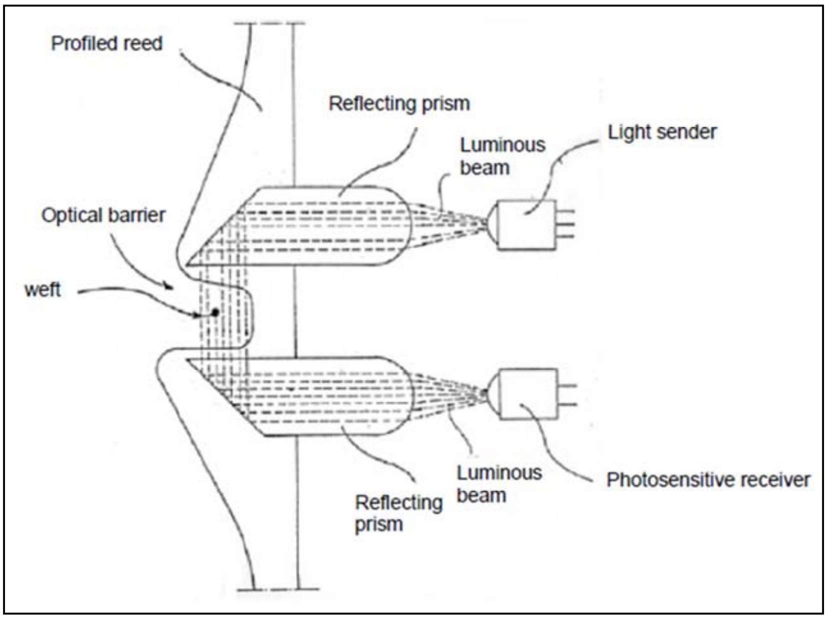



***Figure 6.*** *Optical Sensor applied on Air Jet Loom.*

The two photo-elements are opposing as schematically indicated in above Fig. and constitute an optical barrier which is disturbed by the weft thread when it is crossed by this thread. In the case of air jet machines for staple yarn weaving, an opto-electronic weft stops motion in twin arrangement can be delivered. While the first of the two weft stop motions serves as support for the machine control, the second one records the weft threads broken in the shed or expelled.

### 2.3. PSO (Pre-winder Switch Off)

PSO is the system by which the machine does not stop immediately after a bobbin breakage, but continues to weave, until the weaver is available to repair breakage. The weaver is informed by flashing orange light that the machine carries PSO action. Consequently the waiting period for intervation of weaver reduced to zero, weaver can decide himself when breakage must be repaired, for this Piezo-Electric filling detector is used [6].

### 2.4. Warp Stop Motion

- The purpose of warp stop motion is to stop the loom when a warp thread breaks
- The loom also stops when a warp thread becomes excessively loose
- The warp stop motion is useful not only for the efficient production of high quality fabrics but also to allot more looms to a weaver.
- If a broken warp thread is not detected immediately, it will tend to get entangled round adjacent threads thus causing more end breakages or create a fault known as a float in the woven cloth

#### 2.4.1. Types

There are two types of warp stop motions, the mechanical and electrical

Both the cases the basic principle of working is the same, that is, every warp thread is sensed by a thin strip of metal, known as drop pin.

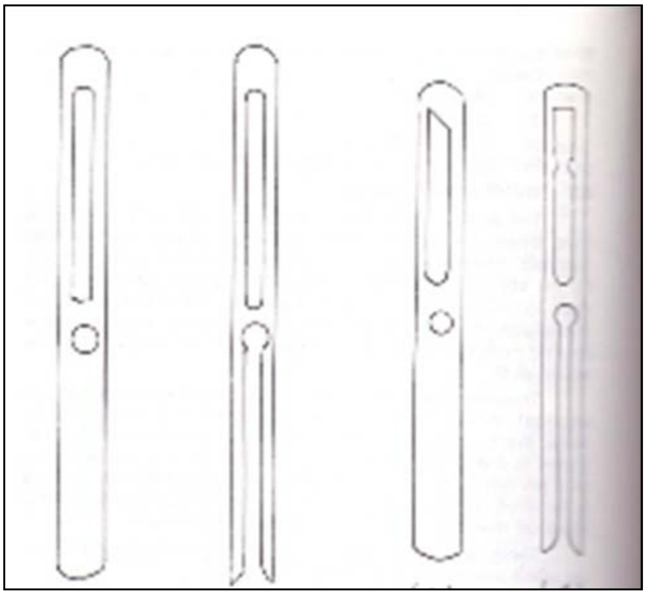


***Figure 7.*** *Different Types of Drop Wire/Pin.*

- When a warp thread breaks the corresponding drop pin falls by its gravity into a moving part of slide over which it is threaded

- The lateral motion of the slide is thus arrested and a knock-off mechanism will operate and stop the loom

### 2.4.2. Category of Existing Drop Wire

- Closed end drop wires
- Open end drop wires
- Open ended drop wires are more popular type used for dropping in the warp threads after the warp has been gaited in the loom
- Closed type drop wires are positioned in the preparation department, the warp threads being drawn through the drop wires and the heald eyes at the same time.

### 2.4.3. Mechanical Warp Stop Motion

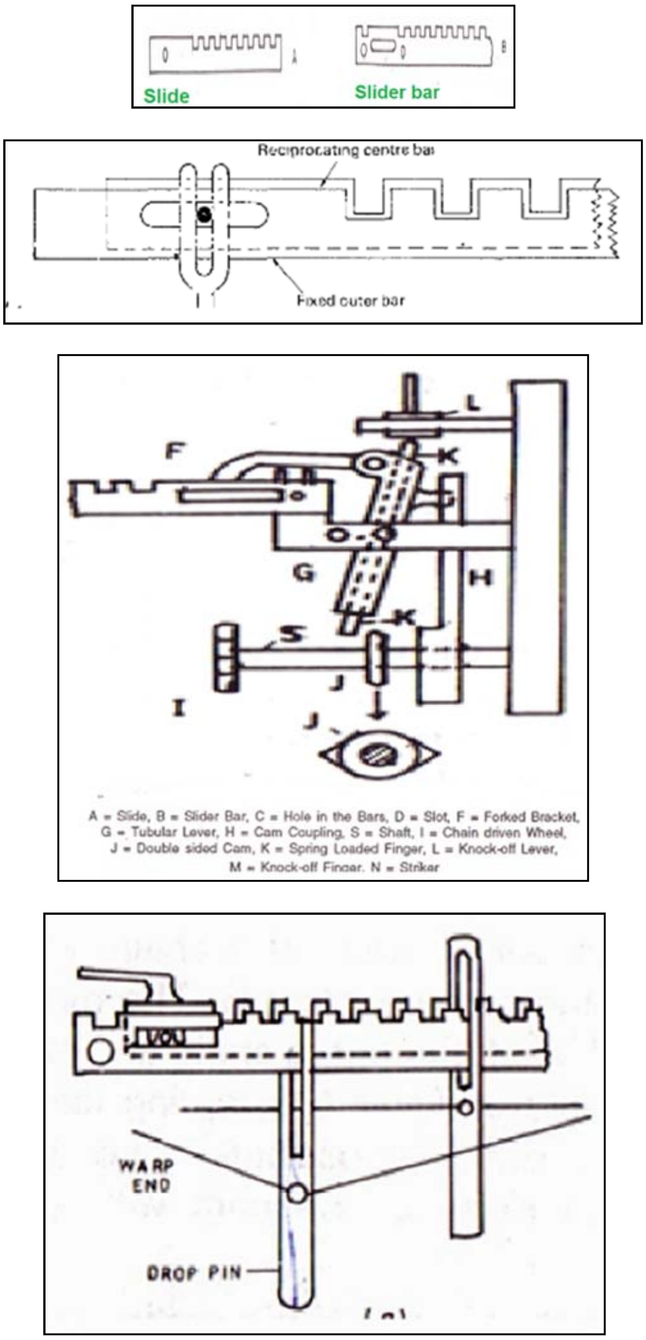



*Figure 8. Mechanical Warp Stop Motion.*

### 2.4.4. Warp Control

The supervision of the warp threads is an essential factor for the fabric quality. The device used is called warp stop motion; it stops the running of the weaving machine at each thread breakage or even when the thread becomes slack, that is when the thread gets a tension level considerably below normal level (delicate fabrics). The warp stop motions generally used today employ electrical or electronic detection systems.

In the past, the Institut für Textiltechnik der RWTH Aachen University, Aachen, Germany successfully atomized several factors of modern weaving machines. Within the AutoWarp concept, an active back rest system was developed using simulation of the warp tension and a genetic optimization algorithm [7]. Also a control for the fabric weight during weaving was developed using an x-ray sensor and a control loop with a smith predictor [8].

### 2.4.5. Electrical Warp Stop Motion

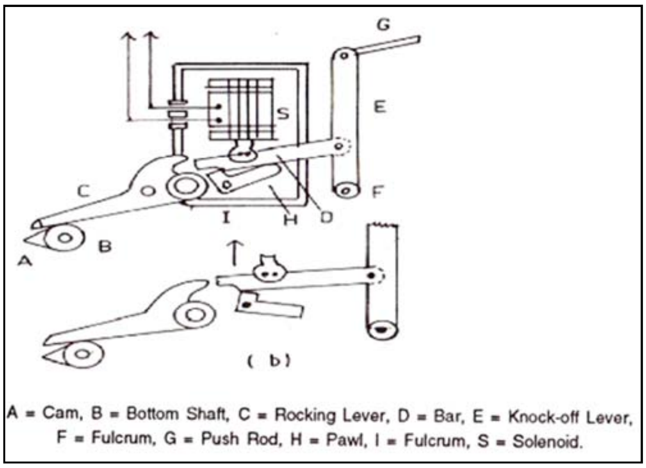
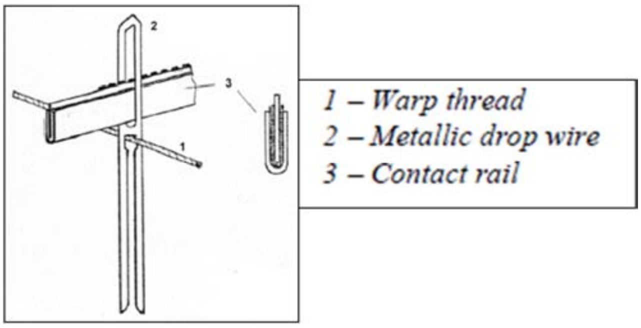



*Figure 9. Electric Warp Stop Motion.*

The operating system is the following Figure each warp thread is passed into the bottom slit of a metallic drop wire 2, which this way is supported by the thread under tension. Through the top slit of the drop wire passes the contact rail 3 composed of an U-shaped outside coating in stainless steel, of a strip of insulating material and of a flat conductive inside blade in nickel-plated copper, provided on the upper part with a toothing. The contact rail 3 is part of a low voltage electric circuit, of which the drop wire 2 acts as circuit breaker. the inside of t he upper part gets it to come into contact at the same time with the outside U shaped drop wire and with the inside drop wire. Thus the circuit is closed and a passage of current is generated which is detected by a processing station of the machine and causes the stop in the desired position (with closed shed, to facilitate the intervention of the operator on the broken thread).




In the version of following Figure, the search for the broken thread is carried out by lateral levers which

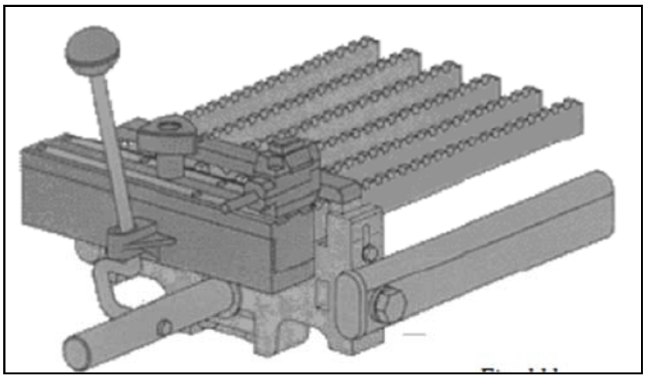


***Figure 10.*** *Electric Warp Stop Motion (Modified).*

Under normal conditions the drop wire is supported by the thread and no current passes through the circuit. However when the thread breaks or loosens too much, the drop wire falls and its asymmetric form in the inside of t he upper part gets it to come into contact at the same time with the outside U shaped drop wire and with the inside drop wire. Thus the circuit is closed and a passage of current is generated which is detected by a processing station of the machine and causes the stop in the desired position (with closed shed, to facilitate the intervention of the operator on the broken thread). In the version of last Figure, the search for the broken thread is carried out by lateral levers which cause the sliding of the toothed bars in order to pinpoint with their movement the fallen drop wire.

### (i) Electronic Warp Stop Motion

This is the latest solution proposed by the manufacturers of weaving machines. The electronic warp stop motion in Fig. signals, by means of a digital indicator, the contact rail and the position of the drop wire which originated the contact. In the example of Fig., the drop wire is placed on the fifth contact rail at a distance of 275 cm; the measuring ribbon with its scale guides the operator directly to the breakage zone. This solution permits not only the quick finding of the broken thread by the weaver, but allows also an automatic analysis of the warp stops through a data detection system. To facilitate the detection of the broken ends, some manufacturers offer the possibility of installing electronic warp stop motions with luminous signaling diodes on both sides of each control rail. The model in Fig. signals by the lighting of a red light-emitting diode placed at the end of each contact rail the bar and its half on which the drop wire has fallen.

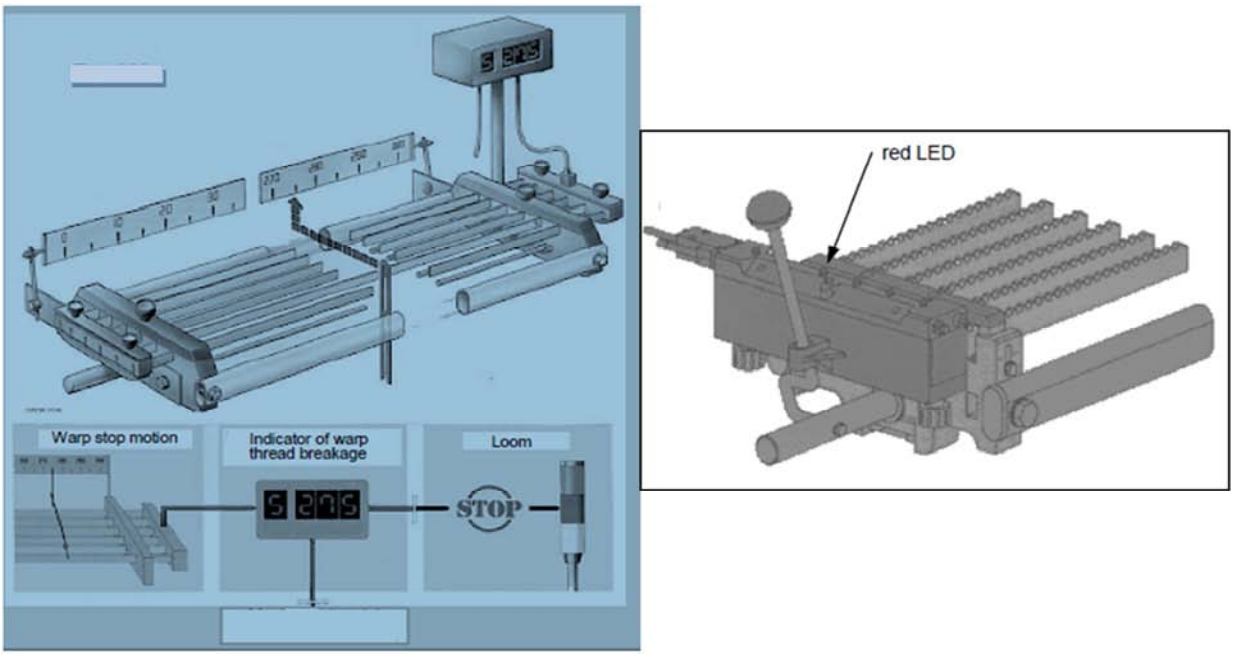



***Figure 11.*** *Electric Warp Stop Motion With LED.*

### (ii) Importance of the Warp Stop Motion Position

The main function of the warp stop motion is to detect breaks of the warp yarns. If a break of any warp yarn is detected, the weaving machine stops immediately. The weaver can repair the warp yarn break before the open end of the broken yarn gets stuck in moving machine parts. Beside this security feature, the warp stop motion redirects the warp yarns. The position of the warp stop motion therefore influences the appearance of the produced web and the tension in the warp yarns. Following Figure shows a schematic weaving shed and that the elongation of the warp yarns in the different shed positions is different, depending on the vertical warp stop motion position.

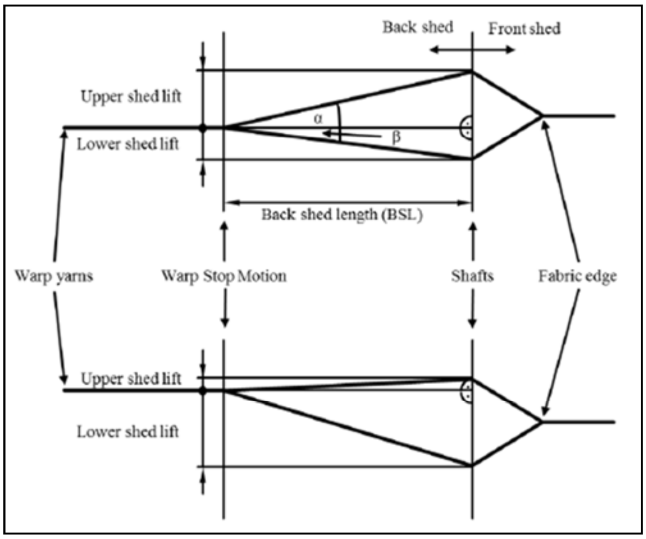



***Figure 12.*** *Two schematic weaving shed geometries.*

The amount of yarn delivered by the warp beam is equal for all warp yarns. Between the warp beam and the warp stop motion, the yarn length of all yarns is the same. Depending on the position of the warp stop motion the warp yarns get elongated differently between the warp stop motion and the shafts. In the upper weaving shed geometry in Figure 2, the angle α is greater than the angle β.

$$\alpha > \beta$$

*Setting of the Warp Stop Motion Position*

Currently the setting of the warp stop motion position is done manual in several working steps. If a weaver produces a new article, it usually takes a number of tries until a setting is found that allows a stable weaving process. Therefore the changeover time of the weaving machine can be significantly reduced if the vertical warp stop motion position is automatized. Figure 4 shows the construction to adjust the vertical warp stop motion position on an OmniPlus 800 air jet-weaving machine from Picanol NV, Ieper, Belgium. The construction is used on either side of the machine. The locking nuts on each side of the machine secure the vertical warp stop motion in its position. To adjust the vertical warp stop motion position, the locking nuts need to be released. The male thread of the locking construction is connected to the warp stop motion and builds a jack screw together with the threaded rod. If the threaded rod is rotated the warp stop motion moves up or down depending on the direction of rotation. The scales assure an exact, even vertical position of the warp stop motion if the same setting is used on both sides of the weaving machine. Concluding the securing nuts gets tightened again.

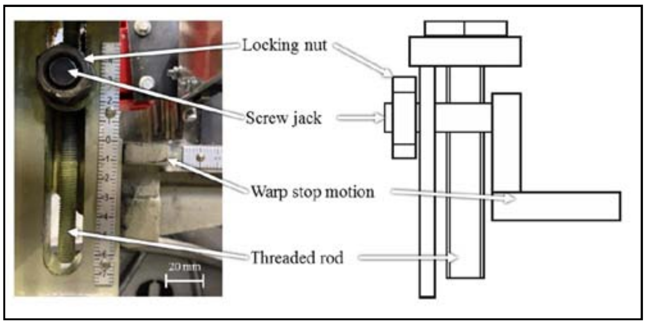



***Figure 13.*** *Vertical Warp Stop Motion adjustment on Omni-Plus 800 Air Jet-Weaving Machine from Picanol. [9].*

#### 2.4.6. Warp Stop Motion Using Laser Beam

Similar to the former methods of warp stop motion, this method also uses the dropper to cross a laser beam preventing it reaching the receiver LDR (Light Depending Resistance). When light falls on the LDR, its resistance falls to almost zero, but when no light reaches it, its resistance remains very high. This phenomenon is used in an electronic circuit to cause the required stopping effect.

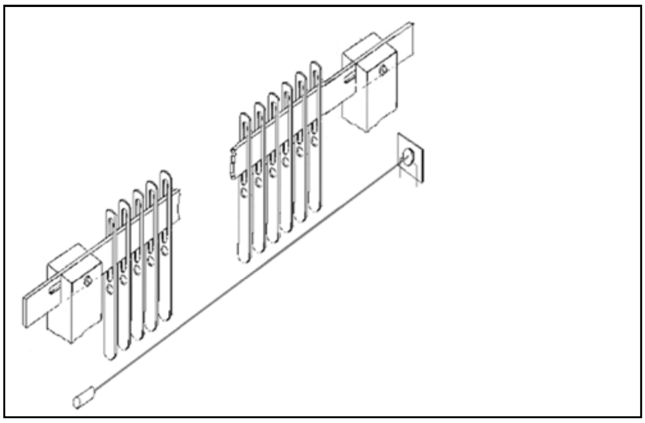


***Figure 14.*** *Arrangement of Fixing the Source of the Laser Beam.*

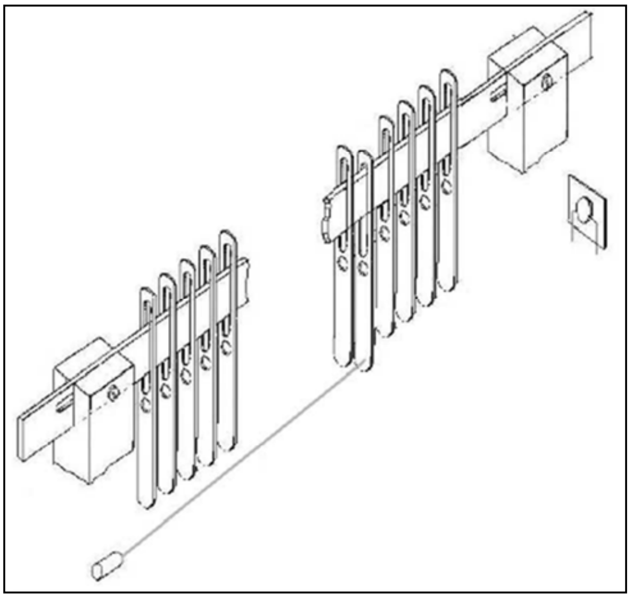


***Figure 15.*** *The Falling of the Dropper Cutting the Flow of the Laser Beam [10].*

### 2.4.7. Warp Stop Motion 5800

For the High-Density Filament Constructions

The design of the warp stop motion (KFW) 5800 with eight contact bars is based on the KFW 5600. It combines its much-proven features and is also espciallaly applicable for the high-density filament constructions.

The contact bars, measuring 13mm x 3.4mm, are available either serrated or unserrated executions. Both executions are also available with a central interruption – to allow indication of yarn breakage in the left- and right-hand sections of the weaving machine.

#### (i) Features and Advantages

- Robust and dependable design
- Adaptable and reliable functioning
- Improved fabric quality
- Time savings when repairing yarn breaks
- Simple handling

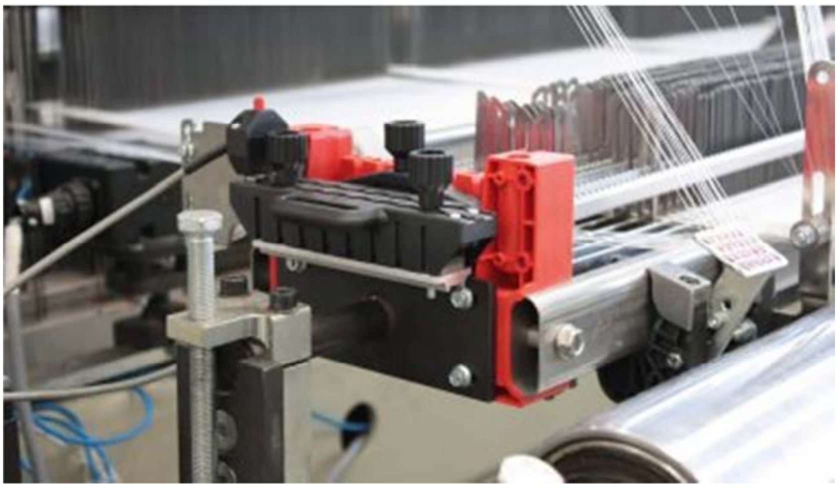


***Figure 16.*** *The Falling of the Dropper Cutting the Flow of the Laser Beam [11].*

#### (ii) Applications

Warp stop motion 5800 is primarily used for high-density filament constructions.

## 3. Discussion and Results

All types of modern and primitive stop motions have been discussed here. However their evolutions are chronological and necessary. In addition to this, uses of the motions are depends on fiber and fabric used on that particular loom.

## 4. Conclusion

To get high productivity and good quality of fabric, additional mechanisms, called auxiliary mechanisms e.g. Warp Stop Motion and Weft Stop Motion, are added to a loom. Once, it was thought that the auxiliary mechanisms are useful but not absolutely essential. However this idea has been changed and in recent time they are consider the most integral part of loom.

## References

[1] http://nptel.ac.in/courses/116102005/52 [Accessed 17 Oct, 2016].

[2] Giovanni, C.; Salvatore, M.; Giuseppe S. and Ivo, M. S. (2000). Weaving Reference Book for Textile Technologist), pp. 71-71

[3] https://docs.google.com/presentation/d/1-j4RRw94cH5SvOSKIeNySKGR2gNNytdUXxi9YB0VLyw/edit#slide=id.p6 [Accessed 15 Oct, 2016].

[4] Fabricclub.Blogspot.Com http://fabricclub.blogspot.com/2010/10/weft-stop-motion-conventional-loom.html [Accessed 15 Oct, 2016].

[5] Fiber 2 Fashion.com http://www.fibre2fashion.com/industry-article/7197/center-weft-fork-motion-of-loom [Accessed 15 Oct, 2016].

[6] https://textlnfo.wordpress.com/2011/10/29/modern-developments-in-weaving/ [Accessed 16 Oct, 2016].

[7] Osthus, T. Prozessoptimierung in der Weberei durch automatische Einstellung von Streichbaum und Kettfadenwächterkorb. Ph.D. Thesis, RWTH Aachen University, Aachen, Germany, 1996.

[8] Gloy, Y.-S.; Büllesfeld, R.; Islam, T.; Gries, T. Application of a Smith Predictor for Control of Fabric Weight during Weaving. J. Mech. Eng. Autom. 2013, 3, 29–37.

[9] Cloppenburg F, Gloy Y. S. and Gries T., “Realization of an Automated Vertical Warp Stop Motion Positioning”, Actuator, 2015, 4, 2-16.

[10] Hashim, A. S.; Ali, M. A. A. and Mozamil, K. O., “Design and Application of a New Warp Stop Motion by using a Laser Beam”, Textile Engineering Department, Sudan University of Science & Technology, pp. 1-12

[11] https://www.grozbeckert.com/cms/en/products_services/weaving/w_produkt/w_weaving/w_warp_stop_motion/w_warp_stop_motion_5800/ [Accessed 16 Oct, 2016].