A REVIEW - DESIGN AND ANALYSIS OF PICKING & CHECKING MECHANISM OF SHUTTLE LOOM

[1] Dhaval Patel , [2] Tejal Patel
[1]M.E. Student (CAD/CAM) , [2] Assistant Professor
Mechanical Engineering Department
Hasmukh Goswami College of Engineering ,Gujarat, India

ABSTRACT

The Shuttle loom machine is basic machine by combining weft thread to warp thread to make form of fabric. The fabric is make by combining weft thread to warp thread. The combining of weft thread and warp thread is make by using different mechanism Picking mechanism , checking mechanism , let – off mechanism , Take – off mechanism. The Picking mechanism and Checking mechanism are most important mechanism of shuttle loom machine to make combining weft thread to warp thread to make form of fabric.

The Shuttle loom machine old and basic machine for weaving of cloth very efficiently and easy. The Shuttle loom machine most commonly use in india for weaving of cloth.. This ancient machine is still used by many weavers in India. The problem in Shuttle loom machine is high Power Consumption and more losses of energy.

In the Checking mechanism operates by applying brakes to the shuttle, which is at very high speed, and prepare the shuttle for next cycle of picking mechanism. The spring loaded swells to retard the shuttle. Due to retardation, velocity of shuttle decrease to zeroHence it is extremely necessary to design and develop a mechanism to compliment the checking mechanism and to move in the direction of achieving minimum power consumption.
The Detailed study is done on Picking mechanism and checking mechanism of shuttle loom machine.
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Keywords *: Shuttle loom machine , Picker , Shuttle , Picking mechanism , Picking Shaft , Checking mechanism*

1. Introduction

From time immemorial clothing is one of basic need along with food and house for mankind. With the growth of mankind all over the world, there has been a growth of textile manufacturing processes, products and textile machinery simultaneously. The process of development in this area still continues. This industry contributes 4 percent to countries G.D.P and 14 percent to countries industrial production. India has very large source of installed looms for textile manufacturing products. Different types of fabrics are woven by loom to manufacture cloth. . According to latest survey by textile ministry of India, India has 1.8 million shuttle looms which is 45 percent of world capacity. There are different types of loom available to weave cloth.

Loom is a device used to knit fabric or cloth. Its function is to hold the longitudinal threads or warp threads and to insert laternal thread or weft threads into warp threads. Process of inserting weft threads into warp threads is known as weave.There are different types of loom available to wave cloth and it is classified in following paragraph. Then its necessary to understand the weaving process in this loom, basically we will see it according to shuttle loom.

This ancient machine is still used by many weavers in India, So they face many problems because of high power consumption and more losses of energy. To improve tproduction rate, it is mandatory to increase the speed of picking mechanism, which plays main role in weaving of the fabric.

1.1 Classifiaction of Looms

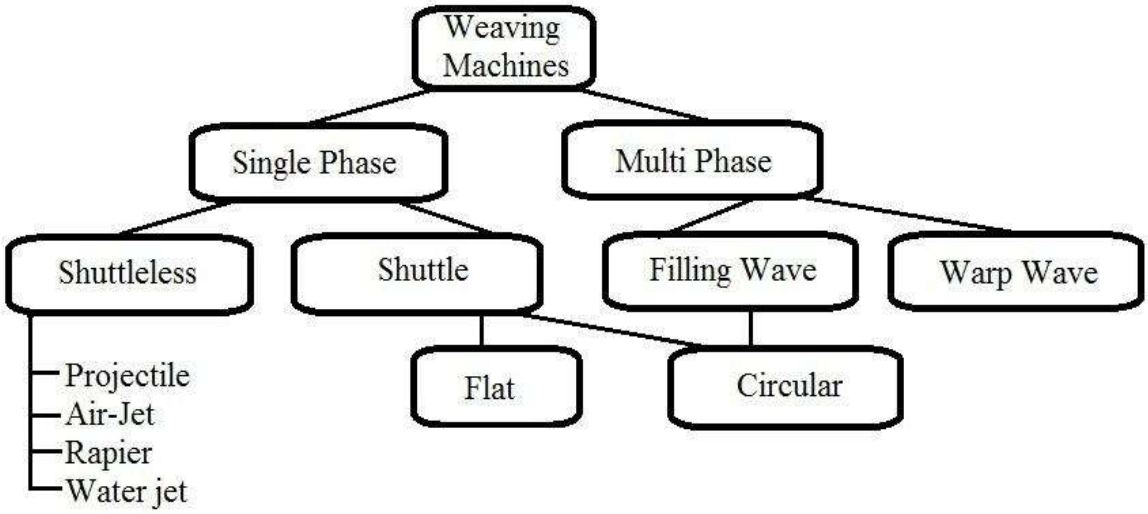

Figure - 1 Classification of weaving machines

1.1.1 Shuttle loom

For power loom machinery, shuttle loom is the basic and former weaving machine for all types of fabrics. In shuttle loom weft is inserted by a shuttle that traverses back and forth across the loom width. The shuttle can be made of compress wood, plastic or a combination of both. As the shuttle move across the loom the weft yarn is unwound from the pirn and laid in the shed. The shuttle moves continuously back and forth across the loom.

1.1.2 Shuttle less loom

As the latest technologies for weaving of cloth developed it uses different devices rather than the shuttle, which carries weft from one side to another side for this process. There are many types of shuttle less looms, which are used for weaving such as Projectile Looms; Rapier Looms; Water Jet Looms; and Air Jet Looms.

- **Projectile loom**

The projectile weaving machine was introduced by Sulzer in 1952. And this was the successful, shuttleless weaving machine. Projectile weaving machine use a projectile equipped with a gripper to insert the filling yarn across the machine. The unique principle of projectile weft insertion allows the insertion of practically any yarn. This loom works up to 300 ppm and is less noisy compared to shuttle loom.

- **Rapier loom**

In rapier loom a 'rapier' is used to insert the filling yarn for weft insertion process. Rapier is a flexible or solid element. The rapier head picks up the filling yarn and carries it through the shed. After reaching the destination, the rapier head returns empty to pick up the next filling yarn, which completes a cycle. Rapier weaving machine can be of two types. It is Single rapier machine and Double rapier machine.

- **Air jet loom**

In Air-Jet weaving compressed air is used to insert filling yarn into the warp shed.The filling is fed into the reed tunnel via tandem and main nozzles. The tandem and main nozzle combination provides the initial acceleration, where the relay nozzle provide the high air velocity across the weave shed.This type of loom is not suitable for heavy threads. But many varieties can produce by this loom. The airjet loom is type of shuttle loom in which air is used for weaving process.

- **Water jet loom**

In Water-jet weaving machine highly pressurized water is used to inserts the filling yarn. The tractive force is stipulated by the relative velocity between the weft and the water jet. The traction force can be affected by the viscosity of water and the roughness and length of the filling yarn, higher viscosities cause higher tractive forces. The viscosity of water relies on the temperature. For this loom lament yarn of acetate, nylon polyester, and glass are more suitable because it is non-absorbent fabric to water.

- **Circular looms**

These looms are particularly used for making tubular fabrics rather than at fabrics. A shuttle device in it circulates the weft in a shed formed around the machine. A circular loom is primarily used for bagging material. The two or more shuttles move in circle , laying weft thread into warp thread forming a shed. The Circular looms are use for production of bags.

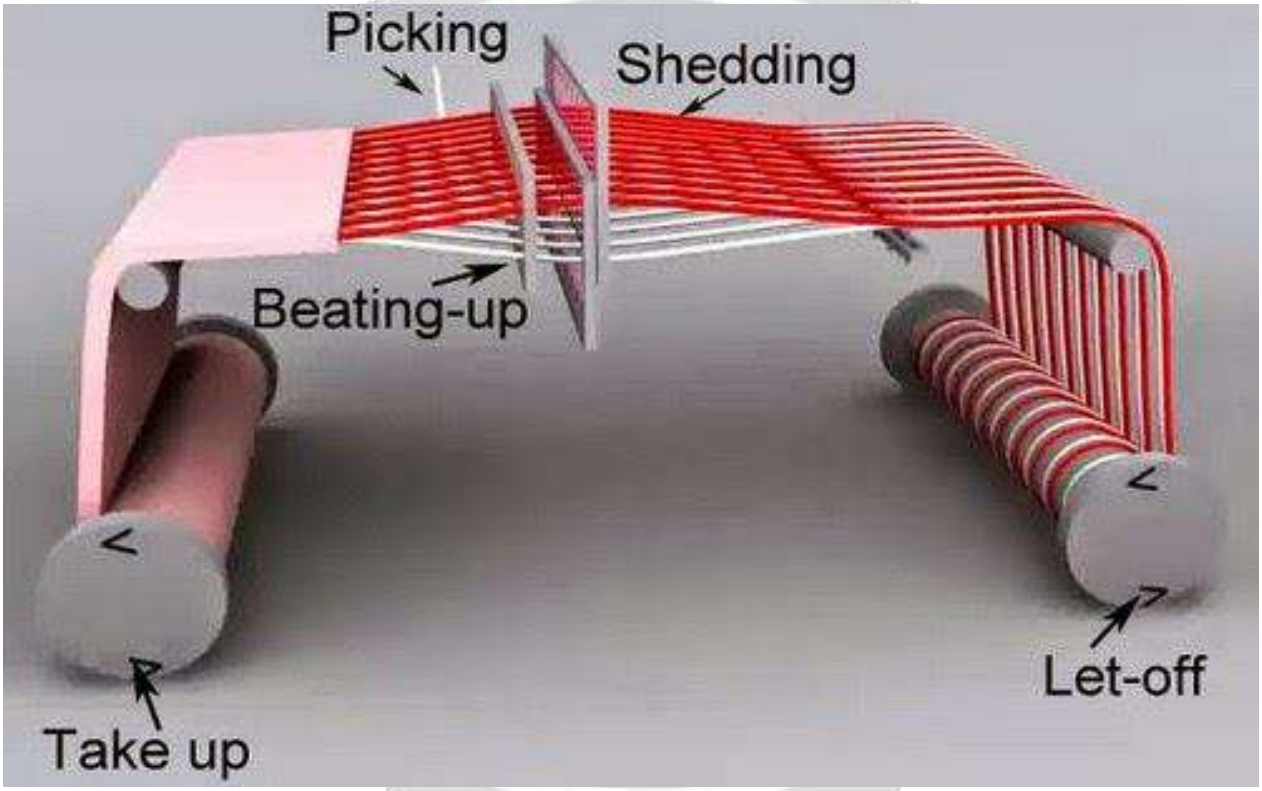

Figure - 2 Weaving Technology

1.1.3 Shedding

Division of warp is called shedding. Shedding is done by heald frames mounted on the base frame of loom. Heald frames are moved with the help of dobby or cam or jacquard in order to create necessary pattern in cloth. Needles are connected with the heald frame and the warp coming from the let off passes through these needles as shown in figure.

1.1.4 Picking

As the harnesses raise the heddles or healds, which raise the warp yarns, the shed is created. The filling yarn in inserted through the shed by a small carrier device called a shuttle. The shuttle is normally pointed at each end to allow passage through the shed. In a traditional shuttle loom, the filling yarn is wound onto a quill, which in turn is mounted in the shuttle.

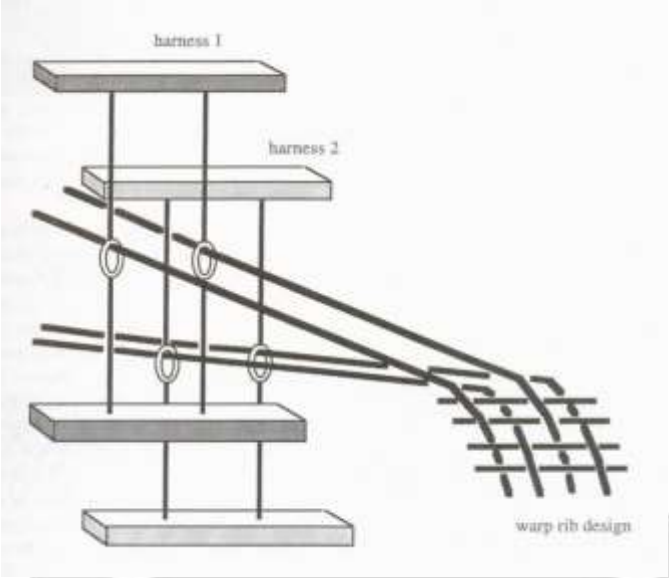

Figure - 3 Shedding

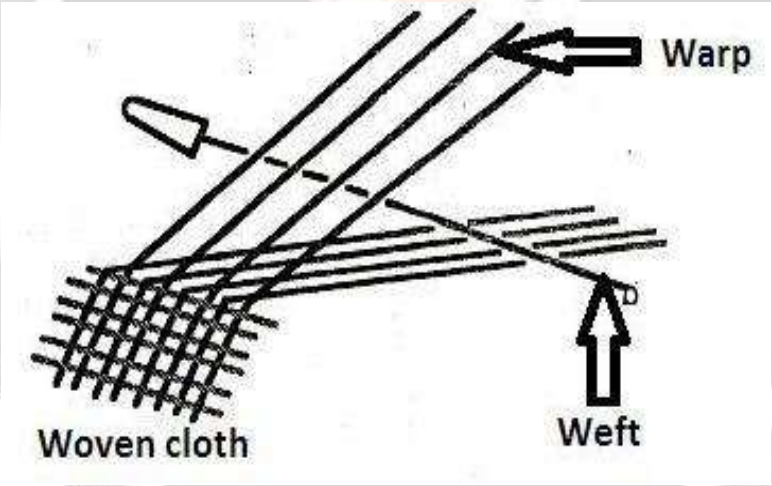

Figure - 4 Picking

2. Literature Survey

- **Ngangom Nabakumar Singh , Bishnupur, Manipur**

In the conventional shuttle looms a shuttle passes from one side to the other of the warp shade, running on the warp beam. A small rob/string is used to pull the shuttle from side to side. A horse shoe shape slider, commonly made of hard leather, fixed on the end arms of warp beam, pushes the shuttle to and fro from one end to the other. In a double shuttle loom there is a common horse shoe in middle. When the first shuttle strike from one end ,the middle horse shoe strike the second shuttle in same direction.

Therefore, both the shuttles move in the same direction simultaneously and the middle horse–shoe strikes one shuttle at a time. Many ball bearings have also been added to the new machine. Therefore weaving on the double shuttle loom has become easier than any other single shuttle loom.The double shuttle loom is probably the only treadle operated shuttle loom with double shuttles.

- **T. Ishida & K. Chikaoka**

The fiight conditions of the shuttle have a considerahle effect on the efficiency and the quality of the fahric woven. Hence the shuttle oust be adjusted to fly smoothlyas well as precisely in its passage through the loom. In this paper, the actual flight conditions of the shuttle are discussed in relation to an increased loon speed.Among the factors that influence the flight conditions of the shuttle, the following,based on the experimental results obtained previously, were investigated:

(a) the movement of the picking stick
(b) the vibration of the loom
(c) the permissible time for the shuttle passage
(d) the shape of the shuttle.

The vibrations of the loom caused by picking and by only the sley movement were reduced by the reinforcement of the loom. From this observation, it was evident that not only the picking vibration but also the shuttle beating-up vibration strongly influenced the shuttle-flight conditions. (iii) The shut tie-passage time was also one of the important factors controlling the shuttle-flight conditions. Hence several passage times based on the reed-displacement curve were used. The trapezium -shaped shuttle was effective in eliminating the disturbance caused by the sley movement to the shuttle flight.

- **Yixuan Wang , Ying Wang, Xin Liu**

Firstly the take-up and let-off mechatronics are considered as the winding and also unreeling machines respectively. The mathematics model of the servo control system is set up , and the MATLAB software is used to model and also simulate.Secondly the actual system has been simplified to establish mechatronics model of the regular system.On the made virtual prototype platform of new loom, the control of toolbox of ADAMS software is used to establish control model of system, and a simulation has made. The Control plug-in modules of ADAMS software are combined with this MATLAB / Simulink to establish a unite simulation model of the mechanical and control system .

The interactive simulation and analysis has beenmade, not only reflects the advantages of combinations of two kinds of excellent engineering software, but also achieves collaborative design strategy of the new mechanical and control systems. The parameters of winding and unreeling ,reducer and increaser controller have been decided. In this paper , the 3D virtual prototype of a typical mechanical transmission system (speed regulation) of the loom is completed. The modeling and simulation methods to be applied to the Proposed performance analysis and design of other system, and have important theoretical significance and practical engineering value.

- **Xiao_guang Wu , Chao Yu , Li Zhu**

The aimed at the problem of high failure rate in the tension control system of traditional circular knitting machine, this paper proposes and develops a kind ofembedded yarn tension control system Systematically study various causes of different failures in yarn tension control system and analysis the influencing reliability factors of real-time control system by FTA (Fault Tree Analysis) method, built system fault tre e with qualitative analysis and quantitative analysis, work out the minimal cut set of system and estimate the occurrence probability of the top event..

The basic Figure out specific improvement measure and provide reference to enhance the system reliability. The improved tension control system is running steadily in the experiments, and Analyzes the result turns to be beneficial to improve the reliability. This paper analyzes the failure tree in the single chip yarn tension control system controlled by multi-motors, and 9 minimum cut sets are derived. The occurrence probability of those cut sets directly influences the reliability of the system.

- **Dorian Schneider, Dorit Merhof**

A vision-based inspection system to measure woven fabric yarn densities during production is presented. The extension to an developed fabric flaw of detection system, the proposed framework consists of a combination of basic.

The other custom-made image processing techniques that allow to precisely track single wefts and warps within fabric images. Several adaptations allow the measurement of density changes for plain, satin and twill weaves. Only basic 3 parameters are required to set up the system, which can easily be obtained using any common photo processing software. The algorithmic framework has been evaluated in this work on a real-world loom and it proved to be robust and applicable for industrial use.

This work proposed a vision-based sensor system to precisely measure density changes of woven fabrics during the production. The proposed framework was originally designed to detect flaws in fabric materials and has been extended in this workto allow the measurement of varying material densities.It is straight-forward to set up, as only 3 parameters are required which can be also provided using any common photo processing software.

3. Picking mechanism

Picking is a primary motion which intent to propel the weft carrying shuttle along the correct trajectory maintaining requisite velocity through the shed in order to provide lateral sets of threads filling the cloth.

3.1 Factors affecting initial shuttle speed

Several factors affects on the initial shuttle speed in an over pick machine which were thoroughly investigated by Thomas and Vincent. The primary factors which are responsible for controlling the shuttle speed.

- **Shape of picking tappet**

Shape of that part of the picking tappet in contact with the picking bowl will depend on the length of the nose bit of the picking tappet. Depending on the size of the machine width, the nose bits are marked by punches to indicate the range of shuttle speed that would be required for a machine. Wider the machine greater the number of punches marked.

- **Machine speed**

The average machine speed during the shuttle traverse does not matter materially. During picking the machine speed does not differ much. But there is evidence at present time that using sophisticated measuring instruments machine speed does fall during shuttle acceleration.

- **Time of picking**

Variation in the time of picking has a tendency to give higher shuttle speed when picking was formed to be late with respect to the crankshaft position starting from 45o. The changes in speed with timing were less with under pick when with over pick system, and were absent with over pick when the sley was fixed. Higher shuttle speed is necessary as it has to force through the shed as it progressively lowers as the shuttle emerges out of shed.

The time of Picking is also affected Shuttle loom machine. The Picking is important mechanism for Shuttle loom machine.The Picker is use for carry weft thread from one place to another place for Picking mechanism.The different factors affected for Performance of picking mechanism of shuttle loom machine.

- **Mass of shuttle**

The amount of checking is dependent on its mass and its speed. Reduction in momentum is the direct result in reduction of mass and not its speed. It is often viewed that a lighter shuttle moves more slowly than a heavier one but this is not true. From experimental observations, it was found that the shuttle speed is substantially independent of its mass. Timing was not affected through the heavier Shuttle has a tendency.

- **Initial gap between picker and shuttle**

From time to time in course of routine, weaving the shuttle may be obstructed in its passage through the shed and causes a gap between the shuttle and the picker. This naturally leads to a reduction in shuttle speed for the next pick, causing loom bang-o or shuttle trap. With ordinary nose-bits the fall in speed becomes serious when the initial gap exceeds 25 mm, but with constant nominal acceleration the fall is not that serious.

3.2 Cause of rejection for checking mechanism parts

- **Shuttles**

1. About 40% of the shuttles were rejected because of breakages of the shuttle wall. Most of the shuttles had become very thin due to wear. These shuttles can be said to have given a good service life.
2. Another 40% of the shuttles were rejected because of chipping, cracks in the wall or tips becoming loose. It was observed that the walls or shuttles made from coarse grain wood and from wooden blocks which were not cut parallel to the grain of the wood were prone to crack and chip.
3. The remaining 20% of the shuttles were rejected because of damage due to faulty loom setting such as incorrect alignment of reed and box back plate, or due to defective shuttle ight, harsh picking or shuttle taps.

- **Pickers**

1. About 20% of the pickers were rejected due to damaged or worn-out picker foot, 15% due to expanded spindle holes, and 10% due to loosening of rivets. Such defects have to be attributed to manufacturing or raw material defeciencies.
2. About 15% of the picker were rejected due to incorrect striking of the shuttle or excessive use of one side of the picker. These have to be attributed to incorrect loom settings and work practices.
3. The remaining 40% of the pickers were rejected after a gradual expansion of the striking point or of the spindle hole, or due to worn-out picker foot and could be said to have given a satisfactory service life.

4. Conclusion

- The Shuttle loom machine face many problems because of high power consumption and more losses of energy, than any other machinery for this industry. To improve functionality of shuttle loom various parameters are identified for picking and checking mechanism. Both picking and checking are interrelated with each other.Here, checking of the mechanism is developed from scratch to reduce picking force transmitted by picker to shuttle.

- To also improve the production rate, it is mandatory to increase the speed of picking mechanism, which plays main role in weaving of the fabric. The Picking and Checking mechanism directly affected Quality. Hence it is extremely necessaryy to design and develop a Checking mechanism to move in the direction of the achieving minimum Power consumption.

- The operation of Picking mechanism is not smooth in running condition of Shutte loom machine. To also improve the Performance of Shuttle loom machine require to make Smooth running condition of the Picking mechanism of Shuttle loom

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