

# A Review on Redesign of Drive System for Textile Powerloom Machine to Prevent Downtime and Improve Reliability of System

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**Abstract:** - The textile industry is one of the most complicated manufacturing industries because it is a fragmented and heterogeneous sector dominated by small and medium enterprises. A loom is a tool used for weaving yarn into textiles. There are many types of looms, including the hand loom, frame loom, and shuttle loom. A power loom, yet another type of loom, is a mechanized tool that uses a drive shaft for power.

The power loom allowed manufacturers to create textile products quickly than with hand-driven looms. This improvement helped the power loom to become one of the defining machines of the industrial revolution. It is however observed that the chain drive textile power loom machine which transmits the power from a motor to a certain height for jacquard movement. The failure of chain is observed in association with vibration. This vibration and failure can be addressed to a longer length of chain and the associated sag. This leads to breakdown in the production cycle causing a huge financial loss. This problem is addressed by redesigning the drive system and a concept of bevel gear drive system is presented. The new design can improve the functionality and also relieves the vibration.

**Keywords:** Powerloom, chain drive, breakdown, bevel gear system.

## I. INTRODUCTION

The Indian textile industry is one the largest and oldest sectors in the country and among the most important in the economy in terms of output, investment and employment. The sector employs nearly 35 million people and after agriculture, is the second-highest employer in the country. Its importance is underlined by the fact that it accounts for around 4% of Gross Domestic Product, 14% of industrial production, 9% of excise collections, 18% of employment in the industrial sector, and 16% of the country's total exports earnings. With direct linkages to the rural economy and the agriculture sector, it has been estimated that one of every six households in the country depends on this sector, either directly or indirectly, for its livelihood.

A strong raw material production base, a vast pool of skilled and unskilled personnel, cheap labour, good export potential and low import content are some of the salient features of the Indian textile industry. This is a traditional, robust, well-established industry, enjoying considerable demand in the domestic as well as global markets.

Solapur is renowned for chaddars (bed sheets) and towels. The products manufactured in Solapur Textile Cluster units has domestic and export market. The products are also

exported to various European and Gulf countries. Textile industry is one of the oldest and the most widespread in Solapur. The textile industries in Solapur produce cotton yarn and process yarn for doubling, dyeing, warping, and weaving by power looms. Majority of the industries have been in operation for the last 20 to 30 years. The main raw material (cotton yarn) is being procured from local manufacturers/traders.

A loom is a device used to weave cloth. The basic purpose of any loom is to hold the warp threads under tension to facilitate the interweaving of the weft threads. The precise shape of the loom and its mechanics may vary, but the basic function is the same.

Following are the types of looms as follows:-

- |                      |                       |
|----------------------|-----------------------|
| a) Back strap loom   | b) Warp-weighted loom |
| c) Draw loom         | d) Hand loom          |
| e) Flying shuttle    | f) Rapier looms       |
| g) Dobby looms       | h) Circular looms     |
| i) Jacquard looms    | j) Power looms        |
| k) Traditional looms | l) Ribbon weaving     |
| m) Haute-lisse       | n) Basse-lisse looms  |

j) Power looms:-

The power loom sector produces more than 60% of cloth in India and textile ministry's estimation says that more than 60% of the country's cloth exports originated from that sector. With its employment of 4.86mn workers, the power looms sector comprised approximately 60% of total textile industry employment.

As per textile ministry of India up till March 31, 2006, the power looms sector which produces various cloth products, including grease and processed fabrics consisted of 430,000 units with 1.94mn power looms. The ministry projected the number of power looms to rise to 1.95mn in 2006-07. But modernization in looms is less and Indian industry still lags significantly behind US, China, Europe, Taiwan etc. Most of the looms we have currently in country are shuttle-less. There are less than 15,000 modern looms, whereas traditional looms are in large numbers. Value addition and the manufacturing of fabrics according to customer's compliances, is not possible due to obsolete technology of looms.

The jacquard drive system in a power loom is affected by a chain drive system. This drive system is studied in detail.

## II. LITERATURE REVIEW

Srdan M. Bošnjak<sup>[1]</sup> presented a study to diagnose the cause of chain link breakdown occurrence. Working stresses in the chain link are defined by applying FEM. Based on the results of the numerical-experimental analysis, it can be concluded that chain link breakdown is predominantly caused by substantial deviation of the mechanical properties of the material with respect to those prescribed by the standard and the existence of macro and microcracks in the material structure. G.Pantazopoulos<sup>[2]</sup> suggested in their paper steel links used as chain elements in draw benches are subjected to repetitive tensile stressing due to successive loading and unloading conditions. M.Sujata<sup>[3]</sup> taken case study on failure of conveyor chain links in which they determined that failure was caused by defects related to the metal processing. It was recommended that the billet be properly dressed and surface defects are removed prior forging operations. V. Kerremans<sup>[4]</sup> explained in this paper about the capabilities and working principles of the developed laboratory test-rig. They have also derived the contact mechanics of the chain and pressure-velocity limit of the roller materials, the design constraints for the laboratory test-rig.

Umesh Singh<sup>[5]</sup> presented a case study and stress calculation on failure of bridle chain links used for hoisting in mines. In which they have identified the origins for defects and also analyzed causative factors for failure of materials. T. Osthus<sup>[6]</sup> introduced a system for adjusting the settings on a rapier loom automatically using stepping motors is presented. Finally, design possibilities are considered for automatically adjusting the settings on the loom using setting parameters which have been optimized mathematically. Dr. Rajendra N. Shendage<sup>[7]</sup> presented in their paper five major problems of textile industry in solapur. They are such as Powerlooms have become outdated or too old to handle newer fabrics due to associated with vibration; Labour has become moody-irregular attendance and non-punctuality are rampant; Prices of raw materials and other inputs are always unstable; Competition from other powerloom centres and modern textile- mills is rising; Tradition-bound mindset of textile unit owners.

A.N.M. Masudur Rahman<sup>[8]</sup> introduced a study to find out the effects of various parameters on efficiency in rapier looms. The main objective of this study is to increase the efficiency and through that increase the productivity and profitability. N Gokarneshan<sup>[9]</sup> presented critical analysis of the recent research developments in the loom shedding mechanisms has been reported. The use of angle shedding disks without warp loading in multi-phase weaving machines enables to weave higher pick densities and difficult varieties of fabrics.

Ali Hasanbeigi<sup>[10]</sup> in provides information on energy-efficiency technologies and measures applicable to the textile

industry. It includes case studies from textile plants around the world and includes energy savings and cost information when available. Finally it also includes a short section dedicated to highlighting a few emerging technologies in the textile industry as well as the potential for the use of renewable energy in the textile industry.

## III. PROBLEM IDENTIFICATION

The jacquard drive system using chain drive is illustrated in figure 1 which is presently used in a Powerloom textile machine.

In the present system, following observations are noted:

- a) Frequent Chain Failure
- b) Jerky Power Transmission
- c) Effect of vibration on weaving process
- d) Sudden breakdown of machine
- e) Redesigning of Power Transmission system



Figure 1. Chain Drive System

As discussed above the problems of chain failure jerky power transfer vibrations can be addressed to the long length of chain used for jacquard movement. This problem is dominantly due to longer centre distance of driver and driven shaft and sagging of the chain, frequent lubrication is also required for this drive system.

In figure 1 the motor shaft and the jacquard shaft are shown which are in parallel arrangement to replace chain drive

with another positive drive and reliable system gear transmission has been thought of.

However spur gear can't be used in this typical system and hence to have a desired gear ratio a bevel gear system at motor end and at jacquard shaft end is proposed as shown in figure 2.

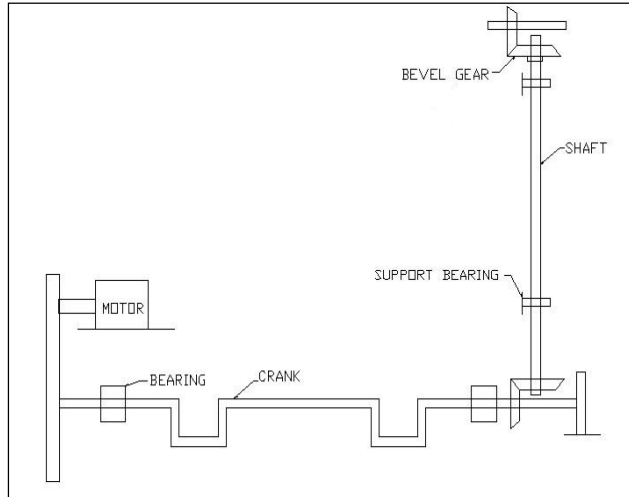


Figure 2: Proposed System

#### IV. CONCLUSION

1. The need of improvement in drive system of textile Powerloom machines is identified.
2. The existing chain drive system has a longer centre distance of about two meter. The position is such that the centre's are offset in different planes in working condition resulting in the chain sway and a significantly reduced transmission efficiency. The failure of chain drive occurs frequently. This leads to increase a downtime and financial loss.

3. A new power transmission system design is conceptualized for eliminating the above all problems in existing chain drive of Powerloom machine.
4. Next phase of this research is to model a conceptual design in order to assess its functionality.

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