

# Study of Coiler Mechanism for Mini Carding Machine: A Review

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**Abstract**— It is well known that the effectiveness of the textile machine has remarkable effects on its performances. Therefore, correct design of carding machine and its mechanism is vital. A carding machine in combination with an apparatus for charging a flat coiler can with sliver. The apparatus is disposed at the outlet of the carding machine and includes a rotary coiler head receiving sliver from the carding machine outlet and depositing the sliver in coils in the coiler can. In this paper detailed study of carding machine and its mechanism is discussed. The distinct problem identification will make known. In the proposed work analysis of existing machine will be performed. Design and development of the machine will be performed as CAD modeling will be accomplished in CAD software and analysis of developed model will be done with the help of analysis software. Results will be discussed and design will be finalized.

**Keywords:** Carding Machine

## I. INTRODUCTION

Carding is one of the most important textile technological processes whose aim is intermixing loose fibers, removing rubbish and short fibers as well as straightening and parallel arrangement of the fibers left. Next, they are to be formed into a semi-finished product in the form of a thin layer of fibers with the width of the machine – web or sliver which is formed by condensing the web. Woollen and wool-like fibers (chemical fibers with similar properties) are reworked with the use of roller carding machines.

The paper involve study and analysis of existing coilers. Using that basics and existing coiler mechanism a new concept will be developed for design of coiler for slow speed mini carding machine.

This work involve design and development of coiler attachment of mini carding machine. The work also include 2D & 3D CAD models of the coiler attachment along with its animation. The analysis of critical component will be done using analysis software like ansys.

### A. Object or task of the card:

#### 1) Opening to individual fibers:

The blow room only opens the raw material to flocks whereas the card opens it to the stage of individual fibers. This enables the eliminations of impurities and increases the performance of other operation.

#### 2) Elimination of impurities:

Impurities are mostly eliminated in taker in and a small portion of it is eliminated by flat stripping. Modern card removes 80 – 90% impurities from lap and slivers contain only 0.05 – 0.3% foreign matter.

#### 3) Elimination of dust:

Card is good dust removing machine. It removes free dust as well micro particles by significant friction.

#### 4) Disentangling of neps:

Blow room increase neps from machine to machine, but card reduce it to a small friction. The card does not remove neps but disentangles it by opening them. Low space between the clothing, sharper clothing optional speed of taker in, low

doffer speed etc. Can improve the disentangling process of neps.

#### 5) Fibre blending:

The card scarcely improves long term blending as the residence time of the material in the machine is too short. The card improves traverse blending and fibre with fibre mixing.

#### 6) Coiling

The process (Cyclonical deposition) by which the delivered sliver is uniformly deposited in a sliver can in an orderly manner is called coiling.

The slivers without coil formation if drawn from the card sliver can to draw frame then definitely the slivers will result in fuzz and apparently would have hampered the production. To reduce this problem coiling mechanism was introduced. It would be very difficult if the slivers are deposited in the can straightly without coil formation.



Actual Images of coiler

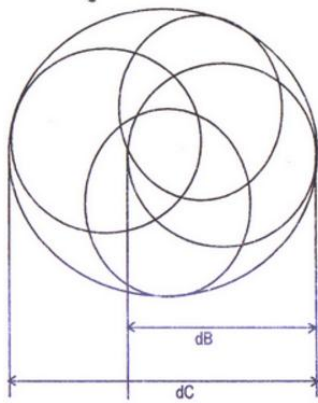
### B. Object of coiling mechanism

The function of coiler mechanism is to lay the condensed sliver delivered by the calendar rollers in an orderly manner (Cycloidal deposition) in a cylindrical can. Sliver from the can may be pulled out at the next process without becoming entangled or stretched.

### C. Types of coiling

#### 1) Over centre coiling:

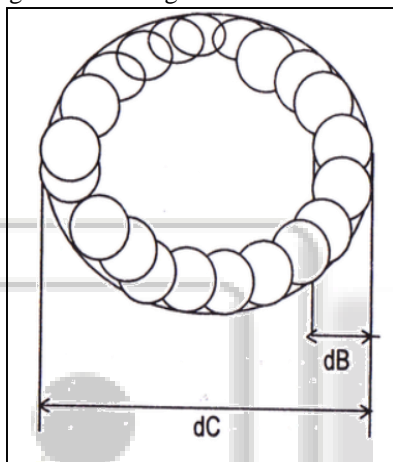
Over centre coiling is the coiling where the dia of circle of the sliver i.e., the dia of coils is greater than the radius of the can. Over centre coiling is generally used in small to medium sized cans up to 24" dia.



Over centre coiling

2) Under centre coiling:

Under centre coiling is the coiling a can where the dia of circle of the sliver is less than the radius of the can. Under centre coiling is used in larger diameter cans.



Under centre coiling

II. LITERATURE REVIEW

DetlefBettinger[1]A carding machine in combination with an apparatus for charging a flat coiler can With sliver. The apparatus is disposed at the outlet of the carding machine and includes a rotary coiler head receiving sliver from the carding machine outlet and depositing the sliver in coils in the coiler can. The coiler can is reciprocated underneath the coiler head in a first direction for depositing sliver along a coiler can length extending parallel to the first direction. When charging of the coiler can is concluded, a device shifts the coiler head in a second direction over an additional coiler can for switching coiler cans from a full can to an empty can. A slack forming device for forming a slack in the sliver is arranged between the carding machine outlet and the coiler head.

Mr. Gaurav D. Thakur, Mr.Ujjawal D. Gulhane[2]It is well known that the effectiveness of the feeding system of a textile machine has remarkable effects on its performances. Therefore, when talking about card, correct feeding is vital. Feeding Machine is provided for automatically and sequentially supplying of cotton. Feeding process is nothing but a conveyor system through which ginned cotton is passed through the rolling system with uniform speed and with specific density of cotton. The ginned cotton, before get feed in to the carding machine it is getting transferred in to lap

form by passing it through the rolling pairs which is then feed in to the carding machine.

JurgFaas[3] A sliver-delivering machine such as a card and a sliver coiler are each provided with an independent drive including a frequency-controlled free-phase motor. In addition, a frequency converter is connected in common to the motor of each drive for supplying power to each. The motors of the sliver-delivering machine and the coiler have a load—dependent speed characteristic, for example, each is an asynchronous motor with a maximum slip of 3% over a delivery speed range of upto 300 m/min.

Galina A. SIVYAKOVA [4]This article is devoted to questions of building of un-coiler electric drive simulation model at rolling mill. Model detects current, moment, electro driving power, magnetic flow and engine rotation speed.

In sheet rolling mills there is important to adjust the tension of the strip which is unwound from the un-coiler reled wound onto a coiler. Rolling of metal without creating tension is not possible because in this case the quality of the metal is reduced (appear different thicknesses plots ripple), possible rush band, i.e. the accuracy of maintenance of tension exerts a decisive influence on the course of the process

PiotrDanielczyk,JacekStadnicki[5]The following paper presents the solution to the problem of searching the best shape structural form of the bottoms and optimal dimensions of the main cylinder of the carding machine with consideration to the criterion of minimal deflection amplitude. The ANSYS package of the Finite Element Method has been used for the analysis. Polak-Ribery conjugate gradient method has been applied for searching the optimal solution, basing on the parametric model of the cylinder written with the use of Ansys Parametric Design Language. As a result of the performed analyses, reduction of maximum deflection value at approximately 80% has been obtained. Optimal cylinder dimensions enable application of a new textile technology – microfiber carding and improvement in the quality of traditional carding technology of woolen and wool-like fibers.

Mohammad Eghtesad, EbrahimFarjah, SamadJavid and MojtabaRasouli[6]This paper presents problems in the coilers section of hot strip mill of Mobarakeh Steel Company, including the work piece loosening and telescopic form which resulted in production of undesirable products. The paper reports the study of the electrical and mechanical parts of the coilers section in which the coiler motors and the other parts have been simulated along with the existing controls; a suitable model for analyzing the operation of the coiler motors has been attained. The simulation results are in good conformity with the observed outputs of the coilers' section. The purpose of this paper is to propose a model to analyze the performance of coiler motor. The first section explains coiler system functionality and control circuits and the second section presents the simulation of coiler system accompanied with its controllers

M.E.M. LEE, and H. OCKENDON [7]The problem of understanding the transfer of fibers between carding-machine surfaces is addressed by considering the movement of a single fibre in an airflow. The structure of the aerodynamic flow field predicts how and when fibers migrate between the different process surfaces. In the case of a

revolving-flats carding machine the theory predicts a “strong” aerodynamic mechanism between taker-in and cylinder and a “weak” mechanism between cylinder and removal cylinder resulting in effective transfer in the first case and a more limited transfer in the second.

Michael Eung-Min Lee [8] In this work A model for a slender thread or fibre in a slow viscous incompressible fluid is derived. The material of the thread is assumed to have no bending stiffness and to be strictly inextensible. The model is then applied to a simplified industrial situation found in carding, where a thread hangs off a hook. In two limiting cases, perturbation methods give approximate asymptotic solutions, and numerical solutions are found for the general case.

Dr. SarinaBintiShafie[9] - A coil winding machine is a machine for winding coil onto a spool, bobbin and many more. This coil winding machine is one of types of winding machine that available in industries today. From multi speeded machines to medium, large and extra-large machines, these machines come in various types and categories, performing a range function. The common applications for a coil winding machine are to wind coils for transformer, inductors, motor and chokes. To complete a coil using manual coil winding machine will be inconvenience and waste of time. Therefore, fabrication of coil winding machine will be done in this project which is controlled by two stepper motor using Arduino program. This machine is inexpensive, easy to operate and build in a small-scale size. This project also can be used for training students in winding of small transformers & relay coils. Typically, a winding machine winds a material such as metal wire, thread, or paper, onto a core, spool, or bobbin. There are several different types of winding machines, from simple manual feed machines to complex computer-numeric-control (CNC) machines. Some of the more common uses for winding machines are coil winding, rope winding, and continuous filament winding.

Akshay Patel, RohitPawaskar, AdityaThete, Suryakant Thakur[10] Proper material handling systems in the industries provide a very cost efficient and fast process of production. Designing proper material handling systems is the major need in every industry. Even though there are good material handling systems available with large industries, design and completion of a new model or a system provides a better usability to the workers. The new design is easily accessible and designed according to the requirements of the industry. The aim of the paper is to design and fabricate a system for loading the coils on the de-coiler machine. This will help to improve the material handling system of the industry. Also, it will reduce the final cost of production by a huge margin. The design will be done with the help of various softwares.

### III. IDENTIFIED GAPS IN THE LITERATURE

Most of the projects on carding machine till now is based on carding machine effectiveness, optimization on its structure and dimensions of carding machine components, review on problems caused during coiling of fibers, fibers quality produced after carding, etc. From our research the improvement in design is still needed and very limited work has been observed on the design improvement of coiler

mechanism for mini carding machine. This work is focused on design and modeling of coiler mechanism for mini carding machine.

### IV. PROBLEM FORMULATION

This objective of the proposed work is to design and modelling of coiler mechanism for mini carding machine. Existing coiling mechanism is suitable for & in accordance with the large scale carding machine.

The speed of coiling is very high and the cost of the mechanism is high. To overcome from the above mentioned problem we are performing Analysis of existing coiler mechanism which is vital for the development of new coiler. Also Mini carding machine needs slow speed coiling, hence new design will be preferred.

### V. RESEARCH METHODOLOGY

In present study, we will be accumulating all the necessary data of existing Carding machine .Analysis of existing machine will be performed. Design and development of the machine will be performed as CAD modelling will be accomplished in CAD software and analysis of developed model will be done with the help of analysis software. After that results will be discussed and design will be finalized.

### VI. CONCLUSIONS

The detailed study of the carding machine, its mechanism and carding machine components from the literatures and available sources assisted us to apprise us with the deep information and knowledge about the machine. With the successful completion of this project, the company will be directly benefited as design and modeling of coiler mechanism for carding mechanism will increase the production rate, increase the quality of sliver produced and reduce the unavoidable neps formed during the process.

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