Comparison of cleaning efficieny of old & new cotton card

[MS programme]

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Chapter I

INTRODUCTION

Topic description

This topic is related to textile spinning technology and especially it is related with the carding section of spinning technology. This project concerns with the cleaning ability of old and new carding machines and their comparison on basis of clean ability.

OBJECTIVES

Objectives of this project are

- Comparison of cleaning efficiency of old and new cards

  The main difference between old and new card is its cleaning efficiency. And this difference is mainly carried out by using different devices like Suction devices, electrostatic fiber openers in new cards.

- Determination of DC (Degree of Cleaning)

  The numerical evaluation of the cleaning effect of a machine in spinning preparation is generally effected by detailing the degree of cleaning, which indicates in percentage terms the quantity of trash removal relative to the trash content present in the feed material.

What is spinning?

Spinning is an ancient textile art in which plant, animal or synthetic fibers are twisted together to form a yarn.

HISTORY

HAND SPINNING

In the most primitive type of spinning, tufts of animal hair or plant fiber are rolled down the thigh with the hand, and additional tufts are added as needed until the desired length of spun fiber is achieved. Later, the fiber is fastened to a stone which is twirl round until the yarn is sufficiently twisted, whereupon it is wound upon the stone and the process repeated over and over.
The next method of twisting yarn is with the *spindle*, a straight stick 8-12 inches long on which the thread is wound after twisting. At first the stick had a cleft or split in the top in which the thread was fixed. Later, a hook of bone was added to the upper end. The bunch of wool or plant fibers is held in the left hand. With the right hand the fibers are drawn out several inches and the end fastened securely in the slit or hook on the top of the spindle. A whirling motion is given to the spindle on the thigh or any convenient part of the body. The spindle is then dropped, twisting the yarn, which is wound on to the upper part of the spindle. Another bunch of fibers is drawn out, the spindle is given another twirl, and the yarn is wound on the spindle, and so on.

The *distaff* was used for holding the bunch of wool, flax, or other fibers. It was a short stick on one end of which was loosely wound the raw material. The other end of the distaff was held in the hand, under the arm or thrust in the girdle of the spinner. When held thus, one hand was left free for drawing out the fibers. A spindle containing a quantity of yarn rotates more easily, steadily, and continues longer than an empty one; hence, the next improvement was the addition of a weight called a spindle whorl at the bottom of the spindle. These whorls are discs of wood, stone, clay, or metal with a hole in the center for the spindle, which keep the spindle steady and promote its rotation. Spindle whorls appeared in the Neolithic era.

INDUSTRIAL SPINNING

Modern powered spinning, originally done by water or steam power but now done by electricity, is vastly faster than hand-spinning.

The spinning jenny, a multi-spool spinning wheel invented circa 1764 by James Hargreaves, dramatically reduced the amount of work needed to produce yarn, with a single worker able to work eight or more spools at once. At roughly the same time, Richard Arkwright and a team of craftsmen developed the spinning frame, which produced a stronger thread than the spinning jenny. Too large to be operated by hand, a spinning frame powered by a waterwheel became the water frame.

In 1779, Samuel Crompton combined elements of the spinning jenny and water frame to create the spinning mule. This produced a stronger thread, and was suitable for mechanization on a

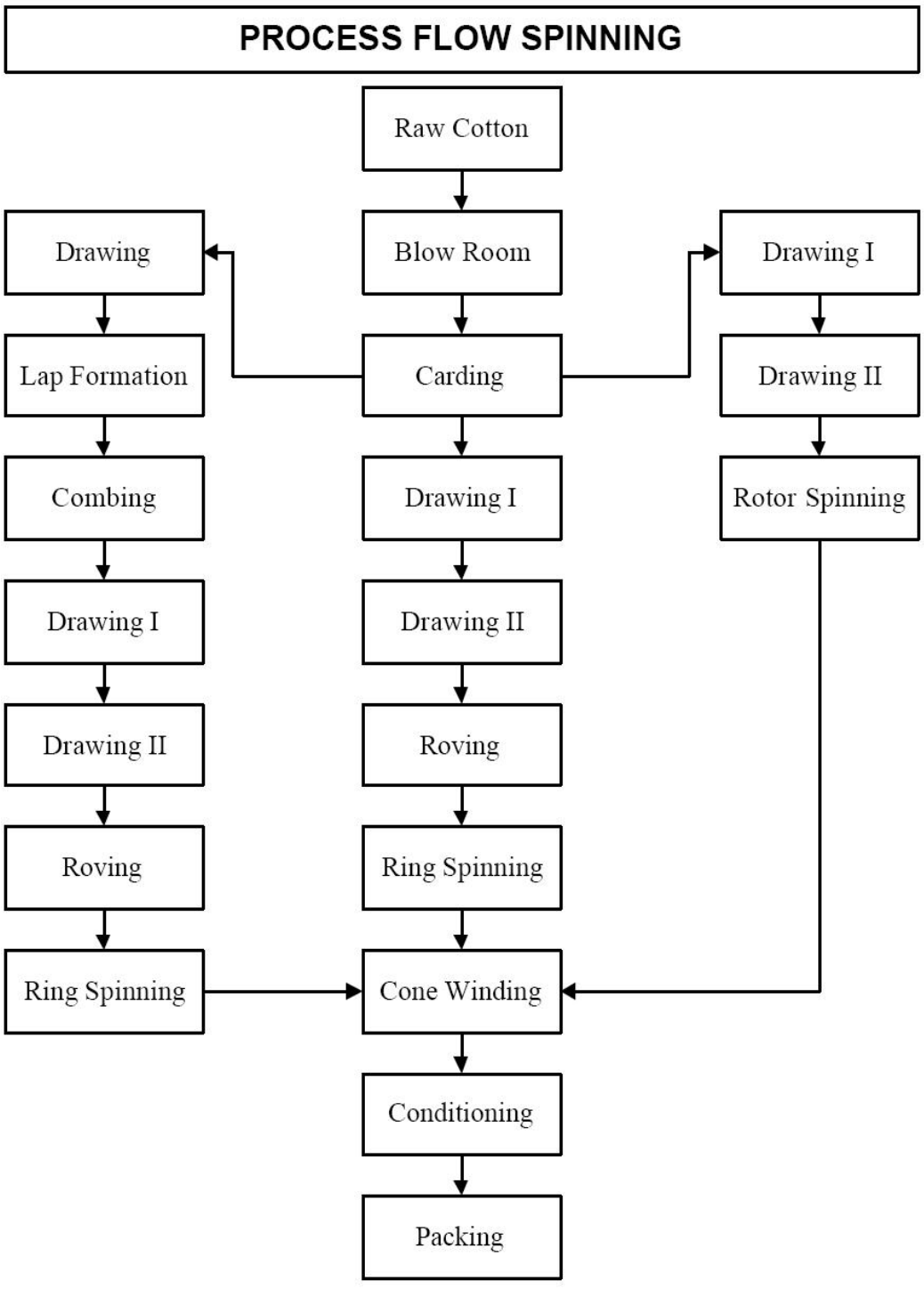
grand scale. In the 20th century, new techniques including Open End spinning or rotor spinning were invented to produce yarns at rates in excess of 40 meters per second.

TYPES OF SPINNING:

There are two main types of spinning

1. Normal spinning
2. Compact spinning

SPINNING PROCESS CYCLE:



PROJECT CONCERN:

"Comparison between cleaning efficiency of new & old cotton cards"

CARD

WHAT IS CARD

Introduction: The proverbs of the experts "**The Card is the heart of the Spinning Mill"** and "**Well Carded is half spun"** demonstrate the immense significance of carding for final result of the spinning operation. - There is a strong relationship between increase in production and reduction in quality: the higher the performance, the more sensitive becomes the carding operation and the greater the danger of a negative influence on quality. - The concept of carding machine is unchanged since 1770. - Since 1965 production rate has been increased from about 5 Kg/h to about 100 Kg/h, a rate of increase not matched by any other machine except the draw frame.

THE TASKS OF THE CARD:

New cotton card can perform the following tasks:

- ***Opening to individual fibers***, this enables elimination of impurities and performance of other operations.

- ***Elimination of impurities*** occurs mainly in the region of the taker-in. The degree of cleaning achieved by modern card is very high, in the range of 90 -95%. Thus, the overall degree of cleaning achieved by the blow-room and carding room together is as high as 95 -99%. Card sliver still contains 0.05 – 0.03% of foreign matter.

- ***Elimination of Dust,*** which are bound to the fibers. Significant fiber/metal and/or fiber/fiber friction is needed in order to loosen such particles, this are available in carding operation.

- ***Disentangling of neps,*** The number of neps increases from machine to machine in the blow-room, the card reduces the remaining number to a small fraction, they are mostly opened out. Improvement in disentangling of neps is obtained by closer spacing between clothing; sharper clothing; optimal speed of taker-in; low doffer speeds; lower throughput.

- ***Elimination of short fibers,*** this may occur at flats. Long fibers have more contact with the clothing of the main cylinder than the short fibers. Thus longer fibers are continuously caught and carried along the main cylinder, where the short fibers stay caught in the flats clothing, press into it and leave the machine in the flat stripping. The card eliminates very small percentage of short fibers about 1%.

- ***Fiber Blending,*** transverse blending occurs because the card is the only machine to process individual fibers. In formation the web, and with repeated rotation of the fibers on the main cylinder, intimate fiber with fiber mixing is achieved.

- ***Fiber orientation:*** The card is often attributed the effect of paralyzing. A parallel condition is achieved on main cylinder, but it disappears during web formation between cylinder and doffer.

- ***Sliver formation,*** for further processing. Generally the hank lies between 4 and 5.5 Ktex in the short staple spinning mill.

OPERATING PRINCIPLE:

Elements of Card:

1. Pipe ducting for supplying raw material,
2. Chute feed; evenly compress a bat of 500 – 900 Ktex.
3. Transport roller; forwards the material to feed arrangement
4. Feed arrangement, consists of feed roller and feed plate,
5. Taker-in, opens the material to small flocks, when the material passes to main cylinder, mote knifes; grid bars and carding segments eliminate a great part of impurities.
6. Grid equipment
7. Suction duct to carry away the waste.
8. Main cylinder
9. Fixed carding segments designed to assist the carding operation.
10. Flats, the main carding operation occurs between flats and cylinder. Flats comprise 80 to 116 individual carding bars combined into a band moving on an endless path. 30 to 46 of flats are always in action.
11. Cleaning unit, strips fibers, neps and foreign matters from flats,
12. Fixed carding segments designed to assist the carding operation.
13. Grid or cover plate
14. The doffer, combine the fibers into a web, because of its substantially lower peripheral speed relative to the cylinder.

15. Stripping deice, doffing master, draw the web from the doffer.

16. Calender rollers

17. Can

18. Coiler

DEVELOPMENTS IN CARDS FOR IMPROVED CLEANING

The card is the heart of the spinning mill because if we see the card sliver, it is just the magnified replica of the yarn. Quality of yarn is directly related to the quality of card sliver. Thus the modern developments, in the carding machine, are carried out to produce better sliver. The following sections discuss some of the modern developments in the carding machine.

1. UNIDIRECTIONAL FEED UNIDIRECTIONAL FEED

results in gentle fibre treatment because fibre feed and licker-in rotation is in the same direction. The latest version of Rieter card C60 and Trützschler TC 07 feature with unidirectional feed system.

2. MULTIPLE LICKER-IN

The concept of using three licker-in place of one is basically for better cleaning of the feed material. Here the concept of clamped and unclamped feeding is used. The latest version of Rieter card and Trützschler card feature with multiple licker-in system. The modular design of Rieter C 60 card makes it possible to convert from 3 licker-in units to 1 unit.

3. INCREASE IN THE CARDING ZONE/WIDTH OF CARD

The modern machines achieve production rates of 60 - 220 kg/h, compared with output of 5 - 15 kg/h in 1970. One of the many factors behind increase in the production, without deteriorating quality, is increase in the carding zone area, particularly width of the card and/or long carding section.

3.1 RIETER C 60 WIDE WIDTH CARD

Compare with the previous version of the card (C 51), Rieter C 60 Card has 50% more working width (from 1 m to 1.5 m). The diameter of the cylinder has been reduced (but RPM is increased) whereas the take-off roller diameter is increased. Thus, the cylinder can take higher fiber mass, resulting in higher production without deterioration in carding intensity. An increase in production is equivalent to increased fiber mass on the cylinder that will result in poor sliver and yarn quality. But because of more carding width, the available carding surface is more, hence this enables output to be increased by 50% without deterioration in sliver or yarn quality.

3.2 Trützschler TC 07 CARD WITH LONGEST CARDING SECTION

Trützschler TC 07 has 2.82 m carding section. The pre-carding area ensures optimal fiber web preparation for better carding. Better the pre-opening, more intensive the carding and higher the production.

4. USE OF PRE AND POST-CARDING SEGMENTS

The opening/individualization of fibers achieved by the carding action between the cylinder and the flats is expressed by the number of wire points per fiber. Higher production rate decreases wire points per fiber and thus deteriorate carding action. So pre and post-carding elements are used to achieve better carding action.

4.1 RIETER PRE AND POST-CARDING AREA ON C 60 CARD

Pre-carding zone of Rieter C 60 Card has 6 carding units along with guiding elements and mote knife. The guiding element and the associated mote knife extract impurities while suctions hoods take these extracted impurities to centralised waste chamber. Similarly, post-carding zone has 2 carding elements, one guiding element and a mote knife are used.

4.2 Trützschler PRE AND POST-CARDING AREA ON TC 07 CARD

Pre-carding zone of Trützschler TC 07 card has 3 carding elements (2 clothing strips each) and 3 cleaning elements whereas post-carding area has 6 carding segments (12 clothing strips) with 3 cleaning elements. The pre- and post-carding area has total ten elements each.

Cleaning element, carding element and control element are standard parts whereas the remaining eight elements can be flexibly selected according to the required task. Cleaning element has a mote knife with a suction hood and is designed to separate tiny dirt particles, seed coat fragments, dust particles, and fiber fragments. Carding element consists of two clothing strips equipped with different clothing types and finenesses depending on raw material. The control element is similar to a cleaning element, but it manipulates air-stream on the cylinder surface thus optimize the function of the cleaning elements. When none of the elements described above is used in the pre- and post-carding area, a cover element is mounted.

4.3 Marzoli PRE AND POST-CARDING AREA ON C601 N CARD

The pre-carding zone of Marzoli C601 N Card has nine carding segments and a knife to eliminate the waste. The total length of the pre-carding zone is stated to be 720 mm whereas that of post-carding zone is 550 mm. The post-carding zone has six carding segments with two suction and knives to eliminate remaining trash.

5. INTEGRATED GRINDING SYSTEM

Card wire grinding is not only a troublesome job but also time consuming. The machine manufacturers are now coming out with a unique idea of wire grinding on the machine itself while the machine is in production.

5.1 RIETER INTEGRATED GRINDING SYSTEM (IGS-TOP AND IGS-CLASSIC)

Rieter IGS-System comes in two versions; IGS-Classic for cylinder wire grinding and IGS-Top for flat wire grinding. IGS-Classic has a grindstone, which moves across the cylinder under automatic control during production. This process is performed 400 times during the planned lifecycle of the clothing as compared with every 80 to 100 tonnes in case of manual grinding. This results in better quality in terms of reduction in neps and trash of card sliver. IGS-Top is installed permanently over the returning flats after the flats cleaning unit and it performs automatically more than 100 grinding cycles per clothing lifecycle. The flats rods are raised one after the other by spring force and pressed against the rotating grinding brush. Short, hard bristles grind the flat points while longer, softer bristles keep the later edges sharp. IGS-System gives prolonged cylinder clothing life to the tune of 10 to 20%.

6. USE OF AUTOLEVELLER

To control card sliver count variations, count CV% and unevenness, modern cards are equipped with autoleveller.

6.1 Rieter MEDIUM AND LONG TERM AUTOLEVELLER ON C 60 CARD

Medium-term leveller of Rieter C 60 card measures the feed mat thickness at the feed trough and, as required, the feed roller speed is adjusted through the control system. Similarly, long-term leveller measures the sliver thickness by the step roller pair and adjusts the chute system accordingly.

6.2 Trützschler SHORT-WAVE AND LONG-WAVE AUTOLEVELLING SYSTEM

For the short-term autolevelling, the Integral Feed Tray SENSOFEED of Trützschler TC 07 card constantly scans the thickness of the tuft web and the required adjustment in the speed of the

feed roll is made through the card control system. Similarly, long-term autoleveller measures the sliver mass through the sensor in the card's sliver trumpet and control the speed of the feed roller accordingly. A single sensor can be used for the entire card sliver counts.

6.3 Marzoli Short Term and Medium Term Levelling System

The short term leveller senses the web thickness (weight) through the load cell. When the web weight exceeds by ±10% of its basic, the sliver draft is adjusted via, microcomputer.

a. This system functions over a sliver length as low as 4 cm. The MT leveller senses the mat thickness (weight) and varies card draft as required.
b. This system functions over a sliver length as low as 1 m (40").

7. ONLINE FLATS SETTING AND LICKER-IN WASTE SETTING

All the major machine manufacturers are improving the card with manual or motorized reproducible setting of licker-in mote knife and fats. The setting can be optimized while the machine is in running conditions.

7.1 RIETER FLAT AND LICKER-IN SETTING SYSTEM

The C 60 Card of Rieter has a central flat setting system to adjust and reproduce the flats setting precisely. The licker-in under casing is also fitted with adjustable knife (manually or electronically) to alter the setting. Thus the optimal trash removal at the licker-in during the card production can be determined.

7.2 Trützschler PRECISION SETTING AND MEASURING SYSTEM (PMS, PFS AND TC-FCT)

Precision Knife Setting (PMS) System of Trützschler Card adjusts the distance of the knife to the needle points and clamping point between feed roll and needle roll to alter the degree of cleaning. The knife setting can be adjusted manually or through motor while the carding is running and can be seen through the transparent suction ducts.

Similarly Precision Flat Setting (PFS) System adjusts the flat-cylinder gauge manually or through motor.

A scale fitted on the frame shows the actual setting. The Flat Measuring System (FLATCONTROL TC-FCT) is used to measure the distance between cylinder and flat. For measurements, three regular flats are removed with measuring flat.