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Design and Analysis of selective components of the roving machine

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ABSTRACT

There are numbers of parts in Roving Machine some of them are Aprons (top and bottom), Spacer, Condenser, Flyer. In this report, we have analyzed the functions of this component and designing of a roving machine. The effect of process variables like:-lap hank, card draft, draft/doublings, and drafts at speed frame, ring frame, rotor, and air-jet spinning machine on packing density parameters of respective technology yarn was Analyzed The effect of noise variables were also accounted for. The trends of change in packing density with process variables are opposite to those of yarn diameter and helix angle of the ring, rotor, and air-jet yarns studied. The packing density is found to be the highest in air-jet yarn and the lowest in rotor yarn. An increase in the draft in air-jet spinner and decrease in rotor spinner increase packing density of the respective yarns. The change in noise variables does affect the packing density parameters of yarns.

***Keywords**: Yarn Production, Yarn Manufacturing Department*

1. INTRODUCTION

Textile industry is one of the oldest and the largest industries in the world. Richard Arkwright is said to be the first founder of textile machinery. Richard Arkwright was a barber and wig maker in Bolton around 1750 where he learnt that he could make a lot of money if you could invent a machine to spin cotton fibre into yarn or thread quickly and easily he teamed up with the clockmaker called John Kay and by the late 1760's they had a workable machine that could spin 4 strands of cotton yarn at the same time. Arkwright paid for a patent in 1769 to stop others copying his invention. During that period James Hargreaves also invited a multi spool spinning wheel in 1764 which dramatically reduced the amount of work needed to produce yarn of high consistency, with a single worker able to work eight or more spools at once so, this was the beginning of the textile machineries and hence so-called textile industries. The textile industry is primarily concerned with the design, production and distribution of yarn, cloth and clothing. the raw material may be natural or synthetic using a product of the chemical industry made by extruding a polymer. Cotton is the world's most important natural fibre with the global yield of 35 million hectares cultivated in more than 50 countries out of which India is the leading cotton producing countries worldwide in 2019-20 with the cotton production amounted to around 6.42 million metric tons. India also has the distinction of having the largest area under cotton cultivation in the world I.e. about 126.07 lakh hectares.

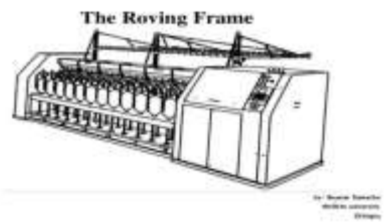


Fig. 1: Roving Frame Machine

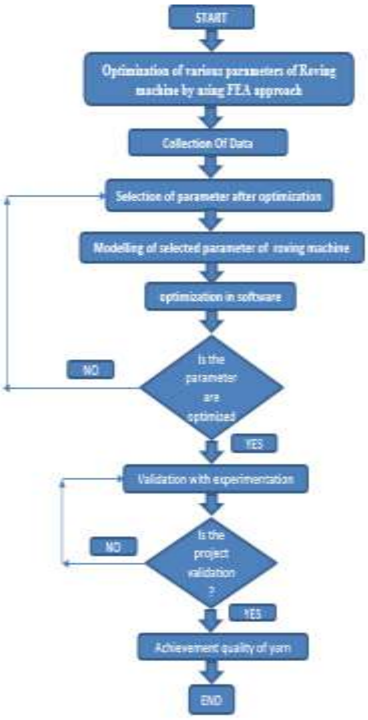
2. METHODOLOGY

The input of roving frame is silver that comes from draw frame section where only parallel of comber sliver. The roving section reduces the linear density of draw frame silver by drafting. After reducing the linear density the silver is transfer into roving (a thin form of rope)

2.This is the first stage where the twist is inserted for making a yarn in a spinning mill. The output of this section is roving which is wind on a bobbin and this is suitable for the further process.

3.n-ring spinning system, conversion of sliver into yarn through a single step has not succeeded since the total draft needed is in the range 300-500 which is very difficult to apply on sliver in a single step and obtain good quality yarn. Sliver cans occupy large space in comparison to the space of one spinning position

of ring spinning frame, so there is need to have finer strand wound on smaller packages, which the roving operation satisfy.
4.Sliver is a thick, untwisted strand that will lead to more hairs and fly while converting it directly to yarn when a high draft is applied. In contrary, rovings are finer and twisted so the chances for generation of hairs and fly are less with the roving operation.Roving frames are also called Speed Frames, Flyer Frames, and most popularly Simplex Machines.



3. SELECTIVE COMPONENT OF ROVING MACHINE

3.1 APRON

3.1.1. Aprons are one of the most effective means to support the floating fibers and drastically reduce the drafting wave. Apron wear is accelerated by high drafts and sliver linear density.
3.1.2. It is essential that the aprons should extend as closely as possible to the nip line of the front rollers.
3.1.3. The top apron is short and made of synthetic rubber that has a thickness Of about 1 mm. Bottom apron is larger and made of the same material as the upper one.
3.1.4. Basically, synthetic aprons are made in an endless tubular form whereas leather aprons are made in open strips that are subsequently glued together to form an apron.
3.1.5. The advantage of tubular construction is seamless and uniform along Its circumference.
3.1.6. The length of the aprons also called as the cradle length is kept approximately equal to the staple length of the fibers. The cradles for different staple length are shown in Figure

Fig 3.1.1 Apron

3.2 Spacer

3.2.1. Plastic elements which maintain space between two aprons is termed as spacer.
3.2.2. We can also say wider the cradle opening, lesser will be the control of fibers between aprons leading to thick place in the yarn.
3.3.3. The distance between top and bottom aprons is maintained by a small component called "cradle spacer" or "spacer," which is inserted between the nose bar of the bottom apron and the cradle edge of top apron. The selection of spacer for a process depends on the hank of the sliver, break draft, and roving hank.

Advantages and disadvantages of reducing the spacer size :
- Advantages of reducing the spacer size.
1. Improves the uniformity of roving.
2. Reduces the imperfection level.
Disadvantages of reducing the spacer size:
1. Drafting problems.
2. Affects the running behavior of speed frame.
3. Generation of slug due to over control of fibers.

Fig 3.2.1 Spacer

3.3 Condenser

3.3.1. Condensers placed in the drafting zone help to prevent the fiber Strand from spreading apart during drafting.
3.3.2. Condensers can be classified as feed (or inlet) condenser, middle Condenser and delivery (or floating) condenser (Figure). Feed condenser is used just before the back pair of drafting rollers.

3.3.3. The middle condenser is used near the nip of the middle pair of rollers and the third one is used just before the front pair of rollers.
3.3.4.The main function of the feed condenser is to lead the sliver properly into the drafting arrangement.
3.3.5. The main function of the last two guides is to bring back the fiber Mass into a strand that tends to tear apart because of the drafting action The size of condensers should be selected according to the volume Of the fiber sliver (Table).

Fig 3.3.1. Condenser.

3.4. Flyer

The flyer is a special component of the roving frame that helps to insert twist in the roving. The flyer speeds employed normally range from about 1000 to 1400 rpm. The flyers' special shape offers less air resistance, preventing roving breakages. The features of a good flyer are summarized as follows:
1. 1t should improve the quality of twisting by inserting false twist.
2. The flyer should produce balanced running condition, especially at higher speed.
3. The design and quality of the metal of flyer should be such that there is no chance of spreading off layer.
4. There should be provision for slight changes in roving tension.
5. There should be facility for easy and simple doffing operation. It should be maintenance Friendly.
6. Earlier flyer were invariable made of steel but they are most made of light alloy.
7. The amount of the spreading depends upon the rotation speed. When this varies e.g. during starting and stopping. The processor arm adopts continually shifting varying inclination which causes continual shifting of the winding point of bobbin.
8. In light alloy flyer have lower weight can have varying sizes which are specified in inches.
9. The stated size are actual winding dimension i.e. Maximum height Maximum diameter of wound package of material.
10. Limits of the performance roving frame are determine by both delivery speed and rotation speed of flyer.
11. The influence of the flyer depends upon its form and drive using these criteria as a basis, the following distinctions can be drawn between 3 flyer types.

3.4.1 Spindle mounted flyer:
1. The standard form has in the past been the spindle mounted flyer .
This is simple as far as design and drive are concerned, but not form the service point of view or for automation purposes.

3.4.2 Closed flyer:
1. In closed flyer, supported both above and below, has been used only by Platt Saco Lowell in the Rovematic machine.
3.4.3 op-mounted flyer:
1. among other things, this form facilities automation of the doffing Operation.

2. The flyer is supported by ball bearing at the neck and is driven by gear wheels or toothed belts form above.

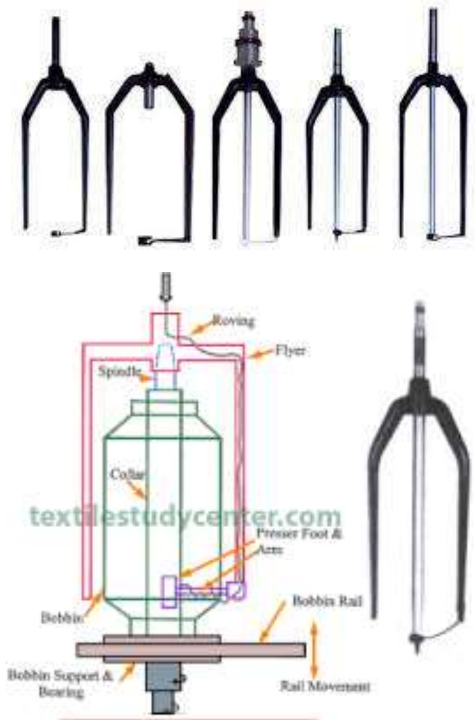


Fig 3.4.1. Flyer

3.5.1 Formulas.
1) Surface speed = $\pi DN min/$
D = dia. of rotating element
N = rpm (no. of revolutions/min)

$$\text{Mechanical Draft} = \frac{S.S\ of\ front\ roller\ (\pi DN)}{\text{S.S of back roller } (\pi DN)} > 1$$

3)

$$\text{Actual Draft} = \frac{\text{count delivered}}{\text{count fed}}$$

$$\text{A.D} = \frac{\frac{W}{l}\text{delivered}}{\frac{W}{l}\text{fed}}$$

Indirect system
4)

$$\text{Actual Draft} = \frac{\text{count fed}}{\text{count delivered}}$$

$$\text{A.D} = \frac{\frac{W}{l}\text{fed}}{\frac{W}{l}\text{delivered}}$$

direct system
5) No. of Twists Per Inch,

$$\text{TPI} = \frac{\text{rpm of flyer}}{\text{S.S of F.R}}$$

Simplex

$$\text{Efficiency} = \frac{output}{input}$$

Its value ranges from 0→1. it has no units

7)

$$\text{Beats/inch} = \frac{\text{beater rpm} \times \text{no.of arms}}{\pi \times \text{feed roller dia} \times \text{feed roller rpm}}$$

8) Twists per inch (TPI) $= \frac{\text{spindle speed (rpm)}}{\text{front roller delivery} \left(\frac{in}{min}\right)}$

4. CONCLUSION

With the increase in flyer speed, the roving U% and brakage rate increase but imperformace and yarn tenacity initially decrease and then incrase The optimum values of different variable are; Flyer speed, 1040rpm and condenser width 8mm. Top roller pressure 2.2kg/cm². Lower condenser width improve most of the quality parameters but decrease roving breakage rate. Although compact yarns produced from convectional roving are found to be less hairy and stronger than convectional yarns, compact yarns produced form roving show outstanding performance. 3/3 system with double apron is quite commonly used in roving frame. It is because it has high drafting speed as well as high draft ratio. Top mounted flyers should be used as it povides grater lift of the spindle for winding of bobbin. The roving is wrapped two or three times around the yoke. The number of turns determine the roving tension. If this is high, thenba hard, compact package is increase .

The textile industry is primarily concerned with the quality of design, production and distribution of yarn, cloth and clothing, making the role of process controlling parameters extra significant in this customer influenced market and hence a meticulous understanding of process control is of supreme important to manage the nearing challenges like increase in cost of raw material, shortage in supply of raw material, impact of GST, compliance: Environmental issues, shortages of laborer’s due to mass return, etc.

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