High speed drafting of textile material with high draft ratio and its impact on cots and aprons in ring spinning machines

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Abstract:

The two key factors which determine the increased productivity are spindle speeds of ring frame and end breakage rate. Modern ring frames can run at high spindle speeds of 25000 rpm. End breakage rate in ring spinning is influenced by the quality of raw materials used, level of modernization and condition of machinery, type of opening and blending operations, regularity of draw frame sliver and roving, effective humidification control, use of optimum process parameters, efficient house-keeping and careful materials handling.

For a spinning mill, an increase in spindle speed leads to a reduction of overheads and wages costs per unit production. On the other hand increase in spindle speed's proportionately increases the load on drafting unit , Drafting speed will be increased with respect to spindle speed , drafting force gets increased in case of high draft ratio (in particular for processing long staple fibres).These factors directly or indirectly increase the mechanical load on cots & aprons. A spinning cot or an apron has to withstand these high speeds drafting with high draft ratio in order to deliver high quality yarns with better consistency.

Key words:

Draft, draft ratio, roller drafting, feed hank, delivery hank, apron surface speed, front cot surface speed, fibre pulling force, fibre gripping force , drafting force, resilience, abrasion resistance , wear and tear resistance.

Introduction:

Draft:

The amount of attenuation of textile material at different stages of spinning preparatory and spinning process, for example. 1 m of input material when delivered as 5 m is said to have undergone a draft of 5.In other words reducing the linear density of textile material with respect to time by passing the material through successive pair of roller's rotating at higher peripheral speeds.

Various formulas used in textile industry to calculate the draft as follows:

Draft (mechanical) = $\frac{\text{surface speed of the delivery roller}}{\text{Surface speed of feed roller}}$

Draft (Actual) = $\frac{\text{Feed material linear density or weight per unit length fed}}{\text{Delivered material linear density or weight per unit length delivered}}$

Draft = $\frac{\text{No. of fiber's available at cross sectional area of feed material}}{\text{No. of fiber's available at cross sectional area of delivered material}}$

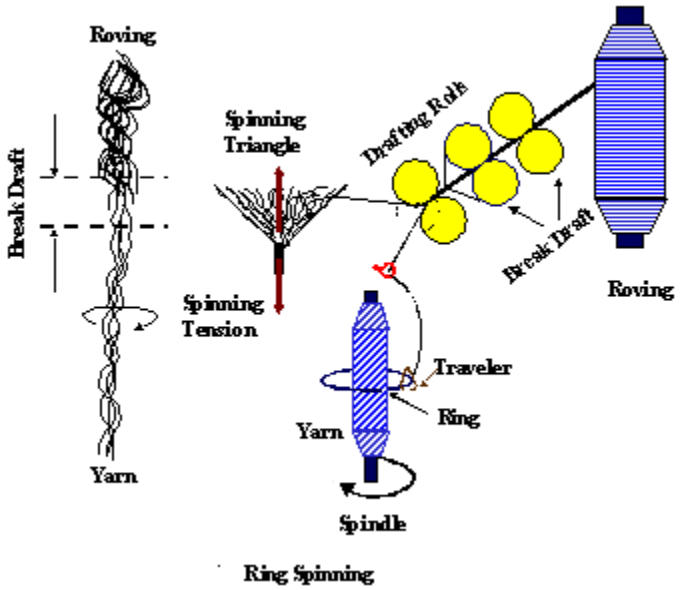
Draft is just a mere number and has no unit's.

Drafting:

It is a process of reducing the bulk and weight per unit length of a semi processed textile material such as rove or sliver and simultaneously parallelizing its fibrous components, as it passes through the various machines used in making yarn

Roller drafting system:

Commercially , there are various methods to draft the textile fibrous material like roller drafting system applied at ring spinning, speed frame and draw frames etc , aero dynamic drafting functional at rotor spinning , electro mechanical drafting , frictional drafting , etc . Out of these techniques, roller drafting system is the most commercially successful one due to its high versatility, simple design and construction, high reliability and can handle variety of fibres and a wide spectrum of count range can be spun.



3/3 ROLLER DRAFTING SYSTEM AT RING SPINNING

High speed drafting of textile material on 3/3 double apron drafting system and its impact on cots and aprons at ring spinning machine:

Theory:

High speed drafting:

Increasing the delivery speed or productivity of a spinning machine but maintaining the same hank or feed material linear density will proportionately increase the speed of drafting but draft ratio remains constant.

High draft ratio:

Maintaining the same delivery rate or productivity of the spinning frame but reducing the feed hank from finer side to courser side will proportionately increase the draft ratio.

High speed drafting with high draft ratio:

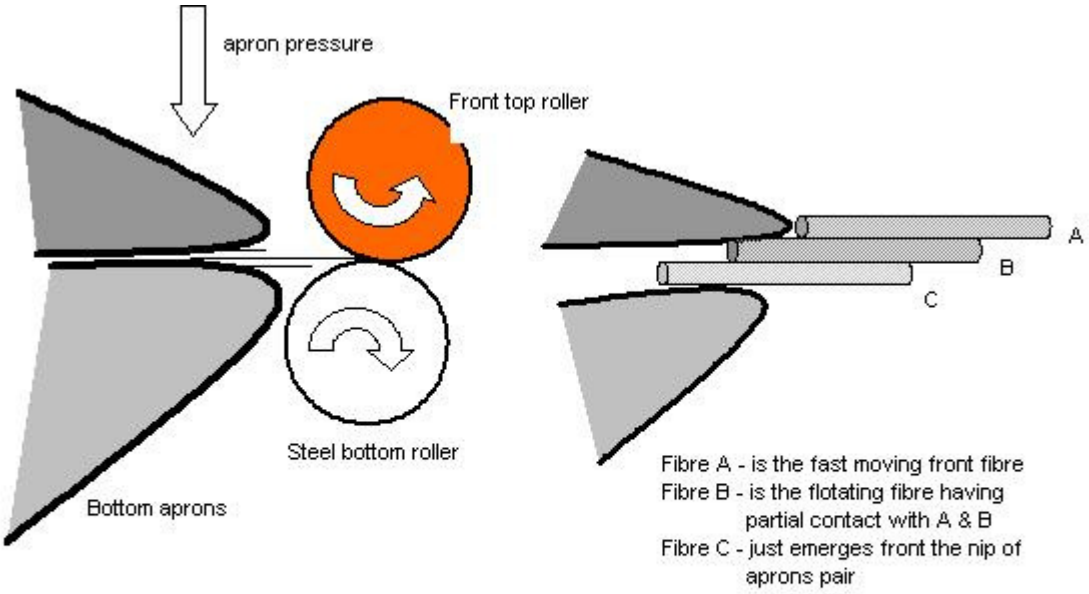
Increasing the delivery speed or productivity of a spinning machine and the same time reducing the feed hank from finer side to courser side will proportionately increase both the speed of drafting and also draft ratio.

Parameter	High speed drafting	High draft ratio	High speed drafting with high draft ratio
Front roller speed or Delivery rate	increases	remains same	increases
Feed hank	remains same	decreases	decreases
Surface velocity of apron	Increases	decreases	remains same
Surface velocity of Front top cot	increases	remains same	increases
Front zone Draft	remains constant	increases	increases

Case Study – 1 Mills normal parameter to spun 100s Ne:

Make of RF	LR 6	**Material Processed**	100% Cotton
Drafting type	P 3-1	**Fibre Length / Denier**	35.5
Blend ratio	N/A	**Total draft**	35.71
Dyed / grey	N/A	**Break Draft**	1.136
Yarn Count In Ne	100s Cwd	**Spindle speed**	19000
Roving hank	2.8	**FRS**	12.46 Mts / Min
Roving TM	1.12	**RF - TM**	3.8

Parameter	Normal	High speed drafting	High draft ratio	High speed drafting with high draft ratio
Front roller speed or Delivery rate mts /min	12.46	16	12.46	16
Feed hank	2.8	2.8	2.0	2.0
Delivery hank	100s	100s	100s	100s
Surface velocity of apron in mts/min	0.396	0.509	0.283	0.396
Surface velocity of Front top cot	12.46	16	12.46	16
Front zone Draft	31.43	31.43	44	44



Impact of high speed drafting/ high draft ratio on cots & aprons:

1. The surface speed of front top roller cot increases as a result it has to make more revolution per unit time (rpm) as a result cot's relaxation time (Rt) gets reduced proportionately. Here resilience property along with low compression set values of a cot plays a vital role. A cot having poor resilience will not recover its original geometry within that time interval and it may have permanent deformation leading to quality detoriation.

2. For the same time period, the cot and aprons should handle more volume of fibres since the productivity is more. Here abrasion resistance, wear & tear property along with other physical properties of the cots and aprons plays an important role.

3. Due to increased surface speed, handling high volume of fibres chances of lapping will be high (especially while using softer cots) due to excess static charge generation on the cots surface. In this case rubber compound conductive properties, core conductivity plays an important role.

4. In case of high draft ratio, the load on the aprons will be very high. This is due to the fact that front roller cot will have to exert more pulling force to get the fibres out of apron nip since surface speed of aprons will be lesser and more static friction takes place between fibers and apron surface. This increases the wear and tear of drafting apron.

5. The drafting combination had a significant influence on fiber speed. Increasing the drafting ratio will result's in higher fiber speeds

Conclusion:

High speed drafting with increased draft ratio significantly affects the life of individual drafting zone components especially cots & aprons. Frequency of flexing of bottom aprons at nose bar, wear out on both inner/outer layers generally increases .Cots rubber compound's abrasion resistance, anti-lapping properties together with high resilience property plays a vital role in deciding definitive yarn quality with consistency even at increased drafting speed with high draft ratio.