14. Ring Spinning Systems

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Learning objectives

On completion of this topic you should be able to:

- Explain the principles of ring spinning and the roles of the components of a spindle assembly in all three machinery versions

Key terms and concepts

Ring spinning, slubbing, sliver, roving, singles and folded yarns, gilling, drafting, combing, noils, ring frame, spindle, traveller, balloon, end break, package build, false twist device, drafting rollers, apron.

Introduction to the topic

This topic covers the most widely used means of producing a wool yarn, the ring spinning technique, which is common to all three wool processing routes.

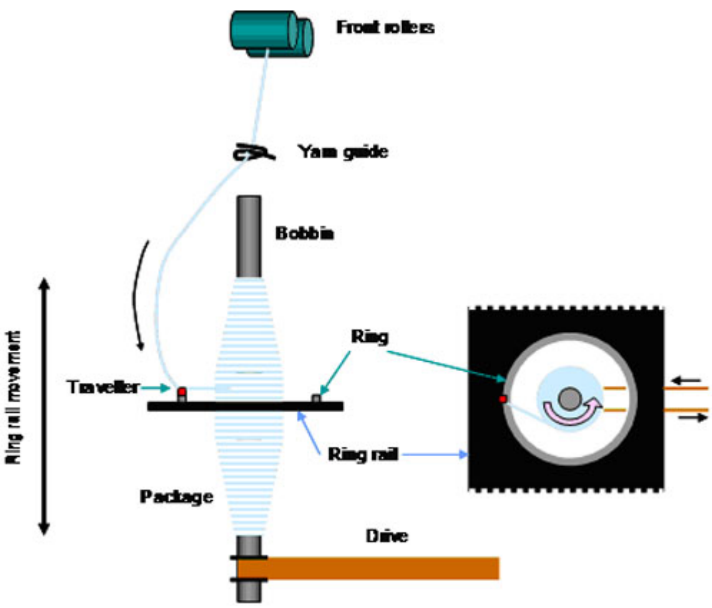
14.1 The principles of ring spinning

The input into a ring frame can be any of the following:

- Twisted (flyer) rovings – worsted and semiworsted system
- Twistless (rubbed) rovings – worsted and semiworsted system
- Sliver – semiworsted system
- Slubbings – woollen system.

Figure 14.1 shows the essential features of a single spindle assembly, which is one production unit of a ring spinning frame.

Figure 14.1 A single spindle of a ring spinning frame. Source: Wood, 2006.

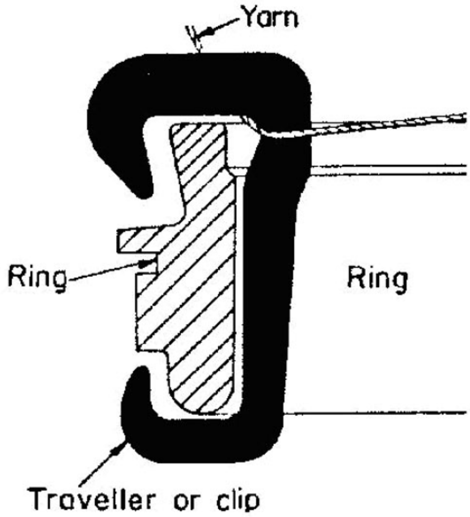


The spindle is driven by a tape or belt, making the bobbin rotate at high speed. Surrounding each spindle is a flanged metal ring fastened in a ring rail. During the operation of the frame the ring rail traverses up and down to distribute the yarn on the bobbin.

Attached to each ring is a small metal or synthetic clip called a traveller (Figure 14.2), which is free to rotate around the ring. The yarn coming from the front rollers is threaded through this traveller and fastened to the bobbin. Winding-on of the yarn is accomplished by the traveller lagging behind the spindle and bobbin, the yarn thus being drawn on to the bobbin; ie, the traveller guides the yarn on to the bobbin. The level of twist inserted in the yarn is governed by a combination of the surface speed of the front rollers and the rotational speed of the spindle.

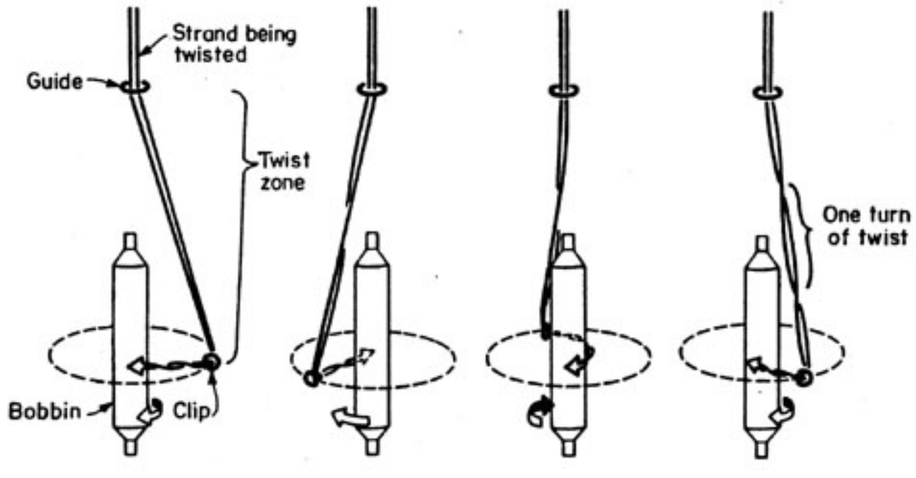
The rotation of the bobbin causes the traveller to cycle rapidly around the 'ring' at speeds of up to 40 metres per second. The speed of the traveller limits the productivity of ring frames, because of excessive wear and heat generated at high speeds. To reduce friction between traveller and ring, oil is continually applied to the ring as a lubricant.

Figure 14.2 Traveller on ring. Source: Wood, 2006.



Ring spinning frames are used for worsted, semiworsted and woollen yarns, the major differences being the sizes of packages and travellers, the diameter of the ring and the drafting rollers.
Figure 14.3 shows the mechanism by which twist inserted as the traveller moves around the ring. One cycle of the traveller on the ring inserts one turn of twist in the strand.

Figure 14.3 Inserting one turn of twist. Source: Wood, 2006.

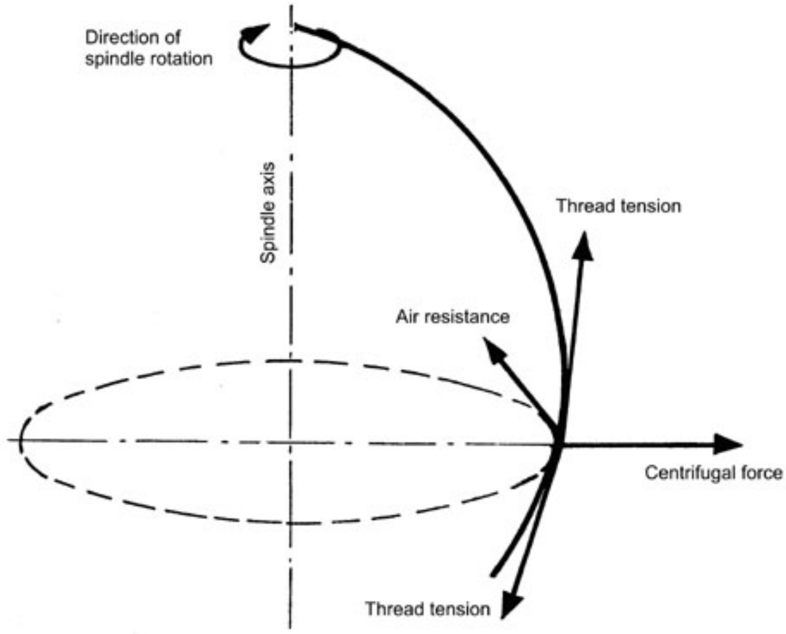


The tension applied to the yarn is affected by the air resistance on the yarn, the friction of the ring and traveller and the centrifugal force set up as the 'balloon' of yarn and the traveller revolve (Figure 14.4). (The balloon is the curved section of yarn between the guide and the traveller.) These in turn are influenced in varying amounts by:

a) the mass and shape of the traveller
b) the yarn count and twist
c) the diameter of the ring in relation to the diameter of the bobbin
d) the speed of the bobbin, which impacts on the speed of the traveller.

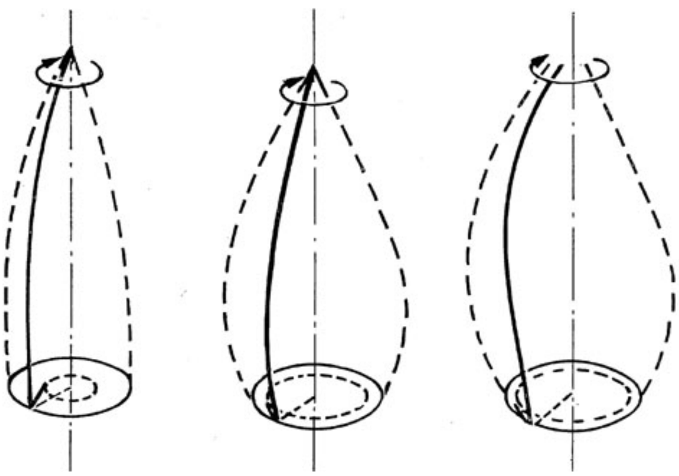
The usual method of altering the tension or drag is to change the size (mass) of the traveller. A heavier traveller imposes a greater tension while a light traveller causes more ballooning. In general, heavier travellers are used for heavier counts and usually the maximum traveller mass is used which is consistent with good spinning performance, ie, an acceptable rate of end-breakages. As a last resort it may be necessary to reduce the spindle speed to control the end-breakage rate.

Figure 14.4 Forces acting on the yarn during ring spinning. Source: Wood, 2006.



The speed of the traveller is the limiting factor in ring spinning, with a maximum traveller speed of around 45 m/s. Smaller ring sizes enable high spindle speeds to be achieved whilst keeping traveller speed below the maximum. Spindle speeds range from 2,000 - 17,000 rpm while ring sizes go from around 45 mm to 300 mm. Figure 14.5 shows the effect of ring size on the shape of the balloon. The balloon profile becomes larger and bulges out more at the base as the tension decreases.

**Figure 14.5 Balloon shapes under various ring spinning conditions.
Source: Wood, 2006.**



Separating plates between each spindle prevent each yarn balloon from fouling the neighbouring spindle positions.

Traveller and spindle speeds

To maximise production, it is usual to try to run the spinning frame as fast as possible without an excessive number of end breaks occurring. The maximum spindle speed is generally determined by the end break rate, the number of operators manning the frames and the speed and dexterity of the operators in making a good *piecening* in a yarn after an end break.

The traveller guides the yarn on to the tube and traverses up and down with the ring rail as well as moving at high speed around the ring. The travellers are typically ear-shaped and are made of steel, nylon, nylon with glass or carbon fibre and nylon with steel inserts in contact with the yarn.

The usual method of altering the tension or drag in ring spinning is by changing the size or weight of the travellers. A heavier traveller imposes a greater tension, while a light traveller allows more ballooning of the yarn to occur. Most traveller weights vary between 7 and 70 mg. The choice of traveller depends on the spindle speed (n rpm), the ring diameter (d mm), the yarn count, the yarn type and yarn strength.

The value of the product *nd* can be used as a guide to the spinning performance of a yarn, with excessive heating of the ring and traveller (which reduces traveller life) being the limiting factor. The traveller has a maximum speed of about 40 metres per second (or 140 km/h). A typical value of the product *nd* for nylon travellers is around 7×10^5.

A speed limitation arises due to the count of the yarn. When spinning yarns heavier than 200 tex from wool or wool-rich blends wear of the yarn on the traveller may occur. The yarn gradually wears a deep groove, and long before a traveller breaks this groove causes a much hairier (rougher) yarn to be produced, with possibly more end breaks.

It is usual to try to run the spinning frame as fast as possible without an excessive number of end breaks occurring. For example, if the spindles are running at 5000 rpm and the yarn is leaving the delivery rollers at 20 metres per minute then it will have 5000/20 or 250 turns per metre of twist inserted. If a high twist yarn of, say, 500 tpm is required then only 5000/500 or 10 metres per minute of yarn will be produced.

The spindle speeds can be readily checked by a stroboscope, a light source which flashes at regular short intervals. When the frequency of the stroboscope light equals the rotational frequency of a spindle, the spindle appears stationary. Any slight deviations from the stroboscope frequency appear as slow rotations of the spindle. Using the stroboscope, significant deviations (~ 7 – 10%) from the required spindle speed, which might arise from belt slippage, can be identified and eliminated.

Spinning end breaks

As the yarn is wound onto the bobbin it is under tension. A component of this tension is the force required to move the traveller against the friction between the ring and the traveller. The centripetal force of the balloon rotation also contributes to the tension, and air resistance, yarn count and twist also have an effect. If the tension on a strand exceeds its breaking strength, an end break will inevitably occur.

The important factors influencing end breaks are:

1. the number of fibres in the strand;
2. the propagation of twist up the strand to this point;
3. the mean tension and tension fluctuations on the strand.

The weakest part of forming a yarn will be at the point where the twist is inserted. In ring spinning this point is just below the front drafting rollers (the so-called ‘spinning triangle’), and most breakages occur here. No twist exists for fibre cohesion at this point, so when the number of fibres becomes too low to support the tension on the strand of fibres, the end breaks.

Obviously, the more fibres in the cross-section of the strand, the more the yarn will be able to withstand the tension applied. Problems will arise when the number of fibres in the cross-section of the strand varies significantly or the peak value of the tension fluctuation is too high. The number of fibres is determined by the laws of probability, so that even if the number of fibres in the yarn cross-section is 35, the actual number will be lower than this 50% of the time.

The variation of the number of fibres in the cross-section causes thin and thick places in the fibre strand. As these pass through the twist insertion point, the thin places are more easily twisted than the thick places; hence thin parts will tend to have more twist than the thicker parts. A very thin part of the ribbon will become over twisted and weak, and this will make the yarn susceptible to peak tension fluctuations.

The tension on the yarn is greatest when the winding circumference is smallest. This leads to the common practice of slow start up speeds for spinning frames.

Package build

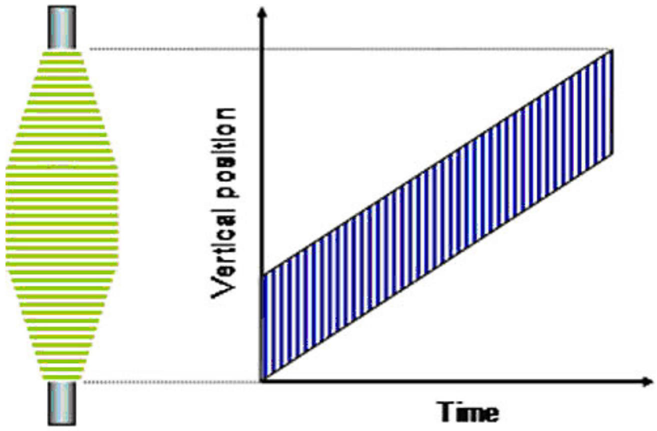
The yarn is wound onto the bobbin in an orderly manner so that the package formed can withstand handling and can be unwound without becoming entangled.

Variable speed drives are often used on ring frames to counteract the effect on tension of a varying winding-on diameter, especially when a new set of tubes is being started. A slow speed is needed when the package is small and the tension is highest, and is then gradually raised to its maximum value. As the package increases in size the speed of the spindle is kept almost constant, and then is gradually reduced until the package is complete.

The drives can also be used to control the speed of the spindle throughout the up and down cycle of the ring rail, with the highest speed at the bottom of the cycle where the package (or cop) has its maximum diameter. The lowest speed occurs at the top of the cycle where the yarn is being wound onto the diameter of the empty tube.

When the twisted yarn passes down on to the package it is necessary to wind the yarn on in an orderly manner so that it forms a package which can withstand handling and which will unwind without become entangled. This is achieved by controlling upward and downward traverses of the ring rail. A common form of traverse is shown in Figure 14.6, along with the shape of the package produced. This shape of package is called a *cop*. Here the yarn moves down slowly and up quickly to provide locking coils and to avoid sloughing-off when the yarn is subsequently unwound.

Figure 14.6 Ring rail traverse and package shape for cop build. Source: Wood, 2006.



Spinning frame features

Modern ring frames have a number of features which enhance their performance. Some of these features are standard on almost all machines, while others are optional extras.

1) Variable speed motors can counteract the tension changes of varying winding-on diameters. When a new bobbin is started a slow speed is required because when the bobbin is narrowest the tension is highest
2) By restricting the maximum balloon radius using a control ring, the air drag and centrifugal force is reduced on the balloon. Hence the tension in the yarn is reduced. With finer yarn counts the maximum balloon diameter is reduced and it may be less than the spinning ring diameter. Under such conditions the effectiveness of control rings ceases
3) Improved design of both rings and travellers, together with improved ring lubrication, permit higher spindle speeds
4) Nylon travellers also enable higher spindle speeds
5) Other aids such as the 'Pneumafil' system use suction to remove broken ends and facilitate piecening, hence improving production efficiency
6) A stop motion device where electronic sensors detect end breaks
7) Suction and/or blowing heads move back and forth along the machine removing dust and fly
8) Automatic doffing systems are available to save labour costs. These may doff the frame in one unit or remove full spindles from a group of spindles only. The empty tubes are automatically loaded from a magazine by a conveyor, while the bobbins are transported to a container or the next stage (usually winding).

Advantages and disadvantages of ring spinning

The most expensive process in yarn production is the insertion of twist into a strand of fibres. This is due to the fact that at each spindle position both the strand mass per unit length and the strand velocity are very small. As a result, the production at each spindle is severely limited. The capital cost, power cost and labour cost per spindle have been reduced as far as possible by the spinning machinery manufacturers, but they still remain very high in relation to the production rate. This follows directly from the method used both to insert twist and to wind the yarn onto a package.

Generally, ring and traveller systems have the following technical advantages and disadvantages:

Advantages

- Offer a wide spinning count range (5 – 300 tex)
- Can process most natural and man-made fibres, and blends
- Produce yarns with tensile strength and handling aesthetics suitable for the majority of fabric end uses.

Disadvantages

- Even with the ideal situation of no end breaks, spinning is still discontinuous because it has to be stopped for doffing
- To attain high twisting rates (and hence high production speed) the yarn package must be reduced in size, resulting in more frequent stoppages for doffing
- The maximum speed is restricted by the frictional contact of ring and traveller, and the yarn tension
- Bobbin size is restricted by ring diameter
- Yarn has to be re-wound to larger size packages.

14.2 Ring spinning machines

While the same general principles hold for worsted, semiworsted and woollen spinning, there are major differences in the machines used in the three systems. These differences are summarised in Table 14.1. Wide ranges within each spinning system are evident in the draft levels, ring diameters and spindle speeds. These may be varied depending mostly on the twist and count of the yarn being produced.

Table 14.1 Comparison of spinning machines (typical). Source: Wood, 2006.

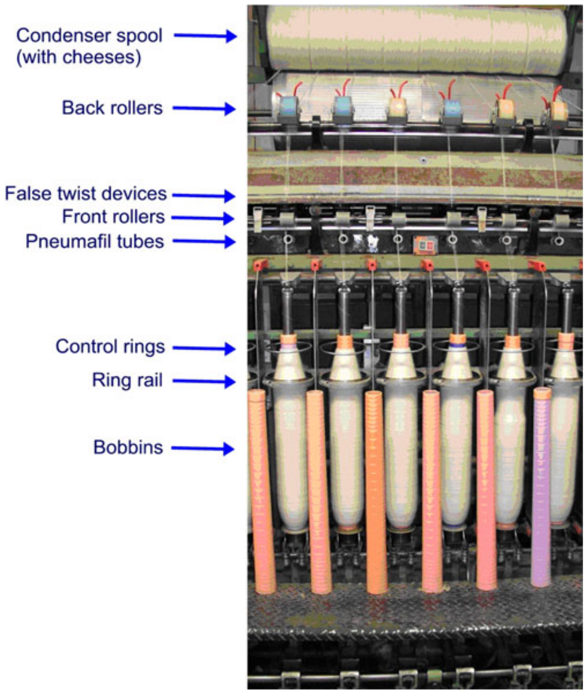
	Worsted	Semiworsted	Woollen
Input material	Roving	Sliver	Slubbing
Drafting system	Rollers and aprons	Rollers and aprons	Rollers
Level of draft	15 – 30	80 – 120	1.2 – 1.3
Diameter of ring (mm)	45 – 65	75 – 180	100 – 300
Spindle speed (rpm)	7,000 – 17,000	3,000 – 6,000	2,500 – 4,000

Woollen ring spinning

A woollen ring spinning frame, as shown in Figure 14.7, comprises:

- an overhead creel to hold the spools, with positive let-off drum feed
- a drafting system incorporating a false-twist device, and
- collapsed-balloon spindles.

Figure 14.7 Spindles on a woollen ring spinning frame. Source: Wood, 2006.



Operation of the spinning frame

Slubbing is unwound by frictional contact between the spools and the drum. Each slubbing end is taken through the nip of the back rollers. The thread then passes through the false twisting device which is close to the nip of the front rollers (see the next section).

There are many variations of the path of the yarn from the nip of the front roller until the yarn is placed on the yarn package via the traveller. The traveller slides on the inside of the ring and rotates around the rotating spindle. Friction between the traveller and ring as well as drag on the yarn causes the traveller to lag behind the spindle. The difference in speed between the spindle and traveller causes the yarn to wind onto the package.

The spindle is driven by the driving belt connected to the spindle. A suction tube is positioned just below the front rollers of each spindle to collect a broken end and send it to a cabinet for collection (and subsequent recycling back to the card hopper). This helps to keep the spinning frame clean, prevents fibres from lapping around the front roller and makes it easier to join (*piecen*) a broken end. Suction (or pneumafil) tubes are also essential for removing broken ends in worsted and semiworsted spinning frames.

During ring spinning a balloon is formed by the yarn, due to the action of the centrifugal force on it (see Figure 14.5). Woollen ring frames have relatively large rings in comparison with worsted spinning in order to obtain an adequate length of yarn on the yarn packages. But when larger rings are used and acceptable spindle speeds are maintained, yarn tension is increased due to the larger diameter of the balloon and a higher chance of end breaks is the result.

One or two balloon control rings may be used to restrain the size of the yarn balloon. Almost invariably there are also separating plates to restrain the balloon. The spindle top (or *crown*) may have a 'finger' attached to it which entraps the yarn and brings the top of the balloon down to near the top of the spindle. Alternatively, the spindle top may be shaped with notches so that the balloon is completely collapsed, except in the region of the traveller. The yarn, instead of ballooning, coils around the spindle and also around the yarn tube near the top. The yarn then travels out to the traveller before it is wound onto the yarn package.

With this 'collapsed balloon' spinning it is most desirable that the yarn guide (or lappet or 'pigtail') be maintained at a certain distance above the spindle top. The notched spindle top inserts twist in the yarn – by driving twist up to the nip of the front rollers where the thread of fibres is twistless and hence weakest, the rate of end breaks is reduced at higher spindle speeds.

Recent developments in the ring spinning of woollen yarns mostly involve automation, ie,

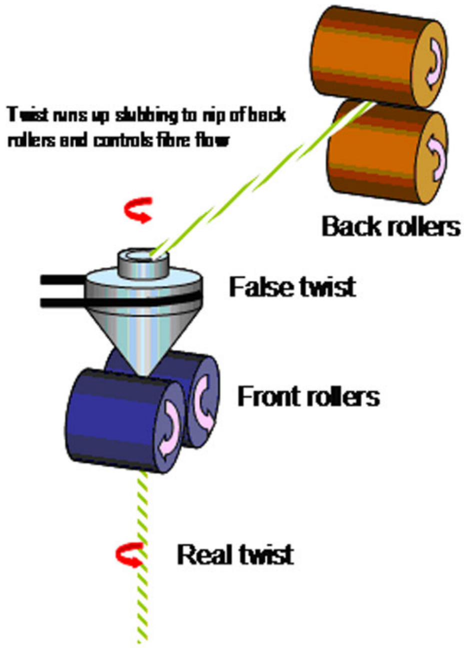
- Automatic doffing of full packages, fitting of new tubes, replacing slubbing packages, and joining of slubbings are available. Automatic doffing reduces labour and improves productivity
- End-break detectors and monitors allow problem spindles to be identified
- Provide information on traveller, roller and spindle speeds enables yarn production and twist to be determined by monitoring systems
- Adjustment of the various spinning operations and parameters is possible at an electronic console.

These innovations are also available in worsted and semiworsted spinning frames.

Drafting and the false twist device

Because the blends used for woollen yarn are relatively short, they are not suited to roller drafting (as used in worsted and semiworsted processing to convert a sliver into a finer strand of fibres). The drafting of the slubbings is in the range 20-30%, which is exceptionally low in comparison with the drafts used in worsted and semiworsted spinning. Drafting of delicate woollen slubbings is only feasible because they are given cohesion by the application of false twist. The false-twist device (Figure 14.8) rotates at about half the speed of the spindle and inserts about 80 – 160 turns per metre of twist in the strand.

Figure 14.8 False twist device. Source: Wood, 2006.



The count and quality of the yarn produced by a woollen frame are largely determined by the quality of the slubbings supplied. Small corrections to the count of the yarn can be made by adjusting the draft. Drafting is controlled by the speed of rotation of the false-twist unit, which increases the inter-fibre friction and thereby provides greater fibre control during drafting. It reduces the strand irregularity by preferentially drafting thick places with low twist since twist generally runs into thinner places thereby increasing the inter-fibre cohesion there.

A speed that is too high on the false-twist unit causes the fibres to bind and this inhibits drafting. On the other hand, fibre control is lost when the speed is too low and the number of end-breaks increases. Longer fibres need less drafting twist than short fibres.

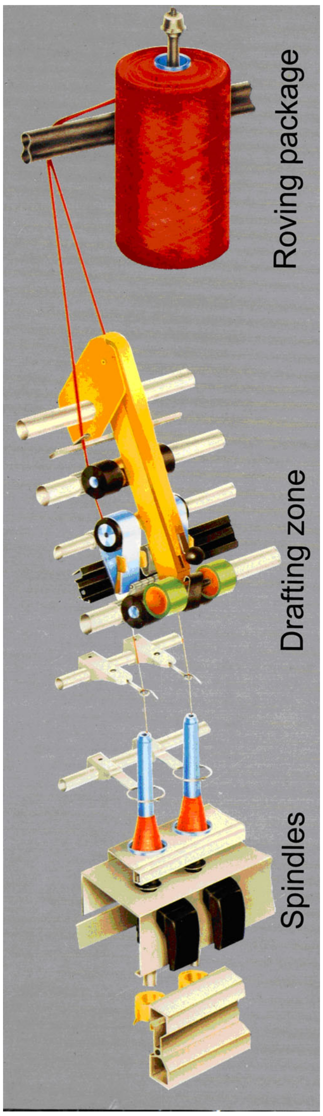
Worsted spinning frame

Figure 14.9 shows a typical worsted spinning frame with:

- A pair of rovings wound off the package
- Drafting zone with a combination of aprons and rollers
- Spindles including control rings.

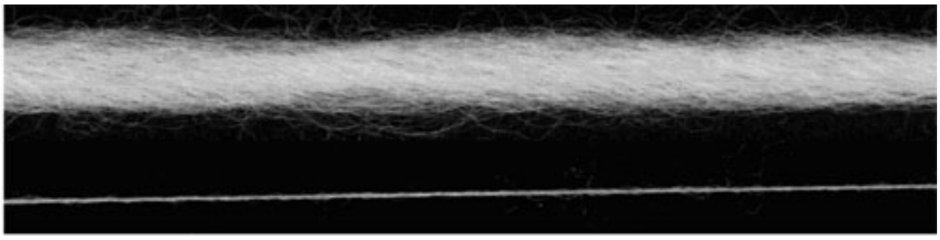
The sizes of the travellers, rings and packages are much smaller than those on a typical woollen spinning frame, reflecting the finer counts of yarn produced on such machines.

Figure 14.9 Worsted spindles. Source: Wood, 2006.



Because of the high level of fibre alignment achieved through the gilling, combing and roving steps, very fine, even, firm yarns with satisfactory strength can be spun on the worsted system. Figure 14.10 shows a roving and a worsted yarn, illustrating the high level of draft required to convert a riving into a yarn.

Figure 14.10 Roving and worsted yarn. Source: Wood, 2006.



Semiworsted spinning frame

For most semiworsted yarns spinning takes place directly after the third gilling step. However, for fine yarns it is necessary to produce a finer sliver than can be produced on a gillbox. In these cases a roving frame is used prior to spinning. As an alternative, a two-zone drafting system may be used on a spinning frame to provide the high drafts required.

Figure 14.11 shows the drafting section of a semiworsted spinning frame used for the production of carpet yarn. The top drafting rollers have been raised to reveal the slivers in position for drafting.

Figure 14.11 Drafting section of semiworsted spinning frame (HDB). Source: Houget Duesberg Bosson.

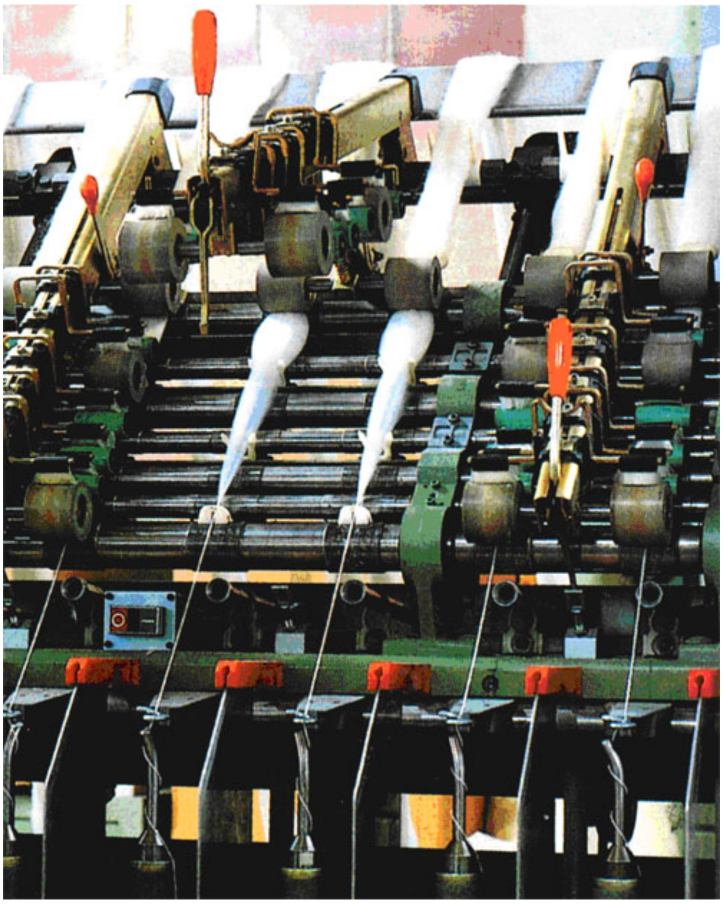
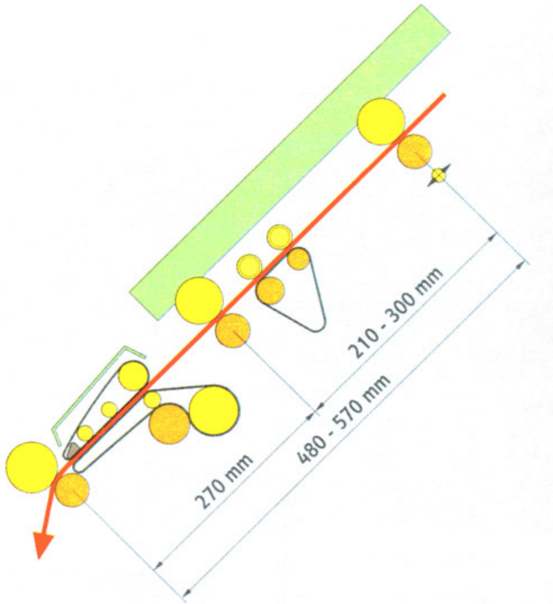


Figure 14.12 shows a relatively complex, double zone drafting device.

Figure 14.12 Double zone drafting system. Source: NCS Schlumberger.



The ratch (the distance between the back and front drafting rollers) should be set such that no fibre has both ends nipped at the same time. Fibres a little shorter than the ratch will pass easily from the back nip to the front nip. Short fibres are not nipped at all for a significant period of their passage across the drafting zone. Such “floating fibres” tend to be carried in groups towards the front rollers, creating thick and thin places in the yarn. The function of the drafting aprons and the intermediate rollers is to control the movement of the floating fibres and hence promote evenness.

Lighter counts of semiworsted yarn (eg, for face-to-face carpets) can be spun using a double-zone drafting system where a roller drafting system, perhaps with a short apron, is followed by a conventional double-apron system. The first zone applies a draft up to 8 and the draft in the second zone may be up to 25, giving a total maximum draft of 200. Floating fibres in the first zone are controlled by soft “Sampre” rollers which apply light pressure to the sliver.

Irrespective of whether single or double zone drafting is used, the general principle followed is to operate the card and gillboxes at standard settings and to adjust the draft at the spinning frame to achieve the required yarn count.

Readings

The following readings are available on CD

1. Wool Research of New Zealand. 'What makes a good yarn'? From the Tangling With Wool Series. WRONZ, Lincoln, New Zealand.
2. Wool Research of New Zealand. 'More good yarns'. From the Tangling with Wool Series. Wronz, Lincoln, New Zealand.

Activities	Available on WebCT
Multi-Choice Questions	Submit answers via WebCT
Useful Web Links	Available on WebCT
Assignment Questions	Choose ONE question from ONE of the topics as your assignment. Short answer questions appear on WebCT. Submit your answer via WebCt

Summary

Summary Slides are available on CD

This lecture compares the three main routes for converting wool into yarn. These routes differ significantly in their fibre requirements, the machinery required and the characteristics of the yarn they produce. However, the three routes also have a number of common features such as the need for carding, the organising of the carded fibres in an appropriate form for spinning, and the application of twist as the yarn is formed into a package.

The most widely used method of forming a wool yarn is by the ring spinning technique. This method, which is common to all three routes, is examined in some detail in the lecture. While ring spinning frames for woollen yarn manufacture impose very little draft on the fibrous strand (slubbing), the worsted and semiworsted machines use high draft systems on roving and sliver, respectively

References

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Oxtoby, E, (1987), *Spun Yarn Technology*, Butterworths, ISBN 0-408-01464-4.

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Glossary of terms

Apron	A small belt that assists in controlling fibres in the drafting zone of a worsted and semiworsted spinning frame
Backwashing	The washing of wool sliver before or after gilling and/or combing
Balloon	The curved path of a yarn between the yarn guide and traveller on a spindle
Bobbin	A slightly tapered tube, mounted on the spindle, onto which the yarn is wound in ring spinning

Bulk	The space-filling characteristic of a yarn that contributes desirable handle and warmth to knitwear and good cover to carpet pile
Burr beater	A brushed roller on a worsted and semiworsted card that works in tandem with a Morel roller to eject vegetable matter from the wool flow
Carbonising	A chemical (acid) process for eliminating vegetable matter from wool by degrading it to a friable state
Card	Machine for carrying out carding, the disentangling, cleaning and mixing of fibres to produce a continuous web or sliver suitable for subsequent processing
Carding wool	Wool more suited for woollen processing (as opposed to combing wools)
Carder	The second half of a woollen card, between the intermediate feed and the condenser section
Clearing	Automatic and detection and removal of yarn thickness faults
Clothing	The pinned, spiked or toothed metallic layer covering the surface of a card roller
Comb	Machine for carrying out combing (removal of short fibres, vegetable matter and neps) and straightening of fibres in the worsted processing route
Combing wool	Superior wool with suitable properties for worsted processing (as opposed to carding wools)
Condenser	The final section of a woollen card; divides a broad web of fibres into narrow strips which are then consolidated by a rubbing action into slubbings
Count	See Linear density
Doffer	The large, slow roller that removes fibres from the swift of a card
Doffing	Removing full yarn packages from a spinning frame and replacing them with empty tubes
Drafting	Process of reducing the linear density of a sliver or roving by causing the fibres to slip relative to each other. Occurs in the drafting zone. (See Roller Drafting)
Draft ratio	The ratio of the front roller speed to the back roller speed in a drafting zone
Dry spinning	Woollen yarn making using a sufficiently low level of lubricant that no subsequent scouring step is required
Evenness	(or regularity, uniformity) In slivers, the absence of thick and thin places; in yarns the absence of thick and thin places, periodic variations in thickness or neps or slubs
False twist	Insertion of temporary twist in a slubbing to provide it with sufficient strength for drafting and twist insertion in woollen spinning
Fancy	The fast, long-bristled roller on a card that raises fibres to the surface of the swift so that they are more easily removed by the doffer
Feed sheet	The slow-moving conveyor that transfers the wool from the feed hopper to the first stage of the card
Floating fibres	Fibre is a sliver or roving in a drafting zone that are not in contact with any rollers
Fly	Fibres floating away from the wool flow and settling on flat surfaces etc.

Folded yarn	A yarn composed of two or more singles yarn, twisted together (sometimes called twisted yarn or plied yarn)
Gillbox	A machine for carrying out the gilling operation
Gilling	The process of aligning fibres in a sliver by drawing lines of pins through it (as well as performing drafting by drafting rollers)
Hank dyeing	Process where hanks of finished yarn are immersed in dye liquor for dyeing
Intermediate feed	Mechanism in a woollen card for transferring the web from the scribbler section to the carder section, and cross-lapping the web to improve side-to-side blending
Kilotex	The unit of linear density for slivers and tops - 1 ktex = 1 gram per metre
Linear density	The mass of material in a given length, ie grams per kilometre (the tex) and grams per metre (kilotex); used for slivers and yarns (often called yarn 'count')
Loose stock dyeing	Dyeing process where the material is in loose form, eg, scoured wool, carried out before carding
Lubricant	An emulsion of a special oil and water, sprayed as a mist onto wool before carding to aid processing (sometimes called a fibre processing aid)
Morel roller	A roller on a worsted card with special flat-topped teeth which is designed to release vegetable matter fragments by the action of a burr beater
Nep	Small entangled knot of fibres; often produced in carding
Noils	Fibrous waste removed by a comb; may be suitable for recycling
Package build	The formation of a yarn package of the required shape for stability
Piecening	The joining of two strands of fibre either manually or automatically, eg, to mend a spinning end break
Peralta roller	A pair of heavy steel rollers that apply high pressure to the card web, crushing particles of vegetable matter so they fall away more readily
Pneumafil tube	Suction tube for removing a broken end from the spindle area of a woollen spinning frame
Ratch	The distance between the front and back rollers in a drafting device
Regain	Moisture content of wool or yarn; calculated by expressing the mass of water in a sample as a percentage of the original mass of the sample (ie, before it is dried)
Ring	Provides a circular path for the traveller in a ring spinning frame
Ring spinning	A spinning system in which twist is inserted in a yarn using a traveller revolving around a ring
Roller drafting	The process of drawing out a sliver or roving to reduce its linear density using two pairs of rollers having different surface speeds. The region between the pairs of rollers is the drafting zone
Roving	A fine, even, well-aligned strand of fibres formed by drafting a top; the input material to worsted spinning
Scribbler	The first half of a woollen card, between the feed hopper and intermediate feed
Semiworsted route	The process of spinning yarn from a sliver produced by carding and gilling, the sliver not having been combed

Setting	The process of stabilising the twist in a yarn by heat, steam or chemical means
Singles yarn	The twisted strand produced by ring spinning (as opposed to a folded yarn)
Sliver	An untwisted rope of fibres, produced by carding or gilling
Slubbing	A thin untwisted strand of fibres produced by the tape condenser of a woollen card
Spindle	The driven shaft on a ring spinning frame that rotates the bobbin
Stripper	A small, high speed roller on a card that transfers fibres from a worker roller back onto the swift
Swift	The large roller with a high surface speed that moves fibres through a card
Tape condenser	The final unit of a woollen card that (1) divides the web into narrow strips, and (b) uses a rubbing action to convert each strip of fibres in slubbing
Tape scour	A series of bowls (scouring and rinsing) interspersed with squeeze rollers, used for scouring (and sometimes chemical setting) of yarns. The hanks of yarn are transported by tapes that run through each bowl
Tex	The unit of linear density for yarns (1 tex = 1 gram per km)
Top	A combed sliver of exceptional cleanliness, evenness and fibre alignment; the input material for worsted spinning
Topmaking	The production of a top using the sequence of operations: carding, gilling and combing
Traveller	The small metal or plastic guide through which the yarn passes to the spinning (or twisting) package. It is mounted on the ring and is dragged around by the yarn
Tufting	Formation of a pile fabric where loops of yarn are inserted in a base fabric
Twisting	The combining two or more singles yarns to produce a two-fold yarn (or three-fold, etc.)
Warp	The set of threads fed lengthwise into a weaving loom, often from a warp beam
Web	The thin, uniform sheet of fibres produced by a card
Weft	The threads inserted width-wise in a loom when forming a woven fabric
Woollen route	The production of yarn by carding on a woollen (condenser) card, followed by ring spinning and twisting
Wool scouring	High production, gentle washing of wool to remove wool grease and other contaminants before yarn manufacture
Worker	A slowly rotating roller on a card that interacts with the swift to open and blend the tufts of fibre
Worsted route	The production of yarn from combed wool, in which the fibres are reasonably parallel. It uses the processes of carding, gilling, combing, backwashing, roving, ring spinning and twisting