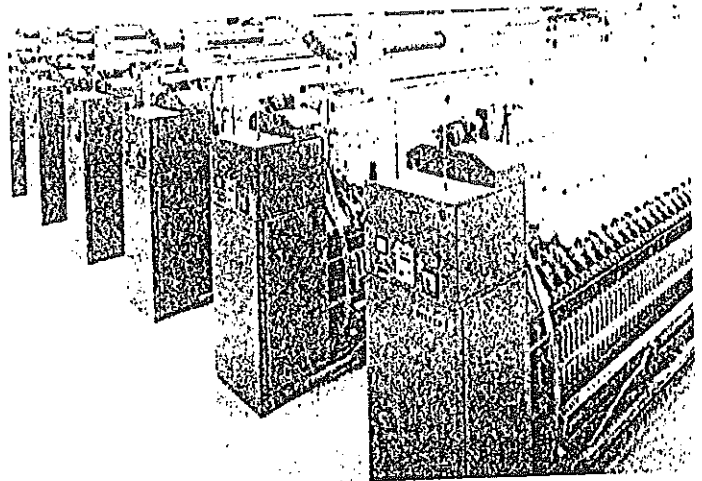


Rotor spinning: the Schlafhorst Autocoro is among the leading machines using this technology.



Ring spinning: Rieter's G/5 series of ring spinning frames has enjoyed worldwide sales success.

# Importance of yarn surface appearance

Alan Parker discusses some of the key parameters in the selection of an appropriate spinning system

**A**lthough economics and machine performance will always be important considerations as to the acceptance or otherwise of a process this article will concentrate on how yarn characteristics affect the choice of spinning system.

Particular attention will be paid to the surface character of the yarns produced on the different spinning systems. It will also assess the likelihood of other technologies making a significant impact on future machinery sales.

A subsequent article will concentrate on whether friction spinning has a possibility of establishing itself as a major force in the short staple yarn spinning industry.

The 1980s saw a decade in which spinning mills around the world invested vast sums in automated rotor spinning machines. For the first time there were more equivalent spindles of rotor installed than ring.

The market was dominated through most of this decade by Schlafhorst with their Autocoro machine. This machine,

because of its potential for high quality piecings, permitted the concept of fault free staple yarn.

The real breakthrough in ring spun yarn has been in the application of splicing to automatic winding machines, and there has been an ever increasing application of splicers to ring spinning plants. This has allowed ring spun yarn produced in very well run ring spinning plants also to be classified as fault free, and negated one of the major advantages offered by automated rotor spinning machines.

Companies are now having to examine automated rotor spinning in a new more competitive situation. As high quality, fault free ring spun yarn becomes increasingly available, customers are able to apply different parameters on which to select yarn.

It has been particularly evident that some customers who have already purchased automated rotor machines, are finding market preference turning against rotor spun yarn. Rotor spun yarn has not suddenly gone

worse. It is merely that attention is now being drawn to its inherent disadvantages rather than its advantages.

## Substantial niche markets

The production of staple yarns is a massive world wide business even though the higher productivity of modern machines and an increased level of automation continue to reduce both the number of individual plants and people employed in the industry.

Niche markets can be very substantial, and are often more profitable than high volume commodity products. If a niche market was defined as representing less than say 2% of the total yarn market, all but ring and rotor would fall into this category.

For a spinning technology to achieve commercial success, it will either have to match the fault free yarn now offered by both ring and rotor spinning, plus other technical and/or economic advantages, or alternatively, a yarn which can not be

produced effectively by other means.

Spinning technologies that fall into the niche range include wrap spinning, fancy yarn machines, self-twist spinning, and the DREF range of machines. The likelihood that any of these technologies are going to move away from being niche markets into mainstream products is remote in the extreme.

It is difficult to see any future at all for technologies such as Twilo and Bobtex.

## Ring spun yarn

For a technology that has been around for over 50 years it is difficult to say anything that has not been said many times before. However, modern, well run ring spinning plants are able to produce yarns of a standard that could not be achieved in the past.

It is important to always realise that the production of yarn is only an intermediate stage in the production of fabric to be used for a wide range of applications which place different emphasis on and thus yarn

characteristics.

The major advantages of ring spun yarn are that it produces the strongest, most lustrous staple yarn and needs fewer fibres in a yarn cross section to form a yarn. A ring spun yarn depends for its strength on a combination of good fibre alignment held together by twist and further complemented by fibre migration.

The fact that it can produce yarns across a wide range of counts is only important in that it increases its opportunity for sales. If, say, rotor was the best for coarse yarns, friction the best for medium count yarns and jet spinning the best for fine yarns and ring was the second best in three areas, nobody would purchase ring spinning because it was the most versatile.

As it is the traditional method, many of its deficiencies have been with us for so long that we tend not to think of them as disadvantages. Taking a fabric from a textured filament yarn as a standard, all fabrics from ring yarn would be classed as having a patchy, very uneven appearance. This is particularly evident on single jersey and low weight woven fabrics. This unevenness has even become established as a required feature of some ring spun products, as for example Oxford chambray and muslin fabrics.

If ring spinning were a new yarn type trying to get established today in a market place accustomed to regular fabric appearance, then, for all its advantages, this unevenness would have prevented its widespread acceptance.

The short term regularity of ring spun yarn, as for instance measured on an Uster regularity tester, has steadily improved in the last 40 years which has permitted an overall improvement in fabric regularity. In the distant past many fabrics were produced from 2-fold yarns whereas today, apart from technical yarns, economic considerations require most fabrics to be produced from singles yarn.

Ring spinning has many inbuilt operational difficulties in maintaining a

consistent product. These are:-

- The change in twist and hairiness that occurs, throughout an individual cop, due to the yarn being wound onto the cop with different balloon heights, and at different cop diameters. As short term yarn regularity has improved greater attention has been drawn to variations in these two other yarn parameters. The move to smaller rings and shorter lift has afforded an opportunity to

reduce the overall variation in these parameters within individual ring cops.

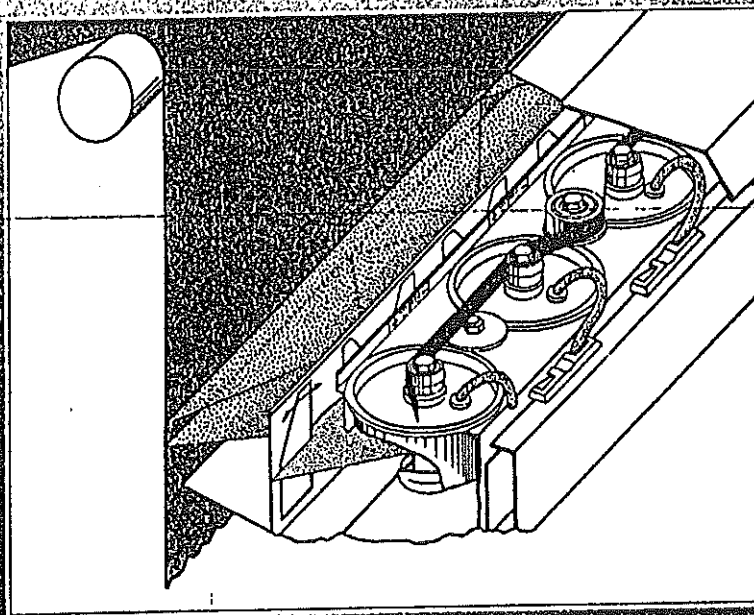
- The use of a ring and traveller system has an inbuilt performance variability due to traveller wear. Operating closer to the limiting speed for travellers will inevitably demand greater control on operating procedures to maintain quality.

The use of apron drafting, albeit to a much lesser extent is also prone to deterioration in performance with time.

In the past doubling and/or the very poor short term yarn unevenness tended to mask variations between individual cops. There can therefore be little doubt that as the consistency of yarn produced on individual cops has improved this has demanded greater consistency between individual cops to prevent differences being detected in fabric.

To achieve this increased uniformity now being increasingly required, makes great demands on both maintenance and quality control procedures because of the sheer number

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of spindles to be mixed into the product. The throughput of a ring spinner is very low being only about 10-30 metres/min. and commonly yarn produced from more than 10,000 spindles has to be used in one product.

Merely as an example to demonstrate the point, a modern, small package, high spindle speed, 20,000 ring spindle plant spinning 20 Tex (30 c.c.) would produce approximately 5000 cops/hour. If at any moment in time, say 0.1% of spindles - in this case 20 out of 20,000 - were producing faulty yarn, this faulty yarn would find its way onto around 3% of all rewound yarn packages. Laboratory testing of yarn is only truly useful in maintaining an average standard and reducing the time that faulty yarn is produced.

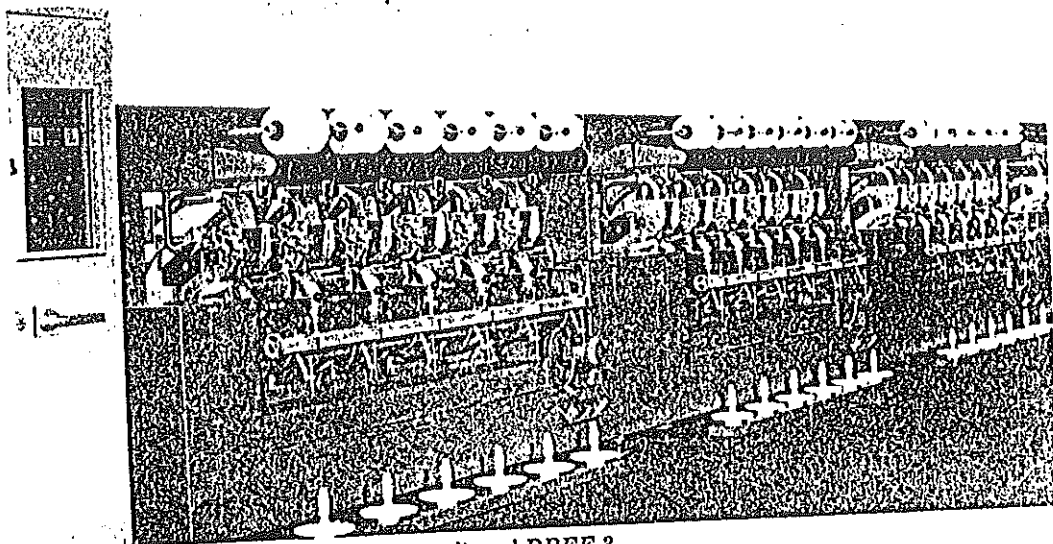
The fact that most of the yarn on these 3% of packages would come from cops which are satisfactory does not matter as the knitter or weaver would not be prepared to waste time and money in finding out, and would merely reject the package. If the yarn goes through to fabric this is clearly worse as randomly occurring faults will result.

It is only when 'on-line' quality monitoring of all the features which can affect fabric appearance are available that a truly fault free ring yarn will be guaranteed. Until that time a purchaser of yarn will still be dependent on the supplier applying increasingly stringent quality control and maintenance procedures.

**Combing vs carding:**  
When discussing ring spinning the difference between a combed and carded product can not be ignored.

With carded products:

- Yarns containing cotton produce fabrics with a high level of trash. There are some who might argue that this is not being fair to tandem carding but when compared to combed ring spun or carded rotor yarn products it is justified.
- Fabrics have a very patchy uneven appearance.
- Blending of different



*Friction spinning: the DREF 2 (pictured) and DREF 3 machines from Dr. Ernst Fehrer are seen as commercially successful systems for niche applications.*

- fibres is good.
- With combed products:
  - Fabrics are clean and have a lustrous less patchy appearance.
  - Blending of different fibres must take place after combing and is therefore less effective.
  - It is still an expensive process, and only 85% to 90% of the input fibre is converted into yarn. The remainder has to be re-cycled.
  - Only certain grades of cotton are suitable for combing.

## Rotor spun yarn

In the early days of rotor spinning one of the major stumbling blocks to getting rotor yarns accepted was the incidence of wrapper fibre. A great amount of development went into trying to eliminate wrapper fibre, and although ways were found to reduce it, some wrapper fibre always remained.

In recent years there has been an acceptance that wrapper fibre is fundamental to rotor spinning, and it has been demonstrated that wrapper fibre gives some very positive advantages. The move to smaller rotors has even increased the level of wrapper fibre. The future commercial acceptance of rotor yarn is going to be increasingly determined by the acceptance, or otherwise, of the characteristics wrapper fibre imparts to fabrics produced from rotor yarn.

Wrapper fibre affects

rotor yarn characteristics in a number of ways.

**Strength:** - Rotor yarn is dependent for its strength on a complex inter-relationship between the achieved fibre alignment, yarn twist, wrapper fibre and fibre entanglement.

There is little doubt that, particularly at low twist factors, wrapper fibre is a significant contributor to holding the bundle of fibres together. The greater the level of wrapper fibre, and the more tightly it is wrapped around the yarn, the greater is its contribution to yarn strength.

**Yarn Twist:** - It is impossible to measure twist in a rotor yarn. There are those who believe there is a correlation between measured twist and actual twist, but this is simply not true. Two yarns with identical twist and different levels of wrapper fibre will have different measured twist levels.

Using twist measurement as a quality control procedure is quite legitimate, as long as there is an understanding that any measured differences may be due to either twist and/or wrapper fibre.

Twist liveliness is a feature of all unidirectionally twisted yarns, and the greater the twist the more twist lively is the yarn. Wrapper fibre reduces the twist liveliness that would be evident in yarns of similar twist without wrapper fibre.

## Yarn performance

Rotor yarns have demonstrated that, although always weaker than ring spun yarns, they have frequently outperformed them. Many observers have attributed this to the reduced coefficient of strength variation of rotor yarn but, this may be a far too simplistic view.

It only requires the examination of the different unwinding characteristics of rotor and ring yarn to understand how the difference in surface characteristics is a major contributing factor to yarn performance. The combination of wrapper fibre with twist in the rotor yarn undoubtedly assists to prevent yarns snagging and thus improve performance.

**Fabric finishing:** - A major problem of yarns with a low level of wrapper fibre is that its contribution to the surface characteristics of the yarn is prone to considerable variation along a yarn length. Specialist finishing techniques applied to the fabric tend to exaggerate this difference, and thus create an irregular final product.

At higher levels of wrapper fibre, finishing techniques have to be adapted to try to take account of this increased level, but the resultant fabric is less variable.

**Fabric features:** -

- Due to the lower yarn strength woven fabrics have lower fabric strength. However

there is sufficient data available to indicate that these lower strength values do not, in most cases, result in a less satisfactory fabric performance.

- Wrapper fibre undoubtedly assists to improve abrasion resistance and to help prevent fibre shedding.
- In general terms fabrics from rotor are more regular than from ring. However wrapper fibre is not a consistent effect and detracts from the overall regular appearance. As mentioned earlier, yarns with a low level of wrapper fibre tend to be the most variable.
- The major effect of wrapper fibre is that it markedly affects the surface characteristics of the yarn and thus the fabric. The handle of all fabrics from rotor yarns are harsh in relation to ring, and the greater the level of wrapper fibre the harsher the fabric.
- Wrapper fibre destroys any possibility of matching the lustre that is one of the appealing features of combed ring spun products.

### Jet spun yarn

It is normal to define a yarn either by the machine type or the yarn structure. Jet spinning machines produce a fasciated yarn in which surface fibres are caused to wrap around a substantially untwisted core. Examining only the surface of the yarn, there are many similarities between wrapper fibre on rotor yarn and fasciated fibre on jet yarn.

Jet spun yarns derive their strength by good fibre alignment due to apron drafting, held together by "wrapper" fibre in the form of fasciation. Although a number of Japanese manufacturers have made jet spinning machines, the Murata machine has achieved the greatest commercial success, even though very limited in application to ring or rotor spinning. Even though this technology has been around for many years, it has not yet achieved an installed

production capacity relating to a market share of 1%.

Fabrics produced from Jet spun yarn are characterised by their harshness of handle, which is hardly surprising considering the surface of the yarn, and the restrictions on fibres which can be processed. It is generally accepted that to utilise a jet spun yarn, special fabrics, products, and finishing procedures need to be established to allow for the unique characteristics of the yarn.

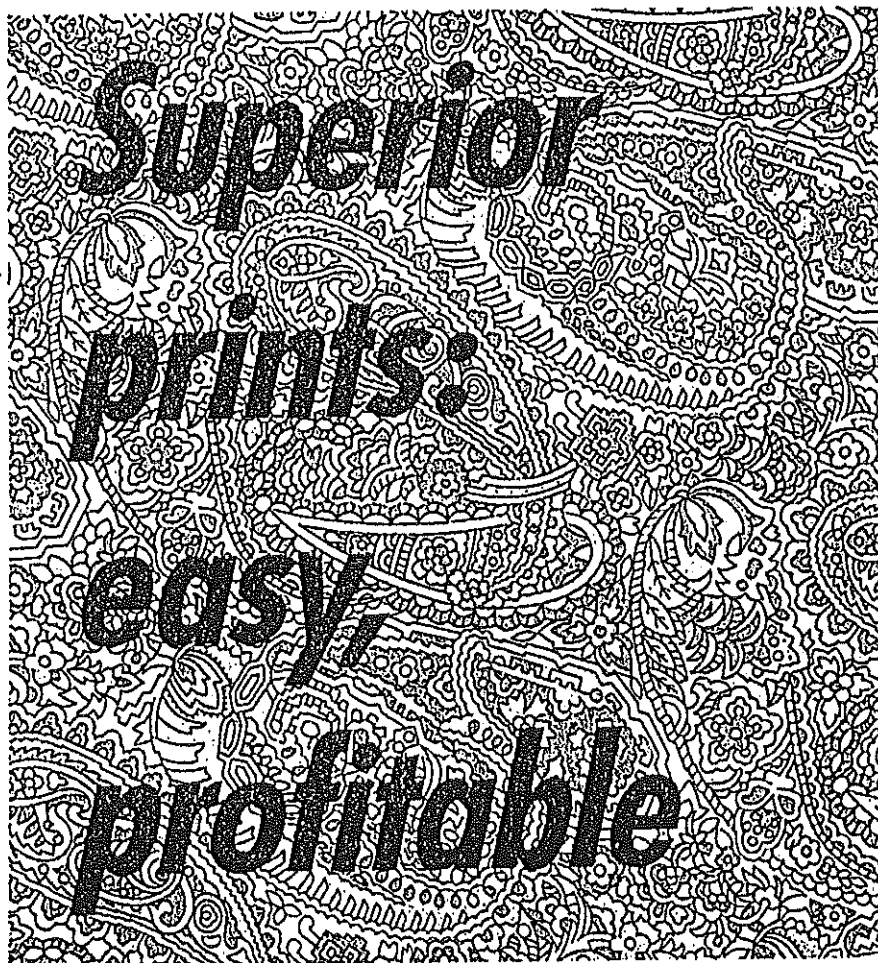
For this technology to move from a niche to a mainstream product will need a major technological breakthrough or a complete change in attitude of most consumers to such harsh fabrics.

### Conclusion

Ring and rotor spinning are both well established technologies and irrespective of sales in the next few years, will remain major suppliers of yarn for

many years to come.

Both systems have positive and negative features and the fabric application and country in which the fabrics are used place differing emphasis on these features. It must however be a major concern for existing users of rotor machines, as well as the suppliers of these machines, that the better aesthetic appeal of ring spun yarns may become an increasingly important factor on which yarn selection is made. ■



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