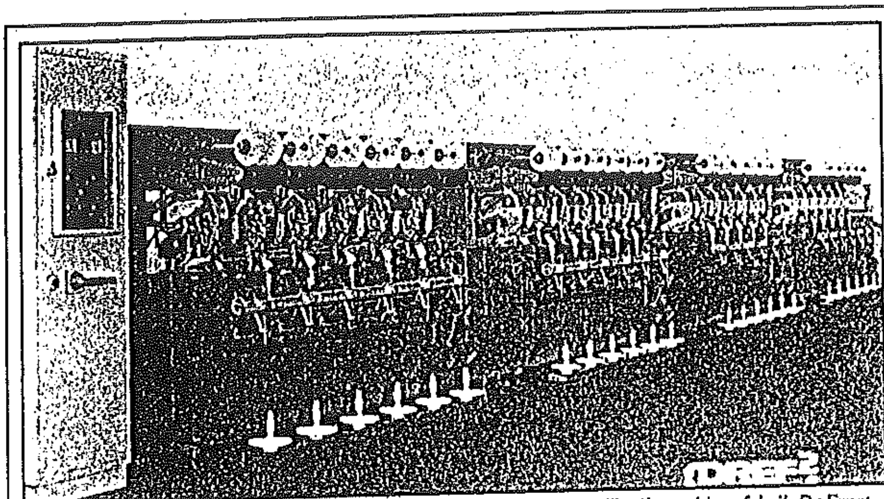


Friction spinning has been commercialised by the Austrian company Textilmaschinenfabrik Dr Ernst Fehrer IAG. This DREF 2 machine has 24 spinning positions and is capable of building multi layer yarns.

Is friction spinning alive or dead?

Alan Parker, who is designing an advanced form of friction spinning machine now at the prototype stage, feels sure that there will continue to be a preference for fabrics from yarns which are dependent on yarn twist, rather than wrapper fibre, for their surface characteristics.

Unlike rotor or jet spinning, open end friction spinning offers the potential to produce conventional twisted yarns without wrapper fibre, and to be able to produce these yarns at speeds more than ten times faster than ring spinning. It is only by being able to exploit this capability that friction spinning will be able to achieve commercial success.

The characteristics of an open end friction spun yarn are primarily determined by how effectively the fibres are aligned to lie along the yarn axis, the twist in the yarn, and the way individual fibres relate to each other within the structure.

In this article, I will examine how these characteristics can be optimised to produce a commercially acceptable yarn and the other requirements needed to achieve a commercial process.

Fibre alignment

It is essential to align individual fibres along the yarn axis, to achieve maximum yarn strength. A spinning system with poor fibre alignment will always produce weak yarns. However, good fibre alignment is only one of the factors which determine yarn strength.

The optimum fibre alignment is achieved on friction spinning due to the relationship between:

★ Angle and speed at which fibres approach forming yarn.
★ Surface speed of yarn at points at which fibres are attached to forming yarn and method by which fibres are attached to, and retained on, the forming yarn.
★ Yarn withdrawal speed.
★ Rigidity, length and friction characteristics of fibres.

Twist

There are a number of alternative ways to apply the twist to create an open end friction spun yarn. There have been many patents filed covering different derivatives of the basic friction spinning concept. The common feature of all the systems is that negative air pressure is employed to help to restrain the forming yarn as this forming yarn is rotated, and the yarn is rotated many times for each revolution of the twisting surfaces.

All my investigations show that there is substantial uniform twist from the core to the surface of the open end friction spun yarn we have developed. This demonstrates that once a fibre has become attached to the forming yarn, the fibre undergoes no further rotational movement in relation to the remainder of the yarn.

When examining twist in a yarn, the important factor is the so-termed twist factor and not merely the level of twist. Open end friction spun yarns are formed in interlocking layers of fibres and the twist factor reduced from the outside to the core of the yarn.

Relationship between individual fibres

All friction spun yarns produced by known commercial technologies have had either a very high level of wrapper fibre, or a lower level of loosely bound wrapper fibre.

We have established a unique friction yarn structure, which can substantially eliminate the loosely bound wrapper fibre. Additionally, the yarn is now smoother, and has an improved fibre alignment, thus giving it a much better lustre than rotor yarn. The smoother yarn surface also permits good unwinding characteristics.

Comparison between Belroy's friction and rotor yarns

After a number of years of extensive development our yarn structure provides a better fibre alignment than rotor yarn, and with a surface appearance that is dramatically closer to a true twist structure.

There are far fewer fibre loops on our friction yarn and a better alignment along the yarn axis, and thus, it will never produce a quality yarn.

Economic considerations

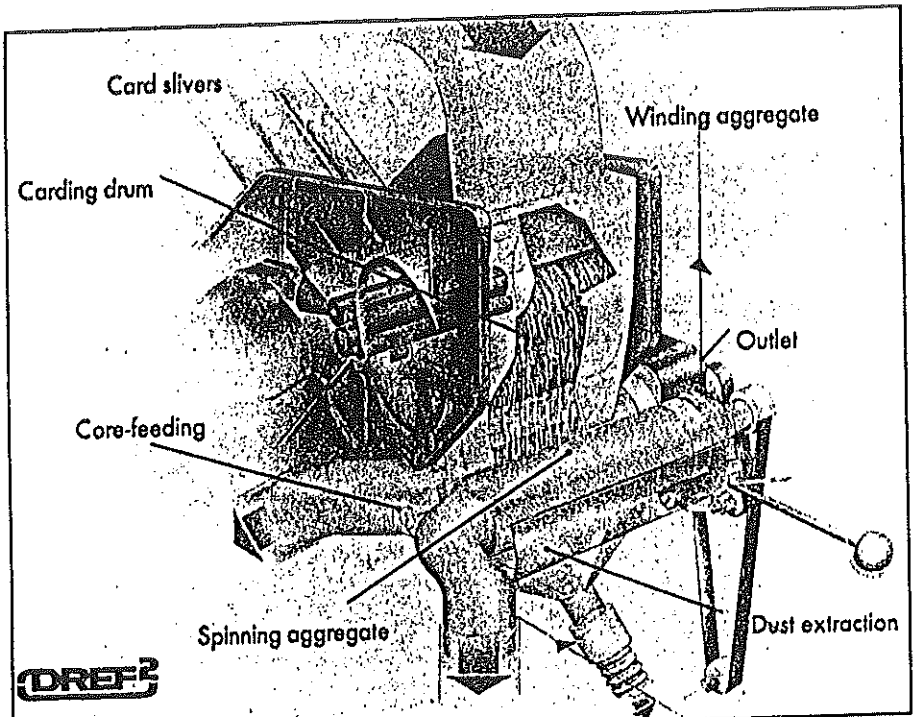
The friction spinning components to form and rotate the yarn are more complex than on a rotor spinner. Therefore, the throughput speed needs to be greater to be economically competitive with rotor spinning.

Friction spinning undoubtably has the potential for far higher speeds than will ever be achieved by rotor spinning. It will also be possible to achieve these higher speeds on finer yarns than can be achieved with rotor spinning.

The improvements and cost reduction in the mass production manufacture of engineering components to the exacting tolerances needed for friction spinning make friction spinning an increasingly viable process.

Further requirements

In today's highly developed world the friction spinning technology will be required to produce a commercially acceptable yarn at an economically attractive speed and must also be an integral part of a multi-position spinning machine which incorporates:



The concept of friction spinning showing how slivers are opened to individual fibres, taken by an 'air bridge' into the suction zone where they are assembled into yarn by the friction of perforated rollers.

★ High quality packaging
★ Fully automated doffing of packages to a specified size.
★ Fully automated piecing to a high quality standard.
★ Quality monitoring of all the yarn produced.

Additionally the machine must be able to perform reliably in a round the clock operation in a mill environment.

As in most new technologies, there are many operational problems for which solutions are having to be found, and the provision of automation with high quality piecing is being established.

Friction spinning is a less precise twist insertion method than either ring or rotor. Although this can be counteracted, to a large extent, by the torque able to be generated by the use of a long twisting zone, occasional weak spots still occur.

We believe we are now in a position to be able to reduce the frequency of occurrence of these weak spots sufficiently to allow them to be replaced by piecings, and which we can now detect by a new monitoring system under development.

Conclusions

I believe all the ideas are in place to enable the friction spinning technology to become a major competitor to the established technologies of ring and rotor.

To be successful, it is essential that all the steps indicated in the report are put in place, because any potential customer will have to make a large commercial investment in new technology. He will thus demand that he has substantial benefits and minimal deficiencies compared to existing products. □