We, MASCHINENFABRIK RIEGER A.G., of CH 8406 Winterthur, Switzerland

hereby apply for the grant of a Standard Patent for an invention entitled:

METHOD AND APPARATUS FOR FALSE TWIST SPINNING

which is described in the accompanying complete specification.

Details of basic application:

<table>
<thead>
<tr>
<th>Number</th>
<th>Convention Country</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>3633/83-3</td>
<td>SWITZERLAND</td>
<td>1 July 1983</td>
</tr>
</tbody>
</table>

The address for service is care of DAVIES & COLLISON, Patent Attorneys, of 1 Little Collins Street, Melbourne, in the State of Victoria, Commonwealth of Australia.

Dated this 21st day of June 1984.

To: THE COMMISSIONER OF PATENTS

(a member of the firm of DAVIES & COLLISON for and on behalf of the Applicant).

Davies & Collision, Melbourne and Canberra.
DECLARATION IN SUPPORT OF CONVENTION OR NON-CONVENTION APPLICATION FOR A PATENT

COMMONWEALTH OF AUSTRALIA
PATENTS ACT 1962

DECLARATION IN SUPPORT OF CONVENTION OR NON-CONVENTION APPLICATION FOR A PATENT

25/7/84

In support of the Application made for a patent for an invention

entitled:  METHOD AND APPARATUS FOR FALSE TWIST SPINNING

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HERBERT STALDER,
Vord. Bahntalstr. 9, CH-8483 Kollbrunn, both of Switzerland


I, Carlo Gaggini, and Robert Wehrli,

Switzerland

do solemnly and sincerely declare as follows:—

1. (a) We are the applicant(s) for the patent.

or

(b) I am authorized by MASCHINENFABRIK RIETER AG,

CH-8406 Winterthur/Switzerland

the applicant(s) for the patent to make this declaration on its behalf.

2. (a) I am the actual inventor(s) of the invention.

or

(b) E. BRINER, Auwiesenstr. 3, CH-8406 Winterthur

HERBERT STALDER,
Vord. Bahntalstr. 9, CH-8483 Kollbrunn, both of Switzerland


I, Carlo Gaggini, and Robert Wehrli,

Switzerland

are the actual inventors of the invention and the facts upon which the applicant(s)

are entitled to make the application are as follows:—

By virtue of the employment contracts of 01.11.63 and 06.05.70, the applicant(s), if a patent were granted upon an application made by the said inventors, be entitled to have the patent assigned to it.

3. The basic application as defined by Section 141 of the Act was made

in SWITZERLAND

by MASCHINENFABRIK RIETER AG

on the 01.07.83

in...

by...

in...

by...

4. The basic application referred to in paragraph 3 of this Declaration was

the first application made in a Convention country in respect of the invention the subject

of the application.

Declared at 21st May day of 1984

Maschinenfabrik Rieter AG
CH-8406 Winterthur

by CARLO GAGGINI

ROBERT WEHRLI

DAVIES & COLLISON, MELBOURNE and CANBERRA.
FALSE TWIST SPINNING

A method of false twist spinning in which:
- a fibre sliver is drafted to a desired yarn count in a drafting mechanism, being delivered as a drafted fibre sliver from a delivery roller pair of the drafting mechanism;
- the drafted fibre sliver is thereafter sucked in a substantially spiral fashion into a converging passage and subsequently taken up by a false twist member, and
- a part of the drafted fibre sliver is twisted by means of the false twist member to a so called false-twisted yarn core with the formation of a spinning triangle, characterized in that:
  The drafted fibre sliver is delivered by the delivery rollers with a width such that only a part of the width of the drafted fibre sliver is caught up in the spinning triangle, that is, is twisted to a false-twisted yarn core, and...

Fig. 4 shows a modification of the false twist unit 106 in that a suction portion 123 is provided between the suction passage 115A and the throttle
the so called edge fibres which are not caught up by the spinning triangle are sucked in such manner and are so guided by means of the suction airstream that, as viewed in the direction of travel of the yarn core, the front end of a fibre which has a length corresponding to the average length of the processed fibres, is caught up by the rotating yarn core when it is assured that this fibre only leaves the nip line of the delivery roller pair after it has been twisted about the yarn core and after it has been caught up in the spinning triangle, whereby the rear end is bound into the yarn core.

15. An apparatus for false twist spinning having a drafting mechanism delivering a drafted fibre sliver to a suction passage, and a false twist member arranged after the suction passage, the suction passage converging towards its narrowest position in a direction towards the false twist member, characterised in that:

upstream of the drafting mechanism delivery roller pair which deliver the fibre sliver to the suction passage, means are provided which guide the fibre sliver in the drafting mechanism in such manner that the drafted fibre sliver delivered by the delivery roller pair has a width which is greater than the width of the spinning triangle of the yarn core rotated by means of the false twist member; the spacing between the nip line formed by the delivery roller pair and the narrowest position of the suction passage is not larger than 75% of the
average fibre length of the fibres contained in
the fibre sliver, and
the suction passage has a converging form such
that free front fibre ends, which are delivered
by the delivery roller pair are guided in the
airstream and are not bound into the rotating
yarn core produced by the false twist member, are
so guided towards the rotating yarn core shortly
before the narrowest position of the suction
passage that they are thereby caught up by the
rotating yarn core in the region of the spacing.
METHOD AND APPARATUS FOR FALSE TWIST SPINNING

The following statement is a full description of this invention, including the best method of performing it known to us:

-1-
Title: METHOD AND APPARATUS FOR FALSE TWIST SPINNING

The invention relates to a method of false twist spinning in which:

- a fibre sliver is drafted to a desired count in a drafting mechanism and is delivered as a drafted fibre sliver from a delivery roller pair of the drafting mechanism;
- the drafted fibre sliver is thereafter sucked, in substantially spiral fashion, into a converging passage and is subsequently taken up by a false twist member, and
- a part of the drafted fibre sliver is twisted by means of the false twist member to a so-called false-twisted yarn core with the formation of a spinning triangle.

The invention further relates to an apparatus for false twist spinning with a drafting mechanism for delivering a drafted fibre sliver to a suction passage beyond which a false twist member is arranged, the suction passage converging to its narrowest location in a direction towards the false twist member.

The problems associated with yarns produced by the false twist spinning method in further processing to a finished fabric, lie substantially in the evenness, strength and extensibility. For example, non-measurable, recurrent weak places, even when the measured strength of the yarn is much higher, represent substantial disadvantages in warping and weaving processes, and nops reduce the value of the finished fabric even where the yarns produce no problems in the subsequent processing stages.

A method and an apparatus in accordance with the method apparatus described above are known from

In this known method, and in this known apparatus, which is illustrated schematically and partly in section in Fig. 1 of the accompanying drawings, a fibre sliver 2 delivered to a drafting mechanism 1 is standardised by funnels 5 and 6 provided respectively before an infeed roller pair 3 and an intermediate roller pair 4, and is guided by an apron pair 8 extending from the intermediate roller pair 4 towards a delivery roller pair 7 (the roller pairs are indicated by dotted lines).

In the converging space of the delivery roller pair 7 a further funnel 9 is provided for collecting the edge fibres F and to avoid, as far as possible, loss of these edge fibres.

In this method according to the prior art, the fibre sliver 2 is delivered from the apron pair 8 (of which only the lower apron is shown) with a width BA, and is fed to the nipline K formed by the delivery roller pair 7.

In the converging space of the delivery roller pair 7, the fibre sliver undergoes spreading due to the peripheral air of the rotating delivery roller pair transported into this space and escaping in the axial direction. This spreading is limited by the funnel 9 to a width BB.

The edge fibres resulting from the difference between the width BB and the smaller width BC of the spinning triangle, are drawn by suction into a suction passage 10 and at the latest at the narrowest location of the suction passage, that is before the throttle position 11, are for the most part caught up by the rotating false-twisted yarn core 12. The twist in the yarn core 12 arises from the pneumatic false twist member 13 arranged downstream from throttle position 11.
The essential disadvantage of this method lies in inadequate evenness of the yarn in respect of weight-evenness, weak places and nops. Also, the strength of the yarn is substantially lower than that of the normal ring-spun yarns. This inadequate regularity is substantially due to the fact that the described fibre spreading occurs randomly and is uncontrolled.

It is therefore an object of the present invention to produce a method and an apparatus for producing a yarn which is more even in respect of the said characteristics.

According to the present invention a method is provided in which a drafted fibre sliver is delivered from the delivery rollers with a width such that only a part of the width of the drafted fibre sliver is caught up by the spinning triangle, that is, is twisted to a false-twisted yarn core, and in that the so-called edge fibres, which are not caught up by the spinning triangle, are taken up by suction in such manner and are so guided by means of the suction air stream that, as viewed in the direction of transport of the yarn core, the front end of a fibre, which has a length corresponding to the average length of the processed fibres, is caught up by the rotating yarn core when it is ensured that this fibre leaves the nip-line of the delivery roller pair only after it has been twisted about the yarn core in the same direction as but with a steeper angle of twist than the yarn core, for so long that it is caught up in the spinning triangle and thus the rear end is bound into the yarn core.

The apparatus according to the invention is characterised in that the drafting mechanism is provided, before its delivery roller pair delivering the fibre sliver to the suction passage, with means which guide the fibre sliver in the drafting mechanism in such manner that
the drafted fibre sliver delivered by the delivery roller pair has a width which is greater than the width of the spinning triangle of the yarn core twisted by means of the false twist member; in that the spacing between the nip-line formed by the delivery roller pair and the narrowest location of the suction passage, is not larger than the average fibre length of the fibres in the fibre sliver, and in that the suction passage has a converging form such that free-front fibre ends (which are delivered by the delivery roller pair, are guided in the airstream and are not bound into the rotating yarn core produced by the false twist member), are guided by the airstream shortly before the narrowest location of the suction passage in such manner towards the rotating yarn core that the rear ends of the fibres are still nipped by the delivery roller pair.

Correspondingly, advantages produced by the invention lie in a yarn of high strength, and which is more even, with the above-mentioned characteristics. These properties are mentioned in the following description in relation to embodiments of the present invention.

Thus, embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Fig. 2 shows a longitudinal section of an apparatus according to the present invention, represented schematically and partly in section;

Fig. 3 shows the part which is represented in section in Fig. 2 illustrated on a larger scale and part-schematically, viewed in section in the direction I in Fig. 2;

Figs. 4, 5, 5a respectively show modifications of the part shown in Fig. 3 viewed in the same direction, and illustrated in section and part schematically;

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A method of false twist spinning in which:
   - a fibre sliver is drafted to a desired width
   - said sliver is delivered by a delivery roller pair to a suction passage
   - the delivery roller pair has a width which is greater than the width of the spinning triangle of the yarn core twisted by means of the false twist member;
   - the spacing between the nip-line formed by the delivery roller pair and the narrowest location of the suction passage is not larger than the average fibre length of the fibres in the fibre sliver;
   - the suction passage has a converging form such that free-front fibre ends, which are delivered by the delivery roller pair, are guided in the airstream and are not bound into the rotating yarn core produced by the false twist member;
   - the rear ends of the fibres are still nipped by the delivery roller pair.

Correspondingly, advantages produced by the invention lie in a yarn of high strength, and which is more even, with the above-mentioned characteristics.
Figs. 6 to 8 show respective process steps represented part-schematically,

Fig. 9 shows the finished yarn represented part-schematically,

Fig. 10 is a diagram showing the strength of the finished yarn in dependence upon a characteristic parameter,

Fig. 11 shows a fibre loss diagram for the yarn in dependence upon a characteristic parameter,

Fig. 12 shows a modification of the arrangement of Fig. 2, and

Fig. 13a to 13d show various yarn property diagrams.

In a drafting mechanism 101 (Fig. 2), a fibre sliver 102 is drafted to the count of a finished yarn in a break drafting field, between an infeed roller pair 103 and an intermediate roller pair 104 and in a main drafting field, between the intermediate roller pair 104 and a delivery roller pair 105, and is twisted to a yarn 107 in a false twist spinning unit 106 (illustrated in section).

The drafting mechanism further comprises a condenser 108 as a first fibre sliver guide element before the infeed roller pair 103, a condenser 109 as a second fibre sliver guiding element before the intermediate roller pair 104 and an apron pair 110 as a further fibre sliver guiding element before the delivery roller pair 105. The apron pair comprises an upper apron 111 and a lower apron 112. Guidance of the roller pairs and apron is known and not the subject of the invention.

The condenser 108 serves for primary guidance of the fibre sliver 102 and the condenser 109 serves for secondary guidance thereof. The bore-section of these condensers is such that between the apron the fibre sliver has a width $B_1$ of 10 to 19 mm; for a yarn
titer of approximately 15 tex, width B1 is preferably in the range from 14 to 15 mm. In order to maintain this width B1 substantially unchanged up to the nipline K produced by the delivery rolls 105, as a first step, one of the two aprons of the apron pair 110 is brought further into the converging space 113 of the delivery rolls 105 than the other apron, e.g. the lower apron 112.

By this means, at the reversing position 114 of the apron 112, a diversion of the fibre sliver out of the plane (not shown) containing the nipline K and the nipline (not shown) produced by the intermediate rollers 104, arises. Shifting of this reversal into the converging space 113 also produces an additional fibre guidance at a surface portion of the upper roller 105 A of the delivery rollers 105 indicated by the angle A (Fig. 2).

As a further means for maintaining the width B1, the aprons 111 and 112 are led so close to the corresponding rolls of the delivery rolls 105 that the spacings M and N respectively are close to zero, so that the airstream produced by the rotating delivery rolls 105 is practically hindered from flowing into the converging space 113.

These additional steps supplement the first step which substantially avoids spreading of the edge fibres which occur in the prior art described and are indicated at F and FA in Fig. 1.

The false twist unit 106 downstream of the delivery roller pair, comprises substantially a suction passage 115 a throttle position 116, known from the Swiss Patent Specification 615 467, and a pneumatic false twist element 117 with at least one air infeed duct 119.

As can be seen from Figs. 3 to 5a and as is known from the theory of false twist spinning (also called jet
spinning), the twist created in the false twist member produces in practice a so called false-twisted yarn core 119 with a twist inclination at the angle $\beta$ (Fig. 7), e.g. with an S-twist as shown in Figs. 3 to 5a.

Through this twisting a spinning triangle arises defined by the hipline K with a width B2 (illustrated in Figs. 3 and 6) given by the intensity of the twisting effect; width B2 should be substantially smaller than the above-mentioned fibre sliver width B1, that is for a given width B2, the width B1 is so chosen in dependence upon the average processed fibre length and spun yarn titer that an adequate number of edge fibres F is produced for wrapping of the yarn core 119. It was established that the front ends (as viewed in the direction of transport R - Fig. 2 - of the yarn core 119) of the edge fibres F drawn in by the suction passage 115 (Fig. 2) are guided along a path corresponding substantially to a conical spiral towards the yarn core 119 rotating with a high speed (e.g. 200 000 rpm), and are generally caught up by the rotating yarn core 115 before the narrowest position of the suction passage. The said path arises due to an air vortex produced by the rotating yarn core. Thereafter, as is illustrated in Figs. 6 to 8, the following occurs:

After the front end of the edge fibre F has been caught up by the rotating yarn core 119, provided that the rear end of the caught fibre is still guided in the hipline K, this edge fibre wraps around the yarn core 119 in the same twist direction, that is, with S-twist of the yarn core 119 S-twist of the wrapping fibre also occurs, but with a substantially larger twist inclination of the angle $\gamma$ (see Fig. 7). However, the angle increases towards the spinning triangle and can correspond to the angle $\alpha$ shortly before the spinning triangle.

This increased inclination arises because the wrap average fibre length of the fibres contained in the fibre sliver, and the suction passage has a converging form such as the swirled jet
travels in a direction opposite to the forward movement of the yarn, that is towards the spinning triangle, with a speed greater than that of the forward movement of the yarn core. Provided that the rear fibre end is still caught by the nipline K, the increased inclination ensures that this end is twisted into the spinning triangle so that the rear fibre end thereafter released by the nipline K remains held in the yarn core of the finished yarn.

The inclination is greater by an amount corresponding to the speed of wrap travel. In order to ensure winding of the rear fibre end into the spinning triangle, the distance D between the narrowest position of the suction passage l15 and the nipline K must be smaller than the length of the edge fibres F. Premature winding in of the front fibre end can shorten the wrapping length of the edge fibre in such manner that the wrapping strength produced by the adhering length of the wrapping fibre is inadequate to impart a sufficient breaking strength to the finished yarn.

Furthermore, it has been shown that the spinning triangle continually and variably divides into smaller spinning triangles with the varying width b2 (Fig. 6a), so that the edge fibres F must arise not only in the edge regions of the width B1 but also over the whole width B1 distributed outside and between the individual small spinning triangles.

In comparison with the unitary spinning triangle explained by reference to Figs 6 to 8, the following relations can therefore be established:

unitary spinning triangle: \[ B1 = 10 - 30 \% \times B2 \]
distributed spinning triangle: \[ B1 = 10 - 30 \% \times \sum b2 \]

This division into small spinning triangles arises through the tendency to hold the fibre density at the nip gap K at such a low value that the already
mentioned free edge fibres \( F \) (not bound into the spinning triangle) can arise.

This division into small spinning triangles produces an advantage in that these edge fibres, as shown in Fig. 6a, can arise at positions distributed across the width \( B_l \), whereby a statistically regular occurrence of these edge fibres \( F \) arises.

Furthermore, it is possible that certain fibres of a fibre group forming a spinning triangle are nevertheless not contained in the spinning triangle as they leave the nipline \( K \), namely, when e.g. the adherence force between these fibres and the rollers is greater than to the other fibres forming the spinning triangle. Like the so-called edge fibres \( F \) such fibres remain with their front ends free until, like the edge fibres \( F \), they are caught up by the rotating yarn core 119 and also form wrapping fibres.

Further, the optimum distance \( D \) should correspond to approximately 70% of the average spun fibre length but should not amount to less than 60% of this average fibre length. The useful range for the distance \( D \) is 60% to 75% of the average spun fibre length.

The finished yarn which is passed by a withdrawal roller pair (not shown) provided after the false twist unit to a winding unit (not shown), consists of a substantially untwisted yarn core 120 (Fig. 9), which is held together by edge fibres \( F \), now called wrapping fibres \( F_l \), wound around the core.

The inclination \( \Delta \alpha \) (Fig. 9) of these wrapping fibres \( F_l \) corresponds substantially to the inclination difference \( \Delta \) (Fig. 7) which arises from the difference between the inclination \( \beta \) of the yarn core 119 and the inclination \( \gamma' \) of the edge fibres \( F \). The wrapping direction of the wrapping fibres \( F_l \) is, however, opposite to that of the edge fibres \( F \), that is if the
edge fibres had an S-direction before the twist member then the wrapping fibres have a Z-direction. During the untwisting, the wound fibres have a disposition along a part of their length, and for a short time interval, lying parallel to the longitudinal axis of the yarn core until, due to the further untwisting, they increasingly take up the opposite wrapping direction.

The already-mentioned advantages of this method in comparison to the previously known method arise in that the wrapping takes place under a certain tension of the edge fibres due to catching of the front free fibre end and wrapping during a time in which the rear end of the edge fibres is still held by the nipline K, and furthermore, the rear end is clearly and firmly wound into the yarn core and firmly held therein.

Wrapping under tension produces a strong wrap in which the wrapping fibres stand under a certain pre-tension within their extensibility, so that upon untwisting of the yarn core not only the lengthening of the yarn core and the increase in the yarn core diameter but also the pre-tension, assist in avoiding separation of the wrapping fibres from the core fibres in the intermediate position in which they lie partly for a short time parallel to the yarn axis.

This pre-tension cannot arise either in those processes in which the fibre end belonging to wrapping portion of the fibre projects freely during the wrapping stage, or in those processes in which the edge fibres lie parallel to the core fibres after the nipline and the wrapping occurs without binding in of the one or the other end of wrapping fibres.

A further contribution to the said advantages is to be seen in the fact that, through the selectable width Bl an adequate and assured quantity of edge fibres can be made available for wrapping, which number of fibres is substantially constant over time.
Fig. 4 shows a modification of the false twist unit 106 in that a suction portion 123 is provided between the suction passage 115A and the throttle position 116. This suction portion comprises a short intermediate chamber 124 connecting the suction passage 115A and the throttle position 116 and a suction bore 125 joining this intermediate chamber with the environment of the false twist unit. Connected to this suction bore is a suction system (not shown) with which a quantity of air is drawn through the suction passage 115A additional to that drawn in by the false twist unit.

The additional quantity of air serves to increase the air speed in the suction passage so that the spiral path, in which the forward ends of the edge fibres F are transported, acquires a greater inclination. Through this increased inclination, or higher speed of suction, there is a tendency to ensure that the said front fibre ends are better directed and are not caught up too early but as close as possible to the narrowest position of the suction passage 115A. Also, by means of the suction on bore 125, a possible loss of the edge fibres between the delivery roller pair 105 and the entry to the suction passage 115A is reduced.

Fig. 5 shows in suction passage 115B, an additional variant of the suction passage for the last-mentioned purpose of fibre end guidance. This suction passage 115B has a bell-shape to counteract still further the tendency towards premature catching of the said fibre ends by the rotating fibre core 119.

With the tulip-shaped suction passage 115C shown in Fig. 5A, the front ends of the edge fibres F are fed into the upper region B of the suction passage 115C. In the intermediate region M, the edge fibres F are fed to the narrowest position of the suction passage 115C while being guided in such manner that they are, for
as long as possible, not caught up by the rotating fibre core 119.

In lower region U, the edge fibres F are guided into a position in which the ends of the edge fibres F tend to take up a disposition parallel to the yarn core. In this last mentioned disposition, the ends of the edge fibres F can be better caught up by fibre ends (not shown) projecting from the rotating yarn core than in a disposition normal to the yarn core.

The suction passage is, however, not limited to the forms shown in Figs. 4 to 5a. Variations thereof can be optimised by tests. Likewise, the suction bore 125 can open tangentially into the intermediate chamber 124 so as to assist the above-mentioned rotation of the air drawn in.

Spin tests have been carried out with the false twist spin unit and suction passages as set out in the following examples:

The values given for the yarn properties are partly value ranges and since they were always measured with the same process or with the same device, they serve mutually as comparison values.

In connection with these tests the following data remains unchanged:

- drawing frame sliver 3000 tex; 65% PES (fibre length 40 mm)/35% combed BW.
  (PES = Polyesterfibre/BW = Cottonfibre)
- Yarn 16 tex
- Sliver width Bl: 15 mm
- Bore Section W (only shown in Figs. 4 and 5a): approx. 22 mm
- Diameter Ø (only shown in Fig. 4) of the narrower position of the suction passage 115A, 115B and 115C: 2,5 mm
- Throttle position 116
  a) diameter: 0,8 mm
  b) length: 3 mm
Quantity of air drawn in:

a) referring to suction passage 115:
   approx. 9 litres/min.

b) with reference to suction passages 115A, 115B, 115C:
   23 to 25 litres/min.

Drafting mechanism arrangement according to Fig. 2.

Further, the stated \( CV_{\text{Uster}} \) values are mass evenness values; that is, the larger the value the worse the evenness.

<table>
<thead>
<tr>
<th>Suction Passage</th>
<th>( CV_{\text{Uster}} )</th>
<th>Nop</th>
<th>Rkm</th>
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<tbody>
<tr>
<td>No. 10 /Fig. 1</td>
<td>19,2</td>
<td>450</td>
<td>12,0</td>
</tr>
<tr>
<td>No. 115 /Fig. 3</td>
<td>16,8</td>
<td>200</td>
<td>13,8</td>
</tr>
<tr>
<td>No. 115A /Fig. 4</td>
<td>15,6</td>
<td>170</td>
<td>17,1</td>
</tr>
<tr>
<td>No. 115B /Fig. 5</td>
<td>16,1</td>
<td>135</td>
<td>16,7</td>
</tr>
<tr>
<td>No. 115C /Fig. 5a</td>
<td>15,9</td>
<td>125</td>
<td>17,2</td>
</tr>
</tbody>
</table>

In the above table, Rkm is the breaking strength of the yarn as represented by the length of the yarn which would break under its own weight if freely suspended ('break km').

Spinning with a diameter \( \varnothing \) (Fig. 4) of the narrowest position of more than 2.5 mm is possible but increasing diameter \( \varnothing \) produces progressively worse properties. For example, the properties with a diameter \( \varnothing \) of 4 mm are clearly worse.

On the other hand, it has been shown that, with a diameter \( \varnothing \) of 2.5 mm, fine and coarse yarns (e.g. 8 tex and 30 tex) can be spun with good yarn properties.

Values for diameter \( \varnothing \) of less than 2.5 mm require greater suction pressures (higher energy) for the same air throughput (litres/min), and, in dependence upon the value, produce such a high air speed that free
front fibres ends are occasionally caught up not by the rotating yarn core but by the suction air, so that the corresponding edge fibres P are fed as waste to the suction installation.

The relation between under pressure $\Delta \rho$ (at the narrowest position) and diameter $d$-value $d$ (Fig. 4) can be expressed with the following formula for a given suction airstream.

$$\Delta \rho \cdot d^4 = \text{constant}$$

The influence of the sliver width $B_1$ on the yarn properties indicated with Fig. 10 and 11 relates to the above-mentioned drawing frame sliver of 3000 tex and to the yarn of 16 tex spun with a false twist unit according to Fig. 4.

From the ordinates in Fig. 10 the breaking strength can be read in break km (Rkm) and the sliver width $B_1$ can be read from the abscissa. This shows that the Rkm-value begins to stabilize from sliver widths $B_1$ above 14 mm.

The fibre loss in grams/hour can be read from the ordinate of Fig. 11 and the sliver width $B_1$ can be read from the abscissa.

From comparison of these two diagrams it can be seen that for this yarn a sliver width $B_1$ of 15 mm is optimal. A broad fibre distribution between the aprons also brings the advantage of better fibre distribution in this drafting zone which carries out the main draft. This better fibre distribution results in a more even draft in this zone together with a longer life for the aprons.

Other yarn counts and other fibre lengths produce different spinning triangle dimensions and correspondingly require different sliver widths $B_1$. The optimal sliver width $B_1$ must be established from case to case. For example, with the false twist spinning unit in accordance
with Fig. 4, it could be established that an optimal width $B_1$ for a yarn of 8 tex lies between 10 and 12 mm and for a yarn of 30 tex, between 15 and 19 mm.

Furthermore, it has been shown that a fibre sliver wrap angle, indicated by angle $\lambda$ in Fig. 2, on one of the two delivery rolls aids separation of the edge fibres from the spinning triangle. This wrap can be achieved in that either, the false twist spinning unit 106 diverges by the angle $\lambda$ from an imaginary plane passing tangentially through the nip line $K$ as shown in Fig. 2 or that, as shown in Fig. 12, the false twist spinning unit 106 is arranged parallel to but displaced from the said plane. The displacement (Fig. 12) is measured in mm.

In the last-mentioned arrangement, spinning tests were carried out in order to establish the influence of a departure from the optimal distance $D$. The tests were carried out with the use of a false twist spinning unit according to Fig. 4 parallel to the above-mentioned plane and displaced therefrom by 5.5 mm, and with the mentioned data of the previously described test unchanged. The results of these tests are represented graphically in Figs. 13a to d. The abscissas shown Fig. 13d also applies to Figs. 13a to 13c and shows values for the distance $D$ in percent above and below the optimal distance of 70% of the average fibre length. The ordinates of Fig. 13a to 13d show, in sequence, the CV-Uster-values, the number $N$ of hops per 1000 m with a setting stage 3, the breaking strength $R_{km}$ (CN/Tex) and the waste in percent $A%$. These values were obtained by internationally standardized measurement methods.

These figures show that with a decreasing distance, the CV-Uster-values, the number of hops and the waste reduces as a substantially linear function over the illustrated range, while the breaking strength...
Finally, the false twist member does not have to be pneumatic, as shown in Figs. 2 to 5. It is quite possible for a purely mechanical false twist member (not shown) to be used in conjunction with the suction passage 115A, 115B or 115C. The essential inventive concept of the relation of the width B1 to the length D can also be obtained using a purely mechanical false twist member. Thus, the present invention is not limited to the use of a pneumatic false twist member.
CLAIMS
THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A method of false twist spinning in which:
   - a fibre sliver is drafted to a desired yarn count in a drafting mechanism, being delivered as a drafted fibre sliver from a delivery roller pair of the drafting mechanism;
   - the drafted fibre sliver is thereafter sucked in a substantially spiral fashion into a converging passage and subsequently taken up by a false twist member, and
   - a part of the drafted fibre sliver is twisted by means of the false twist member to a so-called false-twisted yarn core with the formation of a spinning triangle, characterized in that:
     - the drafted fibre sliver is delivered by the delivery rollers with a width such that only a part of the width of the drafted fibre sliver is caught up by the spinning triangle, that is, is twisted to a false-twisted yarn core, and
     - the so-called edge fibres which are not caught up by the spinning triangle are sucked in such manner and are so guided by means of the suction airstream that, as viewed in the direction of travel of the yarn core, the front end of a fibre which has a length corresponding to the average length of the processed fibres, is caught up by the rotating yarn core when it is assured that this fibre only leaves the nip line of the delivery roller pair after it has been twisted about the yarn core and after it has been caught up in the spinning triangle, whereby the rear end is bound into the yarn core.
2. A method according to claim 1 wherein the width of the drafted fibre sliver is 10 to 30% greater than the width of the spinning triangle.

3. A method according to claims 1 or 2 wherein the width of the drafted fibre sliver is achieved by a correspondingly broad guidance of the fibre sliver before the infeed roller pair and before the delivery roller pair.

4. A method according to any of claims 1 to 3 wherein the fibre sliver is additionally, guided correspondingly broad before the intermediate roller pair.

5. A method according to claims 1 or 2 wherein the fibre sliver is fed directly into the converging space of the delivery roller pair.

6. A method according to claims 1 or 2 wherein the penetration of the circumferential air of the rotating delivery rollers into the converging space is substantially prevented.

7. A method according to claim 1 wherein the front edge fibre end is caught up by the rotating yarn core when the fibre has left the nipline by up to 60 to 75% of the average fibre length of the processed fibres.

8. A method according to claim 7 wherein the preferred range lies in the region of 68 to 72% of the average fibre length.

9. A method according to any preceding claim, wherein the false twist member is a false twist jet and the suction airstream is produced by this false twist jet.

10. A method according to claim 9 wherein the suction airstream produced by the false twist jet is supplemented by a suction part provided between the false twist jet and the converging passage.

11. A method according to any preceding claim wherein the suction airstream is given a rotation so that the free ends of the edge fibres drawn by suction are set
into rotation about the yarn core on the path to the region in which they are caught up by the rotating yarn core and due to the centrifugal force arising therefrom are subjected to a force directed towards the wall of the suction passage so that these fibre ends reach the said region on a conically-spiral-shaped path around the yarn core.

12. A method according to claim 11 wherein the rotation of the suction air is produced by the rotating yarn core itself.

13. A method according to claim 11 or 12 wherein the rotation of the suction air is additionally produced by a correspondingly formed suction portion.

14. A method of false twist spinning substantially as herein described, with reference to Figures 2 and 3 with or without reference to any of Figures 4 to 13d of the accompanying drawings.

15. An apparatus for false twist spinning having a drafting mechanism delivering a drafted fibre sliver to a suction passage, and a false twist member arranged after the suction passage, the suction passage converging towards its narrowest position in a direction towards the false twist member, characterised in that:

- upstream of the drafting mechanism delivery roller pair which deliver the fibre sliver to the suction passage, means are provided which guide the fibre sliver in the drafting mechanism in such manner that the drafted fibre sliver delivered by the delivery roller pair has a width which is greater than the width of the spinning triangle of the yarn core rotated by means of the false twist member;
- the spacing between the nip line formed by the delivery roller pair and the narrowest position of the suction passage is not larger than 75% of the
average fibre length of the fibres contained in
the fibre sliver, and
the suction passage has a converging form such
that free front fibre ends, which are delivered
by the delivery roller pair are guided in the
airstream and are not bound into the rotating
yarn core produced by the false twist member, are
so guided towards the rotating yarn core shortly
before the narrowest position of the suction
passage that they are thereby caught up by the
rotating yarn core in the region of the spacing.

16. An apparatus according to claim 15, wherein the
said means comprises fibre sliver guidance elements
provided respectively before an infeed roller pair and
before the delivery roller pair of the drafting mecha-
nism.

17. An apparatus according to claim 16 wherein the
fibre sliver guiding element provided before the infeed
roller pair is a condenser.

18. An apparatus according to claim 16 or 17 wherein
the fibre sliver guiding element provided before the
delivery roller pair projects into the converging space
of the delivery roller pair.

19. An apparatus according to claim 16, 17 or 18
wherein the fibre sliver guiding element provided before the delivery roller pair is an apron pair.

20. An apparatus according to claim 19 wherein one
of the two aprons projects further into the converging
space than the other apron and both aprons are guided
close to the corresponding roller of the delivery
rollers such that the spacings between aprons and the
corresponding rollers are approximately zero.

21. An apparatus according to claim 15 or 16 wherein
said means comprise a fibre sliver guiding element
provided before an intermediate roller pair.
22. An apparatus according to claim 21 wherein the fibre sliver guiding element is a condenser.

23. An apparatus according to any of claims 15 to 22 wherein the spacing between the nip line and the narrowest position of the suction passage is equal to 60 to 75% of the said average fibre length.

24. An apparatus according to claim 23 wherein said spacing represents in a preferred manner 68 to 72% of the said average fibre length.

25. An apparatus according to any of claims 15 to 24 wherein the false twist member is so formed that the suction airstream is produced by the false twist member.

26. An apparatus according to any of claims 15 to 25 wherein the narrowest position of the suction passage is a throttle position provided between the suction passage and the twist member.

27. An apparatus according to claim 26 wherein a suction portion is provided between the suction passage and the throttle position to reinforce the suction airstream.

28. An apparatus according to claim 27 wherein the suction portion comprises an intermediate chamber adjoining the suction passage and having a suction bore.

29. An apparatus according to claim 28 wherein the suction bore opens tangentially into the intermediate chamber.

30. An apparatus according to claim 27, 28 or 29 wherein the narrowest position of the suction passage is the diameter of the suction portion communicating therewith.

31. An apparatus according to claims 15 to 30 wherein the suction passage is a passage which converges substantially uniformly.

32. An apparatus according to any of claims 15 to 30 wherein the suction passage is a passage which converges
33. An apparatus according to any of claims 15 to 30 wherein the suction passage is a passage which converges in a substantially tulip-shaped manner.

34. An apparatus for false twist spinning substantially as herein described with reference to Figures 2 and 3 with or without reference to any of Figures 4 to 13d of the accompanying drawings.

35. The steps or features disclosed herein or any combination thereof.

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