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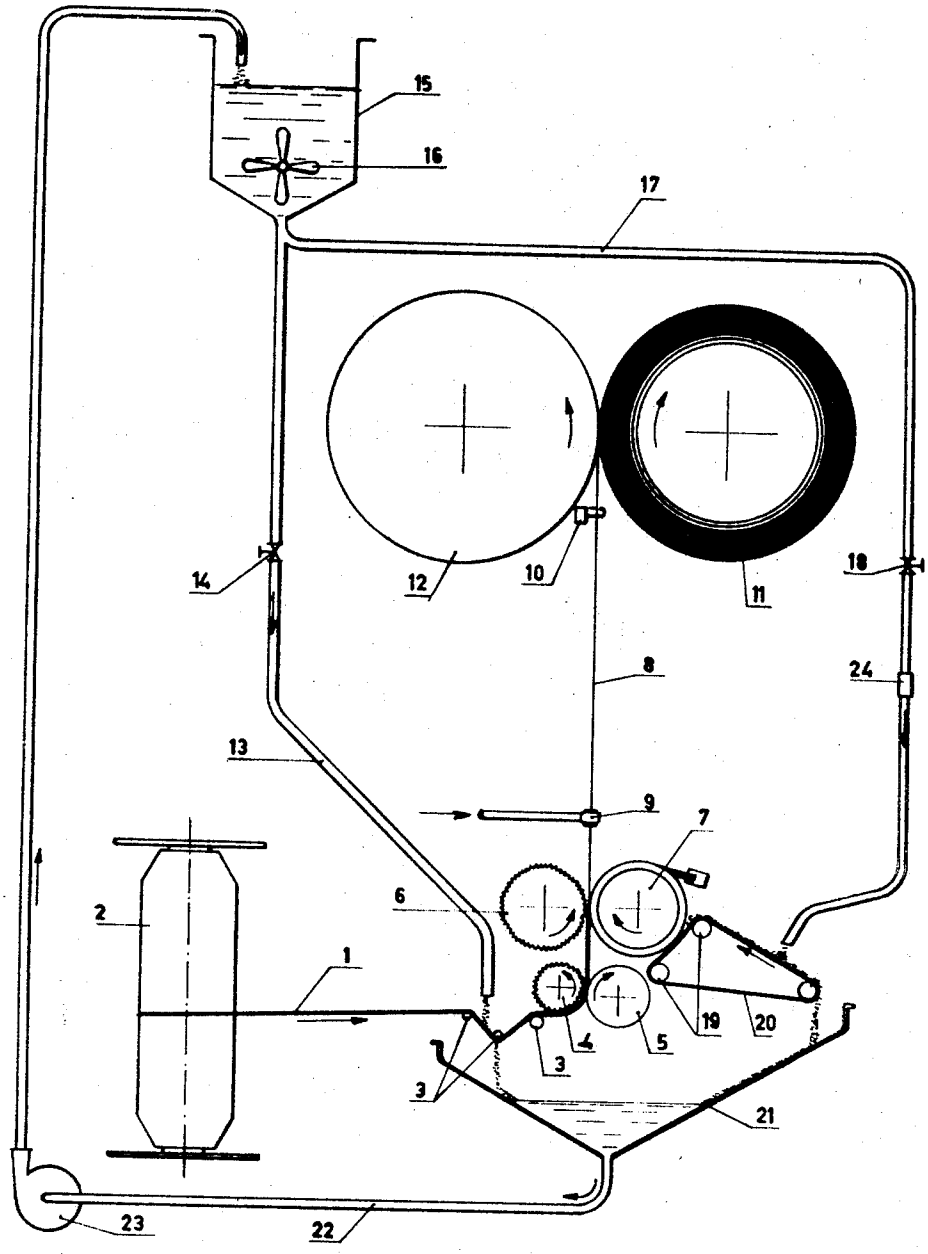

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METHOD FOR THE PRODUCTION OF YARN AND A YARN OBTAINED BY APPLYING THE SAID METHOD

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ABSTRACT OF THE DISCLOSURE

A method for the production of untwisted yarn from staple fibre material. A roving or sliver is brought into a wet condition and is, under maintenance of the wet condition, subsequently drawn at a high speed to form a thin sliver, false-twisted and cross-wound into a fibre packet. By sizing this fibre packet an unwindable yarn packet is obtained, the yarn being suitable for weaving like conventional twisted yarn.

The present invention relates to a method for the production of yarn from a roving of staple fibre material. Here and hereinafter the word "roving" is understood to include twist-free or substantially twist-free fibrous slivers, which are adapted to be worked up into a final yarn.

Many variants of such methods are known and they consist in drawing and roving to form a thin fibrous sliver by means of a drawing device and in twisting of the sliver delivered by the drawing device by means of a twisting winding device.

In the manufacture of yarn it is aimed at to come to lower production costs by speeding up the tempo of production. This makes it necessary for the number of revolutions of the twisting winding device, for example the spinning spindle of a ring spinning machine, to be increased likewise. As a matter of fact, this number of revolutions is determined by the product of the delivery speed of the drawing device in metres per minute and the number of twist turns per metre which is required to give the yarn the desired properties.

In practice, the allowable number of revolutions of the spinning spindles and the like is found to form the limitation to the speed with which the yarn can be produced.

Revolution numbers up to 20,000 revolutions per minute are already being used and by this means a yarn production of 40 m. per minute can be reached, but, although owing to the progressive refinement of technique a further increase of the allowable number of revolutions is not excluded, yet this matter continues to form a decisive impediment to any important increase of the speed of production.

Another limitation of production speed is met with in drawing the roving to form a thin fibrous sliver. When the speed of the delivery rollers of the drawing device is too high, the fibres are torn from the roving supplied by the feeding rollers at such a rate as to cause a disruption of the coherence among the fibres giving rise to interruptions in the fibrous sliver, which means ruptures in the yarn.

These difficulties have to a certain degree been met by applying various measures directed to the improvement of the coherence of the fibres among themselves during the drawing process, such as extra rollers, belts and the like, but even so velocities exceeding 40 m. per minute cannot be realized.

It is an object of the present invention to provide an improved method for the production of yarn, which is free from the above-mentioned impediments to the production speed and by using which a considerable increase of the velocity can, therefore, be realized.

For this purpose, the method according to the present invention has the characterizing feature that the roving is subjected to a number of treatments, among which the treatments that are of importance for yarn formation exclusively consist in bringing the roving into a wet condition, drawing the said roving at a great speed to form a thinner fibrous sliver, false-twisting the said fibrous sliver, winding the fibrous sliver into a fibre packet in the shape of a cross-wound bobbin and sizing the fibre packet so as to form an unwindable yarn packet.

In this connection it is observed that a wet condition of fibrous material is understood to mean the presence of so much water as to have it adhering to the surface of the fibres as free water, such in contradistinction to a humid condition, in which the water has been entirely absorbed by the fibres. By a cross-wound bobbin is understood a coil the turns of which only touch each other when crossing.

In this method, no use is made of a twisting winding device, so that in this respect the production speed does not meet with any impediments and is only limited by the cross-winding, which allows of a much greater winding velocity.

As it has surprisingly been found, the fibres, owing to the roving being drawn in wet condition, show such a firm coherence as to make it possible for an uninterrupted and smooth thin sliver to be formed specially at high delivery speeds of the drawing device and the smoothness of the yarn improves as the speed increases. This may perhaps be attributed to forces of mass inertia, viscous forces and surface tensions, which cause more regular differences in speed between the fibres while being drawn. With this in view, drawing is effected at a delivery speed of at least 50 m. per minute.

It is not necessary for the drawing of the roving that the water to be used for wetting the fibrous material should contain dissolved or suspended additives. It is possible, however, to use such additives with a view to later treatments of the yarn or for the obtention of special properties.

According to a further feature of the method according to the invention, the drawing of the roving is effected on a drawing device comprising two or more pairs of rollers and in which the roving runs between two successive pairs of rollers through a free drawing field. As a matter of fact, it has been proved by experiments that the provisions usually present in the drawing field, such as needles, pins, rollers and belts, which serve the purpose of increasing the coherence among the fibres while being drawn, exert an adverse influence on the drawing process and on the quality of the yarn where the method according to the present invention is concerned.

The false-twisting causes the coherence of the fibres to be temporarily increased after drawing to such an extent as to render the sliver strong enough to cover the distance between the drawing device and the winding device and to resist any tensile stresses it may meet with on its way.

It is usual for a pneumatic false-twisting device to be employed in false-twisting. For this purpose, the fibrous sliver is guided through a mainly cylindrical bore, into which a number of blowing nozzles open in a tangential way. In this manner a rotating air column forms within the bore, the rotation of the said air column being trans-

mitted on to the passing sliver. The number of its revolutions may easily be increased to such an extent that in this respect no limitation whatever of the speed of the yarn is met with.

The absence of speed limitations to which the known methods are subject, has the result that the method according to the present invention permits of relatively very high velocities. It has been found that a velocity of, for instance, 400 m. per minute may easily be applied and considerably higher speeds are simply counted among the possibilities of the method according to this invention.

While winding the thin sliver that has been formed into a fibre packet, it is of importance that no part of the sliver should anywhere be touched in a parallel way by another part of the sliver, because, after the sizing, these two parts of the sliver would be connected together so firmly that yarn rupture would almost certainly occur in this place when the yarn was being unwound. For this reason, it is necessary to use the cross-wound bobbin, the turns of which touch each other at the crossings only, as the winding form of the sliver, because it has been found that two sliver parts that cross each other, after they have been sized will not form a connection, which is stronger than the yarn itself.

The sizing can be effected by using a perforated core when winding the fibre packet and by introducing the sizing agent into the packet by means of this core. However, when using this method, it is difficult to obtain an even concentration of the sizing agent in the packet and to maintain it. Specially when the obvious sizing agents on basis of starch are used, the drying process, during which hot air is blown through the packet by way of the core, will give rise to migration phenomena, with the result that the content in sizing agent of the yarn can not have the desired value in all places.

In order to improve the situation, the method according to the present invention is preferably carried out in such a way that the sizing agent required for the sizing of the fibre packet is added to the roving in a non-active form and that the fibre packet is subsequently subjected to a treatment that activates the sizing agent.

This can be realized by bringing the sizing agent on one or more of the delivery rollers of the drawing device, so that the fibrous material will absorb the sizing material while passing the delivery rollers.

Another possibility is that, for instance, when starch is being used as the sizing agent, the roving, which is in an unsaturated wet condition, is washed with an excess supply of starch-grain suspension, after which the fibre packet is subjected to a heat treatment, the temperature, the environmental moisture and the duration of which are adapted to the gelatination of the starch grains present in the fibre packet, and subsequently dried. A combination of these two methods is also possible. As has been found, these methods do not give rise to any migration phenomena of the starch in the packet.

The method according to the invention offers the additional advantage that any further treatments of the fibrous material that may be necessary, such as bleaching, dyeing, mercerizing, or rendering the material self-ironing (no iron), fire-resistant or rotproof, can be carried out while it is still in the roving stage, so that these treatments can work themselves out more fully and sometimes can be carried out in a more economical way, because the roving is already in the wet condition in view of the further working-up into yarn.

The yarn which is obtained by the method according to the present invention is twist-free or, such in connection with the twist of the roving and the twist which may have been given to the yarn through the unwinding of the packet in axial direction, substantially twist-free. The coherence among the fibres is entirely obtained by means of the glueing and is so strong that the yarn can be used as a weaving yarn just as the usual twisted yarns. This implies that a cotton yarn manufactured according to method of the present invention can immediately be used as a warp yarn, whilst a woollen yarn has only to be doubled in the usual manner to obtain the resistance against wear and shock required in a warp yarn.

Besides for cotton and woollen yarns, the method according to this invention may also be used for yarns made of other fibrous materials and for yarns consisting of mixtures of different fibres.

This invention also relates to yarns which have been manufactured by using the above-described method. It is distinguished from twisted yarns, besides by its entire or substantially entire lack of twist, by its somewhat flat-cross-section. When it is used as a single warp yarn, this flatness has the advantage that it easily passes the healds and the reed of the weaving loom and, because it comes to lie flat in the web, it has the effect that the web is of a closer structure than is an otherwise similar fabric of twisted yarn.

In the following, the invention will be elucidated with reference to the accompanying drawing which shows a diagram of the arrangement of a spinning machine, and to an example.

The roving **1**, which is pulled off the wet roving bobbin **2**, is guided along some guiding elements **3** towards a drawing device, the feeding roller set of which is formed by the serrated roller **4** and the rubber roller **5** and the delivery roller set of which is formed by the serrated roller **6** and the rubber roller **7**. Here, the roving **1** is drawn to form the thin fibrous sliver **8**, which subsequently passes the pneumatic twisting element **9** and the traversing element **10** and is wound up to form a fibre packet **11**, which is driven by the winding roller **12**.

While passing the guiding elements **3**, the roving is washed with a suspension of potato starch in water, which is supplied from the reservoir **15** through the pipe **13** with the control cock **14**. An agitator **16** is provided in the reservoir to prevent the suspension from sedimenting.

The suspension from the reservoir **15** is also supplied to the delivery rollers of the drawing device through the same pipe **17** with the control cock **18**. For this purpose, a circulating band **20** is provided about the rollers **19**, one of which is driven by the feeding roller set in the direction indicated at a low speed. The band **20**, which presses against the roller **7**, brings a thin layer of the suspension, which is supplied through the pipe **17**, on to the roller **7**, which in turn transmits part of this layer to the fibrous sliver **8**.

The excess of the suspension, which is supplied through the pipes **13** and **17**, is collected in the basin **21**, whence it is recycled by the pump **23** through the pipe **22** to the reservoir **15**.

The suspension-content gauge **24** is provided in the pipe **17**, by which gauge changes of the suspension can be established and, if necessary, corrected.

When carrying out the method according to this invention, a cotton roving of 300 tex was wound on roving bobbins, brought into a wet condition by boiling off and defattened and subsequently bleached and dyed. The moisture content was reduced to about 150% by means of suction.

Being in this condition, the roving was unwound from the bobbins and, after having been washed by the stream of a suspension of 10% of potato starch in water issuing from the pipe **13**, it was taken through the drawing device. The compressive force of the feeding rollers amounted to about 1 kg., so that the roving, after it had passed these rollers, had a moisture content of about 180%.

The drive of the drawing device was arranged in such a manner that the peripheral velocity of the delivery roller set was 15 times as high as that of the feeding roller set and amounted to about 200 m./minute.

The fibrous sliver having a thickness of 20 tex which issued from the drawing device, was taken through the pneumatic twisting element at this same velocity. This twisting element consisted of a cylindrical channel having

a length of 6 mm., a diameter of 1.5 mm. and bevelled end parts, and 6 tangential blowing nozzles having a diameter of 0.4 mm. each and having an axial deviation of 5° in the running direction of the yarn. The twisting element was fed with air of 0.4 atmosphere, the air consumption amounting to about 7 l./min.

After having passed the twisting element, the sliver was wound up on a perforated core in the shape of a cross-wound bobbin. The peripheral velocity of the driving roll was about 3% lower than the velocity of delivery of the drawing device, so that unallowable tensions in the fibrous sliver were avoided.

After the sliver had in this way been formed into a packet, the latter was taken from the core and was subjected to a treatment with low pressure steam in an air-free space for 30 minutes. The packet was subsequently dried, after which the sized yarn could be unwound from the packet.

It appeared that the yarn contained about 16% of adhesive.

Working experiments went to show that the yarn could normally be used for weaving without presenting any difficulties. It was found that a fabric made from this yarn had mechanical properties, which were in no respect unfavourable as compared with a similar fabric made from a yarn manufactured in a conventional way, not even after the sizing agent had been washed out of the fabric, this being indicative of the fact that the coherence among the fibres was produced by the structure of the fabric and was not dependent on the structure (twist) of the yarn. It was also found that the fabric, after a pertinent after-treatment, was considerably less air permeable and had a substantially better watertightness than comparable fabrics made from yarns produced in the conventional way.

We claim:

1. A method for the production of yarn from a roving of staple fibre material having insufficient natural sizing agents to be able to form a twist-free yarn, wherein the roving is subjected to a number of treatments, among which the treatments that are of importance for yarn formation exclusively consist in bringing the roving into a wet condition, drawing the said roving at a great speed to form a thinner fibrous sliver, false-twisting the said fibrous sliver, winding the fibrous sliver into a fibre packet in the shape of a cross-wound bobbin and sizing the fibre packet so as to form an unwindable yarn packet.

2. A method according to claim 1, in which the drawing of the roving is effected on a drawing device comprising two or more pairs of rollers, wherein the roving runs between two successive pairs of rollers through a free drawing field.

3. A method according to claim 1 wherein the sizing agent required for the sizing of the fibre packet is added to the fibre material in a non-active form and that the fibre packet is subjected to a treatment that activates the sizing agent.

4. A method according to claim 3, wherein the sizing agent is added to the fibrous material by means of at least one of the rollers of the delivery roller set.

5. A method according to claim 3, wherein the roving, which is in an unsaturated wet condition, is washed with an excess supply of starch-grain suspension and that the fibre packet is subjected to a heat treatment, the temperature, the environmental moisture and the duration of which are adapted to the gelatination of the starch grains present in the fibre packet, and is subsequently dried.

6. A method according to claim 3 wherein said sizing agent is added to the fiber material as an aqueous solution or suspension prior to the false twisting of said roving.

7. A method according to claim 6, wherein the non-active but activatable sizing agent applied to the roving is a starch-grain suspension and wherein the fiber packet is subjected to heat treatment, the temperature, the environmental moisture and the duration of which is adapted to gelatinize the starch-grains present in the packet, and subsequently drying said fiber packet.

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