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(54) Method for manufacturing a yarn, and a yarn manufactured according to this method

(57) A method for manufacturing a yarn consisting of at least two threads wound around each other, containing fibres of a length which is shorter than or equal to 60 mm, which fibres either belong to the polyolefin group or are a physical and/or chemical mixture containing at least one component of this group, in which method the threads are manufactured by conveying respective fibre bundles (1), (2), simultaneously and separate from each other, through a feed-through or drafting device (5), (6), (7) and subsequently twisting and copping each fibre bundle in the same operation, so that they are wound around each other.

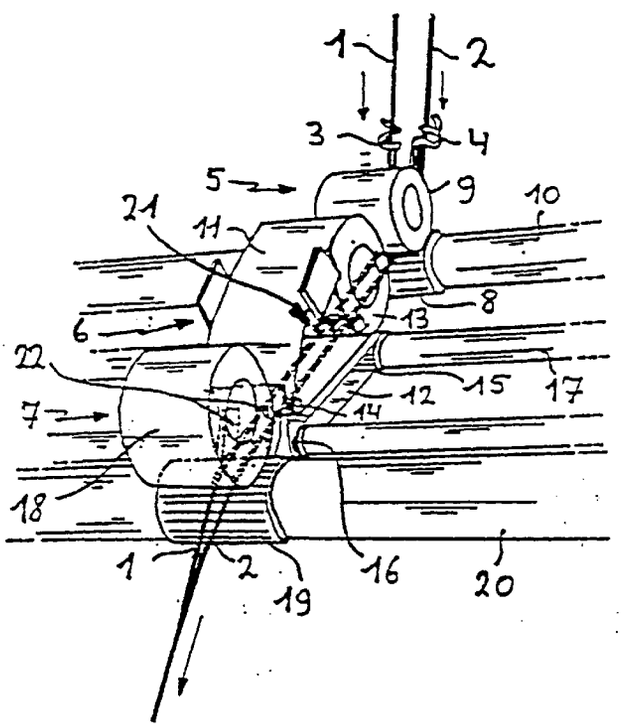

FIG.1

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Description

The present invention relates to a method for manufacturing a yarn consisting of at least two threads wound around each other, containing fibres of a length which is shorter than or equal to 60 mm, which fibres either belong to the polyolefin group or are a physical and/or chemical mixture containing at least one component of the polyolefin group, in which method the threads are manufactured by conveying respective fibre bundles through a feed-through or drafting device, and subsequently twisting and copping each fibre bundle.

The expression physical and/or chemical mixture containing at least one component of the said group is meant to convey, inter alia, the following: bicomponent fibres, copolymer fibres, terpolymer fibres etc...

It is known to use the spinning process described above on the abovementioned fibres in order to obtain individual threads. (A known spinning process is, for example, the ring spinning process). The yarn is obtained by winding the individual threads around each other (doubling), using a special device.

The successive steps of the known method are described below.

A series of preparatory operations are carried out on a quantity of incoherent fibres with the object of manufacturing a continuous, coherent fibre stream, called rovings, from which threads can be spun by means of a spinning machine. These operations are: opening and unravelling the fibres, forming a fibre bundle, drafting a continuous and uniform slubbing with parallel fibres in two or more successive operations, and finally manufacturing roving from the slubbing.

The rovings are then transferred to a ring spinning machine. Each roving is first fed through a separate drafting device on the spinning machine, and is then wound by a winding device onto a tube as it leaves the drafting device, in such a way that it is twisted.

The drafting device consists essentially of three pulling devices disposed one after the other for pulling a roving along. The first pulling device consists of two infeed cylinders disposed one above the other, and rotatable about their longitudinal axis. The bottom infeed cylinder can be driven so that it rotates about its axis at a constant speed of rotation. The roving placed between the two infeed cylinders is clamped between the two infeed cylinders and, by driving the bottom infeed cylinder, the roving is pulled along at a constant pulling speed, while the top infeed cylinder also rotates along with the bottom cylinder.

The second pulling device comprises two closed, relatively broad belts, which are disposed one above the other and are rotatable respectively over two cylinders disposed at a distance from each other. The top and the bottom belt are disposed in such a way that the roving coming from the first pulling device can be clamped between the respective belts. One of the cylinders of the bottom belt can be driven at a constant speed of rotation, in order to make said belt rotate, so that a roving clamped between the belts is pulled along at a constant pulling speed in the same direction as that through the infeed cylinders, while the top belt also rotates along with the bottom belt. The pulling speed of the second pulling device is greater than that of the first pulling device, so that the roving is stretched in the lengthwise direction.

The third pulling device is virtually identical to the first pulling device. The roving coming from the second pulling device can be clamped between the delivery cylinders of the third pulling device and be pulled along (by driving the bottom delivery cylinder) at a constant pulling speed which is greater than that of the second pulling device, so that the roving is again stretched in the lengthwise direction.

Beyond the third pulling device, the fibre bundle runs to a copping device, which simultaneously introduces a twist into the thread and cops said thread.

A bundle of fibres extending virtually parallel to each other has very little coherence, and consequently has very low tensile strength. Spinning such a bundle of fibres introduces a twist into said bundle, as a result of which the fibres are coiled together. The result of this is that the fibres are pressed more against each other, and the increased friction forces mean that it is more difficult for them to slide apart, so that the tensile strength of the fibre bundle is increased considerably.

The copping device comprises a spindle which can be driven at a constant speed of rotation, and on which a tube is mounted. By driving the spindle, the tube is rotated about its longitudinal axis at a constant speed of rotation. The tube is disposed centrally relative to a fixed ring, over which a ring traveller can slide. Said ring is provided with a top edge with a T-shaped profile, while the ring traveller, for example a C-shaped piece of metal or plastic, grips over the horizontal legs of the T-shaped edge. The fibre bundle extends through a thread guide situated above the tube, and runs to the tube through the opening formed between the ring traveller and the top edge of the ring.

The fibre bundle is placed under tension through the rotation of the tube. This causes the ring traveller, which sits loosely over the ring, to be set in motion. The fibre bundle is wound onto the tube while rotating about its longitudinal axis. This produces the desired twist in the fibre bundle.

After spinning, the threads are spooled onto larger bobbins. The threads are subsequently combined in pairs, and in a last, separate operation are wound around one another with a particular twist (doubled). The direction of the twist of the two threads relative to each other is opposite to the direction of the twist in the individual threads. In this way the fibres (which in the individual threads are in a slanting position relative to the longitudinal axis of the thread) ultimately lie approximately parallel to the longitudinal axis of the doubled yarn.

The strength of such a yarn is consequently greater than the sum of the strength of the individual threads, and is also greater than the strength of an individual yarn (a yarn consisting of a single thread) of the same count.

The use of this method on fibres which belong to the polyolefin group, or which are a physical and/or chemical mixture containing at least one component of this group, produces a yarn which is very difficult to process on a weaving loom or a knitting machine. The following problems are in fact found.

A large number of breakages occur on the weaving loom or the knitting machine, inter alia due to the low abrasion resistance of the yarn.

Adjacent yarns stick together in the shed formed by the weaving loom, with the result that the insertion of the weft threads into the shed is impeded. This can lead to damage or breakage of the yarns or to weaving faults. It is consequently impossible to weave these yarns efficiently to a high-quality woven fabric.

During the weaving or knitting, the fibres are fibrillated as a result of the intensive and frequent mechanical actions, which results in unacceptable dust formation. During the weaving or knitting of a woven or knitted fabric from differently coloured yarns, this makes it impossible to prevent the colour fields formed in the fabric from being contaminated with dust from a colour differing from the respective colour fields. This produces a woven or knitted fabric of lower quality.

Besides, the high and unacceptable dust formation is also extremely unpleasant and unhealthy for the people in the vicinity of the weaving loom or knitting machine.

In order to go some way towards reducing the problems encountered during the processing of these yarns, it is customary to treat the yarns with chemical products. The ratio between the weight of the added chemical products, on the one hand, and the weight of the yarn, on the other hand, must be relatively high in order to obtain the desired results, and it is usually approximately 6%.

After the weaving, these chemical products have to be washed out of the fabric, in the course of which highly environmentally polluting effluent is obtained. The additional operations for adding and removing these chemical substances also increase the production costs.

The object of this invention is to provide a method with the characteristics indicated in the first paragraph of this description, which produces a yarn which is easier to process than the yarn obtained according to the known processes.

This object is achieved by the method described in the first paragraph of this description, through the fact that the respective fibre bundles:

- are conveyed simultaneously and separately from each other through the feed-through or drafting device, and
- are twisted and copped in the same operation, so that they are wound around each other.

In the case of this method, the copping of the fibre bundles produces, on the one hand, a twist in each bundle individually (with the result that the respective threads are spun) and, on the other hand, a twist of the different threads relative to each other, with the result that the threads are wound around each other. Both twisting operations are consequently carried out in the same direction. In the case of this method, the spinning and doubling are carried out in the same operation. This method is called the SPT process hereinafter.

It is known to use an SPT process to manufacture yarns from long fibres which do not have the characteristics indicated in Claim 1.

It emerges from various studies and scientific articles that the use of the SPT process on these fibres produces a yarn with a lower abrasion resistance than the yarns manufactured by other processes.

During weaving or knitting, the yarns are subject to friction (on the one hand, against metal parts of the machine and, on the other hand, against other yarns). These frictions can result in damage or breakage of the yarns. The abrasion resistance is a measure of the resistance of the yarn to damage or breakage as a result of these frictions. Therefore, the lower the abrasion resistance, the more difficult it is to process the yarn on a weaving loom or a knitting machine.

It therefore emerges from the technical literature that it is generally accepted that yarns manufactured by the SPT process have a lower abrasion resistance and are consequently more difficult to process than yarns manufactured by other processes.

Any person skilled in the art of this invention who had set himself the task of using the fibres specified in Claim 1 to manufacture a yarn which was easier to process than the known yarns consequently until now never considered applying the SPT process in order to achieve his objective. For experts were always convinced that this process would produce a yarn with a lower abrasion resistance than the existing yarn, and that a yarn which was more difficult, and certainly not easier, to process would consequently be obtained.

However, it now appears that, contrary to expectations, the use of the SPT process in the method according to this invention produces a yarn with superior processing characteristics compared with the (separately doubled) yarn manufactured by the existing method.

It was also found that the tensile strength of the SPT yarn on average is 15% higher than in the case of a separately doubled yarn of the same count, that the elasticity (the elongation at break) on average is 6% higher, that the absolute strength on average is 14% higher, that the output on average is 20% higher, that the evenness of the yarn, contrary to what was to be expected, is considerably improved (virtually no thin places, 24% fewer thick places, 65% fewer unevennesses) that the hairi-

ness is about 50% lower, and that the coefficient of friction of yarn on metal is about 30% lower.

The properties of the yarn according to this invention indicated in this description are based on the results of comparative experiments and a thorough study carried out by Dr L. Van Langenhove of the Textile Science Department at the University of Ghent (Belgium).

It was also found that the SPT yarns have a much more regular, and a smoother and more compact structure than the separately doubled yarns. More specifically, it was found (by carrying out comparative experiments) that the diameter of the SPT yarn is on average approximately 15% smaller.

The result of the high degree of packing of the SPT yarn is that the yarn is stronger than the separately doubled yarns, that the fibres are less quickly damaged, and that the structure of the yarn is less adversely affected by friction, for example during the weaving or knitting process. The chance of yarns sticking together and of dust formation is greatly reduced as a result.

Production costs are reduced through the fact that the use of the SPT process results in the yarn in production having to undergo at least one operation less (the doubling). Besides, it is less necessary to treat the yarn with chemical products.

According to a preferred method, the yarn can also be manufactured from a mixture of different types of fibres in which the fibre mixture has one of the following compositions:

- 50% fibres belonging to the abovementioned group, and 50% other fibres;
- 67% fibres belonging to the abovementioned group, and 33% other fibres;
- 33% fibres belonging to the abovementioned group, and 67% other fibres.

According to a most preferred method according to this invention, the yarn is manufactured mainly from polypropylene fibres.

Other special characteristics of the method according to this invention are specified in Claims 4 to 8.

This invention also relates to a yarn which was manufactured by a method according to this invention, and to a woven fabric or a knitted fabric comprising such a yarn.

The invention is explained further in the detailed description which follows of a possible method according to this invention. However, this does not restrict the invention to this method alone. In this description reference is made to the appended drawings:

Figure 1 shows in perspective parts of a three-cylinder drafting device for simultaneously drafting two rovings, by a method according to this invention;

Figure 2 is a diagrammatic top view of the bottom part of the three-cylinder drafting device of Figure 1;

Figure 3 is a perspective drawing of a device for spinning according to the ring spinning process.

In the case of a method according to this invention, two rovings (1), (2) which have been made by a known method from short polypropylene fibres (for example, having a length of 40 mm) are conveyed simultaneously through a three-cylinder drafting device (Figure 1). The feed-through direction is indicated by an arrow in the figure.

The rovings (1), (2) are first guided through respective roving guides (3), (4), and are then conveyed through three pulling devices (5), (6), (7) disposed one after the other. The first pulling device (5) comprises a bottom infeed cylinder (8) and a top infeed cylinder (9). The rovings (1), (2) extend between the two infeed cylinders (8), (9), which are disposed close enough together to pull the rovings (1), (2) along during the rotation of said cylinders (8), (9). The bottom infeed cylinder (8) is fixed on a drive shaft (10), which can be driven at a constant speed of rotation. The bottom infeed cylinder (8) is caused to rotate by driving said shaft (10). The cylinder (8) drives the top infeed cylinder (9), and the rovings (1), (2) are pulled along at a constant pulling speed.

The rovings (1), (2) then extend to the second pulling device (6). Said pulling device (6) comprises a top closed belt (11) and a bottom closed belt (12), which are rotatable over two cylinders (13), (14); (15), (16) respectively which are disposed apart from each other.

A cylinder (15) of the bottom belt (12) is fixed on a drive shaft (17) with a constant speed of rotation.

The top belt (11) runs flat at the bottom. The bottom belt (12) runs flat at the top. These flat parts lie above one another at a short distance from each other, so that the rovings (1), (2) which extend between said flat parts can be pulled along by the turning of the belts (11), (12).

For this, the cylinder (15) of the bottom belt (12) is driven. The rotating bottom belt (12) drives the top belt (11). The direction of rotation of the cylinder (15) is the same as the direction of rotation of the cylinder (8), so that the rovings (1), (2) are pulled along in the same direction by the first pulling device (5) and the second pulling device (6). The rovings (1), (2) then extend to the third pulling device (7), consisting of a top delivery cylinder (18) and a bottom delivery cylinder (19), which are designed and disposed relative to each other in the same way as the infeed cylinders (8), (9).

Driving of the drive shaft (20) of the bottom delivery cylinder (19) causes the rovings (1), (2) present between the two cylinders (19), (20) to be pulled along further in the same direction.

The drive shaft (17) is driven at a higher speed of rotation than the drive shaft (10), and the drive shaft (20) is driven at a higher speed of rotation than the drive shaft (17).

The speeds of rotation of the various drive cylinders

(10), (17), (20) are adjustable and can be changed automatically during the same operation, for example in order to manufacture a yarn with a special effect.

Between the first pulling device (5) and the second pulling device (6) there is a guide means (21), provided with two separate passages, in order to keep the two rovings (1), (2) apart.

Two openings (22) are provided in a vertical plate between the second pulling device (6) and the third pulling device (7), also with the object of keeping the two rovings (1), (2) apart during their passage through the pulling device.

The roving guides (3), (4), the guide means (21) and the openings (22) are provided in such a way that they keep the rovings (1), (2) apart at a constant distance of approximately 12 mm between them.

Beyond the third pulling device (7) the stretched rovings (1), (2), hereinafter called threads (1), (2), are brought together by twisting them and making them run together through a common guide means (24).

The threads (1), (2) are then guided together to a ring spinning device (Figure 3), and are spun by the ring spinning process and in the same operation wound around each other and wound onto a tube (27).

The combined threads (1), (2) come from between the delivery cylinders (18), (19) and run through a thread guide (24) by way of a ring traveller (25) on a ring (26) to the tube (27). The tube (27) is fixed on a spindle which is driven by a drive mechanism (28) at a constant speed of rotation.

The tube (27) is disposed centrally relative to the fixed ring (26).

The ring (26) has a T-shaped profile. A C-shaped metal piece (25) - called the ring traveller - which can slide over the ring (26) grips over the horizontal legs of said profile. The threads (1), (2) run through the opening formed between the ring traveller (25) and the ring (26).

Due to the fact that the tube (27) rotates and takes the threads (1), (2) with it, the latter are placed under tension. This causes the ring traveller (25) to slide over the ring (26), with the result that a twist is produced in the threads (1), (2). The threads (1), (2) are wound onto the tube (27). Due to the fact that they rotate about their longitudinal axis during the winding motion, a twist is introduced into the individual threads (1), (2).

This also causes the threads (1), (2) to be wound around each other with a twist.

The end result is a yarn with the superior qualities mentioned above in this description. This method is also very advantageous as regards production costs.

Moreover, the problems experienced during weaving of the known yarns - low abrasion resistance, dust formation and the yarns sticking to each other - are as good as eliminated altogether in the weaving of the yarn according to this invention.

Claims

1. Method for manufacturing a yarn consisting of at least two threads wound around each other, containing fibres of a length which is shorter than or equal to 60 mm, which fibres either belong to the polyolefin group or are a physical and/or chemical mixture containing at least one component of the polyolefin group, in which method the threads are manufactured by conveying respective fibre bundles (1), (2) through a feed-through or drafting device (5), (6), (7), and subsequently twisting and copping each fibre bundle (1), (2), **characterized in that** the respective fibre bundles (1), (2):

   - are conveyed simultaneously and separately from each other through the feed-through or drafting device (5), (6), (7), and
   - are twisted and copped in the same operation, so that they are wound around each other.

2. Method according to Claim 1, **characterized in that** the yarn is manufactured from a mixture of different types of fibres, in which the fibre mixture has one of the following compositions:

   - 50% fibres belonging to the abovementioned group, and 50% other fibres;
   - 67% fibres belonging to the abovementioned group, and 33% other fibres;
   - 33% fibres belonging to the abovementioned group, and 67% other fibres.

3. Method according to Claim 1, **characterized in that** the yarn is made mainly of polypropylene fibres.

4. Method according to one or more of the preceding claims, **characterized in that** the fibre bundles (1), (2) are conveyed through the feed-through or drafting device (5), (6), (7) at a distance of at least 8 mm between them.

5. Method according to one or more of the preceding claims, **characterized in that** the respective threads are conveyed through a common guide means (24) after they leave the feed-through or drafting device, and in that beyond said guide means (24) the threads are copped.

6. Method according to one or more of the preceding claims, **characterized in that** the threads are copped by the ring spinning process.

7. Method according to one or more of the preceding claims, **characterized in that** a drafting device is provided, comprising at least two pulling devices (5), (6), (7) for simultaneously pulling along at least two fibre bundles in the same pulling direction (5),

(6), (7), and in that the pulling speed of the successive pulling devices (5), (6), (7) increases.

8. Method according to Claim 7, **characterized in that** three pulling devices (5), (6), (7) are provided, and in that each pulling device (5), (6), (7) comprises a drive cylinder (10), (17), (20).

9. Yarn, manufactured by a method according to one of the preceding claims.

10. Woven fabric or knitted fabric, comprising a yarn which was manufactured by a method according to one of the preceding claims.

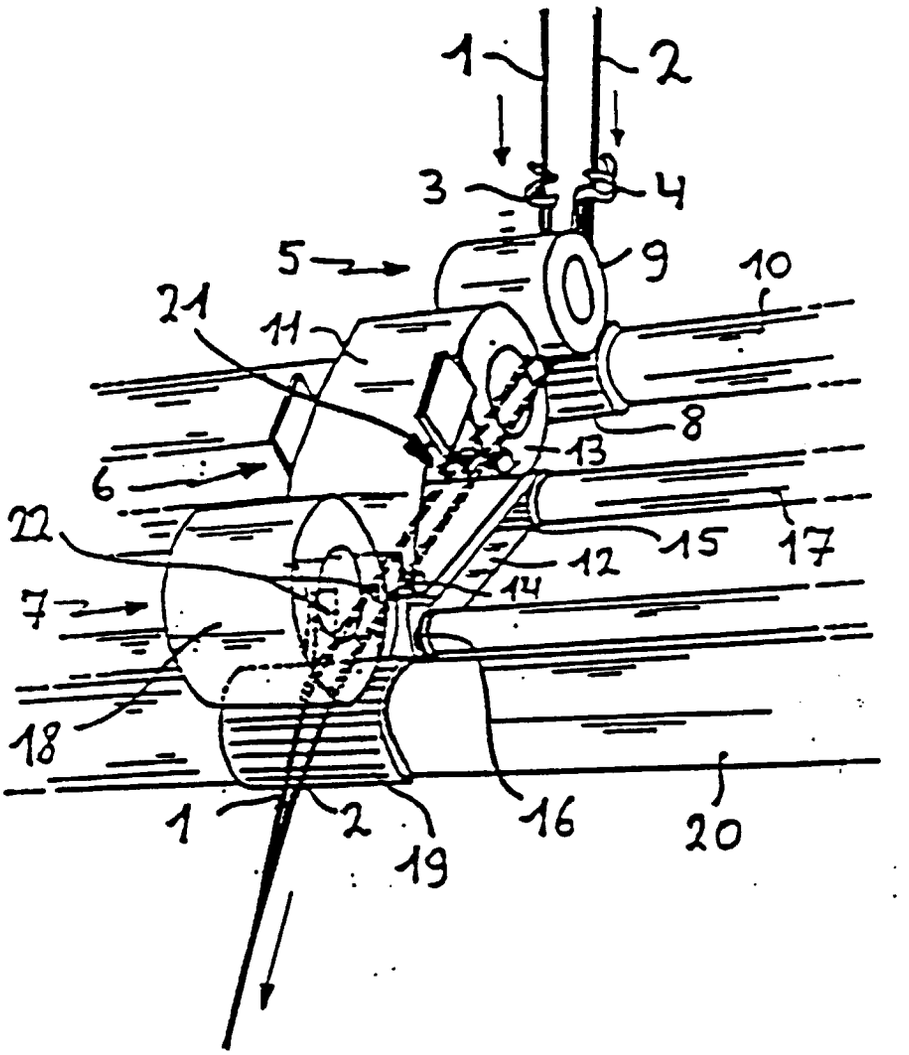

FIG.1

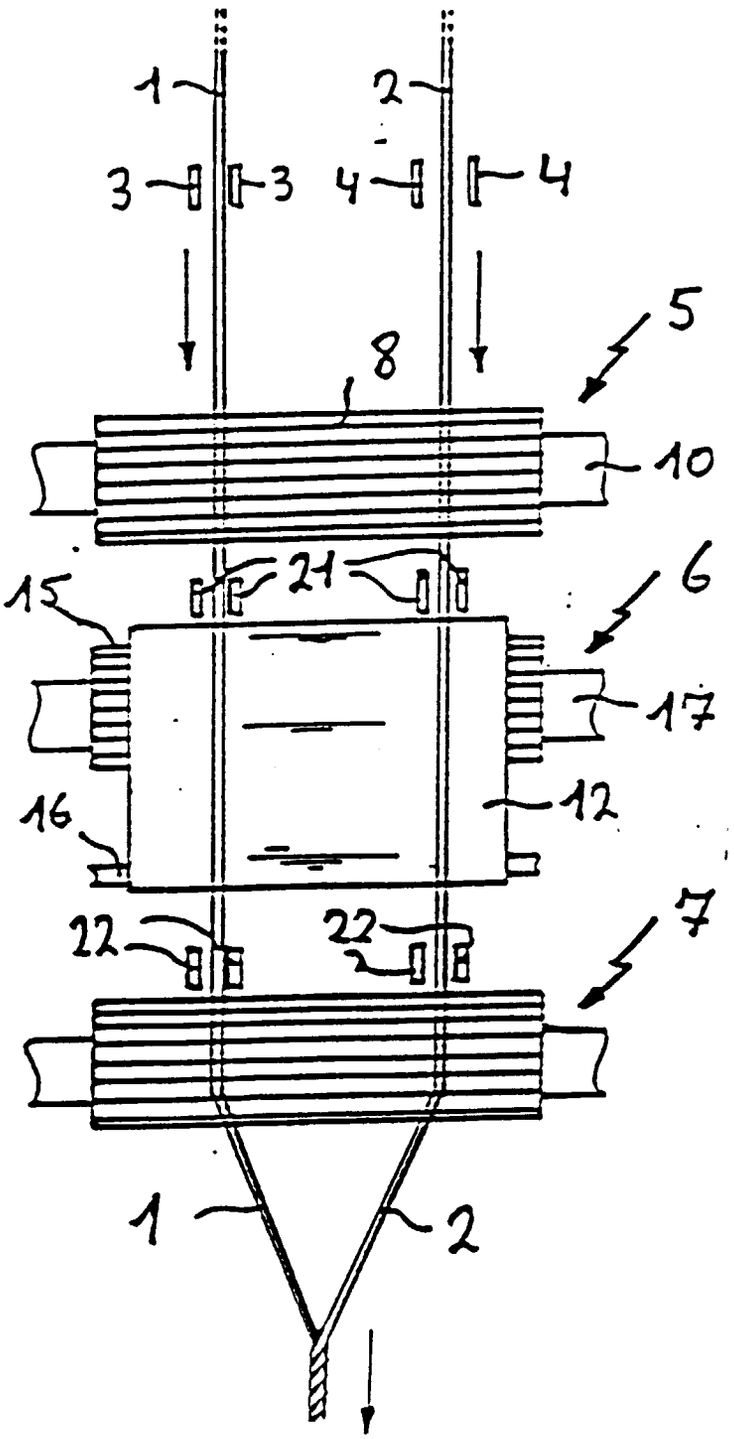

FIG.2

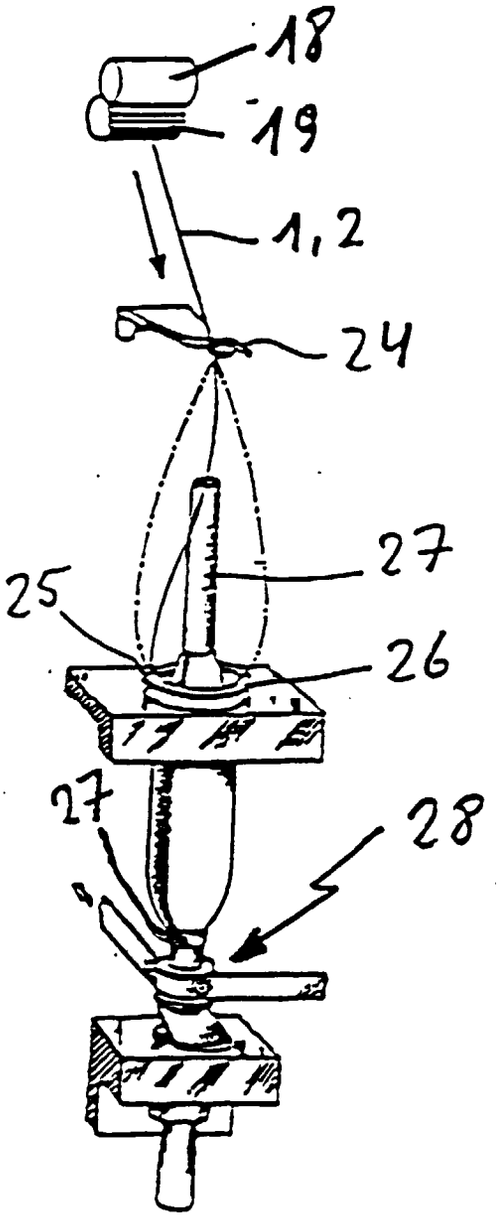

FIG. 3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 20 1304

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	DE-A-21 34 372 (HERCULES INC.) * page 14, last paragraph *	1,9,10	D02G3/28
A	DE-A-40 15 062 (ZINSER TEXTILMASCHINEN GMBH) * the whole document *	1-10	
A	WO-A-81 03501 (ZINSER TEXTILAMSCHINEN GMBH) * the whole document *	1-10	
A	MELLIAND TEXTILBERICHTE INTERNATIONAL, vol. 63, no. 7, July 1982, HEIDELBERG DE, pages 475-479, XP002012610 DINKELMANN, HERDTLE: "Neues Verfahren kann den Zwirnprozess ersparen" * the whole document *	1	
A	PATENT ABSTRACTS OF JAPAN vol. 9, no. 36 (C-266), 15 February 1985 & JP-A-59 179823 (NITSUTOU SHOJI KK), 12 October 1984, * abstract *	1	TECHNICAL FIELDS SEARCHED (Int.Cl.6) D02G D01H
A	PATENT ABSTRACTS OF JAPAN vol. 15, no. 96 (C-0812), 7 March 1991 & JP-A-02 307919 (UNITIKA LTD), 21 December 1990, * abstract * & DATABASE WPI Week 9106, Derwent Publications Ltd., London, GB; Class F01, AN 91-040653	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	5 September 1996	Tamme, H-M

CATEGORY OF CITED DOCUMENTS

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