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(54) **BUFFER METHOD AND SYSTEM FOR ALTERNATING TWIST PLIED YARN**

(57) The present invention relates to an improved system and method for the production of heatset yarns, in particular for the production of heatset alternating S/Z cabled yarns. The invention also relates to the product obtained according to the method, namely an improved heatset twist plied yarn.

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Description**TECHNICAL DOMAIN**

[0001] The invention relates to an improved system and process for twist plying and heatsetting yarns, in particular an optimized alignment of subprocesses or subsystems with different operating speeds.

STATE OF THE ART

[0002] Nowadays, yarns are usually twist plied and heatset into two separate, successive processes.

[0003] In a first process the yarns are twist plied on a twist plying device; this twist plying device twist two or more into one twisted yarn, and rinses it up on a cross spool.

[0004] In a second process, these cross spool are placed on a heatset device; the heatset device of several cross spool simultaneously unwinds the twisted yarn, heats these yarns, and then rinses again on (other) cross spool.

[0005] These two processes cannot possibly be linked together in an economically manner, because the process speed of the twist plying is much lower than the process speed of the heatsetting.

[0006] However, the process of alternating S/Z twist as described in the publication WO2012/059560 or the patent BE1023286 can be done at the same process speeds as the heatsetting of the yarn.

[0007] Consequently, the process of alternating S/Z twist plying can be linked to the process of heatsetting, which rinses the twist plied yarns on cross spool, and makes the manipulation of these cross spool between twist plying and heatsetting unnecessary, thus resulting in enormous cost savings.

[0008] The applicant notes that the process of alternating S/Z twist plying is technically by far the most difficult step, and the most difficult to control. Moreover, it is clear that it is crucial that the step of the alternating S/Z twist plying be continuously conducted, and not be stopped to ensure that the desired twist level is achieved and maintained during the entire process. When stopping the twist plying (for example to solve defects, to replace cases, to carry out corrections, or others), the already twisted yarns spontaneously untwist through which they are lost. Hereby, it should also be mentioned that this is almost impossible to rewind afterwards, given that the detection of the twist level is technically very difficult, especially in a fast and reliable manner.

[0009] For that reason, it is almost an obligation to allow the twist plying device to run continuously. However, the heatsetting device cannot always remove the produced yarns from the twist plying device in a continuous, reliable manner. In case of problems in the heatsetting device, or the subsequent windings stations, the process must be stopped for repairs. This also ensures that the twist plying device has to be shut down, with the consequenc-

es that were discussed earlier.

[0010] The present invention aims to find a solution to the above-mentioned problem.

SUMMARY OF THE INVENTION

[0011] The invention relates to a system for the production of heatset twined yarns, comprising:

- a. at least one twist plying device for producing a twist plied yarn from at least two incoming yarns;
- b. at least one accumulation device for receiving, accumulating and passing the twist plied yarns from the at least one twist plying device, the accumulation system being adapted for the temporary accumulation of the twist plied yarns;
- c. at least one heatsetting device suitable for receiving and heatsetting the twist plied yarns of the at least one accumulation device for the manufacture of at least one heatset twist plied yarn;

wherein the at least one twist plying device is configured to operate uninterruptedly, the heatsetting device being adapted to operate intermittently and periods of operation of the heatsetting device being alternated with periods of stopping the heatsetting device, and wherein the accumulation device it is configured to temporarily retain the accumulated twist plied yarns when stopping the heatsetting device.

[0012] In a second aspect, the invention relates to a method for the production of heatset twist plied yarns, comprising the following steps:

- a. twist plying one or more groups of two or more yarns for the production of one or more twist plied yarns;
- b. receiving the one or more twist plied yarns on at least one accumulator;
- c. accumulating the one or more received twist plied yarns on the at least one accumulation device wherein the accumulation device is adapted for the temporary accumulation of the twist plied yarns;
- d. passing the accumulated twist plied yarns from the at least one accumulation device to at least one heatsetting device;
- e. the heatsetting of the twist plied yarns in the at least one heatsetting device for the manufacture of at least one heatset twist plied yarn;

wherein the step of twist plying takes place continuously, while the step of heatsetting occurs intermittently and periods of heatsetting are alternated with periods of stopping of the heatsetting, and the step of passing the twist plied yarns from the accumulation device to the stopping the heatset device, the accumulated twist plied yarns are temporarily stopped.

[0013] In a further aspect, the invention relates to a twist plied yarn, preferably a set of heatset alternating

S/Z twist plied yarn or a set of heatset alternating S/Z cabled yarn or set of heatset and connected alternating S/Z twist plied yarns obtained on a method according to this document.

DESCRIPTION OF THE FIGURES

[0014]

FIG. 1 shows a possible embodiment of the system according to the invention.

FIG. 2 shows a further possible embodiment of the system according to the invention.

FIG. 3 shows a possible embodiment of an accumulation device according to the invention.

FIG. 4 shows a detailed section of the head end for a possible embodiment of the accumulation device of Figure 3 on the yarn supply side.

FIG. 5 shows a detailed perspective view of the head end for a possible embodiment of the accumulation device of FIG. 3 and / or 4 at the yarn supply side.

DETAILED DESCRIPTION

[0015] Unless otherwise defined, all terms used in disclosing the invention, including technical and scientific terms, have the meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. By means of further guidance, term definitions are included to better appreciate the teaching of the present invention.

As used herein, the following terms have the following meanings:

"A", "an", and "the" as used herein refers to both singular and plural referents unless the context clearly dictates otherwise. By way of example, "a compartment" refers to one or more than one compartment

"About" as used herein referring to a measurable value such as a parameter, an amount, a temporal duration, and the like, is meant to encompass variations of +/-20% or less, preferably +/-10% or less, more preferably +/-5% or less, even more preferably +/-1% or less, and still more preferably +/-0.1% or less of and from the specified value, in so far such variations are appropriate to perform in the disclosed invention. However, it is to be understood that the value to which the modifier "about" refers is itself also specifically disclosed.

"Comprise", "comprising", and "comprises" and "comprised of" as used herein are synonymous with

"include", "including", "includes" or "contain", "containing", "contains" and are inclusive or open-ended terms that specifies the presence of what follows e.g. component and do not exclude or preclude the presence of additional, non-recited components, features, element, members, steps, known in the art or disclosed therein.

The term "twist plying device" can here refer to an apparatus, or assembly of devices, for processing extruded BCF (Bulk Continuous Filament) yarns into twist plied yarns. In particular, this may concern devices as described in WO 2012/059560 or the patent BE 1023286.

The term "twist plied yarn" is used herein as a general term denoting yarns which have been provided with a twist. In particular, the term may refer to alternating S/Z twist plied yarns or alternating S/Z capped yarns or connected alternating S/Z twist plied yarns, whereby a distinction will be made in the text in situations where this is relevant.

[0016] The citation of numerical intervals by the endpoints includes all integers, fractions and/or real numbers between the endpoints, including these endpoints.

[0017] In a first aspect the invention relates to a system for the production of heatset twist plied yarns:

- a. at least one twist plying device for producing a twist plied yarn from at least two incoming yarns;
- b. at least one accumulation device for receiving, accumulating and passing the twist plied yarns from the at least one twist plying device, the accumulation system being adapted for the temporary accumulation of the twist plied yarns;
- c. at least one heatsetting device suitable for receiving and heatsetting the twist plied yarns of the at least one accumulation device for the manufacture of at least one heatset twist plied yarn;

wherein the at least one twist plying device is configured to operate uninterruptedly, the heatsetting device being adapted to operate intermittently and periods of operation of the heatsetting device being alternated with periods of stopping the heatsetting device, and wherein the accumulation device it is configured to temporarily retain the accumulated twist plied yarns when stopping the heatsetting device.

[0018] The applicant noted that in a large number of production processes and production units a problem arose in the alignment of the subprocesses, in particular at the bottleneck of the production of the twist plied yarns, and the heatsetting that follows. In particular, problems arose when the heatsetting device had to be temporarily shut down, because the twist plying device then had to follow it, with the result that the already twist plied yarns spontaneously untwisted. It was also noted here that in

the case of saturated steam in the heatsetting device through which the twist plied yarns are conducted, the yarns may remain here for a fairly long period of time (up to 20-30 minutes) without negatively impacting the quality of the yarns. In other words, the heatsetting device can be shut down without any problems during this period without the need to take measures for the yarns contained therein. As said, it is of the utmost importance that the twist plying device can continue to run continuously, also although the heatsetting device is stationary, and for this reason the applicant provides an accumulation device which serves as storage or buffer between the heatsetting device and the twist plying device. The accumulation device accumulates twist plied yarns from the twist plying device in normal operation and supplies them to the heatsetting device. When the heatsetting device is shut down, the accumulation device collects a 'supply' of twist plied yarn from the twist plying device, after which the heatsetting device restarts, and the accumulated yarn can be partially processed by the heatsetting device, which in principle is higher volume than the twist plying device normally delivers. This process can then be repeated, whereby the heatsetting device is shut down at some moments, without the twist plying device having to stop.

In this way it is ensured that the twist plying device can continue to run continuously, whether or not at the same speed, while the heatsetting device can temporarily stop without causing problems. As said before, the stoppage time can in principle be increased to half an hour without having adverse effects on the yarns in the heatsetting device, and it is therefore interesting to provide an accumulation device which can accumulate at least an equivalent amount of yarn as manufactured in one half hour by the twist plying device. This ensures that the heatsetting device is used as efficiently as possible, and that it therefore runs substantially independently of the twist plying device.

[0019] In a preferred embodiment, the twist plying device is adapted to match the speed of manufacture of the twist plied yarns to the amount of accumulated yarn on the accumulation device, and to the operating status of the heatsetting device (whether or not operative thereof, and preferably further details, such as processing speed and suchlike).

[0020] The purpose of the invention is, inter alia, to develop a system and method for manufacturing a pair of heatset twist plied yarns in which the twist plying device can run continuously, independently of the heatsetting device, and preferably also of other subsystems. For that reason, an accumulation device is provided which can act as a buffer between twist plying and heatsetting device. However, given the difference in flow that these two devices can handle, but also and especially due to the fact that the heatsetting device is shut down regularly, it is important to align the buffer and the two subprocesses (twist plying and heatsetting) as well as possible with each other. Thus the accumulation device has a maxi-

mum capacity, and it must be ensured that it does not become full before the heatsetting device revolves, if not, the twist plying device must be shut down with all its consequences. Since the twist plying device can produce a fairly large volume on short time units, taken into account the situation in which the heatsetting device does not start up again in time, so the speed at which the alternating S/Z twist plied yarns must be manufactured, must be adapted to this. Thus, the twist plying device can automatically reduce the speed at which it produces yarns when the heatsetting device is not operative to cause the accumulation device to fill up more slowly (to prevent the twist plying device from being shut down). The reduction of the speed at which the yarn is made can be, for example, 85% of the normal speed, or for example 80%, 75%, 70%, 65%, 60%, 55%, 50%, 45%, 40%, 35%, 30%, 25% or even less. Although this temporarily lowers the flow rate, it is still more convenient and efficient than having to temporarily stop the twist plying device if the accumulation device were to be flooded. In a further embodiment the twist plying device can also operate at a lower speed, after the temporary set-up of the heatsetting device, after a temporary stop, depending on the amount of accumulated yarn. In this way, a backlog of the heatsetting device can be eliminated more quickly to avoid problems if the heatsetting device is stopped again (unexpectedly early). For example, the twist plying device may be configured in a fairly general manner to tune with the level of fullness of the accumulation device. Below a certain level of fullness the twist plying device operates at a 'full speed', which may or may not be the maximum speed of the twist plying device, above a certain level of fullness, the twist plying device works at an 'empty' speed', which is lower than the full speed. In addition, it is also possible to work at still intermediate speeds, with a plurality of predetermined levels of filling which trigger one of the different production speeds, or even with a continuously changing speed, tuned to the continuum of fullness.

[0021] In a preferred embodiment the at least one twist plying device is configured to automatically adjust the speed of manufacturing the twist plied yarns to whether or not the heatsetting device is operating.

[0022] In the first instance, it is important for the twist plying device to reduce the production rate if the heatsetting device is not operational, in order not to fill the accumulation device too quickly. More complex systems or configurations for tuning the speed of the twist plying device can follow, for example, a gradually increasing production speed after becoming operational again, or a fixed or variable period of lower speed after becoming operational.

[0023] In a preferred embodiment, the speed of manufacturing the twist plied yarns is automatically reduced within a predetermined period of time after the heatsetting device stops operating, and preferably wherein said speed is reduced at least until the heatsetting device proceeds to operate.

As discussed earlier, the reduction can take place under a large number of profiles.

[0024] In a preferred embodiment, the speed of manufacturing the twist plied yarns is automatically reduced, taking into account an estimated length of time of stopping the heatsetting device, in order not to exceed a predetermined maximum amount of the accumulated twist plied yarn on the accumulation device.

[0025] By estimating how long the heatsetting device would stop working, the speed of the twist plying device can be adjusted to lose a minimal production, but nevertheless (with some margin for assurance) to ensure that the accumulation device is not full. In certain situations, the duration of stopping the heatsetting device can, for example, be fairly standard and predictable, e.g. replacement of elements, maintenance, checks, etc. A substantial reduction of the speed of the twist plying device ensures that the accumulation device does not fill up, but thus also causes a loss in production capacity. A too limited reduction of the speed of the twist plying device does maximize the production capacity when the heatsetting device is at a standstill, but can cause the accumulation device to fill up and the twist plying device to be shut down, thus causing a loss in production capacity.

In the case of 'predictable' situations for the shutdown of the heatsetting device, such as standard maintenance, replacement of elements, or the like, a relatively reliable estimate can be made of the maximum time duration, with a certain margin, in order to tune the speed of the twist plying device.

[0026] In a preferred embodiment the incoming yarns comprise extruded BCF yarns, and wherein the at least one twist plying device is suitable for manufacturing one or more alternating S/Z twist plied yarns or alternating S/Z capped yarns or connected alternating S/Z twist plied yarns.

[0027] In an alternative embodiment, the manufactured yarns involve so-called 'real twist' yarns; these are yarns whose twisting direction does not change over the longitudinal axis of the yarn. The applicant noted that the invention can in principle also be applied to this situation.

[0028] In a further preferred embodiment the system comprises a control system configured for monitoring the amount of accumulated twist plied yarn on the accumulation device, and adapted to control the speed of manufacturing of the twist plied yarn by the twist plying device on the basis of at least the amount of accumulated twist plied yarn and whether or not the heatsetting device is active.

[0029] The term "accumulation device" refers to a system adapted to collect and temporarily store the twist plied yarns (e.g. alternating S/Z cabled yarns). For example, the accumulation device may be a spool or bobbin or sheath around which the yarns are wound in a way that they are easily unwindable with the deepest end (so without a newer, superposed layer of yarns preventing it).

[0030] The term "heatsetting device" refers to a system that exposes the produced yarns to a high temperature,

typically above 100 ° C, in order to produce a shrinkage in the yarns that somewhat tightens the yarn twist, and also for a certain volume in the yarns. Often the heatsetting device is a chamber in which the heat is generated, the yarns being conducted through the chamber, often on a conveyor belt or suchlike, under a limited longitudinal tension.

[0031] By providing a control system or mechanism as described above, the speed of the twist plying device can be perfectly controlled to ensure continuous operation of the twist plying device. The control system takes into consideration both the degree of accumulation of the accumulation device and the status of the heatsetting device (active, inoperative, optionally also in intermediate positions such as 'in start-up' and the like), in order to improve the speed of the twist plying device. determine. The determination of the fullness of the accumulation device can be realized in a number of ways. This can be done, for example, on the basis of mass, but on the other hand visually, through the twist plied yarns to wind a tubular structure and inspect it visually. One possibility for this is to provide a number of photocells which can inspect the degree of filling of the (spool of the) accumulation device, and in which the photocells are positioned along the length of the accumulation devices.

[0032] In a second aspect, the invention relates to a method for the manufacture of heatset twist plied yarns, comprising the following steps:

- a. twist plying one or more groups of two or more yarns to produce one or more twist plied yarns;
- b. receiving the one or more twist plied yarns on at least one accumulation device;
- c. accumulating the one or more received twist plied yarns on the at least one accumulation device wherein the accumulation device is adapted for the temporary accumulation of the twist plied yarns;
- d. passing the accumulated twist plied yarns from the at least one accumulation device to at least one heatsetting device;
- e. heatsetting the twist plied yarns in the at least one heatsetting device for the manufacture of at least one heatset twist plied yarn;

wherein the step of twist plying takes place continuously, while the step of heatset occurs intermittently and periods of heatset are alternated with periods of stopping of the heatset, and wherein the step of passing the twist plied yarns on the accumulation device at the stopping the heatsetting device, the accumulated twist plied yarns are temporarily stopped.

[0033] The above mentioned method enjoys the advantages of the above-discussed systems for manufacturing the heatset twist plied yarns. By responding to the intermittent interruption of the step of heatset, and accumulating the twist plied yarns for heatset in an accumulation device, it is ensured that the twist plying device can continue to run continuously, thereby ensuring that the

twist plied yarns that the twist plying device manufactured from a reliable (and fixed) level of contention.

[0034] In a preferred embodiment, the speed of the step of producing the twist plied yarns is automatically adjusted to the amount of accumulated yarn on the accumulation device.

[0035] The adjustment of the speed of manufacture of the twist plied yarn depends, among other things, on the amount of accumulated yarn. In this way, it is thus ensured that the amount of accumulated yarn does not exceed a maximum capacity of the accumulation device and the twist plying device can continue to run.

[0036] In a preferred embodiment, the speed of the step of producing the twist plied yarns is automatically adjusted to whether or not the step of heatsetting is interrupted.

[0037] In a preferred embodiment, the speed of the step of manufacturing the twist plied yarns is automatically reduced within a predetermined period of time after the step of heatsetting is discontinued, and preferably wherein the said speed is reduced at least until the step of the heatset no longer has been interrupted.

[0038] In a preferred embodiment, the speed of the step of manufacturing the twist plied yarns is automatically reduced, taking into account an estimated length of time of the intermittent being stopped from the step of heatset, where the speed is being adjusted to be, based on said estimated time period, not to exceed a predetermined maximum amount of accumulated twist plied yarn on the accumulation device.

[0039] In a preferred embodiment the speed of the twist plied step for manufacturing one or more twist plied yarns is adjusted on the basis of at least the amount of accumulated twist plied yarn, and on the basis of whether or not have place for the step of the heatset.

[0040] In a further preferred embodiment, the two or more yarns are twist plied in the step of alternate S/Z twist plied yarns or alternating S/Z capped yarns or connected alternating S/Z twist plied yarns.

[0041] In a further aspect, the invention relates to a twist plied yarn, preferably a set of alternating S/Z twist plied yarn or a set of heatset alternating S/Z yarn or connected alternating S/Z twist plied yarns obtained on a method as discussed in this document.

[0042] In a further aspect the invention relates to an accumulation device for receiving, accumulating and passing through twist plied yarns, wherein the accumulation device comprising a spool, a yarn supply, a yarn exit and a yarn guide, wherein the yarn guide being connected to the yarn supply and suitable is to receive twist plied yarns through the yarn supply, and wherein the yarn guide is adapted to rotate around the longitudinal axis of the spool, wherein with respect to the yarn supply the distal end of the yarn guide describes a substantially circular path around the spool, and wherein the accumulation device comprises one or more yarn detection systems suitable for determining a degree of filling of the spool with twist plied yarns. Preferably, the one or more

yarn detection systems involve a plurality of photodetectors along the longitudinal axis of the spool provided around the spool, which photodetectors are adapted to detect the degree of filling of the spool at the level of the photodetectors.

The accumulation device may be provided with further modifications as discussed in this document (in terms of control).

In addition, the invention may relate to a composite system comprising an accumulation device as described in this document, and a heatsetting device which has been adapted to take accumulated yarn on the accumulation device off and to heatset them.

[0043] In what follows, the invention is described through non-limiting examples illustrating the invention, and which are not intended or may be interpreted to limit the scope of the invention.

EXAMPLES

EXAMPLE 1: System overview

[0044] Figures 1 and 2 show block diagrams of two possible embodiments of a system according to the invention. The twist plying device (1) produces twist plied yarns (preferably alternating S/Z twist plied yarns or alternating S/Z cabled yarns or connected alternating S/Z twist plied yarns) which are taken to an accumulation device (2) and temporarily collected there before passing it on to a heatsetting device (3). In Figure 1, whether or not the heatsetting device (3) acts as feedback (4) to the accumulation device (2) on the one hand, to indicate that it is temporarily not required to pass accumulated yarns to the heatsetting device. Otherwise, it also sends this feedback (4) to the twist plying device (1) to thereby determine the speed at which the incoming yarns are machined into twist plied yarns, so that the accumulation device (2) does not become full during being inoperative of the heatsetting device (3).

[0045] In Figure 2 there is an additional feedback (4a) from the accumulation device (2) (typically the degree of filling) which, together with the feedback (4b) of the heatsetting device (3), the speed of operation of the twist plying device (1). It should also be noted that the accumulation device (2) can also receive the feedback (4b) from the heatsetting device (3).

EXAMPLE 2: Accumulation device

[0046] Figure 3 shows a possible embodiment of an accumulation device (2) according to the invention. The accumulation device comprises a spool, basket or roller (5) (typically approximate cylindrical) around which the twist plied yarns are collected before they are put into place. The twist plied yarns are supplied via a yarn supplier (6) which connects to a yarn guide (7) which rotates (relatively) about the longitudinal axis (13) of the spool (for instance rotation of the yarn guide around a stationary

spool, rotation of the spool with stationary yarn guide, or rotation of both, with a net rotation relative to each other that is not zero - note that preferably the spool is kept immobile which makes winding and unwinding easier). The incoming twist plied yarns are passed through the yarn guide (7) and wound around the spool (5) by the rotation thereof. The accumulation device (2) is further provided with a propagation mechanism (8) which moves yarns (continuous or not) around the spool further along the longitudinal axis (13) of the spool (for practical reasons, of the supplied yarns). The accumulated yarns are discharged at the opposite end (with respect to the incoming yarns) through a yarn exit (9). The amount of accumulated yarn can be detected in a number of ways. For example, in Figure 3 a number of photocells (10) are visible which detect the degree of filling on the spool (possible alternatives for this are, for example, the registration of the mass of the spool). The photocells (10) are directed radially towards the longitudinal axis (13) of the spool. The use of the photocells (10) gives the possibility to determine in a simple manner the degree of filling at a number of longitudinal positions on the spool, which simplifies the removal of the yarns. In Figure 3, the propagation mechanism (8) is a disk or ring which makes a tilting movement at each complete rotation of the yarn guide with respect to the spool. The disc or ring (8) pushes with the tilting movement the recently wound around the spool yarn further away from the yarn supply along the longitudinal axis (13) of the spool, thereby releasing space for a new winding of the yarn. The tilting movement can for instance be created by the rotation of the ring or disc (8), around the longitudinal axis (13) of the spool, with respect to the spool, whereby the ring or disk (8) is not being positioned perpendicularly in view of the longitudinal axis (13) of the spool around which it rotates. An alternative embodiment for the propagation mechanism (8) is described under Example 3.

EXAMPLE 3: Detailed accumulation device

[0047] Fig. 4 and Fig. 5 show a detailed representation of the 'entrance' of the accumulation device (2), in which the yarns are wound around a basket (5), which comprises a plurality of elongated rods (5a) which forms approximately a cylinder side of a role, and thus receive the yarn thereabout. The rods (5a) are provided at the supply end (where the yarns are wrapped around the basket) with a widening (11) which gradually narrows (over a short distance) (12), whereby the wound yarns at the supply ending can easily be pushed further towards the yarn exit. Also the use of the rods (5a) contributes to this, since the friction between the wound yarns and the surface of the basket is limited (as opposed to a full roll).

[0048] A possible way to hang up and rotate the basket is also clearly shown in Figure 4 and is discussed further below. The spool (5) is held essentially rigid (with respect to the yarn guide (7) rotating around it, and is mounted on a central axis (100) with bearings (106) and a bearing

bushing (105), and therefore does not rotate with the central axis (100). This central axis (100) is mounted in a stator (102) by means of bearings (101). The central axis (100) can herein be driven by a pulley (103), for instance with the aid of an electric motor. On the central axis a rotor (104) is rigidly mounted, which comprises a satellite axis (109) on which satellite pulleys (110, 111) are provided, preferably both toothed. The bearing bush (105) is provided with a pulley (108), preferably toothed. The stator (102) is also provided with a pulley (107), also preferably toothed. The pulley (108) of the bearing bush is connected to the satellite pulley (111) via a belt (toothed belt preferably), the same applies to the pulley (107) of the stator and the second satellite pulley (110). On the basis of the transmission by the belts and pulleys (107, 108, 110, 111), the spool (5) can be kept stationary, or more generally, a fixed difference in rotational speed can be provided between the yarn guide (7) and the spool (5). The propagation mechanism (8) comprises a disc mounted on the central axis (100) by means of bearings (112). The disk (8) follows the rotation of the spool (5) around the longitudinal axis (13), in this case through one or more rods (5a) extending through one or more holes (113) of the disk (8). However, the bearings (112) with which the disk (8) sits on the central axis (100) are mounted on an asymmetrical portion (115) of the central axis (100). This asymmetrical portion (115) of the central axis is cylindrical, the longitudinal axis (114) of the asymmetrical portion (115) being non-parallel with the longitudinal axis (13) of the central axis. This also amounts to a difference between the longitudinal axis (114) of the portion (115) around which the bearings (112) of the disc (8) are mounted and around which the disc is movably disposed, and the axis of the central axis (100), around which the bearings (101) allow the rotation of the central spindle (100) relative to the stator (101). The angle between these axes leads to a tilting movement of the disk (8) upon rotation of the central spindle (100), and thus the rotation of the asymmetrical portion (115) of the central axis on which the disk (8) is mounted, round the longitudinal axis of the central axis (100). To this end, the rods (5a) must have some play in the holes (113) of the disc (8) in order to allow the tilting movement. The axis (114) of the asymmetrical part (115) follows in this way the rotation of the yarn guide (7) in terms of speed, and the mutual positioning of the yarn guide (7) and the asymmetrical part (115), as well as the rotation direction of the central axis (100) are chosen such that the yarn guide (7) travels yarn on the spool (5) at the location where the disk (8) is most proximal to the head end of the spool at that moment, being in the direction of yarn supply (6). Once the rotation continues, the disk (8) will move away from the head end and push the yarn away towards the yarn exit (9).

[0049] The principle of the widened end at the supply ending can also be applied to a spool or roller.

Claims

1. A system for manufacturing heatset twist plied yarns, comprising:

- a. at least one twist plying device for twist plying at least two incoming yarns;
- b. at least one accumulation device for receiving, accumulating and forwarding the twist plied yarns from the at least one twist plying device, the accumulation system being adapted for temporary accumulating the twist plied yarns;
- c. at least one heatsetting device suitable for receiving and heatsetting the twist plied yarns of the at least one accumulation device for the manufacturing of at least one heatset twist plied yarn;

characterized in that the at least one twist plying device is configured to operate uninterruptedly, the heatsetting device being adapted to operate intermittently and periods of operation of the heatsetting device being alternated with periods of stopping the heatsetting device, and whereby the accumulation device is configured to temporarily retain the accumulated twist plied yarns when stopping the heatsetting device.

2. The system for manufacturing heatset twist plied yarns according to the preceding claim 1, **characterized in that** the twist plying device is adapted for matching the speed of manufacturing the twist plied yarns to the amount of accumulated yarn on the accumulation device.

3. A system for manufacturing heatset twist plied yarns according to any one of the preceding claims 1 or 2, **characterized in that** the at least one twist plying device is configured to automatically adjust the speed of manufacturing the twist plied yarns to whether or not the heatsetting device is operating.

4. The system for manufacturing heatset twist plied yarns according to any one of the preceding claims 1 to 3, wherein the speed of manufacturing the twist plied yarns is automatically reduced within a predetermined period of time after the heatsetting device stops operating, and preference whereby said speed remains reduced at least until the heatsetting device proceeds to operate.

5. The system for manufacturing heatset twist plied yarns according to any one of the preceding claims 1 to 4, **characterized in that** the speed of manufacturing the twist plied yarns is automatically reduced, taking into account an estimated length of time for the heatsetting to be stopped, to not exceed a predetermined maximum amount of accumulated twist

plied yarn on the accumulation device.

6. The system for manufacturing heatset twist plied yarns according to any one of the preceding claims 1 to 5, wherein the at least one twist plying device is adapted for manufacturing one or more alternating S/Z cabled yarns from incoming alternating S/Z twist plied yarns.

7. The system for manufacturing heatset twist plied yarns according to any one of the preceding claims 1 to 6, comprising a control system configured to monitor the amount of accumulated twist plied yarn on the accumulation device, and adapted to control the speed of the production of the twist plied yarn by the twist plying device on the basis of at least the amount of accumulated twist plied yarn and whether or not the heatsetting device is active.

8. Method for manufacturing the heatset twist plied yarns, comprising the following steps:

- a. twist plying one or more groups of two or more yarns to produce one or more twist plied yarns;
- b. receiving the one or more twist plied yarns on at least one accumulation device;
- c. accumulating the one or more received twist plied yarns on the at least one accumulation device wherein the accumulation device is adapted for the temporary accumulation of the twist plied yarns;
- d. passing the accumulated twist plied yarns from the at least one accumulation device to at least one heatsetting device;
- e. heatsetting the twist plied yarns in the at least one heatsetting device for the manufacture of at least one heatset twist plied yarn;

characterized in that the step of twist plying takes place continuously, while the step of heatsetting occurs intermittently and periods of heatsetting are alternated with periods of stopping of the heatsetting, and whereby the step of passing the accumulated twist plied yarns to the accumulation device when the heatsetting device is stopped, is temporarily stopped.

9. A method for manufacturing heatset twist plied yarns according to the preceding claim 8, wherein the speed of the step of manufacturing the twist plied yarns is automatically adjusted to the amount of accumulated yarn on the accumulation device.

10. A method for manufacturing heatset twist plied yarns according to any one of the preceding claims 8 or 9, wherein the speed of the step of manufacturing the twist plied yarns is automatically adjusted to whether or not the step of heatsetting is interrupted.

11. A method for manufacturing heatset twist plied yarns according to any one of the preceding claims 8 to 10, wherein the speed of the step of manufacturing the twist plied yarns is automatically reduced within a predetermined period of time after the step of heat-setting is discontinued, and preferably wherein said speed is reduced at least until the step of the heat-setting is no longer interrupted. 5
12. A method for manufacturing heatset twist plied yarns according to any one of the preceding claims 8 to 11, wherein the speed of the step of manufacturing the twist plied yarns is automatically reduced taking into account an estimated length of time of the intermittent being stopped of the step of heatset, the speed being adjusted so as not to exceed a predetermined maximum amount of accumulated twist plied yarn on the accumulation device on the basis of said estimated length of time. 10
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13. The method for manufacturing heatset twist plied yarns according to any one of the preceding claims 8 to 12, wherein the speed of the twist plying step for manufacturing one or more twist plied yarns is adjusted on the basis of at least the amount of accumulated twist plied yarn, and on the basis of whether or not the step e. of heatsetting is being performed. 25
14. Accumulation device for receiving, accumulating and transmitting incoming, preferably twist plied, yarns, comprising: 30
- a. a spool for receiving yarns wound around it;
 - b. a yarn supply through which the incoming yarns are guided; 35
 - c. a yarn guide, which is connected to the yarn supply, which guides the yarns supplied by the yarn supply further to the spool, the yarn guide being adapted to rotate relative to the spool about the longitudinal axis of the spool; 40
 - d. a yarn exit for exiting the yarn wound around the spool;
 - e. a propagation system for moving the yarn wound around the spool along the longitudinal axis of the spool in the direction of the yarn exit; 45
 - f. and one or more detection systems for determining a degree of filling of the spool with the yarns wound around it.
15. Heatsetting system for receiving and heatsetting incoming, preferably twist plied, yarns, comprising: 50
- a. an accumulation device according to the preceding claim 14;
 - b. and a heatsetting device suitable for heatsetting of yarns, which heatsetting device is adapted to receive exited yarns from the yarn exit of the accumulation device. 55

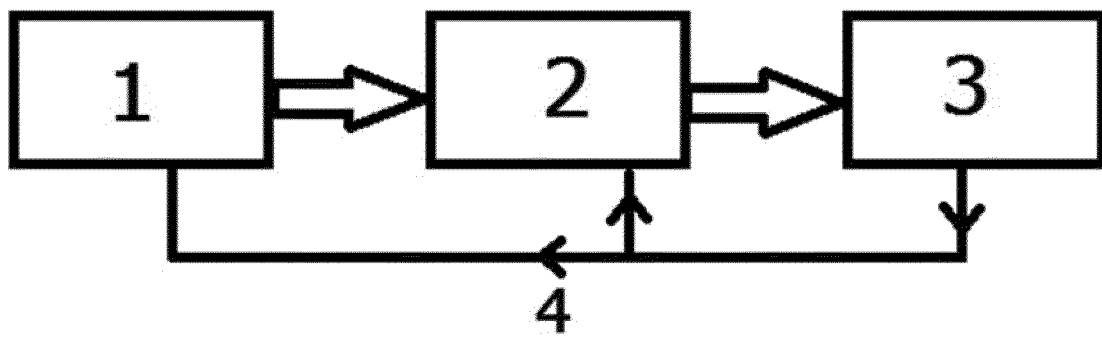


Fig. 1

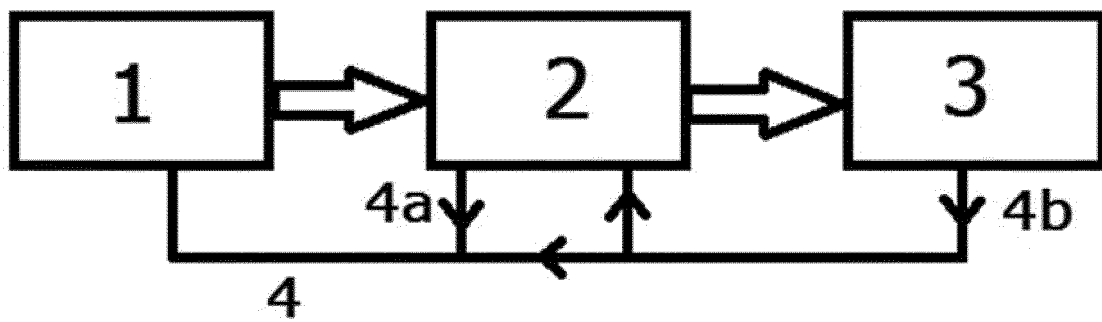


Fig. 2

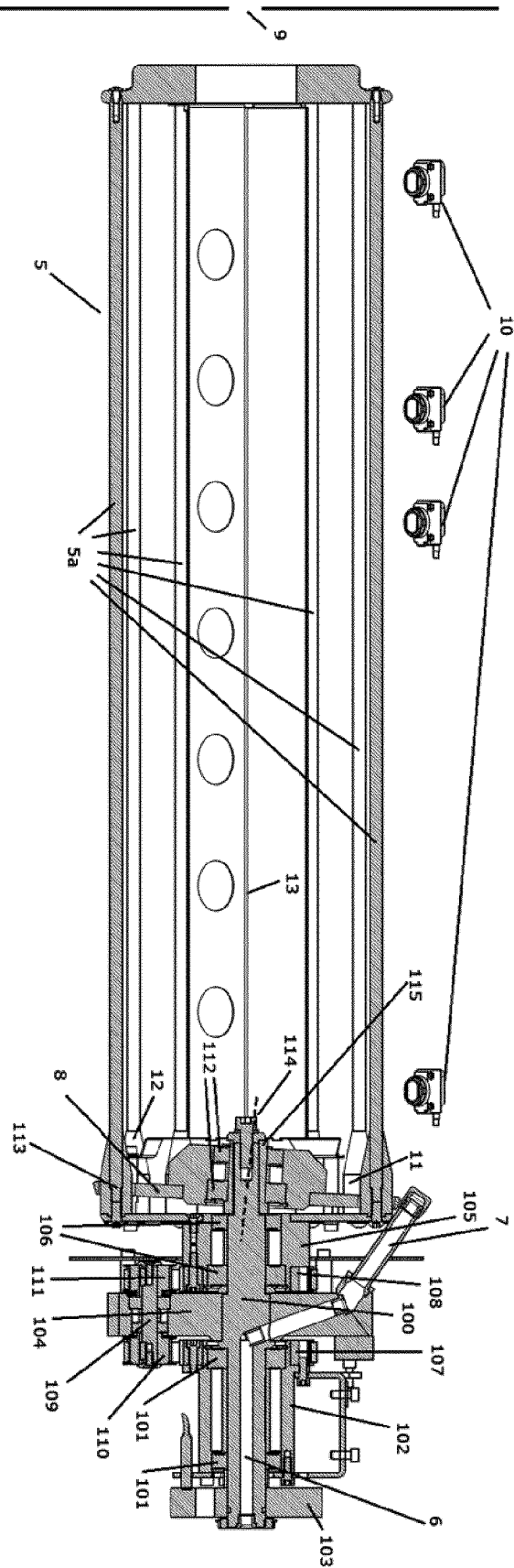


Fig. 3

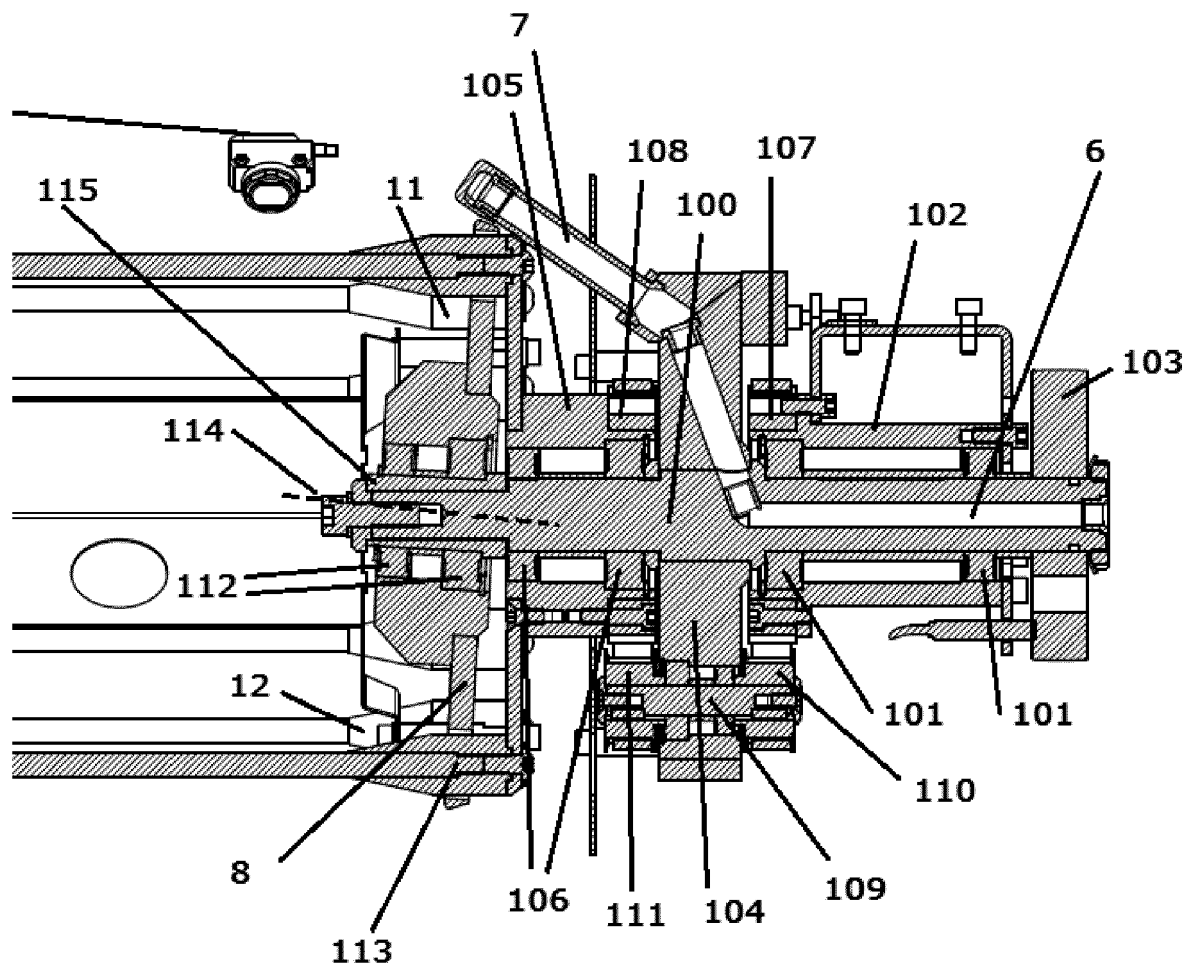


Fig. 4

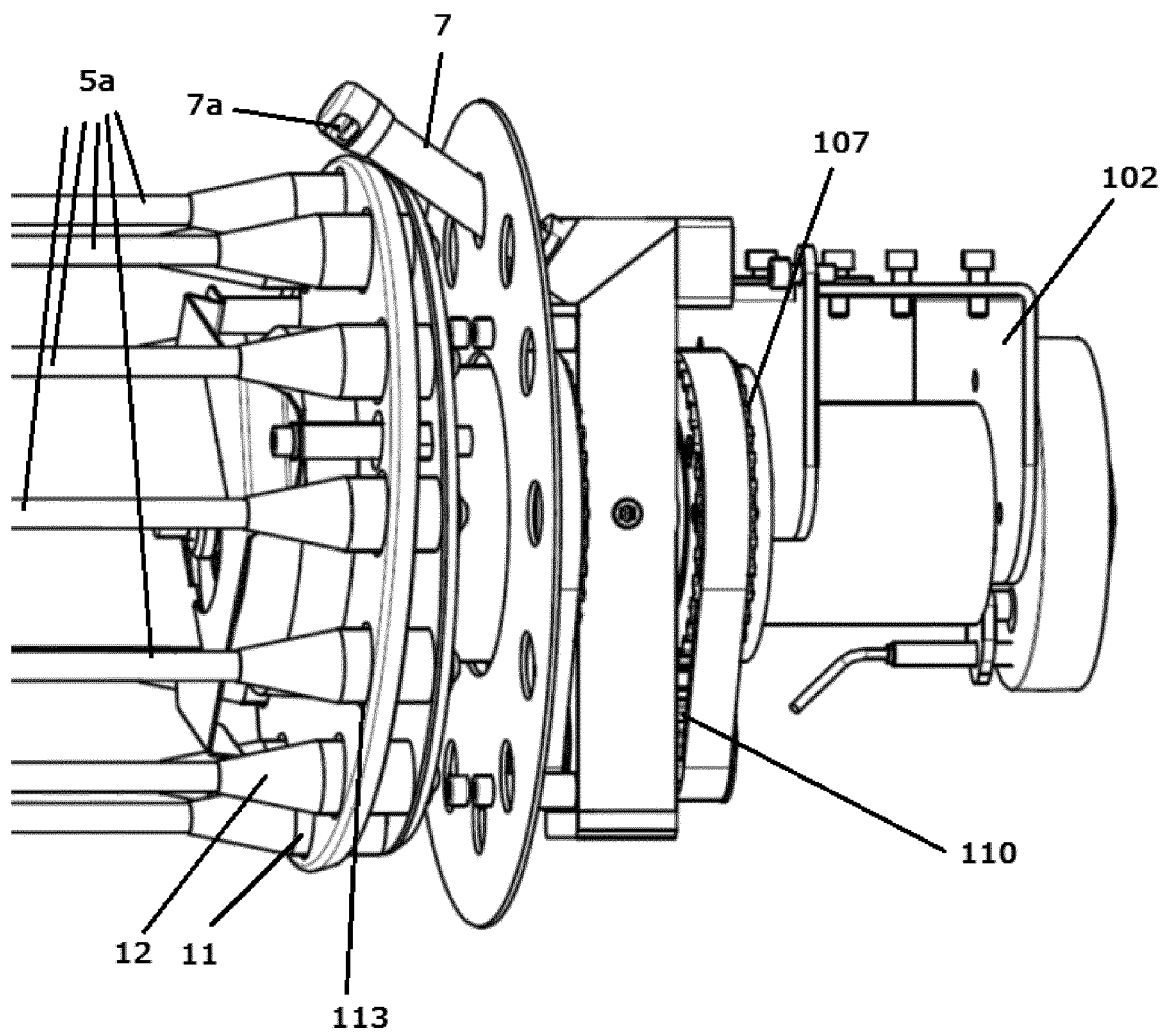


Fig. 5



EUROPEAN SEARCH REPORT

 Application Number
 EP 18 21 4790

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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X,D	WO 2012/059560 A1 (GILBOS NV [BE]; GILBOS ERIK [BE]; VERMANDEL MIGUEL [BE]; EVENEPOEL HAN) 10 May 2012 (2012-05-10) * page 5, line 22 - page 6, line 14 * * page 9, line 23 - line 24 * * page 14, line 13 - line 19 * * page 19, line 29 - page 20, line 3; figure 1 * * page 21, line 25 - line 33 * -----	1,6,8	
			TECHNICAL FIELDS SEARCHED (IPC)
			D02G D02J B65H
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		1 February 2019	Pollet, Didier
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)



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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1-13

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



**LACK OF UNITY OF INVENTION
SHEET B**

Application Number

EP 18 21 4790

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-13

A system and method for manufacturing heatset twist plied yarns comprising at least one twist plying device, at least one accumulation device and at least one heatsetting device whereby the accumulation device is configured to temporarily retain the accumulated twist plied yarns when stopping the heatsetting device.

2. claims: 14, 15

Accumulation device for receiving, accumulating and transmitting incoming yarns comprising a spool, a yarn supply, a yarn guide, a yarn exit, a propagation system and one or more detection systems for determining a degree of filling of the spool with the yarns wound around it.

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 18 21 4790

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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01-02-2019

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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