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(54) **Method and apparatus for the production of weaving warps of monofilament thermoplastic synthetic yarn.**

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Description

In the following disclosure, the term "weaving warp" is used synonymous with "warp section" i.e. a warp containing a fractional number of yarns relative to the total number of yarns which will be placed on the weaving loom, it being possible to obtain a weaving warp suitable for direct use on the loom by unwinding a plurality of warp sections and rewinding them onto a single beam by a process known as assembly winding. Although the disclosure refers specifically to warps for weaving end-use, there is not restriction intended on the use of such warps to any particular textile application.

In traditional systems for the preparation of weaving warps of mono-filament thermoplastic synthetic yarn, the spinning device contains one or more single nozzle spinneret(s). After cooling and oiling, the monofilaments corresponding to the nozzles are wound up individually on the take-up device, each monofilament being wound up on its own spool or package.

The spinning head can house only a limited number of spinnerets and the subsequent filament cooling device and take-up device(s) can serve only one single spinning head with the said limited number of yarns. In other cases, spinnerets provided with a plurality of nozzles are used, and all the yarns emerging from such a spinneret are cooled, oiled and parallel-wound on a single spool. This spool, containing a plurality of individual yarns, is then unwound by the rolling take-off method and the individual yarns are rewound, each yarn being wound onto its own single spool. The weaving warp is then obtained by the warping of a large number of yarns coming from as many spools (or "packages") placed on a creel.

If the yarn obtained in the melt spinning stage is not sufficiently drawn, it is necessary to submit it to a drawing process, carried out on suitable machines, before warping. Normally such drawing machines act individually on each undrawn spool to produce a corresponding drawn spool ("single end processing").

The object of the present invention is to improve a system for the production of weaving warps wherein the spinning device is able to produce simultaneously the exact number of yarns required to form the weaving warp.

The method of the present invention is proper for the production of weaving warps from monofilament thermoplastic yarns of the following types: polyester, polyamides, polypropylene.

The device for accomplishing the process shown schematically in the figures, comprises the following features known e.g. from US—A—2 964 827:

—Extruder and melt spinning head (1), comprising one or more pump(s) (2) for metering the molten polymer, spin back and spinneret retaining block (3) and a spinneret with as many nozzles as the number of yarns required;

—Extruded filament cooling device, constituted by an air blowing chamber (4);

—Spinning duct (5);

—Spin finish application or oiling device (6) and yarn guides (7);

—Yarn suction device (8), activated in the event of yarn breakage, and a yarn separating guide (9);

—Yarn transport rolls ("godets") (10), (11), which may also be used to stretch or draw the yarn sheet, and optional drawing devices and apparatus;

—Yarn sheet nipping (13), cutting (14) and taping (15) devices, used in order to replace the fully wound warping beam during continuous spinning operation;

—Yarn separating guide ("reed") (16);

—Warping beam winding assembly (17).

According to the present invention, the equipment also incorporates:

—Yarn accumulation and recovery device (12), allowing the yarn sheet to be stored during a beam change without interrupting the spinning process, it being only necessary to reduce the speed of spinning during such a beam change.

The more typical parts and functions of the equipment are now considered in greater detail.

The melt spinning head may have a single spinneret having a number of nozzles equal to the number of yarns constituting the weaving warp, or it may be provided with a plurality of spinnerets, with the total nozzle number equal to the number of yarns constituting the said warp.

By using a plurality of spinnerets, a greater temperature uniformity can be obtained, as the surface in contact with the heat transfer medium within the spinning head is increased.

The number of yarns required for a weaving warp is normally at least 500.

By means of the weaving warp production system according to the present invention, the equipment is substantially reduced compared to the traditional systems, in that it is not necessary to pass through the single spool ("package") stage, the yarns obtained from spinning being used directly to form the weaving warp.

The warp manufacturing process is therefor absolutely continuous. It is not divided into two separate stages, as in the traditional systems, where there is a separate spinning stage with the yarn being taken up on spools, followed by a second warping stage, starting from such spools previously loaded onto a feed creel.

By means of the process according to the present invention, the production of weaving warps with a single spinning head and a single collection device is therefore made possible, in contrast to the traditional systems, where it is necessary to have a large number of spinning heads for each weaving warp, and the warping operation is moreover carried out in a subsequent stage completely separated from the melt spinning stage.

According to the preferred embodiment of the present invention, an essential element in the process, and in the related equipment, is constituted by the device for the accumulation and recovery of the yarn sheet arising from the con-

tinuous spinning stage; it allows the replacement of the warping beam without the need to stop the spinning process, it being only necessary to reduce the spinning speed.

The above device may be constituted in particular by two sets of rolls both positioned horizontally and with their axes perpendicular to the direction of travel of the yarn sheet, the rolls of the first set (19), located at the lower level, being in a fixed position, whilst those of the second set (20) are in a staggered position relative to the rolls of the first set, and can moreover be shifted vertically downwards.

Under normal operating conditions, the yarn sheet runs between the two sets of rolls, without coming into contact with the said rolls.

In the accumulation stage, however, the upper set of rolls is lowered beneath the stationary set, until the position (2) is reached, thus completing the yarn sheet to run along a looped path.

The amount of yarn which can be accummulated in such a way will be proportional to the number of rolls and to the maximum possible distance between the stationary rolls and the movable rolls.

The accumulation device starts operating simultaneously with the yarn sheet nipping, cutting and taping devices during a beam change. It is obvious that, in the process according to the present invention, every known device for the accumulation and changing of the warp beam may be used.

The spinning process may be advantageously integrated with a yarn sheet drawing device using two sets of rolls, preferably constituted by a main roll of greater diameter and two pressure rolls per each set, the peripheral velocity of the second set being greater than that of the first system, so that the ratio of the two relative peripheral velocities is equal to the desired yarn draw ratio.

Immediately after the drawing and before the accumulator, according to the final desired characteristics of the warps, it could be convenient to include a conventional device for thermal relaxation and heat setting of the warp.

By means of the industrial process which is object of the present invention, it is thus possible to obtain weaving warps composed of yarns having different characteristics, essentially depending on whether the drawing device just described is used or not, and/or on the final wind-up speed.

It is obvious that, by using the drawing device, completely drawn yarns can be produced. In the absence of the drawing device, the final wind-up speed determines the molecular orientation (and characteristics) of the so-produced yarn, with increasing wind-up speed resulting in increased molecular orientation.

According to the characteristics of the thermoplastic resin used, a high wind-up speed allows nearly completely drawn yarns to be obtained, such yarns being suitable for direct use in weaving.

At an intermediate wind-up speed, incompletely drawn yarns are obtained, and the warps so obtained can be advantageously drawn by using the wet warp-drawing process, as disclosed in the earlier Italian Patent Applications No. 19907/82, 23476/83 and 24050/83, of the present Applicant.

A typical characteristic of the novel process for the preparation of warps is that it permits extremely high yarn wind-up speeds, speeds in excess of 6000 m/min, without any mechanical problems being evident, as the collecting beam is anchored on both sides in the winding machine.

This results in less wear and greater reliability than is found in traditional spool winding systems.

For the nipping, cutting and taping of the warp sheet at a beam change, various known systems may be used, essentially constituted by rubber clamping jaws, by devices for feeding and applying an upper and a lower layer of adhesive tape, and by a yarn sheet cutting device.

Example 1

Starting from a semi-dull polyester resin obtained by poly-condensation of terephthalic acid and ethylene glycol, having the following main characteristics:

intrinsic viscosity	0.648
melting point (Mettler)	260.9°C
acidic —COOH end groups	36.0 eq./10^6
DEG (diethyleneglycol) groups	1.88 mol.%
Colour (Colormaster)	4.34 Y%
ash	0.30%
TiO_2	0.28%

a weaving warp constituted by 580 monofilament yarns of round cross section was prepared, collected on a small hosiery beam having a distance of 22 inches between the flanges.

The spinning was carried out at a polymer temperature of 297°C through a spinneret of rectangular shape, of dimensions 620 mm×55 mm, having four mutually staggered rows of 154 round nozzles.

The oiling device was calibrated so as to obtain 0.4% of oil on the yarn.

No drawing devices were used, and a final collection speed of 1560 m/min. was maintained.

A warp, consisting of yarns having a count of 71 denier, was obtained.

The warp was then submitted to a wet drawing and hot fixation treatment according to the Applicants' process disclosed in the hereinabove mentioned Patent Applications.

The final count of the yarn was 20 denier, and the residual elongation was 34%.

Example 2

Starting from the thermoplastic resin in Example 1, and using the same spinneret, the spinning was carried out at 299°C, the spin finish application device having been calibrated so as to obtain 0.55% of finish on the yarn.

No drawing devices were used, and a final wind-up speed of 6100 m/min. was maintained.

Eight small hosiery beams, having 580 yarns each, were obtained.

The final yarn count was 20 denier, and the residual elongation was 63%.

By means of a Raschel knitting machine, onto which the above small beams of semi-dull polyester mono-filament yarns were loaded, together with small beams of 40 denier, 12 filament polyester yarn, a knitted fabric having the monofilament yarn as its substrate, was obtained.

After subsequent dyeing with a dye sensitive enough to reveal possible irregularities, the substrate of monofilament yarn showed uniform dye absorption.

Claims

1. Continuous process for the production of textile warps or warp sections, collected on beam, constituted by monofilament thermoplastic synthetic yarn made of polyester or polyamide or polypropylene, comprising the direct and continuous production of the warp sheet yarns by means of a single spinning device, without winding up the yarn on intermediate spools or packages, and wherein the replacement (changing) of the beam comprises a nipping, cutting and taping step, characterized by the use of a warp sheet accumulation and recovery device, placed downstream of the melt spinning device and upstream of the nipping device, to allow the beam to be replaced without interruption to the spinning operation, by simply reducing the speed thereof.

2. Process according to claim 1, wherein the warp sheet accumulation and recovery device is constituted by two sets of rolls positioned horizontally and with their axes perpendicular to the direction of travel of the warp sheet, the rolls of the first set, in a lower position, being stationary, while those of the second set are in an upper and staggered position relative to the rolls of the first set under normal operating conditions, and can moreover be shifted vertically downwards to a position beneath the rolls of the first set during the accumulation stage, the yarn sheet running between the two roll sets under normal conditions without coming into contact therewith.

3. Process according to claim 1, characterised by the simultaneous starting of the warp accumulation device and the warp nipping, cutting and taping device during the beam replacement operation.

4. Process according to claim 1, incorporating moveover a device for the drawing of warped yarns by means of a double system of coupled rolls, rotating at different speeds.

5. Process according to claim 4, incorporating moreover a device for thermally relaxing and heat setting the warp sheet after drawing and before winding up on beam.

Patentansprüche

1. Kontinuierliches Verfahren zum Herstellen von textilen Ketten oder Kettenteilen, die auf einem Baum gesammelt werden und aus thermoplastischem synthetischem Monofilamentgarn hergestellt aus Polyester oder Polyamid oder Polypropylen bestehen, umfassend die direkte und kontinuierliche Herstellung der Kettenflächengarne mittels einer einzigen Spinnvorrichtung, ohne daß das Garn auf Zwischenspulsen oder -pakete aufgewickelt wird, und worin der Ersatz (die Änderung) der Baumes den Schritt des Kämmens, Schneidens und Versehens mit einem Band umfaßt, gekennzeichnet durch die Verwendung einer Kettenflächensammel- und -gewinnungseinrichtung, die stromabwärts der Schmelzspinnvorrichtung und stromaufwärts der Kämmeinrichtung angeordnet ist, so daß der Baum ohne Unterbrechung des Spinnvorganges durch einfaches Vermindern der Geschwindigkeit desselben ersetzt werden kann.

2. Verfahren nach Anspruch 1, worin die Kettenflächensammel- und -gewinnungseinrichtung aus zwei Sätzen von Walzen besteht, die horizontal und mit ihren Achsen senkrecht zur Bewegungsrichtung der Kettenfläche angeordnet sind, wobei die Walzen des ersten Satzes in einer niedrigeren Stellung stationär sind, während unter normalen Arbeitsbedingungen jene des zweiten Satzes in einer oberen und versetzten Stellung in bezug auf die Walzen des ersten Satzes sind und außerdem während des Sammelschrittes vertikal nach unten in eine Stellung unterhalb der Walzen des ersten Satzes verschoben werden können, wobei die Garnfläche unter normalen Bedingungen zwischen den beiden Walzensätzen läuft, ohne damit in Berührung zu gelangen.

3. Verfahren nach Anspruch 1, gekennzeichnet, durch das gleichzeitige Inbetriebsetzen der Kettensammeleinrichtung und der Einrichtung zum Kämmen, Schneiden und Versehen mit einem Band der Kette während des Baumersatzvorganges.

4. Verfahren nach Anspruch 1, wobei außerdem eine Einrichtung zum Strecken von Kettgarnen mittels eines Doppelsystems von gekoppelten Walzen, die mit verschiedenen Geschwindigkeiten rotieren, vorgesehen ist.

5. Verfahren nach Anspruch 4, wobei außerdem eine Einrichtung zum thermischen Entspannen und Wärmehärten der Kettenfläche nach dem Strecken und vor dem Aufwickeln auf den Baum vorgesehen ist.

Revendications

1. Procédé pour la production en continu de chaînes ou de chaînes sectionnelles, rassemblées sur ensouple, composées de fils synthétiques thermoplastiques monofilaments faits en polyester ou polyamide ou polypropylène, comprenant la production en direct et en continu de la nappe de fils de chaîne à l'aide d'un unique dispositif à filer, sans renvidage des fils sur des bobines de

filés ou enroulements intermédiaires et dans lequel le remplacement (changement) de l'ensouple de chaîne comprend une étape de pincement, de coupe, et d'enrubannage, caractérisé en ce qu'on utilise un dispositif d'accumulation et de rétablissement de la nappe d'ourdissage, placé en aval du dispositif de filature en fusion et en amont du dispositif de pincement, pour permettre à l'ensouple d'être replacée sans interruption de l'opération de filage, en diminuant simplement la vitesse de celle-ci.

2. Procédé selon la revendication 1, caractérisé en ce que le dispositif d'accumulation et de rétablissement de la nappe d'ourdissage est constitué par deux trains de rouleaux positionnés horizontalement et avec leur axe perpendiculaire à la direction de déplacement de la nappe d'ourdissage, les rouleaux du premier train, dans une position inférieure, étant stationnaires, alors que ceux du second train sont dans une position supérieure et en quinconce par rapport aux rouleaux du premier train dans des conditions opératoires normales, et peut en outre être abaissé verticalement jusqu'à une position en dessous des rouleaux du premier train pendant l'étape d'accumulation, la nappe de fils défilant entre les deux trains de rouleaux dans des conditions normales sans rentrer en contact avec eux.

3. Procédé selon la revendication 1, caractérisé en ce que l'on fait démarrer simultanément le dispositif d'accumulation de la chaîne et le dispositif de pincement, de coupe, et d'enrubannage de la chaîne pendant l'opération de remplacement de l'ensouple de chaîne.

4. Procédé selon la revendication 1, caractérisé en ce que l'on incorpore en outre un dispositif pour l'étirage des fils de chaîne à l'aide d'un système double de rouleaux accouplés, tournant à des vitesses différentes.

5. Procédé selon la revendication 4, caractérisé en ce que l'on incorpore en outre un dispositif pour la relaxation thermique et le thermo-fixage de la nappe d'ourdissage après l'étirage et avant le renvidage sur ensouple.

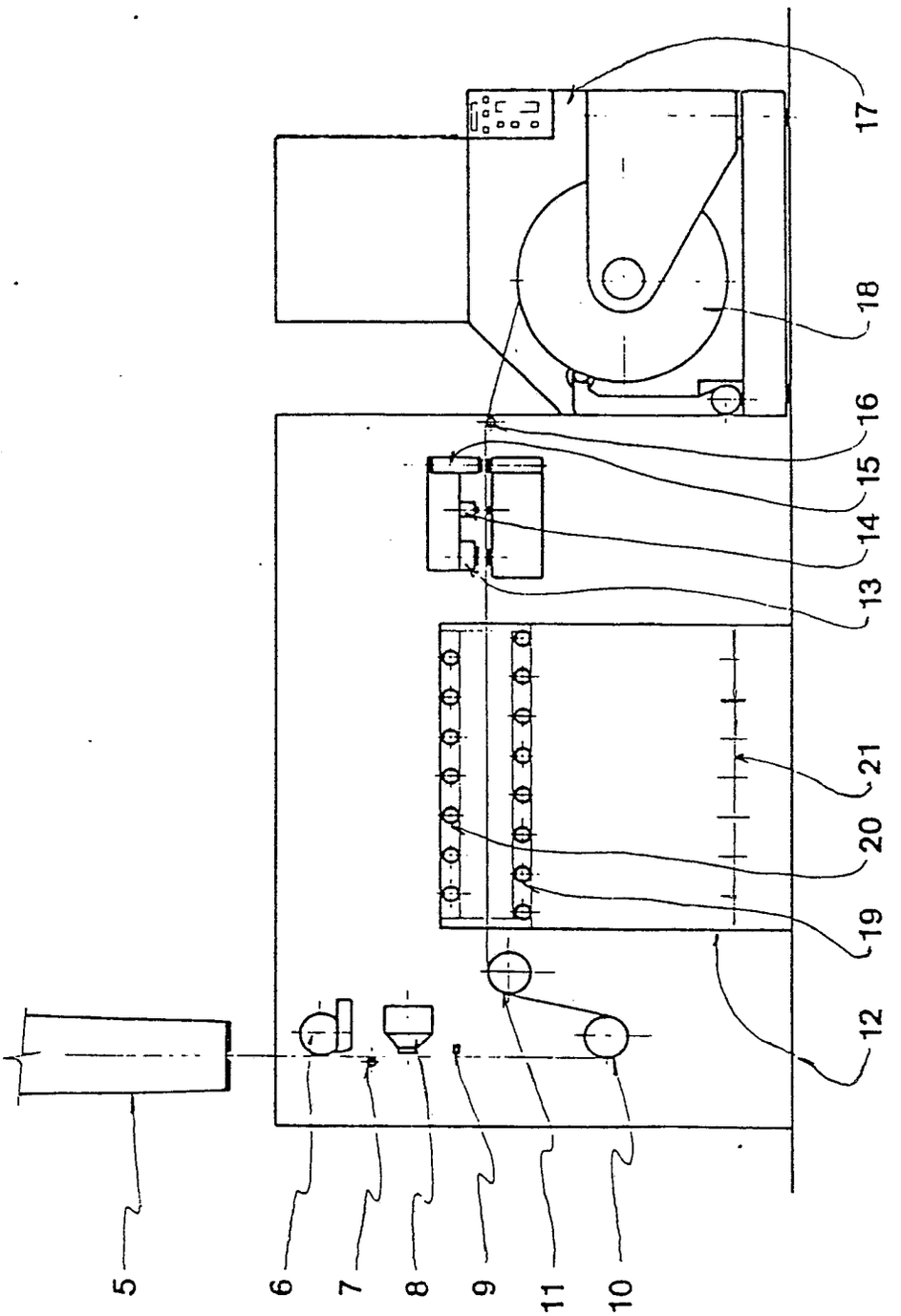
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FIG 2