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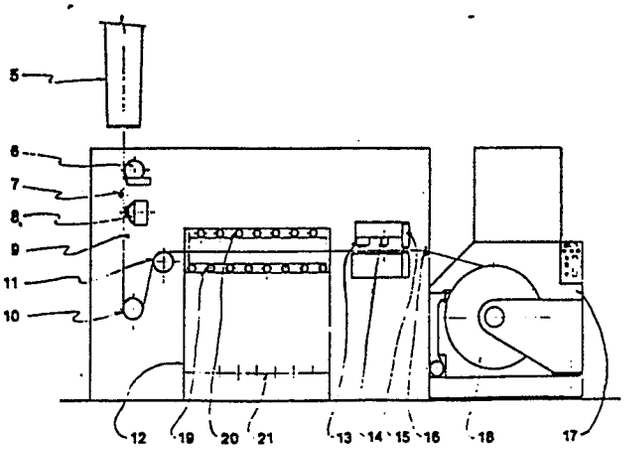
(54) Method and apparatus for the production of weaving warps of monofilament thermoplastic synthetic yarn.

(57) Method for the preparation of a weaving warp or warp section (18) formed by monofilament thermoplastic synthetic yarns, characterized by the use of a spinning head (5) providing continuously the number of yarns required to form the warp, by the direct use of the bundle of so obtained yarns in the subsequent warping process and also by the use of a yarn accumulation and recovery device (12) in order to avoid the need for stopping the spinning process at a beam change.

FIG 1



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METHOD AND APPARATUS FOR THE PRODUCTION OF WEAVING WARPS OF MONOFILAMENT THERMOPLASTIC SYNTHETIC YARN.

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 monofilament 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 provide 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 according to the invention shown schematically in the figures, comprises:

- Extruder and melt spinning head (1), comprising one or more pump(s) (2) for metering the molten polymer, spin pack 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 continous spinning operation;

- Yarn separating guide ("reed")(16);
- Warping beam winding assembly (17).

According to a preferred practical embodiment of the present invention, the quipment 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 continuous 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, wihtout 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 compelling the yarn sheet to run along a looped path.

The amount of yarn which can be accumulated 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, culting and taping device 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 weaning.

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 N° 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 teraphthalic 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 x 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 spinnig 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.

C L A I M S

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, and characterised by 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 and further 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 trawel 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 moreover 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.

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FIG 1

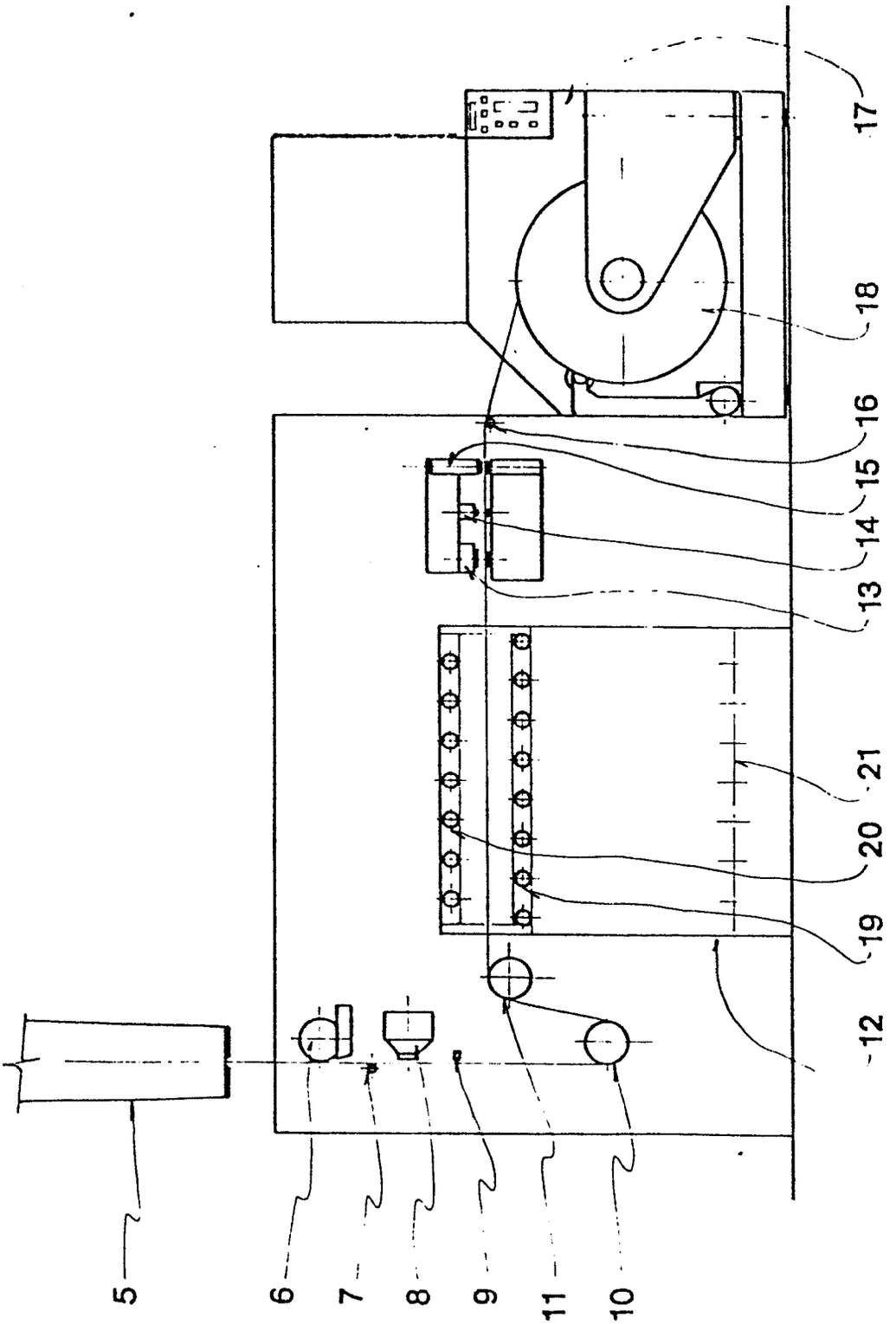

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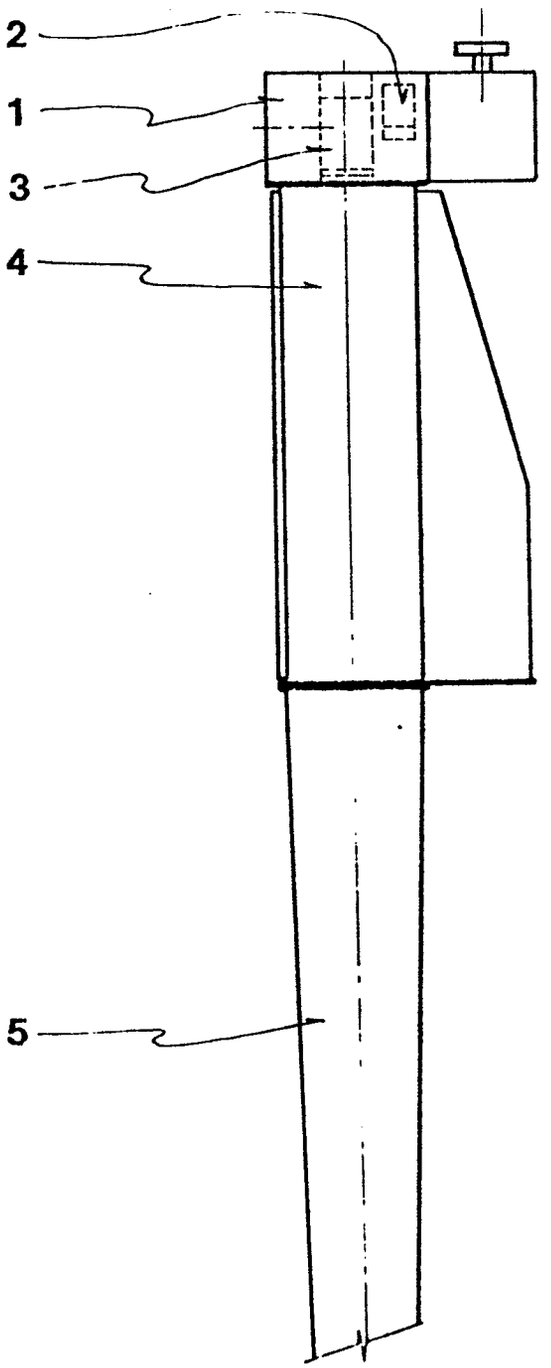
FIG 2



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Application number

EP 85 11 3114

EUROPEAN SEARCH REPORT

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.4)
10	A	FR-A- 881 312 (SCHLAFHORST) * Abstract, points 1,2b,c; page 3, right-hand column, paragraph 2; page 2, left-hand column, paragraph 5 *	1-4	D 02 H 5/02 D 01 D 7/00 D 02 J 1/22
10	A	US-A-2 964 827 (DU PONT DE NEMOURS) * Claims 1-4; column 1, lines 18-47 *	1	
6	A	DE-A-3 233 279 (SCHLAFHORST) * Claims 1,6,7 *	2	
2	A	DE-A-3 018 373 (MAYER) * Claims 1,5 *	4	
3	A	TEXTILBETRIEB, vol. 102, no. 9, September 1984, page 32, Würzburg, DE; "Draw-warping - A new generation in warp preparation"	4	TECHNICAL FIELDS SEARCHED (Int. Cl.4) D 02 H D 01 D D 02 J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	05-12-1985	CATTOIRE V.A.

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
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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

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