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Method and apparatus for the manufacture bobbins comprising indigo dyed weft yarn.

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**EP-A- 0 202 197
BE-A- 698 860
BE-A- 2 033 351
GB-A- 645 591**

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Description

BACKGROUND OF THE INVENTION

Field of the invention

This invention principally belongs to the technical field of weaving textile fabrics. More particularly, it is related to a new and useful method to prepare weft yarn spools filled with indigo dyed yarns, in order to supply weft yarn to a conventional weaving loom. The invention further concerns a new and useful apparatus to implement the method of this invention.

Description of the prior art

Indigo dyed fabrics are well known, and they have acquainted an extraordinarily wide use in garments such as "blue jeans" made of "real indigo" denim. The man skilled in the art is well informed of the fact that such "real indigo" denim cannot be made in dyeing an already woven fabric with indigo vat dyestuff since the "real indigo" has certain specific and intrinsic wear properties which are greatly desired and which are inseparably linked to its special mode of manufacture.

This manufacture comprises, as it is familiar to the man skilled in the art, the indigo dyeing of warp yarns, be it in the so-called slasher dyeing process or in the chain-dyeing process, and the weaving in-to denim with undyed or bleached cotton threads as weft yarns.

Undyed weft yarns had to be used, since it has not been technically possible, until now, to obtain indigo dyed weft yarns starting from the above mentioned indigo dyed warp yarns, and since it is not possible to dye yarns which are wound up on bobbins, in dyeing apparatuses with indigo vat dye. These facts are well known to the one skilled in the art.

However, there is a strong need for denim fabrics wherein the weft yarns are "real indigo" dyed. Of course, it is not impossible to provide weft yarns which are dyed with non-vat dyestuffs, such as a naphthol dyestuffs, but the customer does not accept the fabrics otherwise dyed than with indigo, and there is a strong need for denim garments and apparel made from "blue-in-blue" real indigo denim, i.e. from denim where the warp yarns as well as the weft yarns are dyed with indigo vat dyestuff.

The prior art does not disclose the problem of making weft yarn which is indigo dyed.

U.S. patent no. 2,889,120 describes and claims a machine for winding a series of sewing machine bobbins or self-sustaining cops. British patent specification No. 340 978 describes a warp beam for the treatment of artificial silk. British patent specification No. 645 591 teaches improvements in sectionalized yarns beams for warp yarns. Still other publications describe the winding or other mechanical treatments of warp yarns.

No publication puts forward the problem of providing indigo dyed weft yarn nor teaches any method for obtaining weaving spools of such weft yarn.

EP-A 0 202 197 of the same applicant deals with this problem and a first approach of its solution by a two-step process. A layer made up of a plurality of parallel, individual yarns is separated in a two-step process into individual yarns which are wound on flanged (and not cross-wound) spools. This application was not yet published on the filing date of the instant application.

DE-A 2 033 351 mentions a two-step process where a yarn made up of several threads is separated into these individual threads. However, the present invention deals with the separation of yarn bundles into individual yarns. Furthermore, the prior art succeeds in the separation of only fifteen threads whereas the invention contemplates bundles of several hundreds of yarns.

The device for winding up disclosed in this prior art is a basically mechanical one which would work well with some threads, e.g. up to 15, and with other bobbins than cross-wound one which seem not to be disclosed.

Objects of the invention

Therefore, it is the first and principal object of this invention to provide a method for obtaining an indigo dyed cotton weft yarn on spools ready for weaving from a bundle of yarns to be divided into individual yarns and to be wound up on non-flanged weaving spools in a two-step process, which spools should be ready to be used in weaving looms to produce, together with indigo dyed warp yarn, for example real indigo blue-in-blue denim. The bobbins should preferably be cross-wound bobbins, more preferably cone-bobbins.

Another object of the invention is to provide a method as set forth above which allows an economical operation free from time consuming breakdowns, for example due to yarn ruptures, and free from avoidable wastes.

Still another and equally significant object of this invention is to provide a simple but performant installation for obtaining cross-wound weft yarn bobbins from a bundle of indigo dyed yarn comprising a multitude of threads which also allows to implement the new method and which produces weft yarn loom bobbins filled with indigo dyed yarn, in excellent yields and without substantial waste.

Summary of the invention

The invention allows for the first time to produce non-flanged weaving bobbins wherein an indigo dyed weft yarn is wound on crossed bobbins for example. The basic idea of the invention is to collect a weft yarn from indigo dyed warp yarns.

The dyeing of warp yarns with an indigo vat is known *per se*, see, e.g. Swiss patent specifications nos. 612 557 and 613 333 and the article by P. Richter in "Textilveredlung", 1975, pp. 313-317. These publications teach that warp yarns may be indigo dyed in one of two processes called "chain dyeing" and "slasher dyeing", respectively.

The chain dyeing comprises the forming of yarn cables from about 300 to 400 individual warp yarn,

and several cables are dyed simultaneously and in horizontal relationship to each other in the indigo vat liquor, air passages of the cables for the oxidation of the indigo being introduced between sequential vat passages. The cables are then rinsed, dried and warped. On the warp bobbins, there are lengths of about 10,000 m of a yarn cable each.

In the "slasher dyeing" method, several thousand yarns are arranged in horizontal relationship to form a sheet-like structure. This "sheet" is dyed as explained above, and finally as much as warp beams are used as there were superimposed yarn sheets, whereupon these sheets are wound up in the form of a weaving chain each.

In the "slasher dyeing" method, several thousand yarns are arranged in horizontal relationship to form a sheet-like structure. This "sheet" is dyed as explained above, and finally as much as warp beams are used as there were superimposed yarn sheets, whereupon these sheets are wound up in the form of a weaving chain each.

The above mentioned basic idea of the inventors, namely to collect a weft yarn from dyed warp yarns, was very difficult to put into practice since it is not possible to process the wound packages on the bobbins, obtained in either of the two processes depicted above, so as to obtain windings of single yarns on weaving spools, because the individual yarns of the dyed cables are so twisted and entangled with each other that a separation attempt always leads to yarn break. Furthermore, the 300 to 400 individual spools necessary to receive each one single strand of the yarns in the cable, would take much more space than it is normally available, and each spool should have its own individual drive which represents a too big technical complication.

It has now been found that these difficulties can be obviated, and individual weaving spools filled with indigo dyed weft yarns can be manufactured starting from windings of cabled warp yarns on a cable spool if, according to the invention, said plurality of yarns is first wound up simultaneously on a series of intermediate spools, each of said intermediate spools receiving a group of yarns comprising about the same number of individual yarns, the yarn group on each intermediate spool is then separated, in a second step, into individual yarns, and each yarn thus obtained is wound up individually on a non-flanged weaving spool e.g., in the form of a cross-wound bobbin, preferably a cone bobbin. A plurality of weaving spools, corresponding to the number of yarns in the said group, are manufactured simultaneously in the manner still to be described.

When the weft yarn is prepared from a yarn cable which has been indigo dyed in the chain dyeing process, the auxiliary spools (i.e. the intermediate spools) which receive the said yarn groups are preferably arranged side by side on a common shaft. When these spools are filled by the wound up yarn groups which have been formed by separating the starting yarn cable into strings each of which being composed of about the same number of yarn threads, the auxiliary spools are removed from their

common shaft, the individual yarn threads on each spool are identified and separated, and from each yarn a cross-wound bobbin may be produced on a cone winding machine which has been modified according to this invention, as it will be described later in detail.

It has further been found that it is highly advantageous when the dividing factors of each rewinding step are selected in such a manner that they are comprised within $\pm 25\%$ of the same value. The dividing factors are defined as the product of spool width, spool count and yarn speed during each step of the method. This will be explained in detail later. Of course, the number of threads on the auxiliary spools must be equal to the number of threads accepted by the cone winding machine.

In the first step of the method described above, the auxiliary spools are typically arranged side by side on a common shaft and fixed thereon, e.g. by lateral clamping with the aid of screw nuts, or by means of a driver such as a key and key way pair, or both. The individual auxiliary spools which hold each about 5,000 m of yarn, multiplied by the number of yarns per spool, are preferably metal (aluminium alloy) spools having a hollow cylinder as a core and plane parallel circular plates as flanges.

Experiments and tentatives carried out by the inventors have shown it was not possible to use a conventional spooling frame in the second step of the present method, i.e. for the purpose to produce non-flanged bobbins from the yarn wound up on the auxiliary spools, since the tensile forces of the individual threads on the intermediate or auxiliary spool were considered as very different. Thus, if a conventional cone spooling frame is used as such, there are always yarns breakages. Thus it would be necessary to provide an individual drive device for each cone bobbin; this solution would however be highly disadvantageous as it may be understood without further explanation.

The fact mentioned above has lead to a technical prejudice which is disclosed in the specification of European patent application No. 0 202 197 unpublished before.

Extensive experiments and research efforts have now resulted in the quite surprising finding that the manufacture of non-flanged weft yarn bobbins on a corresponding spooling frame is nevertheless possible when this machine, which is basically known per se to the man skilled in the art, is modified in a special, inventive manner.

Under normal operation of a spooling machine, each bobbin to be produced is fed from its own individual yarn supply, for example cops. Therefore, each of the yarns to be wound up has its own yarn brake, and the yarn tension can individually be set and controlled for each bobbin.

This condition is however not fulfilled in the present case. The plurality of yarns wherein each of which is to form a bobbin, typically 30 to 40 yarns, is supplied by one yarn source only, namely the already mentioned intermediate or auxiliary spool. These 30 to 50 yarn threads have been wound up in substantially parallel relationship in superimposed layers on a cylindrical spool.

It has been found during the said experiments wherein a spooling machine was used, that the yarn breakages which occur during the starting-up phase of the spooling frame seem not to be due to a substantially different tension in the individual threads but to a jerking increase of the overall winding-up tension when the machine is started. Due to this rather sudden and violent increase, those yarns which are under a somewhat higher winding-up tension on the intermediate spool than the bulk, will therefore necessarily break. Now, the invention copes with this surprising facts in providing a smooth starting-up phase of the spooling frame, in continuously measuring the yarn tension and controlling it constant to a predetermined value or range, until full speed is achieved. A linear increase of machine speed during the starting-up may be provided but in practice, the speed increase rate which is automatically obtained when a constant yarn tension is set, is preferred. Another possibility is to begin the operation of the spooling machine with the yarn tension value prevailing during steady-state operation, and to allow a gradually increasing and finally decreasing yarn tension. Typically, this starting-up period lasts about 5 to 20 seconds.

Thus, the method of this invention is defined in claim 1 and the installation for winding up a weft yarn in claim 6 whereas the remaining claims are directed to embodiments of these main subjects.

The working speeds which are obtained are relatively very high. Thus, in the first step, linear yarn speeds of up to 200 m/min have been realized, and in the second step, yarn speeds of the same order had been expected. However, the steady improvement of the spooling frame employed, in particular its yarn advancing, feeding and spooling systems together with the appertaining electronics, has resulted in actual working speeds of 500 m/min.

The control of the yarn tension may be effected by means known per se. It is presently preferred to apply a predetermined and controllable braking force to the intermediate spool as will be explained later. The electronic control means which are employed are also known per se or may easily be provided by a man skilled in electronics. The parts of such devices are conventional ones, and thus the following description will be limited to the function of these control devices.

BRIEF DESCRIPTION OF THE DRAWING

The invention will still better be understood and objects other than these set forth above, will become apparent when consideration is given to the following detailed description thereof, making reference to the annexed drawing wherein:

FIGURE 1 shows a top view of a first rebeaming system of this invention implementing the first step of the method of the invention, in a schematical manner,

FIGURE 2 represents a top view of a second rebeaming system for implementing the second step of the method of this invention,

FIGURE 3 is a partial elevational view of the device shown in FIGURE 2 along arrow III in that FIGURE, and

FIGURE 4 is a vertical section in a plane according to IV-IV in FIGURE 2, shown in schematical representation.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGURE 1 shows a conventional cable bobbin 10 having an indigo dyed yarn cable 12 wound up thereon. The process of indigo dyeing does not make a part of this invention and is known as such to the man skilled in the art. By the way, the invention is not limited to the application of the indigo dyeing of fiber bundles or other arrangements of yarns; it may be implemented at all instances where indigo dyed weft yarns should be recovered from warp yarns. The cable 12 is made up by a total of 320 indigo dyed individual yarns of cotton having a titer of from about 7.5 to 16 NE, typically about NE 12 for denim. The length of the cable amounts to about 5,000 to 10,000 m.

This cable should now be opened and simultaneously divided into 8 beams having 40 yarns each. These figures have been selected since in the second, subsequent rebeaming step there will be 40 cross-wound bobbins to be produced. However, the cable 12 may also contain 40, 80, 120, 160 ... more individual threads, and in this case, a correspondingly lower number of divided beams will be provided.

Groups 14 having 40 yarns each are produced by the grid 16 which receives at the beginning of the rebeaming work corresponding yarn bundles divided by hand. At least one second grid 18 further smoothens the yarn sheaf 14, only one second grid 18 being shown. Instead of the grids, other known separating and smoothening devices may be used.

The individual yarn sheaves 14 having 40 yarns each, are simultaneously wound up on eight auxiliary spools 20. However, in FIGURE 1, only seven spools 20 are shown. The auxiliary spools 20 are secured to a shaft 22 with blocking means 24. A motor 26, preferably a driving means having a constant torque, assures the rotation of the shaft 22. The auxiliary or intermediate spools 20 are preferably made from an aluminium alloy.

In FIGURE 2, the second stage of the rebeaming method is represented as a device schematically shown as a top view. FIGURE 3 shows a partial side view in the direction of arrow III.

The spooling device 42, capable of producing simultaneously 40 cross-wound conical bobbins ready for use as weft yarns in conventional weaving looms, is a typical cone winder, well known in the textile industry, which has been modified as it will now be described.

An auxiliary or intermediate spool 20, as described above, is mounted on a shaft 30 and fixed thereon by a quick-fixing device 31. The shaft 30 rotates in bearings 44 and can be braked by a braking device 46 to be described later.

The winding 32 on the spool 20 comprises, as already mentioned, wound-up layers of 40 yarns each, the length thereof is from about 5,000 to 10,000 m. This yarn layer or group, as it is unwound from the spool 20, is separated into 40 individual yarns 34 in the grid 36, and the yarns 34 are fed through eyelet bars 38 and 40 individually to the spooling machine 42.

The braking device 46 whose operation will be explained later, is capable of exerting a varying braking action to be electrically controllable. Electric brakes working on the bases of eddy currents or magnet powder brakes, are known *per se*. The braking device 46 is connected by line 48 to the control unit 50.

In the embodiment shown in FIGURES 2 and 3, the braking force is not applied, for example, by a constant torque motor equivalent to motor 26 already described (see above). Such a motor provides a constant tension in the leaving yarn threads. Although such a constant torque device might be used, the inventors presently prefer a magnet powder brake.

However, the action of such a constant force brake must be adapted during operation to the decreasing diameter of the winding 32 remaining on spool 20. Two possibilities are contemplated to adapt the braking force to that decreasing diameter. The first one is to provide an electric, optoelectric, mechanical or other probe or sensor for sensing the actual yarn tension in the yarn sheaf 34, and an electronic device for comparing the sensed tension with a predetermined tension value, any difference thus calculated being used to lower or increase the said braking force. The second one, preferred at present, is to provide a mechanical diameter sensor which can simultaneously be used as an end stop device.

This sensor is shown in FIGURES 2 (at the left) and 3. The sensor arm 54 is journaled to pivot about a shaft 56. At the upper end of sensor arm 54, there is a friction wheel 58 which rotates about an axis (not shown) and which drives a yarn length counter 60. Furthermore, a potentiometer 62 is coupled directly or via a reduction gear, with the shaft 56. Such a reduction gear (not shown) may be used to adapt the pivoting movement of sensor arm 54 to the maximum rotation angle of the potentiometer 62 and to its optimal sensitivity; the man skilled in the art will be aware that the reduction is selected such as to employ the whole rotation angle of the potentiometer, as far as possible. Potentiometer 62 and yarn counter 60 are connected to control unit 50 by lines 64 and 66, respectively. The pivoting angle of sensor arm 54 is referenced as 52 in FIGURE 3.

Furthermore, a stop switch (not shown) is mounted on sensor arm 54 cooperating with an adjustable abutment (not shown too) on the spool support bracket 68 (or vice versa, in interchanging these parts). The stop switch provides a signal to the control unit 50 when there are only few or a single yarn layer 32 on the intermediate spool core. Thus, the stop switch is also connected with control unit 50.

The grid 36 is fitted with an overall clamping device, not shown but known *per se*, for simultane-

ously clamping all 40 yarns when the machine is stopped and a new intermediate spool 20 must be put in operation.

Downstream to the first eyelet bar 38, there is a thread watching device 69, comprising one watchkeeper for every one of the 40 yarns. These watchkeepers are known devices; in operation, they are held in an elevated position by the yarn under tension and fall down, closing an electric contact, should the yarn break and become tensionless. The watching device is connected, with all contacts in parallel, via line 70 to the central control unit 50.

The grid 36 and the eyelet bars 38 and 40 are typically composed of porcelain eye hooks arranged in suitable arrays. Such eyelets have only little sliding resistance.

The yarn array composed of 40 single threads - other counts can of course be used - is now fed to the spooling frame 42. The first yarn 34' which is the undermost one in FIGURE 2, is deflected by a porcelain eyelet 72' fixed on the machine bank 41, towards the first cone cross-wound bobbin 74' and wound thereon. Between the eyelet 72' and the bobbin 74' and the appertaining yarn guide roller 75, the yarn 34' passes through another yarn watchkeeper 43, 45 (FIGURE 4); the roller 45 lifted by the yarn under tension falls down on the bar 47 should the yarn 34' break. The purpose of this additional yarn watching device is to duplicate the action of the first yarn watchkeeper 69 since when a yarn breaks, the spooling machine must positively and rapidly be stopped.

The machine 42 which is used is a conventional cone cross-wound bobbin machine adapted and modified for the purpose of this invention. Thus, for example, the normally present individual yarn brakes are omitted but the cross-winding system has been maintained.

The second yarn 34" of the yarn array 34 is deflected by a second eyelet 72" on the frame 41 towards the second cone bobbin 74", and so on. All forty yarns are thus led to a corresponding bobbin 74. The other side of the machine, represented by the bank 41A, can also be fitted with 40 bobbin winders, fed from a second auxiliary spool 20 and its appertaining devices (not shown).

The cross-winders and the yarn guiding rollers 75, which are mounted on the spindle 76, are driven by a motor 80 via a pulley 78. The motor 80 is preferably a direct current electric motor whose torque and rotational speed are controllable. This motor 80 is connected by electric lines 84 and 86 to the control unit 50 and the power unit 82.

The installation now described operates as follows. First, an intermediate spool 20, comprising 40 indigo dyed yarns of about 5,000 m each, is fixed on shaft 30 with the aid of the blocking wheel 31. A sheaf of 40 yarns is drawn by hand through grid 36 and the eyelets at 38, 40, 72, the yarn watchkeepers 69 and 45 not to be forgotten, until reaching bobbin cones, still empty, on the machine 42 at 74. Then, the spooling machine can be started. Beforehand, the sensor 54 is set so that the friction wheel 56 contacts the winding 32.

In the contrary to alternating current motors

(squirrel cage motors) used in conventional spooling machines, which reach as rapidly as possible their working speed, the motor 80 of the machine 42 is constructed otherwise. A time delay circuit comprised in the control unit 50 or 82 ascertains that the machine, on starting, begins slowly to run and becomes gradually faster and faster.

According to a gradually increasing direct tension applied to direct current motor 80, the spindle 76 begins to rotate, first slowly, the yarns 34 begin to be wound upon the bobbins 74, and the yarns whose movement is slowly starting, begin to smoothly rotate the supply spool 20 with its brake 46. Due to the very smooth beginning of these operations, the tension in the yarns is not increased to a great extent, and this increase is furthermore not an abrupt one. The smooth starting of the rotation of shaft 30 will also start to induce an electric tension in the brake 46 which is compared in unit 50 with the actual, gradually increasing motor tension. Thus brake 46 will simultaneously serve as the yarn tension sensor. Now, an output circuit - known *per se* - in unit 50 produces, in response to the difference obtained by said comparison, a corresponding braking tension to be applied to the brake 46, in order to increase or to relieve the brake action and, accordingly, the drawing tension in the yarns 34. Thus, the braking effect is held constant in response to the predetermined difference between the motor supply tension and the brake tension, independently from the increasing absolute value of the tension applied to motor 80, so that the yarns 34 are at all times under the same drawing tension which is also kept to about the same level when the spooling machine has reached its operational speed. By this new measures, the breaking of yarns is positively avoided, whose cause had first be attributed to a great irregularity of individual yarn tensions.

It seems also possible to control the yarn tension, starting from about zero when the machine starts, linearly to the operational tension during steady-state machine operation, by proportional circuits also principally known *per se*.

The supply spool 20 gradually empties, and the sensor arm 54 follows this decreasing diameter. It rotates the potentiometer 62, and the varying potentiometer resistance will be used in control unit 50 to correspondingly vary, i.e. to lower, the braking force.

Within 10 to 15 seconds, the spooling machine has reached its full speed, presently 450 to 500 m/min. The machine is stopped when a yarn breakage, a length limit set on counter 60, or the end of the winding on spool 20 is sensed. This stop is also effected not too abruptly by the electronic circuits within control unit 50.

A cone cross-wound bobbin 74 which will be used as a weft yarn bobbin, can receive up to about 20,000 m of yarn. This corresponds to the capacity of about 4 intermediate spools 20. When an intermediate spool 20 is emptied but the spools 74 are not yet filled, the yarn sheaf 34 is clamped in the clamping device of the grid 36, the empty spool 20 is exchanged against a new, full one, and the leading end of the yarns wound on spool 20 are knotted to the

trailing end of the yarns in the sheaf 34. Instead of knotting, and if the weaving loom accepts, knotting may be replaced by cementing. During the time necessary for these operations, the second rebeaming group (not shown) on the other side 41A of the spooling machine will be in operation.

Substantial advantage of the method of this invention is the possibility of producing cross-wound bobbins of any conventional size, typically conical ones, starting from indigo dyed or otherwise pretreated warp yarns, for the use as weft yarn sources in conventional weaving looms. This possibility allows to use the looms without any adaptation to other weft yarn bobbins. Furthermore, the method is rapid, and frequent yarn breakages are avoided.

The method of this invention has the additional advantage that smaller weft yarn bobbins can be manufactured with a minimum of waste would there be dyeing defects in the starting warp yarn.

The machine of the invention will accept yarns having any sizes in the range of from Ne 6 to Ne 20. Typically, denim yarns are used having a strength of about Ne 7 or Ne 12. When operated with a yarn of Ne 7, the following yarn tensions have been measured at an operational speed of about 400 m/min:

- between the porcelaine eyelets of the grids 36 and 38 (on the same yarn): about 0.54 N;
- between the grids 38 and 40, about 0.78 N; and
- between the grid 40 and any single eyelet 72: about 0.88 N.

In the preceding specification and in the drawing, all characters and their technically reasonable combinations are important for this invention, unless they are expressly designed otherwise, and will be the basis for optional features of the invention defined in the dependent claims.

The solutions as found for the problems and objects of this invention may be varied within the limits of equivalents without departing from the scope of the claims. Thus, for example, the described direct current motor of the spooling frame may be replaced by other electronically controlled, programmable driving means, such as hydraulic or pneumatic ones. Necessary or preferred additional or auxiliary devices of the machines are not specially described and shown since their construction and use will be self-understanding to the man skilled in the art.

It must be emphasized that the installation of the invention, namely the different machines as shown and described, may also generally serve to provide yarns in general on cross-wound bobbins starting from a bundle made up by a plurality of threads.

Claims

1. A method for obtaining an indigo dyed cotton weft yarn on spools ready for weaving from a bundle of yarns to be divided into individual yarns, and to be wound on non-flanged weaving spools in a two-step process, characterized by the following steps:

(a) dividing a bundle composed of a plurality of indigo dyed cotton threads, into a predetermined number of yarn groups each comprising about the same number of threads,
 (b) winding up said yarn groups simultaneously on a first rebeaming device on intermediate spools, the threads of each yarn group being substantially parallel and forming a flat sheet of yarns,
 (c) transferring the intermediate spools from step (b) to a second rebeaming device, and
 (d) isolating the individual threads of each of said yarn groups and winding up each thread from the intermediate spool to a cross-wound weft yarn bobbin, the starting of the winding-up being controlled such that the operational yarn tension remains below a predetermined yarn tension value in order to avoid yarn breakage, and that the winding-up speed increase is controlled to a constant yarn tension.

2. The method of claim 1 wherein step (b) is operated in winding up said yarn groups on intermediate spools fixed side by side on a common horizontal shaft.

3. The method of claim 1 wherein in step (d) the said operational yarn tension is controlled continuously constant, the winding up being effected under smooth but steady increase of winding speed.

4. The method of claims 1 and 4 wherein the operational yarn tension is provided by applying an appropriate braking force to said intermediate spool, and kept constant by controlling said braking force.

5. The method of claim 1 wherein cone cross-wound weft bobbins are produced.

6. An installation for obtaining cross-wound weft yarn bobbins from a bundle of indigo dyed yarn comprising a multitude of threads, characterized by

(a) a first rebeaming station containing a yarn cable supply; grids or eyelet bars, and a plurality of intermediate spools being secured side by side on a common horizontal winding shaft, adapted to wind up the same predetermined number of yarns obtained by the division of said yarn bundle, and
 (b) at least one second rebeaming station containing a yarn group supply on an intermediate spool being the same as the defined under (a) above, grids and eyelet bars, a yarn sheet clamping device, and a cross-winding spooling machine fitted with a yarn tension dependent driving means.

7. The installation of claim 6, wherein said spooling machine is a cone cross-winding spooling frame.

8. The installation of claim 6, wherein the intermediate spool of the second rebeaming section is secured on a unwinding shaft fitted with a braking device whose braking force is variable and controllable; wherein means are provided to adapt said braking force, in the sense of keeping the operational yarn tension constant between unwinding and cross-winding on the spooling frame and to the decreasing diameter of the yarn winding on the intermediate spool; and wherein the spooling machine is fitted with a slow starting-up device and with means for keeping the yarn tension constant.

9. The installation of claim 6, further comprising at least one yarn breakage watchkeeper device capable of providing an electric signal when at least

one yarn breaks, said signal being used to stop the spooling machine.

10. The installation of claim 6, further comprising in station (b) a yarn length metering device driven by the yarn winding on said intermediate spool, said metering device providing an electrical signal when a predetermined yarn length has been unwound.

11. The installation of claim 6, further comprising in station (b) a sensor device cooperating with the yarn winding on said intermediate spool, said sensor providing an electrical signal proportional to the decreasing diameter of said yarn winding.

12. The installation of claim 11, wherein the sensor further comprises a stop switch being activated when the diameter of said yarn winding falls below a predetermined value.

13. The installation of claim 11 wherein cone cross-wound bobbins are produced.

Patentansprüche

1. Verfahren zur Herstellung eines webfertig aufgespaltenen indigogefärbtem Baumwollschussfadens von einem in Einzelfäden aufzuteilemde Garnbündel, wobei die Einzelfäden auf flanschlose Webspulen in einem zweistufigen Vorgang aufzuwickeln sind, gekennzeichnet durch die folgenden Schritte:

(a) Aufteilung eines aus vielen indigogefärbten Baumwollfäden bestehenden Bündels in eine vorbestimmte Anzahl von Fadengruppen mit jeweils ungefähr gleicher Fadenanzahl,

(b) gleichzeitige Aufwicklung der Fadengruppen in einer ersten Umwickelvorrichtung auf Hilfsspulen, wobei die Fäden jeder Gruppe im wesentlichen parallel liegen und eine flache Fadenlage bilden,

(c) Ueberführung der Hilfsspulen des Schritts (b) in eine zweite Umwickelvorrichtung, und

(d) Vereinzelung jeder Fadengruppe in Einzelfäden und Aufspulen jedes Fadens von der Hilfsspule in Form einer Schussfaden-Kreuzspule, wobei der Anlauf der Aufwicklung derart geregelt wird, dass die jeweilige Fadenspannung unter einem vorgegebenen Wert bleibt, um Fadenbrüche zu vermeiden, und dass der Anstieg der Aufspulgeschwindigkeit auf konstante Fadenspannung geregelt wird.

2. Verfahren nach Anspruch 1, worin der Schritt (b) so ausgeführt wird, dass man die genannten Fadengruppen auf Hilfsspulen aufspult, die nebeneinander auf einer horizontalen Achse befestigt sind.

3. Verfahren nach Anspruch 1, worin in Schritt (d) die genannte Fadenspannung beim Betrieb kontinuierlich konstant geregelt wird, wobei das Aufspulen unter langsamer und stetiger Erhöhung der Aufspulgeschwindigkeit ausgeführt wird.

4. Verfahren nach Anspruch 1 und 4, worin die Fadenspannung beim Betrieb dadurch erzeugt wird, dass man eine passende Bremskraft auf die genannte Hilfsspule einwirken lässt und die Fadenspannung durch Regelung der Bremskraft konstant hält.

5. Verfahren nach Anspruch 1, worin Konus-Kreuzspulen mit Schussgarnen hergestellt werden.

6. Vorrichtung zur Herstellung von Kreuzspul-Schussfadenspulen aus einem indigogefärbten Fadenbündel mit einer Vielzahl von Fäden, gekennzeichnet durch

(a) eine erste Umwickelstation mit einem Kabelgarn-Vorrat; Rechen- oder Oesenleisten sowie mehreren Hilfsspulen, die mit ihren Seiten aneinanderliegend auf einer gemeinsamen horizontalen Wickelwelle aufgespannt und zum Aufspulen der gleichen vorbestimmten Anzahl an Fäden eingerichtet sind, die durch eine Aufteilung des genannten Fadenbündels entstehen, und

(b) mindestens eine zweite Umwickelstation mit einem Fadengruppen-Vorrat auf einer Hilfsspule, welche die gleiche ist wie unter (a) definiert, Rechen- und Oesenleisten, eine Klemmvorrichtung für die Fadenschar und eine Kreuzspul-Wickelmaschine mit Antriebsmitteln, welche von der Fadenspannung abhängig sind.

7. Vorrichtung nach Anspruch 6, worin die genannte Aufspulmaschine eine Konus-Kreuzspul-Wickelmaschine ist.

8. Vorrichtung nach Anspruch 6, worin in der zweiten Umwickelstation die Hilfsspule auf einer Abspulwelle befestigt ist, die mit einer Bremsvorrichtung ausgerüstet ist, deren Bremskraft veränderlich und regelbar ist; und worin Mittel vorgesehen sind, um die Bremskraft im Sinne einer Konstanthaltung der Fadenspannung beim Betrieb zwischen dem Abwickeln und dem Aufwickeln auf Kreuzspulen konstant zu halten und an den abnehmenden Durchmesser der Garnwicklung auf der Hilfsspule anzupassen; und worin die Wickelmaschine mit einem Langsam-Anfahrtrieb und Mitteln zur Konstanthaltung der Fadenspannung versehen ist.

9. Vorrichtung nach Anspruch 6, welche weiterhin mindestens einen Fadenwächter aufweist, der ein elektrisches Signal erzeugt, wenn mindestens ein Faden bricht, wobei dieses Signal zum Halt der Spulmaschine benutzt wird.

10. Vorrichtung nach Anspruch 6, welche weiterhin in der Station (b) einen Fadenlängenzähler aufweist, der von der Fadenwindung auf der Hilfsspule angetrieben wird, wobei die Vorrichtung ein elektrisches Signal liefert, wenn eine vorbestimmte Fadenlänge abgespult worden ist.

11. Vorrichtung nach Anspruch 6, welche weiterhin in der Station (b) eine mit der Fadenwicklung auf der Hilfsspule zusammenwirkende Fühlereinrichtung aufweist, die ein elektrisches Signal proportional zum abnehmenden Durchmesser auf der Fadenwicklung abgibt.

12. Vorrichtung nach Anspruch 11, worin der Fadenfühler weiterhin einen Stoppschalter aufweist, der betätigt wird, wenn der Durchmesser der Fadenwicklung unter einen vorbestimmten Wert fällt.

13. Vorrichtung nach Anspruch 11, in der Konus-Kreuzspulen hergestellt werden.

Revendications

1. Procédé pour obtenir un fil de trame en coton teint à l'indigo et embobiné prêt au tissage, à partir

d'un faisceau de fils devant être divisé en fils individuels à enrouler, dans une opération en deux étapes, sur des bobines à tisser sans boudins, caractérisé par les étapes suivantes:

5 (a) division d'un faisceau composé d'une pluralité de fils en coton teints à l'indigo, en un nombre prédéterminé de groupes de fils comprenant chacun environ le même nombre de fils,

10 (b) enroulement simultané des dits groupes de fils sur des bobines intermédiaires dans un premier dispositif d'enroulement, les fils de chaque groupe étant sensiblement parallèles et formant une nappe plate de fils,

15 (c) transfert des bobines intermédiaires obtenues dans l'étape (b) dans un second dispositif d'enroulement, et

20 (d) isolation des fils individuels de chaque groupe, et enroulement de chaque fil à partir de la bobine intermédiaire sur une bobine croisé de fil de trame, le départ de l'enroulement étant contrôlé de telle façon que la tension opérationnelle de fil reste au-dessous d'une valeur prédéterminée de tension afin d'éviter la rupture du fil, et que l'augmentation de la vitesse d'enroulement est contrôlée à une tension de fil constante.

25 2. Procédé selon la revendication 1 dans lequel l'étape (b) est effectuée en enroulant les dits groupes de fils sur les bobines intermédiaires fixées côte-à-côte sur un arbre commun horizontal.

30 3. Procédé selon la revendication 1 dans lequel la dite tension opérationnelle de fil dans l'étape (d) est contrôlée continuellement constante, l'enroulement étant effectué avec une augmentation lente mais continue de la vitesse d'enroulement.

35 4. Procédé selon les revendications 1 et 4 dans lequel la tension opérationnelle de fil est obtenue en appliquant une force de freinage appropriée à la dite bobine intermédiaire, la tension étant maintenue constante par contrôle de la dite force de freinage.

40 5. Procédé selon la revendication 1 dans lequel on produit des bobines croisées coniques de fil de trame.

45 6. Installation pour l'obtention des bobines de fil de trame croisées à partir d'un faisceau de fils teints à l'indigo comprenant une multitude de fils, caractérisée par

50 (a) une première station d'embobinage contenant une provision de faisceaux de fils; des râteliers ou des portes guide-fils; et une pluralité de bobines intermédiaires fixées côte-à-côte sur un arbre d'enroulement commun horizontal et adaptées pour enrouler le même nombre prédéterminé de fils obtenus par la division du dit faisceau de fils, et

55 (b) au moins une seconde station d'enroulement comprenant une provision de groupe de fils enroulé sur une bobine intermédiaire qui est identique à celle définie en (a); des râteliers et des portes guide-fils; un dispositif de serrage de nappe de fils; et un bobinoir à fil croisé équipé d'un moyen d'entraînement dépendant de la tension de fil.

60 7. Installation selon la revendication 6 dans laquelle le bobinoir est une machine à produire des bobines à fil croisé coniques.

8. Installation selon la revendication 6 dans laquelle la bobine intermédiaire de la seconde station d'enroulement est fixée sur un arbre de déroulement équipé d'un dispositif de freinage dont la force est variable et réglable; des moyens étant prévus pour adapter la dite force de freinage dans le sens de garder constante la tension opérationnelle de fil entre le déroulement et l'embobinage du fil sur le bobinoir et au diamètre décroissant de l'enroulement sur la bobine intermédiaire, le bobinoir étant équipé d'un dispositif de démarrage lent et des moyens pour tenir constante la tension de fil.

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9. Installation selon la revendication 6, comprenant en outre au moins un casse-fil du bobinoir apte à fournir un signal électrique sur la rupture d'au moins un fil, le dit signal étant utilisé pour arrêter le bobinoir.

15

10. Installation selon la revendication 6, comprenant en plus dans la station (b) un dispositif pour mesurer la longueur du fil entraînée par l'enroulement du fil sur la bobine intermédiaire, ce dispositif de mesure fournissant un signal électrique sur le déroulement d'une longueur de fil prédéterminée.

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11. Installation selon la revendication 6, comprenant également dans la station (b) un dispositif détecteur coopérant avec l'enroulement du fil sur la dite bobine intermédiaire, ce détecteur fournissant un signal électrique proportionnel au diamètre décroissant de l'enroulement du fil.

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12. Installation selon la revendication 11, dans laquelle le détecteur comprend en outre un interrupteur d'arrêt étant activé lorsque le diamètre du dit enroulement de fil tombe au-dessous d'une valeur prédéterminée.

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13. Installation selon la revendication 11 sur laquelle on produit des bobines croisées coniques.

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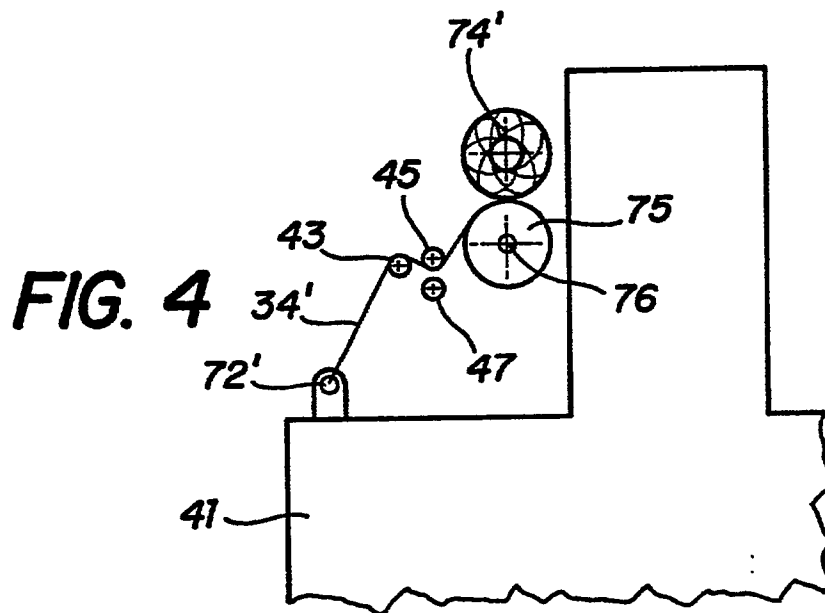
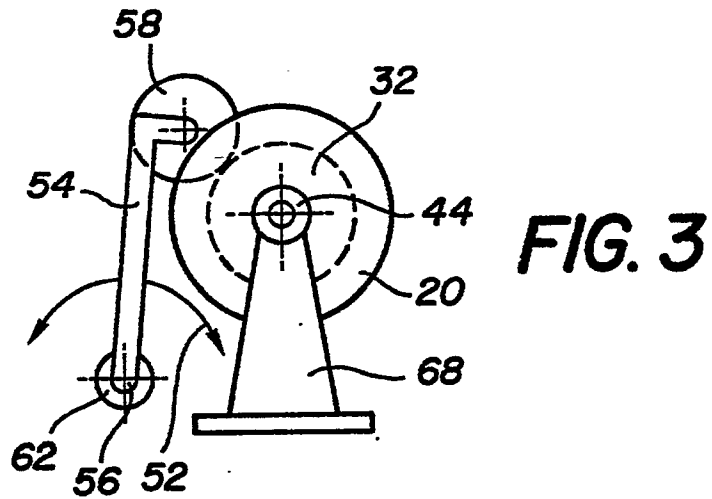
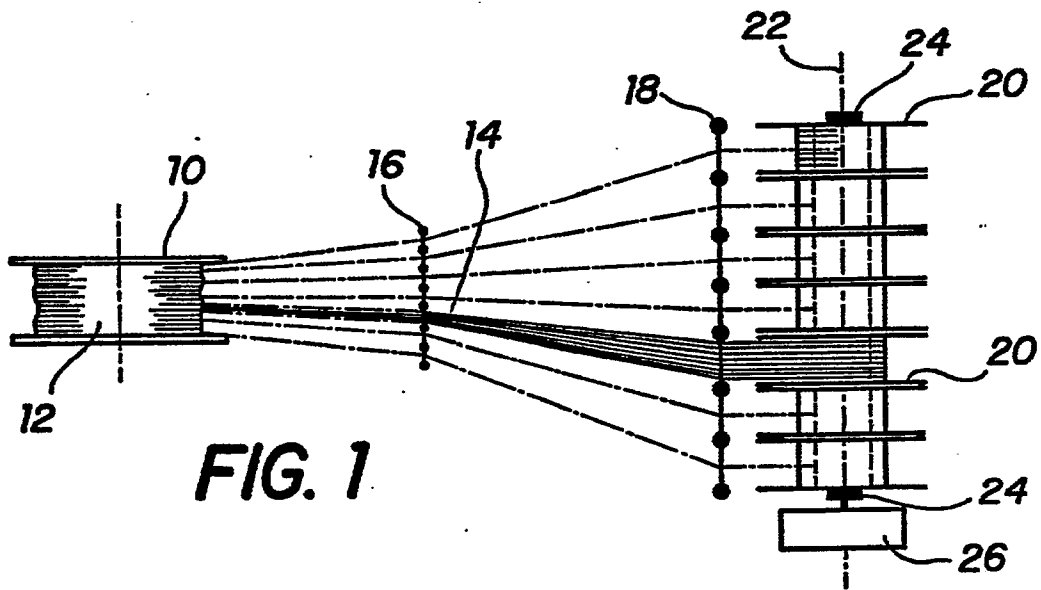
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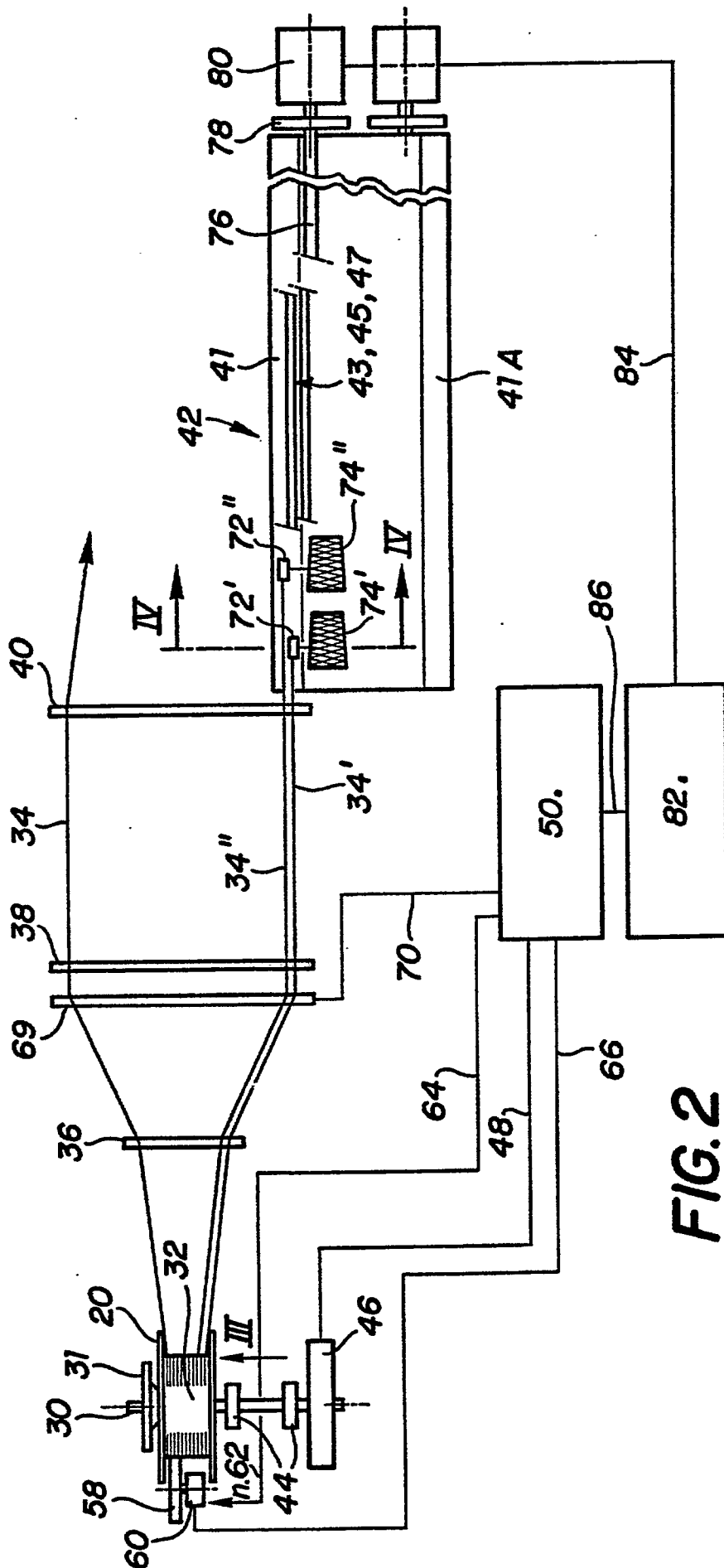


FIG. 2