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(54) **Method and apparatus for the manufacture of spools filled with indigo dyed weft yarn.**

(57) Methods and machines for obtaining weft yarns on weaving spools are described and claimed. These yarns are cotton threads which are real indigo dyed and principally destined for the weaving of blue-in-blue denim. The weft yarns are obtained from warp yarns by special rebeaming and isolating steps.

A new flanged weaving spool is made by injection molding and comprises two geometrically similar halves cemented together.

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METHOD AND APPARATUS FOR THE MANUFACTURE OF SPOOLS FILLED WITH INDIGO DYED WEFT YARN

BACKGROUND OF THE INVENTION

Field of the invention

This invention principally belongs to the technical field of weaving textile fabric. 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, as well as a particular weft yarn disk bobbin, 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 inseparately 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 into 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 get indigo dyed weft yarns from the above mentioned indigo dyed warp yarns, and since it is not possible to dye yarns which are wound up on spools, 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 naphtol dyestuffs, but the customer does not accept the fabrics otherwise dyed as 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 of 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 bobbins of such weft yarn.

Objects of the invention

Therefore, it is the first and principal object of this invention to provide a method to manufacture weft yarn spools filled with indigo dyed yarn, wherein the weft yarn is dyed with real indigo and which are ready to be used in weaving looms to produce, together with indigo dyed warp yarn, for example real indigo blue-in-blue denim.

Another object of the invention is to provide a method as set forth above which allows an economical work 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 apparatus which allows to implement the new method and which produces weft yarn loom spools filled with indigo

dyed yarn, in excellent yields and without substantial waste.

A still other object of this invention is to provide a new disk spool for use as a final yarn receiving bobbin, to be used in the method and the apparatus of the invention for being filled with indigo dyed weft yarn.

SUMMARY OF THE INVENTION

The invention allows for the first time to produce weaving loom spools wherein an indigo dyed weft yarn is wound on flange bobbins or disk spools. 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 yarns, 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 introduces 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, whereon these sheets are wound in the form of a weaving chain each.

The above mentioned basic idea of the inventors, namely to collect a weft yarn form 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 since 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 warp yarns on a cable spool, or a warp beam, 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 the same number of individual yarns, and the yarn group on each intermediate spool are then separated, in a second step, into individual yarns, and each yarn such obtained is wound

up individually on a weaving spool. A plurality of weaving spools are preferably arranged on the same, substantially horizontal shaft.

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 groups have been formed by separating the starting yarn cable into strings each of which being composed of 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 each yarn is wound on a flanged weaving spool, all weaving spools necessary for this final step being preferably also mounted side by side on the same shaft.

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.

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 10'000 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.

It has been quite surprising that especially the second step of the instant method was successful and could be carried out without major difficulties which could be expected with the separation into 30 to 50 individual threads. It seems that the first step has a disentangling and stabilizing effect.

In the second step of the method of this invention, it is not possible to use a conventional spooling frame since the tensile forces of the individual threads on the intermediate spool are very different. Thus, if a conventional spooler frame is used as such, there are always yarns which break. Hence, the spooler frame must be equipped with a rather complicated electronic device for a gradual increase of the spooling speed together with an electronic braking device for gradually changing the braking force of the intermediate spool, both devices being connected by computing and control means.

Therefore, is is preferred to carry out the second step of the above described method on a special spooling device and with the use of new flanged weaving spools of this invention which each may hold the amount of weft yarn normally necessary in weaving looms, i.e. about 10,000 m. It has surprisingly been found that the new flanged weaving spools, in spite of the presence of flanges, allow a perfectly easy delivery of the weft yarn, without any noticeable friction on the flanges, since it has been observed with much surprise, that the

unspooling yarn forms a balloon-like surface so that the yarn is unreeling from the spool rather radially than tangentially; this effect could not be foreseen.

This invention is therefore related furthermore to a special, particular flanged weaving spool which can be used in the method of this invention but which has still its own use. This weaving spool is made of a synthetic resin and comprises a first integral halfspool having an axial, hollow-cylindrically shaped bush and a radial circular ring flange, and a second integral half-spool also having an axial, hollow-cylindrically shaped bush and a radial circular ring flange, said second half-spool bush having the same length as said first half-spool bush plus the thickness of one flange, but an outer diameter fitting in with the inner diameter of said first bush, said two half-spool bushes being cemented or welded together.

The number of flanged weaving spools which are necessary to carry out the second step of the method of this invention in its first principal embodiment, are slipped, one after another, on a suitable driving shaft, without using intermediate washers, and then clamped together and fixed with the shaft. The shaft is then driven preferably by a hydraulic motor which can be adjusted such as to supply a winding-up force of from 40 to 150 mN (per yarn), multiplied by the number of the yarns to be wound up (this is, the number of weaving spools per shaft), preferably 50 to 80 mN per yarn.

The working speed which has been obtained amounts to up to 200 m/min in the first step where the yarns are wound up on auxiliary spools, and typically

300 m/min in the second step, i.e. the winding on weaving spools, or even more.

The flanged weaving spools are preferably made from thermoplastic, resistant, well workable and smooth synthetic resins such as nylon, polyester, ABS (acrylonitrile butadien styrene copolymer), polycarbonate or other polymers or copolymers. The special design of the spools of this invention permits injection molding by one and the same die, only the inner mandrel thereof must be interchangeable to fit in with the two different diameters of the bushes.

When the dyed warp yarn has been obtained by the slasher dyeing method, the dyed yarns are beamed on a warp beam in the future warp configuration, i.e. in the form of several thousands of parallel warp yarns wound up in succeeding "layers". The invention has the task to develop weft yarns from this winding too.

The object is attained, according to the invention, by introducing additional yarns, in the amount necessary for the weft, into the set of warp yarns before the dyeing step, to recover them after the dyeing, and to wind them up, separately from the warp yarns but simultaneously and, of course, with the same speed. Another embodiment of this method is to form the warp beam as described above, without separating the weft yarns, and to recover the weft yarns on the said flanged weaving spools during a subsequent rebeaming of the original warp yarn beam obtained after the dyeing step, said rebeaming and recovering of weft yarns may be effected twice or even more often.

This method has been developed from the finding that there is in the slasher dyeing no substantial entangling of the yarns, and that the relatively slow working speed - which is dictated by the highest possible dyeing speed - prevents a subsequent entangling of the yarns on the warp beam under formation.

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 comprising the first step, 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 a central sectional view of a flanged weaving spool of this invention,

FIGURE 4 a schematical side view of a system for the simultaneous indigo vat dyeing of warp and weft yarns following the slasher dyeing principle, and

FIGURE 5 a schematical side view of a rebeaming system for the recovery of weft yarns from warp yarns being wound up on a warp beam.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGURE 1 shows a cable bobbin 10 having an indigo dyed yarn cable 12 wound up thereon. The process of indigo dyeing does not be a part of this invention and is know 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; is may be implemented at all instances where weft yarns should be recovered form warp yarns. The cable 12 is a composition of 416 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 10'000 m.

This cable should now be opened and simultaneously divided into 13 beams having 32 yarns each. These figures have been selected since the second, subsequent rebeaming will be effected twice as rapid as the first one, and since the second rebeaming should give 42 individual rebeaming spools, a higher number of spools would thus necessitate an asymmetric requirement of space which will be explained later.

Groups 14 having 32 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 32 yarns each, are simultaneously wound up on auxiliary spools 20. 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.

In FIGURE 2, the second stage of the rebeaming method is represented as a device schematically shown as a top view.

An auxiliary spool 20 is fixed on shaft 30 which may be slowed down, as necessary, by a braking device (not shown). The wrapping 32 on the spool 20 which is composed of a group of 32 yarns having a length of each about 10'000 m, is divided in the grid 36 into 32 single yarns 34 which are conducted by the eyelet bars 38 and 40 to the flanged weaving spools 42. There are 32 spools 42 fixed side by side on the shaft 44 by blocking means 46. The shaft 44 is driven by a hydraulic motor 48, and the inlet and outlet of hydraulic flow medium is designed as 50. For each spool 42, a winding force of about 70 N (when yarns with a titer of about NE 12 are used) is maintained; the hydraulic motor 48 should therefore provide a constant torque.

Each flanged weaving spool 42 receives for winding an individual yarn whose length is about 10'000 m, and there are 42 spools side by side on the shaft 44; in FIGURE 2, only the two outermost spools 44 are shown. The winding up is preferably begun in pinching the leading end of yarn between two flanges of adjacent spools. This beginning is the trailing end when the spool will be filled. This trailing end is therefore

directly accessible and can be joined to the normal leading end of the next weaving spool so as to avoid any interruption during the weaving process.

It is preferred to insert a thread stop device, known per se, into the yarn way shown in FIGURE 2. This watching device is not shown in FIGURE 2.

FIGURE 3 shows a central sectional view of a flanged weaving spool of this invention. This construction is not yet known, and it was surprising that such spools can be used on looms.

The spool 42 is composed of two parts which are preferably each manufactured by injection molding from a thermoplastic synthetic resin, namely the inner portion 52 and the outer portion 54. The dimensions of the radial flanges and the axial hub are selected so that the shape represented in FIGURE 3 is obtained when the two portions are put together; then, the two portions 52 and 54 are cemented together with the cylindrical contact surfaces 56 and 56' and form thus a compact and a solid spool body.

In carrying out the process as described, there is twice a rebeaming, and the dividing factor of the threads in each stage is not necessarily the same. For example, this factor is 13:1 in the first step as described and 32:1 in the second one. It has now be found that the overall process gives best results, namely best efficiency of machines, space and labour, if the product of spool width, spool number and thread speed of each step is in the same order, particularly within a difference of $\pm$ 25 %. (Reasonable dividing

factors which do not create winding difficulties are of course presumed.)

The following calculation will serve as an example. The widths of the auxiliary spools of the first step is 175 mm, the spool number is 13 and the advancing speed of the thread is 200 m/min. This will give a working product of $4,55 \times 10^5$ mm.m/min, whereas for the second step (spool widths 50 mm, spool count 42, advancing speed 300 m/min) a working product of 4.8×10^5 mm.m/min is calculated. If the advancing speed of the second step becomes greater which is normally possible, the man skilled in the art therefore receives the teaching to increase the spool number in the first step to 14, for example, and to decrease that of the second step to about 30. (The thread count in the cable which may generally be selected at will, is then increased to $14 \times 13 = 420$.) The working products are then the following:

$$P_1 = 175 \times 14 \times 200 = 4.9 \times 10^5 \text{ m.mm/min}$$
$$P_2 = 50 \times 30 \times 325 = 4.88 \times 10^5 \text{ m.mm/min}$$

when the advancing speed in the second step is selected to 325 m/min; the best advancing speed may also be calculated in first calculatig P_1 in putting P_2 equal to P_1 and finally calculating V_2 which is the advancing speed of the second step.

P_1 and P_2 symbolize the working products in the first and the second step, respectively.

FIGURE 4 shows schematically a side view of a system for the indigo dyeing of warp yarns following the

principle of the slasher dyeing, however comprising means for the separate manufacture of weft yarns. The drawing is most simplified and is only intented to show the general procedure of this invention.

The indigo dyeing machine is designed as 60 and the subsequent devices for washing, optional aviving and drying are designed as the field 62. The warp yarn to be dyed is typically unwound from the warping beams 64 and 66, then the warp yarns are combined, dyed, worked up and divided and separately wound up on two weaving beams 68 and 70. This method is known, see for example the Swiss Patent specification no. 612,557 already mentioned above. According to this invention, a further yarn beam 72 is provided which supplies weft yarns in such a manner that the horizontal distance between two weft yarns is about 50 mm. These weft yarns are now treated together with the warp yarns in the machine 60, 62, are separated when leaving the machine from the upper warp yarn layer 74, and finally wound up separately on flanged weaving spools 42. These weaving spools 42 can thus immediately be used without rebeaming, as a weft yarn supply.

The weft yarns may also be provided with lesser horizontal distance. For space economic reasons, the number of weft yarns should not exceed three times the number of the flanged weaving spools on the spool shaft. In this case, deflecting means must be used, for example eyelet bars (which are shown in FIGURE 4).

Finally, FIGURE 5 schematically shows a side view of a device for providing weft yarns from warp yarns.

The warp beam 80 comprises warp yarns which have previously been indigo dyed in a slasher dyeing machine. The parallel yarn layer 82 is now rebeamed in the direction shown by arrows 84, goes about deflecting rollers 88, 90 and 92, and is wound up on the empty beam 86. The driving and spreading means are not shown in these Figure. On the way described, individual threads are removed and wound up on flanged weaving spools 42 which are fixed on ten shafts 44. The number of the individual threads thus removed (E) is therefore a total of

$$E = \frac{10 \times B}{b}$$

if B is the width of the yarn layer 82 and b that of the weaving spool. When the content of the beam 80 will have been rebeamed on the body 86, the number of weaving spools will be E. Then, fresh weaving spool shafts 44 having empty weaving spools 42 are inserted, and the remaining thread layer on the beam 86 is rebeamed on beam 80, now empty, in the direction of arrows 94. This work is continued until all threads on the beams 80 and 86 will be transferred to the weaving spools 42.

The solutions of the objects of this invention may be modified in the frame of equivalents. For example, the described hydraulic motors of the flanged weaving spool shaft may be replaced by other driving means, for example controlled by electronic means. Additional and complementary means of the described devices are not always described or shown in the drawing since these additional means are normally known the the man skilled in the art.

CLAIMS

1. - A method for obtaining an indigo dyed cotton weft yarn on a spool ready for weaving, comprising the following steps:

(a) dividing a bundle composed of a multitude of indigo dyed cotton threads, into a predetermined number of yarn groups each comprising the same number of threads,

(b) winding up said yarn groups simultaneously and side by side on auxiliary or intermediate spools,

(c) isolating the individual threads of each of said yarn groups and

(d) winding up said isolated individual threads as weft yarns on weaving spools which are arranged side by side on the same shaft.

2. - The method of claim 1 wherein said weft yarns are derived from an indigo dyed warp yarn cable, comprising the following steps:

(a) dividing said yarn cable into a predetermined number of yarn groups each comprising the same number of threads,

(b) winding up said yarn groups simultaneous but separately on auxiliary spools fixed side by side on a shaft,

(c) removing said auxiliary spools from said shaft,

(d) isolating the individual threads on said auxiliary spool, and

(e) winding up each one of said individual threads on a flanged weaving spool, said weaving spool being fixed with other said spools on a common shaft,

the dividing factors of steps (a) and (d), defined as the ratio of the yarn count of the starting spool yarn bundle to that on the produced spool, being selected as to obtain a trouble-free separation of threads or thread bundles.

3. - The method of claim 2 wherein said dividing factors of said steps are selected in such a manner that the product of spool number, width of the individual spools and winding speed, measured as the linear yarn feed per unit time, are identical in the limits of $\pm$ 25 %.

4. - A method for obtaining an indigo dyed cotton weft yarn on a spool ready for weaving, comprising the steps of indigo dyeing undyed weft yarns as an arrangement of a plurality of parallel and mutually spaced individual threads according to the slasher dyeing technique together with at least two warp yarn layers formed by a plurality of parallel warp yarns, separating the weft yarns from the warp yarns after dyeing, and winding said weft yarns individually on weaving spools which are in side-by-side relationship.

5. - A method for obtaining an indigo dyed cotton weft yarn on a spool ready for weaving, comprising the steps of

(a) winding of a plurality of parallel, indigo dyed warp yarns beamed on a warp beam, in the form of a layer formed by a plurality of individual parallel warp yarns,

(b) winding said unwound layer of yarns on a second warp beam,

(c) removing a predetermined number of individual yarns from said layer of yarns during the rewinding,

(d) spooling said removed yarns individually on weaving spools arranged on parallel axes in side-by-side relationship,

(e) reversing the rewinding direction of said layer of yarns and replacing filled weaving spools by fresh and empty ones, and

(f) repeating step (e) until substantial exhaustion of said warp yarns.

6. - A weaving spool for the use in a method of obtaining an indigo dyed cotton weft yarn, comprising a first integral half-spool, having an axial, hollowcylindrically shaped bush and a radial circular ring flange, and a second integral half spool also having an axial, hollowcylindrically shaped bush and a radial circular ring flange, said second half-spool bush having the same length as said first half-spool bush plus the thickness of one flange and an outer diameter fitting in with the inner diameter of said first bush, both half-spool bushes being cemented or welded together, said half-spools being made of synthetic resin.

7. - The flanged weaving spool of claim 6 made of an acrylonitrile-butadiene-styrene copolymer.

8. - A device for the obtaining of weaving spools filled with weft yarn ready for weaving, comprising

(a) a first rebeaming station comprising a yarn cable supply spool, grid or eyelet bars, and a

léplurality of auxiliary spools being secured side by side on a common winding shaft, and

(b) at least one second rebeaming station comprising a yarn group supply spool being the same as said auxiliary spool; grid and eyelet bars, and a plurality of flanged weaving spools secured side by side on a common winding shaft.

9. - A device for the obtaining of weaving spools filled with weft yarn ready for weaving, comprising a warp beam filled with warp yarn in warp configuration, a winding beam for the winding-up of warp yarns unwound from said warp beam, and a plurality of shafts fitted with flanged weaving spools arranged in the travelling space of said warp yarn from said warp beam to said winding beam.

10. - The device of claim 8 wherein said common winding shaft is fitted with a center driving means of constant torque.

11. - The device of claim 10 wherein said center driving means is a hydraulic motor.

12. - The device of claim 9 wherein said shafts are fitted with a center driving means of constant torque.

13. - The device of claim 12 wherein said center driving means is a hydraulic motor.

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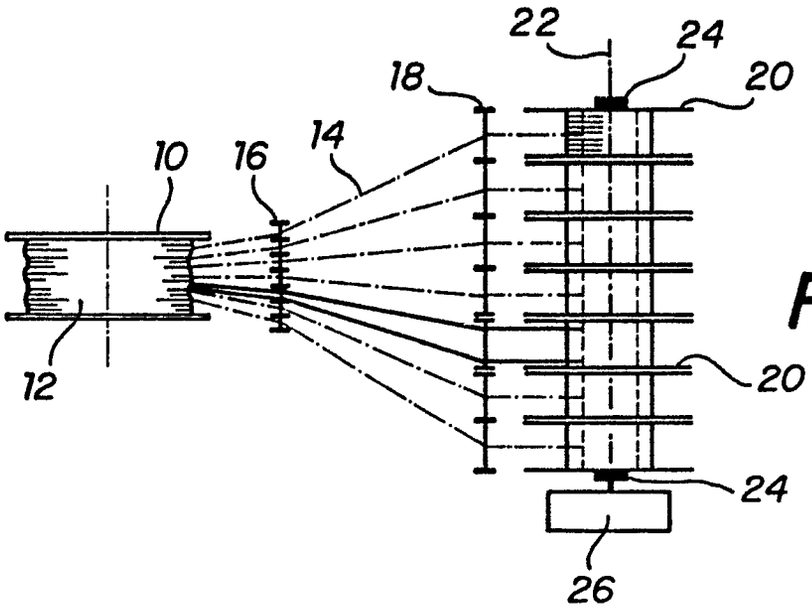

FIG. 1

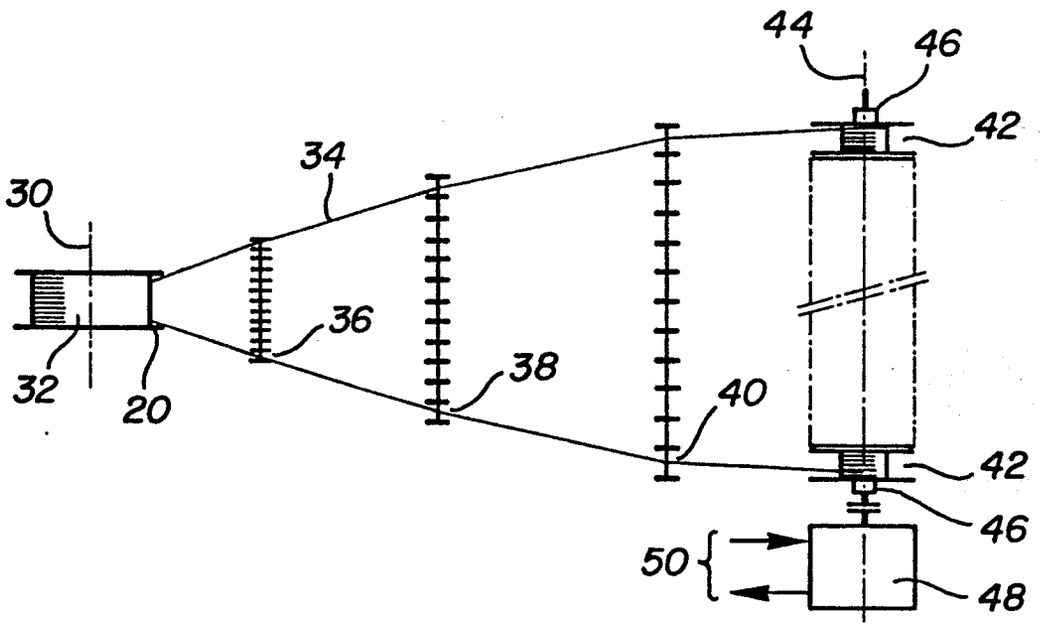

FIG. 2

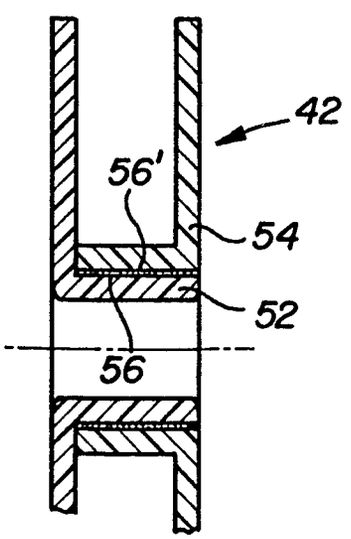

FIG. 3

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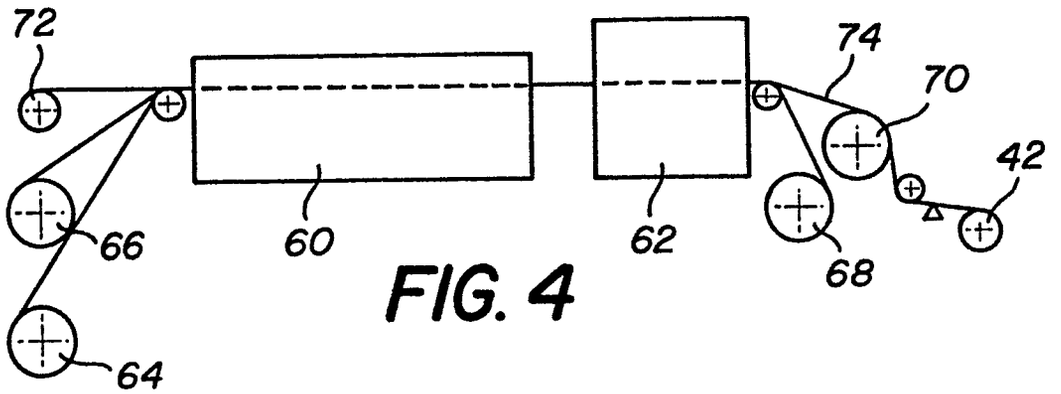

FIG. 4

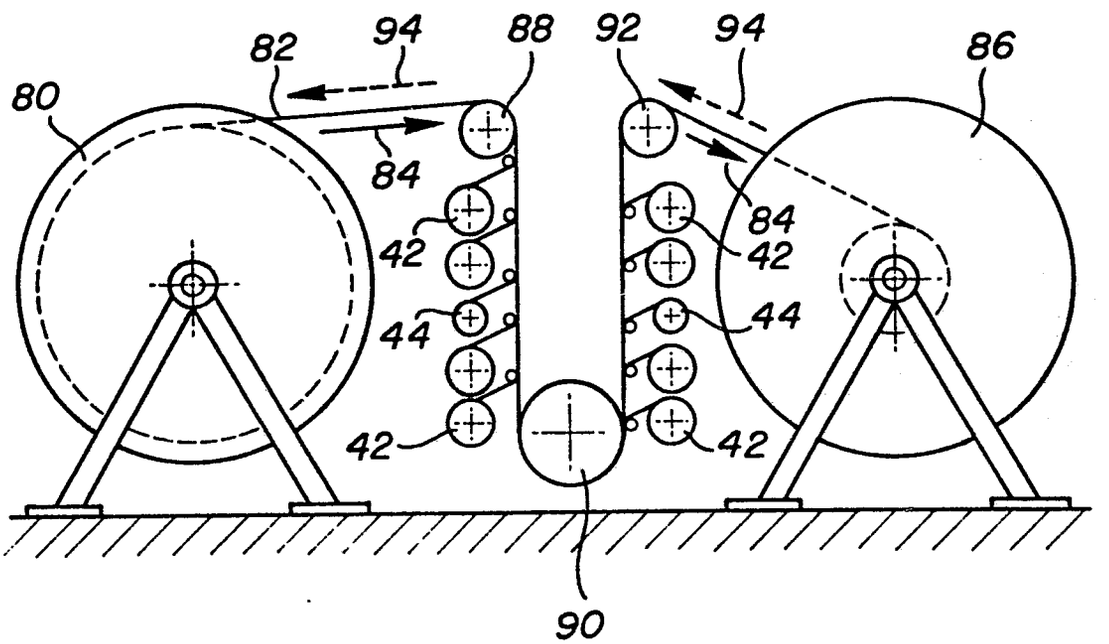

FIG. 5

European Patent Office

EUROPEAN SEARCH REPORT

0202197
Application number

EP 86 81 0213

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)
A	DE-A-3 149 489 (F. MAAG) * Claim 1 *	1,8	B 65 H 51/005 B 65 H 54/20 D 05 B 3/04
A	BE-A- 698 860 (CROON & LUCKE, MASCHINENFABRIK GmbH) * Claim 1 *	1,2,8	
A	DE-A-2 033 351 (I.K. TAKAI) * Claim 1 *	1,2,8	
A	GB-A- 340 978 (S. RAPPOPORT) * Claim 1 *	8	
A	GB-A- 645 591 (H.G. CRUIKSHANK) * Claim 1 *	8	
A	DE-A-1 949 768 (B. DANTE) * Claim 1 *	5,9	TECHNICAL FIELDS SEARCHED (Int. Cl.4) B 65 H D 02 H D 06 B
A	TEXTIL-PRAXIS, vol. 19, no. 10, October 1964, pages 1006-1010, Leinfelden, DE; K. KESSELS: "Die Gummikettschärerei in der Gummibandindustrie - ein neues Verfahren und seine Bedeutung" * Page 1008, left-hand column, paragraph 2 *	5,9	

-/-

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	05-08-1986	HOEFER W.D.

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
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0202197
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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)
A	US-A-2 889 120 (C.F. FITZGERALD) * Claim 1 *	8	
Y	GB-A-1 417 961 (J. DUTTON) * Page 2, lines 85-96; figure 4 *	6,7	
Y	US-A-2 472 248 (J.V. COX) * Column 1, line 48 - column 2, line 4; column 2, lines 20-31; figure 2 *	6,7	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	05-08-1986	HOEFER W.D.

CATEGORY OF CITED DOCUMENTS

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