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(71) Applicant: **Precision Fukuhara Works, Ltd.**
Kobe-shi
Hyogo 651-2242 (JP)

(72) Inventor: **Yamaoka, Takashi**
Kobe-shi, Hyogo 651-2242 (JP)

(74) Representative: **Karakatsanis, Georgios**
Haft Karakatsanis Patentanwaltskanzlei
Dietlindenstrasse 18
80802 München (DE)

(54) Slit yarn knitting method in circular knitting machine, apparatus therefor and knit fabric

(57) A method for knitting a slit yarn made of a sheet-like raw material and having a width of several millimeters by a knitting machine while covering a core yarn with the slit yarn, an apparatus used therefor and a knit fabric obtained thereby are provided. A slit yarn feeding device is provided for feeding a slit yarn (SY), separately from a yarn feeding device for feeding a core yarn (CY). A covering means (80) for wrapping the core yarn (CY) in the slit yarn (SY) is provided between the slit yarn feeding device and a knitting portion (50). Also provided is a guide means (12, 61, 63) for guiding the slit yarn (SY) from the slit yarn feeding device to the covering means (80) such that the slit yarn (SY) will not be twisted and will not crease, and a front and back thereof will not be inverted.

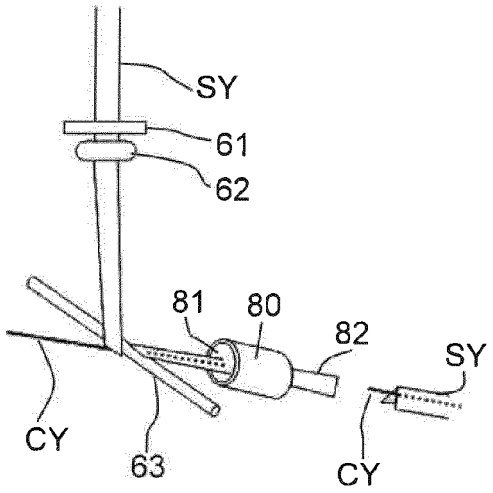

Fig. 4

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a method for knitting a slit yarn made of a sheet-like raw material such as a film or a non-woven fabric and having a width of several millimeters, using a knitting machine while covering a core yarn with the slit yarn, an apparatus used therefor and a knit fabric obtained thereby.

2. Description of Related Art

[0002] Conventionally, knitting has been performed using a knitting yarn obtained through spinning of staples or false- twisting of filaments of natural fiber or chemical fiber for a knitting machine. In recent years, a flat raw material called a slit yarn has been developed that is obtained by cutting, into a width of several millimeters, a sheet- like raw material of, for example, a film made of polypropylene, polyethylene or the like, or a non- woven fabric having a structure in which fibers are aligned and laminated in parallel or undirectionally.

[0003] Note that manufacturers of synthetic fiber call a filament yarn that has not been subjected to crimping processing as a flat yarn. Although the name flat yarn conjures up an image of a flattened yarn, a flat yarn refers to raw yarn that has not been subjected to crimping processing and is not necessarily a flattened yarn. A sheet-like material having a yarn width of 1 to 7 mm is herein called a slit yarn to distinguish it from the flat yarn, regardless of whether or not the sheet-like raw material having a yarn width of 1 to 7 mm is obtained through slitting processing.

[0004] JP- A- 2005- 023445 discloses a circular knitted fabric that is knitted using a yarn obtained by twisting flattened yarns made from Japan paper that has been slit into elongated pieces and then reeled by being wound around a core yarn.

[0005] JP- A- 2005- 248407 discloses a fabric- like material obtained by knitting a biodegradable flat yarn that is a flat, ribbon- shaped long material composed of multiple layers. The knit structures are those obtained by known knitting methods, including, for example, a warp knitted structure, a weft knitted structure, a Raschel knitted structure and a tricot knitted structure.

[0006] JP- A- 2010- 144288 discloses a polyester knit fabric obtained by knitting a flat yarn (raw yarn) and a false- twisted yarn that are put together in parallel. This knit fabric is a mesh reversible knitted fabric having a known knit structure obtained using a double circular knitting machine (model: LIL- 4AL, manufactured by Precision Fukuhara Works, Ltd.) .

SUMMARY OF THE INVENTION

[0007] As described above, JP- A- 2005- 023445, JP- A- 2005- 248407 and JP- A- 2010- 144288 are patent applications relating to yarns related to a flattened yarn and a flat yarn and a knit fabric using such yarns, as well as methods and apparatuses for knitting such yarns with a knitting machine, and the patent documents do not disclose a technique for knitting a slit yarn using a knitting machine while covering a core yarn with the slit yarn. If such slit yarn knitting is to be performed, there is a problem that twist is applied to the slit yarn when the slit yarn is unwound from a cheese- wound bobbin, and the slit yarn is knitted while being twisted. Further, there is also a problem in that the slit yarn creases before it is knitted and the front and back thereof are inverted.

[0008] The present invention solves the problem with regard to how to guide the slit yarn to the covering means located in the final stage while keeping it in a flattened state, and it is an object of the invention to provide a knitting method for a knit fabric with high additional value that fully exhibits the characteristics of a flattened slit yarn that has been developed by being added high functionality and an apparatus therefor, as well as a knit fabric obtained thereby.

[0009] Furthermore in view of the recent economic situations, it is also an object of the invention to reduce the number of manufacturing steps, thus achieving a reduction in manufacturing costs.

[0010] A slit yarn knitting apparatus according to the present invention is a circular knitting machine including legs, a bed supported by the legs, a knitting portion disposed above the bed, a yarn feeding device for feeding a knitting yarn to the knitting portion, and a rolling portion for rolling a knit fabric knitted in the knitting portion, wherein the yarn feeding device is composed of a core yarn feeding device for feeding a core yarn and a slit yarn feeding device for feeding a slit yarn, a covering means for wrapping the core yarn in the slit yarn is provided between the slit yarn feeding device and the knitting portion, and a guide means for guiding the slit yarn from the slit yarn feeding device to the covering means such that the slit yarn will not be twisted and will not crease, and the front and a back thereof will not be inverted.

[0011] Preferably, the slit yarn feeding device is composed of at least two types of yarn feeding devices including a first yarn feeding device located closer to the knitting portion and a second yarn feeding device located farther therefrom, and the covering means is provided between the first yarn feeding device and the knitting portion.

[0012] Preferably, the covering means includes a yarn inlet having a cylindrical shape, a central portion having a diameter that is substantially half the diameter of the yarn inlet, and a yarn outlet having a rectangular shape, and a portion extending from the central portion to the yarn outlet is gradually changed from a cylindrical shape to a rectangular shape.

[0013] Also preferably, a circumference of the central portion and a perimeter of the rectangular shape of the yarn outlet are smoothly connected so as to be equal.

[0014] A shorter side (T) of the rectangular shape of the yarn outlet is preferably 0.3 to 0.7 mm, and a longer side (L) of the rectangular shape of the yarn outlet is preferably $L = 1/2 \times W + \alpha$ (mm), where W is the width of the slit yarn, and α is 0 to 0.6 mm.

[0015] Further preferably, an internal corner of the yarn outlet is rounded.

[0016] Preferably, the guide means is composed of at least three guide means including a first guide means provided in a region of the first yarn feeding device, a third guide means provided immediately upstream of the covering means, and a second guide means provided between the first guide means and the third guide means.

[0017] Further preferably, the guide means is a cylindrical pin.

[0018] A slit yarn knitting method according to the present invention is a slit yarn knitting method using a circular knitting machine including legs, a bed supported by the legs, a knitting portion disposed above the bed, a core yarn feeding device for feeding a core yarn to the knitting portion, at least one slit yarn feeding device for supplying a slit yarn, and a rolling portion for rolling a knit fabric knitted in the knitting portion, the method including the steps of: wrapping the core yarn in the slit yarn between the slit yarn feeding device and the knitting portion, using a covering means; and guiding the slit yarn from the slit yarn feeding device to the covering means such that the slit yarn will not be twisted and will not crease, and a front and a back thereof will not be inverted.

[0019] Preferably, the slit yarn is mountain- folded, i.e., folded into an inverted- V shape by the covering means, and brought into a state in which the core yarn is wrapped therein.

[0020] A knit fabric according to the present invention is a knit fabric knitted by the above-described apparatus or method, including a line of thread in which the core yarn is covered with the slit yarn.

[0021] With the method and apparatus according to the present invention, a flat slit yarn developed by being added with high functionality is knitted in a state in which a core yarn is covered and wrapped in the slit yarn, and therefore, it is possible to obtain a knit fabric that has been knitted with a line of threads exhibiting the respective characteristics of the slit yarn and the core yarn. Also, such a line of threads can be obtained on the knitting machine without the need of a reeling process, and therefore it is possible to achieve a reduction in manufacturing costs. Furthermore, although the slit yarn tends to be detached from the core yarn in a state in which the core yarn is wrapped in the slit yarn due to a lack of stability when the line of threads is wound around the bobbin in the reeling process, such a problem will not arise in the manufacturing method of the present invention since the slit yarn is knitted immediately after the core yarn is wrapped therein.

[0022] Hereinafter, an embodiment of the present invention will be described with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023]

FIG. 1 is a front view showing an entire circular knitting machine.

FIG. 2 is a front view showing a feeding path of a knitting yarn according to the present invention.

FIG. 3 is an enlarged view of a yarn carrier composed of a carrier plate to which a covering means according to the present invention is attached.

FIG. 4 is a schematic diagram showing a feeding path of a knitting yarn in a knitting portion according to the present invention.

FIG. 5a is a perspective view of a covering means according to the present invention.

FIG. 5b is a rear view of a covering means according to the present invention.

FIG. 6 is a diagram of a knit structure obtained by a knitting method according to present invention.

DETAILED DESCRIPTION OF THE INVENTION

1. Overview of Circular Knitting Machine

[0024] FIG. 1 is an overall view of a knitting machine, showing two types of feeding devices, namely, first and second yarn feeding devices 10 and 20, first and second drive pulleys 11 and 21 for driving these yarn feeding devices, a plurality of legs 30, a bed 40 supported by the legs 30, and a knitting portion 50 disposed above the bed. The first and second yarn feeding devices 10 and 20 are driven by the first and second drive pulleys 11 and 21 via a drive belt, but the drive belt is not shown for the sake of convenience.

[0025] Although not shown, in the knitting portion 50, a plurality of cylinder knitting needles are accommodated in needle grooves of a vertically slidable cylinder. Opposing the cylinder, a cam holder provided with a control cam for the cylinder knitting needles is supported by a cam ring. As will be described in detail below, knitting yarns that are fed from the first and second yarn feeding devices 10 and 20 through a plurality of guide means 12, 61 and 63 and guide holes 13 and 62 are fed from a yarn carrier 60 provided with a covering means 80 to the cylinder knitting needles.

[0026] In the double-knit circular knitting machine, a needle dial hub 51 that synchronously rotates with the cylinder is provided above the cylinder. A needle dial having needle grooves on which a plurality of dial knitting needles are horizontally slidable is attached to the needle dial hub 51. A gear ring 41 for driving the cylinder is disposed inside the bed 40, a top gear 42 for driving the needle dial hub 51 is rotatably supported on a dial yoke

43 located above the bed, and the gear ring 41 and the top gear 42 are connected by a driving shaft 44 so as to synchronously rotate with each other. The top gear 42 is covered with a top gear cover 45, a plurality of posts 46 are set up on the top gear cover 45, and the upper portions of the posts 46 are fixed to a horizontal member 48 with a connecting member 47. A rolling portion 70 for rolling a knit fabric that has been knitted is installed below the bed 40.

2. Yarn Feeding Device

[0027] Although a single yarn feeding device is usually used for slit yarn since the yarn has no elongation, two types of yarn feeding devices (the first and second yarn feeding devices 10 and 20) are used in this embodiment as shown in FIG. 1. The first yarn feeding device 10 is driven by the first drive pulley 11. The drive pulley 11 is driven by a gear box 49 driving the knitting machine as the driving source, and drives the first yarn feeding device 10 (for example, an MPF manufactured by Memminger-IRO GmbH in Germany) via a drive belt (not shown). The second yarn feeding device 20 is driven by the second drive pulley 21. The second drive pulley 21 is driven by the above-described top gear 42 as the driving source, and drives the second yarn feeding device 20 (for example, an MER manufactured by Memminger-IRO GmbH in Germany) via a drive belt (not shown). The two types of yarn feeding devices 10 and 20 are fixed to attachment rings 15 and 24 via connecting rods 14 and 23 hanging down from the horizontal member 48 in the same manner.

[0028] Note that the first and second yarn feeding devices 10 and 20 that are used are not limited to the devices described above, and can be appropriately modified according to the raw material of the knitting yarn.

[0029] Although not shown, a core yarn CY that is covered with a slit yarn SY is fed to the first yarn feeding device 10 via a yarn bobbin such as a creel stand separately disposed around the knitting machine.

3. Embodiment of Yarn Feeding Device and Method

[0030] A knitting yarn feeding method according to one embodiment of the present invention will now be described.

[0031] First, the slit yarn SY is "rotationally fed" by the second yarn feeding device 20 from a bobbin 25 around which the slit yarn SY is cheese- wound (FIG. 2) .

[0032] Next, the slit yarn SY fed out from the second yarn feeding device 20 is wound around a spool feed wheel 16 of the first yarn feeding device 10 so as not to be twisted, to such an extent that turns of the slit yarns SY do not overlap, and is fed out into a first guide hole 13 provided in the attachment ring 15 (FIG. 2) .

[0033] The first guide means 12 is attached at the front of the first guide hole 13. The slit yarn SY that has been fed out from the first yarn feeding device 10 is passed through the first guide hole 13 via the first guide means 12, and its direction is changed downward where the knitting portion 50 of the knitting machine is located (FIG. 2).

[0034] Further, the slit yarn SY is passed through a second guide hole 62 via the second guide means 61, and its direction is changed downward where the yarn carrier 60 is located. Further, the slit yarn SY is guided to the third guide means 63, and its direction is changed toward the center of a yarn inlet 81 of the covering means 80 (FIG. 4) .

[0035] The slit yarn SY is passed through the yarn inlet 81 of the covering means 80 via the third guide means 63 (FIG. 4).

[0036] Also, the core yarn CY that has been fed out from another first yarn feeding device (not shown) is passed, by way of another yarn guide hole, through the yarn inlet 81 of the covering means 80 below the slit yarn, along the central portion in the width direction of the slit yarn SY (FIG. 4) .

[0037] The slit yarn SY that has come out from a yarn outlet 82 of the covering means 80 is mountain-folded (folded into an inverted V-shape) by the covering means 80 and is fed to the needle, with the core yarn CY being wrapped therein (FIG. 4).

[0038] Preferably, each of the guide means 12, 61 and 63 is a cylindrical pin having a diameter of about 2.5 mm. The cylindrical pin may be a linear pin 63 as shown in FIG. 4, but may alternatively be gradually curved throughout its length. In the case of curving the pin, taking the pin 63 of FIG. 4 as an example, both ends of the pin are bent toward the covering means 80 side so as to allow the slit yarn SY to pass the back portion of the curved central portion. Doing so provides the effect of stretching any creases in the slit yarn as a result of the slit yarn SY riding on the back portion of the curved central portion. The installation position and the number of the guide means may be appropriately modified according to the type of the knitting machine.

[0039] FIG. 3 shows the yarn carrier 60 including the covering means 80 in which the core yarn CY is covered with the slit yarn SY according to the present embodiment. The covering means 80 including a yarn inlet 81 and a yarn outlet 82 is provided integrally with a lower portion of the carrier plate 64. The covering means 80 and the carrier plate 64 may be a unitary member, or may be separately manufactured and fixed integrally. Any method, including, for example, bonding or welding may be used as the fixation method. The covering means 80 and the carrier plate 64 may be installed separately as long as they achieve their respective objectives.

[0040] A right-hand portion 89 of the yarn outlet 82 is at the position where the latch of the knitting needle starts closing.

[0041] Preferably, a left inclined portion 65 of the carrier plate 64 is expanded to the limit so as to cover the latch opened at a bulging portion 66, such that the open latch of the knitting needle will not be closed before the knitting yarn is fed.

[0042] As shown in FIG. 3, the core yarn CY and the

slit yarn SY that have entered the yarn inlet 81 pass through the inside of the covering means 80, exit from the yarn outlet 82, and reach the knitting point where the latch is closed, with the core yarn CY being wrapped in the slit yarn SY.

[0043] FIGS. 5a and 5b show the covering means 80 for covering the core yarn CY with the slit yarn SY according to the present embodiment. The covering means 80 has the yarn inlet 81 on one end and the yarn outlet 82 on the other end. An inclined portion 84 extending from the cylindrical yarn inlet 81 to a central portion 83 having a diameter that is substantially half the diameter of the yarn inlet 81 is changed in a tapered manner. The portion extending from the central portion 83 to the yarn outlet 82 is gradually changed in its shape from the cylindrical shape of the central portion 83 into the rectangular shape of the yarn outlet 82. Preferably, the circumference 85 of the central portion 83 and the perimeter 86 of the rectangular shape of the yarn outlet 82 are smoothly connected so as to be equal.

[0044] The yarn outlet 82 is a vertically oriented rectangular hole. Preferably, internal corners 87 of the yarn outlet are rounded.

[0045] The width (T) of the yarn outlet 82 is preferably 0.3 to 0.7 mm, more preferably 0.5 mm. It is sufficient that the slit yarn SY in which the core yarn CY is wrapped can smoothly pass through the outlet having this width.

[0046] Preferably, the length (L) of the yarn outlet 82 is changed according to the width of the slit yarn SY used. For example, the length (L) of the yarn outlet 82 relative to the width (W) of the slit yarn is such that $L = 1/2 \times W + \alpha$, and α is preferably in the range from 0 to 0.6 mm. Accordingly, in the case of using 5 mm as the width (W) of the slit yarn, the length (L) of the yarn outlet 82 is preferably 2.5 to 3.1 mm, particularly preferably 2.6 mm.

[0047] In order for the circumference 85 of the central portion 83 and the perimeter 86 of the rectangular shape of the yarn outlet 82 to be equal, the diameter of the central portion 83 is preferably 2.0 mm, and the diameter of the yarn inlet 81 is preferably 4.0 mm, which is substantially two times the diameter of the central portion 83.

[0048] With this dimensional restriction, the slit yarn that is folded substantially in half is caught in the knitting needle, in a state in which it is folded in half without being displaced. Note that the width of the slit yarn SY used is preferably 3 to 7 mm.

4. Example of Manufacture of Knit Fabric

[0049] Knitting was performed using an apparatus according to the present invention under the following conditions.

<Model used> V-LEC6F, 19-inch, 6 gauge-cylinder/24 gauge-dial, manufactured by Precision Fukuhara Works, Ltd.
<Knit structure> Quarter gauge reversible knitted structure
<Yarn used> Plain knitting portion of cylinder : 5-mm-width slit yarn

Product name: MILIFE, Type: TY-grade (cross-laminated fabric), manufactured by JX Nippon ANCI Corporation
Core yarn, polyester, 56-dtex 36 filament

Plain knitting portion of dial: cotton yarn, No. 30 count
Tuck portion: nylon textured yarn, 33-dtex 10 filament

[0050] A method for knitting the above-described knit structure will be described with reference to FIG. 6. Knitting is performed using cylinder needles 52 and dial needles 53 that are aligned as shown in FIG. 6. The slit yarn SY in which the core yarn CY is wrapped is fed at a first yarn feed port [1], and is knitted by the cylinder needles 52. The cotton yarn MY is fed at a second yarn feed port [2] and a third yarn feed port [3], and is knitted by the dial needles 53. The nylon textured yarn NY is fed at a fourth yarn feed port [4], and is tucked by all the cylinder needles 52 and every three other dial needles 53.

[0051] Note that the knit structure that can be knitted by the slit yarn SY in which the core yarn CY is wrapped is not limited to a quarter gauge reversible knitted structure.

[0052] Further, the feeding of the slit yarn SY in which the core yarn CY is wrapped is not limited to that to cylinder needles, and the slit yarn can be fed to both cylinder needles and dial needles in the case of using dial needles and a raw material having an elongation as the slit yarn.

[0053] Possible knit structures include a plain knitted structure, a piqué knitted structure, an inlay knitted structure and the like in the case of a single knitting machine, and an interlock knitted structure in the case of a double-knitting machine. Furthermore, for example, the use of a metal yarn such as copper wire as the core yarn makes it possible to obtain a knit fabric intended for electromagnetic shielding.

[0054] The invention may be embodied in other forms without departing from the spirit or essential characteristics thereof. The embodiments disclosed in this application are to be considered in all respects as illustrative and not limiting. The scope of the invention is indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are intended to be embraced therein.

Claims

1. A slit yarn knitting apparatus for feeding a core yarn (CY) and a slit yarn (SY) to a knitting machine,
wherein a covering means (80) for wrapping the core yarn (CY) in the slit yarn (SY) is provided immediately upstream of a knitting portion (50).

2. The apparatus according to claim 1, wherein the covering means (80) includes a yarn inlet (81) having a cylindrical shape, a central portion (83) having a diameter that is substantially half the diameter of the yarn inlet (81), and a yarn outlet (82) having a rectangular shape, and a portion extending from the central portion (83) to the yarn outlet (82) is gradually changed from a cylindrical shape to a rectangular shape.

3. The apparatus according to claim 2, wherein a circumference (85) of the central portion (83) and a perimeter (86) of the rectangular shape of the yarn outlet (82) are smoothly connected so as to be equal.

4. The apparatus according to claim 2 or 3, wherein a shorter side (T) of the rectangular shape of the yarn outlet (82) is 0.3 to 0.7 mm.

5. The apparatus according to any one of claims 2 to 4, wherein a longer side (L) of the rectangular shape of the yarn outlet (82) is $L = 1/2 \times W + \alpha$ (mm), where W is the width of the slit yarn, and α is 0 to 0.6 mm.

6. The apparatus according to any one of claims 2 to 5, wherein an internal corner (87) of the yarn outlet (82) is rounded.

7. A slit yarn knitting apparatus that is a circular knitting machine comprising legs (30), a bed (40) supported by the legs (30), a knitting portion (50) disposed above the bed (40), a yarn feeding device for feeding a knitting yarn to the knitting portion (50), and a rolling portion (70) for rolling a knit fabric knitted in the knitting portion (50),
wherein the yarn feeding device is composed of a core yarn feeding device for feeding a core yarn (CY) and a slit yarn feeding device (10, 20) for feeding a slit yarn (SY),
a covering means (80) for wrapping the core yarn (CY) in the slit yarn (SY) is provided between the slit yarn feeding device (20) and the knitting portion (50), and
a guide means (12, 61, 63) for guiding the slit yarn (SY) from the slit yarn feeding device (20) to the covering means (80) such that the slit yarn (SY) will not be twisted and will not crease, and a front and a back thereof will not be inverted.

8. The apparatus according to claim 7, wherein the slit yarn feeding device is composed of at least two types of yarn feeding devices comprising a first yarn feeding device (10) located closer to the knitting portion (50) and a second yarn feeding device (20) located farther therefrom, and the covering means (80) is provided between the first yarn feeding device (10) and the knitting portion (50).

9. The apparatus according to claim 7 or 8, wherein the guide means is composed of at least three guide means comprising a first guide means (12) provided in a region of the first yarn feeding device (10), a third guide means (63) provided immediately upstream of the covering means (80), and a second guide means (61) provided between the first guide means (12) and the third guide means (63).

10. The apparatus according to any one of claims 7 to 9, wherein the guide means is a cylindrical pin.

11. A slit yarn knitting method using a circular knitting machine comprising legs (30), a bed (40) supported by the legs (30), a knitting portion (50) disposed above the bed (40), a core yarn feeding device for feeding a core yarn to the knitting portion, at least one slit yarn feeding device (10, 20) for supplying a slit yarn (SY), and a rolling portion (70) for rolling a knit fabric knitted in the knitting portion (50), the method comprising the steps of:

wrapping the core yarn (CY) in the slit yarn (SY) between the slit yarn feeding device (20) and the knitting portion (50), using a covering means (80); and
guiding the slit yarn (SY) from the slit yarn feeding device (20) to the covering means (80) such that the slit yarn (SY) will not be twisted and will not crease, and the front and a back thereof will not be inverted.

12. The method according to claim 11, wherein the slit yarn (SY) is mountain-folded, i.e., folded into an inverted-V shape by the covering means (80), and brought into a state in which the core yarn (CY) is wrapped therein.

13. A knit fabric knitted by the method according to claim 11 or 12, comprising a line of thread in which the core yarn (CY) is covered with the slit yarn (SY).

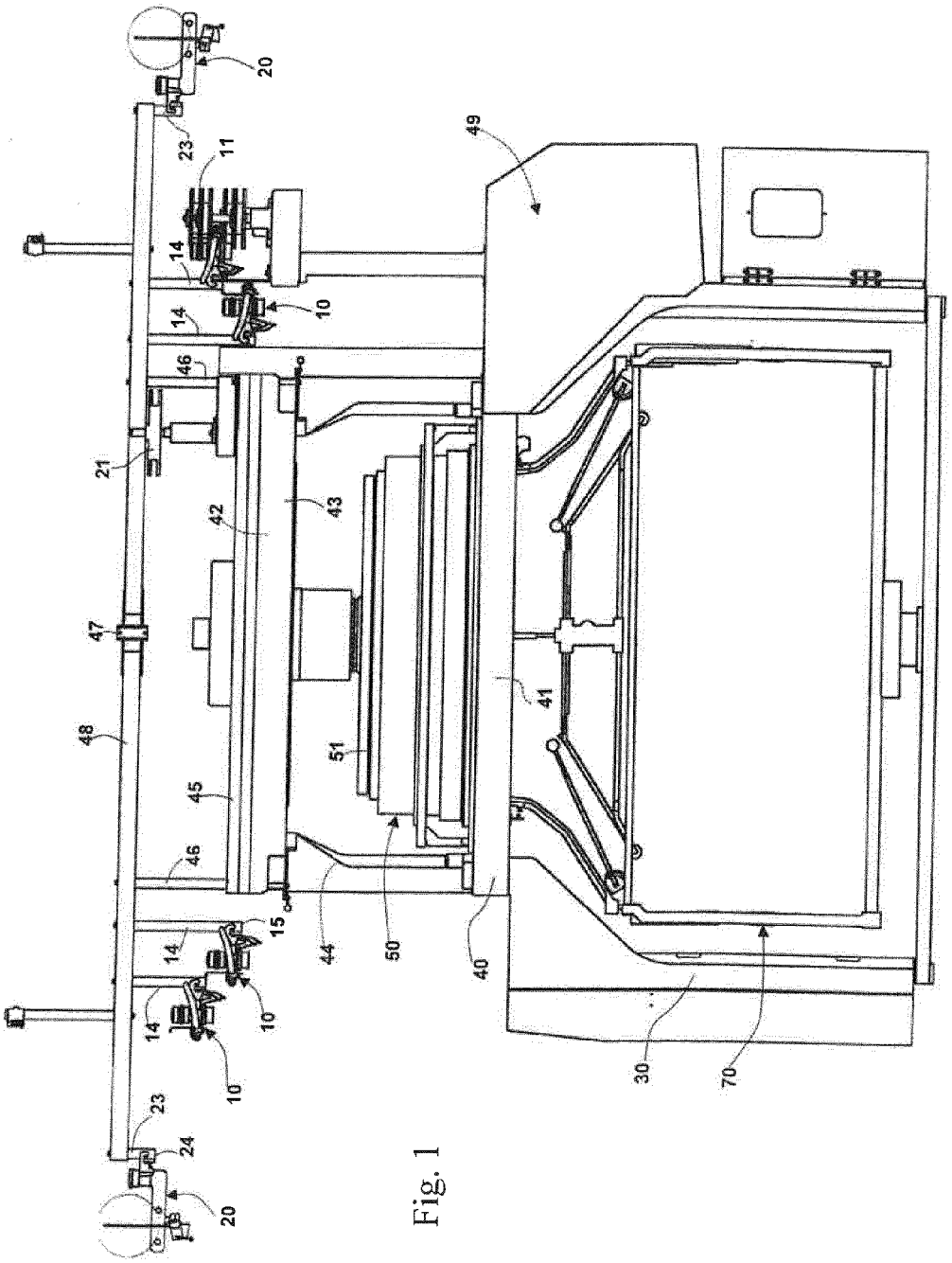
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Fig. 1

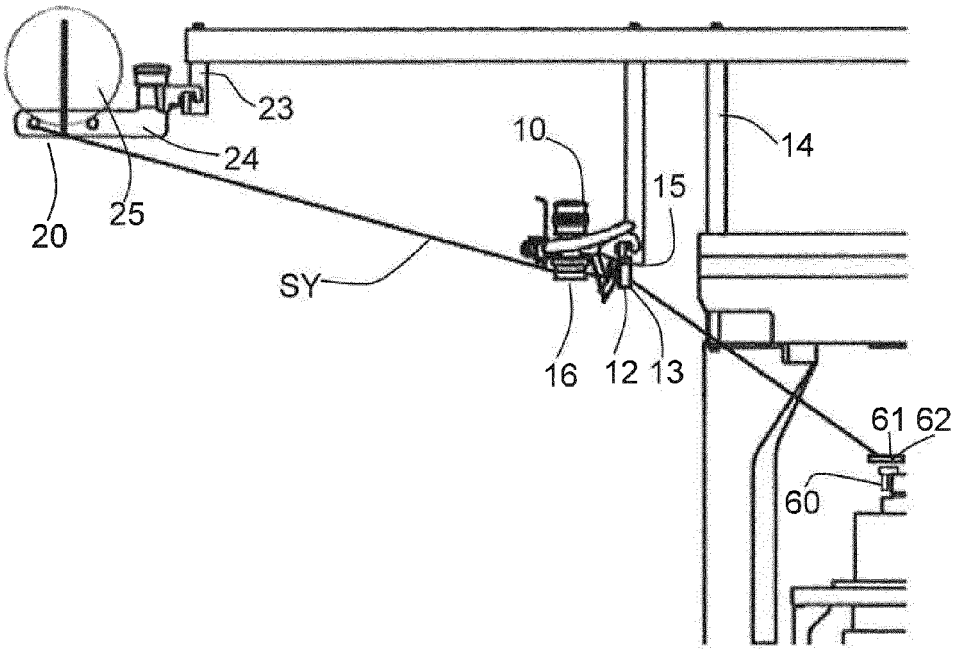


Fig. 2

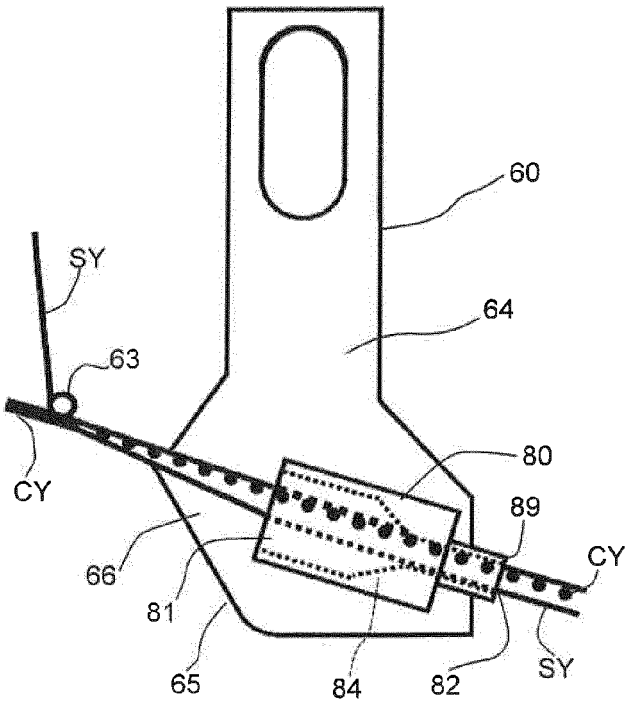


Fig. 3

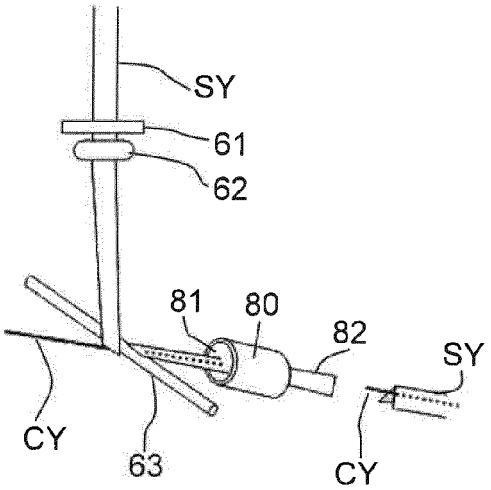


Fig. 4

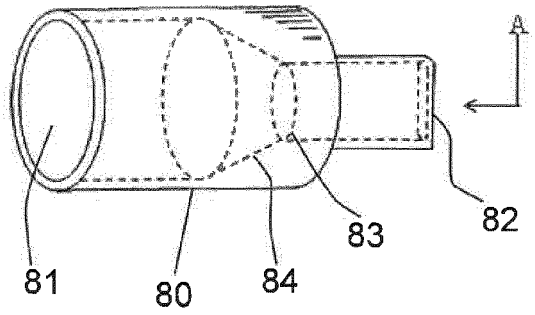


Fig. 5(a)

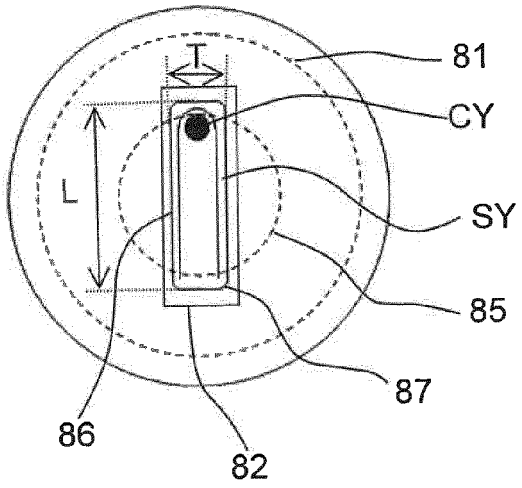
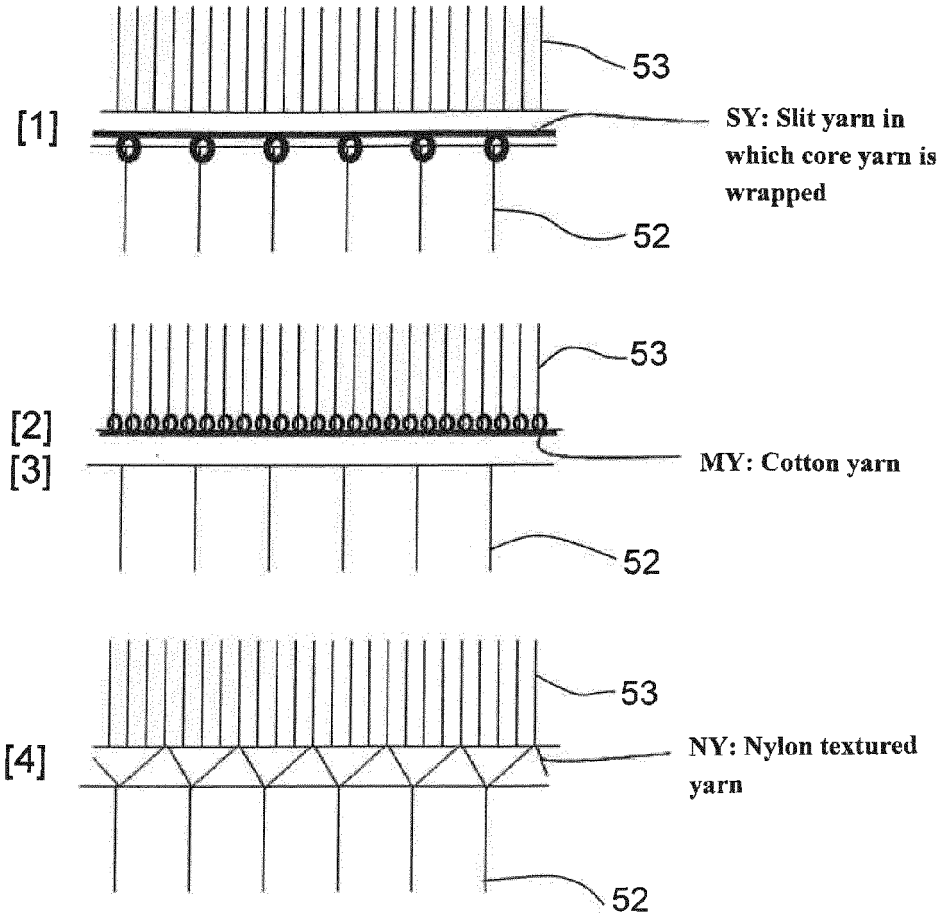


Fig. 5(b)


[1]
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SY: Slit yarn in which core yarn is wrapped
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[2]
[3]
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MY: Cotton yarn
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[4]
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NY: Nylon textured yarn
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Fig. 6

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 13 15 8186

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 1 260 956 A (FORD MOTOR CO [GB]) 19 January 1972 (1972-01-19) * page 3, line 59 - line 108; figure 3 * -----	1,7-13	INV. D04B35/22 D04B1/16
X	US 3 331 222 A (MARKS RONALD H) 18 July 1967 (1967-07-18) * column 7, line 48 - column 9, line 23; figures 3-5 * -----	1,7,11, 13	
			TECHNICAL FIELDS SEARCHED (IPC)
			D04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	9 July 2013	Zirkler, Stefanie

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
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