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(54) **Method of production of knitted collars having at least a band with double colour yarn on a flat bed knitting machine with two carriages**

(57) A method of production of knitted collars and the like having at least a portion with single colour (3a, 3b, 4a, 4b) and at least a portion with double colour of yarn (2a, 2b), by means of a flat bed knitting machine (10) with at least two carriages (11a, 11b) and single system that move along needle beds (12). The steps are provided of: with single colour yarn (3a, 3b) knitting of a first article (1a) by means of a first carriage (11a) and of a second article (1b) by means of a second carriage (11b); at the end of knitting a portion (3a, 3b) of the first and second article (1a, 1b) with single colour yarn, quick

and automatic approaching of the first and second carriage (11a, 11b); continuation of knitting (2a, 2b) of the first and second article (1a, 1b) with a first system of a yarn of a first colour by means of the first carriage (11a) and with a second system of a yarn of a second colour by means of second carriage (11b); at the end of knitting a portion (2a, 2b) with the first and second colour with approached carriages, automatic separation of the first and second carriage (11a, 11b) and knitting a further portion (4a, 4b) with a yarn of single colour with separate carriages.

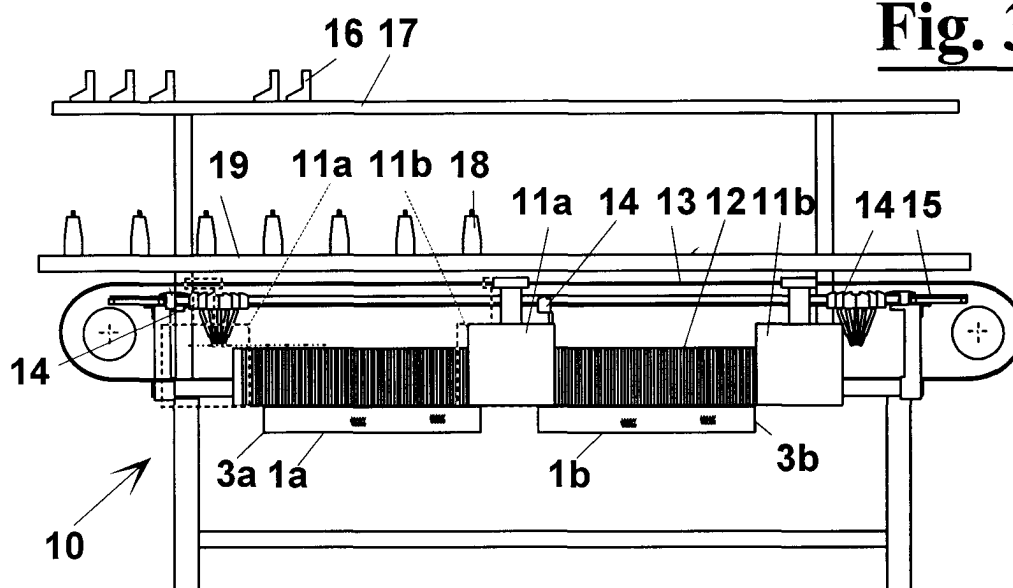
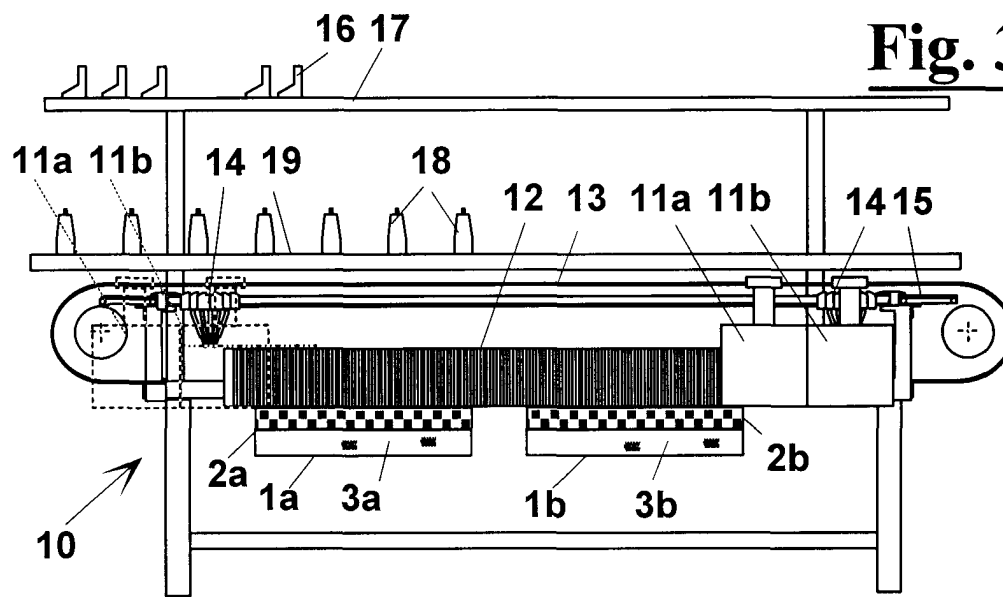


Fig. 3A

Fig. 3B



Description

Field of the invention

[0001] The present invention relates to the field of the machines for knit wear, and more precisely relates to a method for production of collars having portions with double yarn colour on a flat bed knitting machine with two carriages.

Background of the invention

[0002] Flat bed knitting machines are known with double needle beds and two carriages, so called "tandem", wherein two carriages can operate at predetermined distance on two different articles.

[0003] Two carriages move on a guide parallel to the needle beds, or needle beds, and make two identical articles, with single or multiple system, i.e. carrying one or several yarn guides at a time.

[0004] These machines are flexible since, by linking the carriages to each other and working on all the length of the machine, the systems of the machine are doubled. Then, a machine with two carriages with single system can turn into a machine with one carriage with double system, i.e. that carries two yarn guides at a time and makes a single article.

[0005] Machines of this type can also be used in the production of collars, which are rectangular shaped knitted articles, in single colour or with many colours. In the case of collars with many coloured bands, a frequent case is that of two coloured bands knitted at alternate ranks, in order to provide fancy patterns or inscriptions. In this case the collar can have also one or several bands with single colour and one or several bands with two colours.

[0006] The pattern with two colours either can be obtained with the needles moving independently from one another, in jacquard machines, or consists in a not complex interlock with two colours, or pique, or a different pattern, for example formed by small squares. In both cases, the carriage must work every rank of stitches with a different yarn guide.

[0007] When knitting collars with a two colours pattern, jacquard or not, by a machine with two carriages and single system there is a loss of production given to the inactive strokes of the yarn guides in the portions with two colours. In fact, every rank of stitches is knitted with a different yarn guide and every three strokes of the carriage one is an inactive stroke, since the two yarn guides are located at opposite sides of the machine.

[0008] In this case every knitting machine with two carriages and single system would operate as is indicated in table 1.

[0009] As it is apparent every six strokes of the carriage, two are inactive strokes, i.e. 33% of production is lost for every portion with two colours. In fact, the two inactive strokes are necessary for picking up the yarn

guide that is located at the opposite side of the machine. Instead, if the pattern has three or more colours there are not inactive strokes, since at every stroke of the carriage at least one yarn guide is available at both sides of the machine.

[0010] On the other hand, when knitting with carriages coupled to each other and yarn of single colour, a knitting phase with double system without inactive strokes would occur. However, the portions of collar in a single colour with double system knitted by each carriage would never have the same density, with the result of a knitted article having inhomogeneous ranks.

Summary of the invention

[0011] It is an object, then, of the present invention to provide a method of production of collars having at least a band with double colour of yarn, wherein, using a flat bed knitting machine with two carriages and single system, inactive strokes are avoided in the portions with double colour, even if full production is assured in the portions with single colour.

[0012] It is another object of the present invention to provide a machine that allows an easy application of this method.

[0013] These and other objects are achieved by the present invention, wherein the following steps are provided:

- knitting with a yarn of single colour a first article by means of a first carriage and a second article by means of a second carriage, the first and second carriages being distanced from each other with respect to the needle beds and dragged integrally to each other along the needle beds, each carriage having a stroke that involves a single article;
- at the end of knitting a portion of articles with single colour, automatic approaching of the first and second carriage to each other;
- continuation of knitting the first and second article by a first yarn system of a first colour through the first carriage and by a second yarn system of a second colour through the second carriage, the coupled carriages having a stroke that involves both articles;
- at the end of knitting a portion with the first and second colour, automatic separation of the coupled first and second carriage;
- knitting a further portion with a yarn of single colour with separate carriages.

[0014] In the case of articles having several portions with single colour yarn alternate to portions with double colour yarn, the repetition in succession is provided of the alternate steps of knitting further portions of articles respectively by yarn of the first and second colour with coupled carriages and by single colour yarn with separate carriages up to the end of the articles.

[0015] In the case of articles that begin or end with a portion with double colour, a starting or final step is provided with linked carriages and double system with yarns of two different colours.

[0016] According to another aspect of the invention, a flat bed knitting machine is provided with at least two carriages and single system that move along needle beds, comprising:

- means for dragging a first and a second carriage integrally to one another;
- means for adjusting the distance between the first and second carriage from an approached position to a distanced position of a predetermined amount;
- program means for operating the means for adjusting the distance at the end of a knitting step with single colour with distanced carriages by approaching the carriages, and for operating the means for adjusting the distance at the end of a knitting step with double colour yarn with approached carriages for distancing the carriages, the program means selecting for each carriage a yarn of single colour when distanced and a yarn of different colour when approached.

[0017] Preferably, the means for adjusting the distance may comprise a device chosen among:

- means for clamping selectively the first and/or second carriage to the dragging means.
- a linear actuator for linking the first and second carriage to each other.
- first driven dragging means connected to the first carriage and second dragging means connected to the second carriage, the second dragging means being selectively fastened/unfastened from the first dragging means;
- motor means integral to the first carriage that engage with the dragging means, whereby the motor means can move the first carriage with respect to the second carriage along the dragging means.

Brief description of the drawings

[0018] Further characteristics and the advantages of the method and of the apparatus according to the invention will be made clearer with the following description of an embodiment thereof, exemplifying but not limitative, with reference to the drawings and to the attached tables, wherein:

- figure 1 shows a knitted article, such as a collar, made with a band of stitches with two colours set between two portions of stitches with one colour;
- table 1 describes the steps necessary for knitting seven following ranks of stitches on a flat bed knitting machine with single carriage or a tandem machine with separate carriages, with single system

knitting of the stitches with two colours;

- table 2 describes the steps necessary for knitting, according to the invention, seven following ranks of stitches on a tandem flat bed knitting machine with linked carriages, with single system for each rank of stitches with two colours;
- figure 2 shows an elevational front view of a flat bed knitting machine of known type with double carriage used for carrying out the method according to the invention;
- figures 3A, 3B, 3C show three successive steps of the method according to the invention for knitting a collar in single colour with a band with two colours;
- figures 4A, 4B, 4C, and 4D show four possible embodiments for carrying out a quick exchange from knitting with linked carriages to separate carriages in the machine of figure 2 for carrying out the steps of figures 3A-3C;
- figure 5 shows a flow-sheet of the program means for arranging the knitting of the portions with single and with double colour.

Description of a preferred embodiment

[0019] With reference to figure 1, a knitted article 1, for example a collar, has a band of stitches with double colour 2, for example comprising a fancy pattern, an inscription, etc., obtained alternating ranks of stitches knitted with a first colour yarn and ranks of stitches with a second yarn, with either the technique having independent needles (Jacquard) or with the technique having needles not independent.

[0020] The collar 1 has furthermore two portions 3 and 4 knitted with a same yarn of a single colour.

[0021] As already outlined in the introduction, for a collar of this type, when knitting the band with double colour 2 a loss of efficiency arises owing to two inactive strokes every six strokes of one carriage with single system (table 1). This loss arises both when a flat bed knitting machine has a single carriage, and when the machine has double carriage and knits two distinct articles with separate carriages, for doubling the production rate and exploiting better the length of the machine for small articles, such as collars .

[0022] With reference to figure 2, a flat bed knitting machine 10 according to the prior art is capable of knitting two collars 1a and 1b using two carriages 11a and 11b moving on double needle bed 12 dragged integral to each other by a belt 13, shown only diagrammatically. In figure 2 are shown, furthermore, yarn guides 14 slidable on rails 15, yarn stretchers 16 mounted on a frame 17, and yarn feeding spools 18 mounted on a support 19.

[0023] According to the present invention, the machine of figure 2 can operate as shown in figures 3A, 3B, 3C, and outlined in table 2, for reducing the inefficiencies when knitting the portions with double colour.

[0024] In a first step, figure 3A, carriages 11a and 11b

are arranged distanced for knitting separately the single colour portions 3a, 3b, with single system like in a known tandem machine. The strokes of carriages 11a and 11b are set according to the size of the collars and are given by the alternate movement of belt 13. The end of the strokes can be seen by the extreme position of carriages 11a and 11b shown respectively with a continuous line and with a dotted line.

[0025] Then, with reference to figure 3B, for knitting the portions 2a and 2b with double colour, according to the invention carriages 11a and 11b are linked quickly and automatically so that the first carriage 11a knits a rank of stitches with a yarn guide 14 of a first colour and carriage 11b knits a rank of stitches with a yarn guide 14 of a second colour. Carriages 11a and 11b when coupled have a stroke about double with respect to the case of figure 3A, as shown by the extreme positions of carriages 11a and 11b indicated respectively with a continuous line and with a dotted line.

[0026] As described in table 2, when carriages 11a and 11b are coupled there are not inactive strokes, because the linked carriages carry out together a double system knitting, each with a different colour.

[0027] At the end of knitting portions 2a and 2b with double colour, carriages 11a and 11b are separated again, quickly and automatically, for knitting portions 4a and 4b with single colour, as shown in figure 3C.

[0028] Obviously, for articles with many bands with double colour alternate to portions with single colour, in particular collars, the steps of figures 3B and 3C are repeated without any trouble. It is also clear that the bands with double colour can be at the beginning or at the end of the article, and in this case the knitting step with linked carriages is carried out at the beginning or at the end of knitting.

[0029] The union and the separation, quick and automatic, of carriages 11a and 11b can be arranged in different alternative ways, four of which are outlined in figures 4A-4D.

[0030] With reference to figure 4A, when carriage 11b is at the extreme dead centre position at the right of the machine, it is released automatically from belt 13, by loosening a clamp 20, for example electromechanical or pneumatic. Then, belt 13 brings carriage 11a near to carriage 11b, which is independent from belt 13 and then it remains still. At this location the fastening by clamp 20 occurs, whereby belt 13 can move without any delay in the left stroke for knitting with double colour shown in figure 3B. The opposite step is possible at the end of knitting with two colours, since at the extreme dead centre position clamp 20 releases carriage 11b and belt 13 brings carriage 11a appropriately distanced for starting the knitting with one colour with separate carriages. Then the fastening for the step of figure 3C is carried out.

[0031] A way alternative to that of figure 4A is shown in figure 4B, wherein carriages 11a and 11b are connected to each other by means of a piston cylinder 21, or other known linear actuator. In this case a quick release

clamp is not necessary, since carriage 11a can be also supported by belt 13 but sliding on it, or supported by carriage 11b by means of cylinder piston 21, or by a support not shown.

[0032] A further embodiment provides two parallel belts 13a and 13b, shown in the top plan view of figure 4C. One of the belts, 13a, is driven directly by a motor 22, used normally for moving the carriages. Belt 13b, instead, is brought into movement by a clutch 23, which can be released for approaching/distancing the carriages from each other in the steps as above described.

[0033] Finally, another embodiment shown in figure 4D provides that belt 13 is toothed and a motor 24, for example a step motor, brakes carriage 11a and drives the relative movement with respect to carriage 11b for approaching/distancing it at the dead centre position.

[0034] Further embodiments may be used to provide the quick approaching/distancing of carriages 11a and 11b.

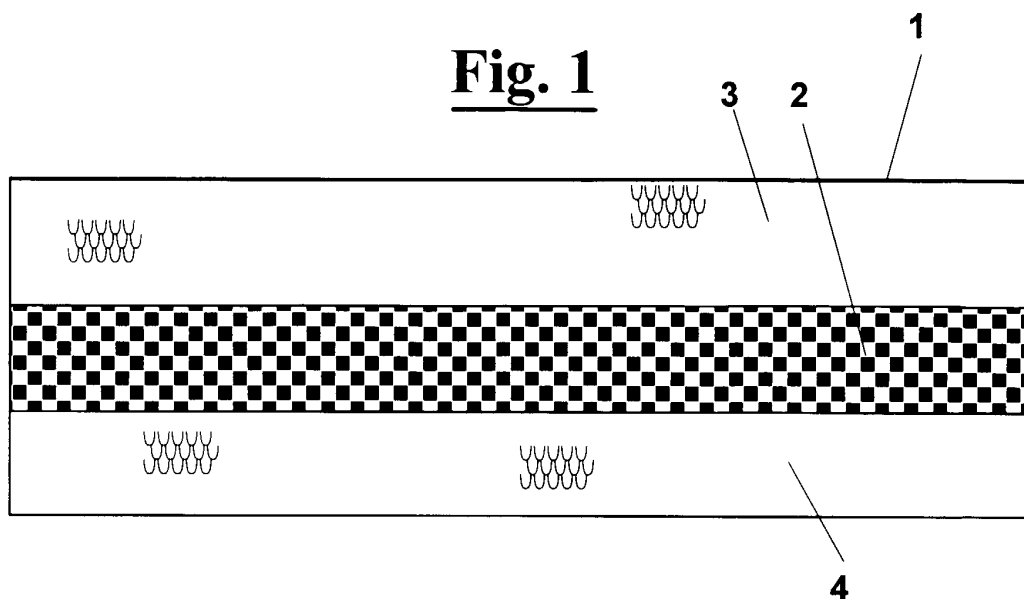
[0035] The foregoing description of specific embodiments will so fully reveal the invention according to the conceptual point of view, so that others, by applying current knowledge, will be able to modify and/or adapt for various applications such embodiments without further research and without parting from the invention, and it is therefore to be understood that such adaptations and modifications will have to be considered as equivalent to the specific embodiments. The means and the materials to realise the different functions described herein could have a different nature without, for this reason, departing from the field of the invention. It is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

Claims

1. A method of production of knitted collars and the like having at least a portion with single colour (3a, 3b, 4a, 4b) and at least a band with double colour (2a, 2b) of yarn, by means of a flat bed knitting machine (10) with at least two carriages (11a, 11b) and single system that move along needle beds (12), **characterised in that** it comprises the steps of:

- knitting with a yarn of single colour (3a, 3b) a first article (1a) by means of a first carriage (11a) and of a second article (1b) by means of a second carriage (11b), said first and second carriage (11a, 11b) being distanced from each other with respect to said needle beds (12) and dragged integrally to each other along said needle beds (12), each carriage (11a, 11b) having a stroke that involves a single article (1a, 1b) ;
- at the end of knitting a portion (3a, 3b) of said first and second article (1a, 1b) with single colour yarn, quick and automatic approaching of

- said first and second carriage (11a,11b) to each other;
- continuation of knitting (2a,2b) of said first and second article (1a,1b) with a first system of a yarn of a first colour by means of said first carriage (11a) and with a second system of a yarn of a second colour by means of said second carriage (11b), the coupled carriages (11a,11b) having a stroke that involves both said articles (1a,1b) ;
 - at the end of knitting a portion (2a,2b) of said articles with said first and second colour and coupled carriages, automatic separation of said coupled first and second carriage (11a,11b) ;
 - knitting a further portion (4a,4b) of said articles with a yarn of single colour and separate carriages (11a,11b).
2. Method according to claim 1, wherein, in the case of articles (1a,1b) having several portions with single colour yarn (3a,3b,4a,4b) alternate to portions with double colour yarn (2a,2b), the repetition in succession is provided of the alternate steps of knitting further portions of said articles respectively by said first and second colour yarn with coupled carriages and by single colour yarn with separate carriages up to the end of said articles (1a,1b).
3. Method according to claim 1, wherein, in the case of articles (1a,1b) that begin or end with a portion with double colour (2a,2b), a starting or final step is provided with coupled carriages (11a,11b) and double system with the yarns of two different colours.
4. Flat bed knitting machine with at least two carriages (11a,11b) and single system that move along needle beds (12), comprising:
- means for dragging (13) a first and a second carriage (11b) integrally to one another;
 - means for adjusting the distance between said first and second carriage (11a,11b) from an approached position to a distanced position of a predetermined amount;
 - **characterised in that** it comprises:
 - program means for operating said means for adjusting the distance at the end of a knitting step with single colour (3a,3b,4a,4b) with distanced carriages by approaching said carriages, and for operating said means for adjusting the distance at the end of a knitting step with double colour (2a,2b) with linked carriages for distancing said carriages (11a,11b), said program means selecting for each of said carriages when distanced a yarn of single colour and when approached a yarn of different colour.
5. Flat bed knitting machine according to claim 4,
- wherein said means for adjusting the distance comprise means (20) for clamping selectively said first and/or said second carriage (11b) to said dragging means (13).
6. Flat bed knitting machine according to claim 4, wherein said means for adjusting the distance comprise a linear actuator (21) for linking said first and second carriage (11a,11b) to each other.
7. Flat bed knitting machine according to claim 4, wherein said means for adjusting the distance comprise first driven dragging means (13a) connected to said first carriage (11a) and second dragging means (13a) connected to said second carriage (11b), said second dragging means (13a) being fastened/unfastened selectively to said first dragging means (13a).
8. Flat bed knitting machine according to claim 4, wherein said means for adjusting the distance comprise motor means (24) integral to said first carriage (11a) that engage with said dragging means (13), whereby said motor means (24) can move said first carriage (11a) with respect to said second carriage (11b) along said dragging means (13).

Fig. 1**Tab. 1****(PRIOR ART)**

Ranks	Carriage Direction	Yarn guides position		Comment
1°	→	1	2 →	Yarn guide 2 stroke
2°	←	1	2	Inactive stroke
3°	→	1 →	2	Yarn guide 1 stroke
4°	←		← 2 1	Yarn guide 2 stroke
5°	→			Inactive stroke
6°	←	2	← 1	Yarn guide 1 stroke
7°	→	1 2 →		

Tab. 2

Ranks	Carriage Direction	Yarn guides position		Comment
1°	→	1 → 2 →		Yarn guide 1 and 2 stroke
2°	←		← 2 ← 1	Yarn guide 1 and 2 stroke
3°	→	1 → 2 →		Yarn guide 1 and 2 stroke
4°	←		← 2 ← 1	Yarn guide 1 and 2 stroke
5°	→	1 → 2 →		Yarn guide 1 and 2 stroke
6°	←		← 2 ← 1	Yarn guide 1 and 2 stroke
7°	→	1 → 2 →		

Fig. 2
(prior art)

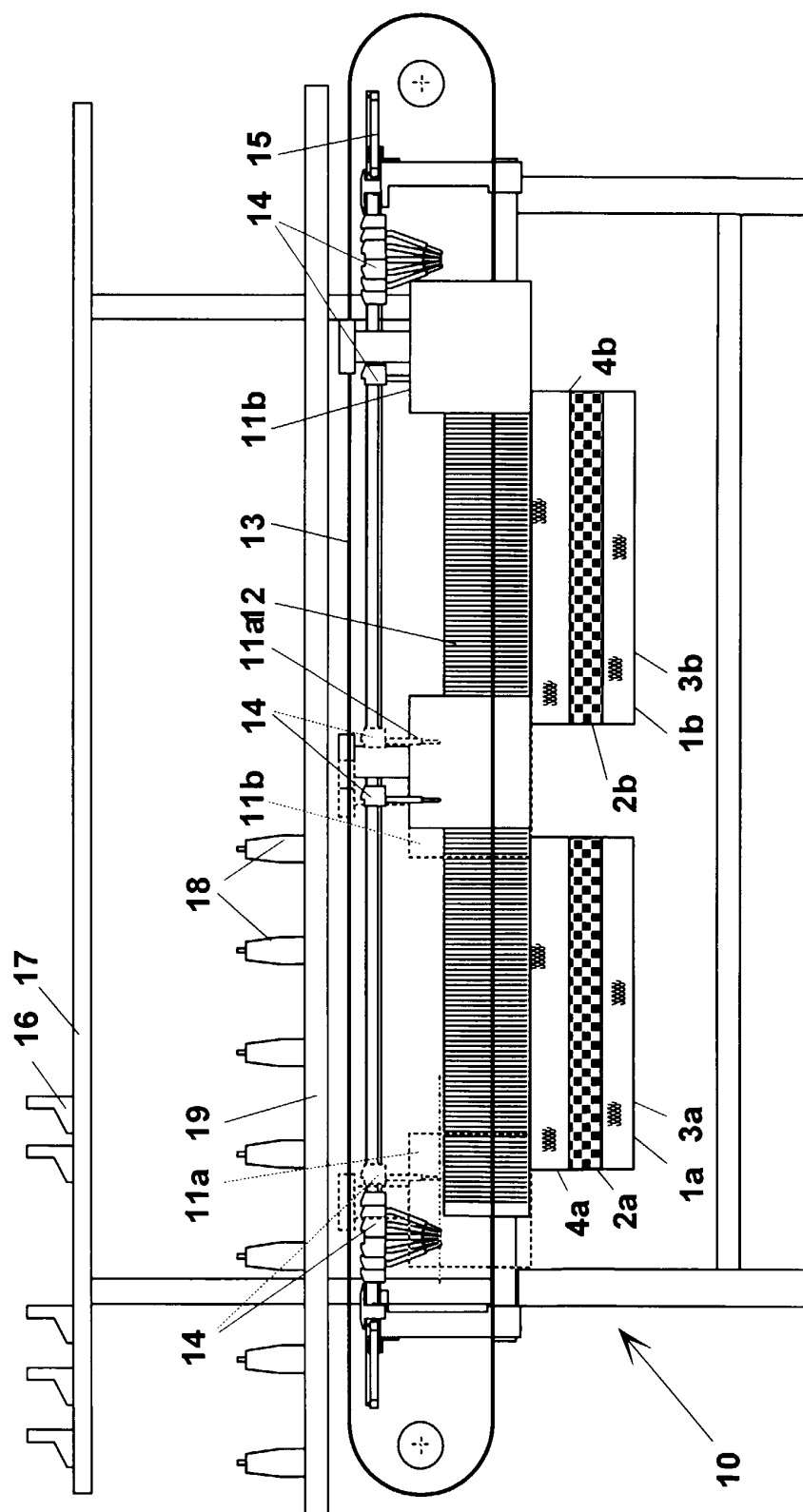


Fig. 3A

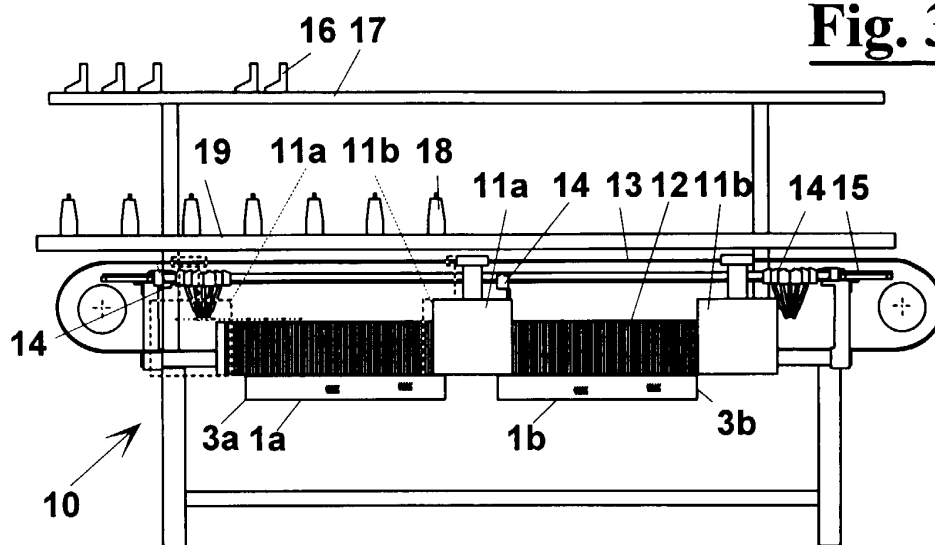


Fig. 3B

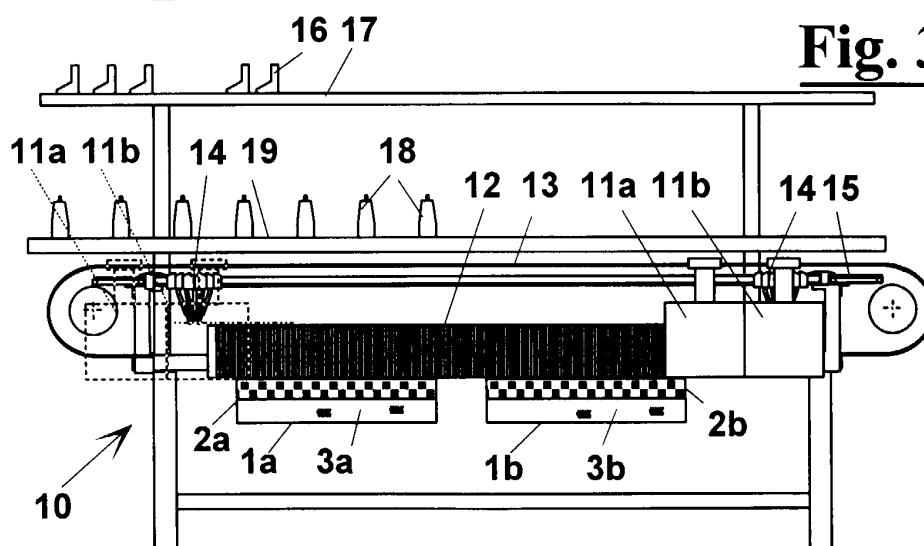
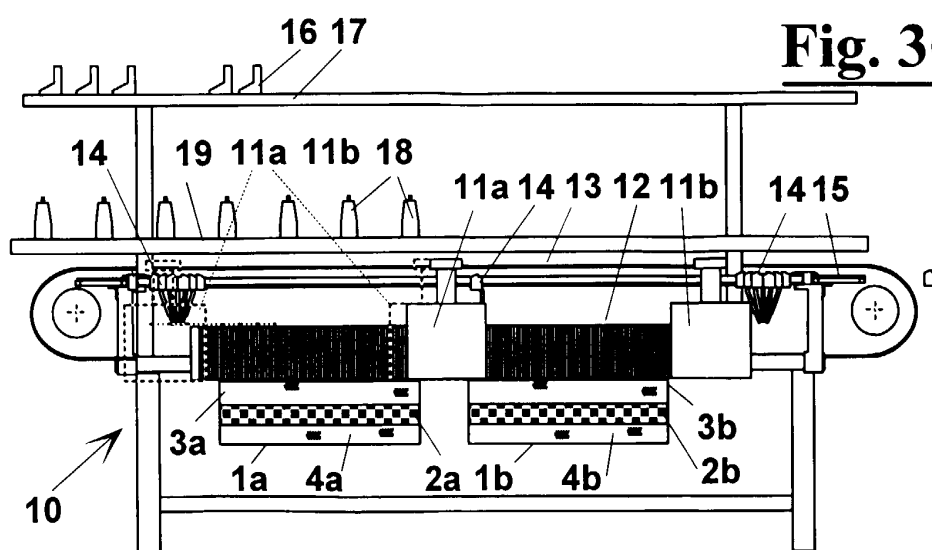


Fig. 3C



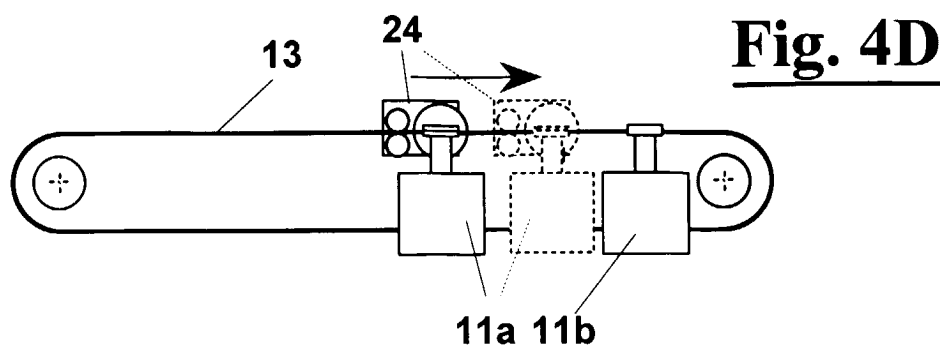
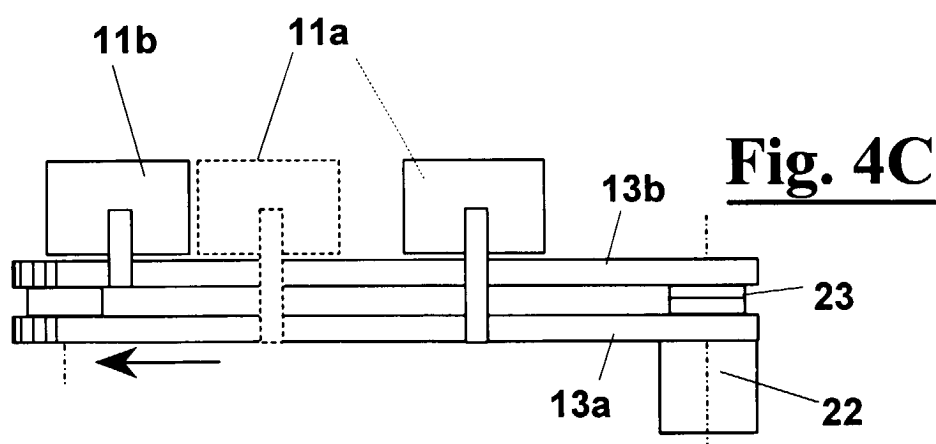
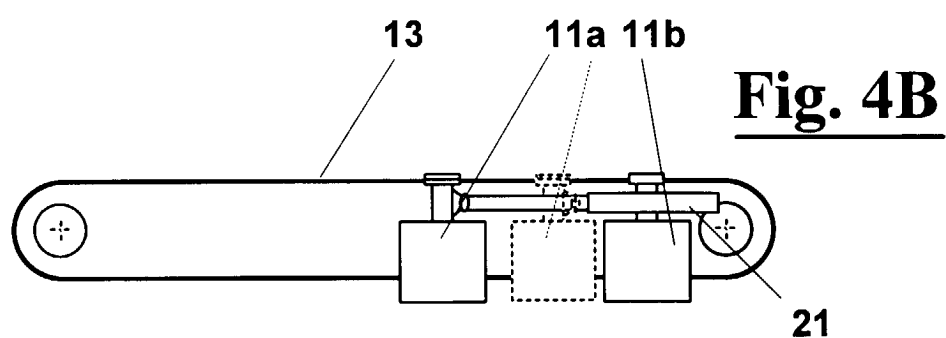
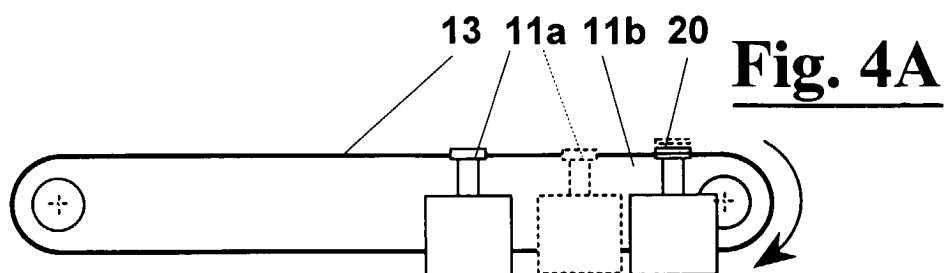
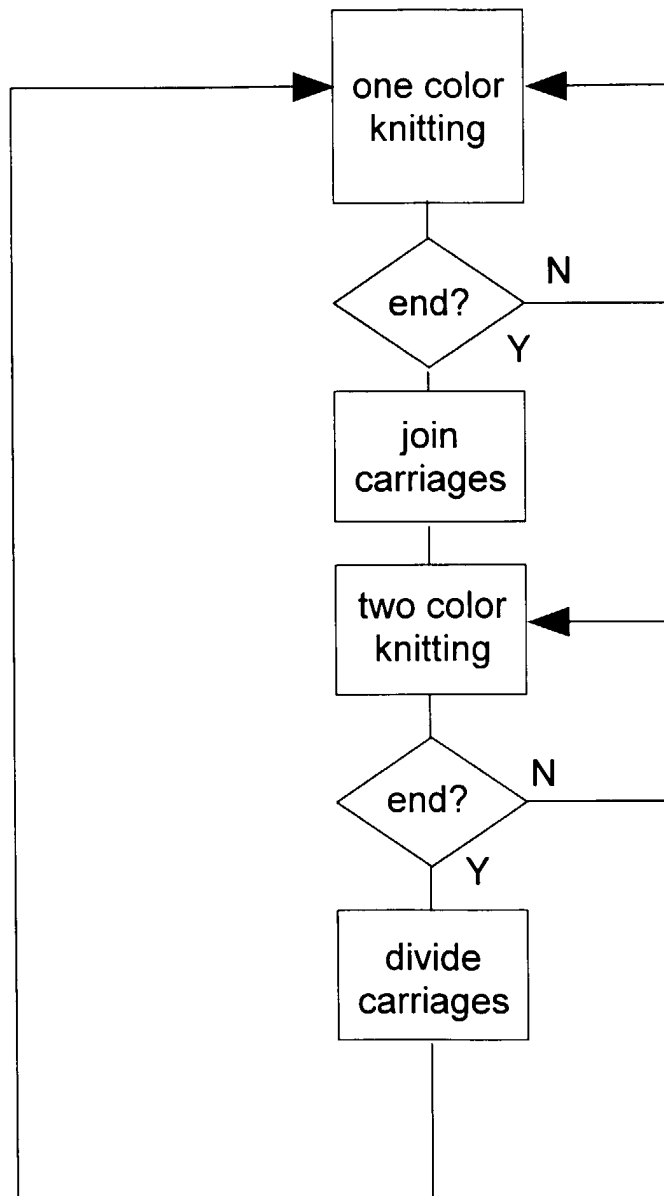


Fig. 5





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 83 0338

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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 11 November 1999	Examiner Van Gelder, P
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