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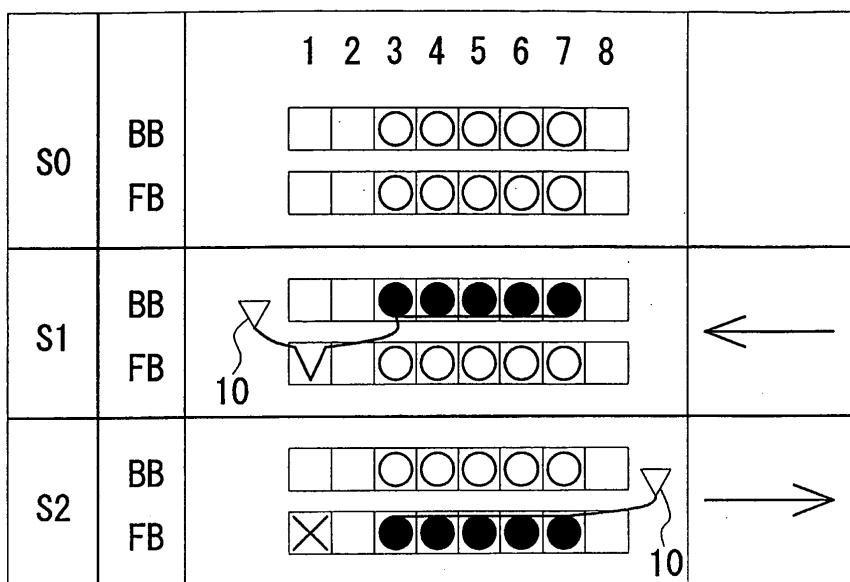
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(54) Plating knitting method

(57) A plating knitting method, in knitting a tubular knitted fabric using a plating carrier, capable of stabilizing intersection locations between a main yarn and a plating yarn at predetermined locations of the tubular knitted fabric in a knitting width direction. First, plating carrier 10 is moved in one of longitudinal directions (leftward on a sheet of a drawing) of a needle bed, one side knitted fabric part is knitted on one needle bed (BB) and then, a hooked loop is formed at a knitting needle (knitting needle

on FB) located on an outer side, in a knitting width direction, than a knitting needle to which a terminal end stitch of the one side knitted fabric part is held. Next, the plating carrier by which the hooked loop is formed is inverted, the plating carrier is moved to the other longitudinal direction (rightward on a sheet of a drawing) of the needle bed, the hooked loop is released from the knitting needle and in this state, the other side knitted fabric part is knitted on the other needle bed (FB).

Fig. 1



**Description****TECHNICAL FIELD**

**[0001]** The present invention relates to a plating knitting method for knitting tubular knitted fabric by feeding yarns to a plurality of knitting needles provided on a needle bed of a flat knitting machine from a plating carrier which simultaneously feeds a main yarn and a plating yarn.

**BACKGROUND ART**

**[0002]** In some cases, plating knitting is carried out using a flat knitting machine having at least a pair of front and back needle beds. The plating knitting is a knitting method in which a main yarn and a plating yarn are fed to a knitting needle of the flat knitting machine to knit a tubular knitted fabric such that, the main yarn is located on a front side and the plating yarn on a back side, respectively, of the tubular knitted fabric to be completed. As the main yarn and the plating yarn, knitting yarns having different characteristics, e.g., knitting yarns having different colors, shapes and elasticity are usually used.

**[0003]** To carry out the plating knitting, there are mainly two methods. According to the first method, a carriage of the flat knitting machine is made to entrain two carriers, preceding one of the carriers is made to feed a main yarn, and the other following carrier is made to feed a plating yarn (e.g., refer to Patent Document 1). The following carrier is called a plating carrier and it has a recess, into which a carrier catching pin of the carriage is fitted when the carrier is entrained by the carriage, different from that of the normal preceding carrier. According to the second method, a carriage of the flat knitting machine entrains one carrier (this carrier is also called a plating carrier) having two yarn feeders, and the carrier feeds a main yarn and a plating yarn (e.g., refer to Patent Document 2). As the plating carrier having the two yarn feeders, there are a rotary type plating carrier (see Fig. 15 of Patent Document 2), and a non-rotary type plating carrier (see Fig. 14 of Patent Document 2).

**[0004]** Fig. 4 is a schematic diagram showing a lower end surface of a non-rotary type plating carrier 10 as viewed from below. The lower end surface of the plating carrier 10 is provided with a substantially circular yarn feeder 11 which feeds a main yarn 11A, and a long-hole yarn feeder 12 which surrounds a half circumference of the yarn feeder 11 and which feeds a plating yarn 12A. In Fig. 4, the yarn feeder 11 is disposed on the side of a back needle bed (BB, hereinafter), and the yarn feeder 12 is disposed on the side of a front needle bed (FB, hereinafter). If the plating carrier 10 is used, the main yarn 11A can be a preceding knitting yarn irrespective of which direction (lateral direction of a sheet of the drawing) along a longitudinal direction of the needle bed the plating carrier 10 is moved as shown in Fig. 4(A) and (B).

**PRIOR ART DOCUMENTS****PATENT DOCUMENTS****5 [0005]**

[Patent Document 1] PCT International Publication No. 2008/139710

[Patent Document 2] Japanese Patent No. 3899269

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**DISCLOSURE OF THE INVENTION****PROBLEMS TO BE SOLVED BY THE INVENTION**

**15 [0006]** When a tubular knitted fabric is knitted using the plating carrier, the main yarn and the plating yarn intersect each other at one of ends in a knitting width direction which is an inverting position of the carrier, and the intersecting state between the main yarn and the plating yarn is reflected in the tubular knitted fabric. For example, when the plating carrier 10 is moved leftward on the sheet of the drawing and a back side knitted fabric part is knitted on the BB as shown in Fig. 5 (A) and then the plating carrier 10 is moved rightward on the sheet of the drawing and a front side knitted fabric part is knitted on the FB as shown in Fig. 5(B), the main yarn 11A and the plating yarn 12A intersect each other. However, a position of an intersection location 13, where the main yarn 11A and the plating yarn 12A intersect, is deviated toward the FB or BB depending upon a knitting course and is not stable. For this reason, according to the conventional tubular knitted fabric using the plating carrier, there is an adverse possibility that intersection locations of the main yarn and the plating yarn in each knitting course vary in a knitting width direction of the tubular knitted fabric as shown in a partial enlarged photograph in Fig. 6. This problem also occurs when two carriers are used or a rotary type plating carrier is used.

**40 [0007]** The present invention has been accomplished in view of the above circumstances, and it is an object of the present invention to provide a plating knitting method of a tubular knitted fabric using a plating carrier, capable of stabilizing locations where a main yarn and a plating yarn intersect each other at predetermined locations in a knitting width direction of the tubular knitted fabric.

**MEANS FOR SOLVING THE PROBLEMS**

**50 [0008]** The present invention concerns a plating knitting method, using a flat knitting machine having at least a pair of front and back needle beds, for feeding a main yarn and a plating yarn to a plurality of knitting needles provided on the needle beds to knit a tubular knitted fabric such that the main yarn is located on a front side and the plating yarn on a back side, respectively, of the tubular knitted fabric to be completed. According to the plating knitting method of the present invention, when one side knitted fabric part of the tubular knitted fabric is knitted

on one of the needle beds toward one of longitudinal directions of the needle bed and then a knitting direction thereof is inverted and the other side knitted fabric part of the tubular knitted fabric is knitted on the other needle bed, if the main yarn and the plating yarn intersect each other, the knitting is carried out in the following manner. After the one side knitted fabric part is knitted and before the knitting direction is inverted, a hooked loop is formed at the knitting needle located on an outer side, in a knitting width direction, than the knitting needle to which a terminal end stitch of the one side knitted fabric part is held. After the knitting direction is inverted, the hooked loop is released from the knitting needle and in this state, the other side knitted fabric part is knitted.

**[0009]** As the tubular knitted fabric in the plating knitting method of the present invention, a tubular knitted fabric which is knitted by a complete circling-knitting is included of course, and knitted fabric having an opening which is knitted by a C-shaped return-knitting is also included.

**[0010]** As one aspect of the plating knitting method of the present invention, it is preferable that the hooked loop is formed at the knitting needle which is separated in the knitting width direction by 1 to 5 knitting needles from the knitting needle to which the terminal end stitch of the one side knitted fabric part is held.

**[0011]** As one aspect of the plating knitting method of the present invention, it is preferable that the hooked loop is formed at the knitting needle on the other needle bed.

**[0012]** As one aspect of the plating knitting method of the present invention, the plating yarn which is fed to the knitting needle together with the main yarn may be an elastic yarn.

#### EFFECTS OF THE INVENTION

**[0013]** As shown in the plating knitting method of the present invention, after the one side knitted fabric part is knitted on a side where the main yarn and the plating yarn intersect each other, a hooked loop is formed before the other side knitted fabric part is knitted, and the hooked loop is released from the knitting needle immediately before a start end stitch of the other side knitted fabric part is formed. According to this, the intersection between the main yarn and the plating yarn can reliably be completed between the terminal end stitch of the one side knitted fabric part and the start end stitch of the other side knitted fabric part. As a result, in a completed tubular knitted fabric, positions where the main yarn and the plating yarn intersect each other can concentrate at predetermined positions in the knitting width direction, and a tubular knitted fabric having excellent visual quality can be knitted.

**[0014]** Here, the hooked loop in the plating knitting method of the present invention is released from the knitting needle before the other side knitted fabric part is knitted. Therefore, in a completed tubular knitted fabric, the hooked loop becomes a knitting yarn which connects the terminal end stitch of the one side knitted fabric part

and the start end stitch of the other knitted fabric part. Therefore, if a position of the knitting needle which forms the hooked loop is excessively separated away from the terminal end stitch of the one side knitted fabric part, the knitting yarn which connects the terminal end stitch of the one side knitted fabric part and the start end stitch of the other knitted fabric part becomes too long, and there is an adverse possibility that visual quality of a completed tubular knitted fabric is deteriorated. In contrast, if the position of the knitting needle at which the hooked loop is formed is within 5 knitting needles from the knitting needle to which the terminal end stitch of the one side knitted fabric part is held, it is possible to avoid a case where the knitting yarn which connects the terminal end stitch and the start end stitch becomes too long.

**[0015]** The needle bed with which the hooked loop is formed in the plating knitting method of the present invention may be the one needle bed which knits the one side knitted fabric part or may be the other needle bed which knits the other side knitted fabric part, but if the hooked loop is formed with other needle bed, it is easy to stabilize the positions where the main yarn and the plating yarn intersect each other in a completed tubular knitted fabric on predetermined positions in the knitting width direction.

**[0016]** If an elastic yarn is used as the plating yarn in the plating knitting method of the present invention, it is possible to knit a stretchable tubular knitted fabric.

#### 30 BRIEF DESCRIPTION OF THE DRAWINGS

#### **[0017]**

Fig. 1 is a knitting step diagram of plating knitting according to an embodiment;

Fig. 2 is a schematic diagram showing a state of a main yarn and a plating yarn on an actual needle bed corresponding to the knitting step diagram in Fig. 1, wherein (S1) and (S2) in Fig. 2 match with the knitting steps (S1) and (S2) in Fig. 1;

Fig. 3 is a partial enlarged photograph of knitted fabric which is knitted by plating knitting according to the embodiment;

Fig. 4 is a schematic diagram showing a lower end surface of a typical plating carrier, wherein (A) shows a yarn feeding state of a main yarn and a plating yarn when the carrier moves leftward on a sheet of the drawing, and (B) shows a yarn feeding state of the main yarn and the plating yarn when the carrier moves rightward on the sheet of the drawing;

Fig. 5 is a schematic diagram of states of the main yarn and the plating yarn on an actual needle bed when conventional plating knitting is carried out, wherein (A) shows a state where a plating carrier is moved leftward on the sheet of the drawing and knitting is carried out by a knitting needle on the BB, and (B) shows a state where the carrier is moved rightward on the sheet of the drawing and knitting is car-

ried out by a knitting needle on the FB after the knitting shown in (A) is carried out; and

Fig. 6 is a partial enlarged photograph of knitted fabric which is knitted by conventional plating knitting.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

**[0018]** An embodiment of the present invention will be described below with reference to the drawings. In the embodiment, there is described a plating knitting method to knit a tubular knitted fabric by feeding a normal knitting yarn as a main yarn and an elastic yarn as a plating yarn from a plating carrier 10 shown in Fig. 4, using a two-bed flat knitting machine having a pair of front and back needle beds extending in a lateral direction and disposed opposed to each other in a cross direction. The flat knitting machine to be used may be a four-bed flat knitting machine of course.

**[0019]** Fig. 1 is a knitting step diagram of plating knitting, (S + number) in a left column indicates a knitting step number, V and "1 to 8" in a middle column respectively indicate a plating carrier and a position of a knitting needle of a needle bed, and an arrow in a right column shows a moving direction of the plating carrier. In Fig. 1, O indicates a stitch which is held by the knitting needle, • indicates a stitch to be newly formed, V indicates a hooked loop, and X indicates a knitting needle from which a hooked loop is released. Fig. 2 is a schematic diagram showing a state of a main yarn and a plating yarn on a needle bed corresponding to the knitting steps shown in Fig. 1.

**[0020]** In Fig. 1, S0 shows a state where a set-up portion of a tubular knitted fabric is formed by knitting needles 3 to 7 on the FB and the BB. From this state, circling-knitting is carried out in a counterclockwise direction using the plating carrier 10. At that time, as shown with S1 in Figs. 1 and 2, the plating carrier 10 is moved leftward on the sheets of the drawings, a main yarn 11A and a plating yarn 12A are fed to the knitting needles 7 to 3 on the BB to knit the back side knitted fabric part (one side knitted fabric part) and then, a hooked loop is formed by the knitting needle 1 on the FB. Next, as shown with S2 in Figs. 1 and 2, the plating carrier 10 is inverted to move rightward on the sheets of the drawings, the hooked loop formed by the knitting needle 1 on the FB in S1 is released from the knitting needle 1, the main yarn 11A and the plating yarn 12A are fed to the knitting needles 3 to 7 on the FB to knit the front side knitted fabric part (the other side knitted fabric part).

**[0021]** If S1 and S2 described above are carried out, as shown in Fig. 2, when the plating carrier 10 is inverted and the main yarn 11A and the plating yarn 12A intersect each other, the intersection can stably be completed between a terminal end stitch of the back side knitted fabric part (stitch which is held by the knitting needle 3 on the BB) and a start end stitch of the front side knitted fabric part (stitch which is held by the knitting needle 3 on the

FB). As a result, if S1 and S2 are repeated to knit the tubular knitted fabric, it is possible to concentrate the intersection locations 13 between the main yarn and the plating yarn at predetermined positions of a completed tubular knitted fabric in the knitting width direction, i.e.,

5 at positions between the terminal end stitch of the back side knitted fabric part and the start end stitch of the front side knitted fabric part. From Fig. 3 which is the partial enlarged photograph of an actually knitted tubular knitted fabric, it can be found that the intersection locations of knitting courses stably appear at predetermined positions of the tubular knitted fabric in the knitting width direction. If the tubular knitted fabric obtained by the plating knitting method of the present invention shown in Fig. 3 10 and a tubular knitted fabric obtained by the conventional plating knitting method shown in Fig. 6 are compared with each other, it is apparent that the tubular knitted fabric in Fig. 3 looks much better.

15 20 <Modification>

**[0022]** The plating knitting method of the present invention is characterized in that the hooked loop which is released later is formed outside of the tubular knitted fabric in the knitting width direction, but a location where the hooked loop is formed is not especially limited. For example, the hooked loop may be formed at the knitting needle 2 on the FB or at the knitting needle 1 or 2 on the BB shown in Figs. 1 and 2. Of the four positions where 25 the hooked loop can be formed, a position where the intersection location in the tubular knitted fabric is most stable is a position of the knitting needle 1 on the FB shown in the embodiment, and a next stable position is a position of the knitting needle 2 on the FB. When the 30 hooked loop is formed at the knitting needles 1 and 2 on the BB, a special difference in stability of the intersection location can not be recognized. Even if the hooked loop is formed on the BB, the intersection location can be more stabilized than that of the conventional plating knitting 35 method of course.

**[0023]** The present invention is not limited to the above-described embodiment, and the embodiment of the present invention can appropriately be changed within a scope not departing from the subject matter of the 40 present invention. For example, the plating knitting of the present invention can also be applied to plating knitting using a rotary type plating carrier and plating knitting using two carriers.

#### 50 DESCRIPTION OF SYMBOLS

##### **[0024]**

FB	front needle bed
BB	back needle bed
1 to 8	knitting needle

10	plating carrier	
11, 12	yarn feeder	
11A	main yarn	5
12A	plating yarn	
13	intersection location	

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### Claims

1. A plating knitting method, using a flat knitting machine having at least a pair of front and back needle beds, for feeding a main yarn and a plating yarn to a plurality of knitting needles provided on the needle beds to knit a tubular knitted fabric such that the main yarn is located on a front side and the plating yarn on a back side, respectively, of the tubular knitted fabric to be completed, wherein  
when one side knitted fabric part of the tubular knitted fabric is knitted on one of the needle beds toward one of longitudinal directions of the needle bed and then a knitting direction thereof is inverted and the other side knitted fabric part of the tubular knitted fabric is knitted on the other needle bed, in a case where the main yarn and the plating yarn intersect each other,  
after the one side knitted fabric part is knitted and before the knitting direction is inverted, a hooked loop is formed at the knitting needle located on an outer side, in a knitting width direction, than the knitting needle to which a terminal end stitch of the one side knitted fabric part is held, and  
after the knitting direction is inverted, the hooked loop is released from the knitting needle and in this state, the other side knitted fabric part is knitted. 15  
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2. The plating knitting method according to claim 1, wherein the hooked loop is formed at the knitting needle which is separated in the knitting width direction by 1 to 5 needles from the knitting needle to which the terminal end stitch of the one side knitted fabric part is held. 40  
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3. The plating knitting method according to claim 1 or 2, wherein  
the hooked loop is formed at the knitting needle on the other needle bed. 50
4. The plating knitting method according to any one of claims 1 to 3, wherein  
the plating yarn is an elastic yarn. 55

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Fig. 1

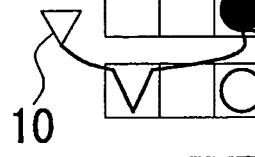
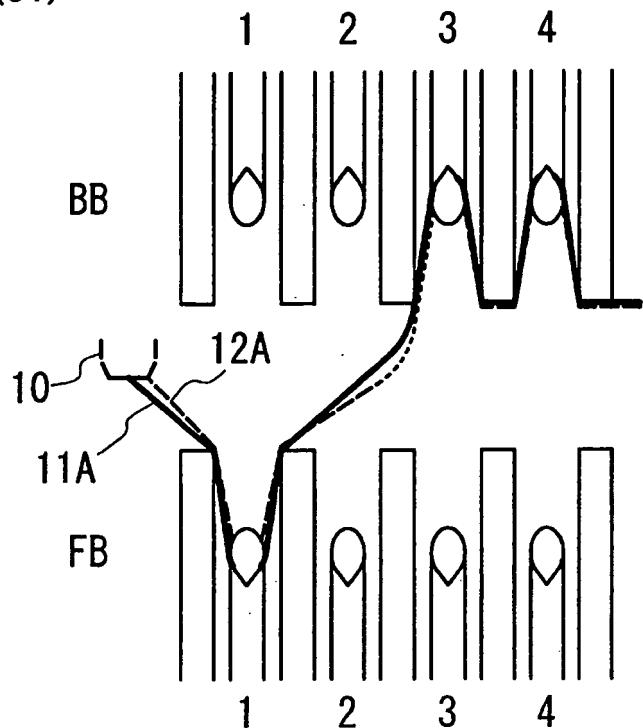
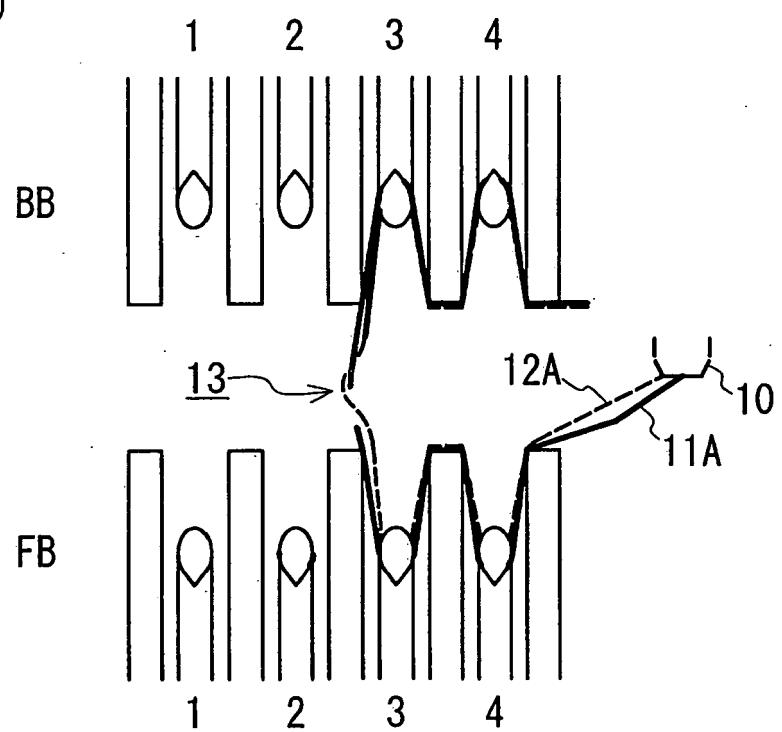
		1 2 3 4 5 6 7 8									
S0	BB	<table border="1"><tr><td></td><td></td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td></tr></table>			○	○	○	○	○		
		○	○	○	○	○					
S0	FB	<table border="1"><tr><td></td><td></td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td></tr></table>			○	○	○	○	○		
		○	○	○	○	○					
S1	BB	<table border="1"><tr><td></td><td></td><td>●</td><td>●</td><td>●</td><td>●</td><td>●</td><td></td></tr></table>			●	●	●	●	●		
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S1	FB	<table border="1"><tr><td>10</td><td>V</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td></tr></table>	10	V	○	○	○	○	○		
10	V	○	○	○	○	○					
S2	BB	<table border="1"><tr><td></td><td></td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td></tr></table>			○	○	○	○	○		
		○	○	○	○	○					
S2	FB	<table border="1"><tr><td>10</td><td>×</td><td>●</td><td>●</td><td>●</td><td>●</td><td>●</td><td></td></tr></table>	10	×	●	●	●	●	●		
10	×	●	●	●	●	●					

Fig. 2

(S1)



(S2)



**Fig. 3**

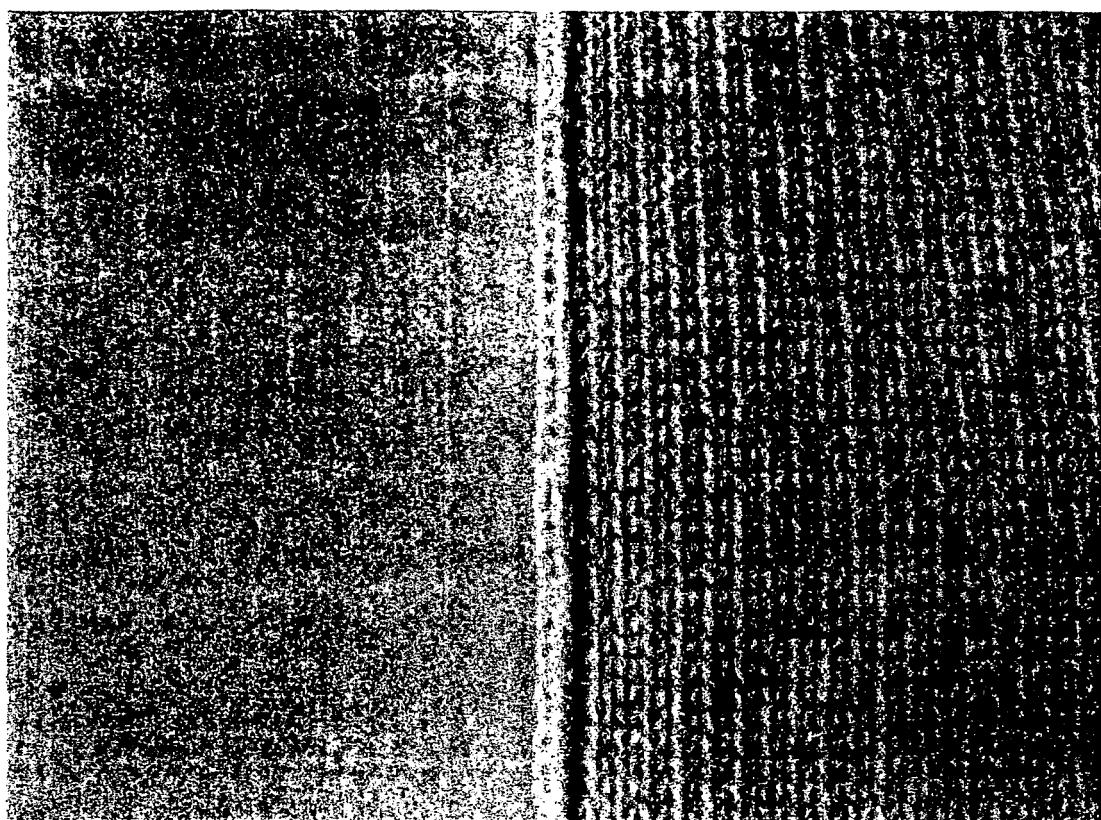
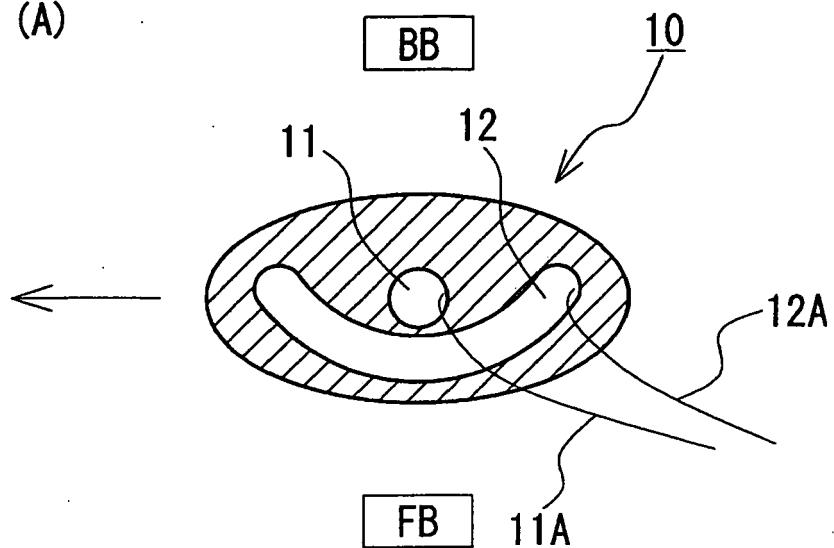


Fig. 4

(A)



(B)

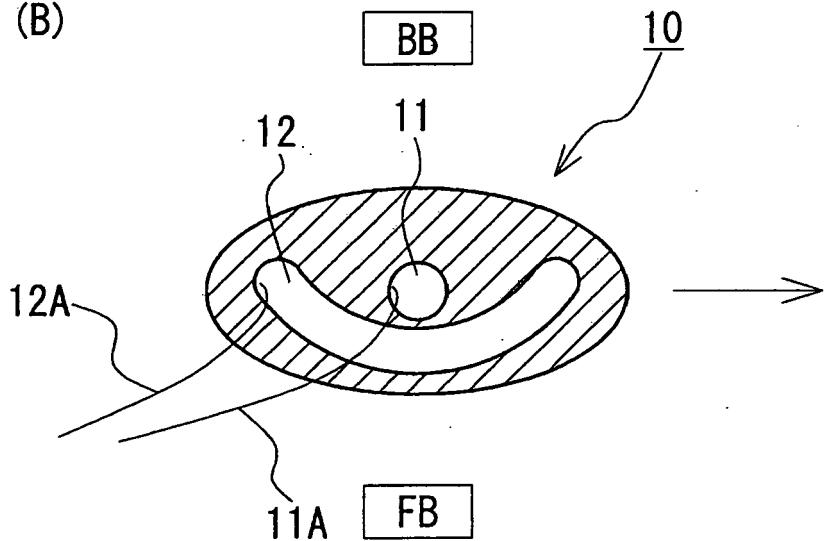
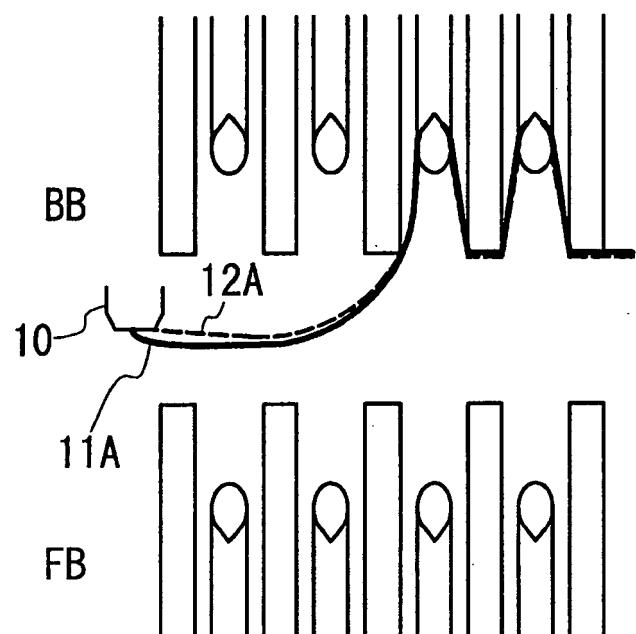


Fig. 5

(A)



(B)

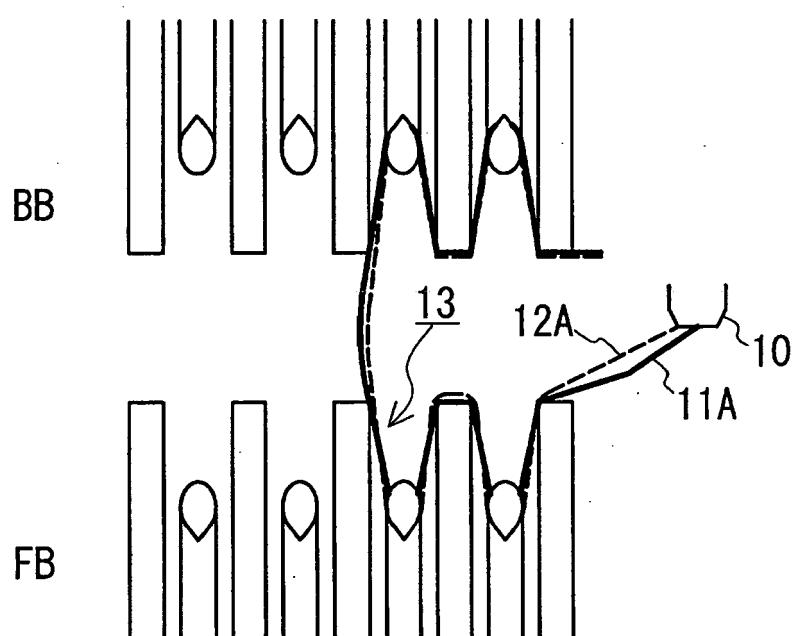
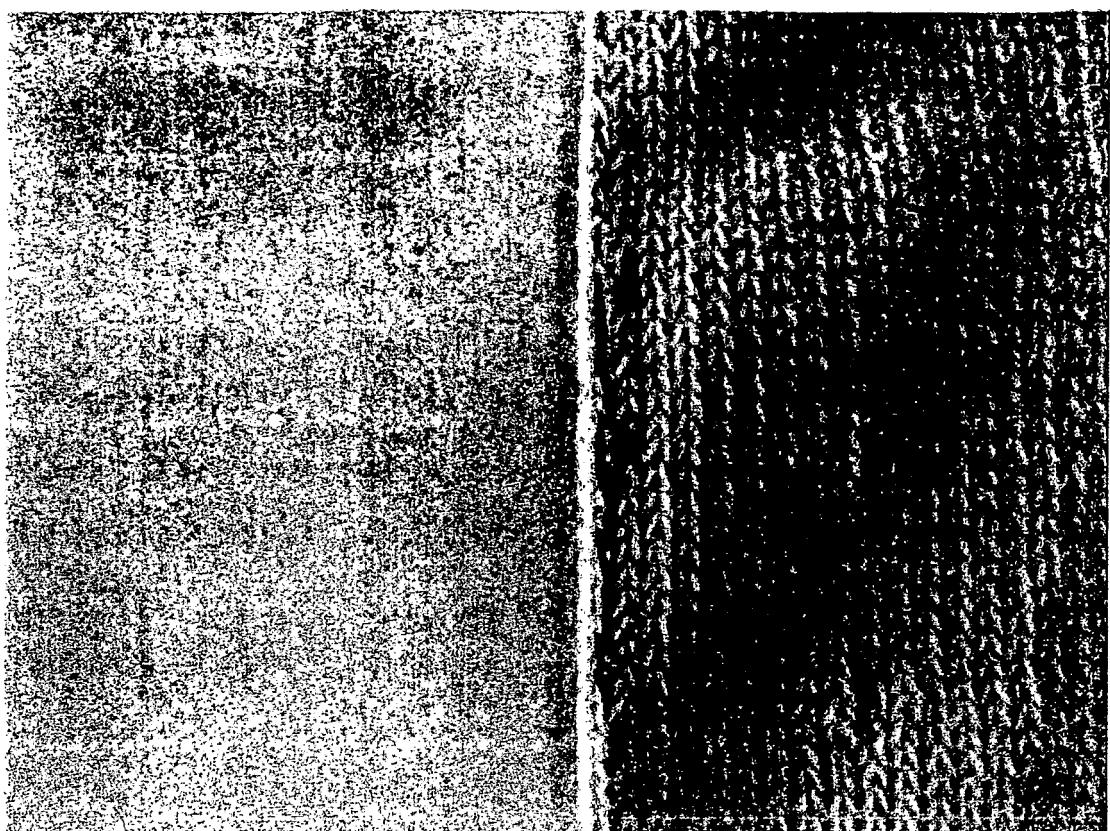


Fig. 6





## EUROPEAN SEARCH REPORT

Application Number  
EP 11 00 0862

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (IPC)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	WO 2008/139710 A1 (SHIMA SEIKI MFG [JP]; YUI MANABU [JP]) 20 November 2008 (2008-11-20) * abstract * & EP 2 157 221 A1 (SHIMA SEIKI MFG [JP]) 24 February 2010 (2010-02-24) * paragraph [0023] - paragraph [0036]; figures 1-7 * ----- A EP 1 918 438 A1 (STOLL H GMBH & CO KG [DE]) 7 May 2008 (2008-05-07) * paragraph [0001] - paragraph [0012] * ----- A EP 1 728 908 A1 (SHIMA SEIKI MFG [JP]) 6 December 2006 (2006-12-06) * paragraph [0001] - paragraph [0008]; figures 1-3 * -----	1-4	INV. D04B1/22
			TECHNICAL FIELDS SEARCHED (IPC)
			D04B
The present search report has been drawn up for all claims			
1	Place of search Munich	Date of completion of the search 19 May 2011	Examiner Zirkler, Stefanie
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document	
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			

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ON EUROPEAN PATENT APPLICATION NO.

EP 11 00 0862

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19-05-2011

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**REFERENCES CITED IN THE DESCRIPTION**

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