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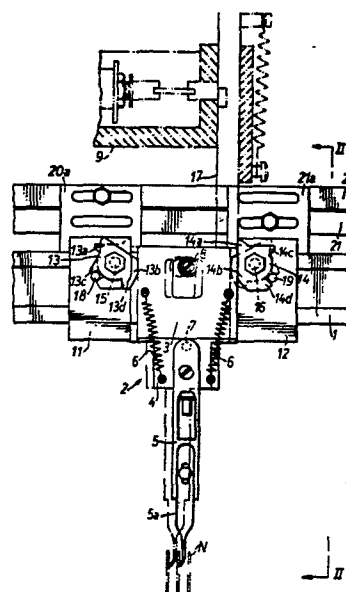
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⑤④ **A warp yarn feeding device for a flat knitting machine.**

⑤⑦ A flat knitting machine including a warp yarn feeding device characterised in that the warp yarn feeding device comprises a yarn guide (2) mounted on a rail (1) to be slidable in two directions, a pair of brake blocks or stop means (11, 12) disposed on either side of said yarn guide (2) with respect to the sliding of said yarn guide, with each of said stop means (11, 12) being symmetrically mounted and each having a yarn guide push-back member (13, 14) and an actuating rod (17) for the yarn guide supported on a carriage (9) and displaceable so as in operation to alternately displace said yarn guide push-back members (13, 14) during the reciprocating movement of said carriage (9) to thereby cause said yarn guide (2) to be pushed back in the direction opposite to that of advance of the carriage to feed the warp yarn guided by said yarn guide (2) to a knitting needle.



A warp yarn feeding device
for a flat knitting machine

The present invention relates to a warp yarn feeding device for flat knitting machines and such machines including the yarn feeding devices.

5 Conventionally, in a step of knitting a chain-like warp in a knitted material such as in the case of an Argyle pattern, ground yarn and warp yarn are passed through the same knitting needle, and the yarn which is positioned on the inner side of a needle hook
10 comes out on the reverse side of the knitted material, and, when seen from the surface side, results in a condition wherein the yarn is sunken in the knitted material, and accordingly, such a knitting process always had the disadvantage that the warp yarn which
15 must be knitted so as to appear substantially linear on the surface of the knitted material came out in a dotted line - thus failing to produce the required beautiful knitted fabrics.

20 The present invention is directed to removal of the disadvantage of the kind described and to the provision of a warp yarn feeding device for a flat knitting machine capable of positively causing the warp yarn to come out on the surface of the knitted
25 material.

 The invention achieves its aims by providing a flat knitting machine including ^{a warp} yarn feeding devices characterised in that ^{the warp} each yarn feeding device
30 comprises a ^{warp} yarn guide, is mounted on a rail to be slidable in two directions, a pair of brake blocks

or stop means are disposed on either side of said yarn guide with respect to the sliding of said yarn guide, with each of said stop means being symmetrically mounted and each having a yarn guide push-back member and an actuating rod for the yarn guide supported on a carriage and displaceable so as in operation to alternately displace said yarn guides push-back members during the reciprocating movement of said carriage to thereby cause said yarn guide to be pushed-back in the direction opposite to that of advance of the carriage to feed the ^{warp} yarn guided by said yarn guide to a knitting needle.

The invention will be described further, by way of example with reference to the accompanying drawings, in which:-

Fig. 1 is a fragmentary elevational view of a yarn feeding device and should be referred to when mention is made of right and left hand positions;

Fig. 2 is a section taken along the line II-II of Fig. 1; and

Figs. 3 to 6 illustrate the relationship between the knitting needle, ground yarn and pattern yarn during the knitting operation;

A fragmentary detail of a flat knitting machine is shown in the drawings, wherein a corner rod or rail 1 is located extending transversely across and above a needle bed (not shown); A yarn guide generally designated as 2 includes a slider 3 slidably mounted on one side of the rail 1, a lifting or

elevating plate 4 displaceably mounted on the slider 3 to be displaceable upwardly and downwardly and a yarn guide member 5a attached to the lower end of the plate 4 by means of yarn guide rod 5. The elevating plate 4 is lifted and biased by a compression spring 6 so as to keep the lower end of the yarn guide member 5a in a position in which it does not hinder advance and retraction of a knitting needle N. A stop member 7 is provided for determining the upper limit position of the elevating plate 4. A cam follower 8 is attached to the front, upper end of the elevating plate 4 and extends through a rectangular aperture in slider 3; Stop or arresting blocks 11 and 12 are slidably mounted on the rail 1 on the left and right hand sides of the slider 3, (when viewed in Fig. 1) and the distance between these blocks 11 and 12 is made wide enough to permit the warp yarn guide 2 to travel to the left and right by one needle with respect to a needle row. The numerals 13 and 14 designate a pair of yarn guide push-back members located on either side of slider 3 and rotatably supported respectively by shafts 15, 16 on the upper part of the front side of each block 11, 12; said push-back members being symmetrically mounted. Two catch pawl portions 13a and 14a are provided on the respective upper parts of the push-back members 13 and 14 and face the line of travel of yarn guide actuating rod 17 provided on carriage 9. Push-back portions 13b and 14b are provided on the respective sides of the slider actuating members 13, 14 facing to the slider 3; and portions 13c, 13d, and 14c, 14d are projections for controlling the angle of rotation and are provided on the opposite sides respectively; said projections being associated and co-operating with stops 18 and 19.

Movable rods 20 and 21 are located parallel to the rail 1 and the blocks 11 and 12 are securely connected to the rods and are adapted to travel along the rail 1 in accordance with the movement of the rods 20, 21. Connection pieces 20a and 21a are provided for connecting the movable rods 20, 21 to the blocks 11, 12 respectively.

The numeral 22 designates ^aan identical ground yarn guide slidably mounted on the opposite side of the rail 1 and guides ground yarn C for producing a ground fabric by a yarn guide member 23 disposed at the lower end of the guide to a latch knitting needle N.

In operation, the carriage 9 advancing from left to right as viewed in Fig. 1 takes the ground yarn guide 22 rightward by another yarn guide actuating rod 17 provided on the carriage, and the yarn guide member 23 of the guide 22 feeds the ground yarn C which the member 23 is guiding to a needle row. Subsequently, when the carriage 9 approaches the position of the warp yarn guide 2, actuating rod 17 for the yarn guide means pushes back the catch pawl portion 13a of the yarn guide push-back member 13 of the left block 11 and rotates the member 13 to the right. The rod 17 is then guided to the inclined surface of the member 13, clears the surface, passes over the upper surface of the slider 3, and presses against the catch pawl portion 14a of the yarn guide push-back member 14 on the right hand side. The push-back member 14 is then rotated clockwise at a predetermined angle about the shaft 16, and the push-back portion 14b pushes-back the rightwardly biased slider ³2 to the left, namely in the direction opposite to that in which the carriage 9 has advanced.

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Thereby, the yarn guide $\frac{1}{2}$ is moved to the left by one needle with respect to the needle row, and guides the warp yarn D, which the guide 3 is guiding, to a specified knitting needle N in racking position. In this state, knitting of the warp yarn D together with ground yarn is carried out by a knitting cam (not shown) in the carriage 9.

When the carriage 9 travels to the left (Fig. 1) opposite portions of the above-mentioned members operate to carry out knitting in the same manner.

A description will now be given of the relationship between the knitting needle N, ground yarn C and warp yarn D with reference to Figs. 4 to 6.

Ground yarn C loosely abuts against the knitting needle N and warp yarn D is brought under tension by the action of a yarn guide push-back member 14 or 15 with the result that the warp yarn D abuts strongly against the needle N. The warp yarn D is positioned above the ground yarn C (the inner side of needle hook).

The needle N is moved back into a needle bed B and a loop is formed with the state of the warp yarn D and ground yarn C being as they are. Thereafter, when the needle N is moved upward, the loop already formed is disengaged from the released latch of the needle N and moves to the upper surface of the needle N. Subsequently, the warp yarn D and ground yarn C are again fed to the hook of the needle N in the same manner as described above, the needle N is moved back into the needle bed B. When the needle N is moved back into the needle bed B, the loop already formed passes over the upper side of the closed latch and is

disengaged from the needle N. At this time, because the upper side of the closed latch is sharply inclined, the warp yarn D, racked and abutting strongly against the needle N, is pulled and is moved slightly downwardly together with the retreating needle N, and passes through the inside of ground yarn C whilst on the other hand, the ground yarn C, because it only abuts loosely against the needle N, is caused to move relatively to the upper side of the warp yarn D from outside of the warp yarn D moving slightly downward.

Thus, the warp yarn D comes out positively on the surface of the knitted material formed mainly by the ground yarn with the warp yarn D being reversed in position.

In the embodiment, the left- and right-hand stop blocks 11 and 12 are constructed such that they are moved to the left and right along the rail 1 by the travel of movable rods 20, 21 and the warp yarn guide 2 between the blocks 11, 12 is also moved to the left and right therewith, but it is not always necessary that the guide 2 have to be moved bilaterally. Namely, if the guide 2 is so designed as to move during knitting, inclined or zigzag patterns are formed and as long as the guide 2 is not moved by way of movable rods 20, 21, a longitudinal linear pattern is formed.

As described, since the machine of the invention is constructed such that a warp yarn guide is bilaterally slidably mounted on the rail, a pair of stop means are disposed on either side with respect to the

sliding of the warp yarn guide, a pair of yarn push-back members are secured symmetrically on either side to the stop means, and the yarn guide actuating rod included on the carriage kicks and moves the yarn
5 guide push-back member alternately to thereby push back the yarn guide in the direction opposite to that in which the carriage advances and to feed the warp yarn guided by the yarn guide to the knitting needle, the invention is effective in that the warp yarn is
10 racked and presses strongly against the needle, thus making it possible for the warp yarn to come out positively on the surface of a knitted fabric and providing a clear pattern in the knitted fabric.

15 Furthermore, since the yarn feeding device itself is simple in structure, it is of advantage that the device may be produced at low cost and sold at low price.

Claims:

1. A flat knitting machine including ^{a warp} yarn feeding devices characterised in that ^{the warp} each yarn feeding device comprises a ^{warp} yarn guide (2) ~~or 22~~, mounted on a rail (1) to be slidable in two directions, a pair of brake blocks or stop means (11, 12) disposed on either side of said yarn guide (2) ~~or 22~~ with respect to the sliding of said yarn guide, with each of said stop means (11, 12) being symmetrically mounted and each having a yarn guide push-back member (13, 14) and an actuating rod (17) for the yarn guide supported on a carriage (9) and displaceable so as in operation to alternately displace said yarn guide push-back members (13, 14) during the reciprocating movement of said carriage (9), to thereby cause said yarn guide (2) ~~or 22~~ to be pushed back in the direction opposite to that of advance of the carriage to feed ^{warp} the yarn guided by said yarn guide (2) to a knitting needle.
2. A machine as claimed in claim 1, characterised in that the push-back members comprise two catch pawl members (13, 14) rotatably mounted on said stop means (11, 12).
3. A machine as claimed in claim 2, characterised in that a stop pin (18, 19) is provided on each stop means (11, 12) to limit the angle of rotation of said pawl members (13, 14).
4. A machine as claimed in any of claims 1 to 3, characterised in that stop means (11, 12) are separately and adjustably mounted on two rods (20, 21) which rods are separately displaceable and extend parallel to the rail (1).

5. A machine as claimed in any of claims 1 to 4, characterised in that the yarn guide member (5a) and yarn guide rod (5) are mounted on a lifting plate (4) spring biased (6) upwardly and displaceable by a cam follower (8) located thereon.

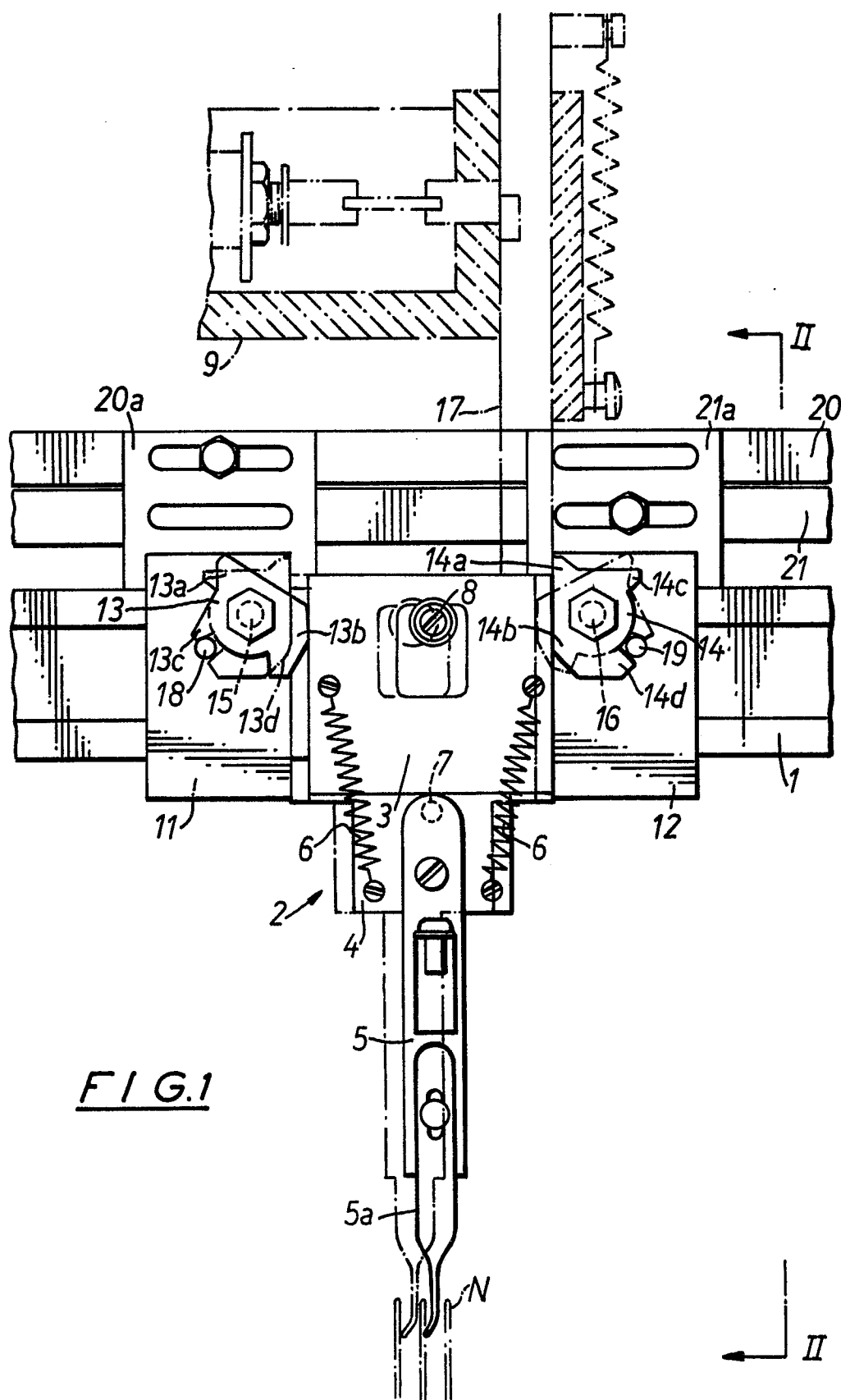
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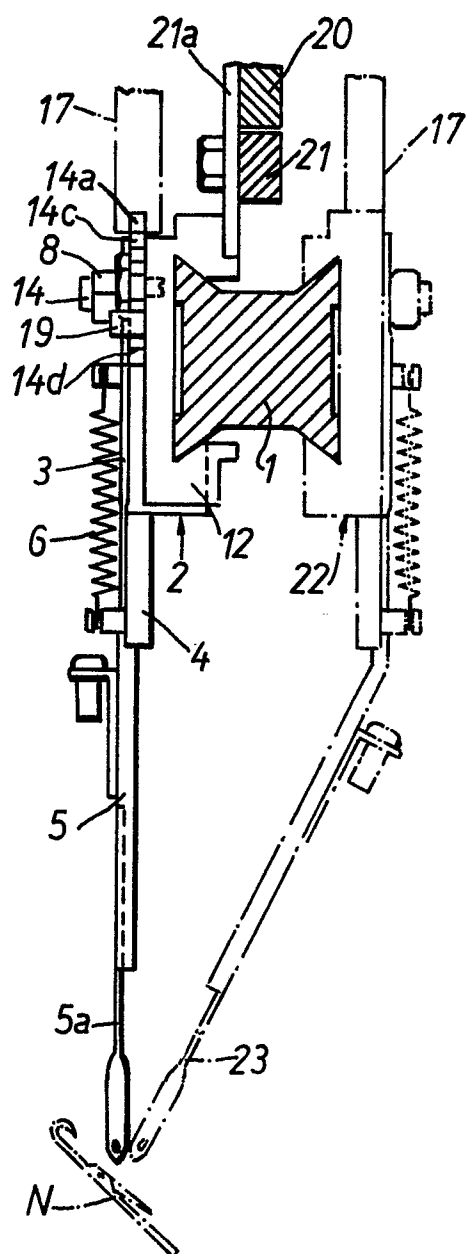
6. A machine as claimed in claim 1, characterised in that the warp yarn guide and ground yarn guides are ~~identical and~~ mounted on opposite sides of the same rail (1).

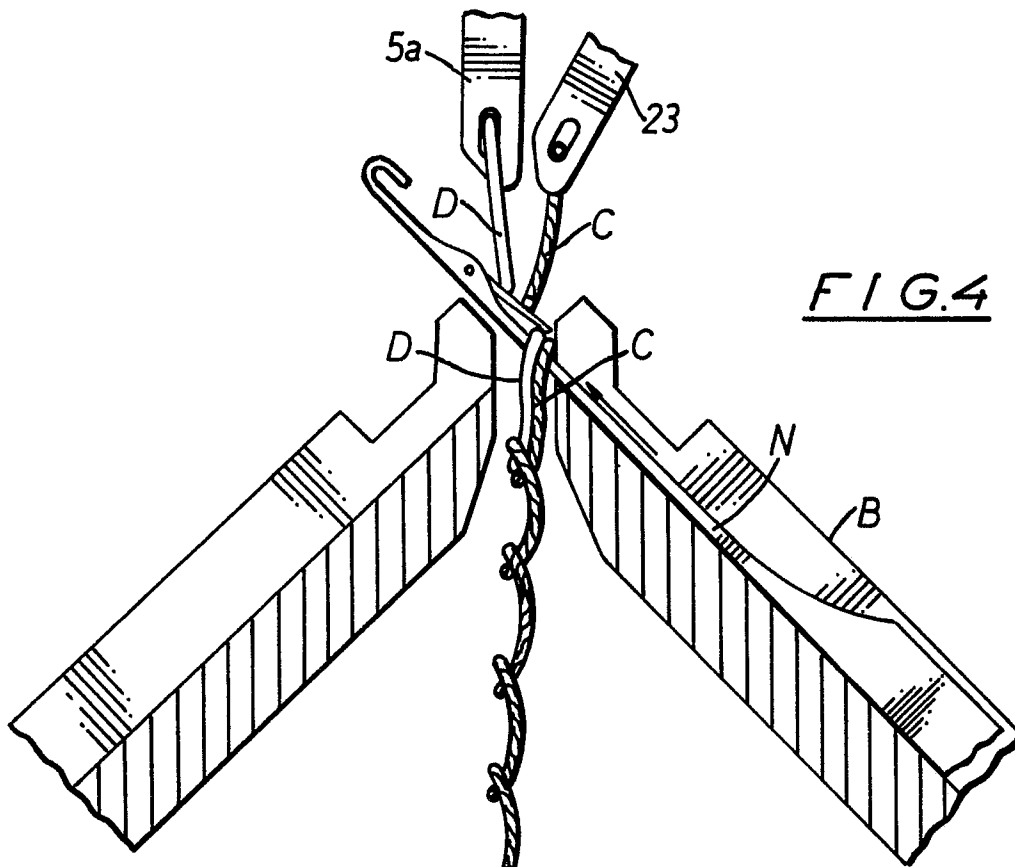
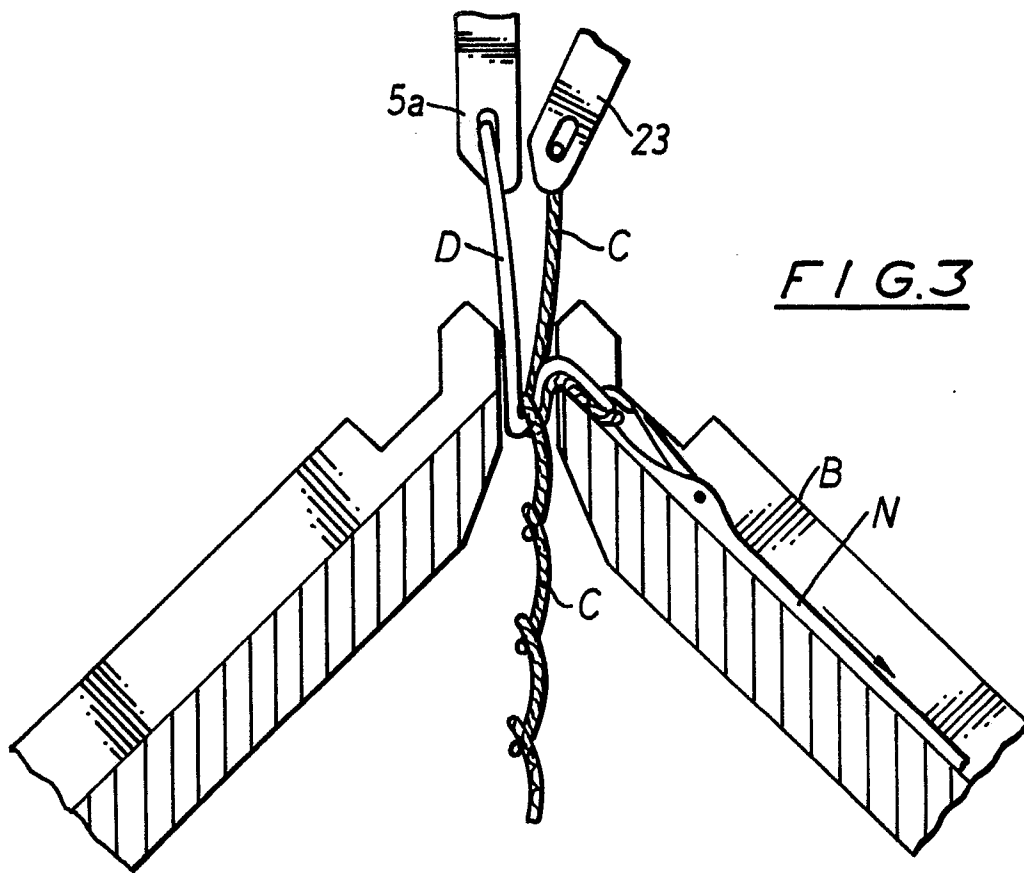
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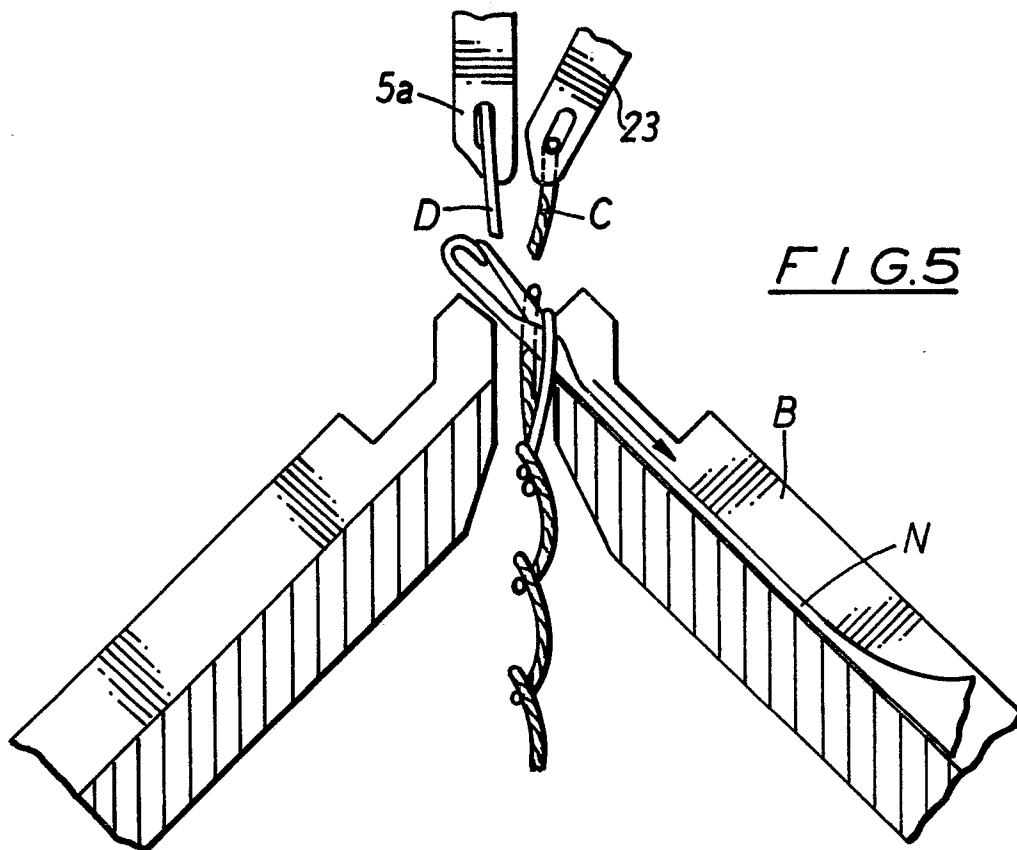
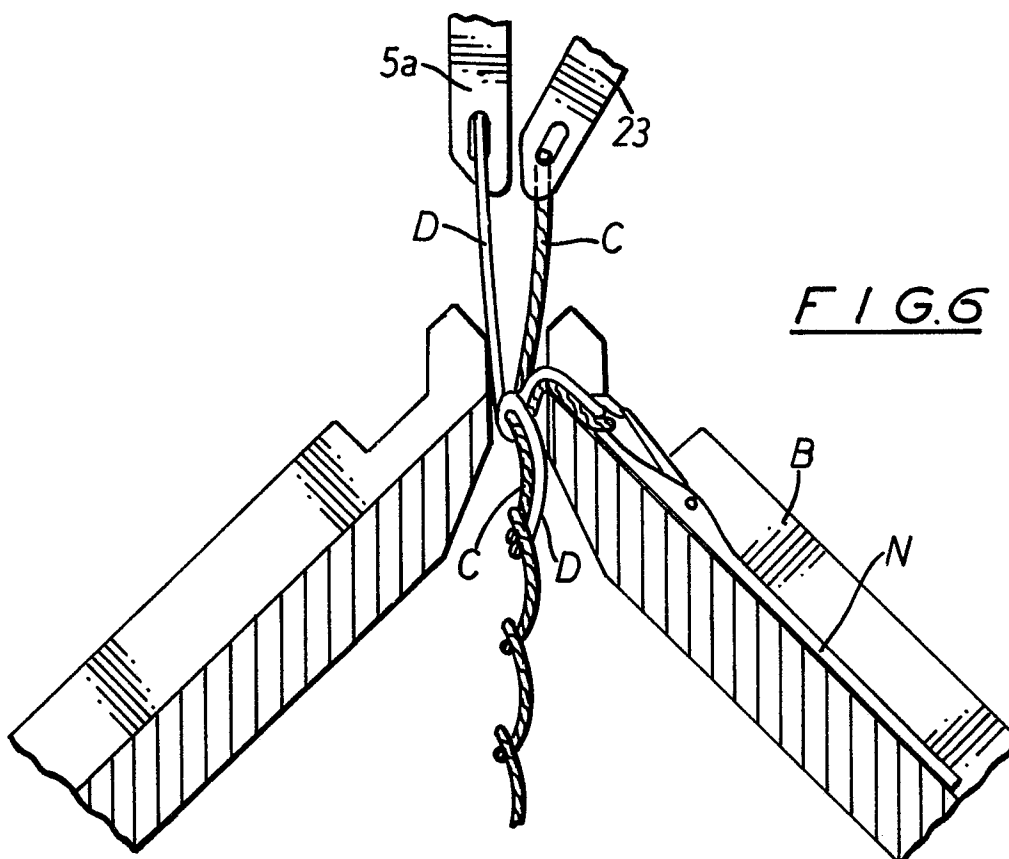
7. A method of knitting substantially as herein described with reference to and as illustrated in the accompanying drawings.

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FIG. 2



FIG. 5FIG. 6



European Patent
Office

EUROPEAN SEARCH REPORT

0055015
Application number

EP 81 30 5123

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	DE - C - 149 352 (GROSCHOPP) * page 2, lines 32-111; figures 1-7 *	1	D 04 B 39/04
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A	FR - A - 2 316 363 (NOMINEE)		
A	US - A - 3 348 389 (PLATNICK)		
A	DE - C - 239 342 (WIELAND)		

			TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
			D 04 B
			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 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
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
The Hague	01-04-1982	VAN GELDER	