Jan. 22, 1952 F. G. WEISBECKER 2,583,453

KNITTING MACHINE ATTACHMENT

Filed April 19, 1950 3 Sheets-Sheet 1

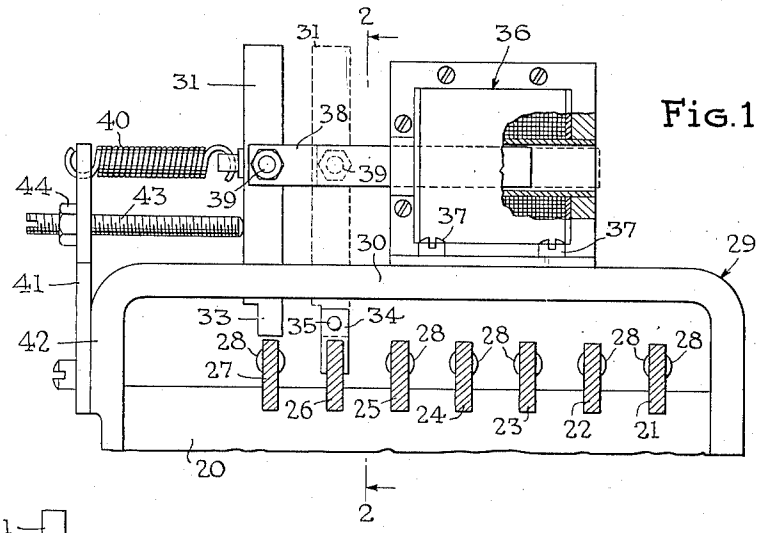


Fig.1

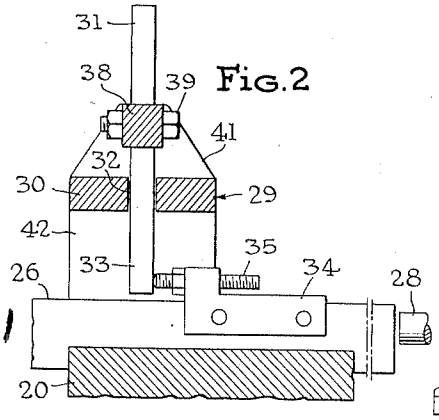
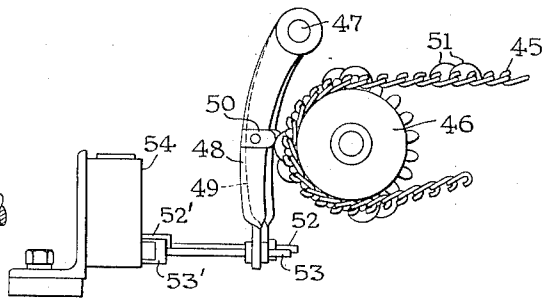


Fig.2

Fig.3



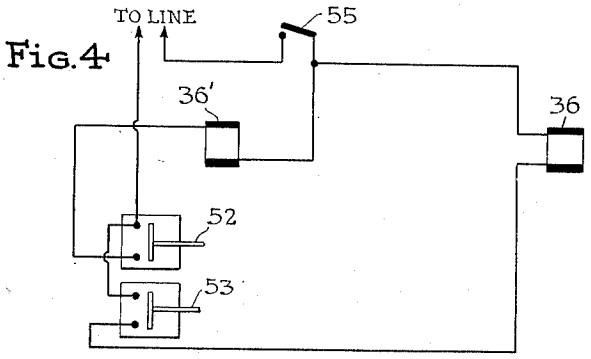


Fig.4

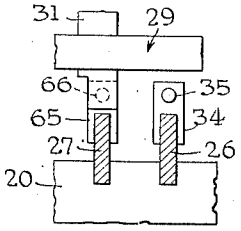


Fig.5

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KNITTING MACHINE ATTACHMENT

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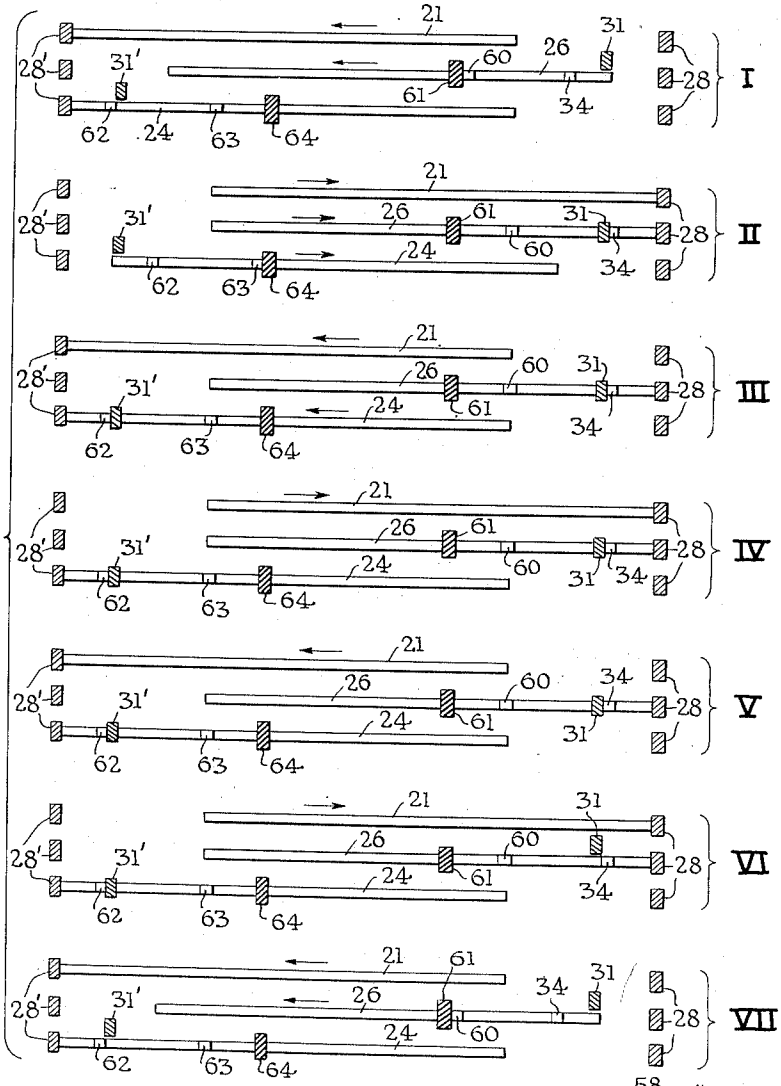


Fig.8

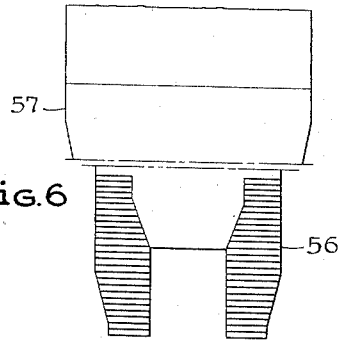


Fig.6

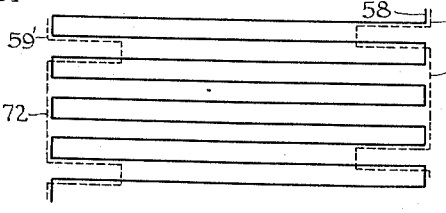


Fig.7

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KNITTING MACHINE ATTACHMENT

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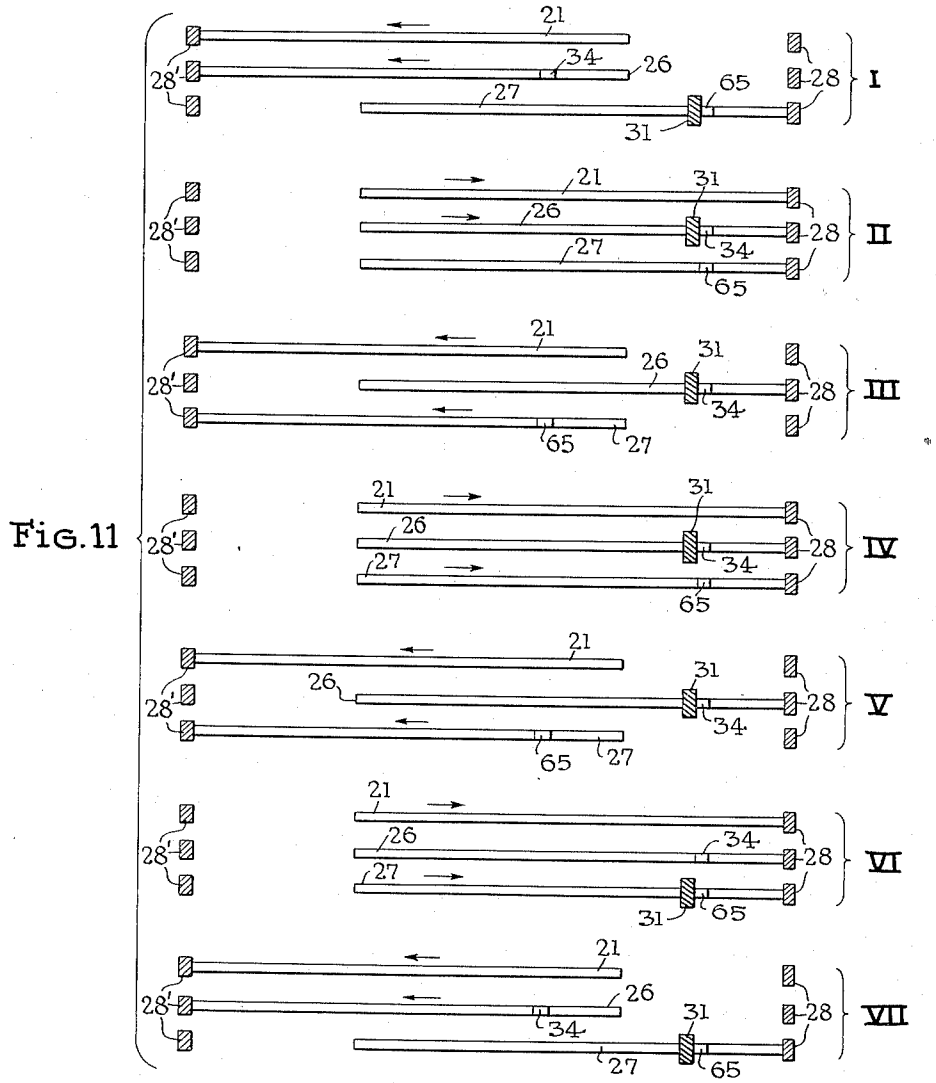
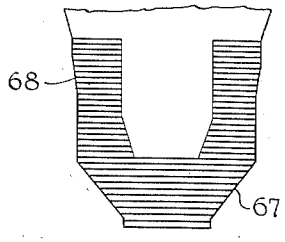


Fig.11

Fig.9



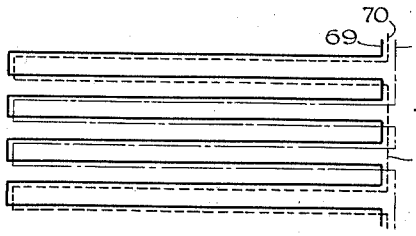


Fig.10

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2,583,453

UNITED STATES PATENT OFFICE

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KNITTING MACHINE ATTACHMENT

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Application April 19, 1950, Serial No. 156,811

5 Claims. (Cl. 66—129)

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This invention relates to straight knitting machines for knitting full fashioned hosiery blanks, and more particularly to a pattern-controlled attachment for selectively maintaining certain of the yarn carrier rods inoperative during the operation of actuating means therefor.

In straight or flat knitting machines now generally used for knitting full fashioned hosiery, the laying of yarn along the needles is effected by a series of reciprocating yarn carrier rods, each supporting a plurality of yarn carriers, one for each knitting section. These carrier rods extend the full length of the knitting machine which is composed of from one to thirty or more knitting sections, each of which produces a single stocking blank. Longitudinal reciprocation is imparted to selected carrier rods, so that their yarn carriers traverse the knitting fields, by friction boxes mounted on a friction rod that is reciprocated by the conventional coulier motion. The length of travel or throw of the carrier rods is limited by end stops mounted on narrowing heads, one at each end of the machine. The narrowing heads automatically diminish the travel of the carrier rods by an equal amount at each end of their travel in order to shape, i. e. fashion, the hosiery blanks.

For plain knitting, the carrier rods are generally operated one at a time to lay a single yarn for each course. A single rod may be used to lay successive single yarn courses or three rods may be alternately operated by known mechanism to lay successive single yarn courses with three different yarns in the so-called ringless method of knitting. Where increased strength is desired in certain portions of the hosiery fabric, for example the heel, sole, and toe areas, the courses in these areas are provided with an additional or reinforcing yarn. The laying of such reinforcing yarn together with the main yarn is accomplished by a well known "plating" or "splicing" operation.

Where such reinforcement extends from edge to edge of the stocking blank, as in the toe portion, at least two carrier rods must be placed in operation, one to lay the main yarn and one to lay the reinforcing yarn. Where the fabric is reinforced only adjacent the selvages of the blank, however, as in the heel and sole portions, at least three carrier rods must be placed in operation, one to lay the main yarn, one to lay reinforcing yarn adjacent one selvage, and one to lay reinforcing yarn adjacent the other selvage. In this latter three-carrier-rod operation, stops are provided for the two reinforcing

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carrier rods intermediate their end stops to limit the extent of their travel inwardly of their corresponding selvages. These intermediate stops can be automatically adjusted by known mechanism to vary the extent of travel of the reinforcing rods in successive courses in order to vary the inner outline of the reinforced areas of the fabric.

If groups of successive unreinforced courses are alternated with groups of successive reinforced courses it is evident that a striped design will be created in hosiery fabric. Such designs will be more pronounced where the main and reinforcing yarns are of contrasting colors, such as a light shade main yarn and a darker shade reinforcing yarn. Such striped design effects also may be varied by varying the number of reinforced and unreinforced courses, for example by alternating two reinforced courses with four unreinforced courses or alternating four reinforced courses with four unreinforced courses. My copending design application, Serial No. D. 4,682, filed August 24, 1949, now Patent No. D. 158,824, illustrates one type of design that may be created by this method of knitting. It also will be evident that similar striped design effects can be created in unreinforced areas by alternate groups of successive courses of two or more main yarns of contrasting shades or colors, such as black and white. These colors may be modified by subsequent dying processes performed on the completed stocking. This type of design obviously also can be created with two or more reinforcing yarns of contrasting shades laid with a main yarn.

Designs of the type described above for reinforced fabric areas can be produced by alternately holding or locking the reinforcing carrier rods at one end of their travel against movement by their friction drive during an even number of main yarn courses and releasing the reinforcing carrier rods for laying one or more successive courses of reinforcing yarn. Where there are two separate areas of reinforcement, one adjacent each selvage, the successive reinforced courses preferably are even in number for reasons later described.

By controlling the number of courses during which the reinforcing carrier rods are locked and the number of courses during which such rods are released, a desired design can be formed. Designs in unreinforced fabric areas can be similarly produced by alternately locking and releasing two main carrier rods laying two main yarns of contrasting shades.

There are known pattern-controlled mechanisms for effecting operation of selected carrier rods. Such mechanisms are generally of two types, one which selectively connects and disconnects the rods from their friction driving device and the other which holds or locks selected rods against movement by their friction driving device. Both types are purely mechanical and consist of numerous linkages, cams, etc. Of necessity they are complex and frequently difficult, if not impossible, to install as an attachment to existing knitting machines. Moreover, because of their complexity such known devices are expensive and for the most part require more than one pattern mechanism.

Accordingly, it is an object of this invention to provide a simple inexpensive pattern-controlled attachment for a straight knitting machine for alternately locking at least one carrier rod at one end of its travel during a predetermined even number of successive knitting courses and for releasing said rod for laying a predetermined number of courses.

It is another object of this invention to provide such an attachment that can be easily attached to a conventional straight knitting machine with a minimum of effort and expense.

It is another object of this invention to provide one or more such attachments that can be controlled by a single pattern mechanism of a conventional type.

It is a further object of this invention to provide a pattern-controlled striped-design-forming attachment for conventional knitting machines.

Other objects and advantages of the invention will be evident from the following description and accompanying drawings in which:

Figure 1 is a fragmentary view, in transverse vertical section, of a portion of the narrowing head of a full fashioned knitting machine illustrating a carrier rod locking device which embodies this invention.

Figure 2 is a fragmentary sectional view taken on line 2—2 of Figure 1.

Figure 3 is a fragmentary elevational view illustrating pattern mechanism for controlling the carrier rod locking device shown in Figure 1.

Figure 4 is a wiring diagram of an electrical circuit for operating the carrier rod locking device shown in Figure 1.

Figure 5 is a fragmentary view, corresponding to Figure 1, illustrating a modification of the invention.

Figure 6 is a diagrammatic plan view, parts being broken away, of a full fashioned stocking leg blank illustrating one type of striped design which may be knitted in the heel portions of the blank by an attachment embodying this invention.

Figure 7 is a diagram showing the manner of laying courses and partial courses at the upper portion of the heel area of the leg blank in Figure 6.

Figure 8 illustrates by sequential diagrams the movements of the carrier rods for laying courses in the manner shown in Figure 7.

Figure 9 is a fragmentary diagrammatic plan view of a full fashioned stocking foot blank illustrating one type of striped design which may be knitted in the sole and toe portions of the blank by this invention.

Figure 10 is a diagram showing the manner of laying courses in the toe area of the foot blank shown in Figure 9.

Figure 11 illustrates by sequential diagrams the movements of the carrier rods for laying courses in the manner shown in Figure 10.

Referring now to Figures 1 and 2, there is shown a portion of a right hand carrier rod nut 20 which is moved by a spindle (not shown) longitudinally of a full fashioned knitting machine. Carrier rod nuts form a part of each of the two narrowing heads of a knitting machine, one at each end thereof. The nut 20 is provided with milled slots to guide the ends of a plurality of yarn carrier rods 21, 22, 23, 24, 25, 26, 27. A modern knitting machine is usually provided with at least seven such rods, as illustrated. End stops 28 for each of the rods are carried by the nut 20.

The carrier rod locking mechanism, which forms a part of the attachment that is the subject of this invention, preferably is carried by a bracket 29 that is bolted or otherwise suitably secured to the carrier rod nut 20. The bracket 29 has a central portion 30 that spans the rods a short distance thereabove. A carrier rod locking element 31 is mounted in a slot 32 (Fig. 2) in the central portion 30 of the bracket for movement transversely over the carrier rods. The locking element 31 has a portion 33 depending below the slot 32 into close proximity with the upper surface of the rods. One of the rods, for example the rod 26, has a dog 34 riveted or otherwise suitably secured thereto. The dog is provided with an adjustable hardened stop screw 35. As can readily be seen from the foregoing, when the rod 26 is positioned against its respective end stop 28 and the locking element 31 moved over the rod 26, movement of the rod 26 away from its end stop is prevented by engagement of the stop screw 35 with the depending portion 33 of the locking element (as shown in Figure 2). Hence, the locking element 31 can be used to prevent the laying of a course by the rod 26. By holding and releasing the rod 26 in accordance with a sequential pattern of courses, a desired design can be formed.

The mechanism for moving the locking element 31 to locking and releasing position consists of a solenoid 36 mounted on the bracket 29, as by screws 37, and having a plunger 38 mounted for reciprocation transversely of the carrier rods. The locking element 31 is fastened to a bifurcated outer end of the plunger 38, by any suitable means, such as a bolt 39. Movement of the locking element 31 into operative position (shown in dotted lines in Fig. 1) is thus accomplished by energization of the solenoid 36. Movement of the locking element into inoperative position, upon deenergization of the solenoid 36, is effected by means of a tension spring 40 having one end thereof secured to the locking element adjacent the outer end of the plunger 38 and the other end thereof secured to an upstanding plate 41 that may be screwed, or otherwise suitably secured, to a leg 42 of the bracket 29. An adjustable stop screw 43, having a lock nut 44, limits the extent of outward travel of the plunger 38 when the solenoid 36 is deenergized.

The mechanism described above for locking a carrier rod in its outside selvage position is duplicated at both ends of the knitting machine. A right hand locking mechanism may hold the rod 26 against movement, as illustrated, while a left hand mechanism may hold the rod 24 against movement.

Selective energization and deenergization of the solenoid 36 in accordance with a predetermined pattern of courses is effected by an end-

less pattern chain 45 (Fig. 3) of well known construction, mounted on a sprocket 46. The sprocket 46 is driven from the main camshaft (not shown) of the knitting machine by step-by-step mechanism well known in the art, such as a pawl and ratchet (not shown). This mechanism advances the chain 45 a definite amount, for example one link, at the end of each course. Pivotally mounted, as at 47, adjacent the sprocket 46 are two parallel levers 48, 49 having lugs 50 each adapted to be engaged by a separate longitudinal row of buttons 51 detachably secured to the chain 45. The free ends of the levers 48, 49 are connected to reciprocating spring-biased switch arms 52, 53, respectively, which open and close switches 52' and 53', respectively, enclosed in a housing 54. Contact of the buttons 51 with the lugs 50 rocks the levers 48, 49 to close the switches 52', 53'. The switch 52' controls the left hand solenoid 36' and the switch 53' controls the right hand solenoid 36, as illustrated by the wiring diagram shown in Figure 4. A hand switch 55 preferably is interposed in the circuit to render the attachment inoperative.

An example of the use of this attachment for knitting a striped design in the heel 56 of a stocking blank 57 is illustrated in Figures 6 through 8. In forming the heel area stripes shown in Figure 6, the reinforcing yarn was alternately laid for two courses and omitted for four courses. This course pattern is illustrated diagrammatically in Figure 7, which shows the yarn courses at the beginning of the heel area 56. The main yarn 58 is shown in solid lines, while the right and left hand reinforcing yarns 59 and 59', respectively, are shown in dotted lines. It is to be noted that the right and left hand two-course reinforcements are offset walewise one course for reasons later described. This offset is of such slight magnitude, however, that it may be disregarded or, if desired, adjusted to align the outside selvage ends of the right and left hand stripes during the operation of seaming the blank 57 to form a stocking.

The sequence of operation of carrier rods to lay the course pattern shown in Figure 7 is shown diagrammatically in Figure 8. The use of a single rod, for example the rod 21, to lay the main yarn 58 is shown in Figure 8, but it will be realized that three rods, such as the rods 21, 22, 23 may be alternately operated to lay the main yarn by the ringless method as previously described.

At the beginning of the first course, the left reinforcing rod 24 is positioned against its left end stop 28', the main rod 21 and the right reinforcing rod 26 positioned against their respective right end stops 28, and the right solenoid 36 deenergized so that the locking element 31 for the rod 26 is inoperative. In laying the first course the main rod 21 and the right reinforcing rod 26 move to the left. The main rod 21 effects a full traverse before it is stopped by its left end stop 28', but the right reinforcing rod 26 effects only a partial traverse before it is stopped by engagement of a dog 60 thereon with an intermediate stop 61. At the end of this course the left solenoid is deenergized to move the left locking element 31' out of engagement with a dog 62 on the left reinforcing rod 24 to release this rod for the next course. In laying the second course all three rods 21, 24, 26 move to the right, with the main rod 21 and the right reinforcing rod 26 engaging their respective end stops 28. The left reinforcing rod 24, however, effects only a partial traverse before being stopped by engagement of a dog 63 thereon with an intermediate stop 64. After this second course has been laid a button 51 on the chain 45 effects energization of the right hand solenoid 36 to thereby move the right locking element 31 into position to lock the right reinforcing rod 26 against movement during the laying of the third course. The left hand solenoid 36' also is energized by a button 51 after the third course has been laid, and a series of buttons 51 on the pattern chain 45 maintains both right and left solenoids energized during the laying of the fourth, fifth, and sixth courses. Hence, both reinforcing rods 24 and 26 are inoperative during the laying of these courses. After the sixth course is laid the right hand solenoid 36 is deenergized to release the right reinforcing rod 26 for the laying of the seventh course which commences another cycle.

It is obvious that the number of both reinforced and unreinforced courses can be varied by varying the number and/or positions of the pattern chain buttons 51.

A modification of the attachment is shown in Figure 5 of the drawings. By the simple expedient of riveting a dog 65 and adjustable stop screw 66 to the carrier rod 27, the locking element 31 will control two rods. When the solenoid 36 is deenergized the rod 27 will be locked and the rod 26 released, and when the solenoid is energized, the rod 27 will be released and the rod 26 locked. By using the rods 26 and 27 to lay two yarns of contrasting colors and by alternately operating these rods to lay groups of successive courses a striped design can be formed in uniformly reinforced fabric, thus eliminating a possible ridged effect produced by the previously described method of forming striped designs.

An example of the use of this modification for forming a striped design in the toe portion of a stocking blank is illustrated in Figures 9 through 11. In forming the striped toe portion 67 of the foot blank 68 shown in Figure 9, two separate reinforcing yarns of contrasting shades were laid in alternate groups of two and four successive courses, respectively. This course pattern is illustrated diagrammatically in Figure 10 which shows the yarn courses at the beginning of the toe area 67. The main yarn 69 is shown in solid lines, while the contrasting reinforcing yarns 70, 71 are shown in dotted and dot-dash lines, respectively.

The sequence of operation of carrier rods to knit a pattern of this type is shown in Figure 11. Since the toe reinforcement extends from selvage to selvage of the fabric, all three carrier rods 21, 26, 27 effect full traverses so that no intermediate stops are required. Additionally only one solenoid need be used. At the beginning of the first course, all the rods are positioned against their respective right end stops 28 and the right solenoid 36 is deenergized, thus locking the reinforcing rod 27 against movement. In laying the first course, the main rod 21 and the reinforcing rod 26 move to the left against their respective left end stops 28' to lay the main yarn 69 and the reinforcing yarn 70, respectively. During the laying of the second course these two rods 21, 26 move back against their right end stops 28. After the second course has been laid, a button 51 on the pattern chain 45 effects energization of the solenoid 36, thus moving the locking element 31 to release reinforcing rod 27 which lays the reinforcing yarn 71 and lock reinforcing rod 26. A series of buttons 51 maintains the solenoid energized during the laying of the third,

fourth, fifth, and sixth courses. After the sixth course is laid, the solenoid is deenergized to lock reinforcing rod **27** and release reinforcing rod **26** so that the seventh course commences another cycle.

This same type of knitting obviously can be accomplished in the heel and sole areas by using five carrier rods, i. e. one main rod, two right reinforcing rods alternately lockable by a right solenoid to lay the reinforcing yarn adjacent the right selvage, and two left reinforcing rods alternately lockable by a left solenoid to lay reinforcing yarn adjacent the left selvage.

It is preferred to lock the reinforcing rods in their outside selvage position so that the relatively long floats extending across four courses, as indicated at **72** in Figure 7 and **73** in Figure 10, will be concealed in the seam of the finished stocking. It is for this reason that the stripes are offset walewise in the course pattern shown in Figure 7. For the same reason the reinforced courses are even in number.

Numerous course laying variations obviously are made possible by this attachment, which can easily be attached to conventional full fashioned knitting machines. Also various changes and modifications of the attachment, which do not depart from the basic principles of the invention, can be made by one skilled in the art. For example, the locking elements can be moved to operative position upon deenergization of the solenoids instead of upon energization. Therefore, this invention embraces all embodiments which come within the spirit and scope of the following claims.

What is claimed is:

1. In a full fashioned knitting machine having a plurality of frictionally-driven reciprocable carrier rods, the combination of means for alternately locking at least one of said rods at one end of its travel during an even number of successive courses and releasing said one rod for at least one yarn-laying traverse thereof, said means including a carrier rod locking element movable into operative and inoperative positions, electrical means for moving said element, switch means controlling said electrical means, and pattern mechanism driven by the knitting machine for operating said switch means.

2. In a full fashioned knitting machine having a plurality of frictionally-driven carrier rods and end stops therefor mounted on the carrier rod nut of the narrowing heads of the machine, and including at least one rod for laying main yarn and at least one rod for laying reinforcing yarn, the combination of means for alternately locking said reinforcing carrier rod at one end of its travel during an even number of successive main yarn courses and releasing said reinforcing carrier rod for an even number of successive yarn-laying traverses thereof, said means including a locking element for said reinforcing carrier rod, said element being mounted on the carrier rod nut of one of the narrowing heads of the knitting machine and being movable into operative and inoperative positions, a dog on said reinforcing carrier rod engageable by said element, a solenoid and a spring for moving said element, a switch controlling said solenoid, and pattern mechanism driven by the knitting machine for operating said switch.

3. In a full fashioned stocking blank knitting machine having a plurality of frictionally-driven carrier rods, including at least one rod for laying main yarn and at least two rods for laying reinforcing yarn adjacent both outside selvages of the stocking blank, the combination of means for alternately locking said reinforcing carrier rods at the corresponding outside selvage ends of their travel during an even number of successive corresponding main yarn courses and releasing said reinforcing carrier rods for an even number of successive corresponding yarn-laying traverses thereof, said means including a carrier rod locking element for each of said reinforcing carrier rods, each of said elements being movable between operative and inoperative positions, electrical means for moving each of said elements, switches controlling said electrical means, and a pattern mechanism driven by the knitting machine for operating said switches.

4. In a full fashioned knitting machine having at least two frictionally-driven reciprocable carrier rods, the combination of means for alternately locking one of said rods at a selvage end of its travel while releasing the other rod for an even number of successive yarn-laying traverses and correspondingly locking said other rod while releasing said one rod, said means including a carrier rod locking element movable between two positions, said element in one position being effective to lock said one rod and release said other rod and in the other position to lock said other rod and release said one rod, electrical means for moving said element, switch means controlling said electrical means, and pattern mechanism driven by the knitting machine for operating said switch means.

5. In a full fashioned knitting machine having a plurality of frictionally-driven reciprocable carrier rods and end stops therefor mounted on the carrier rod nut of the narrowing heads of the machine, the combination of a carrier rod locking element mounted on said carrier rod nut for movement transversely of at least two of said carrier rods, a dog on at least one of said rods engageable with said locking element, when the latter is in operative position, to lock said one rod against movement at one end of its travel, spring-biased solenoid means for moving said locking element into and out of operative position, and a pattern-controlled switch for operating said solenoid means.

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