

Dec. 19, 1967

MOTOYOSHI SUZUKI

3,358,473

NEEDLE SELECTOR FOR A HAND KNITTING MACHINE

Filed July 23, 1965

3 Sheets-Sheet 1

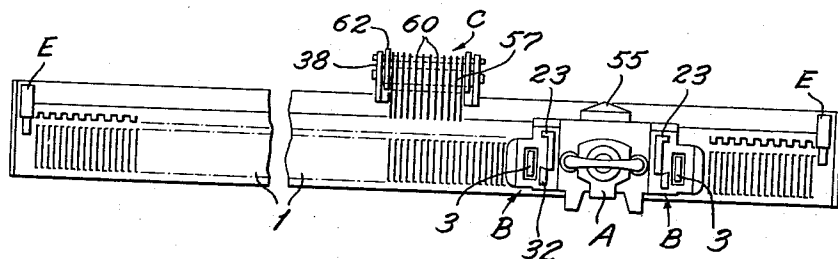


FIG. 1

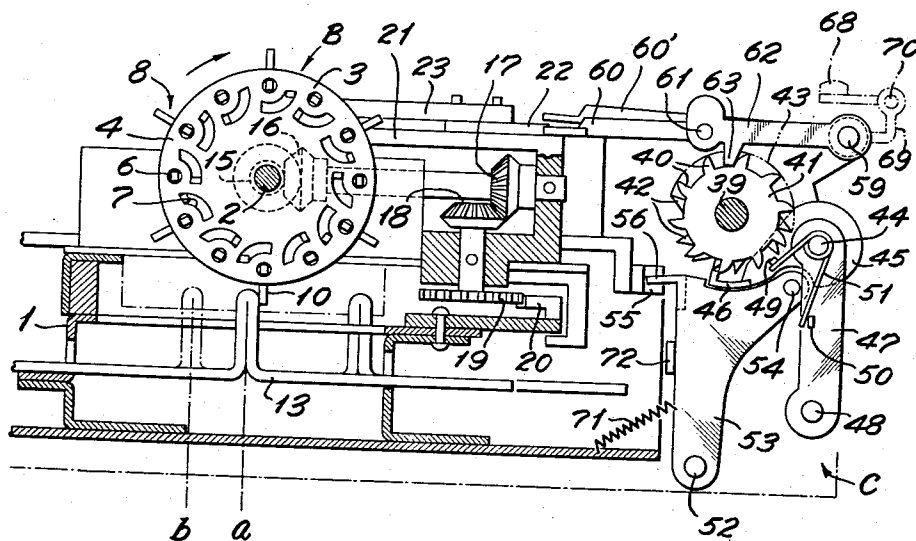


FIG. 2

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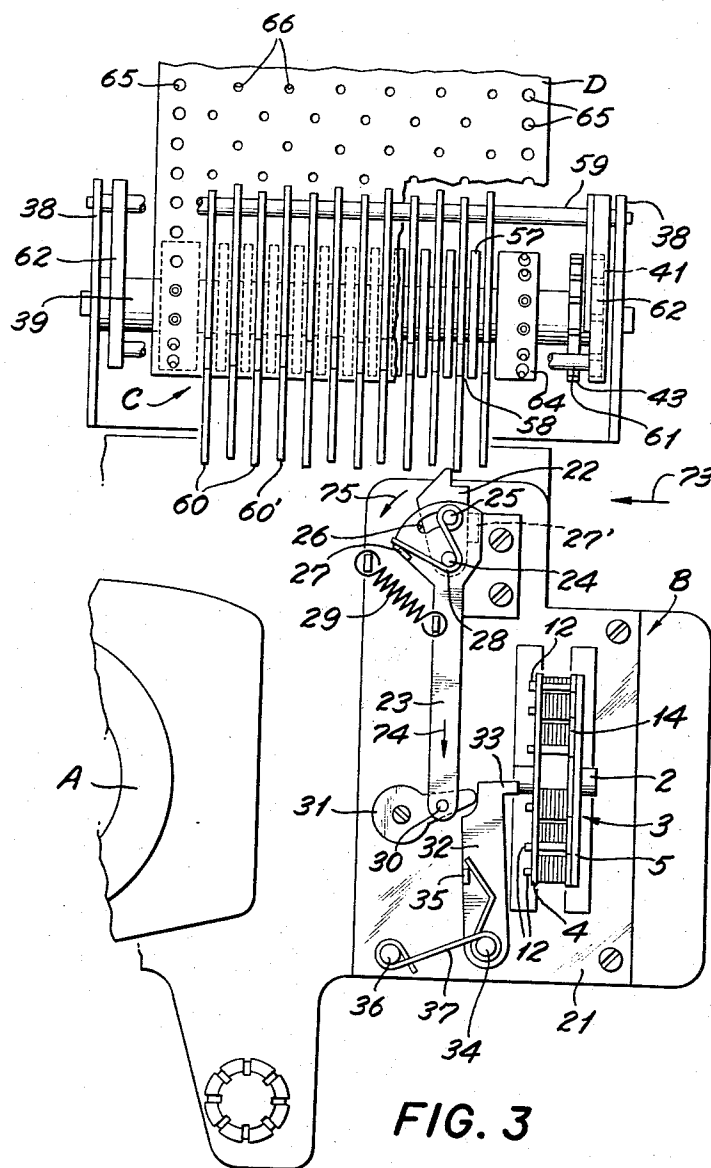
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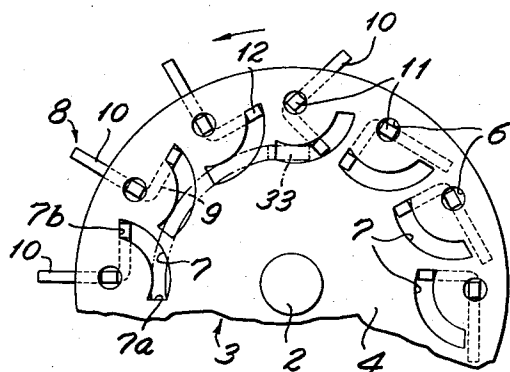


FIG. 4

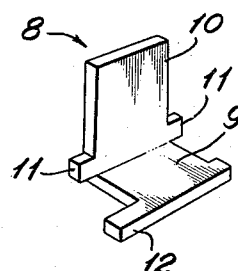


FIG. 5

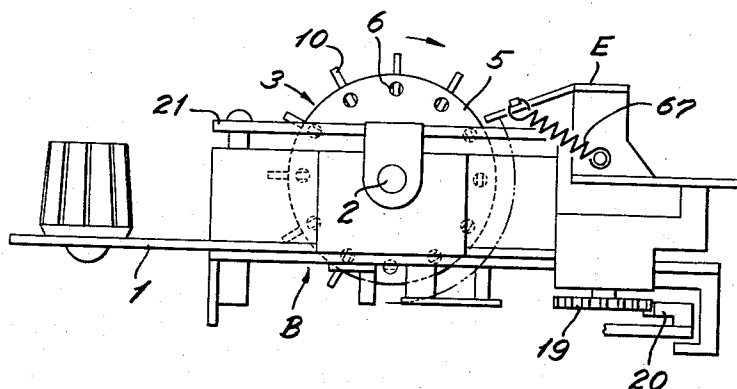


FIG. 6

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NEEDLE SELECTOR FOR A HAND KNITTING MACHINE

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8 Claims. (Cl. 66—60)

ABSTRACT OF THE DISCLOSURE

A needle selecting device for a hand knitting machine wherein a carriage is supported for reciprocal movement between end of stroke positions and carries a needle selector device at its opposite ends so that each selector device can operate a respective needle array at the end of stroke positions, a control means being provided between the end of stroke positions for pre-setting the selector devices as they travel towards their respective needle arrays while permitting their passage in the opposite direction without pre-setting.

The present invention relates to a hand knitting machine and more particularly to a needle selecting and memorizing means therefor.

In a hand knitting machine using a conventional needle selector for pattern working, the first series of needles are pre-selected manually, then the remaining series of needles are selected in accordance with the pre-selection by using a needle selector, and thereafter the carriage is slidably moved to form repeated series of patterns. Recently, it has been proposed to eliminate the manual operation by using a program sheet for the pre-selection. Also, such a machine in which needle selection is effected by a cam action is already known. However, all of these types require many complicated handling steps.

Therefore, it is an object of the present invention to eliminate the above disadvantages and to provide a new and useful automatic needle selector means.

According to the present invention, there is provided a needle selecting and memorizing means for a hand knitting machine comprising a pair of needle selectors provided on each end of the carriage, the arrangement being such that, during knitting, the needle selector at the trailing end of the carriage is prepared for needle selection of the next row by a control means mounted on the machine frame when it passes said control means and the other needle selector at the leading end of the carriage serves to select the needles for the knitting row presently under work.

In order that the invention may be understood, an embodiment thereof will now be described with reference to the accompanying drawings, in which:

FIG. 1 is a plan view of a machine according to the present invention;

FIG. 2 is an enlarged sectional elevation view of the needle selector and the control means in accordance with the present invention;

FIG. 3 is a plan view of the means shown in FIG. 2, in which the cover of the needle selector is removed to illustrate the interior mechanisms;

FIG. 4 is a further enlarged side view of the rotor assembly employed in the needle selector;

FIG. 5 is a perspective view of a rotary element used in the rotor assembly shown in FIG. 4; and

FIG. 6 is a side view illustrating the memory cancelling mechanism.

As shown in the drawings, a carriage A which is slidably mounted on the machine frame 1 has two needle selectors B mounted on opposite ends thereof. Each needle selector B has a shaft 2 carrying a rotor assembly 3 including inner and outer support discs 4 and 5. Each disc 4 and 5 is formed with a specific number (twelve, in the illustrated example) of holes 6 located with equal spacings along its periphery. Further, the inner support disc 4 has the same number of guide slots 7 each of which is curved and concentric with a corresponding hole 6 and of a length in the range of $\frac{1}{2}$ radian. The rotor assembly 3 receives a rotary element 8 shown in FIG. 5 at each of the holes 6 of the discs 4 and 5. The rotary element 8 comprises a base portion 9 and a contactor 10 which is perpendicular to the base portion 9, said contactor 10 being provided with a pair of stub shafts 11 on the opposite sides of the lower end thereof, said base portion 9 having a lug portion 12 at one side of its free end which is longer than the shaft 11. The rotary element 8 is rotatably carried on the aligned holes 6 formed in the inner and outer support discs 4 and 5 of the rotor assembly 3 by its stub shafts 11, and the lug portion 12 is inserted into the guide slot 7 of the inner support disc 4. The guide slot 7 of the inner support disc 4 of the rotor assembly 3 is located at an appropriate position according to the angle between the base portion 9 and the contactor 10 of the rotary element 8 so that, when the lug portion 12 is raised by means of an actuator bar as will be described later, it can engage with the butt portion of a needle 13 parallel thereto. A specific number of rotary elements 8 mounted on the rotor assembly 3 is resiliently held by means of a disc spring 14 interposed between the elements 8 and the outer support disc 5 so as to prevent the raised elements 8 from being retracted and the lowered elements 8 from being raised under the influence of centrifugal force.

The shaft 2 is fixed with a bevel gear 15 which meshes with a bevel gear 16. A bevel gear 17, which is secured on the same shaft on which the gear 16 is secured, meshes with a bevel gear 18 which is connected to a gear 19 engaging a rack 20. The rack 20 is fixed on the frame 1 and its tooth pitch is the same or proportional to that of the needles. Thus, when the carriage A is moved, the gear 19 is rotated through the engagement with the rack 20, and the rotation is transmitted through the bevel gears 18, 17, 16 and 15 to the rotor assembly 3.

A contact bar 22, which is adapted to engage with movable bars 60 of a control device C mounted preferably on the center portion of the machine frame 1, is mounted on the base plate 21 of the needle selector B and has a sloped edge at its upper end so as to effect its downward movement when it comes in contact with any of the bars 60 during its movement in the direction of the arrow 73. The contact bar 22 is pivotally connected with a connecting bar 23 by means of a pivot shaft 24 and has a guide pin 25 engaged in an arcuated guide slot 26 formed in the connecting bar 23. A spring 28 is arranged around the pivot shaft 24 to act between the guide pin 25 of the contact bar 22 and a stopper 27 constituted by a bent lug of the connecting bar 23, so that the spring 28 serves to urge the contact bar 22 against a stopper 27. Further, the connecting bar 23 is provided with a return spring 29 to bias it upwardly since it is caused to move downwardly (direction of arrow 74) due to engagement of the contact bar 22 with the movable bar 60 of the control device C. The connecting bar 23 is connected with a swing lever 31 by means of a pin 30 and the lever 31 engages an actuator bar 32. The bar 32 has a projecting portion 33 adapted to engage the lug portion 12 of a rotary element 8 and a base portion pivotally mounted on the shaft 34. A spring 37 is inter-

posed between a stopper 35 on the arm 32 and a pin 36 fixed on the base plate 21 to urge the arm 32 to rotate counterclockwise.

The control device C has a twelve tooth ratchet wheel 41 and a sixteen tooth ratchet wheel 43 supported on a shaft 39 on the side plate 38. Both wheels 41 and 43 are arranged so as to be able to engage a hook portion 46 of a drive plate 45 fixed on a shaft 44 at the rear portion of a side plate 38. A drive plate 45 is connected with a swing arm 47 by a shaft 44, and the arm 47 is in turn pivotally mounted on a pivot shaft 48. A spring 51 is interposed between a stopper 49 of the drive plate 45 and a stopper 50 of the arm 47 so as to urge the plate 45 toward the shaft 39. Another actuating arm 53 pivotally mounted on a shaft 52 has a pin 54 for engagement with the side edge of the arm 47 and a projection 56 on the free end for engagement with a cam portion 55 provided in the carriage A. The arm 53 is provided with a spring 71 at its lower portion so as to urge it counterclockwise until it engages with a stopper 72 fixed on the side plate 38.

The shaft 39 further supports a drum 57 which is formed with a unit number (e.g. twelve) of peripheral grooves 58, and the movable bars 60 which are rotatably secured on the fixed shaft 59 each engage in a respective groove 58. Each movable bar 60 has a downward projection at its intermediate portion for engagement with a program sheet D and is adapted to engage the contact bar 22 at its forward end.

Each movable bar 60 is formed with an inverted U shape cutout at its lower edge and rests on the movable shaft 61 at this cutout. The movable shaft 61 is fixed at its opposite ends on two side bars 62 pivotally mounted on the shaft 59. Each side bar 62 has a downward projection 63 for engagement with one of the teeth 40 of the wheel 41.

Further, the shaft 39 carries two sprocket wheels 64 at the both sides of the drum 57 so as to drive the program sheet D by engagement with the perforations 65 thereof. On each end of the machine, there is provided a cancelling plate E which is resiliently supported by a spring 67 and engageable with the rotary elements 8 of the needle selector B.

In the illustrated embodiment of the present invention, constructed as described above, pattern working can be carried out automatically by putting a program sheet D having pattern perforations 66 around the drum 57 and moving the carriage with two needle selectors B along the machine frame 1.

In this machine, a needle selector B at the leading end of the carriage A serves to select the needles and the other needle selector B at the trailing end of the carriage A receives the action of the control device C and keeps a memory for the needle selection of the next row.

In short, when the carriage A is slidably moved on the frame 1 toward the left (i.e. in the direction of arrow 73 in FIG. 3), the left needle selector B serves to select the needles according to its memory prior to the knitting, while the right needle selector B gives no influence upon the knitting needles and co-operates with the control device C to receive a needle selection signal which is stored as the memory for the needle selection of the next row. Since the operations of both needle selectors B are identical, the following description will be given in connection with the right needle selector B.

When the carriage A is moved in the direction of arrow 73 along the machine frame 1, the cam 55 provided thereon engages the projection 56 of the arm 53 and thus the arm 53 is caused to swing clockwise against the action of the spring 71. Then the arm 47 engaging with the pin 54 of the arm 53 is forced to rotate clockwise about its pivot shaft 48 together with the drive plate 45 which is connected to the arm 47 by the shaft 44. Therefore, the wheel 41 is caused to rotate counterclockwise through the engagement between the hook portion

46 and one of the teeth 40 of the wheel 41. Since the wheel 41 is rotatably mounted on the shaft 39, its rotation will not cause the rotation of the shaft 39 and the drum 57 fixed thereon. Before the hook portion 46 of the drive plate 45 now in engagement with the wheel 41 comes in contact with the teeth 42 of the wheel 43, the downward projection 63 of the side bar 62 rides on the teeth 40 of the wheel 41. Thus, each side bar 62 is moved upward, carrying the movable shaft 61 upwardly, and therefore all movable bars 60 which are resting on the movable shaft 61, are lifted at their free ends and their downward projections are moved out of engagement with the perforations 66 or the surface of the sheet D. Thereafter, the hook portion 46 of the drive plate 45 engages with one of the teeth 42 of the wheel 43 to rotate the drum 57 through one pitch. Then the program sheet D, engaged by its perforations 65 with the sprocket wheels 64, is caused to advance through one pitch in response to the rotation of the drum 57 so as to place the next series of pattern perforations 66 at the operative position. Immediately after the one pitch rotation of the drum 57, the cam portion 55 of the carriage A is moved from the projection 56 of the arm 53 which is then returned to its normal position under the influence of the spring 71. Then the side bar 62 is lowered together with the movable bars 60 resting on the movable shaft 61, and the downward projections of the movable bars 60 engage the program sheet D. The movable bars 60 are positioned horizontally when engaged with the perforation 66 of the sheet D and inclined when it lies on the surface of the sheet D as shown at 60' in FIG. 2.

After the movable bars 60 are thus positioned in accordance with the program of the sheet D, the carriage A is still caused to continue sliding in the direction of arrow 73 and therefore the rotor assembly 3 of the needle selector B is driven from the gear 19 engaging the rack 20 by means of the bevel gears 18, 17, 16 and 15. When the needle selector B passes through the control device C, the contact bar 22 of the needle selector B is subjected to the influence of the movable bars 60. The contact bar 22 engages only with the horizontally positioned movable bars 60 and does not engage with the inclined bars 60' when it passes through the control device C. Then, the contact bar 22 and therefore the connecting bar 23 attached to it by the pivot shaft 24, is caused to move in the direction of arrow 74 due to the engagement between the sloped edge of the contact bar 22 and one of the horizontally positioned movable bars 60 against the action of the spring 29, and this movement of the bar 23 is then transmitted to the lever 31 through the pin 30 causing the lever to rotate clockwise. Thus, the bar 32 which is in contact with the pointed end of the lever 31 is forced by the latter to swing clockwise about its pivot shaft 34 against the action of the spring 37, and thus it engages by its projecting portion 33 with the lug portion 12 of one of the rotary elements 8 on the rotor assembly 3 which is rotating as described above.

The rotary elements 8 are previously in retracted or non-raised position by means of the cancelling plate E, and the lug portion 12 of each rotary element 8, when engaged by the projecting portion 33, is forced to rotate about its shaft 11 until its lug portion 12 reaches from one end 7a of the corresponding guide slots 7 to the other end 7b thereof. The rotary element 8 is in its raised or erect position when its contactor is at the end 7b of the slot 7. It is important to arrange the arm 32 so that its projecting portion is disposed out of the path of the end 7b of the slot 7 as shown in FIG. 4, because the rotation of the rotor assembly 3 will be interrupted if the portion 33 is in the path of the lug portions 12 of the erected elements 8.

It is obvious that, if the movable bar is inclined as shown at 60' in FIG. 2, the contact bar 22 of the needle

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selector B can pass under the bar 60' without having any effect on the rotary element 8.

The rotary element or elements 8 selectively raised as described above have no influence on the needles until the carriage A is moved to its end of stroke and then the direction of movement is reversed. During reverse movement of the carriage A, the rotor assembly 3 of said means B rotates in the reverse direction and this needle selector B serves to select the needles by engaging with its rotary elements 8, the butt portion of the needle as shown in FIG. 2. Thus, the raised element 8 engages, by its contactor 10, the corresponding needle 13 to advance it to the position shown by the chain line *b* in FIG. 2, while the retracted element 8 passes without engaging the corresponding needle 13, thereby leaving it in its initial position.

During this reverse movement of the carriage A, the contact bar 22 of needle selector B may engage with the horizontally positioned movable bars 60 when it passes the control device C. In this case, however, the guide pin 25 can slide in the guide slot 26 allowing counterclockwise swinging movement of the bar 22 to relieve the engagement. Whereby, the connecting bar 23 and its related parts will be unaffected by the control device C.

The movement of the carriage A is continued until it reaches the end of stroke repeating the needle selection in accordance with the memory.

At the end of the frame 1, all elements 8 are returned to the retracted position by the cancelling cam E and thus the memory is cancelled as shown in FIG. 6.

Alternatively, push buttons 68 may be provided in lieu of the program sheet D to displace the movable bars 60 as shown by chain lines in FIG. 2. Thus, each movable bar 60 may have an extension bar 69 to which a button 68 may be fixed by means of a shaft 70 so that the bar may be displaced through actuation of the button 68.

As described above, in accordance with the present invention, pattern working can be readily and automatically carried out through only the reciprocating sliding movements of the carriage.

Further, the memorizing means in accordance with the present invention is simple in construction and ensures smooth and positive action.

The details of the structure may be modified substantially without departing from the spirit of the invention and exclusive use of such modifications as come within the scope of appended claims is contemplated.

What is claimed is:

1. In a needle selecting and memorizing means for a hand knitting machine: a carriage supported for reciprocal movement between end of stroke positions, said carriage having opposite ends which are alternately leading and trailing ends, needle selector means at each of the ends of the carriage for cooperating with a respective needle array at opposite ends of the stroke of the carriage to select the needles for a knitting operation, and control means between the ends of stroke of the carriage and positioned to engage the needle selector means to pre-

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set the same individually as they travel in the direction towards their respective needle arrays while permitting them to pass without pre-setting in the opposite direction.

2. In a machine as claimed in claim 1 wherein each needle selector means comprises means which is preset by the passage of the needle selector means past the control means in the direction of the associated needle array, said control means being operated by a program sheet.

3. In a machine as claimed in claim 1 wherein each of said needle selector means comprises a rotor assembly including a pre-determined number of rotary elements supported for pivotal movement between retracted and raised positions, each rotary element including a lug portion, said rotor assembly having an arcuate guide slot for each lug portion, and an actuator bar controlled by said control means and engageable with said lug portions to selectively raise said rotary element for engagement with the butt portion of a needle in accordance with the needle selection signal whereby the position of the rotary elements determines the needle selection.

4. In a machine as claimed in claim 3 wherein said control means includes a plurality of spaced contactors located in the path of travel of the carriage for selectively contacting the actuator bar, said contactors being pivotally movable between a first position in which the actuator bar passes unhindered and a second position in which the actuator bar is contacted by the contactor.

5. In a machine as claimed in claim 4 wherein said actuator bar includes means enabling idle passage of the bar past the contactors when the respective needle selector means is moving away from the associated needle array, so that the associated rotary elements are untouched.

6. In a machine as claimed in claim 5 wherein said control means is operated by a program sheet, said program sheet having perforations arranged to control the positions of the contactors.

7. In a machine as claimed in claim 4 comprising means at each of the end of stroke positions for acting on the rotary elements to return the same to their retracted positions after the rotary elements have operated the needle array.

8. In a machine as claimed in claim 6 comprising drive means for advancing the program sheet one step for each stroke of the carriage.

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