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DeBolt et al.

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[54] **PATTERN JACK ACTUATOR MEANS FOR CIRCULAR KNITTING MACHINES**

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[52] **U.S. Cl.** ..... **66/42**, 66/50 R, 335/234

[51] **Int. Cl.** **D04b 15/78**

[58] **Field of Search** ..... 66/50 R, 25, 42, 66/75, 154 A; 310/29, 36; 335/234, 229

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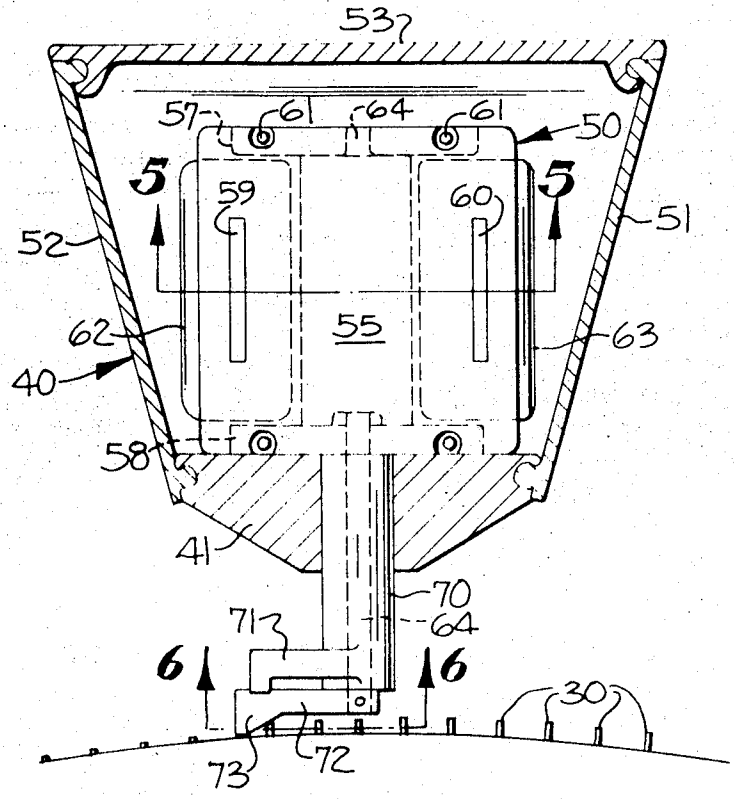
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Primary Examiner—Wm. Carter Reynolds
Attorney—Parrott, Bell, Seltzer, Park & Gibson

[57] **ABSTRACT**

The actuator means is adapted for use with relatively large multi-feed circular knitting machines of the type equipped with pattern jacks and operates in advance of each knitting station to select certain needles to form stitch loops and other needles to remain below the stitch forming level and to form floats in the fabric. An easily removable and replaceable compact pattern unit is provided at each knitting station and includes vertically aligned and closely spaced selector devices which operate on the pattern butts at different levels on the pattern jacks. Each selector device includes a control shaft supported perpendicular to the axis of rotation of the knitting cylinder and for limited rotational reciprocation along a line extending radially from the axis of rotation of the needle cylinder. A pattern lever is connected to the inner end of the control shaft and extends at a right angle therefrom. Electrically controlled actuator means operates to reciprocate the control shaft so that the operating end of the pattern lever is positioned either in or out of alignment with pattern butts at a selected level on the pattern jacks.

4 Claims, 14 Drawing Figures



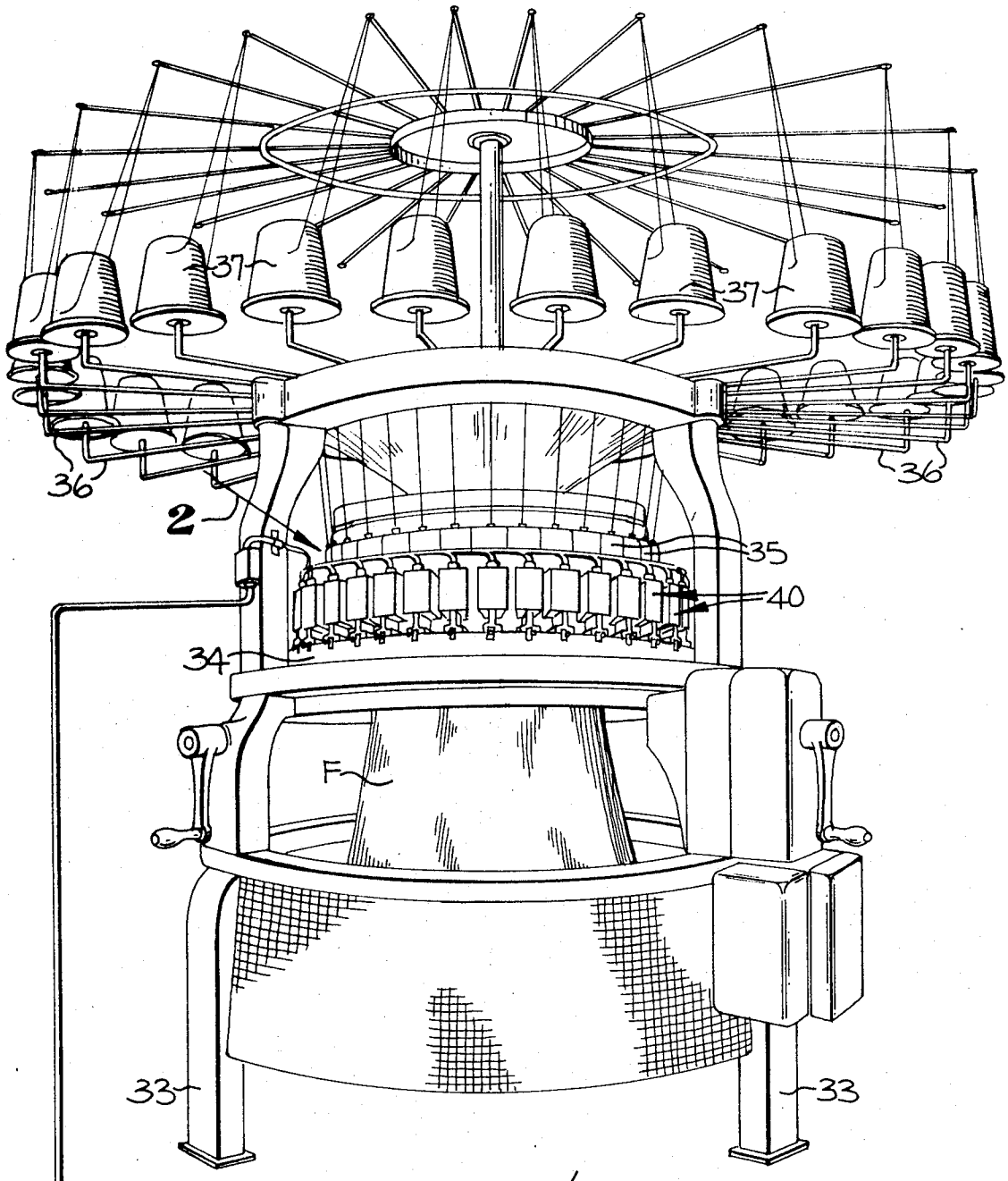


Fig-1

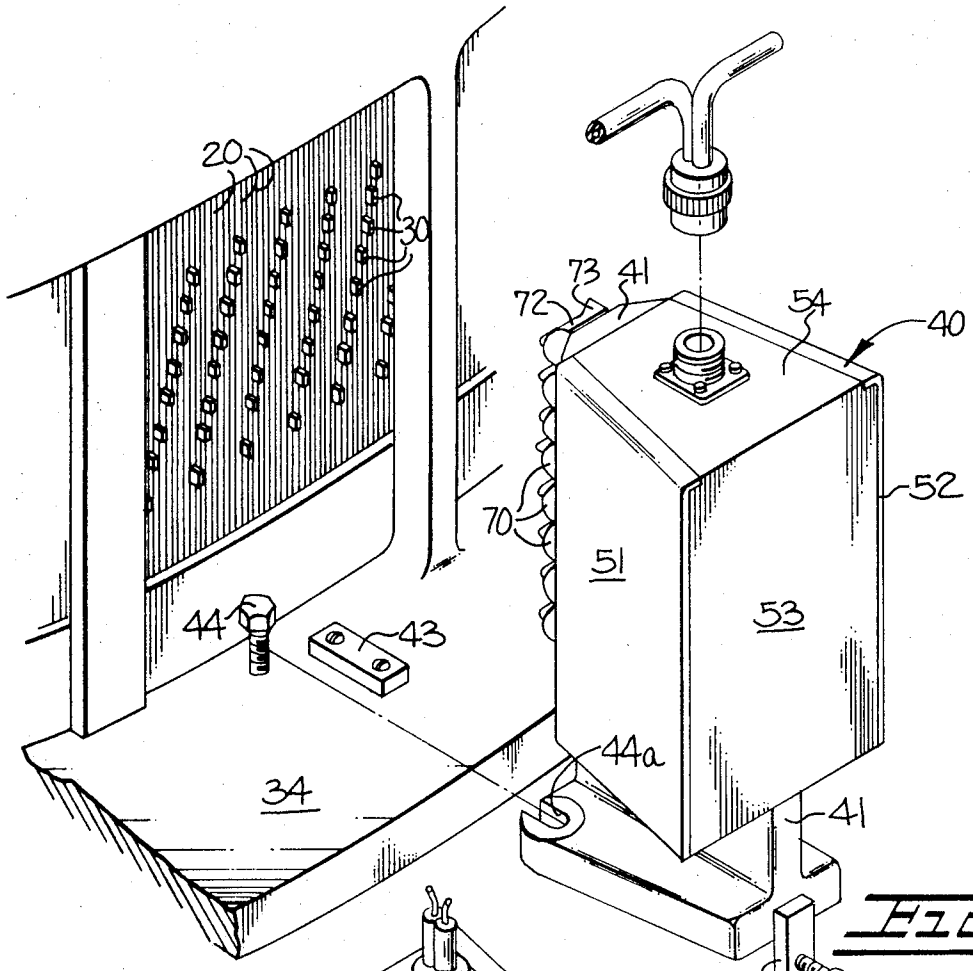

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Fig-2

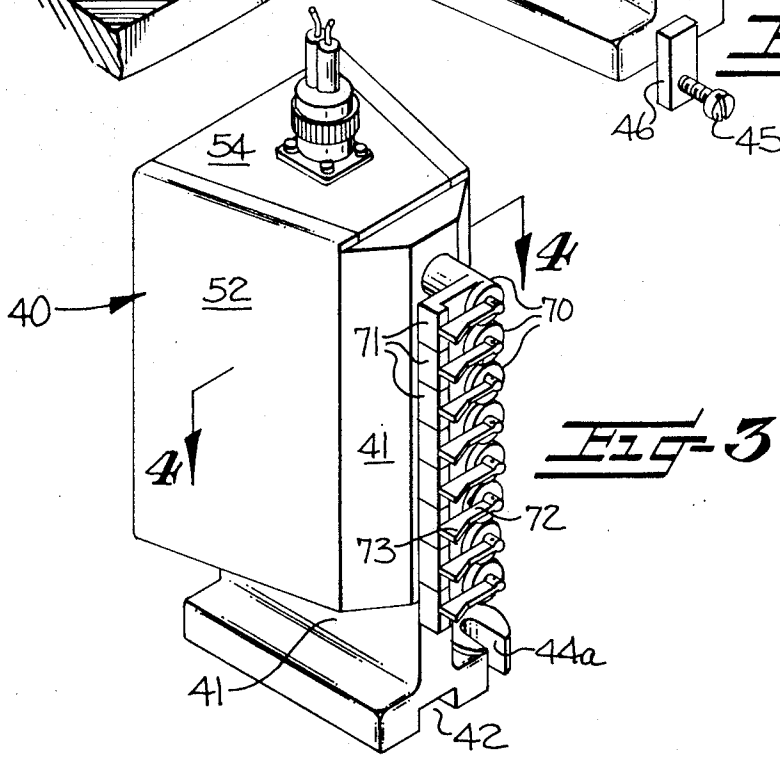

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Fig-3

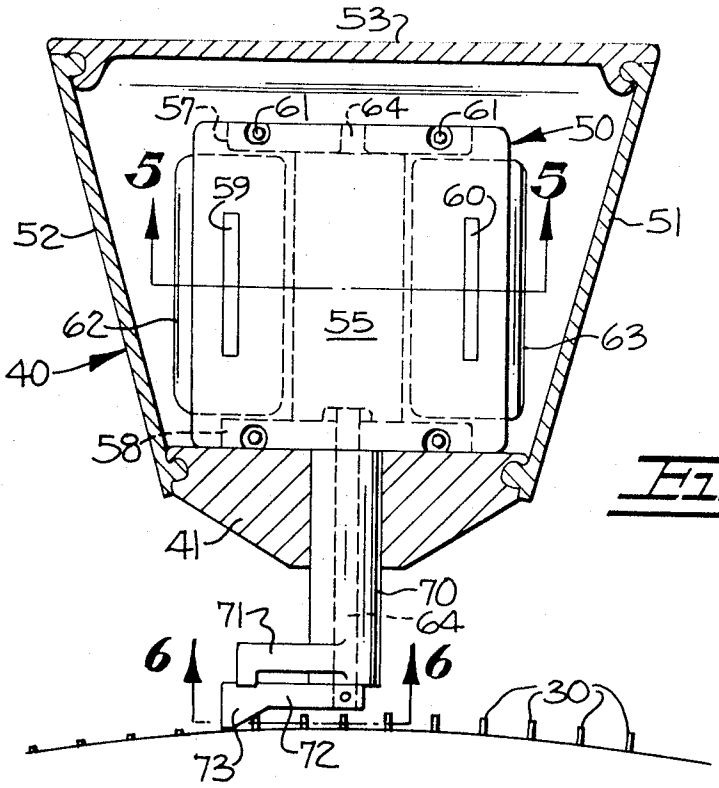


Fig-4

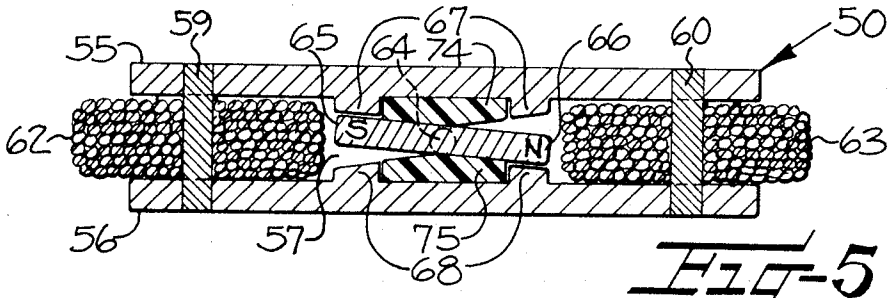


Fig-5

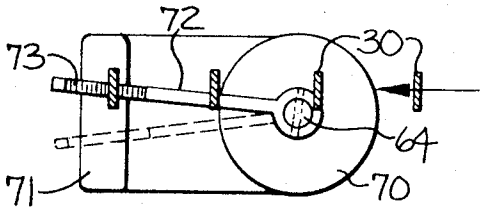


Fig-6

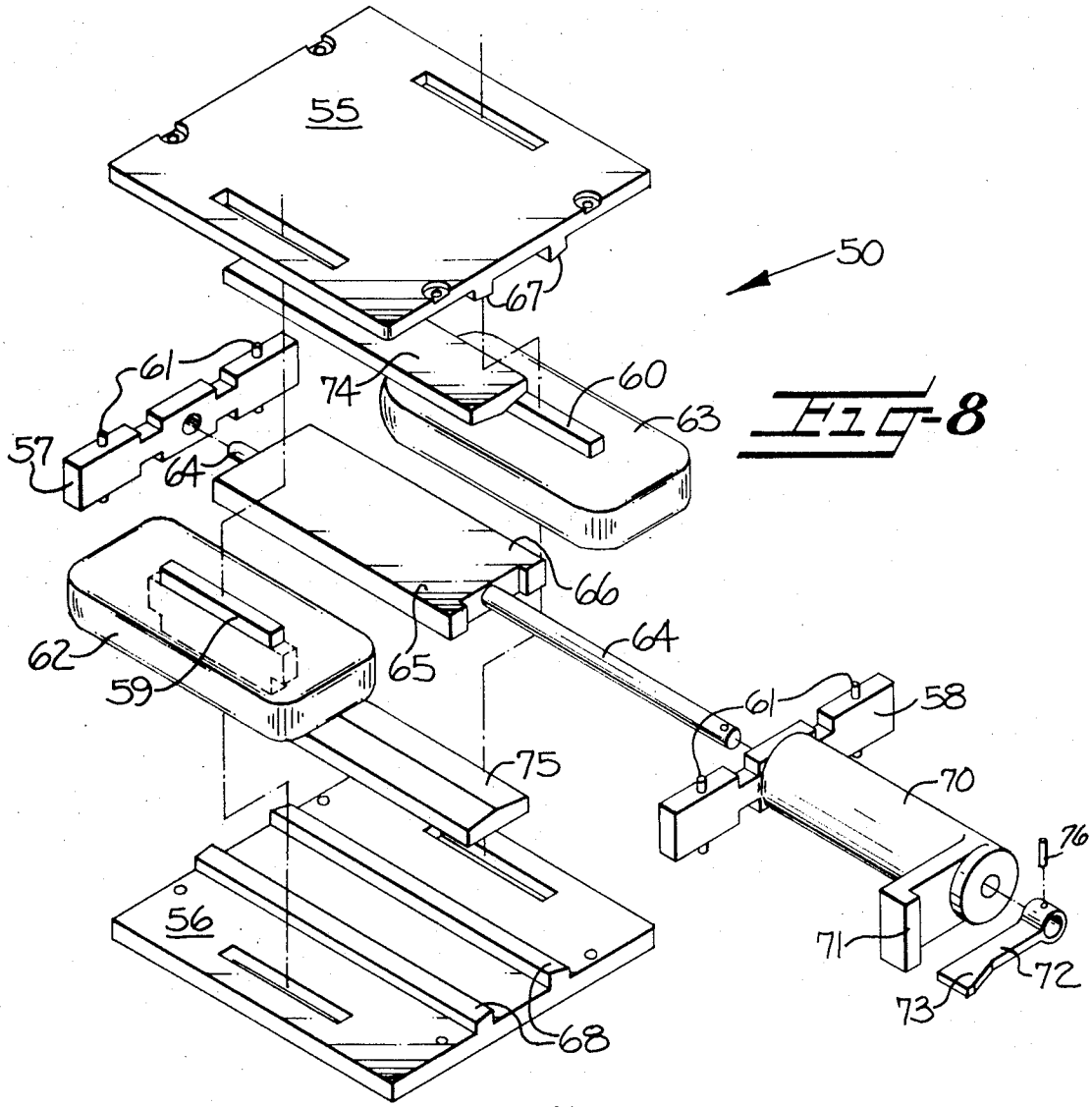

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Fig-8

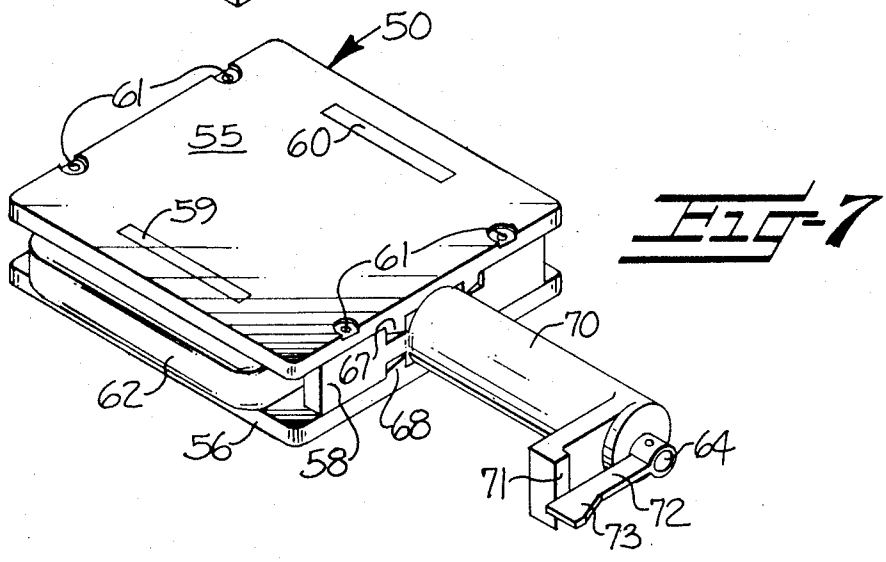

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Fig-7

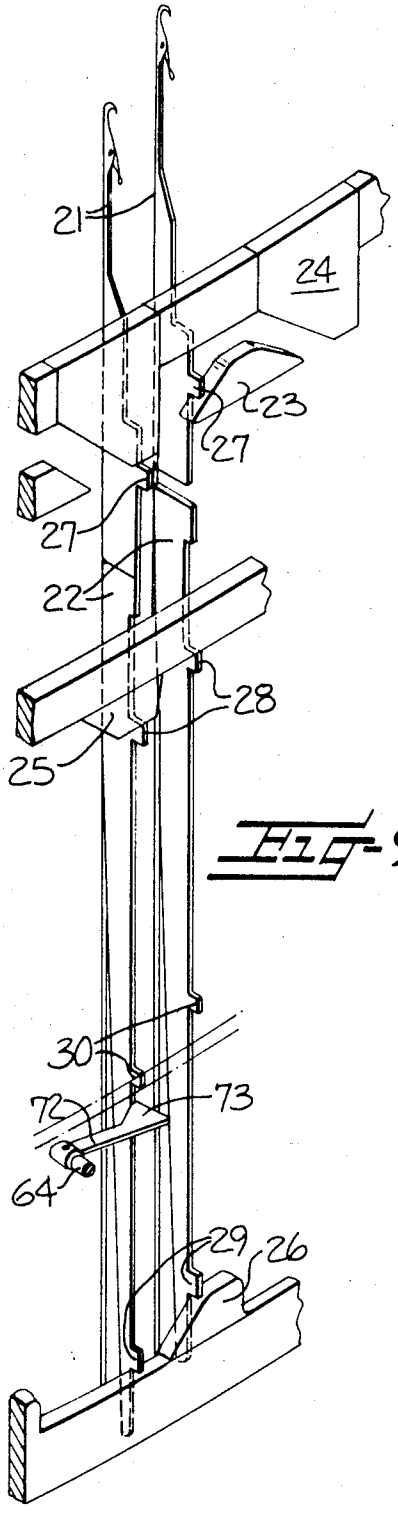

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Fig-9

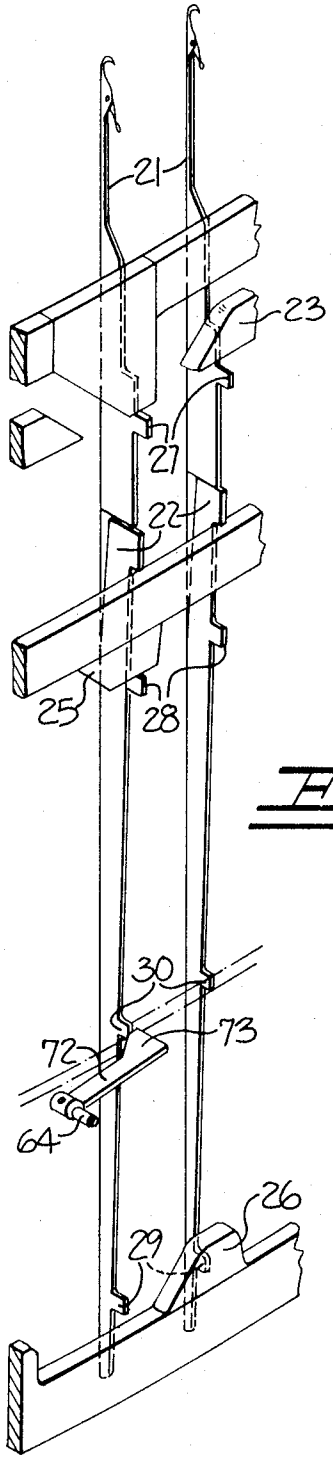

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Fig-10

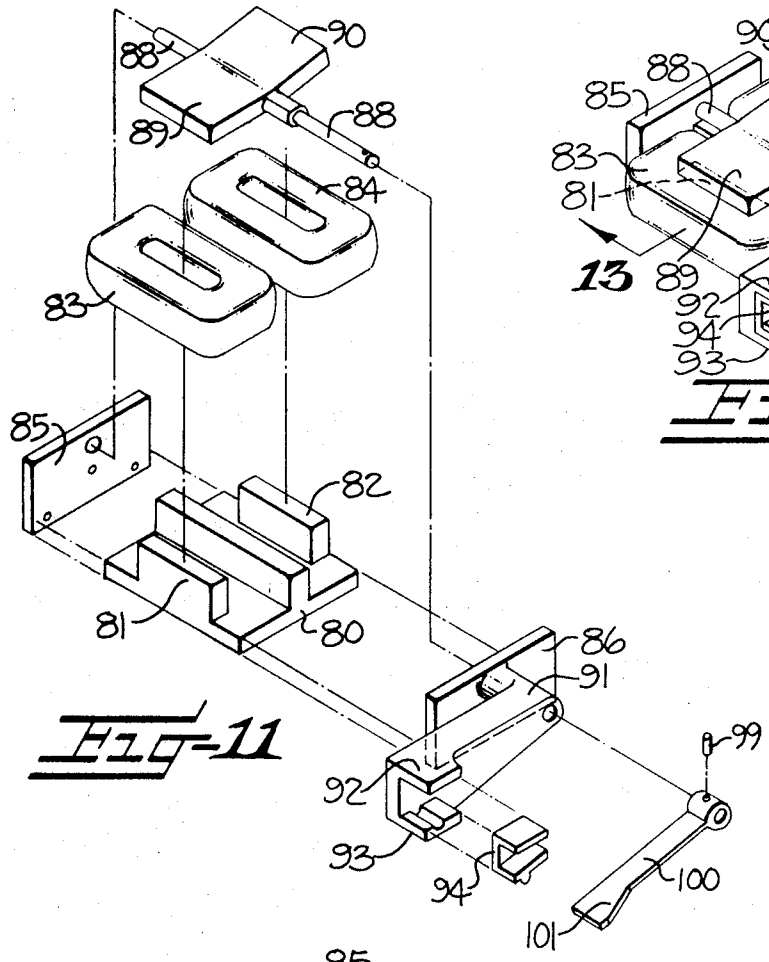


Fig-11

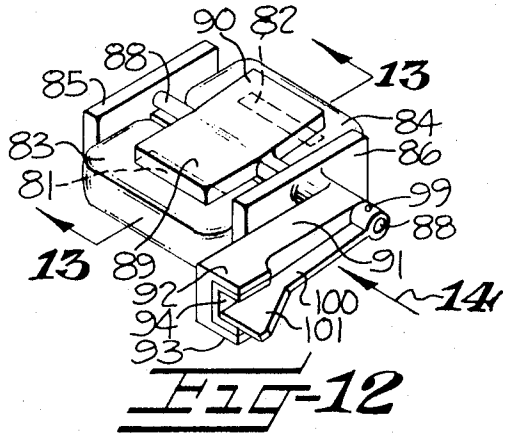


Fig-12

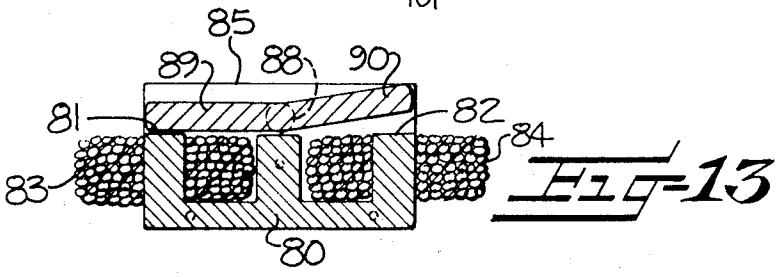


Fig-13

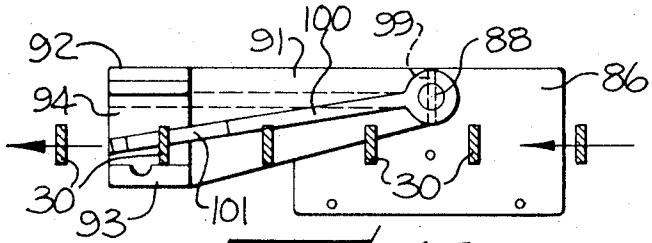


Fig-14

PATTERN JACK ACTUATOR MEANS FOR CIRCULAR KNITTING MACHINES

This invention relates generally to patterning systems and arrangements for large multi-feed circular knitting machines and more particularly to improved pattern jack actuator means for providing individual control of the pattern jacks and the corresponding needles of such machines.

Many different types of electromechanical and electromagnetic devices have been proposed for selectively operating the pattern jacks of knitting machines but these proposed devices have not been put into widespread commercial use. Most presently available machines still utilize mechanical selector means including a rotating pattern drum at each knitting station which operates slides, selectors, levers, and the like. While this type of mechanical selector system is very reliable when the machine is operated at a given speed, the system will not adapt to increases in the speed of operation of these machines. Also, it is difficult and time consuming to change the pattern and the pattern range is very limited.

Although the electromagnetic systems provide some advantages over the mechanical selector means, these electromagnetic systems have been complicated to install, are difficult to adapt for use with present circular knitting machinery, and require extensive retraining of knitting machine operators. Also, some of these prior types of electromagnetic systems require an excessive amount of power to operate.

With the foregoing in mind, it is an object of the present invention to provide improved pattern jack actuator means which is easily adapted for use with existing circular knitting machines or which may be built into new knitting machines, and which permits higher speed operation of the machine, reduces the time required to change patterns, permits the knitting of larger size patterns, and is extremely accurate and reliable.

In accordance with the present invention, the improved pattern jack actuator means includes a plurality of closely spaced vertically aligned selector devices positioned in advance of each of the jack raising cams at the corresponding knitting stations. Each selector device includes a control shaft supported perpendicular to the axis of rotation of the needle cylinder and supported for limited reciprocation and has an inner end positioned closely adjacent the outer periphery of the needle cylinder. A pattern lever is secured to the inner end of each control shaft and extends at right angles therefrom with a cam surface on its outer free end adapted to align with a pattern butt at a certain level on certain of the selector jacks when the control shaft is in one position and adapted to be moved out of alignment with the corresponding butt when the control shaft is moved to the other position. Electrically controlled actuator means is operated by electrical impulses supplied by a suitable pattern controlled actuator means, such as a programming tape or the like, to rotate the control shaft and position the pattern lever in either of the two positions to thereby selectively position the pattern jacks.

Other objects and advantages of the present invention will become apparent in the following description with reference to the accompanying drawings, wherein:

FIG. 1 is a front elevational view of a typical circular knitting machine with the pattern jack actuator means of the present invention applied thereto;

FIG. 2 is an exploded isometric view of a fragmentary portion of the knitting machine and illustrating one of the pattern jack actuator units of the present invention moved back away from the pattern jacks, and being taken looking substantially in the direction of the arrow 2 in FIG. 1;

FIG. 3 is an isometric view looking at the opposite side of the pattern jack actuator unit shown in FIG. 2;

FIG. 4 is an enlarged horizontal sectional view taken substantially along the line 4—4 in FIG. 3 and schematically illustrating the butts on the pattern jacks and the outer periphery of the needle cylinder;

FIG. 5 is an enlarged vertical sectional view taken through one of the stacked selector devices and substantially along the line 5—5 in FIG. 4;

FIG. 6 is an enlarged front elevational view of the pattern lever on the inner end of the selector device, looking in the direction of the line 6—6 in FIG. 4;

FIG. 7 is an isometric view of one of the selector devices in assembled condition;

FIG. 8 is an exploded isometric view of the selector device shown in FIG. 7;

FIG. 9 is a somewhat schematic isometric view illustrating the movement of the selector jacks and the corresponding needles which are raised to a knit position;

FIG. 10 is a view similar to FIG. 9 but illustrating the movement of the selector jacks and the corresponding needles which remain in a lowered or non-knitting, floating position;

FIG. 11 is an exploded isometric view of an alternative form of selector device;

FIG. 12 is an assembled view of the selector device shown in FIG. 11;

FIG. 13 is an enlarged vertical sectional view through the selector device, taken substantially along line 13—13 in FIG. 12; and

FIG. 14 is an enlarged front elevational view of the pattern lever of the selector device shown in FIG. 12 and illustrating the manner in which it is moved between the solid line position where it is aligned with the butts at one level on the selector jacks, and the dotted line position where it is out of alignment with the butts.

The present invention is illustrated as being applied to a Jacquard type of double knit circular knitting machine of the type manufactured by Mayer & Cie and sold as their model OVJA II having 36 knitting stations. This machine is provided with a rotating needle cylinder, indicated at 20 in FIG. 2, and in which cylinder latch needles 21 (FIGS. 9 and 10) are conventionally supported for vertical movement in slots in the needle cylinder. A pattern jack 22 is positioned beneath each of the needles 21 and is supported for rocking movement in the corresponding needle slot. The knitting stations are closely spaced around the needle cylinder and each station includes a needle raising or shed cam 23, a stitch cam 24, a pattern jack leveling cam 25, and a pattern jack raising cam 26. The needles 21 are provided with operating butts 27 which are positioned by the corresponding selector jack 22 to either ride up the cam 23 and raise the needle to take the yarn and form a stitch loop or to pass beneath the cam 23 so that the needle remains in a lowered position and to miss or float the yarn. The selector jack 22 is provided with an upper leveling butt 28, a lower raising butt 29 and intermediate pattern butts 30.

As each needle 21 and the corresponding selector jack 22 approaches a knitting station, they are lowered

to a level position by the stitch cam 24 and the jack leveling cam 25 and the lower end of the jack 22 is rocked outwardly as the upper end of the selector jack 22 is moved inwardly by a conventional push-out lever, not shown, in the manner shown in FIG. 9. If the lower end of this selector jack 22 remains in the outermost position, the lower raising butt 29 will engage and ride up the cam 26 to raise the jack 22 and the corresponding needle 21 so that the butt 27 of the needle 21 engages and rides up the shed cam 23 and the hook of the needle is raised to pick up the yarn from the feed finger, not shown. Then, as the butt 27 engages and is lowered by the stitch cam 24, the needle 21 is lowered to a stitch forming position to form a plain stitch. On the other hand, if the lower end of the jack 22 is moved inwardly, as shown in FIG. 10, the butt 29 passes inside of the cam 29 so that the jack 22 and the needle 21 are not raised at the knitting station.

This particular type of machine is normally provided wilh a pattern drum at each knitting station and rows of pattern pegs engage closely spaced selector levers which are aligned with and engage the pattern butts 30 on the slector jacks 22. The selector levers rock selected jacks 22 inwardly at their lowered ends so that the lower jack raising butt 29 moves along inside of the jack raising cam 26, as shown in FIG. 10. The other jacks 22 are not rocked inwardly by the selector levers so that they and the corresponding needles 21 are not raised. Thus, the selector jacks 22 are movable between a first operative position (FIG. 9) where they engage and are raised by the jack raising cam 26 so that the corresponding needles form plain stitches, and a second inoperative position (FIG. 10) where the selector jacks 22 are not raised by the cam 26 and the corresponding needles remain in a lowered or inoperative position so that floats are formed in the fabric.

In accordance with the present invention, the conventional pattern drums and selector levers are removed from the machine and replaced by pattern jack actuator units of the type illustrated in FIGS. 2 and 3. These units operate in a manner to be presently described, to selectively form stitch loops and floats in the fabric, in accordance with a predetermined pattern.

Referring to FIG. 1, the machine includes the usual supporting frame 33, in the lower portion of which is supported the usual cloth take-up roll for drawing the fabric F downwardly from the needle cylinder and winding it onto the take-up roll under the proper amount of tension. A circular bed plate 34 surrounds the needle cylinder 20 and supports the pattern jack actuator units of the present invention, in a manner to be presently described. Suitable stitch cam blocks 35 (FIG. 1) surround the upper portion of the needle cylinder and the machine is provided with a dial having dial needles supported for radial movement, relative to the needle cylinder, not shown. These dial needles normally form plain stitch loops on every needle. However, it is to be understood that suitable selecting means may be provided to form float or tuck stitches if desired.

A suitable creel or yarn stand 36 is mounted on the upper portion of the machine and supports the usual yarn supply bobbins 37 for each knitting station. The yarns are withdrawn from the supply bobbins 37 and pass through the usual stop motion devices, the yarn feeding devices, and are guided to the yarn feed fingers, not shown, at each knitting station. Although the pattern jack actuator of the present invention is described in connection with the particular machine illustrated in the drawings, it is to be understood that this pattern jack actuator may also be utilized with other types of circular knitting machines.

Each pattern jack actuator unit, broadly referred to at 40 in FIGS. 1, 2 and 3, includes a single support bracket 41 provided with an aligning and mounting groove 42 (FIG. 3) in the lower surface. The groove 42 slides on an upstanding guide bar 43 (FIG. 2) which is fixed on the bed plate 34. When the support bracket 41 is moved inwardly on the guide bar 43, a positioning screw 44 (FIG. 2) moves into a supporting slot 44*a* in the bracket 41. Means for radially adjusting the support bracket 41 is provided in the from of an adjustment screw 45 which is supported in the lower portion of a depending bracket 46 (FIG. 2). The inner end of the screw 45 is adapted to engage the outer surface of the cam ring 34 to provide radial adjustment of the unit 40. Once the unit 40 is properly adjusted, the screw 44 is tightened to maintain the unit in the proper position.

A plurality of closely spaced, vertically aligned selector devices, broadly indicated at 50 (FIGS. 4 and 7) are supported in stacked relationship on the bracket 41 and are surrounded by side cover plates 51, 52, a rear cover plate 53 and a top cover plate 54. These covers are preferably supported for easy removal, such as the tongue and groove arrangement shown in FIG. 4.

As best shown in FIGS. 7 and 8, each selector device 50 includes upper and lower field or base plates 55, 56. These base plates 55, 56 are held in spaced apart relationship by outer and inner end plates 57, 58 and coil plates or pieces 59, 60. The end plates 57, 58 are provided with upwardly and downwardly extending pins 61 which are adapted to extend through suitable openings in the plates 55, 56. The ends of the pins 61 are then flattened to secure the plates 55, 56 to the end plates 57, 58. The coil plates 59, 60 have upper and lower reduced key portions which extend through elongate slots in the field plates 55, 56 to hold the coil plates 59, 60 in position. Electromagnetic coils 62, 63, surround and are supported on the coil plates 59, 60 and form a part of the electromagnetic and permanent magnet means for operating the selector devices, in a manner to be presently described.

The selector device operates on the principle of a pulse motor and includes a control shaft 64 which is supported at its outer end portion for rotational reciprocation in bearing supports in the end plates 57, 58. An elongate relatively flat rotor plate or armature is fixed on the shaft 64 and provides permanent magnet rotor arms 65, 66 extending outwardly on opposite sides of the control shaft 64 and having opposite north and south poles, as shown in FIG. 5. The rotor arms 65, 66 are positioned in 180° relationship and operate in air gaps formed between the electromagnets constituted by the coils 62, 63 and inwardly extending ribs 67, 68 formed on the upper and lower plates 55, 56.

The control shaft 64 (FIG. 8) extends inwardly into an inwardly projecting support housing 70 which is fixed on the inner end plate 58. The inner end of the housing 70 has an integrally formed support bracket 71 provided thereon. A pattern lever 72 is suitably secured at one end, as by a pin 76, to the inner end of the control shaft 64 and has an inclined cam surface 73 on its free end. The control shaft 64 is thus supported perpendicular to the axis of rotation of the needle cylinder 20

and the pattern lever 72 extends at a right angle from the inner end of the control shaft 64.

Buffer stop means, in the form of non-metallic strips or plates 74, 75 are suitably secured to the inner surfaces of the respective field plates 55, 56 and between the ribs 67, 68. These upper and lower plates 74, 75 stop movement of the rotor arms 65, 66 as they are switched from one position to the other. The stop buffer plates 74, 75 may be formed of any suitable non-metallic material, such as nylon, and reduce the noise which would occur if the metal rotor arms 65, 66 made contact with the ribs 67, 68. Also, the plates 74, 75 act as a buffer or cushion to prevent bouncing of the rotor arms 65, 66 as they move between alternate positions.

When an electrical pulse is received in the coil 62 from a suitable pattern control means, such as the electronic pattern device, schematically indicated at 77 in FIG. 1, the upper field plate 55 becomes a part of the electromagnet having a north polarity and the lower field plate 56 becomes a part of the electromagnet having a south polarity so that the permanent magnet south pole of the rotor arm 65 is instantly drawn upwardly toward the rib 67 on the north polarity upper field plate 55, to the position shown in FIG. 5. Upon completion of this pulse signal, the permanent magnet rotor arm 65 remains in this position until the coil 63 receives an electrical pulse. The pattern control means operates in timed relationship to operation of the knitting machine and supplies electrical impulses from a suitable pattern means, such as a pattern tape or the like.

When the rotor arms are in the position shown in FIG. 5, the pattern lever 72 will be in the solid line position shown in FIG. 6, and in alignment with the horizontal row of selector butts 30 so that the lower ends of corresponding pattern jacks will be rocked inwardly as the butts engage and are moved inwardly by the inclined cam surface 73. The lower raising butts 29 of such jacks will pass inside of the raising cam 26 (FIG. 10) and the corresponding needles 21 will not be raised to the knitting level but will remain in a lowered position so that floats will be formed in the fabric.

When an electrical pulse is received in the coil 63 (FIG. 5) the upper field plate 55 then becomes a part of the electromagnet having a south polarity and the lower field plate 56 becomes a part of the electromagnet having a north polarity. Then, the rotor arm 66 will be instantly drawn upwardly toward the sourth polarity upper plate 55 and will be repelled by the north polarity of the lower plate 56 so that the pattern lever 72 is instantly switched from the solid line position shown in FIG. 6 to the dotted line position, below the level of the butts on the pattern jack 22. With the pattern lever 72 in the lowered position, as shown in dotted lines in FIG. 6 and as illustrated in FIG. 9, the inclined cam surface 73 will be out of alignment below the level of the pattern butts 30 of certain of the selector jacks 22 so that the lower ends of these jacks will remain in the outer position and their lower butts 29 will engage and ride up the jack raising cam 26. The corresponding needles 21 will be raised so that their butts 27 will pass above the raising cam 23 and the needles will be raised to pick up yarn in the hooks thereof and form plain stitch loops as the needles are lowered to stitch drawing level by the stitch cam 24.

In the present instance, a repeating pattern of butts 30 is provided on every eighth pattern jack 22 so that the spacing horizontally between the pattern butts at each selecting level is 0.393 of an inch. The spacing vertically between the pattern butts from one selecting level to the next is 0.492 of an inch, from center to center. The overall thickness of each selector device, from the upper surface of the field plate 55 to the lower surface of the field plate 56 is 0.492 of an inch. As illustrated in FIG. 6, the center of the control shaft 64 is aligned with the lower surface of the plane along which the pattern butt 30 travels so that only a slight movement of the pattern lever 72 is required to move the inclined cam surface 73 into alignment with the pattern butt 30 or move it out of alignment below the pattern butt level. The pattern jack 22 is normally provided with 36 evenly spaced pattern butts thereon and, in the present instance, all except one pattern butt on each jack are broken away. The butts remain on the pattern jacks at eight different levels to correspond with the eight selector devices stacked in the selector devices 50. Of course, a greater or lesser number of levels and selector devices 50 may be employed.

Referring to the alternate form of selector device illustrated in FIGS. 11–14, it will be noted that this selector device is also very thin, on the order of about 0.492 of an inch from top to bottom and the selector devices may be stacked in vertical alignment one above the other and suitably supported on the knitting machine in a support bracket similar to that illustrated and described in connection with the first embodiment of selector device. The selector device includes a single piece core body or base 80 having upstanding coil supporting core plates 81, 82 supporting corresponding coils 83, 84. End plates 85, 86 are suitably supported at opposite ends on the core body 80 and provide bearing supports for a control shaft 88 having limited rotational reciprocation. An elongate relatively flat rotor plate or armature is fixed on the control shaft 88 and provides rotor arms 89, 90 extending outwardly on opposite sides of the control shaft 88. As shown, in FIG. 13, the angular relationship between opposite rotor arms 89, 90 is less than 180° so that the rotor arm 90 is positioned at a slight upward angle when the rotor arm 89 is in a horizontal position.

The inner end portion of the control shaft 88 is rotatably supported in a support bracket 91 which is suitably connected to the end plate 86 and extends at right angles therefrom. The free end of the support bracket 91 is provided with inwardly extending upper and lower ledges or shelf portions 92, 93 which support non-metallic buffer stop means in the form of a substantailly U-shaped stop buffer insert 94. The stop buffer 94 is made of some suitable type of material, such as nylon, which will reduce noise and act as a stop against which the pattern lever can operate.

One end of a pattern lever 100 is fixed on the inner end of the control shaft 88, as by a pin 99, and its free end is provided with an inclined cam surface 101 which operates within the U-shaped buffer stop 94 (FIG. 13). When the rotor arms 89, 90 and the pattern lever 100 are in the solid line positions shown in FIGS. 13 and 14, the cam surface 101 is in alignment with the level of the pattern butts 30 and will move any selector jacks passing thereby inwardly so that they move inside of and are not raised by the jack raising cam 26 and the corresponding needles will not knit but form floats in the fabric.

In order to switch the pattern level 100 to the dotted line inoperative position shown in FIG. 14 so that it is

out of alignment with the butts **30** on the pattern jacks, the coil **84** receives an electrical pulse from the electronic pattern device **77.** This forms an electromagnet of the core **82** in the coil **84** to draw the raised rotor arm **90** downwardly, thereby raising the other rotor arm **101** and the pattern lever **100** upwardly above the level of the butts **30,** to the dotted line position shown in FIG. **14.** Although the rotor arms **89, 90** are not permanent magnets, the coil **84** makes a temporary magnet of the core **82** and this magnet is of sufficient permanance and has sufficient remembrance that it will hold the armature in the moved position until an electrical pulse is received by the coil **83.**

When an electrical pulse is received by the coil **83,** the rotor arm **89** is drawn down toward the core **81** and the pattern lever **100** is immediately moved to the lower or active position shown in solid lines in FIG. **14** so that its cam surface **101** will be in alignment with the level of the butts **30** to rock the corresponding pattern jacks **22** inwardly of the needle cylinder.

As will be noted in FIG. **13,** the rotor arms **89, 90** do not engage the upper ends of the cores **81, 82** of either of the coils **83** or **84** because the outer end of the pattern lever **100** first engages the buffer stop **94.** The buffer stop **94** thus acts as a noise eliminator and limits the amount of vertical movement which may be imparted to the pattern lever **100.**

In both embodiments of the invention illustrated in FIGS. **4–8** and **11–14,** the control shaft is supported perpendicular to the axis of rotation of the needle cylinder and is supported for limited reciprocation along a line extending radially from the axis of the needle cylinder. Also, the pattern levers extend at right angles from the inner ends of the control shafts and each pattern lever includes a cam surface which is adapted to align with pattern butts at a certain level on the pattern jacks when in one position and are moved out of alignment with the corresponding butts when the levers are moved to another position. In both cases, electrical actuator means is operable to rotate the control shaft and selectively position the pattern lever in either of these two positions. The pattern jack actuator means of the present invention operate on very low power requirements since it is only necessary that the electromagnetic devices provide sufficient force to move the pattern levers from one position to another. Therefore, it is not necessary that the electromagnetic devices have sufficient force to move the selector jacks inwardly or outwardly, or to maintain the pattern levers in the position to which they are moved. Also, the pattern levers are positioned against stops which prevent any force acting on the pattern lever from setting up any binding action which would create resistance against rotation of the control shaft. Thus, no radial force is applied to the control shafts so that the bearings do not have to be precisely made or manufactured to a very close tolerance.

In the drawings and specification, there have been set forth preferred embodiments of the invention, and although specific trems are employed, they are used in a generic and descriptive sense only and not for purposes of limitation.

That which is claimed is:

1. In a circular knitting machine including a needle cylinder supported for rotation about a vertical axis, needles supported for vertical movement in said needle cylinder, a pattern jack positioned beneath each of said needles, a plurality of knitting stations spaced around said needle cylinder, and cam means positioned in advance of at least certain of said knitting stations and being selectively engageable by said pattern jacks for raising the corresponding needles, said pattern jacks being movable between a first operative position where they engage and are raised by said cam means and a second inoperative position where they are not raised by said cam means, the combination therewith of improved pattern jack actuator means comprising:

a. a plurality of closely spaced vertically aligned selector devices positioned in advance of each of said cam means at the corresponding knitting station, each selector device including

1. a control shaft supported perpendicular to the axis of rotation of said needle cylinder, said control shaft having an outer end portion supported for limited rotational reciprocation and having an inner end positioned closely adjacent the outer periphery of said needle cylinder,

2. a pattern lever fixed at one end to the inner end of said control shaft and extending at a right angle therefrom, the other end of said pattern lever including a cam surface for aligning with pattern butts at a certain level on said pattern jacks when said control shaft is reciprocated in one direction and for moving out of alignment with said pattern butts when said control shaft is reciprocated in the other direction, and

3. electrically controlled actuator means comprising rotor arms extending outwardly from opposite sides of said outer end portion of said control shaft and having outer free ends, and electromagnetic means associated with each of said rotor arms, said electromagnetic means being selectively operable to selectively attract said associated rotor arm and correspondingly reciprocate said control shaft to selectively position the associated pattern lever, said rotor arms constituting opposite poles of a permanent magnet whereby said rotor arms are held in the switched positions by the permanent magnet constituted by said rotor arms, and wherein said selector devices each comprise upper and lower field plates, end plates, connected to and maintaining said field plates in spaced apart relationship above and below said control shaft, said end plates including bearing supports for portions of said control shaft adjacent the inner and outer ends of said rotor arms, coil pieces positioned between said field plates, coils surrounding each of said coil pieces and spaced from the free ends of said rotor arms, ribs extending inwardly from said upper and lower field plates and above and below said rotor arms and forming air gaps in which said rotor arms operate, and

b. pattern control means operating in timed relationship to operation of said knitting machine and being operable to supply electrical pulses to said electrically controlled actuator means in accordance with a predetermined knitting pattern to thereby selectively position said pattern levers of said selector devices.

2. In an apparatus according to claim **1** including a single support bracket supporting said vertically aligned selector devices at each knitting station, and means for removably supporting said support bracket

adjacent said needle cylinder, said support means including means for radially adjusting said support bracket relative to said needle cylinder to thereby adjust the positions of the said cam surfaces of said pattern levers.

3. In an apparatus according to claim 1 including non-metallic buffer stop strips positioned above and below said rotor arms and between said ribs for engagement with said rotor arms, said buffer stop strips preventing movement of said rotor arms into direct engagement with said ribs when being moved from one position to another.

4. In a circular knitting machine including a needle cylinder supported for rotation about a vertical axis, needles supported for vertical movement in said needle cylinder, a pattern jack positioned beneath each of said needles, a plurality of knitting stations spaced around said needle cylinder, and cam means positioned in advance of at least certain of said knitting stations and being selectively engageable by said pattern jacks for raising the corresponding needles, said pattern jacks being movable between a first operative position where they engage and are raised by said cam means and a second inoperative position where they are not raised by said cam means, the combination therewith of improved pattern jack actuator means comprising:

a. a plurality of closely spaced vertically aligned selector devices positioned in advance of each of said cam means at the corresponding knitting station, each selector device including

1. a control shaft supported perpendicular to the axis of rotation of said needle cylinder, said control shaft having an outer end portion supported for limited rotational reciprocation and having an inner end positioned closely adjacent the outer periphery of said needle cylinder,

2. a pattern lever fixed at one end to the inner end of said control shaft and extending at a right angle therefrom, the other end of said pattern lever including a cam surface for aligning with pattern butts at a certain level on said pattern jacks when said control shaft is reciprocated in one direction and for moving out of alignment with said pattern butts when said control shaft is reciprocated in the other direction,

3. elecrically controlled actuator means comprising rotor arms extending outwardly from opposite sides of said outer end portion of said control shaft and having outer free ends, the angular relationship between said rotor arms being less than 180° so that one of said rotor arms is positioned at a slight upward angle when the other rotor arm is in a horizontal position, and electromagnetic means associated with each of said rotor arms, said electromagnetic means comprising an electromagnetic coil positioned beneath each of said rotor arms so that said coils may be selectively energized to attract and lower the rotor arm positioned at a slight upward angle to thereby correspondingly reciprocate said control shaft to selectively position the associated pattern lever, and

4. non-metallic buffer stop means positioned above and below said other end of said pattern lever to limit opposite directional movement of the corresponding control shaft and to prevent direct engagement of said rotor arms with the corresponding electromagnetic coil, and

b. pattern control means operating in timed relationship to operation of said knitting machine and being operable to supply electrical pulses to said electrically controlled actuator means in accordance with a predetermined knitting pattern to thereby selectively position said pattern levers of said selector devices.

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