Nov. 16, 1971 H. PAEPKE 3,620,047

DIAL MECHANISM FOR KNITTING MACHINE

Filed May 19, 1969 3 Sheets-Sheet 1

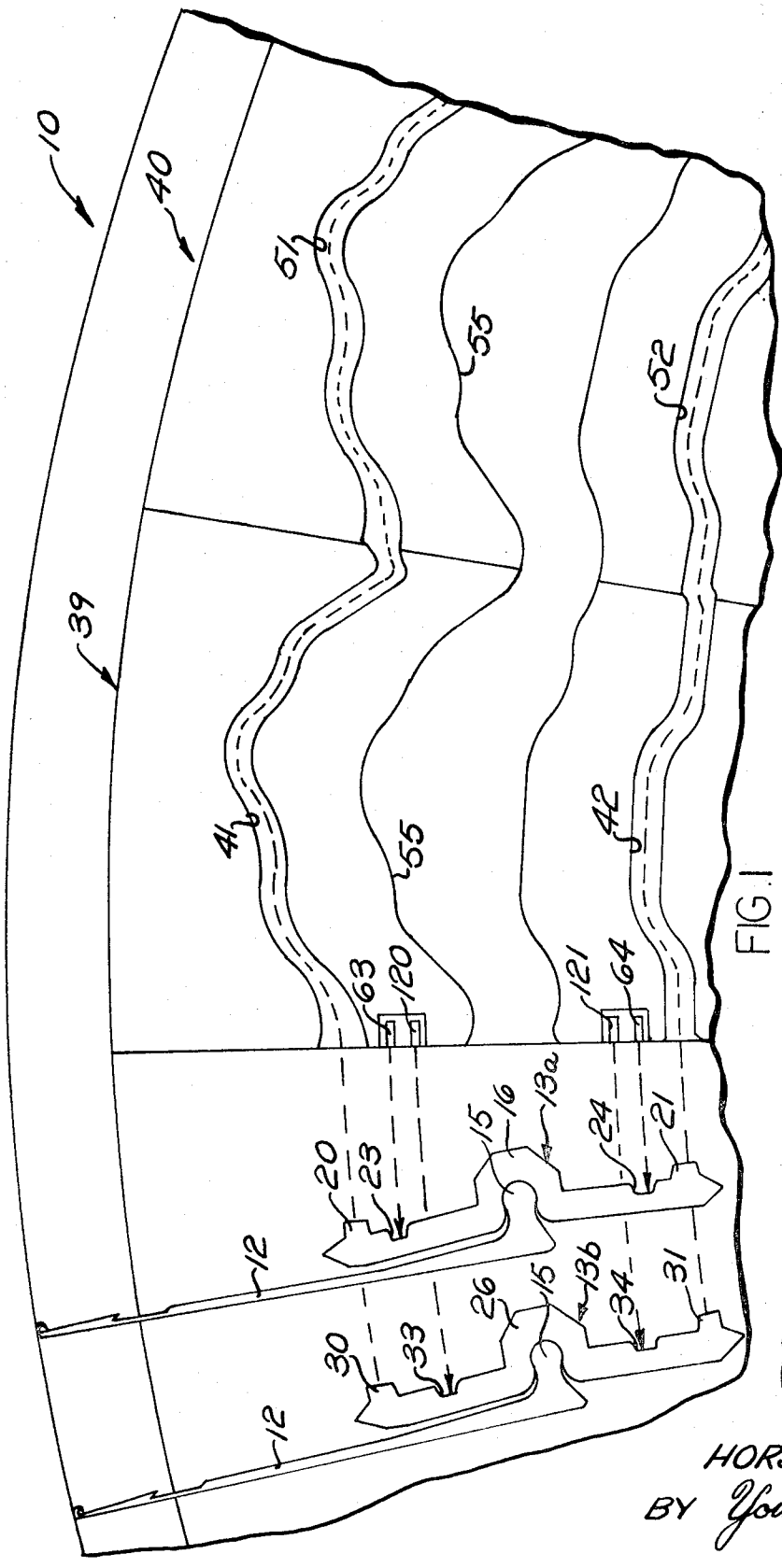

FIG. 1

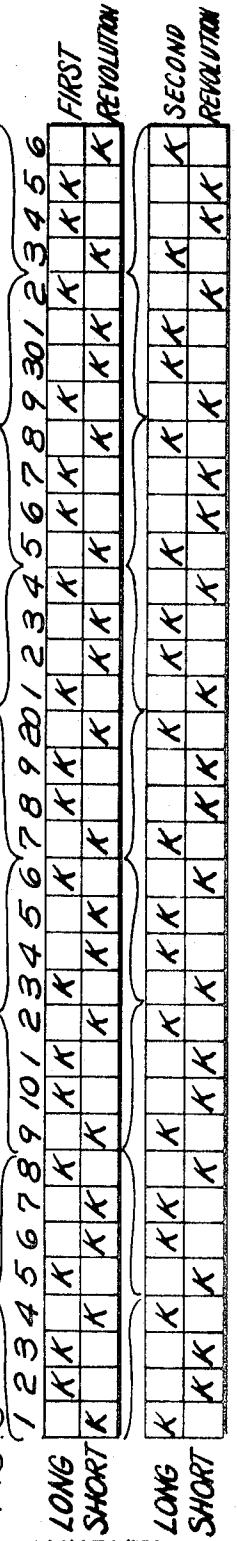

FIG. 6

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DIAL MECHANISM FOR KNITTING MACHINE

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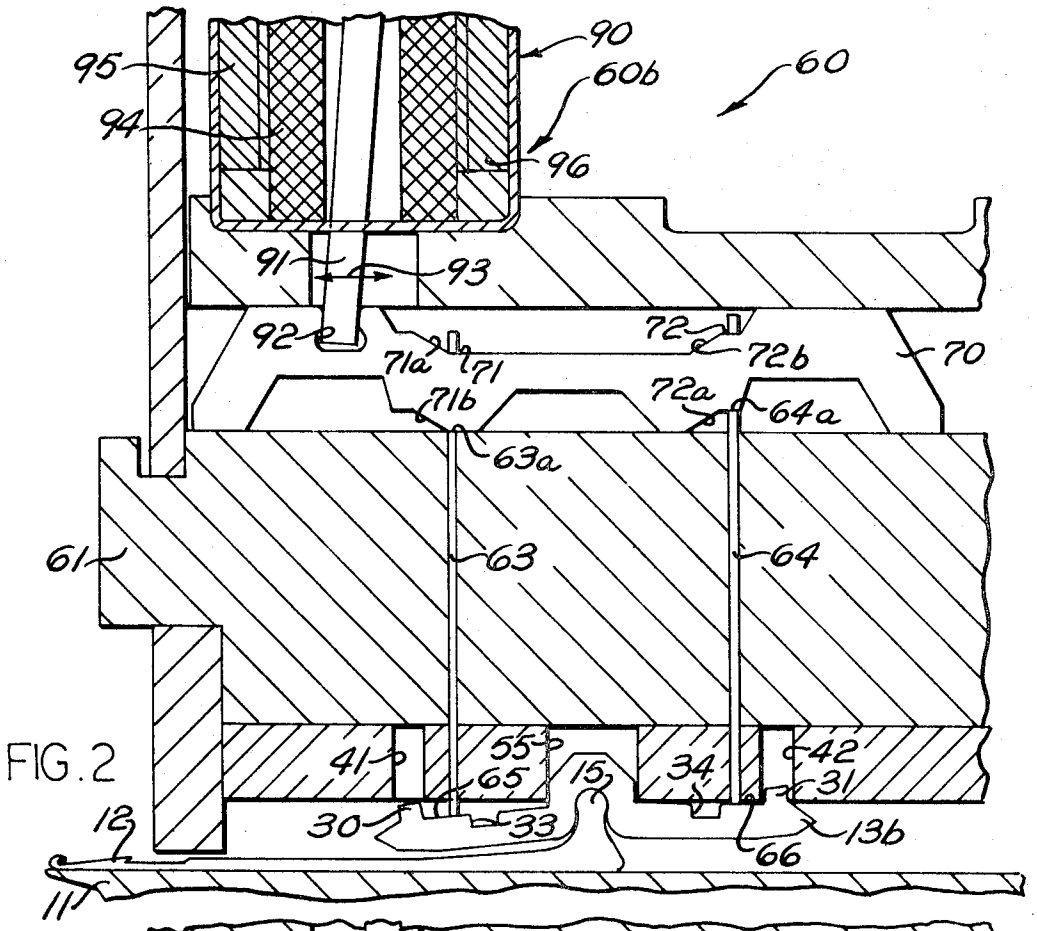

FIG. 2

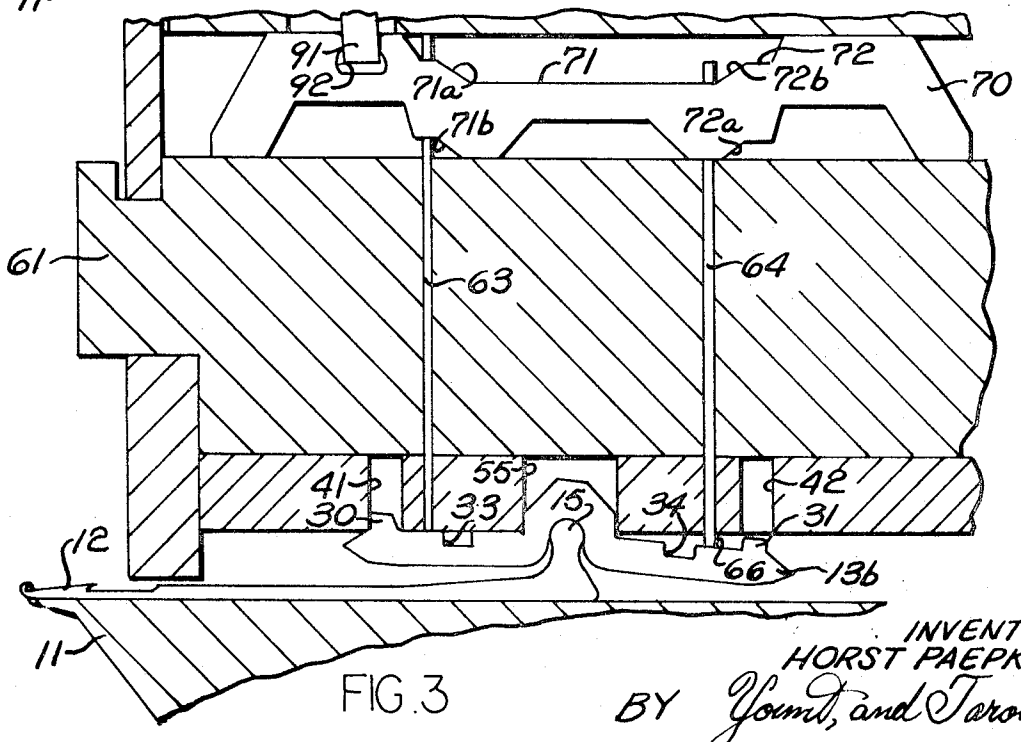

FIG. 3

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DIAL MECHANISM FOR KNITTING MACHINE

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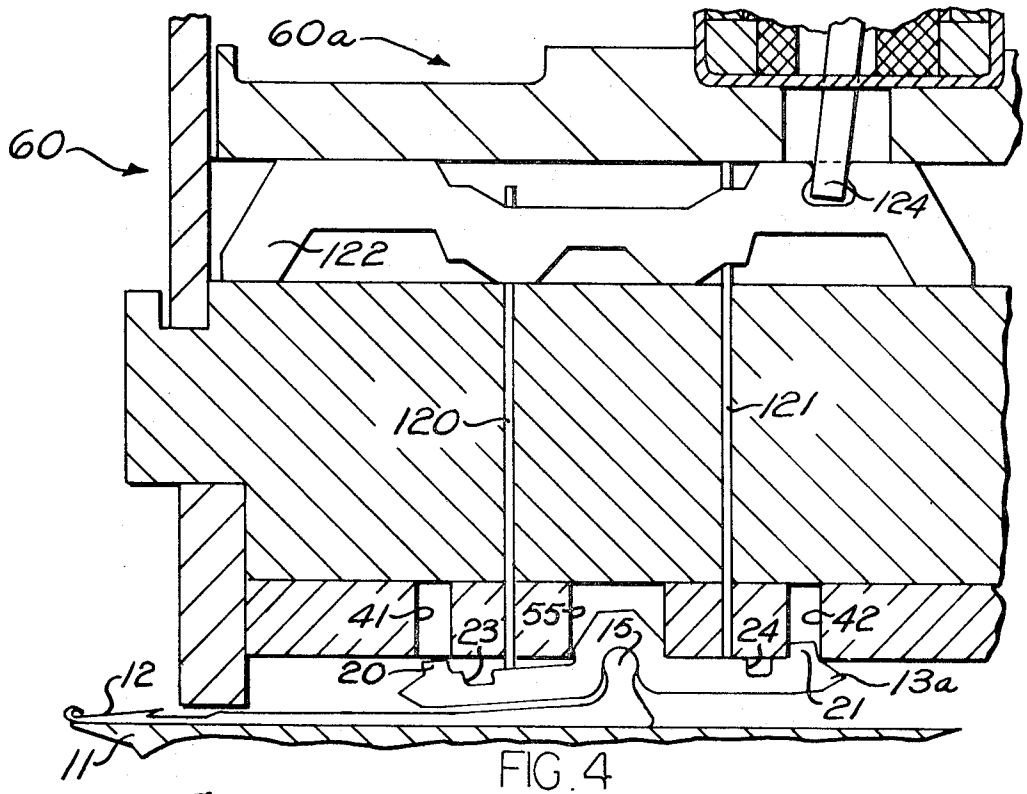

FIG. 4

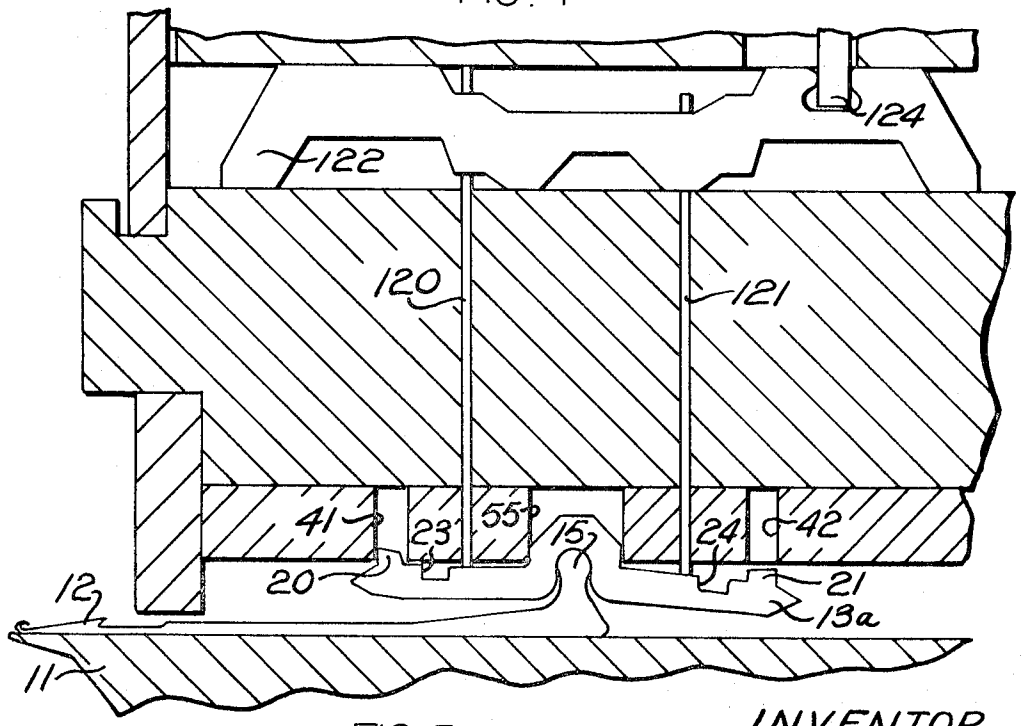

FIG. 5

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DIAL MECHANISM FOR KNITTING MACHINE

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Int. Cl. D04b 9/06, 9/38
U.S. Cl. 66—25 4 Claims

ABSTRACT OF THE DISCLOSURE

A dial mechanism for a knitting machine comprises a dial member rotatable through a plurality of knitting stations. Knitting needles are carried by the dial member. Each of the knitting needles has a needle-moving jack associated therewith. Certain of the needle-moving jacks are long butt jacks and certain of the other needle-moving jacks are short butt jacks. Cam means are located at each knitting station and define a knitting cam track and a welting cam track, respectively, into which butts on the needle-moving jacks move, depending upon the position of the needle-moving jacks as they move through each station. An electromagnetic selector mechanism is provided at each station for varying the position of the needle-moving jacks relative to their associated needle to control the operation of the needles in the station.

The present invention relates to a knitting machine, and particularly relates to a dial mechanism for a knitting machine which includes a dial member rotatable through a plurality of knitting stations and knitting needles carried by the dial member.

Known circular knitting machines include a knitting cylinder which carries a plurality of needles which move in a vertical direction as the needle cylinder rotates. The knitting cylinder has a cooperating dial which rotates in a generally horizontal plane and carries dial needles which cooperate with the needles on the knitting cylinder to effect knitting of the thread as these parts rotate. As is well known, the dial needles work on the back or reverse side of the cloth which is being knitted, while the needles in the knitting cylinder operate on the front or face side of the cloth and knit the particular pattern which is desired therein. In a Jacquard-type machine, the needles on the knitting cylinder are selectively moved to control the pattern which is being knitted on the face side of the cloth, as is well known.

The knitting by the dial needles to form the back side of the cloth is generally performed in a uniform manner and is called twilling. In order to twill the reverse side of a cloth, it requires twice as many feeders or stations as there are colors in the pattern. Moreover, the needle operation must also be controlled in each station. For example, a four-color pattern requires eight feeders to form a twilled reverse side. A conventional knitting machine is arranged so that there are thirty-six feeders around the dial. Accordingly, if eight feeders are necesary to repeat a pattern arrangement on the twill side or reverse side of a Jacquard fabric, the pattern can be repeated on the reverse side only four times. This utilizes thirty-two feeders. As a result, four feeders are not needed or used during the operation of the knitting machine in order to form the pattern on the reverse side. In view of the fact that four feeders are not utilized, this greatly reduces the capacity of the machine.

The present invention involves a mechanism which provides for the use of all thirty-six feeder stations around the dial for purposes of providing a twilled reverse side on a four-color Jacquard fabric. This is accomplished by the

present invention even with a four-color pattern being formed where eight feeder stations are required for a repeat of the pattern on the reverse side. In accordance with the present invention, the pattern is repeated four times in the first thirty-two feeder stations, the last four feeder stations in the first revolution, and the first four feeder stations of the second revolution of the dial form together to create a fifth repeat of the pattern. The last thirty-two feeder stations in the second revolution form the last four repeats of the pattern in the second revolution. In accordance with this invention, each station or feeder has an electromagnetic selector mechanism for controlling the needles in that station. In the example of a four-color fabric, the needles are controlled such that each needle that knitted at a given station in the first revolution, welts in that station in the second revolution, and each needle that welted in a given station during the first revolution of the dial knits in the second revolution of the dial at that station. Accordingly, each needle in two revolutions will move through seventy-two feeder stations and the pattern will be repeated nine times.

In accodance with the present invention, the electromagnetic selector mechanism operates to move a needle-moving jack relative to the associated needle as the needle-moving jack moves past the electromagnetic selector mechanism. A selector mechanism is located at the beginning of each station so that each jack moves thereby as the jack enters a station. The selector mechanism operates to position the jack and the jack remains in that position as it is advanced through the knitting station to effect movement of the knitting needle associated therewith in accordance with the position of the cams at that station.

Accordingly, the principal object of the present invention is the provision of a new and improved dial mechanism which includes an electromagnetic selector mechanism for controlling the operation of the dial needles as the dial needles rotate through the various stations so that all dial stations can be utilized when knitting the reverse side of a Jacquard fabric.

A further object of the present invention is the provision of a new and improved dial mechanism, as noted in the next preceding paragraph, wherein needle moving jacks are pivotally associated with each needle and a selector mechanism is located at each dial station and is operable to pivot the needle-moving jacks associated with the dial needles as they enter a station to thereby control the operation of the needles as they move through the station.

A still further object of the present invention is the provision of a new and improved mechanism for pivoting a needle-moving jack for a dial needle relative to the dial needle in order to position a butt on the needle-moving jack in a given cam track as the needle-moving jack moves with the dial, and wherein the mechanism which efforts the pivoting movement comprises a selector mechanism which includes a pair of vertical sliders which move vertically in response to horizontal movement of another slider.

Another object of the present invention is the provision of a new and improved selector mechanism for effecting movement of a needle-moving jack, as noted in the next preceding paragraph, wherein the vertical sliders have ends thereon which comprise cam surfaces which engage the needle-moving jacks as the jack move thereby to effect a pivoting movement of the needle-moving jacks relative to the associated needles.

Further objects and advantages of the present invention will be apparent to those skilled in the art to which it relates from the following detailed description of a preferred embodiment thereof made with reference to the

accompanying drawings forming a part of this specification and in which:

FIG. 1 is a schematic view illustrating a portion of a dial mechanism for a knitting machine schematically;

FIG. 2 is a sectional view of a portion of the dial mechanism incorporated in FIG. 1 and showing parts thereof in a given position;

FIG. 3 is a view of the mechanism shown in FIG. 2 with parts thereof in a different position;

FIG. 4 is another fragmentary sectional view of the dial mechanism for a knitting machine as shown in FIG. 1;

FIG. 5 is an illustration of the mechanism shown in FIG. 4 with parts thereof in a different position; and

FIG. 6 is a schematic representation showing the operation of a given dial needle at each feeder in two revolutions of the dial to provide a twilled reverse side on a four-color Jacquard fabric.

The present invention relates to a dial mechanism for a circular knitting machine, and particularly relates to a dial mechanism which includes a selector mechanism for selecting and controlling the operation of the dial needles during successive revolutions of the dial needles. By utilizing the present structure, all thirty-six stations around the dial can be utilized for providing a twilled reverse side on a cloth having a four-color pattern being formed therein.

As representing a preferred embodiment of the present invention, the drawings illustrate a dial mechanism, generally designated **10**. The dial mechanism **10** includes a dial member **11** which comprises a disk-like member which carries a plurality of knitting needles **12**. The knitting needles **12** are rotatable with the dial member **11** and rotate through a plurality of knitting stations as the dial member **11** rotates. There are thirty-six knitting stations located around the circumference of the dial member **11** and through which each needle is advanced upon one revolution of the dial member **11**.

Each knitting needle **12** has either a long butt needle-moving jack **13***a* or a short needle-moving jack **13***b* associated therewith. The long and short butt needle-moving jacks are associated with alternate needles positioned around the dial **11**.

Each alternate knitting needle **12** having a long butt needle-moving jack **13***a* associated therewith has a fulcrum portion **15** at the base thereof and which carries or engages in a central portion **16** of the long butt needle-moving jack **13***a*. The portion **16** of the long butt needle-moving jack **13***a* is pivotally connected or carried by the fulcrum **15** so as to provide for pivoting movement of the long butt needle-moving jack **13***a* relative to the fulcrum **15**. The opposite ends of the long butt needle-moving jack **13***a* have ntedle-moving butts **20**, **21**, respectively, thereon. The butts **20**, **21** function in a manner to be described hereinbelow to effect movement of the needle **12** as the needle moves with the dial through the various knitting stations. Each long butt needle jack also has a recess **23** in the forward portion thereof and a recess **24** in the rear portion thereof adjacent the butts **20**, **21**, respectively, for a purpose to be described hereinbelow.

Each short butt needle-moving jack **13***b* is similar in construction to the long butt needle-moving jack **13***a*. Each short butt needle-moving jack **13***b* includes a central portion **26** which is associated with the fulcrum **15** on each needle **12** so as to provide for pivoting movement of the short butt needle-moving jack **13***b* relative thereto. The opposite ends of the short butt needle-moving jack **13***b* include butts **30**, **31**, respectively, which are positioned in alignment with the butts **20**, **21** on the short butt needle-moving jacks. The butts **30**, **31** enter the same cam tracks which the butts **20**, **21**, respectively, enter a the various knitting stations, depending upon the position of the needle-moving jacks, Each short butt needle-moving jack also includes a pair of recesses **33**, **34** in the opposite portions thereof for a purpose to be described hereinbelow.

The movement of the needles **12** as they are advanced through the various knitting stations is effected by cams which are located at each station. At each station, there is a cam mechanism which defines a knitting cam track and a welting cam track. The butts **20**, **21** of the long butt needle-moving jacks **13***a* enter into one of the cam tracks, respectively, so as to cause the knitting needle **12** associated with the long butt jacks **13***a* to either effect a knitting or welting as the needle traverses through that particular station. Likewise, the short butt needle-moving jacks **13***b* control the operation of the alternate needles with which they are associated due to the fact that butts **30**, **31** thereon are received in either the knitting or welting cam track, respectively, as the needles advance through each knitting station.

Two successive knitting stations **39**, **40** are illustrated schematically in FIG. 1. Each knitting station **39**, **40** includes a cam means which defines a knitting cam track thereat and a welting cam track thereat. As shown schematically in FIG. 1, when the butts **21** or **31** of the long and short butt needle-moving jacks **13***a*, **13***b*, respectively, are received in a welting cam track **42** at the knitting station **39**, the needles associated with those needle-moving jacks are moved to a welting position. This, of course, will occur when the needle-moving jacks **13***a*, **13***b*, respectively, are pivoted in a position where the butts **21**, **31**, respectively, thereon will be received in the welding cam track **42**. Moreover, in the event that the needle-moving jacks **13***a*, **13***b* are pivoted so that the butts **20**, **30**, respectively, thereon will be received in a knitting cam track **41** as they traverse through the knitting station **39**, the needles associated therewith will knit.

The cams at station **40** are located similarly to those at station **39**. The cams located at station **40** define a knitting cam track **51** and a welting cam track **52**. The knitting cam track **51** is positioned in alignment with the knitting cam track **41** in station **39**. The welting cam track **52** is aligned with the cam track **42** in the station **39**. Each station also includes a cam track **55** through which portion **16** of the needle-moving jacks **13***a*, **13***b* move. The arrangement of cams shown in stations **39**, **40** is an exemplary schematic illustration and it should be understood that the cams may be positioned at each station differently so that each needle is controlled at that station by the positioning of the cams as desired.

A suitable electromagnetic selector mechanism is located at the beginning of each station. Only the selector mechanism at the beginning of station **39**, however, is illustrated herein and will be described hereinbelow. It should be understood that the selector mechanisms at the other stations are similar to that at station **39**.

The electromagnetic selector mechanism at station **39** is generally designated **60** and illustrated in FIG. 2. The selector mechanism is operable to pivot the needle-moving jacks **13***a*, **13***b* relative to their associated needles and thereby control the positioning of the butts **20**, **21** and **30**, **31** and thereby control which of the cam tracks **41**, **42** they enter. The selector mechanism **60** includes a mechanism **60***a* for operating on the long butt needle-moving jacks **13***a* to effect pivoting thereof, and a mechanism **60***b* for operating on the short butt needle-moving jacks **13***b* to effect pivoting thereof. As noted above, the selector mechanisms **60***a*, **60***b* are located at the entry of station **39**.

The mechanisms **60***a*, **60***b* are supported in a position above the dial member **11** by a support member **61** which supports the cams which define the cam tracks which receive the butts **20**, **21** and **30**, **31**.

As noted above, each jack **13***b* is pivotal relative to the needle **12** with which it is associated about the fulcrum **15**. If the needle-moving jack **13***b* is pivoted in one direction about the fulcrum **15**, the butt **31** is moved into the position shown in FIG. 2 so as to be located in the cam track **42** at station **39**, and if the needle-moving jack **13***b* is

pivoted in the reverse direction, the butt **30** thereon is pivoted so as to be located in the cam track **41** at station **39**. The mechanism **60***b* effects this pivoting movement of the short butt needle-moving jack **13***b*.

The mechanism **60***b* includes a pair of vertical slider members, designated **63**, **64**. The vertical slider members **63**, **64** have bottom edge surfaces which comprise cam surfaces which engage surfaces **65**, **66**, respectively, on the needle-moving jack **13***b* as the needle-moving jack **13***b* traverses around the dial. As shown in FIG. 2, the vertical slider **63** is located in a lower position than the slider **64**. As a result, the slider **63** will engage the surface **65** of the needle-moving jacks **13***b* and will cause a pivoting of the jacks **13***b* in a counterclockwise direction about the fulcrum **15** so as to position the butts **31** in the cam track **42** and remove the butt **30** so that it will not be engaged in the cam track **41**. The slider **64** being in an upper position relative to the slider **63**, does not interfere with this counterclockwise movement of the needle-moving jack **13***b*.

The vertical sliders **63**, **64** are positioned for vertical sliding movement relative to the support **61** and are associated at their upper ends with a horizontally movable slider **70**. The vertical sliders **63**, **64** have openings **63***a*, **64***a*, respectively, therein through which the slider **70** extends. The slider **70** has a surface portion **71** thereof in engagement with the surface defining the opening **63***a* in the slider **63** and a portion **72** in engagement with the surface defining opening **64***a* in the slider **64**. In the event that the slider **70** is moved to the right, as shown in FIG. 3, the surface **71***a* of the slider will move into the opening **63***a* in the slider **63** and result in a vertical shifting of the slider **63** in an upward direction. The surface **72***a* of the slider **70** will engage the opening in the slider **64** and cause the slider **64** to move downwardly. As a result, the sliders **63**, **64** will be changed in position from that shown in FIG. 2 to the position shown in FIG. 3. In order to return the sliders **63**, **64** to the position shown in FIG. 2, movement of the slider **70** to the left from the position shown in FIG. 3 to the position shown in FIG. 2 will effect this movement. Upon such movement of the slider **70** to the left, a tapered surface portion **71***b* of the slider will engage the surface defining the opening **63***a* in the slider **63** and cause the slider **63** to be forced downwardly, as shown in FIG. 3. The surface **72***b* on the slider **70** will engage the surface defining the opening **64***a* in the slider **64** and cause a raising of the slider **64** vertically to the position shown in FIG. 2 from the position shown in FIG. 3. Accordingly, it should be apparent that horizontal sliding movement of the slider **70** will effect a movement or a positioning of the sliders **63**, **64** in either the position illustrated in FIG. 2 or the position illustrated in FIG. 3.

The slider **70** is moved in a horizontal direction between the positions shown in FIGS. 2 and 3 by any suitable mechanism and in the preferred embodiment a suitable electromagnetic mechanism **90** is associated with the slider **70** in order to effect this horizontal movement of the slider **70**. The electromagnetic mechanism **90** includes a control rod member **91** which is pivoted at its upper end and at its lower end is received in a slot or groove **92** in the slider member **70**. The rod member **91** may be pivoted in opposite directions as indicated by arrow **93**, illustrated in FIG. 2. Upon pivoting movement of the member **91**, the slider **70**, of course, is moved therewith due to the fact that the lower end of the member **91** is received in the slot **92** in the slider member **70**.

The member **91** is pivoted upon energization of an electrical coil **94** which encircles the member **91**. The electrical coil **94** is supported interiorly between a pair of permanent magnets **95**, **96**. Permanent magnets **95**, **96** are of opposite polarity, that is, the magnet **95** has its north pole located downwardly and its south pole located upwardly. Whereas, the magnet **96** is just the reverse, with the south pole located in the lower position and the north pole located upwardly. When current flows through the coil **94** in one direction, the member **92** will be attracted toward the north pole of the permanent magnet **95**, whereas, when current is flowed through the coil **94** in the reverse direction, the member **91** is attracted to the south pole of the permanent magnet **96**. In this manner, the member **91** can be pivoted between its positions illustrated in FIG. 2 and FIG. 3, and when so pivoted, the horizontal slider **70** is positioned in one of its two positions. It should be apparent from the above that the vertical sliders **63**, **64** are located and moved between the positions illustrated in FIGS. 2 and 3 and the position of the butts **30**, **31** are controlled thereby.

The positioning of the needle-moving jacks **13***a* so that the butts **20**, **21** thereon engage in a desired cam track at station **39** is controlled by the mechanism **60***a* which is very similar to the mechanism **60***b* described hereinabove in connection with the control of the jacks **13***b*. The mechanism **60***a* which controls the positioning of the jacks **13***a* is illustrated in FIGS. 4 and 5 and will not be described herein in detail in view of the similarity in structure to that described above in connection with FIGS. 2 and 3. It should be clear, however, that the mechanism **60***a* which operates to effect the positioning of the jacks **13***a* includes a pair of vertical sliders **120**, **121** which cooperate with a horizontal slider **122**, in the same manner as the vertical sliders **63**, **64** cooperate with the horizontal slider **70**. The slider **122** is moved between its positions illustrated in FIGS. 4 and 5 by a control rod member **124** which is associated therewith and which is pivoted to effect the sliding movement of the slider **122** in a manner similar to that described above in connection with the slider **70**.

As illustrated in the drawings and noted above, the mechanisms **60***a*, **60***b* are located immediately in advance of the knitting station **39**. Accordingly, as each long butt needle-moving jack **13***a* moves into the station **39**, the sliders **120**, **121** will effect the positioning of the needle-moving jacks **13***a*, as described hereinabove. Likewise, as each short butt needle-moving jack **13***b* enters the station **39**, the sliders **63**, **64** will operate to position each short butt needle-moving jack **13***b* as described hereinabove. The needle-moving jacks **13***a*, **13***b* will remain in position through station **39**. The friction in the pivot connection **15**, coupled with the friction between the sides of the jacks and the dial parts defining the slots in which the jacks are located (as is known), maintains the jacks **13***a*, **13***b* in the position to which they are moved. At the entry of the next successive station **40**, the jacks **13***a*, **13***b* encounter another selector mechanism. The position of the jacks may be changed thereby or the jacks may remain in the same position that they had in station **39**. In any event, the position of the jacks **13***a*, **13***b* may be controlled by the selector mechanism at station **40** to control needle operation at station **40**. In a like manner, the needle operation at each station may be controlled.

The lower ends of the vertical sliders **120**, **121** are positioned during rotation of the dial so as to be aligned with the slots **33**, **34** in the short butt needle-moving jacks **13***b* and, thus, do not affect or engage the short butt needle-moving jacks **13***b*. Likewise, the vertical sliders **63**, **64** are aligned with the slots **23**, **24** in the long butt needle-moving jacks and, thus, the sliders **63**, **64** do not engage or in any way affect the position of the long butt needle-moving jacks **13***a* (see FIG. 1).

The present construction, as described hereinabove, provides for the selection and control of each dial needle at each station. The advantage of this construction can best be appreciated from reference to FIG. 6 which, by way of example, pertains to the knitting of a four-color Jacquard fabric and the reverse side of the fabric is twilled. The dial mechanism operates to twill the reverse side, as noted above, and in order to provide a twilled reverse side on a Jacquard fabric, eight knitting stations are necessary for providing a repeat of a pattern.

As illustrated in FIG. 6, the long and short butt needles as they move through successive stations will either knit or welt. For example, in the first, fourth, sixth and seventh station, all needles having long butt jacks **13***a* will welt and in the second, third, fifth and eighth stations, all needles having long butt needle-moving jacks will knit. This is indicated by a blank or a K, respectively, in FIG. 6. The needles having short butt jacks **13***b* will knit in station **1**, **4**, **6** and **7** and will welt in stations **2**, **3**, **5** and **8**. The short butt needles will knit in those stations where the long butt needles do not knit and will welt in those stations where the long butt needles knit. Accordingly, the cams are arranged so that in a given repeat, namely, in a given succession of the first eight feeder stations, the needles associated with the short butt needle jacks will knit in stations **1**, **4**, **6** and **7**, and the needles associated with the long butt jacks will knit in stations **2**, **3**, **5** and **8** for each successive set of eight stations. The pattern repeats are illustrated in FIG. 6 by brackets. It should be apparent from FIG. 6 that during the first revolution of the dial, the repeat of eight successive stations is effected four and one-half times.

During the second revolution, it is necessary for each knitting needle which knitted at a given station in the first revolution to not knit at that station in the second revolution, and each knitting needle which did not knit at a given station in the first revolution to knit at that station during the second revolution. For example, as illustrated with respect to station **1** in FIG. 6, the long butt needles at station **1** in the first revolution do not knit. At station **1** in the second revolution, they do knit. And this follows through for each station of the thirty-six stations in the second revolution. As a result, repeating of the pattern continues from the first revolution of the dial into the second revolution thereof. As a result, the last four stations of the first revolution and the first four stations of the second revolution of the dial comprise the fifth repeat of the pattern. The repeating of the pattern then continues in the second revolution for four additional repeats. As a result, nine repeats of the pattern can be effected during two revolutions of the dial and all thirty-six stations around the dial can be utilized as opposed to holding four of the stations in an inactive condition in order to provide the proper repeating or repetition of the pattern.

In accordance with the present invention, the control mechanisms **60***a*, **60***b* which are associated with the long and short butt needle-moving jacks **13***a*, **13***b*, respectively, are effective under a suitable control to slide the sliders **70**, **122** respectively, and effect movement of the vertical sliders so that all of the long and short needle-moving jacks **13***a*, **13***b* which traverse thereby are changed in position. As a result, every needle-moving jack may be controlled as it enters each station to thereby control the needle operation in each station. The selector mechanisms are controlled to effect such operation. It should be clear, therefore, that for different fabrics, the dial needles can be controlled as desired.

The description hereinabove refers to the needle-moving jacks **13***a*, **13***b*, respectively, as long and short butt needle-moving jacks. These terms have been given these jacks due to the fact that the actuating portions of the jacks, which are engaged by the sliders which effect pivoting of the jacks, are spaced differently on the alternate jacks. For example, the surfaces of the long butt needle-moving jack **13***b* which comprise the actuating portions which are engageable by the sliders **63** and **64** are spaced apart, as shown in FIG. 3, a distance equal to the spacing between the sliders **63** and **64**. This spacing is substantially greater or longer than the spacing between the actuating portions of the short butt needle-moving jacks **13***a*, which portions are engaged by the sliders **120**, **121**, as shown in FIG. 5. Accordingly, the terms "long and short butt" needle-moving jacks have been given to the jacks **13***b* and **13***a*, respectively.

What is claimed is:

1. A dial mechanism for a knitting machine comprising a dial member rotatable through a plurality of knitting stations, knitting needles carried by said dial member, each of said knitting needles having needle-moving jacks associated therewith, certain of said needle-moving jacks being of one construction and certain of the other of said needle-moving jacks being of another construction, cam means located at each knitting station and defining a knitting cam track and a welting cam track, respectively, each of said needle-moving jacks having butts thereon adapted to be received in one of said cam tracks as the jacks move therethrough during one revolution of said dial, each of said needles either knitting or welting in each station during one revolution of the dial member, first selectively actuatable means located at at least one station for varying the position of all of said needle-moving jacks of said one construction relative to their associated needle as they pass thereby, and second selectively actuatable means located at at least one station for varying the position of all of said needle-moving jacks of said another construction relative to their associated needle as they pass thereby, said needle-moving jacks being pivotal relative to their associated needle and having a pair of butts thereon, said butts being engageable in said respective cam tracks to thereby control operation of the associated needle, said first and second selectively actuatable means for varying the position of said needle-moving jacks relative to their associated needle comprising means for effecting pivotal movement of each of said needle-moving jacks relative to their associated needle, each of said first and second means including a pair of slider members having a portion positionable in the path of movement of the respective needle-moving jacks of said one and another constructions in order to effect pivotal movement thereof as they move thereby, and each of said first and second means including a horizontally movable slider member which cooperates with each pair of said vertical sliders and effects vertical movement of said vertical sliders upon horizontal sliding movement thereof.

2. A dial mechanism as defined in claim **1** wherein each of said first and second means includes electromagnetic means for effecting a horizontal sliding movement of said horizontal sliders.

3. A dial mechanism for a knitting machine comprising a dial member rotatable through a plurality of knitting stations, knitting needles carried by said dial member, each of said knitting needles having a needle-moving jack pivotally associated therewith, certain of said needle-moving jacks being of one construction and certain of the other of said needle-moving jacks being of another construction, cam means at each station defining a knitting cam track and a welting cam track, respectively, each of said needle-moving jacks having butts thereon adapted to be received in one of said cam tracks as the jacks move with said dial, each of said needle-moving jacks being pivotal to locate a butt thereon in said knitting or welting cam track, and means adjacent at least one of said stations and energizable to effect pivotal movement of all of the needle-moving jacks so as to control the positioning of the butts thereof in said cam tracks as they pass thereby, said means for varying the position of the needle-moving jacks comprising a mechanism for effecting pivotal movement of the needle-moving jacks of said one construction and a second mechanism for effecting pivotal movement of the needle-moving jacks of said another construction relative to their associated needles, each of said mechanisms including a pair of slider members having a portion positionable in the path of movement of the respective needle-moving jacks of said one and another constructions in order to effect pivotal movement thereof as they move thereby, and each of said

mechanisms including a horizontally movable slider member which cooperates with each pair of said vertical sliders and effects vertical movement of said sliders upon horizontal sliding movement of said horizontal sliders.

4. A dial mechanism for a knitting machine comprising a dial member rotatable through a plurality of knitting stations, knitting needles carried by said dial member, each of said knitting needles having a needle-moving jack associated therewith, cam means at each knitting station defining a knitting cam track and a welting cam track, each needle-moving jack having a pair of butts thereon each of which is adapted to be received in one of said cam tracks, each of said needle-moving jacks being movable relative to its associated knitting needle between a knitting position and a welting position, and means for selectively moving said needle-moving jacks to position one butt thereon in one of said cam tracks, said last-recited means comprising a pair of vertically movable slider members relatively positionable in the path of movement of said needle-moving jacks and selectively operable to effect movement of said jacks between said knitting and welting positions upon movement thereof thereby, a horizontally movable slider cooperable with said pair of vertically movable slider members for effecting vertical movement of said sliders upon horizontal sliding movement of said horizontal slider, and electromagnetic selector means actuatable to effect horizontal movement of said horizontally movable slider.

References Cited

UNITED STATES PATENTS

3,472,287	10/1969	Ribler	66—75 UX
2,025,462	12/1935	Lombardi	66—50
2,025,463	12/1935	Lombardi	66—50 A
2,025,464	12/1935	Lombardi	66—50
3,262,285	7/1966	Beguin et al.	66—50
3,499,300	3/1970	Zahradka	66—50

FOREIGN PATENTS

1,499,339	7/1966	France	66—50
1,546,919	10/1968	France	66—50
272,307	6/1927	Great Britain	66—50
461,016	2/1937	Great Britain	66—25

OTHER REFERENCES

Knitted Outerwear Times, vol. 37, No. 42, Oct. 7, 1968, pp. 56–60.

WILLIAM CARTER REYNOLDS, Primary Examiner