

Jan. 30, 1968

R. SCHMIDT

3,365,915

DIAL NEEDLE CONTROL ARRANGEMENT

Filed Aug. 5, 1965

3 Sheets-Sheet 1

FIG. 1

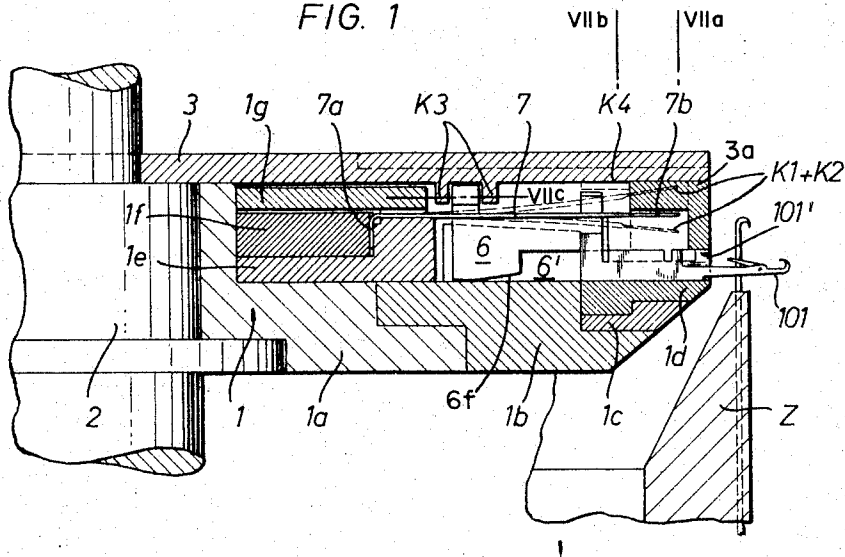


FIG. 3

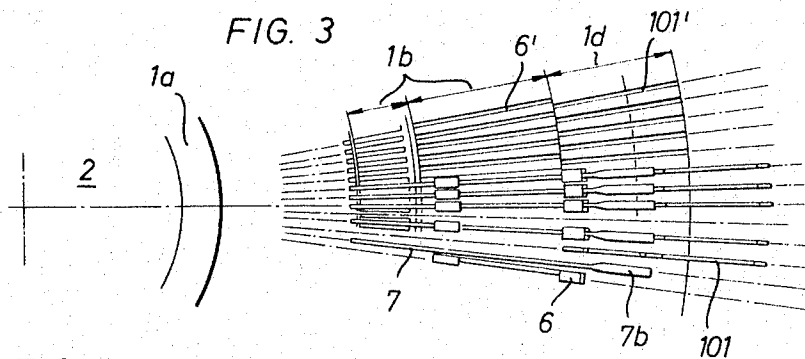


FIG. 4

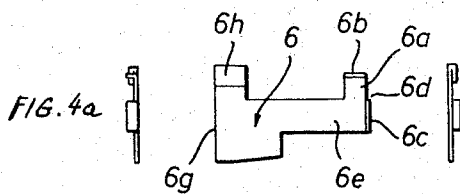
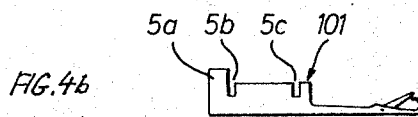
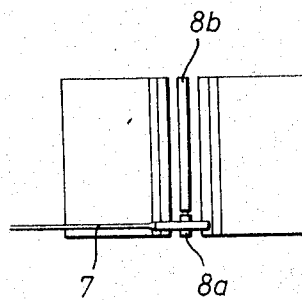
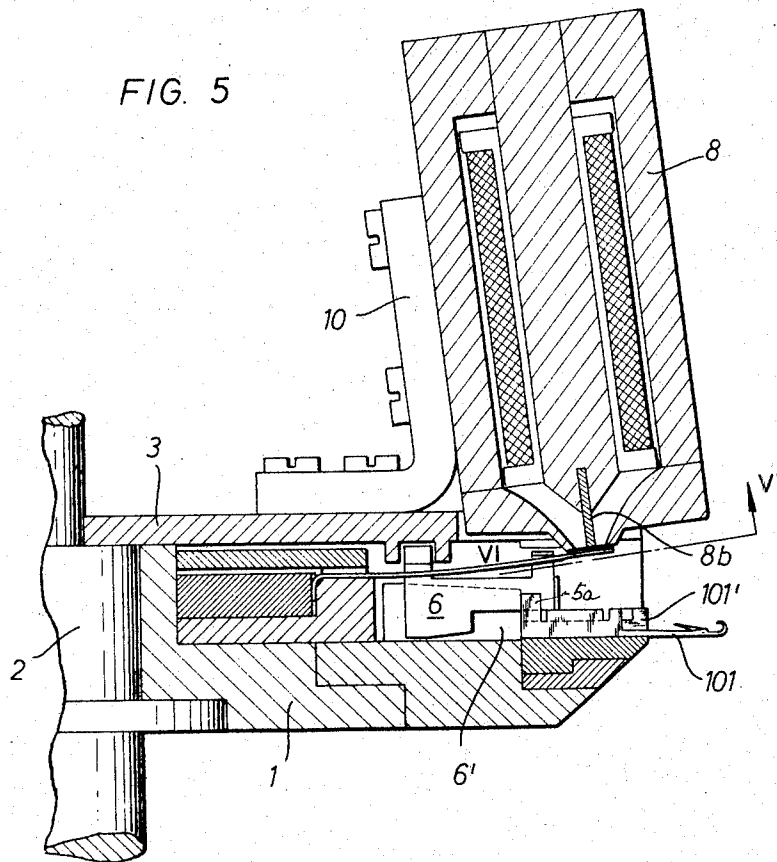


FIG. 2





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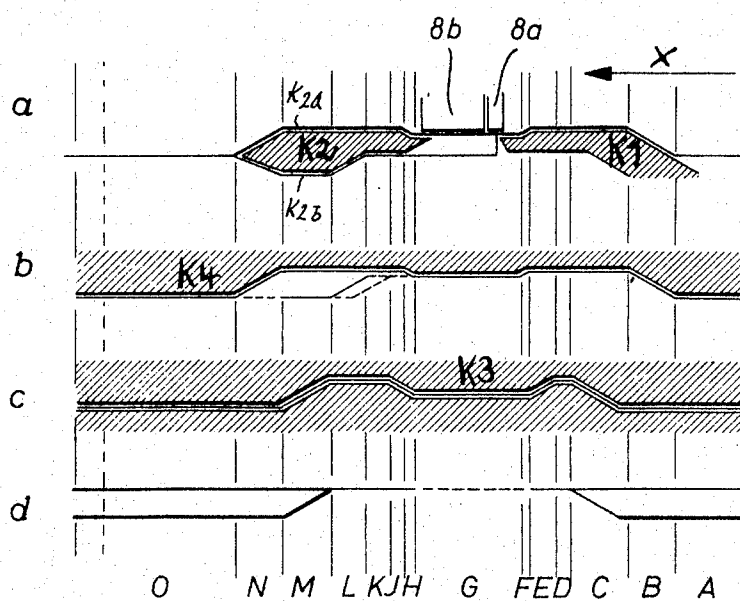
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DIAL NEEDLE CONTROL ARRANGEMENT

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FIG. 7



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DIAL NEEDLE CONTROL ARRANGEMENT
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M 62,022
14 Claims. (Cl. 66—25)

ABSTRACT OF THE DISCLOSURE

Dial needles have coupling portions at their inner ends cooperating with coupling members, and are selectively moved to operative positions by selected coupling members which are operated by control springs moved by electromagnetic selector means and guided by cams on a stationary dial cam plate.

The present invention relates to a dial needle control arrangement for a circular knitting machine, and more particularly to electrical control apparatus for operating dial needles in accordance with a predetermined pattern.

The U.S. Patent 3,079,775, issued to Schaefer et al., and the U.S. Patent 3,170,312 issued to Stock, disclose pattern wheels using electromagnetic means for shifting selected jacks to an advanced operative position in which the jacks act on the cylinder needles of a circular knitting machine on which pattern wheels are provided in addition to the usual cam boxes. Since the axes of the pattern wheels are inclined to the main axis of the needle cylinder, the butts of the cylinder needles are engaged by selected jacks in advanced operative positions and raised to knit or tuck positions in accordance with the desired pattern. Projecting teeth of the pattern wheel extend between the needles of the needle cylinder so that the pattern wheel and the jacks are rotated in synchronism with the needle cylinder.

The present invention employs some of the structural elements of the prior art for operating the dial needles of a circular knitting machine in accordance with a predetermined pattern. The advance and retraction of dial needles in accordance with a pattern presents difficulties inasmuch as the space available for control elements in the dial inwardly of the dial needles is limited, and depends on the diameter of the dial, which in turn must be smaller than the diameter of the needle cylinder.

It is one object of the invention to provide a dial needle control arrangement requiring only little space and adapted to the arrangement within a dial inwardly of the dial needles.

A related object of the invention is to provide a pattern control arrangement for the dial needles of a knitting machine whose dial has a very small diameter, such as 8 inches.

Another object of the invention is to provide dial needles of a specific and novel construction permitting the direct operation of the dial needles by a pattern control apparatus.

Another object of the invention is to use dial needles of such short length that sufficient room is available in the dial for pattern control apparatus.

Another object of the invention is to eliminate pattern wheels for controlling the dial needles of a knitting machine having a plurality of knitting stations.

Another object of the invention is to shift the dial needles between inoperative and operative positions by rigid elements.

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Another object of the invention is to control the selection of dial needles by electromagnetic means, but to shift the dial needles by rigid cams.

With these objects in view, the present invention relates to a dial needle control arrangement for shifting the dial needles of a circular knitting machine in accordance with a predetermined pattern. One embodiment of the invention comprises a plurality of dial needles mounted on a rotary dial for rotation therewith and for movement between inoperative and operative positions, a plurality of coupling members mounted on the dial for movement between an inoperative position and a coupling position coupled with a corresponding dial needle, first control means preferably including electromagnetic selector means and control cams, for moving selected coupling members to and from the coupling position so that only selected dial needles are coupled with the coupling members, and second control means, preferably including stationary cam means for moving the coupling members between inner and outer positions. Selected dial needles which are coupled with coupling members, are shifted together with the coupling members to an operative position in which they participate in the knitting operation together with the cylinder needles of the circular knitting machine.

The dial needles according to the present invention are shorter than standard dial needles, and have a rear part formed as a thin plate provided with a pair of coupling slots and with a coupling projection. The coupling members are thin coupling plates having a cam follower projection cooperating with cams, and a coupling projection adapted to pass into one or the other of the coupling slots of an associated dial needle, and which engages the coupling projection of the corresponding dial needle when it is desired to couple the respective coupling member and dial needle only for movement in inward direction from the operative position to the inoperative position of the dial needle.

Each coupling member has a curved or slanted bottom edge which permits a tilting movement of the coupling member between a higher position in which the coupling projection of the coupling member is located outside of the slots of the dial needle, and a lower coupling position in which the coupling projection of the coupling member is located in one of the slots of the corresponding dial needles.

It is preferred to use radially extending elongated control springs operated by cams and electromagnetic means to move the coupling members to and from the coupling position.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIG. 1 is a fragmentary axial sectional view illustrating a dial provided with a pattern control arrangement in accordance with the present invention, and part of a needle cylinder;

FIG. 2 is a side view of a dial needle according to the invention;

FIG. 3 is a fragmentary schematic plan view illustrating the embodiment of FIG. 1 with the dial cam plate removed;

FIG. 4 is a side view of a coupling member forming part of the embodiment of FIG. 1;

FIGS. 4a and 4b are front and rear views of the coupling member shown in FIG. 4;

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FIG. 5 is a fragmentary axial sectional view showing the embodiment of FIG. 1 in another operational position, and with electromagnetic selector means which are omitted in FIG. 1 for the sake of simplicity;

FIG. 6 is a fragmentary bottom view taken on line VI—VI in FIG. 5; and

FIG. 7 is a diagrammatic developed view illustrating one section of a dial corresponding to one knitting station of a circular knitting machine and including FIGS. 7a, 7b, 7c and 7d; FIG. 7a being a developed sectional view taken on line VIIa in FIG. 1, FIG. 7b being a developed sectional view taken on line VIIb in FIG. 1, FIG. 7c being a developed sectional view taken on line VIIc in FIG. 1, and FIG. 7d being a fragmentary schematic developed plan view illustrating the positions of the dial needles, FIGS. 7a to 7d being coordinated to illustrate the relative positions of the cams and of elements controlled by the cams.

Referring now to the drawings, the dial 1 includes annular parts 1a, 1b, 1c, 1d, 1e, 1f and 1g and is rotated by a shaft 2 to which it is secured. The dial cam plate 3 is stationarily mounted on top of dial 1 and is provided with cams K1, K2, K3, and K4, whose shapes are best seen in FIGS. 7a, 7c, and 7b, respectively. As shown in FIG. 5, an electromagnetic selector means 8 is secured by bracket 10 to dial cam plate 3 and has two poles 8a and 8b, best seen in FIG. 6 which are located in the region of a gap between cams K1 and K2, as best seen in FIG. 7a.

The annular part 1d has radially extending guide channels 101' for dial needles 101, and annular part 1b has radially extending guide channels 6' for coupling members 6, the guide channels 101' and 6' being circumferentially staggered as best seen in FIG. 3. Each dial needle has a plate-shaped rear portion including a higher coupling projection 5a at the rear end, a coupling slot 5b adjacent the front edge of portion 5a, and another coupling slot 5c spaced in radial direction from coupling slot 5b. The front end of the dial needle has the usual hook and latch.

A series of control members in the form of springs 7 is secured between annular parts 1e and 1f, each control spring 7 extending in radial direction and having a flat end portion 7b located between opposite cam tracks of a pair of cams K1 and K2 secured to a circular wall portion 3a of the dial cam plate 3.

As best seen in FIG. 3, each control spring 7 is associated with a dial needle 101 and is operatively connected with the same by coupling member or coupling plate 6.

The shape of coupling member 6 is best seen in FIGS. 4, 4a and 4b. The front end has a projection 6a terminating in a transverse coupling projection 6b, and another transverse lug 6c projects laterally from the front edge 6d of the coupling member. The bottom edge of the coupling member has a first portion 6e, and the rearwardly located portion 6f which is slanted and preferably slightly curved. The rear end of the coupling member has a rear edge 6g, and a higher cam follower portion 6h which is bent upon itself to have greater strength. As best seen in FIG. 1, cam follower portion 6h is located between the pair of endless cams K3, and the bottom edge 6f rests on the bottom of slot 6' formed by the top face of annular part 1b. Due to the slant of bottom edge 6f, each coupling member can perform a tilting movement in a radial plane about the rear end of bottom edge 6f to and from a coupling position in which coupling projection 6c enters either slot 5c or slot 5b of the corresponding radially aligned dial needle 101, depending on the relative position between an associated pair of members 5 and 6.

As shown in FIGS. 1 and 5, each control spring 7 is located between the upper edge of a coupling projection 6c and the transverse projection 6b of the associated coupling member 6. The normal position of a control spring 7 is shown in FIG. 1, but during rotation of the

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dial 1 relative to cams K1 and K2, each control spring 7 is raised to the higher tensioned position shown in broken lines in FIG. 1, or may be bent down to the lower tensioned position shown in broken lines in FIG. 1.

A control spring 7 in the higher position will engage the lower face of projection 6b and hold the respective coupling member 6 in the position illustrated in FIG. 5 in which the lower edge of coupling projection 6c is located above, and does not engage the slots 5b and 5c of the respective dial needle 101. However, projection 6c will cooperate with coupling projection 5a during inward movement so that the dial needle can be retracted in this position of the coupling member but not advanced.

Due to the space between the upper edge of coupling projection 6c and projection 6b, each coupling member can remain in this position even if the respective control spring is in the normal straight position illustrated in solid lines in FIG. 1. However, if a control spring 7 is bent to the lower position shown in broken lines in FIG. 1, then a force will be exerted on coupling projection 6c to urge the same into an aligned slot 5b or 5c in which event coupling member 6 will be coupled with the respective dial needle 101 for radial movement under the control of the pair of cooperating cams K3 which are designed to cause a movement of the dial needles in radial direction for a distance corresponding to the desired displacement of the dial needles between a retracted inoperative position and an advanced operative position.

When the coupling member 6 is in the position shown in FIG. 1 with coupling projection 6c located outside of the coupling slots 5b and 5c, but in engagement with the front edge of projection 5a, coupling member 6 is coupled to dial needle 101 only for movement in inward radial direction.

The endless cam K4, see FIG. 7b, cooperates with the projections 6b of all coupling members 6, and dwells of cam K4 will cause coupling member 6 to tilt downward about edge 6f so that coupling projection 6c will pass into an aligned coupling slot in the corresponding dial needle 101, in the same manner as if coupling member 6 were tilted by the corresponding control spring 7.

During rotation of the dial 1 with members 6, 7 and 101, cams K3 will act as control means for moving coupling members 6 and dial needles 101 in radial direction between inner and outer positions, and cams K1, K2 and K4, as well as control springs 7 will act as control means for moving coupling members 6 between the inoperative position illustrated in FIG. 1 and a coupling position in which coupling projection c engages one of the coupling slots 5b or 5c.

As best seen in FIG. 7a, the broader end portion 7b of each control spring 7 will be guided along the upper cam track of cam K1 when dial 1 rotates in the direction of the arrow X. At the end of cam K1, each control spring 7 will be in a tensioned higher position, and will be in contact with, or very closely spaced from the end face of the pole 8a of an electromagnetic selector 8. If electromagnetic selector 8 is energized at this moment, it will hold the respective control spring in the higher tensioned position, only little magnetic force being required since the bending of control spring 7 from the normal position to the higher tensioned position is not affected by the force of the electromagnetic selector 8, but by cam K1 and by the drive torque of the rotating dial 1. During further rotation of dial 1, control spring 7 in the upper tensioned position will be held by pole 8b until the respective portion 7b, traveling with the dial, arrives at the upper cam track K2a. Return of control spring 7 to its normal position is prevented by cam K2. Pole 8b may be permanently magnetic while the narrower pole 8a is selectively magnetized by a corresponding selectively energized winding of electromagnetic selector 8 to attract only certain control springs 7 while exerting no magnetic force on other non-selected control springs 7 whose associated dial needles are not to be advanced in

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accordance with the pattern. It will be understood that the winding of electromagnetic selector 8 is energized or not energized, respectively, under control of pattern means which are set to a selected program of knitting operations. When a control spring 7 passes beyond the end of cam K1 while selector pole 8a is not magnetized, the respective control spring 7 will be released by cam K1, and will resiliently move to its normal straight position, or resiliently move beyond the same. Such a released control spring 7 is engaged by the cam track K2b and travels along the same while other selected control springs 7 travel along the upper track K2a.

OPERATION

The operation will be best understood with reference to FIGS. 7a to 7d. FIGS. 7a, 7b, 7c show stationary cams secured to the dial cam plate 3, 3a in hatched cross section, while FIG. 7d illustrates schematically the inoperative and operative positions of dial needles 101. FIG. 7a shows cams K1 and K2 which effect the up and down movement of control springs 7, FIG. 7b shows cam K4 which effects the downward movement of coupling members 6 which are not operated by control springs 7, and FIG. 7c illustrates in a horizontal view cams K3 which effect the radial movement of coupling members 6 for the purpose of shifting those dial needles 101 which are coupled to the respective coupling members 6.

Corresponding points of FIGS. 7a to 7d are related by ordinates extending in radial planes passing through the axis of rotation of dial 1. Circumferential sections are indicated by capital letters appearing below FIG. 7d. A knitting station, where the dial needles have to be arranged in operative and inoperative positions, respectively in a selected order corresponding to the desired pattern to be knitted on the knitting machine, is assumed to be located before the beginning of the circumferential section A, and another knitting station is assumed to be located at the end of the circumferential section O. The circumferential section G may be considered as a select-infi station since at this point electromagnetic selector 8 is energized or de-energized in accordance with a pattern to cause selection or non-selection of control springs 7 which determine a corresponding selection of dial needles 101.

At the beginning of a selecting operation, all dial needles 101 are arranged in inoperative or operative positions in accordance with the pattern required for the preceding knitting operation in the preceding circumferential section of the knitting machine. Dial needles 101 have passed through the feeding station, and move along the circumferential section A in the direction of the arrow X due to the rotation of dial 1 with the needle cylinder. FIG. 7d shows two parallel lines in the section A which means that some dial needles are in the outer advanced operative position, and other dial needles are in the inner retracted inoperative position. The old order of dial needles is still maintained in section B.

In the circumferential section A, all coupling members 6 are held by the pair of cams K3 in an outer position, and cam K4 acts at the same time on projection 6b to hold the outer ends of coupling members 6 down in the coupling position in which coupling projections 6c are located in slot 5b of dial needles 101 in operative positions, and located in slots 5c of dial needles 101 in retracted inoperative positions. The dial needles are thus firmly coupled to coupling member 6 and accurately held in place while cooperating with the cylinder needles to knit the yarn into a patterned fabric. Control springs 7 are not engaged by any cam in section A, and are in the normal straight position.

Control springs 7 are raised in section B as shown in FIG. 7a. Cam K4 has a thinner portion in section B so that spring 7 can raise coupling member 6 by engaging projection 6b from below. Consequently coupling projections 6c are pulled out of slots 5b and 5c while the re-

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spective coupling member 6 tilts in counter-clockwise direction about its bottom edge 6f.

In section C, cams K3 are effective to withdraw coupling members 6 to an inner position. Since coupling projections 6 are no longer located in slots 5c of inoperative retracted dial needles, the inward movement of the respective coupling members 6 has no influence on the associated dial needles. However, previously operative advanced dial needles 101 will be retracted, since coupling projection 6c engages the outer edge of coupling projection 5a of the respective dial needle. Consequently, at the beginning of Section D, all dial needles are in the retracted inoperative position as shown in FIG. 7d by a single line. All dial needles 101 remain in this retracted inoperative position until section M is reached in which selected dial needles are advanced to the operative position while the other dial needles remain retracted in the inoperative position, the new arrangement of inoperative and operative dial needles corresponding to the new pattern.

FIG. 1 shows dial needles 101 and coupling members 6 in the retracted position, but in section D, in which no change of position takes place, control springs 7 are in the upper tensioned position shown in broken lines in FIG. 1.

In the following section E, cams K3 advance coupling member 6 so that coupling projection 6c is located between coupling slots 5b and 5c, as shown in FIG. 5. The positions of control springs 7 remain the same, and coupling members 6 are not tilted.

In the following section F, springs 7 are permitted to move downward for a small distance, and cam K4 urges coupling member 6 to move down a corresponding distance so that the lower edge of coupling projection 6c actually abuts the upper edge of dial needle 101, as shown in FIG. 5.

In the following section G, which may be considered as a selecting station, coupling members 6 are not displaced by cams K3 and K4, but remain with the retracted dial needles 101 in the position of FIG. 5.

Control springs 7 are successively guided into the proximity of selector pole 8a. The winding of electromagnetic selector 8 is alternately energized and de-energized in accordance with a program tape in a sequence corresponding to the desired new pattern in which the dial needles have to be arranged during the following knitting operation, as will be understood by those skilled in the art.

When a control spring 7, whose associated dial needle is to remain inoperative, passes beyond the end of cam K1, electromagnetic selector pole 8a is magnetized, so that the respective control spring 7 is held by selector pole 8a, and slides first along the same, and then along the end face of the holding pole 8b which is permanently magnetic. Further rotation of the dial will move the respective control spring 7 beyond holding pole 8b so that the respective control springs 7 will tend to return to the normal straight position, but instead will resiliently engage the upper cam track K2a of cam K2 and slide along the same while passing through sections H and N.

If selector pole 8a is not energized when a control spring 7 passes beyond the end of cam K1, the respective control spring 7 is released and tends to resiliently assume its normal straight position, or slightly beyond the same. Control springs 7 in this position pass into the region of the lower cam track K2b and will remain in the normal position while moving through sections H, J and K.

In section H, control springs 7 on cam track K2a are slightly raised. Cam K4 is recessed to permit an upward movement of the corresponding coupling members 6. At the same time, cams K3 move coupling members 6 radially inward.

In section J, the inward movement of coupling member 6 is continued until projections 6c abut the outer edge of projection 5a of the respective dial needle 5. Coupling members 6 associated with control springs 7 which pass

over the upper cam track K2a are held in the higher position, but coupling member 6 whose associated control springs 7 pass along the lower cam track K2b, are free to turn to a position in which the respective coupling projections 6c are located in the coupling slot 5b of the corresponding dial needle.

In the following section L, control springs 7 on cam track K2b are bent downward to the lower position shown in FIG. 1 in broken lines, engage the upper edge of coupling projection 6c, and force the same into slot 5b of the respective dial needle. Coupling members 6 whose associated control springs 7 slide on the upper cam track K2a, cannot move to this coupling position. Consequently, only selected coupling members 6 are coupled with dial needles 101.

In the following section M, all coupling members 6 are shifted by cams K3 in outward direction a distance corresponding to the spacing between slots 5b and 5c, as best seen in FIG. 7c. The selected dial needles 101, which are coupled with the corresponding coupling members 6, move with the same to the outer operative position, but non-selected dial needles, which are not coupled to coupling members 6, remain in the inner retracted position while the corresponding coupling members 6 move outwardly from a position in which coupling projection 6c is located in the region of slot 5b to a position in which coupling projection 6c is located in the region of slot 5c of the respective dial needle 101.

In the following section N, coupling members 6 which are still in the higher inoperative position, are engaged by a dwell of cam K4, so that the respective coupling projections 6c are pressed into the coupling slots 5c of the associated dial needles. Control springs 7 move in this section toward the normal position so that they do not obstruct the downward movement of coupling member 6 by engagement with the projection 6h. In this position, the dial needles 101 are arranged in operative and inoperative positions in accordance with a new pattern, as indicated in FIG. 7d, and are all coupled with coupling members 6 which are held by a horizontal cam face portion of cam K4 in coupled positions. The coupling members 6 are in the advanced position while dial needles 101 are advanced or retracted according to the desired pattern, and springs 7 are in the normal straight position. With the selected dial needles 101 advanced, and firmly held by the coupling members, the section O is passed, and the dial needles reach the knitting station following section O where they cooperate with the cylinder needles.

After a section O, follows another section A, the circular knitting machine having a plurality of corresponding knitting stations provided with sections A to O. It is evident that the pattern selecting operations described above are again started at the beginning of the next section B to provide a new pattern of advanced and retracted dial needles, if desired.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of dial needle control arrangements differing from the types described above.

While the invention has been illustrated and described as embodied in pattern control arrangement for dial needles having rear ends formed with coupling slots cooperating with cam operated coupling members, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended

to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. A dial needle control arrangement for a circular knitting machine, comprising, in combination, a rotary dial; a plurality of dial needles mounted on said dial for rotation therewith and for movement in radial direction relative thereto between inoperative and operative positions, each dial needle having at the inner end thereof a coupling portion; a plurality of coupling members mounted on said dial for movement between an inoperative position and a coupling position coupled with said coupling portion of one of said dial needles, said coupling members being movable in said radial direction between an inner position and an outer position for shifting in said coupling position said dial needles between said inoperative and operative positions; first control means for moving selected coupling members between said inoperative position and coupling position and including selector means so that only selected dial needles are coupled with said coupling members; and second control means for moving said coupling members between said inner and outer positions so that selected dial needles coupled with said coupling members are shifted to corresponding inoperative and operative positions.

2. A dial needle control arrangement for a circular knitting machine, comprising, in combination, a rotary dial; a plurality of dial needles mounted on said dial for rotation therewith and for movement in radial direction relative thereto between inoperative and operative positions, each dial needle having at the inner end thereof a coupling portion; a plurality of coupling members, each coupling member being mounted on said dial for movement between an inoperative position and a coupling position coupled with said coupling portion of one of said dial needles, said coupling member being movable in said radial direction between an inner position and an outer position for shifting in said coupling position said dial needles between said inoperative and operative positions; a plurality of control members respectively cooperating with said coupling members and being movable for moving corresponding coupling members between said inoperative and coupling positions; selector means for moving selected control members so that only selected dial needles are coupled with said coupling members; and control means for moving said coupling members between said inner and outer positions so that selected dial needles coupled with said coupling members are shifted to corresponding inoperative and operative positions.

3. A dial needle control arrangement comprising, in combination, a rotary dial; a plurality of dial needles mounted on said dial for rotation therewith and for movement in radial direction relative thereto between inoperative and operative positions, each dial needle having at the inner end thereof a coupling portion; a plurality of coupling members mounted on said dial for movement between an inoperative position and a coupling position coupled with said coupling portion of one of said dial needles, said coupling members being movable in said radial direction between an inner position and an outer position for shifting in said coupling positions said dial needles between said inoperative and operative positions; first control means for moving selected coupling members between said inoperative position and coupling position and including electromagnetic selector means so that only selected dial needles are coupled with said coupling members, and stationary cam means for holding said coupling members in said coupling position, respectively, during rotation of the dial; and second control means for moving said coupling members between said inner and outer positions so that selected dial needles coupled with said coupling members are shifted to corresponding inoperative and operative positions.

4. A dial needle control arrangement for a circular knitting machine, comprising, in combination, a rotary dial; a plurality of dial needles mounted on said dial for rotation therewith and for movement in radial direction relative thereto between inoperative and operative positions, each dial needle having at the inner end thereof a coupling portion; a plurality of coupling members mounted on said dial for movement between an inoperative position and a coupling position coupled with said coupling portion of one of said dial needles, said coupling members being movable in said radial direction between an inner position and an outer position for shifting in said coupling position said dial needles between said inoperative and operative positions; first control means for moving selected coupling members between said inoperative position and coupling position and including electromagnetic selector means so that only selected dial needles are coupled with said coupling members, and means for holding said coupling members in said coupling position, respectively during rotation of said dial; and stationary cam means for moving said coupling members between said inner and outer positions, and for holding said coupling members in said positions during rotation of said dial so that dial needles coupled with said coupling members are shifted to corresponding inoperative and operative positions, and then held in said positions during rotation of said dial.

5. A dial needle control arrangement for a circular knitting machine, comprising, in combination, a rotary dial; a plurality of dial needles mounted on said dial for rotation therewith and for movement in radial direction relative thereto between inoperative and operative positions, each dial needle having at the inner end thereof a coupling portion formed with an inner slot and an outer slot spaced in said radial direction; a plurality of coupling members, each coupling member having a coupling projection and being mounted on said dial for movement between an inoperative position and a coupling position in which said coupling projection is located in one of said slots of a corresponding dial needle so that the same is coupled with said coupling member, said coupling members being movable in said radial direction between an inner position and an outer position for shifting in said coupling position said dial needles between said inoperative and operative positions, said coupling projection of a coupling member in said coupling position being placed in said inner slot when the respective coupling member is in said inner position, and in said outer slot when the respective coupling member is in said outer position; first control means for moving selected coupling members between said inoperative position and coupling position and including selector means so that only selected dial needles are coupled with said coupling members; and second control means for moving said coupling members between said inner and outer position so that selected dial needles coupled with said coupling members are shifted to corresponding inoperative and operative positions.

6. A dial needle control arrangement for a circular knitting machine comprising, in combination, a rotary dial adapted to turn past a plurality of knitting stations; a plurality of dial needles mounted on said dial for rotation therewith and for movement in radial direction relative thereto between inoperative and operative positions, each dial needle having at the inner end thereof a coupling portion; a plurality of coupling members, each coupling member being mounted on said carrier means for movement between an inoperative position and a coupling position coupled with said coupling portion of one of said dial needles, said coupling members being movable in said radial direction between an inner position and an outer position for shifting in said coupling position said dial needles between said inoperative and operative positions; first control means for moving selected coupling members between said inoperative position and coupling position

and including selector means so that only selected dial needles are coupled with said coupling members; second control means for moving said coupling members between said inner and outer positions so that selected dial needles coupled with said coupling members in said coupling position are shifted from the inoperative to said operative positions; and third control means operative when selected coupled dial needles are in said operative position, to move the non-selected coupling members to said coupling position so that the same are coupled with the non-selected dial needles and hold the same in said inoperative position whereby said operating stations are passed by selected dial needles in said operative position, and by non-selected dial needles in said inoperative position.

7. A dial needle control arrangement for a circular knitting machine having a plurality of knitting stations, comprising, in combination, a rotary dial adapted to turn past said knitting stations; a plurality of dial needles mounted on said rotary dial for rotation therewith and for movement in radial direction relative thereto between inoperative and operative positions, each dial needle having at the rear end thereof a coupling portion formed with an inner slot and an outer slot spaced in said radial direction; a plurality of coupling members, each coupling member having a coupling projection and being mounted on said dial for movement between an inoperative position and a coupling position in which said coupling projection is located in one of said slots of said coupling portion of one of said dial needles, said coupling members being movable in said radial direction between an inner position and an outer position for shifting in said coupling position said dial needles between said inoperative and operative positions; first control means for moving selected coupling members between said inoperative position and coupling position and including selector means so that only selected dial needles are coupled with said coupling members; second control means for moving said coupling members between said inner and outer positions so that selected dial needles coupled with said coupling members in said coupling position with said coupling projections located in said inner slots, are shifted from said inoperative to said operative positions; and third control means operative when said selected coupled dial needles are in said operative position, to move the non-selected dial needles with said coupling projections located in the outer slots of said coupling portions of said dial needles to hold the same in said inoperative position whereby said knitting stations are passed by selected dial needles in said operative position, and by non-selected dial needles in said inoperative position.

8. A dial needle control arrangement for a circular knitting machine, comprising, in combination, a rotary dial having radial slots; a plurality of dial needles mounted in said radial slots of said dial for rotation with the same and for movement in radial direction relative thereto between a retracted inner inoperative position and an advanced outer operative position, each dial needle having at the inner end thereof a coupling portion; a plurality of coupling members, each coupling member being mounted on said dial for movement between an inoperative position and a coupling position coupled with said coupling portion of one of said dial needles, said coupling members being movable in said radial direction between an inner position and an outer position for shifting in said coupling position said dial needles between said inoperative and operative positions; a plurality of resilient control members respectively cooperating with said coupling members, each resilient control member being movable between a normal intermediate position, a first outer tensioned position, and a second outer tensioned position stressed in the opposite direction for moving the corresponding coupling member to said coupling position; first cam means for moving said resilient control members to said first position during rotation of the dial so that at the end of said first cam means said resilient control members tend to

return to said normal position; electromagnetic selector means located at said end and being selectively energizable so that selected resilient control members are held in said first position while other resilient control members return to said normal position; second cam means having a first cam track for holding said resilient control members in said first position, and a second cam track for moving control members in said normal position to said second tensioned position so that the latter move corresponding coupling members from said inoperative to said coupling position whereby only selected dial needles are coupled with said coupling members; third cam means for holding said coupling members in said coupling position during rotation of said dial; and fourth cam means for moving said coupling members between said inner and outer positions so that dial needles coupled with coupling members are shifted between corresponding inoperative and operative positions.

9. A dial needle control arrangement for a circular knitting machine, comprising, in combination, a rotary dial; a plurality of dial needles mounted on said dial for rotation therewith and for movement in radial direction relative thereto between an inner inoperative position and an outer operative position, each dial needle having at the rear end thereof a coupling portion; a plurality of coupling members, each coupling member being mounted on said dial for movement between an inoperative position and a coupling position coupled with said coupling portion of one of the dial needles, said coupling members being movable in said radial direction between an inner position and an outer position for shifting in said coupling position said dial needle between said inoperative and operative positions; a plurality of control springs mounted on said dial and respectively cooperating with said coupling members and being movable for moving corresponding coupling members between said inoperative and coupling positions; selector means for moving selected control springs so that only selected dial needles are coupled with said coupling members in said coupling position, said selector means including electromagnetic means and cam means on said dial for guiding said control springs toward and away from said electromagnetic means; and control means for moving said coupling members between said inner and outer positions so that selected dial needles coupled with said coupling members are shifted to corresponding inoperative and operative positions.

10. A dial needle control arrangement for a circular knitting machine, comprising, in combination, a stationary dial cam plate; a rotary dial covered by said dial cam plate; a plurality of dial needles mounted on said dial for rotation therewith relative to said dial cam plate, and for movement in radial direction relative to said dial between inoperative and operative positions, each dial needle having at the rear end thereof a plate-shaped coupling portion; a plurality of coupling members, each coupling member being mounted on said dial for movement in a direction transverse to said radial direction between an inoperative position and a coupling position coupled with said coupling portion of one of the dial needles, said coupling members being also movable in said radial direction between an inner position and an outer position for shifting in said coupling position said dial needles between said inoperative and operative positions; a plurality of control springs mounted on said dial and respectively cooperating with said coupling members and being movable for moving corresponding coupling members between said inoperative and coupling positions; selector means for moving selected control springs so that only selected dial needles are coupled with said coupling members, said selector means including electromagnetic means and cam means on said cam plate for guiding said control springs toward and away from said electromagnetic means, said cam means including a first cam portion for guiding all control springs to said electromagnetic means, and a sec-

ond cam portion having two tracks for moving control springs on one of said tracks to a position for moving corresponding coupling members to said coupling position, said electromagnetic means being located between said first and second cam portions and being selectively energizable and de-energizable for effecting engagement of selected control springs by said one track, and of other control springs by the other track of said second cam portion; and control means for moving said coupling members between said inner and outer positions so that selected dial needles coupled with said coupling members are shifted to corresponding inoperative and operative positions.

11. A dial needle control arrangement for a circular knitting machine having a plurality of knitting stations, comprising, in combination, a stationary dial cam plate; a dial mounted for rotation about an axis and adapted to pass during each revolution past said knitting station, said dial being covered by said stationary cam plate; a plurality of dial needles mounted on said dial for rotation therewith and for movement in radial direction between an inner inoperative position and an outer operative position, each dial needle having at the inner end thereof a plate-shaped coupling portion having transverse abutments; a plurality of coupling plates respectively cooperating with said coupling portions of said dial needles and being mounted on said dial for movement in radial direction, and for movement transverse to said radial direction between an inoperative position and a coupling position engaging one of said abutments of the respective dial needle; a plurality of control members mounted on said dial biased to assume a normal position and respectively coupled with said coupling members in a manner permitting relative movement for; a limited distance; selector magnet means mounted on said dial cam plate; first cam means on said dial cam plate for guiding said control members out of said normal position to a displaced position and into the proximity of said selector magnet means so that the same, when selectively energized, hold control members in said displaced position and, when de-energized, permit control members to move to said normal position; second cam means on said dial cam plate having two cam tracks and extending to said selector magnet means so that control members in said normal position move along one of said cam tracks, and control members in the displaced position move along the other cam track, said one cam track urging said control members to a position for shifting said coupling members to said coupling position; and control cam means on said dial cam plate for moving said coupling members in radial direction so that dial needles coupled to coupling members are shifted to said operative position before passing through a knitting station.

12. A dial needle control arrangement for a circular knitting machine having a plurality of knitting stations, comprising, in combination, a dial cam plate; a dial covered by said dial cam plate mounted for rotation about an axis and adapted to pass said knitting stations during each revolution; a plurality of dial needles mounted on said dial for rotation therewith and for movement in radial direction between an inner inoperative position and an outer operative position, each dial needle having at the rear end thereof a plate-shaped coupling portion formed with an inner coupling slot and with an outer coupling slot spaced in radial direction from each other; a plurality of coupling plates respectively cooperating with said coupling portions of said dial needles and being slidable on the surface of said dial for movement in radial direction, each coupling plate being tiltable about an edge thereof between an inoperative position and a coupling position in which said coupling projection is located in one of said coupling slots for coupling the respective coupling plate with the respective dial needle; a plurality of control springs mounted on said dial biased to assume a normal position and respectively coupled

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with said coupling plate in a manner permitting relative movement for a limited distance; selector magnet means mounted on said dial cam plate; first cam means on said dial cam plate for guiding said control springs out of said normal position to a displaced position and into the proximity of said selector magnet means so that the same, when selectively energized, holds control springs in said displaced position and, when de-energized, permits control springs to move to said normal position; second cam means on said dial cam plate having two cam tracks and extending to said selector magnet means so that control springs in said normal position move along one of said cam tracks, and control springs in the displaced position move along the other cam track, said one cam track urging said control spring to a position for shifting said coupling plate to said coupling position located in the inner coupling slot of the respective dial needle; control cam means on said dial cam plate for moving said coupling plates in radial directions so that dial needles coupled to said coupling plate are shifted to said operative position before passing through the knitting station whereby said coupling projections of said coupling plates are located in the region of said outer coupling slots of dial needles remaining in said inner inoperative position; and cam means on said dial plate for moving the coupling plates associated with dial needles in said inoperative position to said coupling position so that said coupling projections of the respective coupling plates are located in the outer coupling slots of the respective dial needles so that the

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same are held in said inoperative position while passing through said knitting stations.

13. A dial needle control arrangement as set forth in claim 12 wherein said control cam means include endless cams for moving said coupling plates inwardly after said dial needles have passed said knitting stations so that dial needles in said operative position are moved to said inoperative position when said coupling plates move inwardly.

14. A dial needle control arrangement as set forth in claim 12 wherein said coupling portion of each dial needle has a coupling projection adjacent said inner slot thereof, said coupling projections of said dial needles being respectively engaged by said coupling projections of the respective associated coupling plates in said inoperative positions of the same for coupling said coupling plates with the respective dial needles only for inward movement in said radial direction.

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