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Schindele et al.

[11] **3,771,328**

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[54] **JACK-CONTROLLING MEANS FOR THE NEEDLES OF A CIRCULAR KNITTING MACHINE**

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[63] Continuation-in-part of Ser. No. 865,402, Oct. 10, 1969.

[52] **U.S. Cl.** ..... **66/50 R**

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

[58] **Field of Search** ..... 66/50 R, 50 B, 25, 66/75, 154 A

[56] **References Cited**

UNITED STATES PATENTS

3,262,285	7/1966	Beguin et al.	66/50 R
3,472,287	10/1969	Ribler	66/154 A X
3,518,845	7/1970	Cerjat	66/50 R
3,564,870	2/1971	Glaunsinger	66/50 R
3,605,448	9/1971	Ribler	66/154 A
3,710,594	1/1973	Bourgeois	66/50 R

FOREIGN PATENTS OR APPLICATIONS

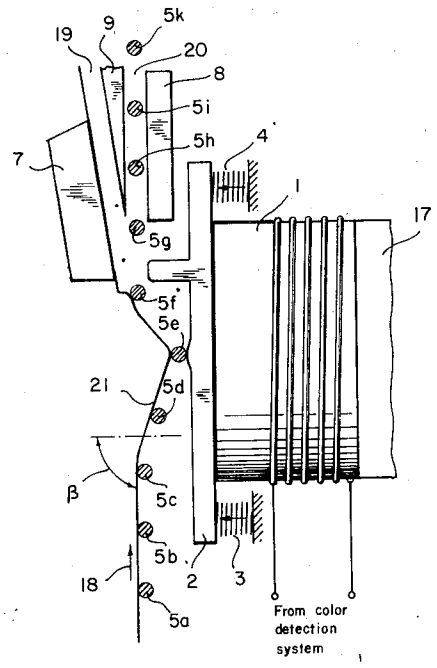
1,546,919	10/1968	France	66/50 R
1,803,296	5/1970	Germany	66/50 R
1,950,846	4/1971	Germany	66/50 R
2,000,578	7/1971	Germany	66/50 R
362,787	8/1962	Switzerland	66/50 R
483,511	2/1970	Switzerland	66/50 R

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Attorney—Arthur O. Klein

[57] **ABSTRACT**

A guiding member is operatively mounted to cooperate with a succession of magnetically-sensitive jacks and needles of a circular knitting machine. The guiding member selectively urges the jacks either into an inner or an outer track of the circular knitting machine which respectively represent a non-knitting and knitting position of the respective jack and needle as they move around the circumference of the circular knitting machine. A guiding member is inwardly biased and is adapted to coact with the armature of an electromagnet. The guiding member has a projection which extends radially inwardly towards the center of the cylinder of the circular knitting machine. The guiding member also has a boss which is obliquely interposed in the path of movement of the jacks when the guiding member is in its inner position. In the inner position, the projection of the guiding member urges the jacks away from the outer track and into the inner track. As each jack engages the interposed boss of the guiding member, the latter is cammed outwardly against its bias thus moving the projection thereof outwardly so as to expose the outer track. When the outer track is thus exposed and the jacks move through this outer track the circular knitting machine is carrying out a patterned knitting operation. The electromagnet can be selectively energized thereby urging the guiding member into its outer, biased position and exposing the outer track of the knitting machine thereby causing a patterned knitting operation. When the electromagnet is not energized, the projection of the guiding member will move inwardly and thereby mechanically urge the jacks to move through an inner track wherein the knitting needles cannot carry out a patterned knitting operation.

4 Claims, 7 Drawing Figures



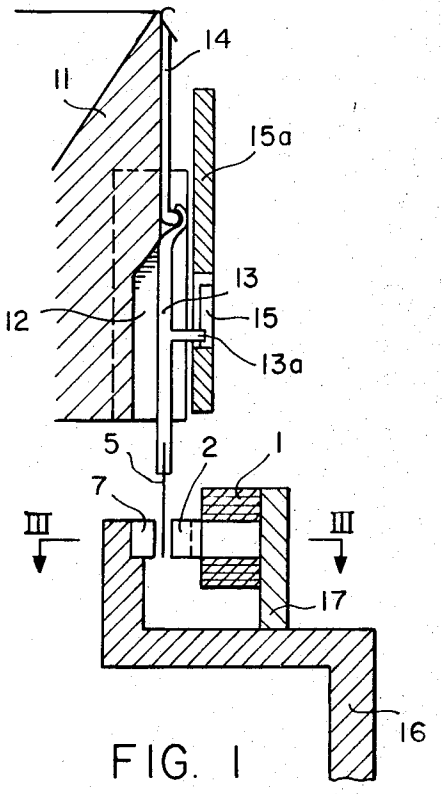


FIG. 1

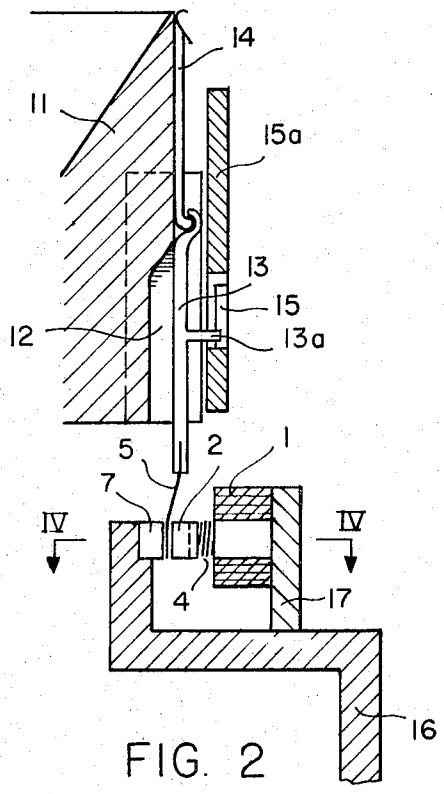


FIG. 2

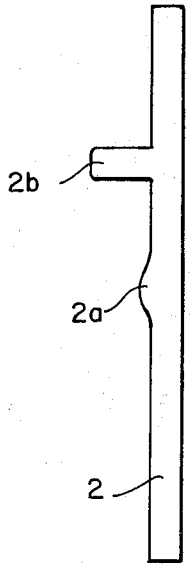


FIG. 5

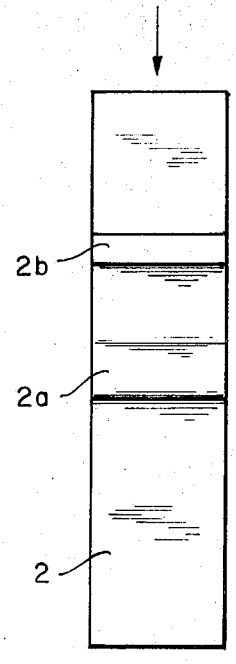


FIG. 6

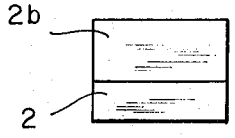


FIG. 7

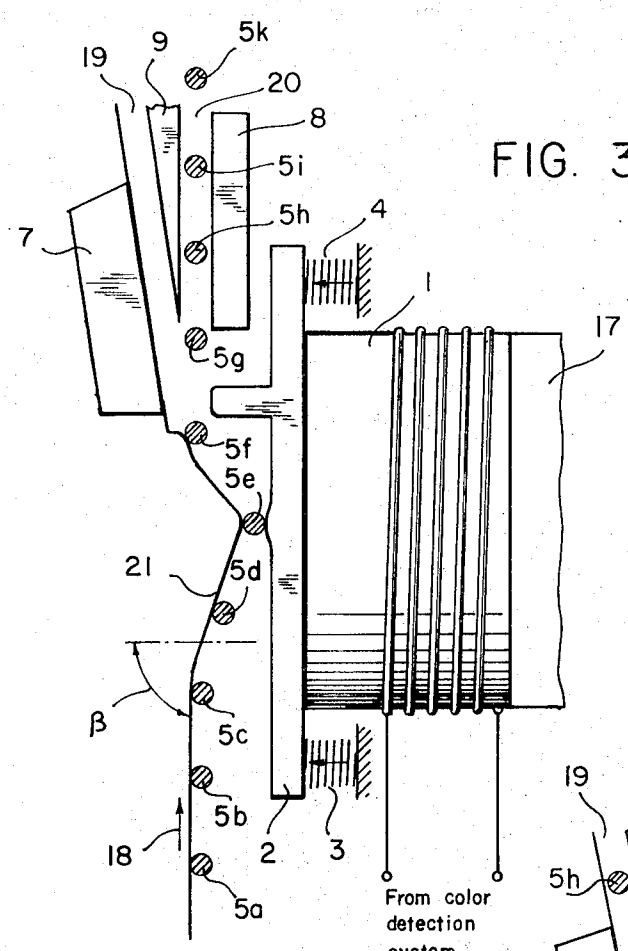

19
9
5k
20
8
5i
5h
4
7
1
17
5g
5f
5e
21
5d
β
5c
5b
18
5a
2
3
From color detection system

FIG. 3

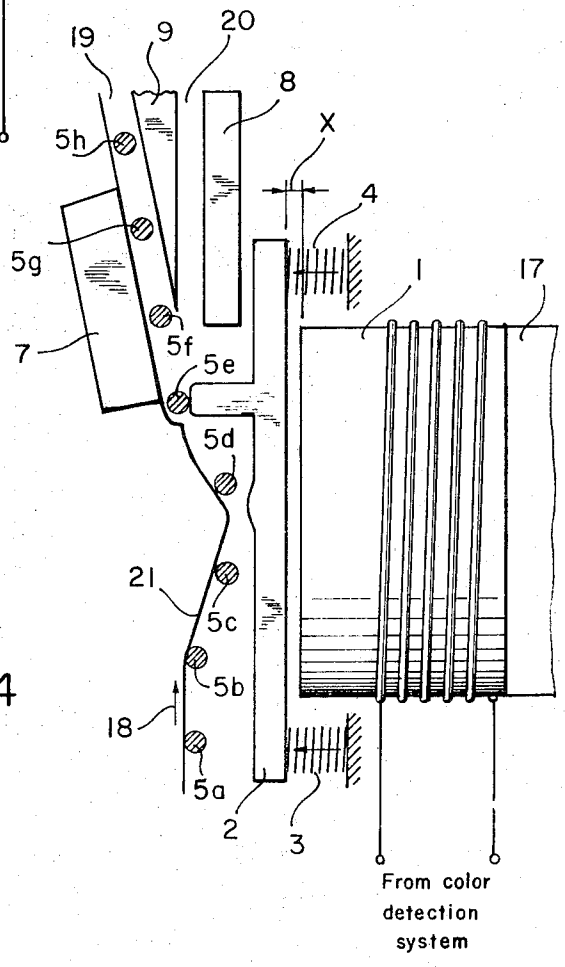

19
9
20
8
X
5h
4
5g
1
17
7
5f
5e
5d
21
5c
5b
18
5a
2
3
From color detection system

FIG. 4

JACK-CONTROLLING MEANS FOR THE NEEDLES OF A CIRCULAR KNITTING MACHINE

RELATED APPLICATION

The present application is a continuation-in-part of applicants' copending application Ser. No. 865,402, filed Oct. 10, 1969.

BACKGROUND OF THE INVENTION

In circular knitting machines of the type described, e.g. in U.S. Pat. No. 3,518,845, a succession of jacks and needles move generally circumferentially around a bed of the circular knitting machine. These jacks are normally guided into a first (e.g. outer) track representative of an operative or patterned knitting position at a feed station. When a jack and associate needle are to be positioned into an inner track where they are not actuated to knit a stitch, an electromagnet responsive to a suitable control pulse is actuated so that the armature of the electromagnet moves the jack into this second (e.g. inner) track representative of a non-knitting position at that feed station. In a common situation, the control pulse for the electromagnet may be generated when a photoelectrically scanned multicolor pattern sample exhibits a color corresponding to the machine knitting system to which the jack is assigned during the knitting cycle of such jack.

In conventional apparatus of this type the electromagnet armature is normally maintained in a biased position out of contact with the jacks. Thus, when a control pulse is applied to the electromagnet coil, the build-up time of the magnetic field of the coil to a degree necessary to overcome the inertia of the armature to move it against the biased force imposes a severe limiation on the speed of operation of the circular knitting machine. Moreover, such operating speed is further limited by the time necessary to execute the relatively long travel necessary for the armature to engage and move the jack into operating position.

SUMMARY OF THE INVENTION

These disadvantages may be overcome by an arrangement in accordance with the invention in which auxiliary forces are applied to a guiding member (which is equivalent to the armature in the aforedescribed prior art arrangements) to permit rapid movement of selected jacks into operating positions upon the application of a control pulse to the electromagnet coil. In the absence of a control pulse, the inwardly-biased guide member is positioned so that a portion thereof is obliquely interposed in the path of movement of the jacks which are made of ferro-magnetic material so that each successive jack exerts an outward camming action against the guide member. The inwardly extending projection, which may be permanently or electromagnetically magnetized, and which forms part of the biased guide member, is normally situated adjacent a first permanent magnet, which in the absence of the projection being situated in its most inward position would normally attract the successive jacks into the outer track. The projection of the guide member thus in its innermost position counteracts the magnetic influence of the first permanent magnet and when receiving the following above-described camming action, is moved outwardly, and is maintained in this outermost position by the electromagnet, which permits the adjacent outwardly-biased jack to pass a second permanent magnet and move along the first permanent magnet which attracts the jack into the outer track. Thus the application of a control pulse to the coil of the electromagnet does not have to move the guide member against the bias thereof. This has already been done by the camming action of a jack acting on the guide member. Such pulse merely serves to retain the guide member in its outermost position, whereby the projection is also maintained in its outermost position so that the first permanent magnet can exert its magnetic influence unimpeded by the projection of the guide member. Under these conditions the jacks may be rapidly and positively selectively urged into the inner or outer track of the circular knitting machine.

With this arrangement, moreover, only a relatively small movement of the projection of the guide member is needed to influence the jacks toward and away from a selected one of the inner and outer tracks, so that a short travel of the guide member (and therefore a short operating time) is feasible.

BRIEF DESCRIPTION OF THE DRAWING

The nature of the invention is set forth more fully in the following detailed description, taken in conjunction with the appended drawing, in which the figures schematically depict a guiding arrangement for a circular knitting machine in accordance with the invention.

FIG. 1 is an elevational schematic partially sectional view of the jack guiding arrangement of the invention wherein the jack is shown in a non-biased position and the guide member is shown in a biased position;

FIG. 2 is an elevational schematic partially sectional view of the guiding arrangement wherein the jack is shown in a biased position and the guide member is shown in an unbiased position;

FIG. 3 is a more detailed plan view along line III—III of FIG. 1;

FIG. 4 is a more detailed plan view along line IV—IV OF FIG. 2;

FIG. 5 is a side elevational view of the guide member;

FIG. 6 is a plan view of the guide member; and

FIG. 7 is an end elevational view of the guide member.

DETAILED DESCRIPTION

Referring now in more detail to the drawing and in particular to FIGS. 3 and 4, there are depicted a succession of conventional jacks having leaf or reed springs *5a*, *5b*, *5c*, *5d*, *5e*, *5f*, *5g*, *5h*, *5i*, and *5k* (represented in plan view as circles) proceeding in the general direction of an arrow **18** around the periphery of a bed of a circular knitting machine having its axis in the upper portion of the sheet as viewed in FIG. 3.

The elevational views of FIGS. 1 and 2 illustrate jacks **13** pivotally connected to knitting needles **14.** The knitting needles carry a male hinge member and the jacks carry a female hinge member to provide the pivotal connection. The individual jacks and needles are disposed in grooves or slits **12** provided along the periphery of the circular knitting machine. Thus each jack **13** can be pivotally moved in the slit **12.** Furthermore, each jack **13** is provided with a butt **13***a* adapted to cooperate with cams **15** of a cam plate **15***a*. The aforedescribed arrangement is known and is, for example, illustrated and described in U.S. Pat. No. 3,518,845. Each one of the jacks **13** has at its lower end a leaf spring **5** securely mounted therein. A carrying member **17** is

mounted on the stationary frame **16** of the circular knitting machine and supports an electromagnet **1.** A guide member **2** is also supported by means of a pair of coil springs **3** and **4** on the member **17** coaxially with respect to the electromagnet **1.** The coil springs **3** and **4** urge the guide member **2** away from the upper surface of the electromagnet **1.** The path of movement of the jack which illustratively extends an at an angle β with respect to a line radial of the needle cylinder (not shown), is bifurcated into a radially inner track **19** and a radially outer track **20.** The radial outer track guides the jacks to cam means which will act on the jacks, and thereby the knitting needles, to bring about a knitting operation. The inner track guides the jacks around the periphery of the knitting cylinder along a path wherein the cam means do not act on the jacks so that the latter do not carry out a knitting operation. The arrangement of this invention therefore constitutes a preselection arrangement for the jacks of the knitting needles.

The general function of the electromagnet **1** is well-known in the art. Thus it is known that such an electromagnet can be energized by the application of a control pulse to a coil of the electromagnet from the color detection system of a circular knitting machine. As has been described hereinabove, the jacks may either move into an inner track **19** representing the non-operative path of the jack or an outer track **20** representing the operative path. The guiding of the leaf or reed springs **5***a*–**5***k* to either the inner track **19** or outer track **20** is effected by means of a guide member **2** and two permanent magnets **7** and **8** as well as a wedge member **9,** as will be described hereinbelow.

When the jacks **13** are in the position illustrated in FIG. **1,** the guide member **2** is urged against the electromagnet **1** against the force of the two coil springs **3** and **4.** When the jacks **13** are in this position the leaf springs **5** thereof are not elastically deformed at the moment the jacks **13** and leaf springs **5** pass the projection **2***b* of the guide member **2.** The jacks **13** will therefore move along the outer track **20** and the knitting needles will carry out a knitting operation according to a preselected pattern. The selecting process for selecting the outer track **20** will be described in greater detail hereinbelow in conjunction with FIG. **3.**

FIG. **2** illustrates the arrangement wherein the jacks are to follow a path which is non-operative or non-knitting with respect to the knitting needles. The guide member **2,** as can be noted from FIG. **2,** is not pulled towards the electromagnet **1** but is pushed by the coil springs **3** and **4** towards the left as shown in FIG. **2.** This displacement of the leaf springs **5** causes the latter to move along the inner track **19** as will be described hereinbelow in conjunction with FIG. **4.** The guide member **2** is therefore influenced by three force components during its operation.

a. An electromagnet **1** having an iron core pulls the guide member **2** in a radially outward direction until the guide member **2** abuts against the electromagnet **1.** The electromagnet **1** is so dimensioned that its force will overcome the force of the coil springs **3** and **4** and maintain the guide member **2** in abutting relationship when the electromagnet **1** is energized.

b. Two coil springs **3, 4** push the guide member **2** away from the electromagnet **1** when the electromagnet **2** is not energized (not-knitting). The movement of the guide member **2** is relatively short (compare FIGS. **3** and **4**).

c. The leaf springs **5** push the guide member **2** against the electromagnet **1** when no decision concerning the "knitting-non-knitting" operation is required.

The guide member **2** has a boss **2***a* against which the leaf springs **5** abut. when they are in the position illustrated in FIG. **3.** The guide member **2** is attracted by the electromagnet **1** in the position illustrated in FIG. **3** so that all knitting needles **14** carry out a knitting operation in accordance with a predetermined pattern, that is, they travel to the outer track **20** and are thereafter acted on by suitable cams for carrying out the patterned knitting operation.

The leaf springs **5** are also influenced by a plurality of force components and the leaf springs have been designated by the reference numerals **5***a*, **5***b*, **5***c*, etc. for purposes of describing these force components.

While the leaf springs **5** are in the positions illustrated by the leaf springs **5***a*, **5***b*, **5***c*, they are moved jointly with their jacks **13** in the direction of the arrow **18** and are not pre-biased. The projection **21** along the periphery of the circular knitting machine causes a pretensioning of the leaf spring **5***d* as illustrated in FIG.**3,** that is, the leaf spring **5***d* is slightly bent by the projection **21** in a manner similar to the illustration of leaf spring **5** shown in FIG.**2.** The leaf spring **5***e* has been pre-biased the full amount. The leaf spring **5***e* can be utilized, when necessary, to push the guide member **2** into abutting contact with the electromagnet **1,** this in the event the electromagnet **1** is not energized. However, since in the illustration of FIG.**3** the electromagnet **1** is energized, the leaf spring **5**e exerts practically no force against the guide member **2.**

The leaf spring **5***f* has again been unbiased and is attracted during its further travel by the permanent magnet **8** and is brought by means of the wedge **9** into the outer track **20.** The same holds true for the reed or leaf springs **5***g*, **5***h*, **5***i*, and **5***k*.

Thus the jack **13** as illustrated in FIG.**1** is not pivoted, which corresponds to the "knitting" operational path.

In FIG.**4** there is illustrated a detailed cross-sectional view along line IV—IV in FIG.**2** wherein the various members of the arrangement are shown in a larger scale. In FIG.**4** the jacks and associated leaf springs travel in an operational path corresponding to a "non-knitting" operation. The guide member **2** is projected inwardly by the coil springs **3** and **4.** The individual leaf or reed springs are again designated with reference numerals **5***a*, **5***b*, and **5***c*, etc. The knitting needles, as illustrated in FIG.**4,** are to pass through an operational path corresponding to a "non-knitting" operation. Such an operation is, of course, required when the knitting operation of certain preselected needles is to terminate. It is, of course, also possible to make certain preselected needles of the circular knitting machine carry out a "non-knitting operation" in accordance with a preselected pattern while other preselected needles carry out a "knitting operation." As can be noted from FIG.**4,** the reed or leaf spring **5***a* is not pre-biased; the leaf or reed springs **5***b* and **5***c* are pre-biased to a different degree; the leaf or reed spring **5***d* has already passed through its most biased condition and has been unbiased to a certain degree; the leaf or reed spring **5***e* is slightly biased in the opposite direction by the projection **2***b* and is attracted by a permanent magnet **7** and

thus guided into the inner track **19** by the permanent magnet **7** and the wedge **9.**

The same applies to the reed or leaf springs **5***f*, **5***g*, and **5***h* which have also been guided by the wedge **9** and the permanent magnet **7** into the inner track **19.**

It should be noted that the jacks **13** are pivoted with respect to the needles **14** in an operation that comprises three sequential steps. (1) In a first step the leaf or reed springs **5** are elastically biased by means of the guide member **2** and electromagnet **1** acting in conjunction with the projection **21.** This operation carries out a decision which only constitutes a preselection and only in this way can the mechanical loading of the individual constructional elements be maintained at an acceptable scale.

It is, of course, also possible in theory to have the jacks **13** directly acted on by a guide member such as the guide member **2.** However, the forces required to carry out such an operation, that is, an operation without the aid of the permanent magnets and the biasing of the leaf springs **5,** requires forces of much higher magnitude and produce corresponding loads on the various constructional elements of much higher magnitude. It should be noted that the two permanent magnets **7** serve to securely guide the leaf or reed springs **5** along either the inner or outer tracks **19** and **20** after the decision whether a knitting or non-knitting operation is to be carried out has been made by means of the guide member **2.** It would, of course, also in theory be possible to have the reed or leaf springs **5** and therewith the jacks **13** pivoted by means of the permanent magnets **7** and **8.** However, here again the forces that would have to be exerted by the permanent magnets in order to bring about a flaw-free operation would have to be of a magnitude that is much larger than that required with the arrangement of the invention. In order to avoid any malfunctioning or undesired switching of the jacks, the pivotal movement proper between the jacks **13** and needles **14** is only carried out in a third step by means of the wedge member **9.** These types of wedge members **9** are well-known in the art and therefore are not described in detail herein.

As stated hereinabove, the projection **2***b* may be permanently or electromagnetically magnetized. If the projection **2***b* is so magnetized and the guiding member **2** is in its outer retracted position the projection 2b will aid in guiding the leaf or reed springs **5** into the outer track **20** against the force exerted by the permanent magnet **7.** The guide member **2** is also provided with an axially extending boss **2***a* which, when the armature is in its inwardly-biased position, extends into the oblique path of movement of the successive leaf or reed springs **5.** Each engagement of a leaf or reed spring **5** with the interposed bars **2***a* which may be formed from wear-resistant material, cams the guide member **2** outwardly against the bias of the coil springs **3** and **4** by the distance X to the position shown in FIG.3, the guide member being restored to the inner position by the action of the coil springs **3** and **4** between successive engagements of the leaf or reed springs **5** and the boss **2***a*. Each time the guide member **2** is outwardly cammed against the spring bias in this manner, the inner end of the projection **2***b* moves outwardly to guide, if magnetized, the adjacent leaf or reed spring **5** into the field of influence of the outer permanent magnet **8** so that the jack is urged into the outer track **20.** Thus, it is seen that in the absence of a control pulse from the color-detection system, both inward and outward components of force are alternatively applied to the guide member **2,** and successive ones of such forces are employed to move each successive leaf or reed spring **5** by magnetic means into the outer track where the jacks **13** are carrying on a knitting operation.

Of course, this operation can also be carried out even if the projection **2***b* is not magnetized if the permanent magnets **7** and **8** are so dimensioned that the leaf or reed springs **5** will enter the outer track unless biased inwardly by the projection **2***b* as illustrated in FIG.4.

It will be appreciated that with this arrangement, the application of the control pulse from the color-detection system can rapidly cause the appropriate jack to enter the inner or outer tracks **19** and **20,** since the usual necessity of moving the armature by excitation of its coil is avoided; instead, such movement is provided by the camming action of the leaf or reed springs **5** and the boss **2***b*.

Although the invention is illustrated and described with reference to one preferred embodiment thereof, it is to be expressly understood that it is in no way limited to the disclosure of such a singular embodiment, but is capable of numerous modifications within the scope of the appended claims.

We claim:

1. In a circular knitting machine having needles and associated jacks pivotally connected thereto, each one of said jacks having a ferro-magnetic spring means axially extending therefrom, an arrangement responsive to a control pulse for normally guiding each of said spring means into an outer track representative of a knitting position and guiding selected ones of the spring means into an inner track representative of a non-knitting position, which comprises:

first and second permanent magnets respectively associated with the inner and outer tracks, the second magnet being positioned ahead of the first permanent magnet in the path of movement of said spring means, said spring means, said spring means normally moving along said outer track;

an electromagnet having a coil and a guide member operatively associated with said coil, the guide member having an axis of movement angularly disposed with respect to the path of movement of the spring means, the guide member having a guiding projection extending radially inward with respect to the circular knitting machine and being in substantial alignment with said second permanent magnet;

means for normally biasing a first region of said guide member into the path of movement of the spring means and for positioning the guiding projection in a first location wherein the guiding projection is biasing said spring means inwardly to bring them under the influence of said second permanent magnet and cause the adjacent spring means to move into said inner track, each of the succession of spring means cooperating with said first region of said guide member in sequence to cam the guide member outwardly against the bias and to move the projection outwardly from the first location to permit the adjacent spring means to move toward the magnetic influence of said first permanent magnet, thereby urging said spring means into the outer track; and

means for applying the control pulse to the coil to maintain the first region of the armature out of the path of movement of said spring means following the camming action and for retaining said projection in a position away from its first inner location so that the magnetic influence of the first permanent magnet on the adjacent spring means is such that said spring means is urged into the outer track.

2. An arrangement as defined in claim **1**, in which said guiding projection is magnetized.

3. An arrangement as defined in claim **1**, in which the first region of said guide member is an inwardly projecting boss.

4. An arrangement as defined in claim **2**, in which the boss is formed from a wear-resistant material.

* * * * *