

[54] APPARATUS FOR PATTERNING KNITTING MACHINES

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[57] ABSTRACT

The present invention relates to apparatus for selecting needles of a circular knitting machine for patterning according to a predetermined patterning program. The apparatus includes control means located in the longitudinal grooves of the needle cylinder which comprises two parts movable with respect to each other, whereby one of such parts only is retained in the lower portion of the groove whereas the other part cooperates with a cam system, upon selection according to the patterning program, and effects the desired needle movement.

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5 Claims, 8 Drawing Figures

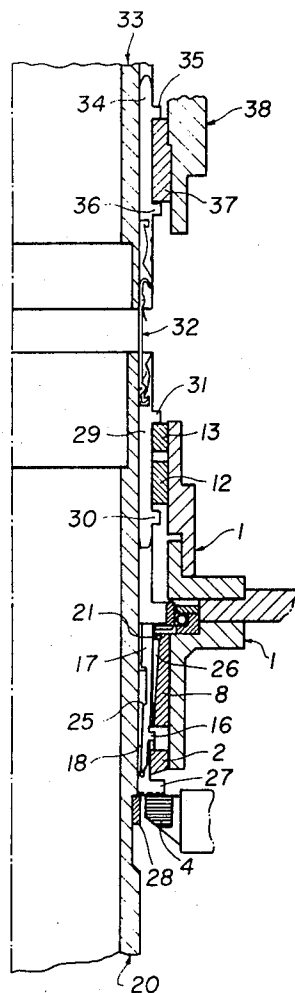


Fig. 6

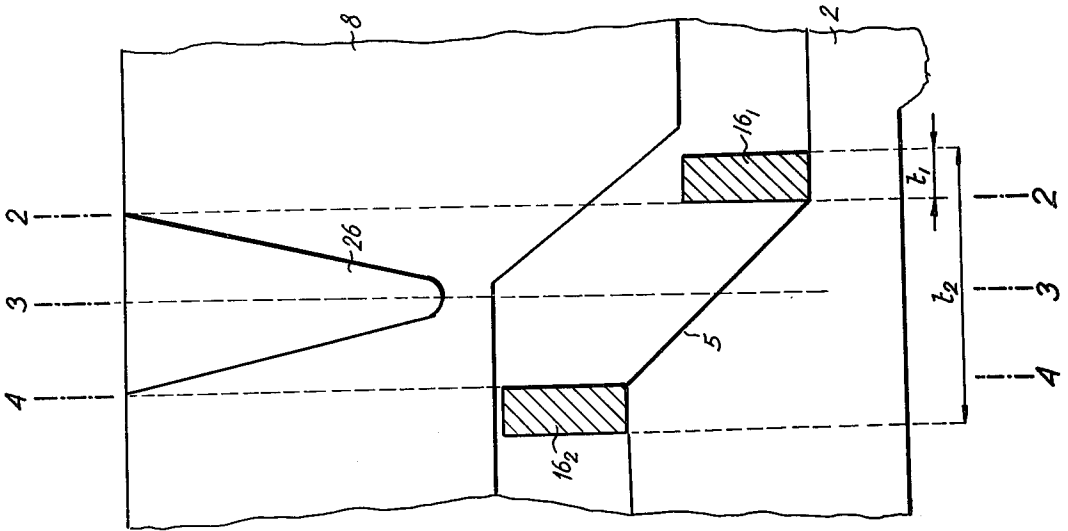


Fig. 1

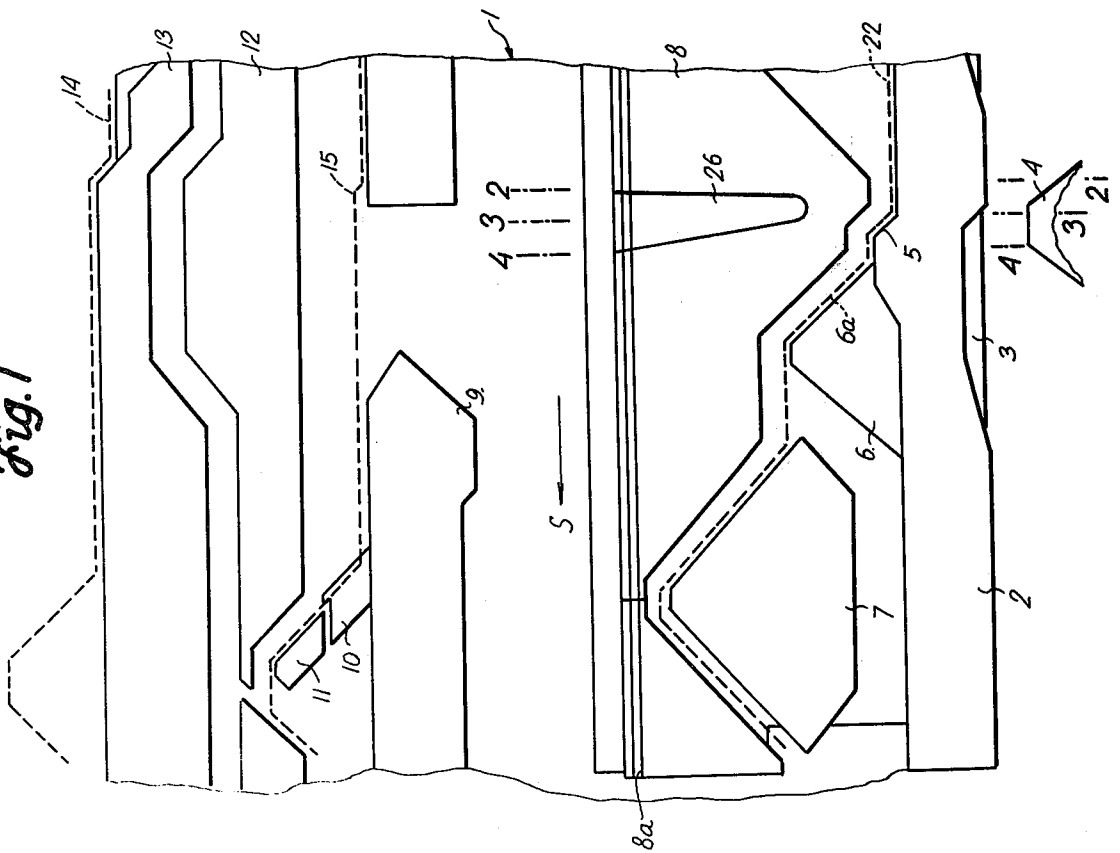


Fig. 2

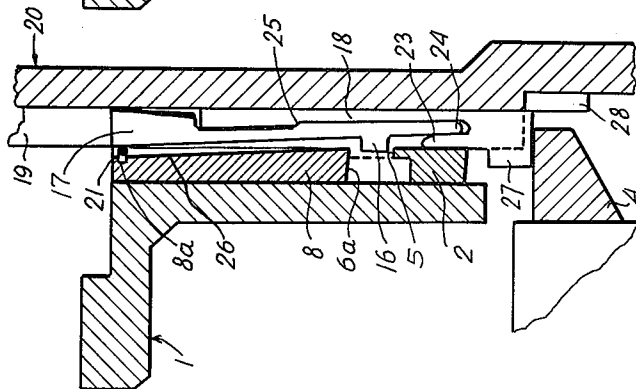


Fig. 3

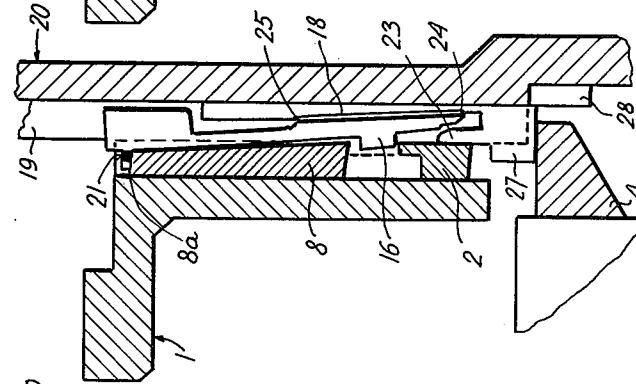


Fig. 4

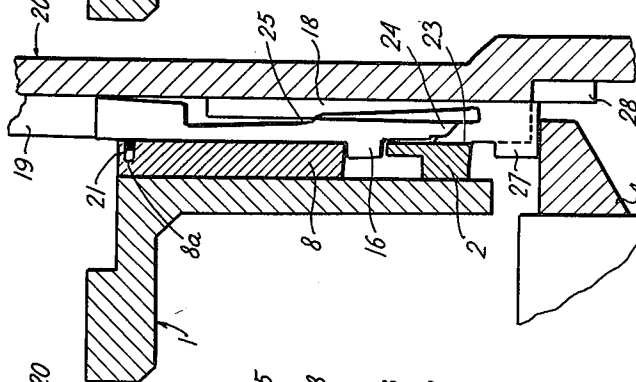
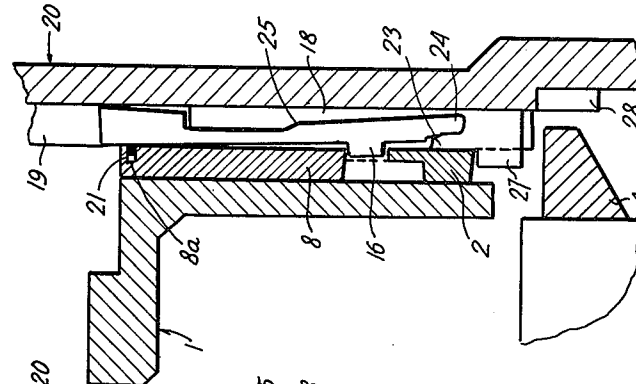


Fig. 5



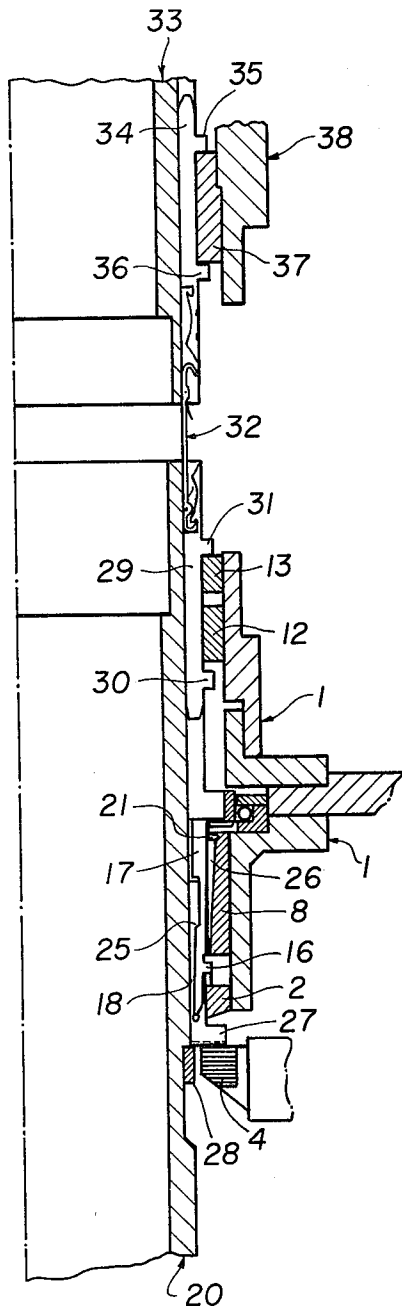


FIG. 7

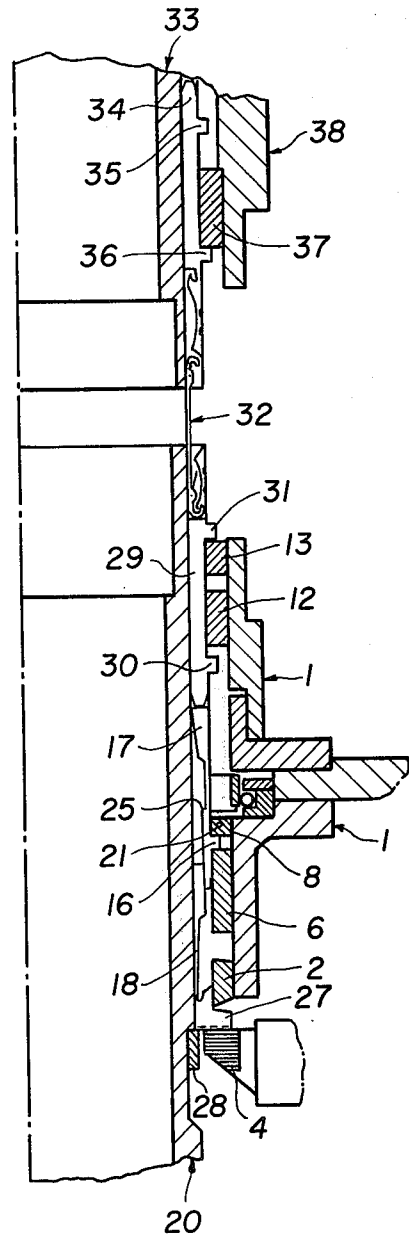


FIG. 8

APPARATUS FOR PATTERNING KNITTING MACHINES

BACKGROUND OF INVENTION

The present invention relates to a device for selecting needles for patterning, particularly in a circular knitting machine, and includes means, preferably an electromagnet, whereby the control means, e.g., control sinkers, arranged together with the knitting needles in the longitudinal grooves of a rotary needle cylinder are selectively controlled.

In one known device of that type a movable electromagnet armature is used. It is made in the form of a hammer for pressing the selected needle jacks into the range of the inclined surfaces of sinker cams which then perform the selection of the needles attached thereto for the purpose of patterning. In view of the high inertial mass of the electromagnet armature, this device cannot readily effect the desired arbitrary selection of needles, particularly upon a finer gauge of needle cylinder with its higher rotational speeds.

A recent known device of that type uses a patterning wheel with needle jacks selected by an electromagnet, each jack being under the influence of tensioned springs which displace the selected jacks according to the pattern, also by means of an electromagnet. This device requires a large space and thus cannot be used in multi-feed knitting machines. Further, this device, because it is based on the principle of individual springs and the resiliency of said springs as well as the displacement of jacks, thus suffers from a relatively high probability of failures requiring constant operator attention.

Another recent device is known, which also uses stationarily mounted electromagnets for selecting auxiliary sinkers which are displaced individually according to a patterning template in such manner, that they are radially drawn out from the longitudinal groove of the needle cylinder into the vicinity of a V shaped recess in the cam housing. The disadvantage of this device lies primarily that in view of the high velocity of rotation of the needle cylinder it is not always possible to obtain a perfect and thus sufficient radial displacement of the auxiliary sinkers, this being, however, a required condition for a correct contact of the selected sinker on to the lifting surface of the cam and for a correct selection of the attached needle to the patterning.

One of the most recent devices of the above type is characterized in that in the cam system, as e.g., in the central and lower cam ring, a recess is made for inserting the butts of auxiliary sinkers into operative position in a direction parallel to the movement of needles in response to electromagnetic pulses which are exerted by the extensions of an electromagnet upon the control butts of the auxiliary sinkers. The disadvantage of that device consist in that even when that device works reliably, considerably strong magnetic pulses must be developed by the extensions of the selecting electromagnets upon the control butts of the auxiliary sinkers. This requires the use of selecting electromagnets of considerable dimensions and this, of course, is a disadvantageous aspect of the modern design of knitting machines.

It is the object of the present invention to overcome the disadvantages of the heretofore known devices.

SUMMARY OF INVENTION

Basically, applicant provides a two-component mov-

able control means comprising upper and lower parts acting upon each other at the point of selection in such manner that the upper parts are under the influence of an elastic element, e.g., a cylindrical spring surrounding the outer circumference of the needle cylinder, and the lower parts are under the influence of either magnetic pulses from the selecting extension of an electromagnet, or equivalent retaining means with a controlling ability, at least one of the components of the control means being provided with a control butt which cooperates with the cam system of a knitting machine.

In order that the invention may be more fully understood it will now be described, by way of example, with reference to the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

In the drawings:

FIG. 1 represents a partial front view of the cam system on a two cylinder circular knitting machine, the most important cam parts being also represented, which cooperate with the control means upon their selection for selecting needles for the purpose of patterning;

FIG. 2 depicts a longitudinal partial section in the plane of section 2—2 of FIG. 1, through a part of the needle cylinder and the cam housing and shows the position of the selecting extension of an electromagnet and the two part control means at the moment of starting selection, this representation of the drawing being identical with the case, in which no selection at all was performed, i.e., when the control means pass through the selecting point without being influenced by the magnetic effects of the said selecting extension of the electromagnet;

FIG. 3 illustrates an analogous longitudinal section as shown in FIG. 2 except that the longitudinal section is made in the point of plane 3—3 as shown in FIG. 1 said view representing from the viewpoint of function a situation which, on the basis of a magnet pulse from the selecting extension of the electromagnet, the control means is selected into such a position, that the attached needle is selected for the purpose of patterning;

FIG. 4 is a view similar to FIGS. 2 and 3, except that this section is made in the plane 4—4 as shown in FIG. 1 and represents, from the viewpoint of function, a situation whereby the control means is finally selected into the operative position;

FIG. 5 is taken along plane 4—4 of FIG. 1 and illustrates a situation where the control means was not selected for controlling the appurtenant needle, i.e., when the control means passed the point of selection without the effect of a magnetic pulse from the selecting extension of an electromagnet; and

FIG. 6 is a detailed enlarged view of the point of selection in view of the mass relations of the major design elements.

FIGS. 7 and 8 are longitudinal section views made through the upper and lower needle cylinder of the double cylinder circular knitting machine.

DESCRIPTION OF INVENTION

The known circular knitting machines, e.g., machines used for the manufacture of hosiery, of both the one and two cylinder type, are usually made in such manner that about the needle cylinder, or the two needle cylinders, the separate cam means for controlling needles,

sinkers, jacks etc., are integrated into a stationary cam system 1 (FIG. 1).

Referring to FIG. 1 of the accompanying drawings, there is shown the cam system for the lower needle cylinder of a two cylinder knitting machine at the selecting point for patterning. This cam system consists of a lower stationary cam ring 2, in the lower edge of which and at the selecting point, there is provided a recess 3, below which recess 3 emerges the selecting extension 4 of an electromagnet. The upper edge of said lower stationary cam ring 2 is, at the point above the selecting extension of the electromagnet provided with a lifting edge 5, which is continued by a rising cam 6 having a rising edge 6a. Further, behind the selecting point, an extensible cam 7 is arranged. Above all of the noted cams there is situated a stationary cam ring 8, in the upper part of which is groove 8a.

At the selecting point are situated operative sinkers (not shown) which are controlled by guiding cam 9, above which is arranged a radially displaceable cam 10, of which operative cam 11 is an extension which is already shifted into the recess in a further stationary cam ring 12. Above the stationary cam ring 12 is mounted a further cam ring 13. The known upper control butts of the operative sinkers upon selecting the attached needles, for the purpose of patterning, move along path 14, whereas the lower butts of said operative sinkers are moved along path 15. The control means by which the selection is performed through magnetic pulses from the said extension of the electromagnet, consists essentially of a two part control sinker. The sinker is provided with a control butt 16 (FIG. 2) in its upper part 17 which, together with the lower part 18 of the sinker, is arranged in the lower region of the longitudinal groove 19 of needle cylinder 20. The upper end of the upper part 17 is under the action of an annular extension spring 21 which surrounds the outer circumference of the needle cylinder 20 and is mounted in groove 8a of the stationary cam ring 8. FIG. 1 shows the path of control butt 16 through the cam system or the purpose of patterning. That path is denoted by reference number 22. The movement of the said control butts by the cam system is performed in accordance with the rotation of needle cylinder 20 (FIG. 2) i.e. in the direction of arrow S (FIG. 1).

The upper parts 17 (FIG. 2) of the control sinkers are provided at their lower ends with a chamfered sinkers are provided at their lower ends with a chamfered portion 23 and finally terminate in a depending terminal finger 24. The centres of the upper parts 17 are tapered as at 25. At the point of selection the upper part 17 can be slid into a conically tapering longitudinal recess 26 in the stationary cam ring 8 against the action of spring 21.

The lower parts 18 of the two-component control sinkers are longitudinally shaped so as to present a complementary face underlying the adjacent face of upper part 17. The lower parts 18 are provided on their lower ends with selecting butts 27 which cooperate with a selecting extension 4 of the electromagnet at the selecting point.

The needle cylinder 20 below the longitudinal grooves 19 is provided with an antimagnetic ring 28.

For the sake of completeness of this specification, it is further mentioned that the width of the longitudinal recess 26 in the stationary cam ring 8 has a dimension

$t_2 - 2t_1$ (FIG. 6), the width of the control butt 16₁ - 16₂ of the sinkers having the dimension t_1 .

In order to effect patterning of the needles the device of this invention operates substantially as follows:

For the patterning of needles in a two cylinder circular knitting machine it is necessary that the control sinkers follow a path in the cam system shown in FIG. 1 as denoted by paths 14, 15. As already mentioned, this provides control of the upper and lower control butts. Since the patterning on the knitting machine is substantially a matter of the individual selection of each individual needle, it is necessary for that purpose to have a reliable and simple device which secures the above mentioned operation of the sinkers in a two cylinder circular knitting machine in any individual case. For that purpose the control sinkers used in this device cooperate similarly with the magnetic pulses and the cam system in each knitting feed equipped with this selecting device.

The control sinkers are brought to the selecting point by rotation of the cylinders in the direction of arrow S in the relative position shown in FIGS. 2 and 5. The upper part 17 and the lower part 18 of the control sinkers are mutually assembled, and the selecting butts 27 with their lower edge contact the upper edge of the selecting extension 4 of the electromagnet. At that moment control butt 16 contacts the initial part of the lifting edge 5 of the lower stationary cam ring 2. If, at that moment, no magnetic pulse is emitted by the selecting extension 4 of the electromagnet, then by bias of spring 21 upon the upper part 17 of the control sinker the said upper part 17 and lower part 18 of the sinker are maintained in close juxtaposition at the selection point, i.e., at that point at which recess 26 is formed in the stationary cam ring 8. The control sinker as one integral member is lifted by the lifting edge 5 and, upon further movement of said control sinker in the direction of arrow S, control butt 16 slides below rising cam 6, which is constantly slightly spaced from the outer surface of needle cylinder 20. It is obvious, that the distance must be such, that the control butts 16 of the non-selected control sinkers can pass freely without riding up on the lifting edge 6a. Otherwise an undesirable selection of control sinkers would take place and thus also patterning mistakes would occur in the pattern to be completed by the needles according to the predetermined patterning program.

When, however, the proper control sinker reaches the selecting point a pulse is given to the electromagnet by a conventional electronic device (not shown) and the selecting extension generates the magnetic effect in the form of a pulse upon selecting butt 27 of the control sinker. The following action then takes place:

Since the force of the magnetic pulse from the selecting extension 4 of the electromagnet on butt 27 is greater than the force which is exerted upon the upper part 17 of selector by spring 21, the lower part 18 remains attracted to the upper edge of the selecting extension 4 of the electromagnet. Thereupon, through the influence of taper 25 and the complementary shaping of the lower part 18 of the control sinker the upper part 17 pivots outwardly in such manner that the upper part 17 of the selector slides into the longitudinal recess 26 of the lower stationary cam ring 8. This condition is shown in FIG. 3. The action of lifting edge 5 of the lower stationary cam ring 8 upon control butt 16 of the control sinker results in the upper part 17 adapting the

position shown in FIG. 4. The upper part 17 takes up a position in which its control butt 16, upon advancement of cylinder 20 in the direction of arrow S, contacts the lifting edge 6a of lifting cam 6 and is raised so as to lift the operative jack mounted thereabove without the effect of the lower control butt upon cam 10 which is, upon selection for patterning, moved away from needle cylinder 20. Thus the bottom butt of the operative jack comes into contact with operating cam 11, which finishes the required path of the operating jack in such manner, as to bring about patterning by means of the attached needle, i.e., as shown by paths 14 and 15. Upon reaching the highest position of control butt 16 of the control sinker, or of its upper part 17, respectively, said control butt 16 is again retracted by the influence of an edge of stationary cam ring 8 in such manner, that upon reaching the lower level, the control sinker is again in its assembled basic position and is again ready to be actuated.

Analogously as mentioned above, it would be possible to utilize the present invention with a one cylinder circular knitting machine or possibly with flap knitting machines.

From the standpoint of the design of the selecting electromagnet, it is of particular importance that at the moment of selecting the control sinkers into their operative position it is not necessary that the magnetic effect of the selecting extension 4 overcome even a minimum air gap in acting on control butt 27. Thus, the magnetic losses are relatively small in the present invention, whereupon a higher reliability of the whole device is achieved in view of the known principles.

It should be appreciated that it is to replace the selecting electromagnet with e.g., a mechanical device which, according to a predetermined program, retains the lower parts 18 of the control sinkers and thereby perform the selection of the desired control sinkers.

Various modifications and changes are possible. Accordingly, the present disclosure should be taken as illustrative and not limiting of the present invention.

What is claimed is:

1. Apparatus for selecting needles of a circular knitting machine for patterning according to a predetermined patterning program, said knitting machine including at least one rotatable needle cylinder provided with circumferentially spaced axially parallel longitudinal grooves in which are located said needles and control means slidable within said grooves and adapted to effect movement of said needles according to said patterning program at a predetermined selection point, said selecting apparatus comprising a control means in each of said grooves having separate upper and lower parts, said upper and lower parts being independently slidable axially within the associated groove with respect to each other and capable of limited pivotal movement within said groove with respect to each

other about an intermediate portion of each of said parts, at least one of the parts of said control means being provided with a control butt adapted to be actuated by a cam system radially spaced about said needle cylinder to axially raise said one part, spring means pivotally urging the upper portion of said upper part towards said needle cylinder to normally bias said control butt into engagement with said cam system, and an electromagnet arranged adjacent the needle cylinder at the selection point below the level of the lower part of said control means said electromagnet being selectively operable to retain certain ones of the lower portions of said control means in the lower region of said groove when said needle cylinder has been rotated so as to position said control means at the predetermined selection point to overcome said bias and prevent actuation of control butt by said cam system.

2. Apparatus according to claim 1, wherein said cam system includes a first stationary cam ring which is provided at the selection point with a longitudinal recess extending from the top surface thereof downwardly and being adapted to receive the upper part of the control means when the same is raised by the cam system at the selection point, said first stationary cam ring also having a circumferential groove in which said spring means is seated, and a second and lower stationary cam ring being provided in radially spaced relationship about said needle cylinder having a cam track adapted to receive said control butt and to actuate same according to said patterning program.

3. Apparatus according to claim 2, wherein the magnetic force generated by said selecting extension of the electromagnet and exerted on said lower part of the control means is greater than the force exerted by said spring means on said upper part of the control means.

4. Apparatus according to claim 2, wherein the upper edge of said lower stationary cam ring is provided at said selection point with a lifting edge which merges into a rising cam adapted to cooperate with the control butt of said control means to effect a raising of the control means part having said control butt and thereby effect the desired movement of the needle associated therewith.

5. Apparatus according to claim 2, wherein the upper part of said control means is provided with said control butt on the outer side thereof, the inner side of said part being provided at an intermediate region with a tapered portion, the lower end of said upper part having a chamfered portion which terminates in a depending finger, the lower part of said control means being provided with a selecting butt cooperable with said retaining means to hold said lower part in the lower region of said groove while the upper part is being moved upwardly and pivoted about said tapered portion.

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