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Ludwig et al.

[11] **3,748,871**

[45] **July 31, 1973**

[54] **APPARATUS FOR CONTROLLING PATTERN DRUMS PARTICULARLY IN CIRCULAR KNITTING MACHINE**

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[52] **U.S. Cl.** ..... **66/50 B**, 66/154 R

[51] **Int. Cl.** **D04b 9/00**

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

[56] **References Cited**

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Attorney—Nolte and Nolte

[57] **ABSTRACT**

A pattern setting memory device controls a vertical stepped slider, and thereby controls a horizontal adjustment slider, which in turn controls a slide rotor element. The sliding motion of the latter element is transmitted, by reciprocating cam motions, to linkage for the setting of plunger members. By means of this linkage and of the plunger members, a unidirectional continuous rotation and memory-controlled sliding of the slide rotor element produces an intermittent forward or backward rotation of the control star. This star, by gearing, correspondingly rotates a pattern drum for the selection of knitting needles in a pattern knitting process.

10 Claims, 7 Drawing Figures

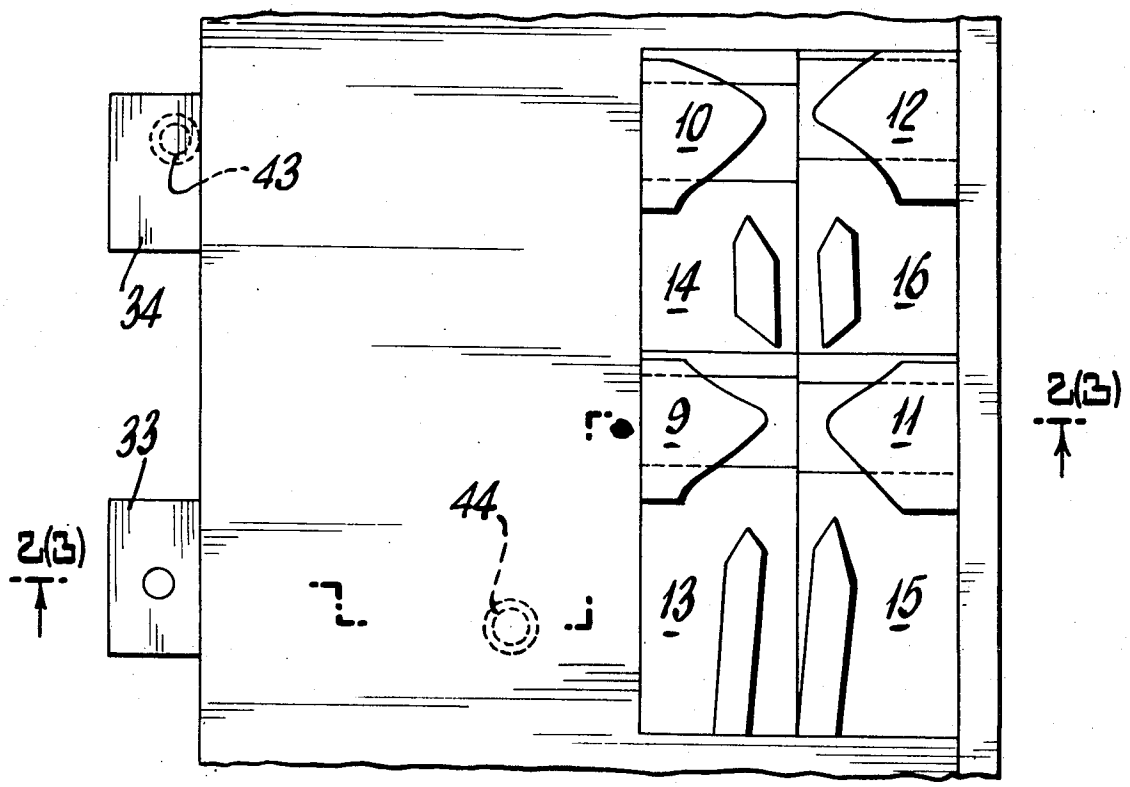


Fig. 1.

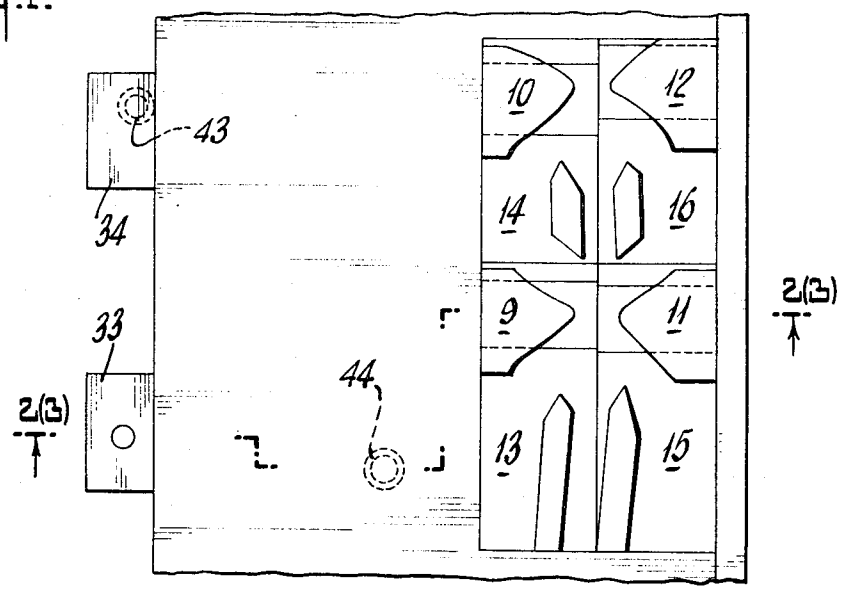


Fig. 3.

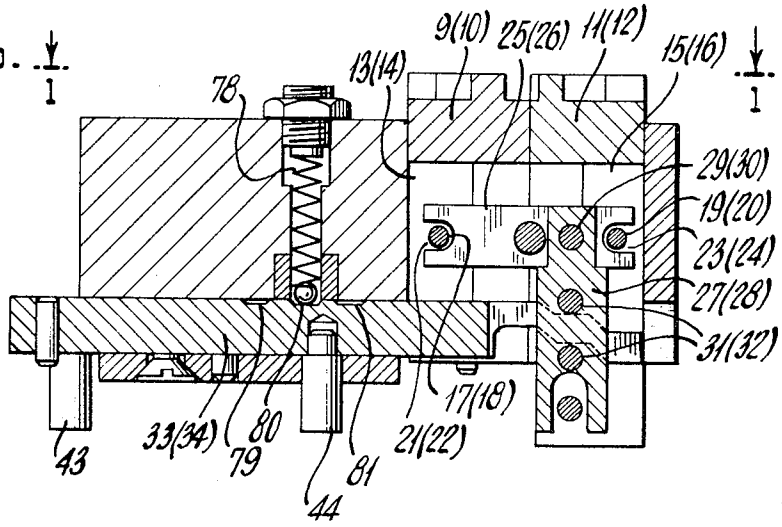
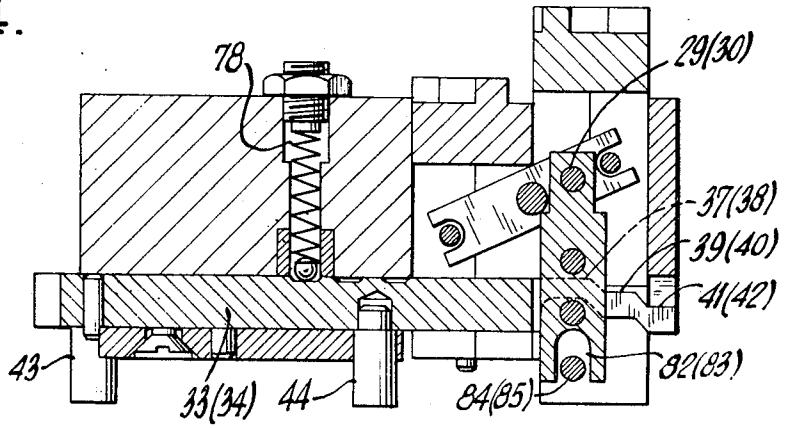


Fig. 4.



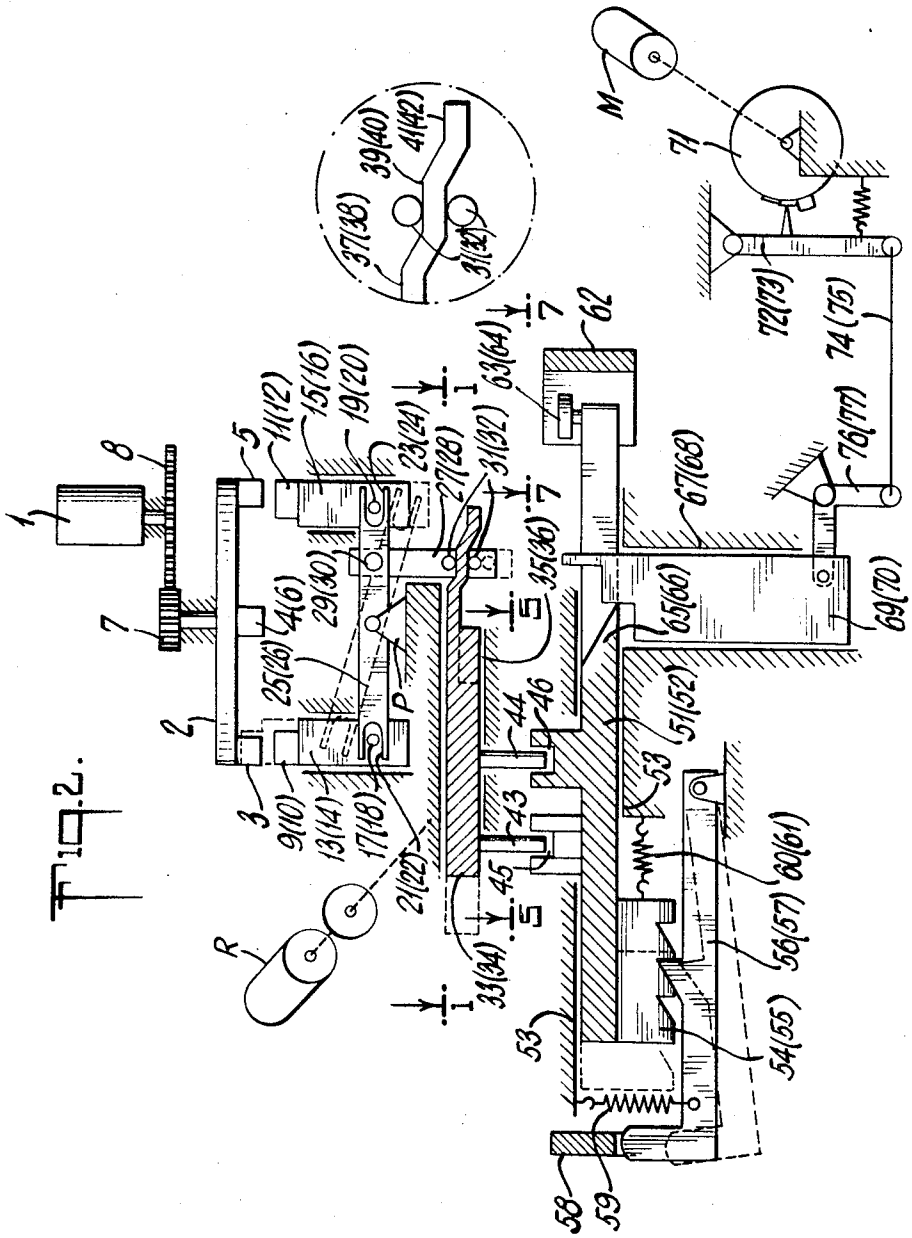

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FIG. 2.

Fig. 5.

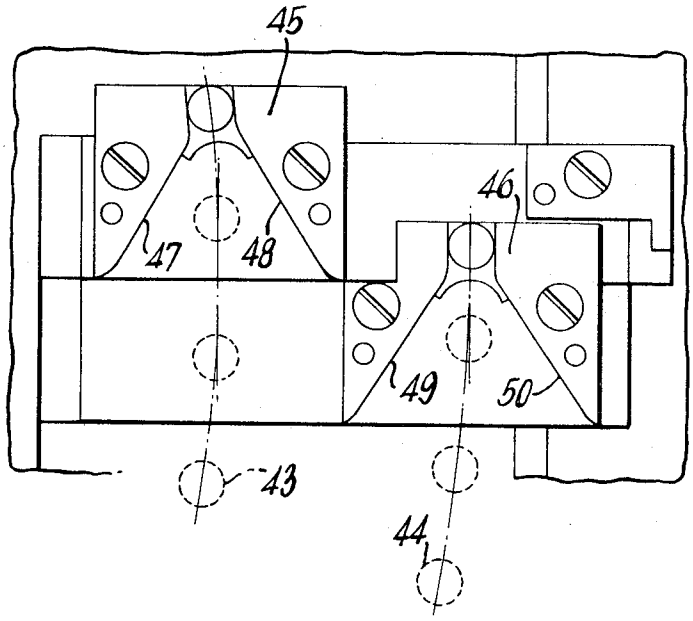


Fig. 6.

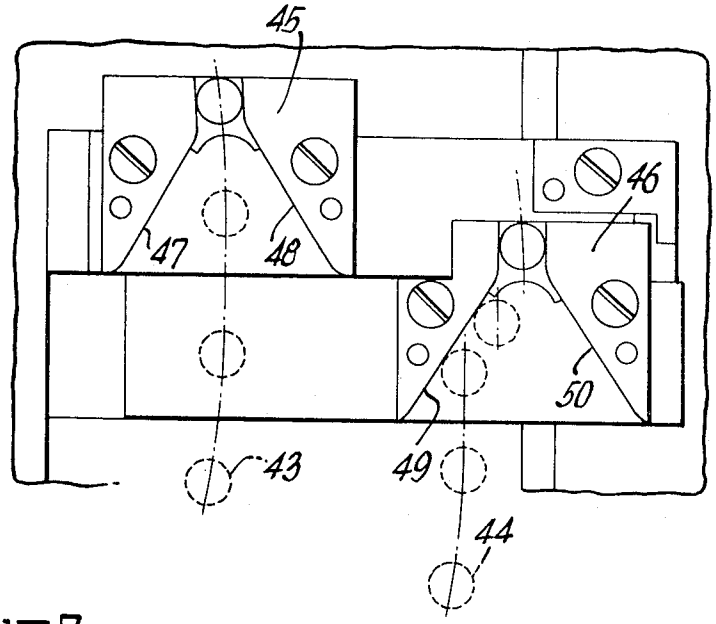
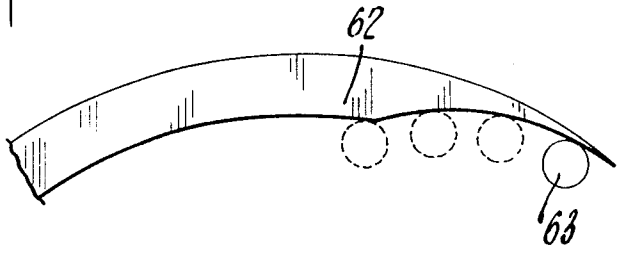


Fig. 7.



APPARATUS FOR CONTROLLING PATTERN DRUMS PARTICULARLY IN CIRCULAR KNITTING MACHINE

BACKGROUND AND NATURE OF THE INVENTION

In circular knitting machines, the pattern drum for the control of knitting needles is periodically turned forward or backward by selected numbers of steps, such as zero, 1 or 2. This is done by a control rotor or "star", which in turn is driven by a rotating rocking lever, equipped with plungers at its ends. It is known to control motions of the plungers by slide mechanisms. However, difficulties have been encountered as the use of known mechanisms for this purpose caused erroneous driving of the "star", mainly in cases where slight inaccuracies or memory devices or the like could not be fully avoided. Such inaccuracies in fact were enlarged, since motion multiplying lever systems had to be used. Often the plungers were insufficiently raised; they then contacted the "star" only with parts of the available contact surfaces and thereby caused high surface pressures, with resulting troubles in the operation of the pattern drum; this was so particularly since the parts usually must move with high velocities. It also happened that a plunger was raised more than desired, causing excessive motions of the "star" and drum. The rocking levers operate subject to friction; this fact has also contributed to inaccurate pattern control.

The invention serves to provide a more reliable pattern control device which avoids the aforementioned difficulties and provides very accurate control of the pattern drum even if the memory devices and transmission means are far less than perfect.

The objective of the invention has been achieved by new structure, provided mainly at and near the foot part of the rocking lever mechanism. According to the invention this part is engaged by a reciprocatory cam device at one end of a rotor slide element. This cam device desirably has a plurality of inclined and flat surfaces for engagement of a link which then engages the rocking lever. Advantageously the new rotor slide element, acting by its cam end on the rocking lever, is provided at its other end with bolts or pins, rotating therewith and accurately meshing with guide surface features on a non-rotating adjustment slider, the position of which is periodically shifted by the rotary equipment, under the control of the pattern memory equipment. These and other features of the invention will now be described with reference to a preferred embodiment thereof.

IN THE DRAWINGS

FIG. 1 is a plan view of a control portion of the apparatus, said portion being seen in the schematic FIG. 2 along lines 1—1, and in the more realistic FIG. 3 along lines of the same designation;

FIG. 2 is a schematic, generally sectional view taken along line 2—2 (3—3) in FIG. 1;

FIG. 3 is a more realistic representation of control portions of the machine, in a view generally similar to that of FIG. 2 and also taken along lines 2—2 (3—3) in FIG. 1;

FIG. 4 shows the apparatus of FIG. 3 in a different position thereof;

FIG. 5 is a fragmentary plan view of an underlying part of the apparatus, seen along lines 5—5 in FIG. 2;

FIG. 6 shows the apparatus of FIG. 5 in a different position thereof;

FIG. 7 is a plan view of a detail from FIG. 2, seen along lines 7—7 in that figure.

Referring first to the upper and directly machine-controlling part of the control apparatus, pattern drum 1 is provided with the usual cams or pattern platens or the like (not shown) for selection of knitting needles (also omitted in the drawing). In order to minimize the need for needle-controlling cams or the like and to allow ready change of patterns, provision is made to successively turn drum 1 by intermittent forward or backward rotary motions in a variable number of steps, for example zero, one or two steps at a time. The drum is driven by a "star" 2, provided with four bolts 3, 4, 5 and 6, the successive turns of the star being transmitted to the drum by gearing 7 and 8.

For turning the star, FIGS. 2 and 3, four star controlling plungers 9, 10, 11 and 12 are provided, each on a carrier 13, 14, 15 or 16. These carriers are mounted on a rocking lever unit 21 to 26, described hereinafter, which is rotated about a vertical axis by suitable power means, not shown. When one of the plungers comes into the engagement area of bolts 3, 4, 5 and 6, star 2 is promoted by one step. It is also possible to engage the same bolt with two plungers successively, whereby the star is promoted by two steps, or to engage an opposite bolt with one or two plungers to turn the star back by one or two steps, or to have the plungers in non-engaging positions, at which time the star remains at rest.

According to the invention, trouble-free control of the star and drum equipment 1, 2 is provided by new apparatus, FIGS. 2 to 6, which make sure that plungers 9 – 12 can be raised only alternately, and are raised accurately even if their rotary impact on star 2 is very rapid.

For these purposes each plunger carrier 13 to 17 has pins (17 to 20), each engaging a recess (21 to 24) of one of two rocking levers 25, 26. Each rocking lever has a drive link 27, 28 engaging an arm of the rocking lever at 29 (30). The rocking levers are pivoted at pivot P. The pivoting, rocker and plunger mechanism, together with other elements to be considered presently, are rotated by suitable rotor means schematically shown at R.

For the accurate performance of rocking movement of the rockers and plungers, each link 27 (28) has guide pins 31 (32), arranged to be raised or lowered by one of two rotor slide elements 33 (34). Rotor slide elements 33 (34) are guided in horizontal guide means 35 (36), which rotate with the rocker - plunger mechanism and also with the needle cylinder of the knitting machine (not shown).

According to the invention, the rotor slides 33, 34 have step shaped profiles in the area of guide pins 31, 32, providing a series of steps 37 to 42 interconnected with one another by uniformly inclined cam surfaces. Sliding of the rotor slides causes these step cams to raise or lower links 27 (28) and thereby to rock the lever and plunger mechanism. This arrangement makes sure that the control equipment at the foot of the rocking levers is safely held in operating position dependent on the position of the rotor slides. Should the control impulse, derived from the memory, be sufficient only for a less than normal plunger lift, the plungers simply

are not lifted at all, the rocking lever is not rocked, and the control star and drum do not rotate.

For horizontal sliding of the rotor slide element 33 (34), this element has a guide bolt 43 or 44, which during the rotation of the rotor slide element periodically engages a corresponding guide recess 45 or 46 on a non-rotating adjustment slider 51 or 52, shown in FIGS. 2 and 5. Dependent on the position of these recesses 45 and 46 the guide bolts 43 and 44 either pass unrestrainedly through the controlling recess mechanism (FIG. 5) or receive horizontal impulses, radially off the rotary motion, thereby sliding the rotor slide elements 33 or 34 (FIG. 6). Each guide recess 45 or 46 has, facing the arriving guide bolts, obliquely arranged guide surfaces 47 to 50. In the position of FIG. 5 these surfaces 47 to 50 do not encounter bolts 43 or 44; in the other position they encounter these bolts and thereby deflect them and their carriers. It is in this latter position that rocker link 27 or 28 is moved vertically and thereby one or the other plunger is raised or lowered.

Adjustment sliders 51, 52 are horizontally slidable in a stationary guide 53 of the knitting machine, and each of them has one portion, between the illustrated end portions, cooperating with a pattern setting device, while also having outer ends, cooperating respectively with a locking unit and a discharge unit.

Each locking unit comprises a locking lever, controlled by an unlocking cam and controlling motions and end positions of the adjustment slider by a stepped detent mechanism. The stepped detent mechanism comprises a locking member 54 or 55, one on each adjustment slider 51 or 52, engageable with a locking lever 56 or 57. The locking levers are periodically engaged by an unlocking cam 58 which rotates with the aforementioned rotary equipment and when engaging the lever, moves the same against the force of return spring 59. Additional springs 60, 61 tend to move adjustment sliders 51, 52 toward the right side in FIG. 2, in the stationary bearing 53.

Right end portions of adjustment sliders 51, 52 extend into the area of a rotating discharge cam 62 shown in FIGS. 2 and 7. For engagement with this cam each of these sliders has a roller bearing member 63 supported on the right hand end, which is periodically engaged by discharge curve 62. The result is that the adjustment sliders receive a sliding motion against this discharge curve 62. This in turn serves to discharge a stepped slider, during the readjustment process applied to the adjustment slider outside of the area of the stepped slider. The adjustment sliders have pointed portions 65, 66 pointing toward the right in FIG. 2 and engageable by the stepped slider; however, under the influence of cam 62, these points are brought out of contact with the stepped slider, thereby enabling the same without undue friction to be raised or lowered in a guide slot 67 or 68, the stepped slider itself being shown at 69 or 70.

For raising or lowering stepped sliders, pattern device 71 is provided, which is connected with the sliders by one arm lever apparatus 72 or 73, link 74 or 75 and bell crank lever 76 or 77.

As the unlocking cam 58 reaches the area of the control unit shown in FIG. 2, both locking levers 56, 57 are unlocked against spring 59, thereby freeing the unit from its former locked position. Thereupon discharge cam 62, which also rotates, becomes effective which by means of rollers 63, 64 shifts adjustment slider 51, 52 toward the left. Thereupon pattern device 71 can raise or lower said slider 69, 70 or leave it in position. Next, as cam 62 has continued to rotate, springs 60, 61 return adjustment sliders 51, 52 into contact with the stepped slider. Dependent on the vertical position of this element, points 65, 66 proceed more or less toward the right, thereby repositioning bolt guides 45, 46.

If these bolt guides remain in their previous position, no new motion is imparted to bolt 33, 34, but if either bolt guide 45, 46 has been repositioned, the rotor slide element 33, 34 is shifted accordingly, thereby repositioning link 27, 28, rocking lever 25, 26, and plunger unit 9 to 12.

These last-mentioned elements are also shown in FIG. 3, which additionally shows a ball type detent device 78, engaging corresponding detent recesses 79, 80, 81 of sliders 33, 34 and fixing the position of said sliders. Additional structural features of the rotor slide element, link, rocker lever and plunger unit are also shown in FIGS. 3 and 4, and the two figures also show the stepped cam mechanism 37 to 42, in two of its actual positions. It will be easy to visualize, from FIGS. 3 and 4 and the foregoing explanations, how steps 37 to 42 make it certain that, in the case of small errors in the sliding motions of rotor slide element 33, 34, plungers 13 to 14 are controlled without error, as guide pins 31, 32 and ball detent allow the cam end of rotor slider 33, 34 to slide only by positive steps, from one to another of the cam levels 37 to 42 and detent recesses 79 to 81.

As further shown in these figures, links 27, 28 are connected with the rocking levers by plain pivots, and desirably have lower recess slots 82, 83 for engagement with pins 84, 85 to limit lateral swinging of these links. This feature additionally contributes to the positive guidance of the new plunger mechanism.

It will be seen that the new plunger mechanism provides accurate repositioning of the plungers even in the event that minor irregularities occur in the sliding of rotor slide element 33, 34, for example, due to similar irregularities in the operation of the mechanism which causes the sliding of this element. In this way it has been made possible to insure perfect control of successive knitting needles regardless of minor design errors or functional errors in the control apparatus.

What is claimed is:

1. In control apparatus for the control star and pattern drum of a pattern knitting machine: a system of plungers; rocker levers pivotally supporting the plungers; a link pivoted to each rocker lever, for rocking the same; guide pin means for raising and lowering the link means; and a slider cam for slidingly raising and lowering the guide pin means in a succession of definite steps.

2. A system according to claim 1 wherein the slider cam has a plurality of surfaces following one another in the manner of stair steps with risers therebetween, and the guide pin means comprises at least one pin in sliding contact with such steps and rigid.

3. A system according to claim 2 wherein said risers are inclined.

4. A system according to claim 1 also having guide bolt means projecting from each slider cam, and control means for sliding said guide bolt means and thereby said slider cam to raise and lower the guide pin means, links, rocker levers, and plungers.

5. A system according to claim 4 wherein the control means is movable relative to the slider cam and has oblique surfaces for impact with said guide bolt means.

6. A system according to claim 5 also having slider means for controlling said control means, and means for resiliently displacing said slider means.

7. A system according to claim 6 having means for locking the slider means and thereby the control means, and means for unlocking the same.

8. A system according to claim 7 also having step slider means for further control of said locking and unlocking of the slider means.

9. A system according to claim 8 wherein the slider means has a rigid pointed portion for contact with the step slider means.

10. A system according to claim 7 including roller bearing means on the slider means, and means for engaging the roller bearing means for said unlocking.

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