Jan. 14, 1958 H. S. BURDETT 2,819,599

CAM-ACTUATING MEANS FOR KNITTING MACHINES

Filed Dec. 5, 1955 3 Sheets-Sheet 1

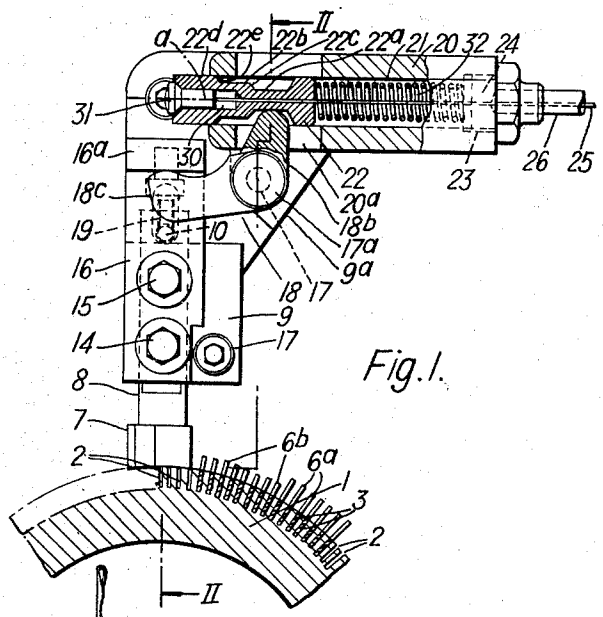

Fig. 1.

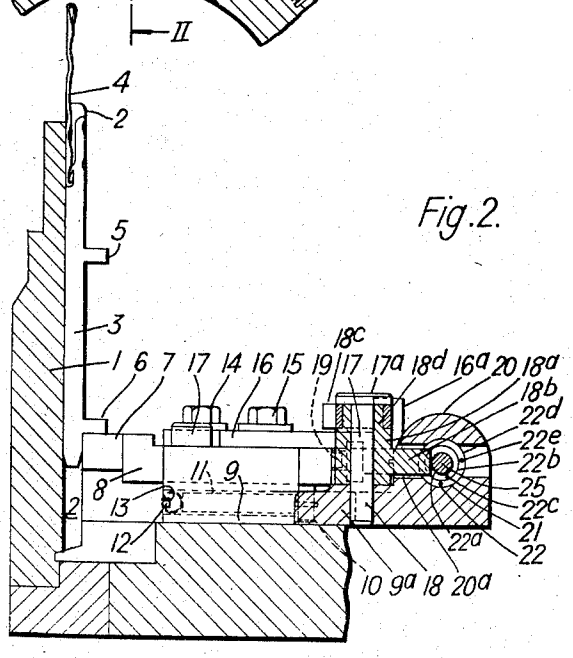

Fig. 2.

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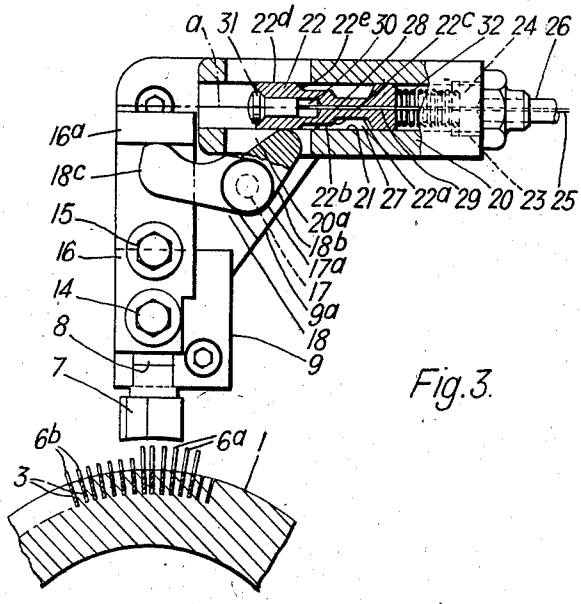

Fig. 3.

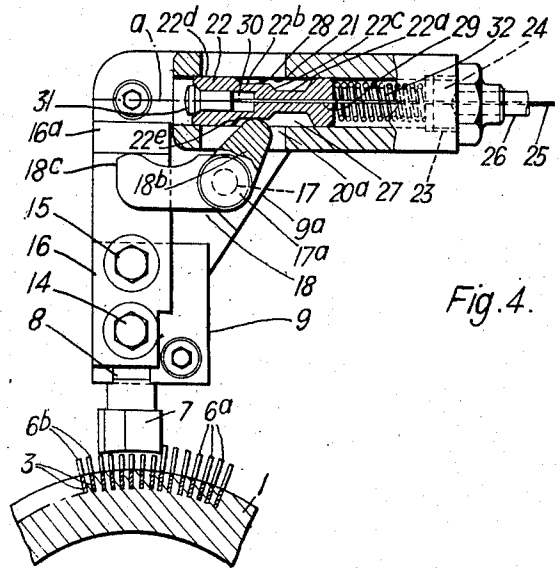

Fig. 4.

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CAM-ACTUATING MEANS FOR KNITTING MACHINES

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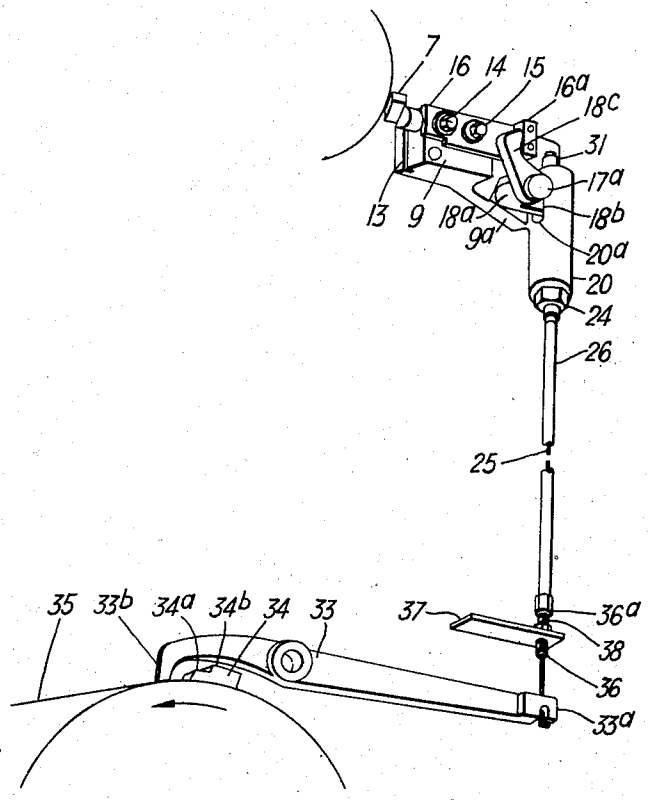

Fig.5.

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2,819,599

CAM-ACTUATING MEANS FOR KNITTING MACHINES

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Application December 5, 1955, Serial No. 551,151

12 Claims. (Cl. 66—50)

This invention appertains to elements used in knitting machines for actuating butted knitting instruments.

The invention concerns particularly mechanism for moving, and controlling the movements, of such elements to selected pre-determined positions in relation to a series of operating, selector or other butts of varying lengths provided on needles, associated needle-actuating jacks or sliders or on any other appropriate knitting instrumentalities.

Thus, although the invention may advantageously be applied to mechanism for moving and controlling axial movements of bolt cams, there is no limitation in this respect. For instance, it may also be applied to similar mechanism for actuating narrowing or even widening pickers of, say, seamless hose machines. But for convenience in the following further description the latter will be concentrated more especially upon bolt cams, it being clearly understood, however, that the term "bolt cam" is used in a generic sense and is intended to include, where the context so admits, any other appropriate cam, picker or similarly functioning element of a knitting machine.

The invention, moreover, is primarily intended for application to circular knitting machines such, for example, as those adapted to produce seamless hose, half-hose and the like, although it may also be applied to straight-bar or flat knitting machines wherein the traversible cam carriages are equipped with cams of the bolt type.

As is well known to those acquainted with the art concerned, a bolt cam can either (*a*) be allowed to move "right in" to a position in which its operative extremity is located close to the bed in which the knitting instruments are arranged to function, or (*b*) be fully withdrawn to an inoperative position in which its operative extremity is sufficiently spaced away from the said bed as to be clear of all the butts of the series, or (*c*) be moved to an intermediate position, or a selected one of a plurality of intermediate positions, as the case may be.

Accordingly, whenever it is permitted to move right in a bolt cam will engage all the butts of the series irrespective of their length. Upon being fully withdrawn, the said cam will miss all of the butts so that none of the corresponding instruments will be displaced endwise by the cam. But if and when, on the other hand, the bolt cam is moved to a predetermined intermediate position it will engage only butts of an appropriate length and miss the remainder of the series of butts.

Bolt cams are of various forms and are used for a variety of purposes of which may be mentioned, merely by way of example, ½-lift cams in seamless hose machines for raising instep needles to heeling height, feed cams for directing butts onto stitch cams, press-off cams, up-throw cams, and so on.

Now a bolt cam is commonly actuated and controlled from cam portions of different heights on a control unit, e. g. drum, through the medium of a suitably fulcrummed cam lever and a flexible cable of the Bowden type. This

cable, which is attached to the cam lever at one end, has heretofore been anchored at its opposite end directly to a slide carrying the bolt cam. Since, therefore, a flexible cable of the type concerned eventually stretches, the precise pre-set positions to which the bolt cam is movable ultimately become upset with disadvantageous and sometimes dangerous and costly results.

The object of the present invention is to obviate this difficulty by the provision of an improved and efficient actuating mechanism of simple construction whereby the initial accuracy of the pre-set positions of a bolt cam or other appropriate element is maintained throughout the life of the mechanism notwithstanding stretching of the cable.

According to this invention, one end of a cam-actuated flexible cable is anchored to a slidable component which has a stepped formation or formations and is adapted to be moved to different positions under control, and there is interposed between the stepped component and a part of or on a suitably biassed carrier for an element, such as a bolt cam, to be actuated, a movable member movements of which to dispose the element in alternative pre-set positions are controlled by the said slidable component.

In a convenient arrangement of the improved bolt cam or like actuating mechanism, the stepped control component is slidable rectilinearly and is provided with longitudinally extending connected surfaces, i. e. steps, located at respectively different distances outwardly from the median line of the component. The outer step, viz, that farthest away from the median line, may advantageously be constituted by a portion of the exterior surface of the component, whilst the remaining step or steps may be formed by appropriately recessing the component. In any event, the steps extend parallel to the median line and may advantageously be connected by inclined surfaces obliquely disposed with respect to the said line.

Thus, although it is within the scope of the invention for the stepped control component to consist of a suitably recessed slide of square, oblong or relatively flat section, it is preferred that it shall be constituted by a circumferentially grooved plunger of cylindrical form. In the latter case the cylindrical plunger may be bored right through axially to accommodate the flexible cable and counterbored at the appropriate end thereof to receive a conventional nipple to which the end of the cable remote from the principal control unit is attached.

The stepped control component is arranged to be pulled by the cable in one direction against spring or weight action, and, when permitted, moves in the opposite direction under the said action.

The aforementioned movable member interposed between the stepped control component and a part of or on the biassed carrier for the bolt cam or the like is provided with an arm or a nose-like protuberance for contact with the stepped surface of the control component so that the particular step opposing this arm or protuberance can be changed to effect a desired change in the position of the bolt cam or the like simply by shifting the component longitudinally to a required extent (not critical) in the appropriate direction. It will accordingly be appreciated that the positions to which the bolt cam or the like is movable are determined by the permanently unchanging distance of the steps from the median line, e. g. longitudinal axis, of the stepped component, and not by the distances through which the component is shifted longitudinally and which are likely to vary due to the stretching of the cable. To achieve the desired result, each of the steps must, of course, be of a sufficient length to allow for the consequential slight variations in the positions to which the stepped control component is shifted. Thus, the accuracy of the preset positions of the

bolt cam or the like is permanently maintained notwithstanding stretching of the cable.

In one embodiment of the invention, the stepped control component is arranged for rectilinear sliding movement within a casing disposed either at any convenient angle, or parallel to the bolt cam or like carrier, in which instance an opening is provided in the wall of the casing to enable the aforesaid arm or nose-like protuberance of the movable member to extend therethrough for engagement with the steps.

In order that the invention may be more clearly understood and readily carried into practical effect, a specific constructional example thereof as applied to a circular knitting machine will now be described with reference to the accompanying drawings, wherein,

Figure 1 is a plan view, partly in section, illustrating a bolt cam and mechanism constructed in accordance with this invention for actuating the same, the cam being shown right in so that it will engage all the needle butts of a series,

Figure 2 is a vertical sectional view of the same taken on the line 11—11 of Figure 1,

Figure 3 is a part-sectional plan view similar to Figure 1, but showing the bolt cam fully withdrawn so as to miss all of the butts,

Figure 4 is yet another similar plan view—this time showing the bolt cam moved to an intermediate position to engage only long butts, and

Figure 5 is a general perspective view depicting, in diagrammatic fashion, the control drum from which the flexible cable anchored to the slidable stepped component is controlled through the medium of a fulcrummed cam lever.

Like parts are designated by similar reference characters throughout the drawings.

In the drawings, the reference numeral **1** indicates a portion of the bottom or plain needle cylinder of a circular knitting machine of the superimposed needle cylinder type. This cylinder has formed therein, in the usual way, axially extending tricks or grooves **2** to receive bottom needle-actuating sliders **3**. One of the double-ended latch needles with which such sliders are engaged is represented at **4** in Figure 2. Each of the sliders **3** has formed thereon an upper knitting butt **5** and a lower "transfer" butt **6** (Figure 2). Of the butts **6** in the specific arrangement shown some of them are long and others short. In each of Figures 1, 3 and 4 the long and the short butts are indicated at *6a* and *6b* respectively.

For action upon the slider butts **6** there is provided a bolt cam **7**. As will be seen, this cam is provided at the leading end of a horizontal slide **8** which is mounted for rectilinear sliding movement in a fixed bracket **9** located adjacent and extending radially or substantially so with respect to the needle cylinder **1**. To a peg **10** (see Figure 2) depending from the rear end of the bolt cam slide **8** is attached one end of a tension spring **11** the opposite end of which is anchored to a pin **12** fitted in a groove **13** formed in the front of the fixed bracket **9**. Upon the top of the slide **8** is secured, by means of screws **14** and **15**, a rectangular plate **16** the rear end of which extends somewhat beyond the slide and has a vertically disposed tail portion **16***a*. Thus, by pressing on the front face of this upstanding tail portion **16***a* the slide **8**, and hence also the bolt cam **7**, can be withdrawn in a direction away from the needle cylinder **1** against the action of the tension spring **11**. Conversely, by relieving the pressure on the tail portion **16***a* of the plate **16**, the slide **8** is permitted to move forwardly towards the needle cylinder **1** under the action of the spring **11**. Mounted to turn about a vertical headed spindle **17** set in a portion **9***a* of the fixed bracket **9** adjacent to the bolt cam slide **8** is the hub **18***a* of a two-armed lever **18**. The arms **18***b* and **18***c* of this lever are relatively disposed at an angle much in the same way as the arms of a bell crank, but as illustrated in Figure 2, are located in suitably spaced horizontal planes. The lower arm **18***b* which is integral with the hub **18***a*, is short and nose-like and is directed rearwardly, i. e. away from the needle cylinder **1**. The upper arm **18***c* is somewhat longer and initially separate from the hub, being rigidly secured upon an upper reduced portion **18***d* of the latter—immediately beneath the head **17***a* of the spindle **17**. The outer end of the upper arm **18***c* is arranged in contact with the front face of the upstanding tail portion **16***a* of the rectangular plate **16**. It is convenient here to mention that provision, e. g. in the form of screw means such as those indicated at **19** in Figures 1 and 2, may be made for longitudinal adjustment of this rectangular plate **16** relatively to the bolt cam slide **8**.

Formed integrally with the rear portion of the fixed bracket **9** and disposed at right angles to the bolt cam slide **8** is a barrel-like casing **20** which is axially bored as at **21** from end to end to receive a stepped control plunger **22** of cylindrical form. The outer end of the casing **20** is counter-bored at **23** and tapped to receive a correspondingly screw-threaded inner portion of a hollow plug **24** through which the appropriate end of the flexible cable **25** extends. The corresponding end portion of the tubular sheath or cover **26** of the cable **25** is fitted into the outer end of the plug **24**. The cylindrical control plunger **22** is circumferentially grooved to different depths at **27** and **28**, intermediate its ends, to form therein two steps **22***a* and **22***b* separated by an intervening portion **22***c* of truncated conical form. The cylindrical surface **22***d* of the un-grooved end portion of the control element adjoining the shallower (**22***b*) of these two steps constitutes a third step—separated from the said shallower step by a further portion **22***e* of truncated conical form. Being cylindrical, the stepped control plunger can be accurately ground to present the three steps **22***a*, **22***b* and **22***d* at the required radial distances from the longitudinal axis *a* of the plunger. The stepped plunger **22** is bored right through axially as indicated at **29** to permit of the cable **25** being threaded therethrough and, at its end remote from the hollow plug **24** is formed with a counter-bore **30** to receive a nipple **31** to which the cable **25** is attached. A compression spring **32** housed within the barrel-like casing **20** and arranged to surround the flexible cable is interposed between the inner end of the stepped cylindrical plunger **22** and the opposed end of the hollow plug **24**. Thus, whenever a pull is exerted on the flexible cable **25**, the stepped control plunger **22** will be drawn along within its casing **20** against the action of the compression spring **32**. When, on the other hand, the cable **25** is released, the control plunger **22** will slide in the opposite direction under the action of the said spring. In the side of the barrel-like casing **20** is formed a rectangular opening **20***a* through which projects the shorter, i. e. lower, arm **18***b* of the pivoted two-armed lever **18** for contact with the surface of the control plunger. The tension spring **11** controlling the bolt cam slide **8** maintains the upstanding tail portion **16***a* of the superimposed rectangular plate **16** in engagement with the end of the longer arm **18***c* and also serves to hold the shorter arm **18***b* in contact with the stepped control plunger **22**.

The end of the flexible cable **25** remote from the stepped control plunger **22** is, as illustrated in Figure 5, attached in the customary manner to the tail **33***a* of a two-armed cam lever **33** the toe **33***b* of which is arranged to be acted upon by a cam **34** secured upon a control drum **35**. The cam **34** has stepped portions **34***a* and **34***b* of two heights. The end of the tubular sheath or cover **26** of the cable **25** remote from the hollow plug **24** is fitted into an enlarged counter-bored end **36***a* of an exteriorly screw-threaded element **36** which is screwed into and is adjustable within a tapped hole formed in a fixed support **37**. The element is secured in position after an adjustment by means of a locknut **38**. It should

be explained that Figure 5 is purely diagrammatic, the end of the control drum 35 being shown, for convenience, in approximately the same plane as the cam slide 8 and with the drum axis parallel to that of the needle cylinder 1. In practice, of course, the said drum is disposed with its axis horizontal, i. e. at right angles to the vertical axis of the cylinder 1; thus for the drum 35 to be viewed in its true position in relation to the bolt cam actuating mechanism shown at the top of Figure 5, the appropriate portion of the paper upon which this figure is printed would require to be bent down at right angles.

The construction and arrangement of the mechanism are accordingly such that whenever the toe 33*b* of the cam lever 33 is in contact with the surface of the control drum 35, i. e. with no cam beneath it, the stepped control plunger 22 will be held, by the associated compression spring 32, at one extreme position with the step 22*a* which is nearest to the axis *a* of the plunger (i. e. the step of least diameter) opposing the shorter arm 18*b* of the pivoted two-armed lever 18. In these conditions the bolt cam slide 8 will be in its most advanced position with the bolt cam 7 located closely adjacent to the needle cylinder 1 and thereby disposed for action on both short butts 6*b* and long butts 6*a* (see Figure 1). If now the control drum 35 is turned to locate beneath the toe 33*b* of the cam lever 33 a cam portion 34*a* of the lesser of the two heights aforesaid, the stepped control plunger 22 will be pulled by the cable 25 against the spring action to position the middle step 22*b* in contact with the shorter arm 18*b* (Figure 4). As a consequence the bolt cam 7 will be partially withdrawn to such a position that it will engage the long butts 6*a* and miss the short butts 6*b*. By locating beneath the said toe 33*b* a cam portion 34*b* of the greater of the two heights, the stepped control plunger will be pulled still further against the action of the spring 32 to position the step 22*a* of greatest diameter in contact with the shorter arm 18*b* and thereby fully withdraw the bolt cam 7 to its inoperative position clear of both the long butts 6*a* and short butts 6*b* (Figure 3). By causing the toe 33*b* of the cam lever 33 to drop off the higher cam portion 34*b* onto a lower cam portion 34*a* and then off said lower cam portion onto the surface of the control drum 35 the opposite results are achieved.

As will be appreciated, it is by no means necessary that the step of least diameter should be relied on to determine the "right in" position of the bolt cam. Accordingly, a gap may be left between this step and the end of the shorter arm.

The number of steps on the control plunger may be increased beyond three if there are three or more different lengths of butts.

In a modification, the casing for the stepped control plunger is arranged beneath and parallel to the bolt cam slide 8.

I claim:

1. In a knitting machine, in combination, a bed, knitting instruments for operation in said bed, said instruments being provided with butts, an element for operating upon said butts for the purpose of actuating the instruments, a biassed carrier for the said element, a slidable component having at least one stepped formation, means including a flexible cable functioning to move the stepped component to different positions longitudinally, a control unit determining said positions, and, interposed between the stepped component and the element carrier, a movable member the movements of which are effected by said stepped component and are transmitted to the element suchwise as to dispose the latter in selected pre-set positions relatively to the butts.

2. In a knitting machine, in combination, an instrument bed, knitting instruments for operation in said bed, said instruments being provided with butts, an element for operating selectively upon said butts and thereby actuating selected instruments, a biassed carrier for said element which is movable to different positions suchwise as to cause the element to act upon or miss desired butts, according to knitting requirements, a rectilinearly slidable stepped component provided with longitudinally extending connected surfaces, located at respectively different distances outwardly from the median line of the component, means biassing the stepped component in one direction, a flexible cable anchored at one end to the said component, lever means connected to the opposite end of the cable and movable in one sense to pull the stepped component against the biassing means to different positions longitudinally and in the opposite sense to permit of return movements of the stepped component under the action of the biassing means, a control unit determining the sense and extent of the movements of said lever means, and, interposed between the stepped component and the element carrier, a movable member the movements of which are effected by said stepped component and are transmitted to the element to dispose the latter in selected positions relatively to the butts.

3. A combination according to claim 2, wherein the longitudinally extending connected surfaces of the stepped component extend parallel to the median line of the latter and are connected by inclined surfaces obliquely disposed with respect to the said line.

4. A combination according to claim 3, wherein the stepped component is in the form of a circumferentially grooved cylindrical plunger.

5. A combination according to claim 4, wherein the stepped control plunger is bored through axially to accommodate the flexible cable and counterbored at the appropriate end to receive a nipple to which the end of the cable remote from the lever means is attached.

6. A combination according to claim 5, wherein the stepped component is arranged to be pulled by the cable in one direction against a spring and, when permitted, to be moved in the opposite direction under the action of said spring.

7. In a knitting machine, in combination, an instrument bed, knitting instruments for operation in said bed, said instruments being provided with butts, an element for operating selectively upon said butts and thereby actuating selected instruments, a biassed carrier for said element which is movable to different positions suchwise as to cause the element to act upon or miss desired butts, according to knitting requirements, a rectilinearly slidable stepped component provided with longitudinally extending connected surfaces, located at respectively different distances outwardly from the median line of the component, means biassing the stepped component in one direction, a flexible cable anchored at one end to the said component, lever means connected to the opposite end of the cable and movable in one sense to pull the stepped component against the biassing means to different positions longitudinally and in the opposite sense to permit of return movements of the stepped component under the action of the biassing means, a control unit determining the sense and extent of the movements of said lever means, a turnable two-armed member having first and second arms, the said first arm contacting the surface of the stepped component and the second arm being arranged to act on the biassed element carrier, and the construction being such that movements of the two-armed member effected and controlled by the stepped component, are transmitted to the element to dispose the latter in alternative positions relatively to the butts, and that any step opposing the said first arm can be changed to effect a desired change in the position of the element simply by shifting the stepped component longitudinally to a required extent in the appropriate direction.

8. A combination according to claim 7, wherein the stepped component is arranged for rectilinear sliding movement within a casing, and an opening is provided in the wall of the casing to enable the said first arm of the

two-armed member to extend therethrough for engagement with the surface of the stepped component.

9. In a knitting machine, in combination, an instrument bed, knitting instruments for operation in said bed, said instruments being provided with butts of different lengths, a bolt cam for operating selectively upon said butts and thereby actuating selected instruments, a spring-influenced slide upon the leading end of which said cam is provided, a fixed bracket in which said slide is slidable rectilinearly to different positions to cause the cam to act upon or miss desired butts, according to knitting requirements, a plate which is combined with the slide and has an upstanding tail portion, a rectilinearly slidable stepped component provided with longitudinally extending connected surfaces located at respectively different distances outwardly from the median line of the component, means biassing the stepped component in one direction, a flexible cable anchored at one end to the said component, lever means connected to the opposite end of the cable and movable in one sense to pull the stepped component against the biassing means to different positions longitudinally and in the opposite sense to permit of return movements of the stepped component under the action of the biassing means, a control unit determining the sense and extent of the movements of said lever means, and, interposed between the stepped component and the upstanding tail portion of the aforesaid plate, a turnable two-armed member mounted upon the fixed bracket with one arm contacting the surface of the stepped component and the other arm acting on the front of the said upstanding tail portion, the construction being such that turning movements of the two-armed member effected and controlled by the stepped component are transmitted through the slide to the bolt cam to dispose the latter in various positions relatively to the butts.

10. A combination according to claim 9, wherein a hub of the two-armed member is mounted to turn about a headed spindle set in a portion of the fixed bracket adjacent to the bolt cam slide, the arms of said member being relatively disposed at an angle.

11. A combination according to claim 9, wherein there is formed integrally with the fixed bracket, a casing which is axially bored to receive the stepped component.

12. In a knitting machine, in combination, an instrument bed, knitting instruments for operation in said bed, said instruments being provided with butts, an element for operating selectively upon said butts and thereby actuating selected instruments, a biassed carrier for said element which is movable to different positions suchwise as to cause the element to act upon or miss desired butts, according to knitting requirements, a rectilinearly slidable stepped component provided with longitudinally extending connected surfaces, i. e. steps, located at respectively different distances outwardly from the median line of the component, means biassing the stepped component in one direction, a flexible cable anchored at one end to the said component, a fulcrumed cam lever which has a protuberant toe and is connected to the opposite end of the cable, said lever being turnable in one direction to pull the stepped component against the biassing means to different positions longitudinally and in the opposite direction to permit of return movements of the stepped component under the action of the biassing means, a control drum provided with a cam having portions of different heights for engagement with the toe of the cam lever, and, interposed between the stepped component and the element carrier, a movable member the movements of which are effected by said stepped component and are transmitted to the element to dispose the latter in selected positions relatively to the butts.

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