July 24, 1956 F. E. DEANS ET AL 2,755,645

SELECTING MECHANISM OF CIRCULAR KNITTING MACHINES

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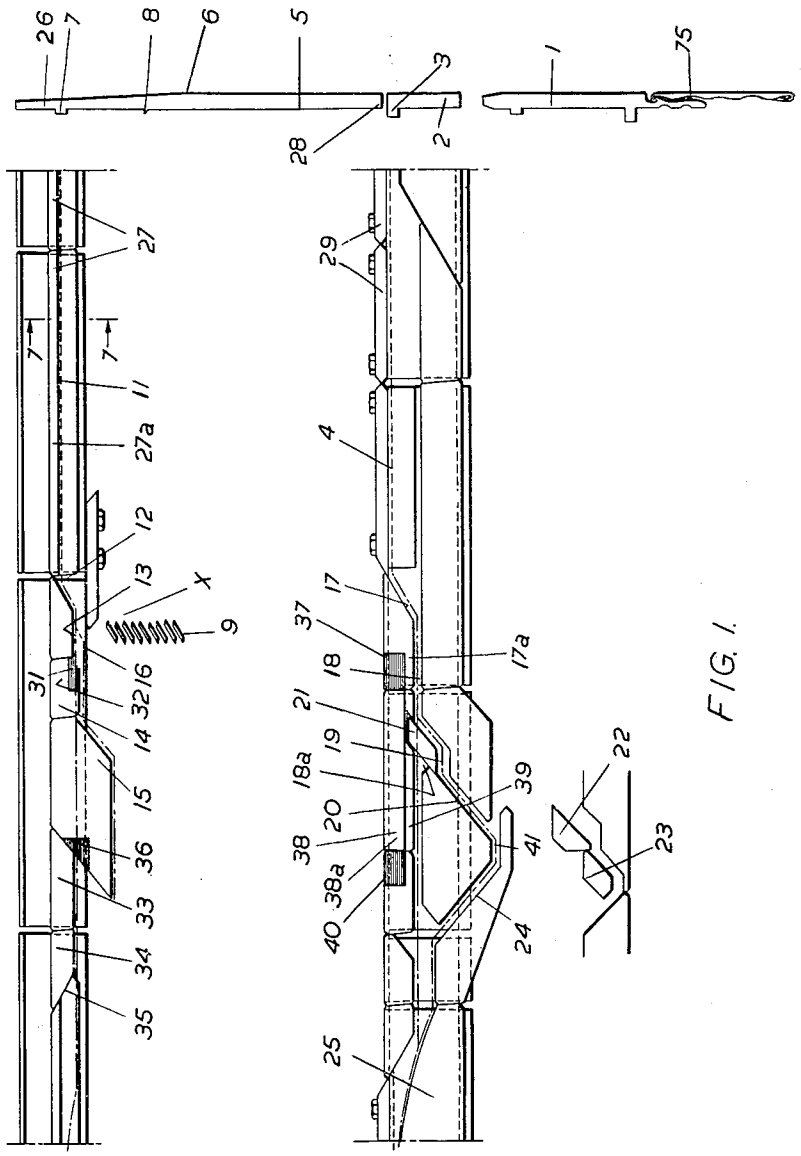


FIG. 1.

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FIG. 2.

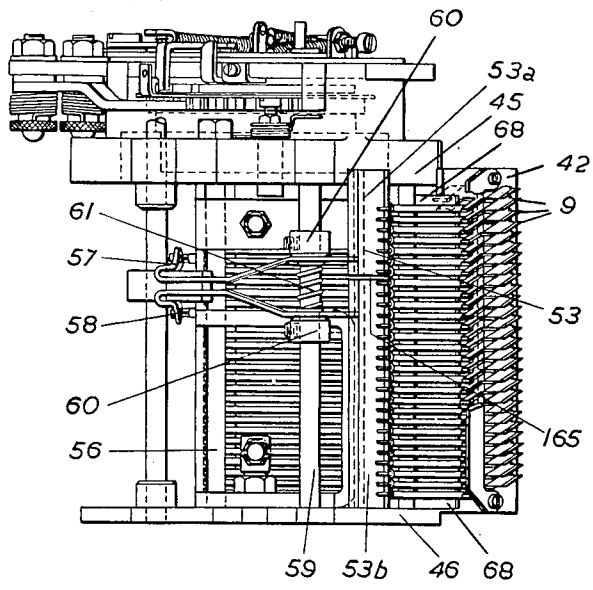
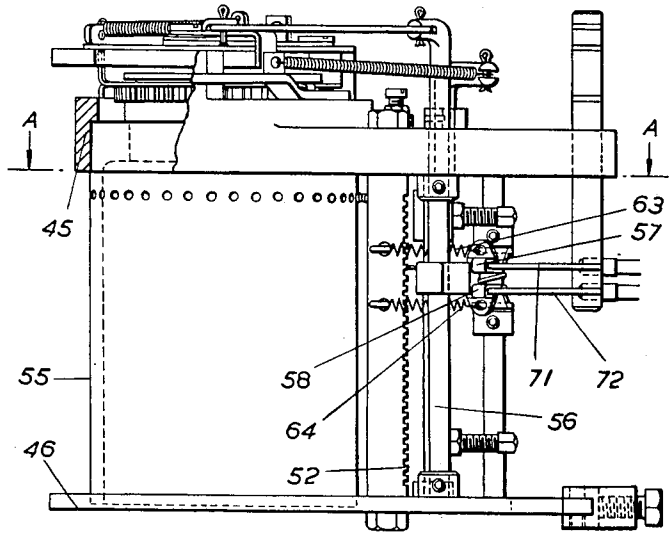


FIG. 3.



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FIG. 6.

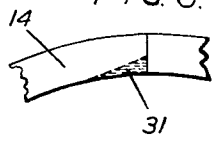


FIG. 7.

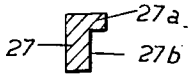
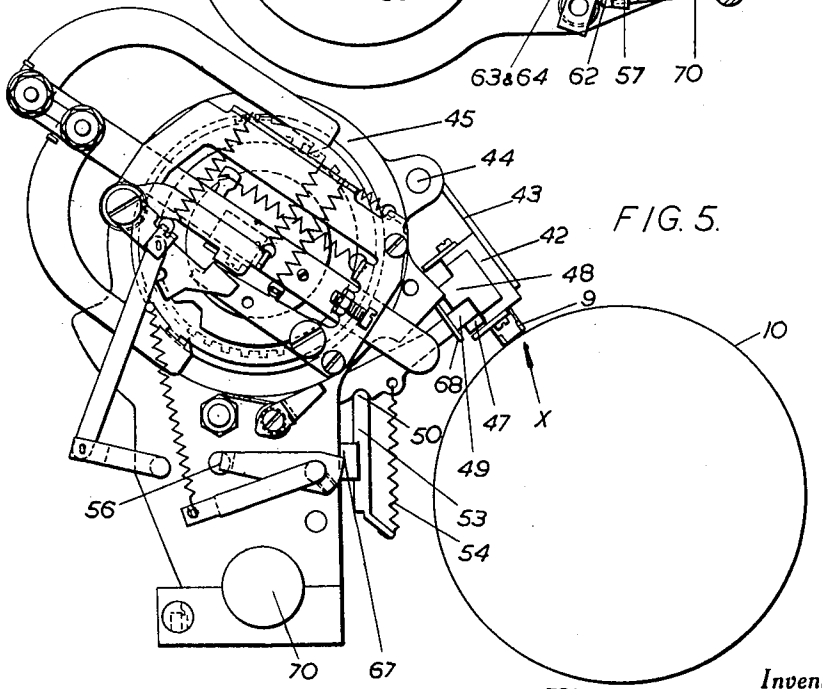


FIG. 4.

FIG. 5.



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SELECTING MECHANISM OF CIRCULAR KNITTING MACHINES

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Application October 1, 1951, Serial No. 249,032

Claims priority, application Great Britain October 9, 1950

15 Claims. (Cl. 66—14)

This invention concerns the selecting mechanism of circular knitting machines, primarily circular knitting machines of the opposed needle cylinder type.

An object of the present invention is an improved selecting mechanism for knitting machines, and a particular object is a selecting mechanism which on the one hand gives a wide range of selection without the use of a long cylinder or other bed and without it being necessary to cut unduly deep tricks, and which on the other hand permits of the use of a pin-drum for controlling the selection. A pin-drum is, for the purpose of this specification, defined as being a drum or cylinder the periphery of which is provided with circumferential rows of holes (at axially spaced levels) for the removable reception of interchangeable pins or screws in any desired pattern arrangement. Such a device has the advantage that the pattern arrangement can readily be changed merely by shifting the position (and if necessary altering the number) of the pins.

This invention provides a circular knitting machine, having a tricked instrument bed, instruments mounted in the tricks for sliding movements and rocking movements therein and having at contrasting selecting levels, selecting butts disposed in the required pattern arrangement, an operating cam for moving along its trick any instrument that it acts on, a depressing cam positioned to engage the instruments and to rock them in their tricks into or out of range of the operating cam, and selecting cams, at the said levels, each movable into and out of operative position in which it acts on such selecting butts as may reach it at that level and thereby slides the associated instrument along its trick to bring it into or out of range of the depressing cam. Preferably, but not necessarily the instrument is thus moved out of range of the depressing cam.

It will be seen that the selecting cams only produce part of the sliding movement of the instruments, this part being that which is required to bring the instruments into or out of range of the depressing cam. Hence, the length of each selecting cam, and the spacing between the various selecting levels, need only be comparatively small; this in turn permits of the use of short instruments and of a comparatively short bed while at the same time permitting a substantial number of selecting cams and a consequental wide range of selection to be provided. Moreover, this range can be achieved without having the spacing between the selecting levels so small as to preclude the use of a pin drum for shifting the selecting cams, it being appreciated that in a pin drum a certain minimum thickness of metal must be left beween pin holes of adjacent circumferential rows.

It will further be appreciated that since the rocking force is applied to the instruments from the depressing cam, it can be applied to each of them at the same point in their length, and this point can be widely spaced from the fulcrum about which they rock; this renders it unnecessary for the tricks to be of inconvenient depth. A

further advantage of the present construction is that, since the rocking movements are not applied through the selecting butts, the latter can be disposed on both sides of the fulcrum, thereby permitting full use to be made of the length of the instruments to accommodate rows of selecting butts.

Preferably, the depressing cam operates on the same parts (e. g. operating butts) of the instruments as does the operating cam.

In order to provide for a still greater sliding movement than that which is derived from the operating cam and the selecting cams, each instrument may be provided in its trick with a secondary instrument or "bit" movable by that instrument, when moved by the operating cam, into range of an actuating cam which then imparts additional movement to the bit.

It is further preferred to provide axially spaced complimentary guards extending around the cylinder, one at each side of the fulcrum, for the positively controlling the angular attitude of each instrument in its trick throughout the entire range of rocking movements.

The foregoing and other features of the invention set out in the appended claims are incorporated in the mechanism that will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is a developed view of the interior of the top cam box, looking on the inside of the cams which control the various instruments in the top needle cylinder; this figure includes at the right hand side a double-ended needle, a typical slider, a slidable bit, and a pattern jack;

Figure 2 is an elevation of the pin drum and associated parts;

Figure 3 is a side elevation of the mechanism shown in Fig. 2, also showing its attachment to a pillar of the machine frame;

Figure 4 is a plan view taken on the line A—A in Fig. 3;

Figure 5 is a plan view looking on the top of the mechanism shown in Figs. 2 and 3;

Figure 6 is a plan view of one of the cams shown in Fig. 1;

Figure 7 is a sectional view taken on the line 7—7 in Fig. 1.

In this example the invention is to be applied to a super-imposed needle cylinder machine, such as is sold under the registered trademark "Komet," for the purpose of controlling the movements of the sliders in the upper needle cylinder in the production of links-links fabric. Machines of this type are well known; they have superimposed coaxial tricked needle cylinders represented diagrammatically at **10** in Figs. 4 and 5 and each cylinder is equipped with sliders (whereof a representative slider of the top cylinder is indicated at **1** in Fig. 1) by which double-ended needles **75**, Fig. 1, are operated. In view of the known character and operation of such machines, further description or illustration is unnecessary.

In the exercise of the present invention above each slider in the top cylinder and in the same trick there is a slidable bit **2** having a butt **3** which throughout the major part of the circle of movement travels in a high inactive track **4** such that the bottom end of the bit is above the highest position to which the sliders are retracted. Above each bit **2** and in the same trick there is a pattern jack **5** capable of sliding and rocking movements, being provided with a fulcrum point **6**, midway in the length of its rear edge, which bears against the back of the trick. Each jack **5** is provided near its top end with an operating butt **7**, and at any one or more of a series of selecting levels is provided with a selecting butt **8**. These selecting levels are all of course below the operating butt **7** and some of them are below and some above the fulcrum point **6**.

At a selecting station which is shown approximately as the region X in Fig. 1 there is provided a battery of selecting cams, one at each level, these cams are shown as **9** in Fig. 2. Each cam **9** is capable of being moved in towards the cylinder as shown in Figs. 4 and 5 when in towards the cylinder as shown the cam is in the operative position and will engage any selecting butts **8** reaching it at that level. The operating butts **7** of the jacks **5** travel throughout the major part of their circle of movement in an upper inactive track **11**, Fig. 1. Immediately before reaching the selecting station X the operating butts **7** are lowered by the levelling cam **12**, from the inactive track **11** to the depressing track **13**. If a jack **5** continues in this depressing track its operating butt **7** is engaged by the depressing cam **14** (a plan view of which is shown in Fig. 6) which forces or depresses the top end of the jack into its trick and so moves the operating butt **7** that it passes behind the lowering cam **15** (the operating cam aforesaid) which immediately follows the depressing cam **14**.

On the other hand if any jack is lowered by a selecting cam **9** Figs. 1 and 2 its operating butt **7** is brought down to pass beneath the depressing cam to a ready track **16** which it travels along into engagement with the operating cam **15** so that this jack is lowered further.

The butts **3** of the bits **2** are also brought down from their inactive track **4**, immediately before the selecting station X, by the bit-levelling cam **17** which brings them to the selecting track **18** in which they are so placed that they will not be further lowered by the jacks **6** at the selecting station X i. e. by the jacks when the latter are lowered by the selecting cams such as **9**. However, when a jack **5** is lowered by the operating cam **15** it lowers its associated bit **2** from this selecting track **18** to track **19** in which it passes into engagement with the bit-actuating cam **20** which lowers that bit still further. Bits that are not so lowered continue in the selecting track **18** into an idle track **18***a* passing over the top of this actuating cam **20**. It will be noticed that tracks **18** and **18***a* are intersected by the bolt cam **21** which in effect constitutes a movable part of the bit-actuating cam and may be inserted as required to cause all the bits to be lowered to the ready level (to be engaged by the actuating cam **20**). Bolt cam **21** (as also the other bolt cams herein referred to) is operated in conventional manner requiring no description or illustration. The additional movement of the bits **2** by the actuating cam **20** brings them into contact with the sliders (such as **1** in Fig. 1) and then moves the latter downwards (e. g. into range of the transfer control bolt cam **22** and from there onto the transfer bolt cam **23**). Shortly after reaching their lower-most position the lowered bits are raised, first to the level of the selecting track **18** by means of the cam **24** and then to the inactive track **4** by the return cam **25**, thereby serving to lift the associated jacks **5** to their inactive track **11** also. Reverting back to the bolt cam **21** it can easily be seen that by providing the bits **2** with butts **3**, Fig. 1, of different length, and by pushing the bolt cam in to differing extents, a selection may be achieved. Specifically, short and medium-length butts may alternate 1 x 1 throughout the major part of the circle, except over a short arc wherein short and long butts alternate in order to permit of the insertion of the bolt cam. This permits every second needle to be transferred to the bottom cylinder at the end of an area of fabric having a rib-knitted pattern (e. g. a stocking top), so that the first course after the patterned area is knitted of 1 x 1 rib. In this connection it will be appreciated that the selecting mechanism provided by the present invention is particularly applicable to the production of rib-knitted patterns.

If reference is made to Fig. 1 it will be seen that if the pattern jack **5** is positioned in its cylinder trick with the butt **7** running in track **11** (as illustrated), the top end **26** is adjacent to the rib **27** (which is shown in side

elevation in Fig. 7) of the cam ring, also the bottom end **28** of the jack **5** is positioned adjacent the rib **29**. Now the two ribs **27** and **29** encircle the cylinder and form a guard which positively controls the angular attitude of each jack in its trick throughout the entire range of its rocking movement. The top guard rib **27** is throughout the major part of the circle rebated at its inner face as shown in Fig. 7 so as to provide a lip **27***a* which closely encircles the surface of the cylinder and therefore prevents the top ends **26** of the jacks **5** from swinging outwards and a rebate **27***b* in which the operating butts **7** of the jacks may move up and down. The levelling cam **12** is in effect a downward continuation of this lip. The depressing cam **14** Fig. 1 is a cam which at its lower part **31** has an incline of its inner face (shown in the plan view Fig. 6), in the depressing track **13**, in the direction of rotation so as to engage the operating butts **7** in that track to force them inwards, and above said incline has a full thickness part **32** which is, in effect, a continuation of the lip **27***a* and engages the top ends **26** of those jacks which have been lowered by the selecting cams **9** into the ready track **16**, and prevents these top ends from swinging outwards. The operating cam **15** (or lowering cam) is also of full thickness except at its reverse edge **36** where its inner face is formed with a reverse incline hereinafter described. Beyond the operating cam **15**, the guard rib continues at full thickness (indicated by the cams **33** and **34**) until, approximately at a stage where the bits are lifted to the idle track **11** by their return cams **24** and **25**, it re-assumes the aforesaid lipped rebated formation. It does so in cam face **35** which serves to lower the jacks **5** to the depressing level **13** during reciprocation in the heel and toe (the selecting cams **9** then being out of operation) whereat their operating butts **7** are engaged and depressed by the reverse incline **36** on the operating cam **15**.

It is now convenient to refer to the bottom guard rib **29**. Throughout the major part of the circle this guard rib is a plain rib which closely encircles the surface of the cylinder and so prevents the bottom ends **28** of the jacks **5** from rocking outwards, without preventing their sliding movements. Immediately before the selecting station X this rib merges into the bit levelling cam **17**. Immediately below the depressing cam **14** the bit levelling cam **17** is provided with an incline **37** which is complementary to (i. e. is sloped in the opposite direction to) that of the depressing cam incline **31**, so as to permit the lower ends **28** of those jacks, which are depressed by the depressing cam **14**, to swing outwards. Below this reverse incline **37**, the bit levelling cam **17** has a lip **17***a* of full thickness which holds in the lower ends **28** of those jacks which have been lowered by a selecting cam **9** and thus have not been engaged and rocked by the depressing cam **14**. Continuing from this reverse incline **37** above the top of the bolt cam **21** and half way along the top of the actuating cam **20**, there is a guard cam **38** which is of L section, having a rebate **38***a* to accommodate the protruding lower ends **28** of those jacks which have been rocked by the depressing cam **14** and a bottom lip **39** which holds into their tricks the bottom ends **28** of those jacks which have been lowered by the lowering cam **15**. At the region substantially above the apex of the bit-actuating cam **20** and below incline **36** this rebate merges by an incline **40** into a full thickness guard cam.

During rotational knitting, this incline **40** serves to press the lower ends **28** of all jacks into their tricks and during the heel and toe it permits said lower ends to move out before the upper ends **26** of the jacks are pressed in by the reverse incline **36** on the operating cam **15**.

It will be appreciated that the jacks have three stages of downwards movement, (*a*) from the inoperative track **11** to the depressing track **13** by the levelling cam **12**, (*b*) from the depressing track **13** to the ready track **16** by the selecting cams **9**, (*c*) from the ready track **16**,

by the operating cam **15**. The bits likewise have three stages of movement (*a*) from the inactive track **4** to their selecting track **18**, by the bit-levelling cam **17**, (*b*) from their selecting track **18** to the ready track **19** by the jacks **5** being lowered by the operating cam **15** and (*c*) to a fourth and lowest level **41**, by the actuating cam **20**. As a result the total movement imparted by the bits **2** to the sliders **1** is much greater than can be derived directly from the selecting cams **9**. Moreover, since the sliding movement required to be imparted to a jack **5** to cause its operating butt **7** to miss its depressing cam **31** is very small the selecting butts **8** and the selecting cams **9** may be closely spaced which in turn permits of a great number of selecting levels and of a wide selecting scope without an undue length of cylinder. On the other hand the pitch between the selecting levels may well be sufficiently large to permit the use of a pin-drum for operating the selecting cams.

Each selecting cam conveniently consists of a strip of sheet metal such as **9** Figs. 2, 4 and 5, disposed radially of the cylinder **10** at station X but with its under face at the angle required to engage and lower the selecting butts **8**. These strips **9** are guided as shown in the vertical post **42** of U section which is supported at the correct height and position by the flat plate **43** which is itself fixed to the pillar **44**. The pillar **44** is therefore used not only as a spacer between the top casting **45** and the bottom plate **46** of the pin-drum assembly but also may be rotated to give the correct position for the guide post **42** and then locked in position.

As can be seen in Fig. 4 each of the selector cams (or blades **9**) has two butts **47** and **48** between which the end of a selector lever such as **49** is inserted. These selecting levers **49** are fulcrummed intermediate their ends at **50** and have one end guided in the vertical comb **68** and at their other end **51** they are also guided in a comb **52** (Figs. 3 and 4) which is another spacing pillar for the top casting **45** and bottom plate **46**. The levers **49** are of sheet metal and are quite flat.

It is usual to pivot such a battery of levers on a spindle which transfixes them all. In the present instance each transmitting lever **49** has a fulcrum notch at **50** in which is engaged the rounded vertical edge of a fulcrum plate **53**. The levers **49** are each provided with a tension spring **54** extending between it and the abutment **55** on the plate **53**, for holding its fulcrum notch against the fulcrum edge. These springs also serve to urge the ends of the levers towards the pin-drum **55**.

If reference is made to Fig. 4 it will be seen that the fulcrum plate **53** is joined securely to the block **67** which is pivoted on the spindle **56**; the block **67** carries a stop screw **69** which butts up to the pillar **70**. It can now be seen that if the block **67** is turned on the spindle **56** in an anti-clockwise direction it will swing the fulcrum plate **53** which will itself move the levers **49** in towards the pin-drum **55**. Now the ends **51** of the levers **49** which are guided in the slots in the pillar **52**, will pivot on the back of the slots as the fulcrum plate **53** is moved and cause the other ends of the levers **49** to slide in the comb **68** and move the blades **9** away from the cylinder **10**, thus putting the whole bank of selector blades **9** out of action. From the foregoing description it can easily be seen that to place the bank of blades **9** into action the block **67** must be turned on the spindle **56** in a clockwise direction. In Fig. 4 the block **67** is turned on its spindle **56** by means of the lever **57** and is there shown in the position where the end **65** of the lever is clear of the abutment **66** of the fulcrum plate **53** thus allowing the selector levers **49** to pivot on their ends **51** under the action of the springs **54** which has caused two things to happen, namely, the blades **9** have been projected in towards the cylinder **10**, and the fulcrum plate **53**, together with the block **67**, has turned on the spindle **56** to the extent allowed by the stop-screw **69** butting up to the pillar **70**. This stop-screw is set to allow the blades **9** to be projected until they are just clear of the cylinder **10**.

It may be desirable to devote the top part of the drum **55** to one pattern (e. g. for the turnover top of a stocking) and the lower part to another pattern (e. g. for the leg of a stocking) and to render either part of the drum inoperative while the other part is in use. For this purpose the fulcrum plate **53** may be made in upper and lower parts **53***a*, **53***b* (shown in Fig. 2 where the plate **53** is split or divided along the line **165**) corresponding to the respective parts of the drum, either of which (together with the group of levers **49** pivoted on it) may be swung to the operative or inoperative position as above described. Both parts may be swung at the same time to render the whole of the drum operative or inoperative.

The controls to both parts **53***a*, **53***b* of the fulcrum plate are shown in Figs. 2 and 3, the levers **57** and **58** controlling the top and bottom plates respectively. These two levers are shown mounted freely on the shaft **59** and positioned at the correct height by the collars **60** and spring **61**, they are constantly urged in one direction by the springs **63**, **64**, and actuated when required by the cables **71**, **72**, the other ends of which are attached suitably to lifter rods operating directly from the main control drum of the machine (or are otherwise operated in conventional manner). It is by operation of the levers **57**, **58** by means of the cables **71**, **72** that the selecting cams **9** as a whole are moved out of operation for the period during which reciprocatory knitting occurs for the purpose of heel and toe formation.

The pin-drum **55** may be of any known construction but is preferably constructed according to co-pending patent application No. 249,232 filed October 2, 1951 (to which reference is to be made for further particulars) and is capable of being racked in either direction. The transmitting levers **49** may also be arranged as described in that application. As far as the mechanism here described is concerned suffice it to say, that, when a pin such as **73**, Fig. 4 is racked between the projection **74** of the lever **49** and the surface of the pin-drum it will cause the lever to fulcrum on the corner **50** of the plate **53**, and thus the end located between the butts **47** and **48** of the selector blade **9** will retract the said blade to its inoperative position and so allow the butt **8** of the jack Fig. 1 to pass by.

We claim:

1. A circular knitting machine having a tricked instrument bed, instruments mounted in the tricks for sliding movements and rocking movements therein about an intermediate fulcrum and having at contrasting selecting levels on both sides of the fulcrum, selecting butts disposed in the required pattern arrangement, an operating cam for moving along its trick any instrument that it acts on, a depressing cam positioned to engage the instruments and to rock them in their tricks to control their engagement with the operating cam, and selecting cams, at the said levels, each movable into and out of operative position in which it acts on such selecting butts as may reach it at that level and thereby slides the associated instrument along its trick to control its engagement with the depressing cam.

2. A machine according to claim 1, wherein the said associated instrument is movable by the selecting cams out of range of the depressing cam.

3. A machine according to claim 1, incorporating a pin-drum for selecting the selecting cams.

4. A machine according to claim 1, having the instruments formed with a fulcrum substantially midway between their ends.

5. A machine according to claim 1, having the depressing cam arranged to operate on the same parts (e. g. the operating butts) of the instruments as does the operating cam.

6. A machine as claimed in claim 1 having axially-spaced complementary guards extending round the cylinder, one at each side of the fulcrum, for positively con-

trolling the angular attitude of each instrument in its trick throughout the entire range of rocking movements.

7. A circular knitting machine having a tricked instrument bed, instruments mounted in the tricks for sliding movements and rocking movements therein about an intermediate fulcrum and having at contrasting selecting levels on both sides of the fulcrum selecting butts disposed in the required pattern arrangement, an operating cam for moving along its trick any instrument that it acts on, a depressing cam positioned to engage the instruments and to rock them in their tricks to control their engagement with the operating cam, selecting cams at the said levels each movable into and out of operative position in which it acts on such selecting butts as may reach it at that level and thereby slides the associated instrument along its trick to control its engagement with the depressing cam, and the machine being arranged to knit by reciprocation as well as by rotation, and having an incline for depressing the instruments out of range of the operating cam in each reverse swing of reciprocatory knitting.

8. A machine as claimed in claim 7 having means for rendering the selecting cams inoperative during reciprocatory knitting.

9. A circular knitting machine having a tricked instrument bed, instruments mounted in the tricks for sliding movements and rocking movements therein about an intermediate fulcrum and having at contrasting selecting levels on both sides of the fulcrum selecting butts disposed in the required pattern arrangement, an operating cam for moving along its trick any instrument that it acts on, a depressing cam positioned to engage the instruments and to rock them in their tricks to control their engagement with the operating cam, selecting cams at the said levels each movable into and out of operative position in which it acts on such selecting butts as may reach it at that level and thereby slides the associated instrument along its trick to control its engagement with the depressing cam, and having each instrument provided in its trick with a secondary instrument or "bit" movable by that instrument, when moved by the operating cam, into range of an actuating cam which then imparts additional movement to the bit.

10. A machine as claimed in claim 9 having a third instrument movable by each bit and actuating cams into range of which the third instrument is thereby brought.

11. A machine as claimed in claim 10 being of the opposed needle cylinder type, wherein the third instruments are needle-controlling sliders and the actuating cams therefore are transfer cams for transferring needles from cylinder to cylinder.

12. A circular knitting machine having a tricked instrument bed, instruments mounted in the tricks for sliding movements and rocking movements therein about an intermediate fulcrum and having at contrasting selecting levels on both sides of the fulcrum selecting butts disposed in the required pattern arrangement, an operating cam for moving along its trick any instrument that it acts on, a depressing cam positioned to engage the instruments and to rock them in their tricks to control their engagement with the operating cam, selecting cams, at the said levels, each movable into and out of operative position in which it acts on such selecting butts as may reach it at that level and thereby slides the associated instruments along its trick to control its engagement with the depressing cam, a secondary instrument or bit provided for each instrument in its trick and movable by that instrument, when moved by the operating cam, into range of an actuating cam which then imparts additional movement to the bit, and wherein the instruments and the bits have three stages of movement, the stages for the instruments being from an inoperaive track to a depressing track by means of a levelling cam in which depressing track the instruments are disposed to be acted on by the depressing cam, from the depressing track to a ready track by the selecting cams in which ready track the instruments are disposed to be acted on by their operating cam, and from the ready track by the depressing cam, and the stages for the bits being from an inactive track to a selecting track by a bit-levelling cam, from the selecting track to a ready track by movement of the instruments by their operating cam, in which selecting track the bits are disposed to be acted on by the bit-actuating cam, and to a further level by the bit-actuating cam.

13. A machine as claimed in claim 12 wherein the selecting track for the bits is intersected by a movable part of the bit-actuating cam, said movable part being movable to an inoperative position.

14. A machine as claimed in claim 12 having return cam means acting on the bits after the bit-actuating cam to lift the bits to the inactive track and the instruments to their inoperative track.

15. A circular knitting machine having a tricked instrument bed, instruments mounted in the tricks for sliding movements and rocking movements therein about an intermediate fulcrum and having at contrasting selecting levels on both sides of the fulcrum selecting butts disposed in the required pattern arrangement, an operating cam for moving along its trick any instrument that it acts on, a depressing cam positioned to engage the instruments and to rock them in their tricks to control their engagement with the operating cam, selecting cams at the said levels each movable into and out of the operative position in which it acts on such selecting butts as may reach it at that level and thereby slides the associated instrument along its trick to control its engagement with the depressing cam, a secondary instrument or bit provided for each instrument in its trick and movable by that instrument, when moved by the operating cam, into range of an actuating cam which then imparts additional movement to the bit, and wherein the instruments and the bits have three stages of movement, the stages for the instruments being from an inoperative track to a depressing track by means of a levelling cam in which depressing track the instruments are disposed to be acted on by the depressing cam, from the depressing track to a ready track by the selecting cams in which ready track the instruments are disposed to be acted on by their operating cam, and from the ready track by the depressing cam, and the stages for the bits being from an inactive track to a selecting track by a bit-levelling cam, from the the selecting track to a ready track by movement of the instruments by their operating cam, in which selecting track the bits are disposed to be acted on by the bit-actuating cam, and to a further level by the bit-actuating cam, and wherein the selecting track for the bits is intersected by a movable part of the bit-actuating cam, said movable part being movable to an inoperative position, and having return cam means acting on the bits after the bit-actuating cam to lift the bits to the inactive track and the instruments to their inoperative track.

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