# United States Patent [19]

**Flavell et al.**

[11] **3,842,623**

[45] **Oct. 22, 1974**


[54] **KNITTING MACHINES**


[75] Inventors: **John Flavell,** Coventry; **Keith Jeffcoat,** Nuneaton; **Max William Betts,** Coventry, all of England

[73] Assignee: **Courtaulds Limited,** London, England



[22] Filed: **May 9, 1973**

[21] Appl. No.: **358,648**

[30] **Foreign Application Priority Data**

May 12, 1972 Great Britain ..... 22330/72

[52] **U.S. Cl.** ..... **66/64,** 66/147

[51] **Int. Cl.** ..... **D04b 7/04**

[58] **Field of Search** ..... 66/147, 64, 60



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 3,007,324 | 11/1961 | Bram | 66/64 |
| 3,049,900 | 8/1962 | Bram | 66/60 |
| 3,153,922 | 10/1964 | Bram | 66/64 |
| 3,685,317 | 8/1972 | Giachetti et al. | 66/64 |



*Primary Examiner*—Ronald Feldbaum

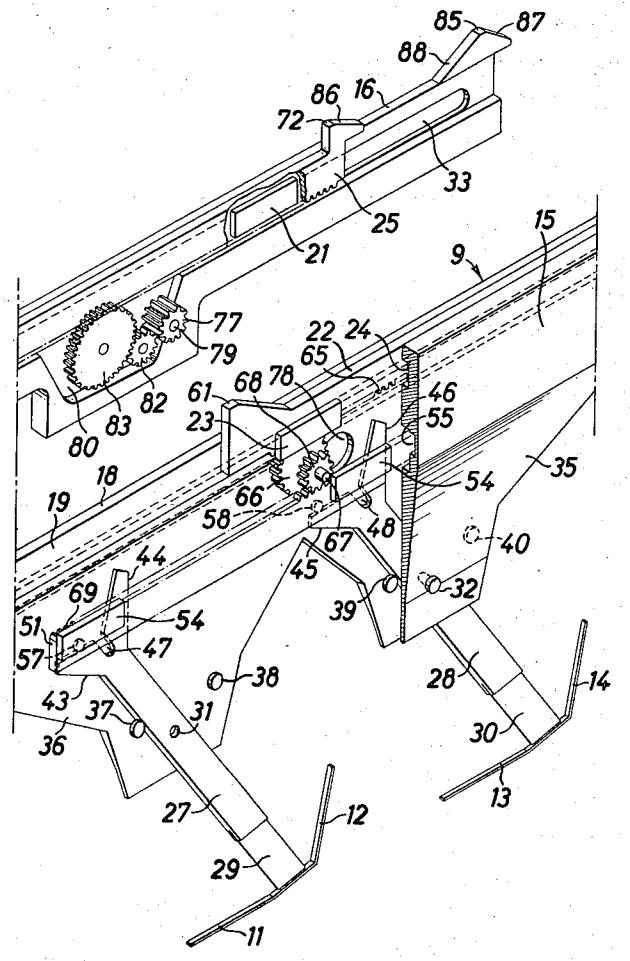
*Attorney, Agent, or Firm*—Davis, Hoxie, Faithfull, & Hapgood



[57] **ABSTRACT**

In a knitting machine in which sequential operation of needles takes place in successively opposite directions along at least one row of needles and there is at least one presser foot to press down loops held on the needles and arranged to move along the row of needles in synchronism with operation thereof, the improvement wherein changeover movement of the presser foot from a position appropriate for movement in one direction along the row of needles to a position appropriate for movement along the row in the opposite direction is carried out partly whilst the presser foot is completing its movement to the end of its movement along the row in one direction and partly whilst it is commencing its return movement.


**2 Claims, 4 Drawing Figures**



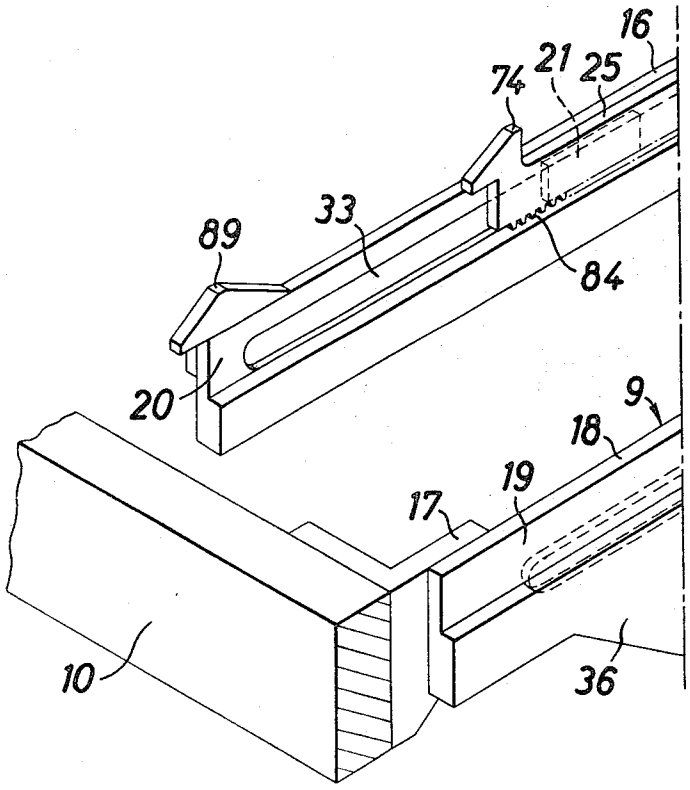



FIG. 1A.

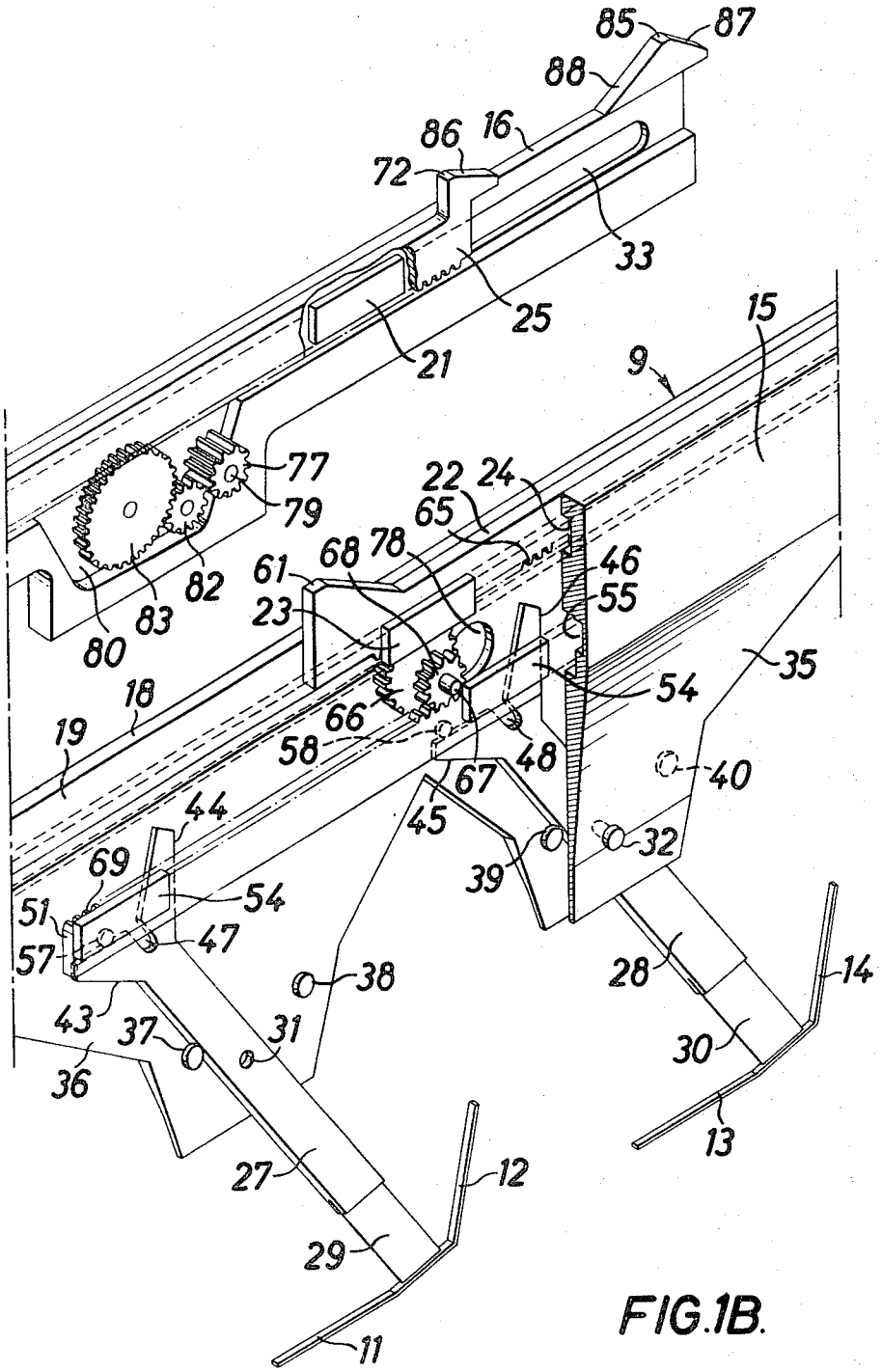

85
87
88
86
16
72
33
25
21
15
9
77
79
22
24
65
68
78
61
46
55
23
82
83
80
54
35
18
19
66
58
48
67
40
45
44
69
32
39
54
51
47
57
38
28
14
43
37
31
30
36
27
12
29
13
11

FIG.1B.

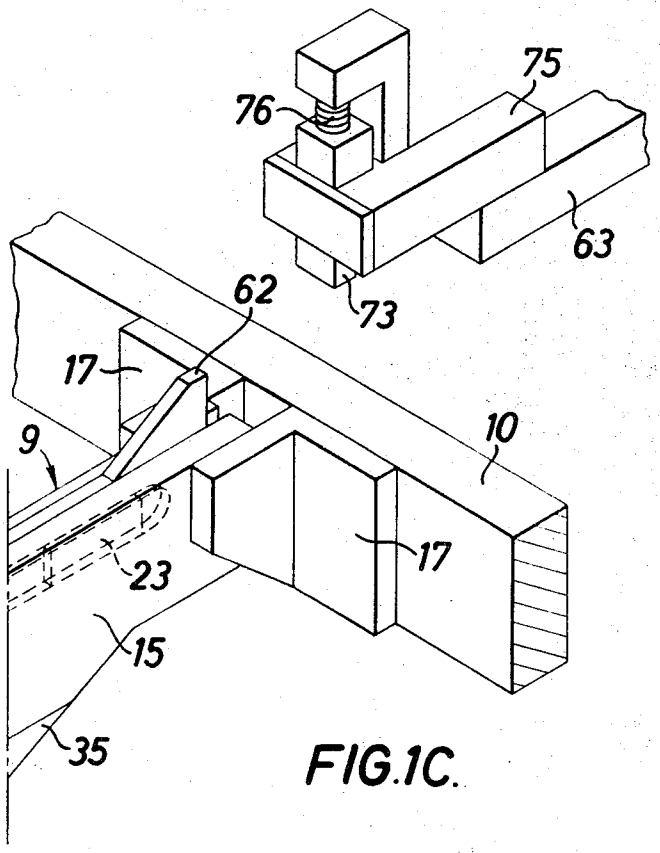



FIG.1C.

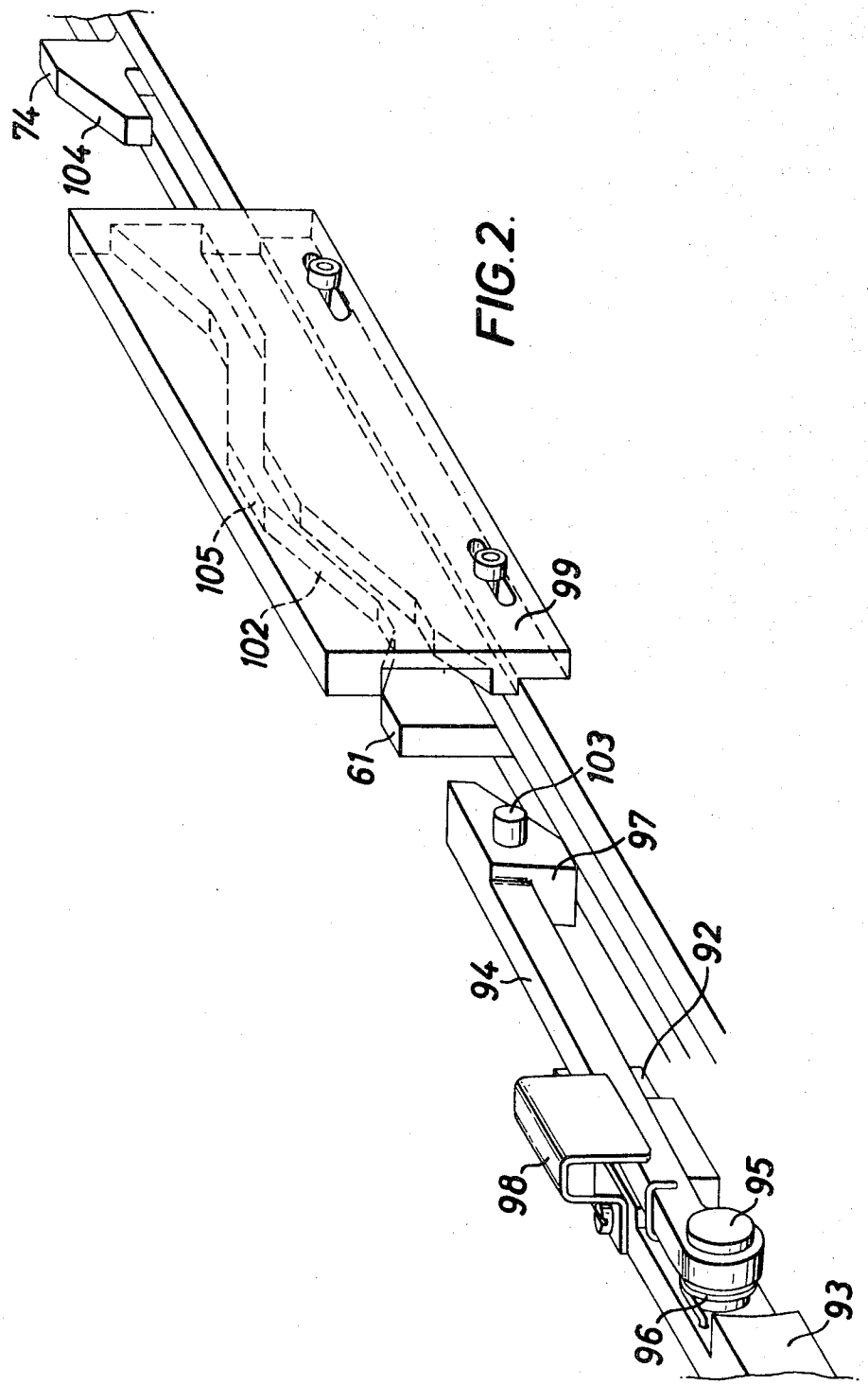



FIG. 2.

# KNITTING MACHINES

This invention relates to a knitting machine having independently operable needles in which sequential operation of needles takes place in successively opposite directions along at least one row of needles. The invention is concerned with such machines which include an element which is arranged to be moved along a row of needles in synchronism with the actuation of the needles and to press down on the knitted loops in such a way as to hold the loops firmly on the needle shanks as the needles rise and fall. The element, which will be referred to in this specification as a presser foot, can be arranged to serve in place of a conventional takedown mechanism. In a knitting machine having straight needle beds, and needles operated by cams mounted in cam boxes, and in which sequential operation of needles in successively opposite directions along the needle beds is achieved by reciprocation of the cam boxes along the needle beds, the presser foot is normally carried on a support mounted on the cam box carriage, but may be mounted on a centre rail on machines with no carriage bow. Usually, two presser feet are associated with each cam system, a different one of the presser feet being arranged to be operative for traverses of the cam box in different directions. A mechanism is incorporated in the machine to move the presser feet alternately into and out of the operative position.

It is, however, possible to have only one presser foot associated with each cam system and to change the position of this single presser foot at the end of each traverse of the cam boxes so that it can be operative in both directions of traverse.

A common method of achieving movement of presser feet between operative and non-operative positions has been by an overrunning movement of the presser feet support beyond the length of needle bed over which a presser foot is required to be operative. During overrunning movement of the support a mechanism is arranged to operate to change the positions of the two presser feet, or to move a single presser foot to a new position. The length of overrun required to effect this movement adds to the total distance over which the cam box must be moved to achieve a given width of knitting and thus reduces the number of traverses which can be completed in a given time.

If the speed at which the change-over movement is carried out is increased in order to reduce the length of overrun required to carry out the movement, difficulties can arise because of the increased accelerations involved and, in the case of pivotally mounted feet, the increased centripetal forces arising.

This invention seeks to reduce the length of overrun required to carry out change-over of a presser foot by an arrangement not requiring an increased speed of change-over movement. If the length of overrun is reduced, the possible width of knitting which can be achieved on a given machine is increased and, on a machine on which the length of the cam box traverse can be reduced, the number of cam box traverses which can be carried out in a given time can be increased.

According to this invention, in a knitting machine in which sequential operation of needles takes place in successively opposite directions along at least one row of needles, part of the change-over movement of a presser foot is effected during overrunning movement of a support therefor beyond a point where the presser foot is required to be operative and part during return movement of the support over the overrun distance.



The change-over movement of the presser foot may be effected by sliders movable on the said support by stops and catches fixed on the knitting machine and co-operating with abutments on the sliders at the end of each traverse of the support along the needle beds.

The invention will be further described, by way of example, with reference to the accompanying drawings in which

FIGS. 1A, 1B and 1C are exploded isometric views, partly sectioned and with some parts cut away, of the lefthand portion, the central portion and the right-hand portion, respectively, of a presser feet support for a flat V-bed knitting machine according to the invention, the three Figures together showing the entire presser feet support,

FIG. 2 is an isometric view illustrating an alternative arrangement for a catch in a presser feet support similar to that of FIGS. 1A–1C.

The presser feet support **9** shown in FIGS. 1A–1C is adapted for mounting above the cam boxes of a V-flat knitting machine, for example on cross-members **10** extending between and secured to the cam boxes (not shown). The support thus reciprocates along the needle beds of the machine together with the cam boxes carrying presser feet **11, 12, 13** and **14** with it. The presser feet are arranged in two pairs **11, 12** and **13, 14,** each pair being arranged for cooperation with a separate cam system. The arrangement is therefore suitable for a double system V-flat machine.

The support comprises two plates **15** and **18** secured to the cross-members **10** by brackets **17** (one of which is not shown). An additional plate **16** is secured by screws and dowels (not shown) to the plate **18.** The plate **18** is recessed and in the channel **19** thus formed between the plates **15** and **18** is located a slider **22** to one side of which are fixed shoes **23** engaged in a guideway **24** constituted by a recess in the plate **15.** The plate **16** is also recessed and in the channel **20** thus formed between the plates **16** and **18** is located a slider **25,** having shoes **21** fixed to it and which are engaged in a guideway **33** constituted by a recess in the plate **16** extending, as does the guideway **24,** longitudinally of the support. As will be explained below, the sliders **22** and **25** carry abutments which cooperate with fixed stops and catches on the machine so that the movement of the support relative to the stops and catches in the end regions of the reciprocating movement of the cam boxes causes movement of the sliders on the support. A gear train, as will also be explained below, translates this movement into movement of the presser feet.

The presser feet are carried in pairs **11, 12** and **13, 14** on rigid arms **27** and **28** having extensions **29** and **30,** respectively, which are constituted by flexible strips of beryllium-copper alloy. The arms **27** and **28** are pivoted at **31** and **32,** respectively, between depending portions **35** and **36** of the plates **15** and **18.** Studs **37, 38, 39** and **40** are secured to and extend between the portions **35** and **36** and serve as stops limiting the pivoting movement of the arms **27** and **28.** At their upper ends the arms **27** and **28** are bifurcated to form V-shaped portions having side parts **43, 44** and **45, 46,** respectively. A slot **47** or **48** extends from the apex of each V-shaped portion in the direction longitudinally of the associated arm.

The arms 27 and 28 are shown in FIG. 1B in positions which put the presser feet 11 and 13 in the operative positions for movement of the support 9 in the direction from left to right along the needle beds (not shown) in FIGS. 1A–1C. Movement of the arms 27 and 28 between the positions shown in FIG. 1B and the positions in which the presser feet 12 and 14 are operative is achieved by means of a further slider 51. The slider 51 is mounted between the plate 15 and the plate 18 for sliding movement longitudinally of the support 9. It is guided by shoes 54 secured to the slider and engaged in a guideway 55 formed in the plate 15.

Projecting from the side of the slider 51 remote from the observer, in FIG. 1B, and at the lower edge of the slider, are two pins 57 and 58 which cooperate with the upper V-shaped ends of the arms 27 and 28. The pin 57 is located further to the right in FIG. 1B in relation to its associated arm 27 then the pin 58 in relation to its associated arm 28. The changeover movement of the arms caused by the pins 57 and 58, as will be described below, is thus staggered so that the arm 27 pivots in advance of the arm 28 from the position shown in FIG. 1B, thus avoiding clashing of the presser feet 12 and 13. When a changeover is made to bring the presser feet 12 and 14 out of the operative positions to the positions shown in FIG. 1B, the arm 28 moves in advance of the arm 27. When the slider 51 is in the position shown in FIG. 1B, the arm 27 is held, in the attitude shown, by the pin 57 which presses the part 43 downwardly, holding the arm 27 securely against the stud 37. Similarly, the arm 28 is held by the pin 58 securely against the stud 39. If the slider 51 is moved to the right in FIGS. 1A–1C relative to the support 9, the pins 57 and 58 move along the parts 43 and 45 and impinge on the parts 44 and 46, at this stage upwardly inclined. Further movement to the right by the slider 51 causes the pins 57 and 58 to begin pushing the parts 44 and 46 in a clockwise arc about the pivot points 31 and 32, respectively, the slots 47 and 49 accommodating the pins during the first part of this movement. At the end of the rightward movement of the slider 51 relative to the support 9, the parts 44 and 46 having been pushed to the horizontal position are held there securely between the pins 57 and 58 and the studs 38 and 40. The presser feet 12 and 14 are then in the operative positions ready for leftwards movement along the needle beds.

At the leftwards end of the traverse of the support 9, movement of the slider 51 to the left relative to the support 9 causes the pins 57 and 58 to impinge on the now upwardly inclined parts 43 and 45 and the arms 27 and 28 are thereby pivoted in the anticlockwise direction in FIG. 1B until each arm is trapped once more between one of the pins 57, 58 and one of the studs 37, 39, respectively.

Movement of the slider 51 relative to the support 9 is achieved as follows:

The slider 22 has an upwardly-projecting abutment 61 or 62 at each end, and at each end of the needle beds of the knitting machine a stop secured to the frame of the machine (not shown) is provided for cooperation with one of the abutments 61 or 62. In FIG. 1C, a stop 63 for cooperation with the abutment 62 is shown. When the support 9 is carried along the needle beds to the right in FIGS. 1A–1C, with the slider 22 in the position shown, the abutment 62 will come into contact with the stop 63 as the support nears the end of its traverse and further movement of the support 9 to the right will cause the slider 22 to be pushed to the left on the support. This movement is transmitted to the slider 51 by a gear train now to be described.

The lower edge of the slider 22 is formed as a rack 65 which is in mesh with a pinion 66 fixedly carried on an axle 67 journalled in the plate 15 and the plate 18. Fixedly, mounted on the axle 67 with the pinion 66 is a smaller pinion 68 which is in mesh with a rack 69 formed on the upper edge of the slider 51. Thus, when the slider 22 is moved to the left in FIGS. 1A–1C, this motion causes the pinions 66 and 68 to rotate in an anti-clockwise direction thereby moving the slider 51 to the right in FIG. 1B. The position of the stop 63 in relation to the movement of the support 9, the slider 22 and its abutment 62 is so arranged that the movement of the slider 22 caused by contact of the abutment 62 with the stop 63 at the end of the rightwards movement of the support 9 is of sufficient extent to move the slider 51 far enough to rotate the arms 27 and 28 to approximately vertical positions (one is a little further advanced than the other). That is, the movement of the slider 22 caused by the stop 63 brings about movement of the presser feet through half of their change-over movement. The remaining half of this changeover movement is brought about by interaction of an abutment 72 on the slider 25 with a catch 73. An abutment 74 on the slider 25 is arranged for cooperation with a catch (not shown) similar to the catch 73 but located at the opposite end of the needle beds. The catch 73 is mounted for vertical movement on a bracket 75 fixed to the frame of the knitting machine and is urged downwardly by a spring 76 secured to the bracket and the catch. When the support 9 is nearing the end of its rightwards traverse, in FIGS. 1A–1C and the presser feet have passed a point at which they are required to be operative and act on the knitting, the abutment 62 on the slider 22 first contacts the stop 63, as described above, and the slider 22 is thus pushed to the left on the support as the support overruns by continuing its rightwardly movement. The slider 22 is connected with the slider 25 by a pinion 77 located in a hole 78 in the plate 18 and in mesh with the pinion 66. The pinion 77 is fixedly carried on a shaft 79 journalled in the plates 15 and 16, and the pinion 77 extends through the plate 18 and is in mesh with a pinion 82 located in a recess 80 in the plate 16. The pinion 82 is in mesh with a pinion 83 also located in the recess 80 and having the same number of teeth as the pinion 66. The pinion 83 is in mesh with a rack 84 formed on the underside of the slider 25 and the gear ratios in the gear train between the slider 22 and the slider 25 are such that movement of either of the sliders in a given direction on the support 9 results in an equal movement of the other slider in the opposite direction on the support. Thus, when the slider 22 is pushed to the left on the support 9 by contact of the abutment 62 on the slider with the stop 63, the slider 25 moves simultaneously to the right on the support. A bluffing cam 85 fixed on the support 9 moves beneath the catch 73 as the support moves to the right beneath the catch in FIG. 1C, the catch riding up over the bluffing cam during this movement. The inclined surface 86 of the abutment 72 on the slider 25 next meets the catch 73 and pushes it up and the abutment 72 moves on past the catch. When the support 9 begins its leftwards movement in FIGS. 1A–1C, the abutment 72 is held by the catch 73 so that the slider

25 remains stationary whilst the support 9 moves to the left and re-traverses the overrun distance to the point at which the presser feet are required to operate as mentioned above. In effect, therefore, the slider 25 moves to the right on the support causing leftwards movement of the slider 22 on the support through the action of the train of pinions 83, 82, 77 and 66, the pinion 66 rotating anti-clockwise. The continued anticlockwise rotation of the pinion 66 is accompanied by anticlockwise rotation of the pinion 68 fixedly carried on the same shaft 67, and this rotation of the pinion 68 causes the rightwards movement of the slider 51 on the support 9 to continue, thus completing the changeover movement of the arms 27 and 28 and the presser feet.

The abutment 72 remains trapped by the catch 73 until the bluffing cam 85 is brought back by the leftwards movement of the support 9 to a position beneath the catch. The catch is then pushed upwards by the bluffing cam 85 and the abutment 72 is released allowing the slider 25 to move to the left with the support 9. The cam 85 has two inclined faces 87 and 88 enabling it to lift the catch 73 when moving in either direction relative to the catch 73. A further bluffing cam 89 similar to the cam 85 is provided on the support 9 to release the abutment 74 from the further catch (not shown) corresponding to the catch 73 but located at the opposite end of the needle beds.

The bluffing cam 85 and the abutment 72 are so positioned that the movement of the slider 25 on the support 9 caused by engagement of the catch 73 with the abutment 72 is sufficient to move the slider 22 to the limit of its leftwards movement on the support and to complete the changeover of the presser feet so that presser feet 12 and 14 are located in their operative positions for the leftwards traverse of the support 9 along the needle beds. At the same time, the sliders 22 and 25 are located in the required positions for cooperation with the stop and catch (not shown) corresponding to stop 63 and catch 73 but located at the opposite end of the needle beds for effecting movements of the sliders and changeover movement of the presser feet at the end of the leftwards traverse of the support 9 in FIGS. 1A–1C.

FIG. 2 illustrates an alternative arrangement for a catch to cooperate with the abutment 74 on the slider 25 (not shown in FIG. 2). The abutment 61 on the slider 22 (not shown in FIG. 2) cooperates, at the left-hand end of the needle beds, with a stop 92 which acts in the same way as the stop 63 on the abutment 62 at the right-hand end of the needle beds in the case of the embodiment shown in FIGS. 1A–1C.

Mounted on a bracket 93 fixed to the frame (not shown) of the knitting machine is a catch bar 94 which can pivot about a pin 95. The bar 94 is urged downwardly by a spring 96 wrapped round the pin 95 and having one end located in a hole in the bracket 93 and the other end hooked over the bar 94. At the free end of the bar 94 is formed a catch 97. A guard 98 fixed on the bracket 93 limits upward movement of the bar 94.

A cam plate 99 is secured on the plate 15 and is formed with a cam track 102. A pin 103 projects from the catch 97 for cooperation with the cam track 102.

The operation of the arrangement shown in FIG. 2 is as follows: When the presser feet support approaches the left-hand limit of its movement, the pin 103 enters the cam track 102. The abutment 61 by-passes the catch 97 and comes up against the stop 92. Further movement of the support causes movement of the sliders 22 and 25 as described in relation to FIGS. 1A–1C. The catch 97 after riding up the chamfer 104 on the abutment 74 engages over the abutment and when the support begins its movement to the right retains the abutment 74 and the slider 25 in the same way as the catch 73 retains the abutment 72 in FIGS. 1A–1C thereby causing similar movements of the sliders 25 and 21 on the support.

When the support has moved sufficiently far to the right to bring the pin 103 to the high part 105 of the cam track 102, the catch 97 is raised above the level of the abutment 74 thus allowing this abutment and the slider 22 to move to the right with the presser feet support.

A similar arrangement would, of course, be provided at the right-hand end of the needle beds.

What is claimed is:

1. In a knitting machine in which sequential operation of needles takes place in successively opposite directions along at least one row of needles, said machine having at least one presser foot, arranged to be moved along said row of needles in synchronism with the actuation thereof and also arranged to be changed at the end of each movement along the row of needles in one direction from its original position to a position appropriate for its movement in the opposite direction, said machine comprising:

a. a support to carry said presser foot, b. means for moving said support to and fro along said row of needles to carry said presser foot in said directions along said row, the travel of said support in each direction being such as to cause said presser foot to overrun the point at which the presser foot is required to be operative, and

c. means mounting said presser foot on said support for changeover movement between a position it occupies for movement along said row of needles in one direction and a position it occupies for movement along said row of needles in opposite direction, the improvement comprising means for causing said changeover movement of said presser foot arranged to effect part of said changeover movement during overrunning movement of said support along said row of needles beyond a point at which the presser foot must be operative, and to effect part of said movement during return movement of the support over the overrun distance.

2. A knitting machine as claimed in claim 1, said machine further comprising sliders movable on said support, mechanism interconnecting said sliders and said presser foot to effect changeover movement of said presser foot, abutments on said sliders, and stops and catches fixed on said knitting machine for cooperation with said abutments at the ends of movements of the supprt along said row of needles to move said sliders on said support.

* * * * *