June 24, 1969 B. A. MONK 3,451,230

FLAT TWIN BED KNITTING MACHINES

Filed March 6, 1967 Sheet 1 of 10

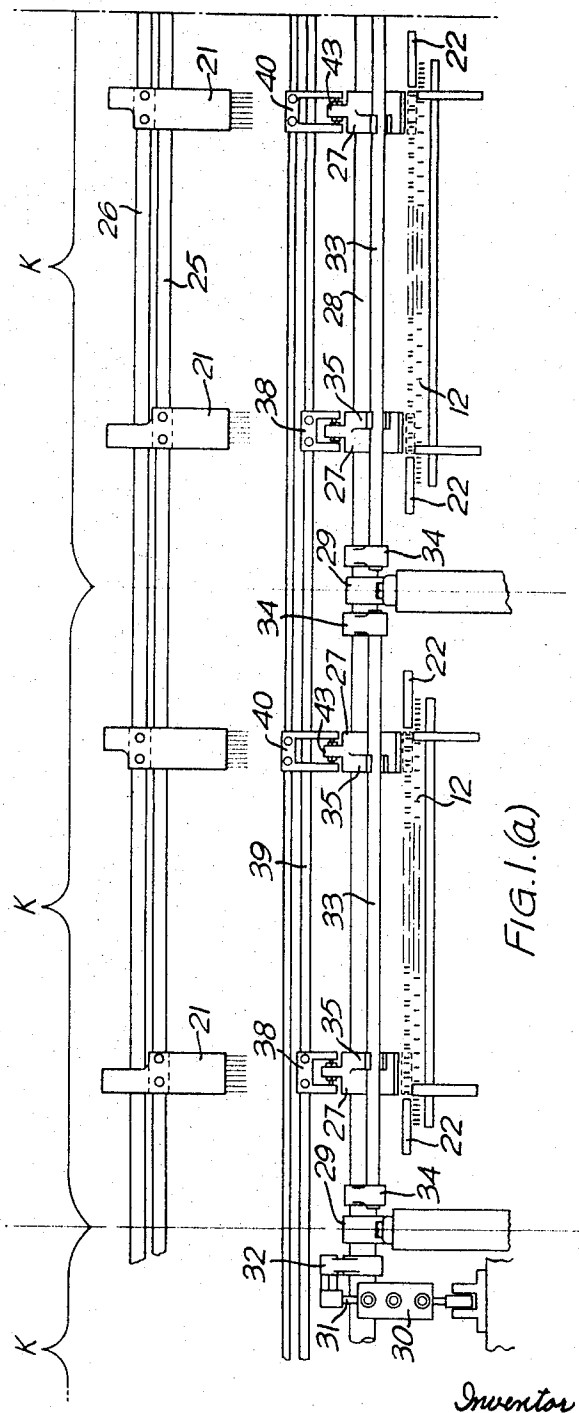


FIG. 1. (a)

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FLAT TWIN BED KNITTING MACHINES

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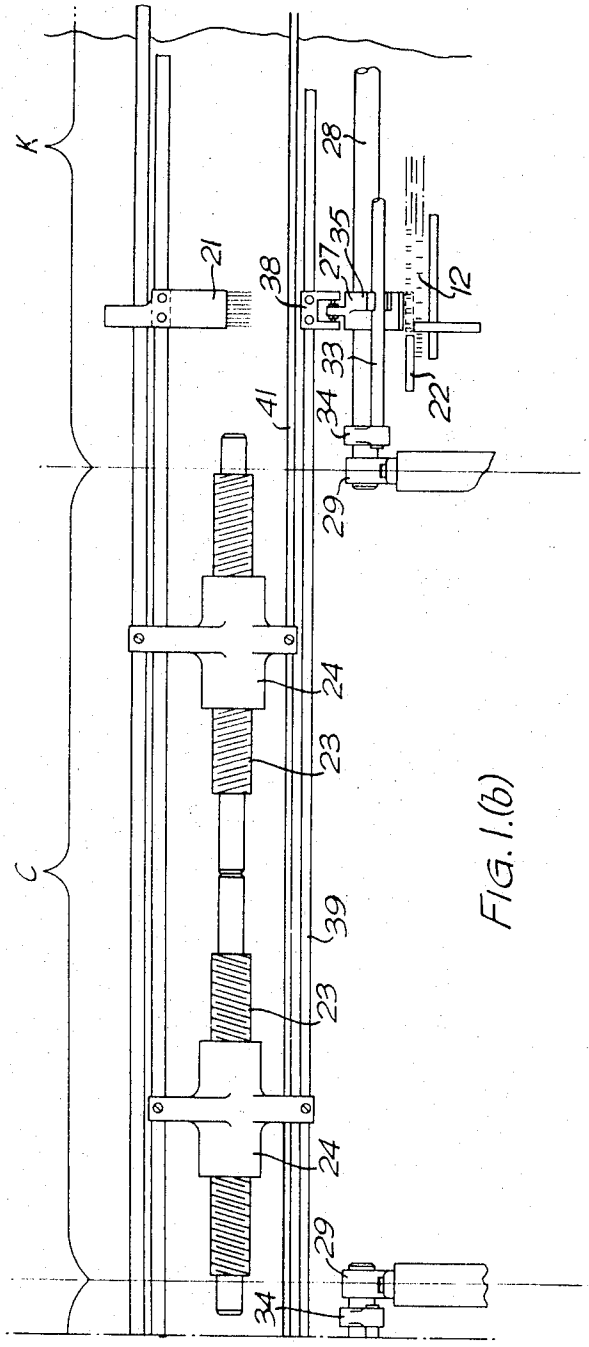


FIG. 1.(b)

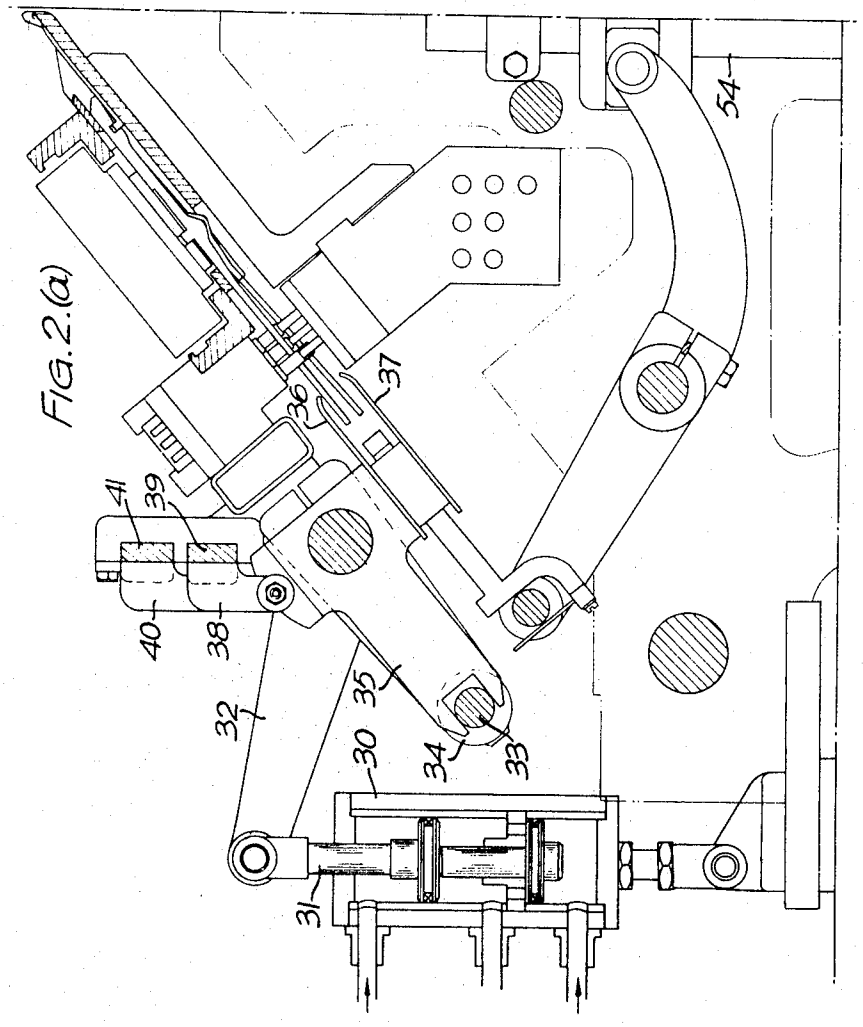
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FLAT TWIN BED KNITTING MACHINES

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FIG. 2.(a)



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FLAT TWIN BED KNITTING MACHINES

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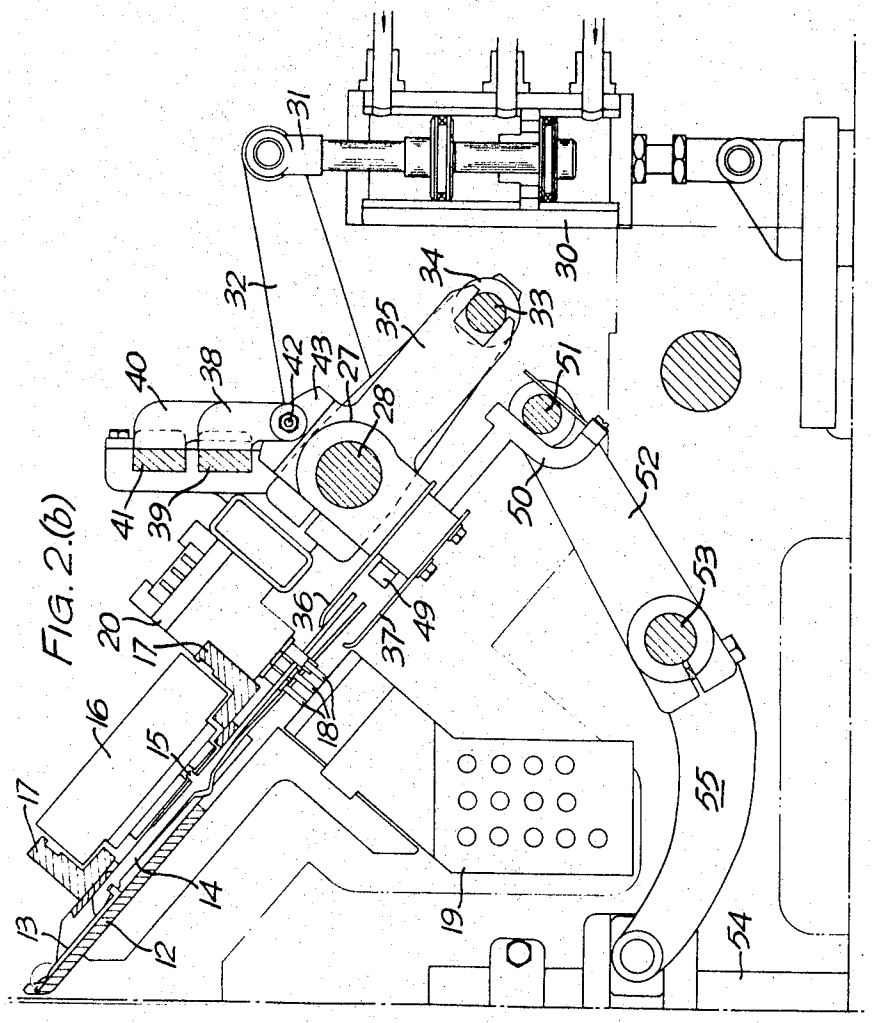


FIG. 2.(b)

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FLAT TWIN BED KNITTING MACHINES

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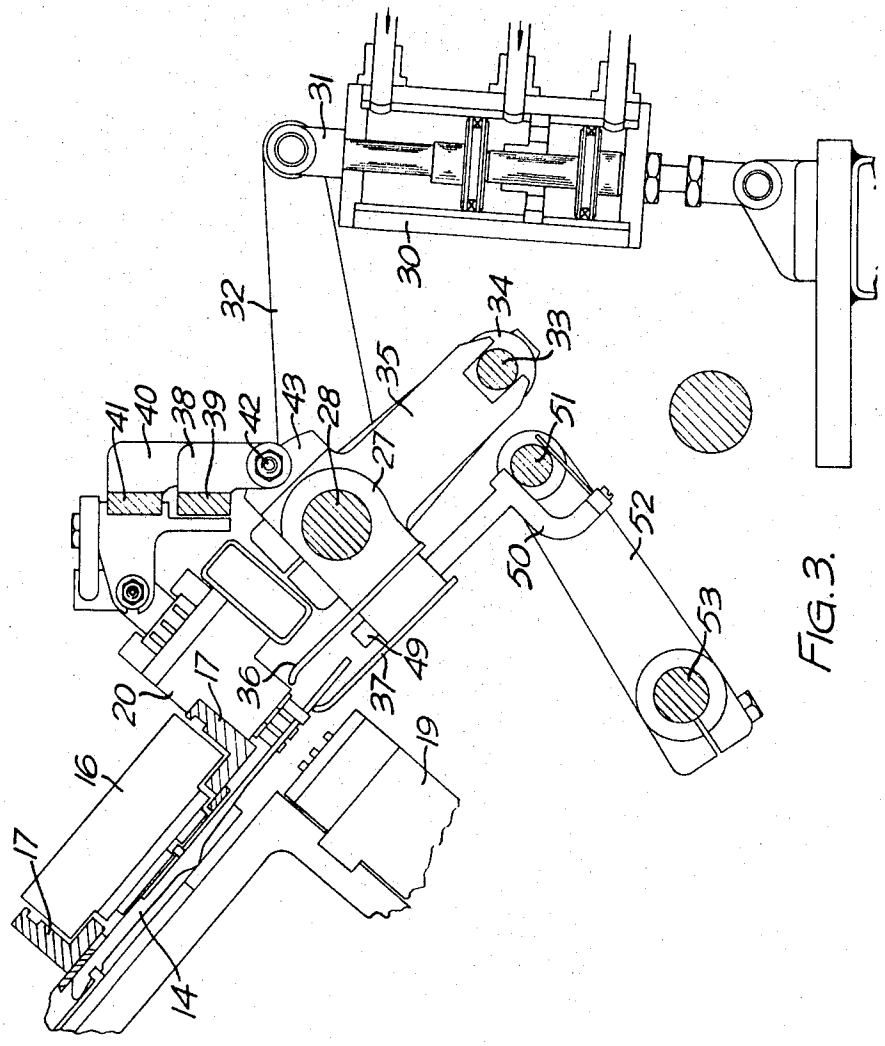


FIG. 3.

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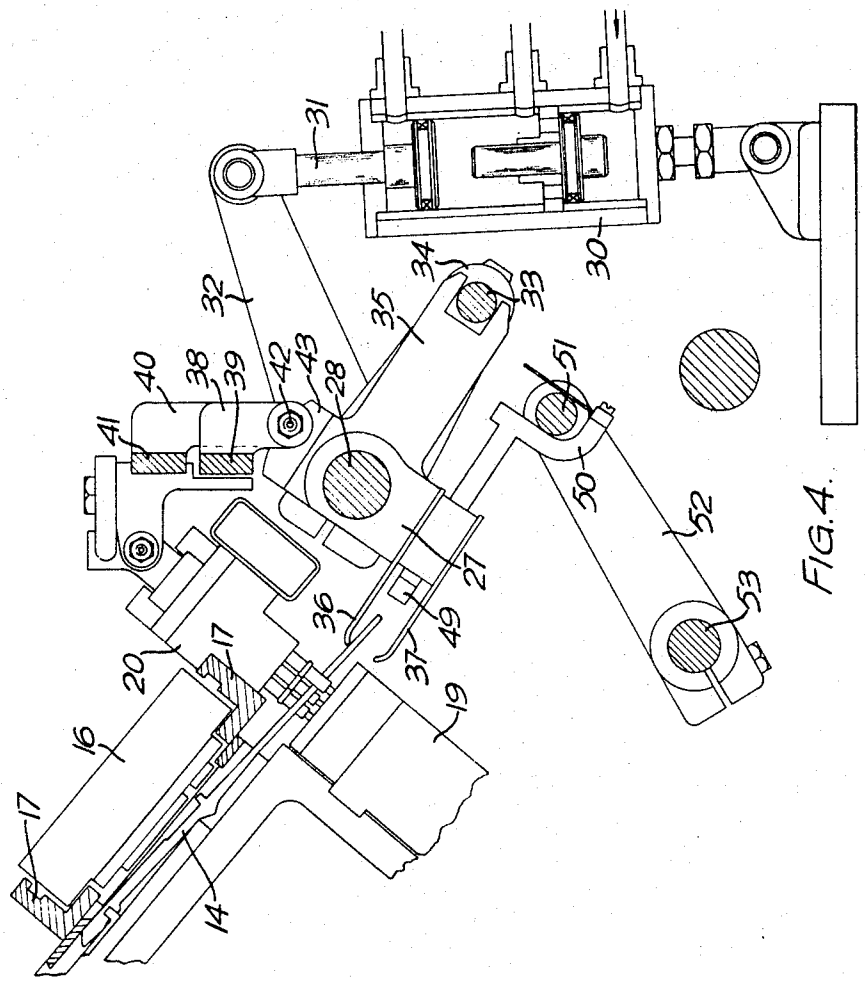


FIG. 4.

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FLAT TWIN BED KNITTING MACHINES

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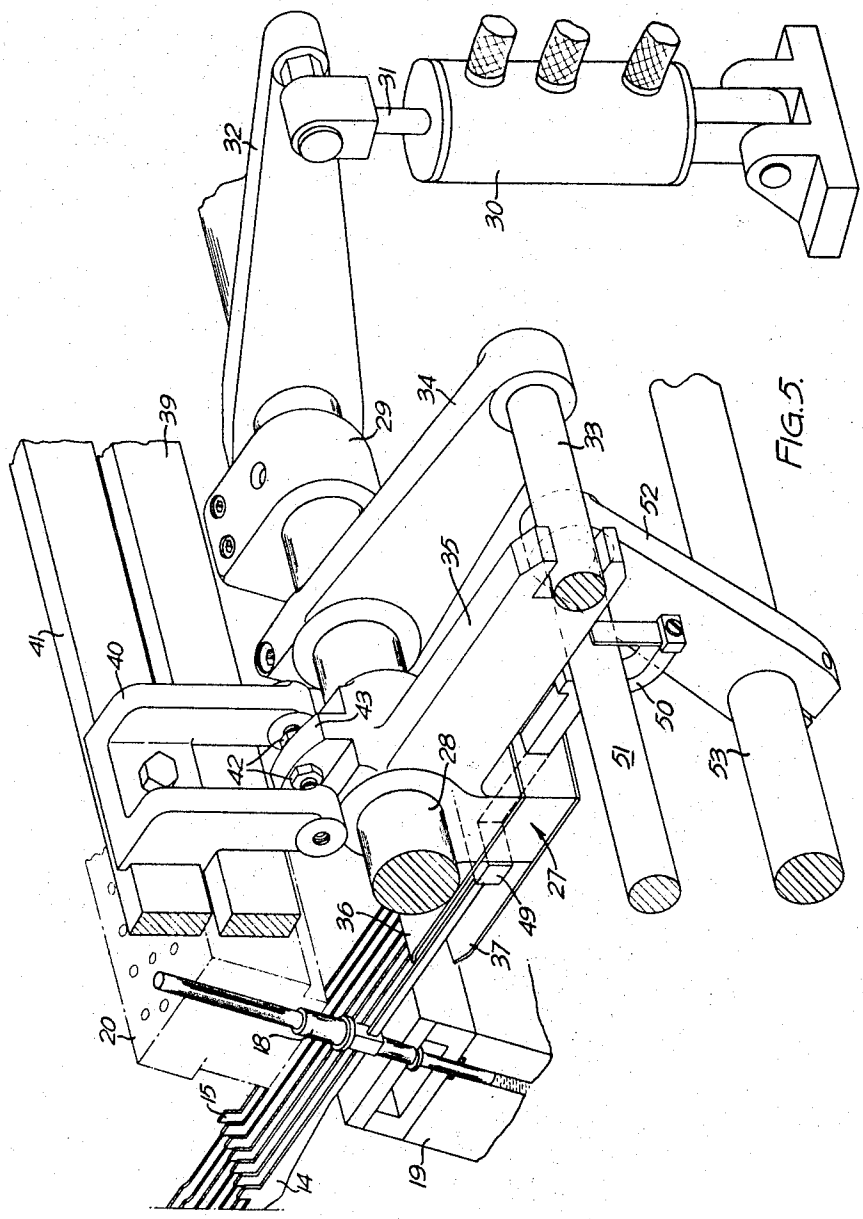


FIG. 5.

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FIG. 6.

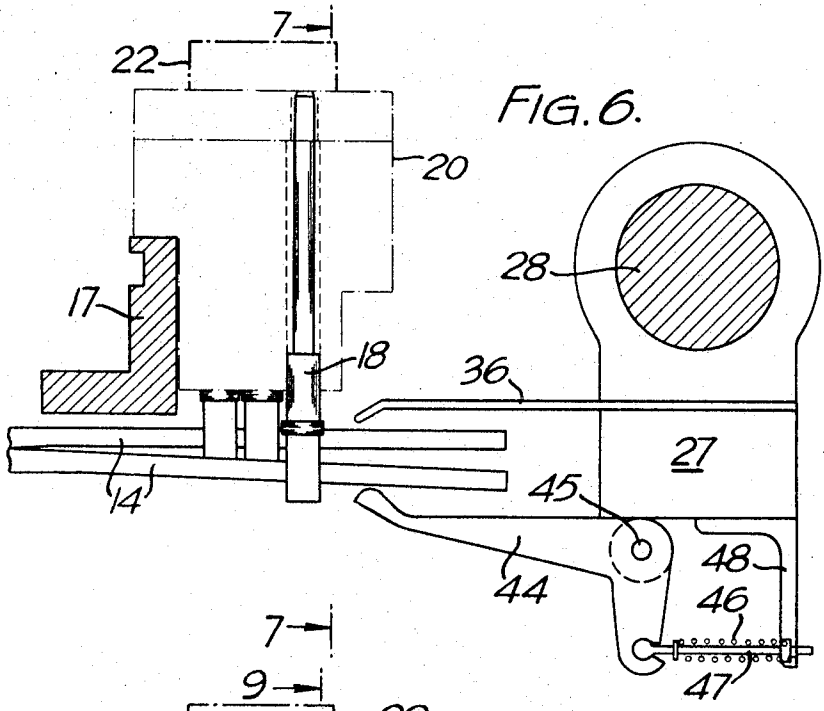
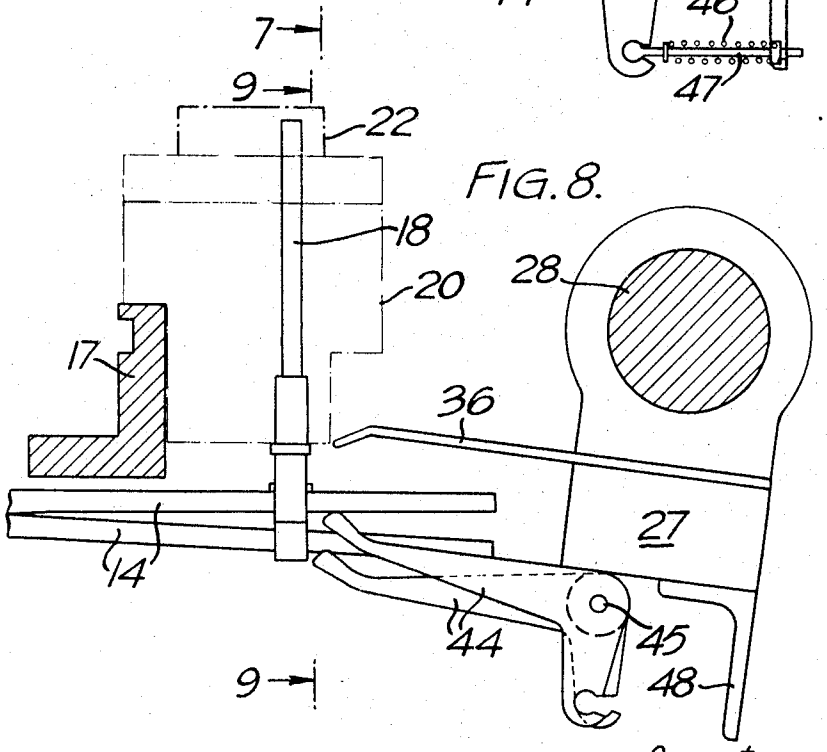


FIG. 8.



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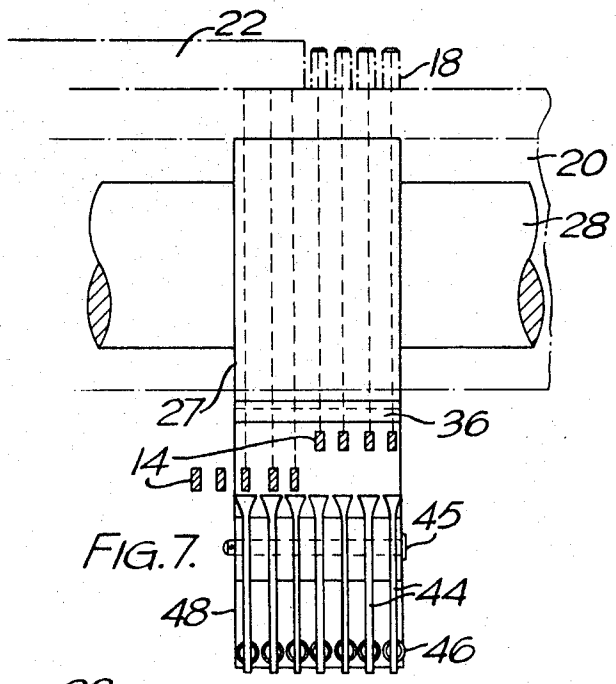


FIG. 7.

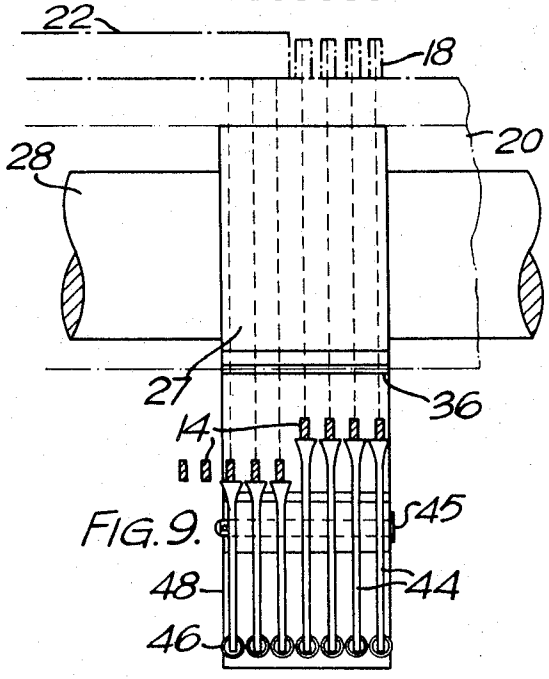


FIG. 9.

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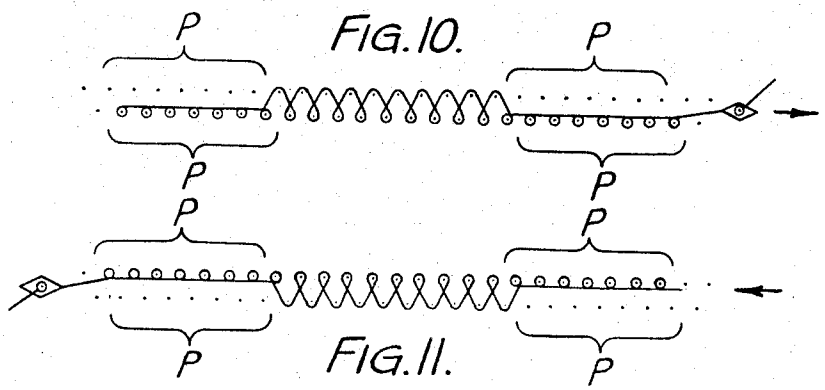


FIG. 10.

FIG. 11.

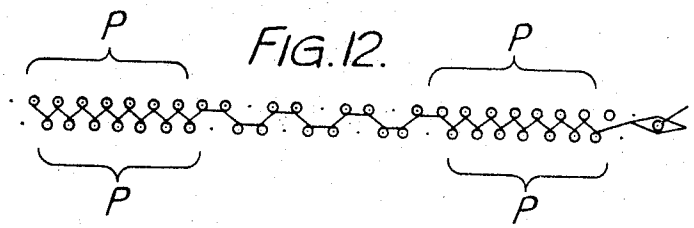


FIG. 12.

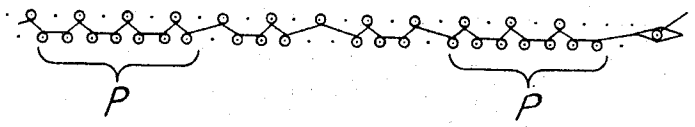


FIG. 13.

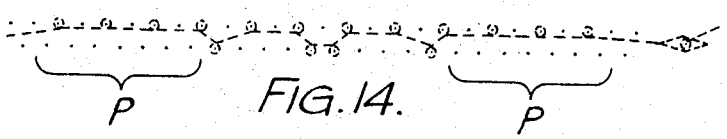


FIG. 14.

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United States Patent Office 3,451,230
Patented June 24, 1969

3,451,230

FLAT TWIN BED KNITTING MACHINES

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Filed Mar. 6, 1967, Ser. No. 620,720
Claims priority, application Great Britain, Mar. 15, 1966, 11,276/66
Int. Cl. D04b 7/04, 15/70
U.S. Cl. 66—64 11 Claims

ABSTRACT OF THE DISCLOSURE

A flat bed knitting machine having needle selection means for patterning purposes, wherein a secondary needle selection mechanism is provided to override the main selection means to produce a plain border on a patterned garment piece, the mechanism comprising longitudinally and angularly adjustable blade elements which co-act with the needle actuating means.

This invention relates to flat twin bed knitting machines of the type comprising, in respect of each needle bed, a series of needles slidable in tricks in the needle bed, a series, corresponding in number to the needles, of needle arms associated with the needles, needle selection means operatively associated with the needle arms, and a cam box arranged to traverse the needle bed to engage butts formed on the needle arms thereby actuating needles preselected by the selection means.

It is among the objects of the present invention to provide, in a knitting machine of the type described, secondary needle selection means which are operable to override the main needle selection means in such manner as to produce an unpatterned border adjacent the selvedges of patterned garment pieces.

By "patterned garment pieces" is meant any knitted fabric, whether single or multi-coloured, which incorporates tucked or missed loops, or any knitted fabric, such as a 2 x 2 or other broad ribbed fabric, which is produced by leaving certain pre-selected needles permanently out of action. By "unpatterned border" is meant:

(1) The edge or edges of the piece of patterned fabric which regardless of the pattern produced in said fabric using needle selection to give diversity of loop formation will be in the form of 1 x 1 loop structure, or

(2) The edge or edges of a piece of patterned fabric made up of coloured yarns which, regardless of the pattern knitted into the fabric, will be in the form of a 1 x 1 border or tubular border of the same colour as the main basic colour of the fabric piece, or

(3) The edge or edges of a piece of patterned fabric made by needle selection, or cam selection, or coloured yarn or any of these collectively, which regardless of the use put to all or any of these patterning means, will be provided, as a plain unpatterned strip or strips.

According to the present invention, in a flat twin bed knitting machine of the type described, there is provided a secondary needle selector mechanism adapted to produce unpatterned borders adjacent the selvedges of patterned garment pieces, said mechanism comprising a pair of needle selector blades extending transversely of the needle bed and supported in such manner that they are adjustable lengthwise of the needle bed, said blades being arranged in operative association with a preselected number of needle arms adjacent the selvedge of the garment piece to be knitted and being angularly movable relative to the needle bed to move the said selected needle arms into or out of an operative position so that

the corresponding needles are caused to knit or to be placed in an inoperative position.

The mechanism of the present invention is particularly advantageous when applied to a fully fashioned knitting machine, where it would be coupled for lengthwise movement to the fashioning mechanisms, although it will be appreciated that it is not limited in this respect.

The invention is illustrated by way of example in the accompanying drawings, in which,

FIGURES 1(*a*) and 1(*b*) combined define a schematic elevation showing in part only the details of a multi-head flat twin bed fully fashioned knitting machine necessary for a clear understanding of the present invention,

FIGURES 2(*a*) and 2(*b*) combined define a cross-section through a flat twin bed knitting machine incorporating the invention and showing only those known details of the machine necessary for a clear understanding of the invention,

FIGURES 3 and 4 are sections corresponding to FIGURE 2(*b*),

FIGURE 5 is a perspective view of that portion of the machine shown in FIGURES 3 and 4,

FIGURES 6 and 7 are respectively a cross-section and a section on the line 7—7 of FIGURE 6 of a modification of the mechanism of the invention shown in one position of operation,

FIGURES 8 and 9 are respectively a cross-section and a section on the line 9—9 of FIGURE 8 corresponding to FIGURES 6 and 7 but shown in another position of operation,

FIGURES 10 and 11 show the mode of operation for knitting a garment piece incorporating tucked or missed loops, the two figures showing alternate courses of knitting.

FIGURE 12 shows the mode of operation for knitting a 2 x 2 ribbed fabric garment piece where each course is the same, and

FIGURES 13 and 14 show the mode of operation for knitting a simple patterned garment piece, the two figures showing alternate courses of knitting.

Referring to the drawings and particularly to FIGURES 1(*a*) and 1(*b*) and FIGURES 2(*a*) and 2(*b*), there is shown a multi-head knitting machine having a central control division C and a plurality of knitting divisions K. Each knitting division K comprises a needle bed **12** formed with tricks to receive a series of needles **13** which are operatively coupled to a correspondingly numbered series of needle arms **14**.

The needle arms **14** are formed at a position intermediate of their lengths with butts **15** which co-operate with the cams of a cam box **16** which is arranged to be reciprocated in guides **17** lengthwise over the needle bed to effect operation of the needles **13**. The tails or free ends of the needle arms **14** are arranged to co-operate with the plungers or pistons **18** of a hydraulically operated needle selection mechanism (hereinafter referred to as the main needle selector means) having a piston block **19** and a manifold **20** in which the plungers or pistons **18** operate. The main needle selection means, which control the selection of needles to knit a predetermined pattern or the like, are preferably constructed in accordance with that described in our prior British patent specification No. 1,029,871 although it will of course be appreciated that other means, such as those described in our prior British specification No. 958,074 may be utilized.

Each knitting division K is further provided, at positions adjacent the selvedge needles, with L.H. and R.H. fashioning or narrowing points **21** which are adapted to be moved towards and away from each other in unison with L.H. and R.H. knitting width control plates indi-

cated at 22. Movement of the fashioning points is effected by L.H. and R.H. fashioning screws 23 arranged in the control division C of the machine, which screws have mounted thereon for movement lengthwise thereof nut housings 24. The L.H. fashioning points 21 of each knitting division K are coupled by a control rod 25 to the nut housing of the L.H. fashioning screw, and the R.H. fashioning points 21 of each knitting division K are coupled by a control rod 26 to the nut housing of the R.H. fashioning screw. Movement of the knitting width control bars 22 is effected in a similar manner.

The above description covers known features of a multi-head flat twin bed knitting machine in respect of the needle beds and associated parts on one side (front) of the machine, it being understood that the needle beds and associated parts on the other side (rear) of the machine correspond thereto.

In accordance with the present invention a secondary needle selection mechanism is provided in respect of each needle bed (front and rear) of the machine.

Each secondary needle selection mechanism comprises, at a position adjacent the free ends of the needle arms 14 of the selvedge needles, and a predetermined number of needles 12 adjacent the selvedge needles, housings 27 which are mounted for angular movement on an actuator shaft 28 mounted in bearings 29 to extend lengthwise of a plurality of needle beds. The shaft 28 is fixed in an endwise direction but is capable of being angularly turned about its longitudinal axis to effect angular movement of the housings 27. Angular movement of the shaft 28 is effected by means of a hydraulically or pneumatically operated ram 30 the piston rod 31 of which is connected to the shaft by means of a lever arm 32. Alternatively, the ram 30 may be replaced by a mechanical linkage system. The ram or the mechanical linkage may be operated under the control of the main control mechanism of the machine which may be in the form of a Jacquard card or punched tape.

Angular movement of the shaft 28 is transmitted to the housings 27 by means of an actuator rod 33 which extends the length of the needle bed of each knitting division K and is coupled to the actuator shaft 28 by means of levers 34 arranged at each end thereof. Connection between the actuator rod 33 and the housings 27 is effected by means of bifurcated projections 35 formed on the housing 27.

The housings 27 are also capable of being moved lengthwise of the shaft 28 in unison with the fashioning points 21 and the knitting width control plates 22. For this purpose, the housings 27 are coupled to the nut housings 24 of the fashioning screws 23. As shown particularly in FIGURES 1 and 5, the L.H. housings 27 are coupled, via brackets 38, to a control bar 39 fixed to the L.H. nut housing 24, and the R.H. housings 27 are coupled, via brackets 40, to a control bar 41 which is fixed to the R.H. nut housing 24. For accurate positioning of the housings 27 the arms of the brackets 38 and 40 are provided with adjusting screws 42 which engage opposite sides of a lug 43 on the housing 27.

Each housing 27 is provided with a pair of spaced blade arms 36, 37 which extend transversely of the needle bed and are disposed on opposite sides, i.e. above and below, of the needle arms 14 which are hingedly connected to their co-acting needles 13 and which are arranged to be moved in a vertical direction, under the action of the main selection means, so that the lugs 15 thereof are engaged by the cams of the cam box 16 to cause actuation of the needles.

The spaced arms 36, 37 are preferably of spring steel and are of a width which corresponds to a pre-selected number of needle arms, for example seven, in each bed, so that the plain border is knitted on the outer seven needles of each bed at each end of the selected knitting width. In this respect, it will be obvious that, since the housings 27 are coupled to the nut housings 24 of the fashioning screws 23 and therefore move with the fashioning points and the knitting width control plates, they are always in the correct position to act on the selected number of marginal needles.

The controlled angular movement of the housing 27 is such that the blade arms 36, 37 can be angularly moved to take up one of three positions, the first position shown in FIGURE 2 being a neutral position where the blade arms 36, 37 have no influence over the needle arms 14 and therefore the needles operate as dictated by the main selection means, the second position shown in FIGURE 3 being such that the lower blade arm 37 is raised to move, into an operative position, any needle arms 14 which were not previously so moved by the main selection means, and the third position shown in FIGURE 4 being such that the upper blade arm 36 is lowered to move, into an inoperative position any needle arms 14 which were previously moved by the main selection means into their operative positions.

With the means according to the invention, by selectively controlling the position of the blade arms 36, 37 of each needle bed of the machine, it is possible to produce a plain border of single thickness (FIGURE 10 or FIGURE 11), or of double thickness (FIGURE 12), or of tubular formation (FIGURES 10 and 11).

To knit a single thickness border, in one course (FIGURE 10), the secondary needle selectors of the rear needle bed are operated to move their co-acting pre-selected needle arms P into an inoperative position (FIGURE 4) while the secondary needle selectors of the front needle bed are moved in their neutral position (FIGURE 2) so that the needles are caused to knit as dictated by the main needle selection means. Thus, the needles of one bed only are made to knit. Alternatively (FIGURE 11), the arrangement is reversed and selection is such as to cause the preselected needles P of the front bed to remain inoperative and those of the rear bed to knit as dictated by the main needle selection means.

To knit a double thickness border (FIGURE 12), the secondary needle selectors of both front and rear needle beds are operated to move their co-acting pre-selected needle arms P into an operative position (FIGURE 3). Thus, the needles of both front and rear beds are caused to knit together.

To knit a border of tubular formation (FIGURES 10 and 11), the secondary needle selectors of each needle bed are operated alternately in each course of knitting to move their co-acting pre-selected needle arms P into and out of an operative position, the alternate movements of the secondary selectors of one needle bed alternating with the alternate movements of the secondary selectors of the other needle bed. Thus, during the knitting of one course the pre-selected needles of one bed are out of action and during the knitting of the next course the preselected needles of the other bed are out of action.

To knit a plain border on a simple patterned fabric (FIGURES 13 and 14), in one course (FIGURE 13), the secondary needle selectors of the front needle bed are operated to move their co-acting preselected needle arms P into an operative position (FIGURE 3) while the secondary needle selectors of the rear needle bed are moved into a neutral position (FIGURE 2) where the preselected needles P knit as dictated by the main selection means. In alternate courses (FIGURE 14) the secondary needle selectors of the front bed are moved to place the preselected needle arms P in an inoperative position (FIGURE 4) and the secondary selectors of the rear bed are moved into a neutral position (FIGURE 2).

It will of course be appreciated that the main selection means are such that they select needles according to the pattern required over the full knitting width and, where it is desired to provide a plain border, it will be understood that the secondary selection means are such as to override, where necessary, any selection made by the main selection means. With respect to this, it will be ap-

parent from the drawings that the total cross sectional area of the piston of the ram **30** is greater than the combined cross sectional areas of the pistons **18** for the needle arms **14** being controlled by the ram **30** so that the action of the blades **36, 37** of the secondary selection means will override any selection made by the main selection means **18, 19, 20**. In addition, there is both the mechanical advantage of the linkage between the ram **30** and the blades **36, 37** and the mechanical advantage of the blades **36, 37** over the pistons **18** on the needle arms **14**. Furthermore, it will be apparent to anyone skilled in the art that sufficiently high pressure may be applied to the ram **30** to effect the desired overriding.

In an arrangement hereinbefore described, the blade arms **36, 37** are provided as a single strip of a predetermined width which is such as to co-operate with, for example, seven needle arms **14**. Since it may be necessary or desirable for the operator to provide a plain border with say the outer four needles only, it is proposed that the blade arms **36, 37** be provided in the form of a comb or as a plurality of closely adjacent narrow members each co-operating with one needle arm **14** only.

Such an arrangement is shown in FIGURES 6 to 9 of the drawings where it will be noted that the upper blade arm **36** is in the same form as that described with reference to the previous embodiment but that the lower blade arm **37** is replaced by a plurality of bellcrank levers **44**. The levers **44**, of which there are for example seven associated with each housing **27**, are hingedly mounted on a pivot rod **45** which is supported on the housing **27**. The levers **44** are each held in their normal position by means of a compression spring **46** mounted on a guide rod **47** arranged between one arm thereof and an angle bracket **48** fixed to the housing **27**. In this arrangement, the knitting width control plates **22**, which serve to control the overall knitting width and positively prevent needle arms outside the desired knitting width from being moved into an operative position, are moved relative to the levers **44**, or vice versa, so that the two overlap to provide the desired border width of the plain border. In operation, it will be understood that those levers **44** which overlap the knitting width control plates **22** will, when the housing **28** is turned angularly, remain stationary whilst their springs **46** are compressed, and will not therefore have any influence on their co-acting needle arms **14**. In this respect, it will be understood that the strength of the springs **46** is such that they will be unaffected by the resistance provided as a result of the main selection means.

For fashioning purposes, each housing **27** may have associated therewith a pusher bar **49** which is operated to act on the pre-selected needle arms P and to move the needles **13** forward to open the latches in readiness to receive the fashioning points **21**. The pusher bar **49** is slidably mounted in the housing **27** and is of L-shaped formation the rear end thereof being provided in the form of a yoke **50**. The yoke **50** is adapted to receive an operating rod **51**, of which there is one to co-operate with each needle bed, the rod **51** being connected, by means of levers **52**, to a main shaft **53** which extends the full length of the machine. The main shaft **53** is adapted to be angularly turned about its longitudinal axis to effect endwise movement of the pusher bar **49** and thus also of the needle arms **14** and the needles **13**. The means for effecting angular movement of the main shaft **53** comprise a cam actuated vertically disposed reciprocatory rod **54** (FIGURE 2) which is coupled to the main shaft **53** by means of an arcuate link **55**.

Alternatively, the pusher bar and its operation may be in accordance with that described and illustrated in our prior British specification No. 1,029,871 or any other known means may be utilized for opening the latches of the needles on which fashioning is to take place.

From the above, it will be understood that the mechanism of the present invention provides a simple but efficient means with the minimum number of parts for forming a plain border on an otherwise patterned garment piece.

What I claim is:

1. In a flat twin bed knitting machine having main needle selection means which are operatively associated with needle arms attached to needles disposed in needle beds of the machine, a secondary needle selection mechanism adapted to oppose and override said main needle selection means to produce unpatterned borders on an otherwise patterned garment piece, said secondary selection mechanism comprising a pair of needle selector devices extending transversely of said needle arms, support means arranged so that said needle selector devices can be adjustably moved lengthwise of said needle beds, said needle selector devices being arranged in operative engagement with a pre-selected number of said needle arms adjacent the selvedges of a garment piece to be knitted and being angularly movable relative to said needle beds to selectively move said pre-selected needle arms into and out of an operative position whereby the needles corresponding to said pre-selected needle arms are selectively caused to knit and to be placed in an inoperative position irrespective of said main selection means.

2. In a flat twin bed knitting machine having main needle selection means which are operatively associated with needle arms attached to needles disposed in needle beds of the machine, a secondary needle selection mechanism adapted to oppose and override said main needle selection means to produce unpatterned borders on an otherwise patterned garment piece, said secondary selection mechanism comprising a pair of needle selector devices extending transversely of said needle arms each of said devices comprising a housing to which is fixed a pair of spaced blade-like arms disposed respectively above and below a preselected number of said needle arms, support means arranged so that said devices are adjustably movable lengthwise of said needle beds, and other means for moving said selector devices angularly relative to said needle arms, whereby said pre-selected needle arms are movable into and out of an operative position so that the needles corresponding to said pre-selected needle arms are selectively caused to knit and to remain in an inoperative position irrespective of said main selection means.

3. A knitting machine as claimed in claim **2**, wherein said housings of said selector devices are mounted on an actuator shaft extending lengthwise of said needle beds, movement of said housings lengthwise of said beds being effected by means of fashioning screw mechanisms of the machine.

4. A knitting machine as claimed in claim **3**, in which said housings of said selector devices are operatively connected to said actuator shaft via an actuating rod and levers, and angular movement of said actuating devices is effected by turning said actuator shaft about its longitudinal axis.

5. A knitting machine as claimed in claim **4**, in which turning movement of said actuator shaft is effected by a fluid operated ram which is connected thereto by a transversely disposed lever arm.

6. A knitting machine as claimed in claim **2**, in which for the purpose of carrying out a fashioning operation, a pusher bar assembly is operatively associated with said pre-selected needle arms, said pusher bar being slidable in said housing of said selector device in such manner as to effect endwise movement of said pre-selected needle arms and their co-operating needles.

7. In a flat twin bed knitting machine having main needle selection means which are operatively associated with needle arms attached to needles disposed in needle beds of the machine, a secondary needle selection mechanism adapted to oppose and override said main needle selection means to produce unpatterned borders on an

otherwise patterned garment piece, said secondary selection mechanism comprising a pair of needle selector devices extending transversely of said needle arms, each of said devices comprising a housing, a blade-like arm attached to said housing and disposed above a pre-selected number of said needle arms and a series of individually spring loader bellcrank levers corresponding in number to said preselected number of needle arms attached to said housing and disposed below said needle arms, support means arranged so that said selector devices are adjustably movable lengthwise of said needle arms, and other means for moving said selector devices angularly relative to said needle arms, whereby said pre-selected needle arms can be moved into and out of an operative position so that the needles corresponding to said pre-selected needle arms are selectively caused to knit and to remain in an inoperative position irrespective of said main selection means.

8. A knitting machine as claimed in claim **7**, wherein said housings of said selector devices are mounted on an actuator shaft extending lengthwise of said needle beds, movement of said housings lengthwise of said needle beds being effected by means of fashioning screw mechanisms of the machine.

9. A knitting machine as claimed in claim **8**, in which said housings of said selector devices are operatively connected to said actuator shaft via an actuating rod and levers, and angular movement of said actuating devices is effected by turning said actuator shaft about its longitudinal axis.

10. A knitting machine as claimed in claim **9**, in which turning movement of said actuator shaft is effected by a fluid operated ram which is connected thereto by a transversely disposed lever arm.

11. A knitting machine as claimed in claim **7** in which, for the purpose of carrying out a fashioning operation, a pusher bar assembly is operatively associated with said pre-selected needle arms, said pusher bar being slidable in said housing of said selector device in such manner as to effect endwise movement of said pre-selected needle arms and their co-operating needles.

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W. CARTER REYNOLDS, *Primary Examiner.*

U.S. Cl. X.R.

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