April 2, 1968 B. A. MONK 3,375,681

FLAT BED KNITTING MACHINES AND METHOD OF KNITTING

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FIG. 1a.

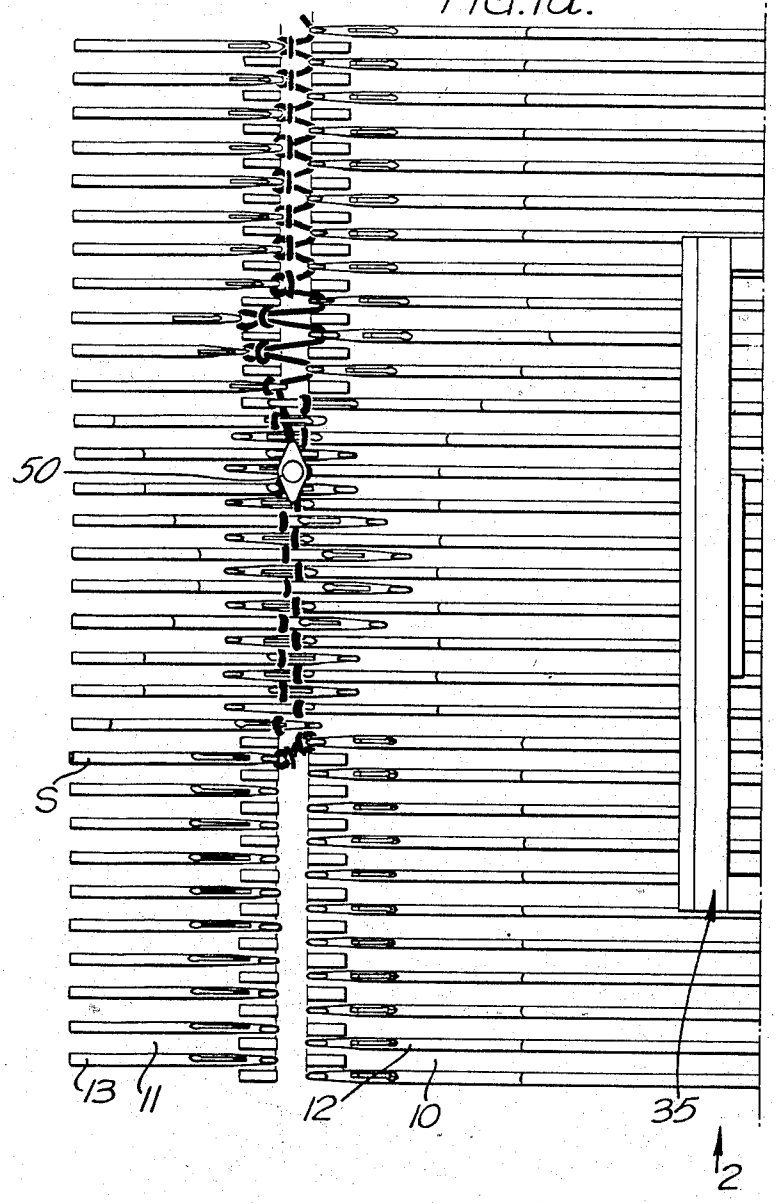

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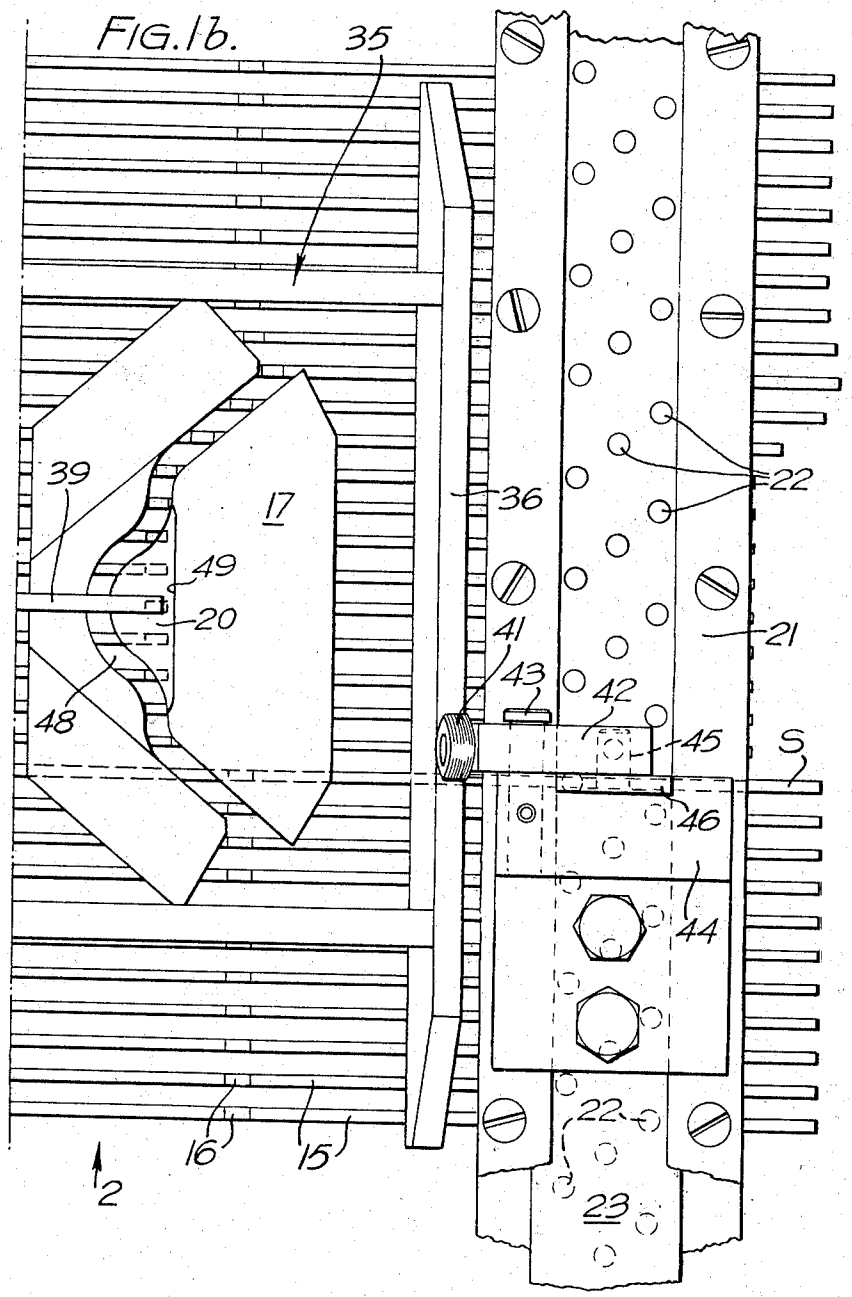
FIG. 1b.



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FLAT BED KNITTING MACHINES AND METHOD OF KNITTING

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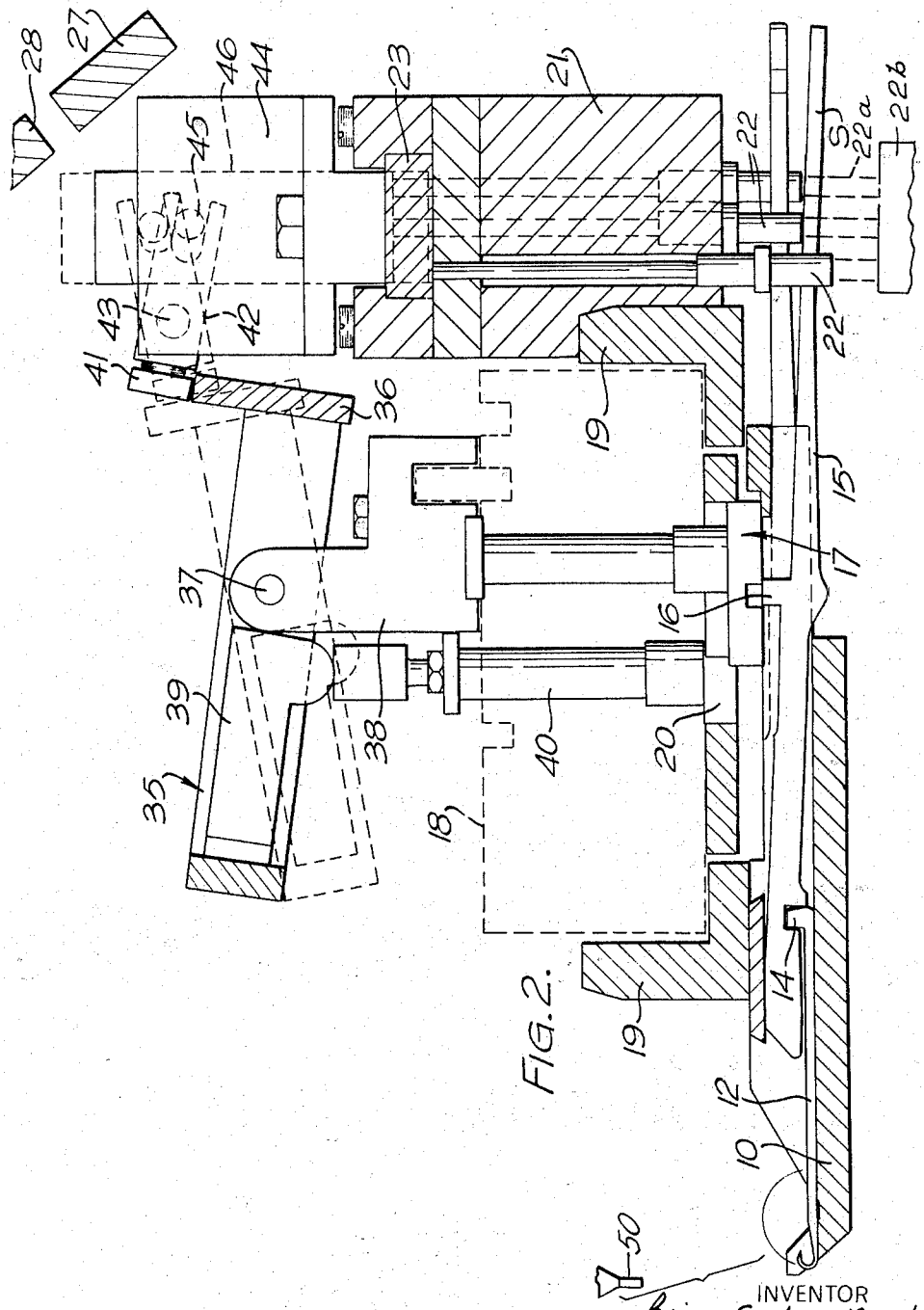

FIG. 2.

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FLAT BED KNITTING MACHINES AND METHOD OF KNITTING

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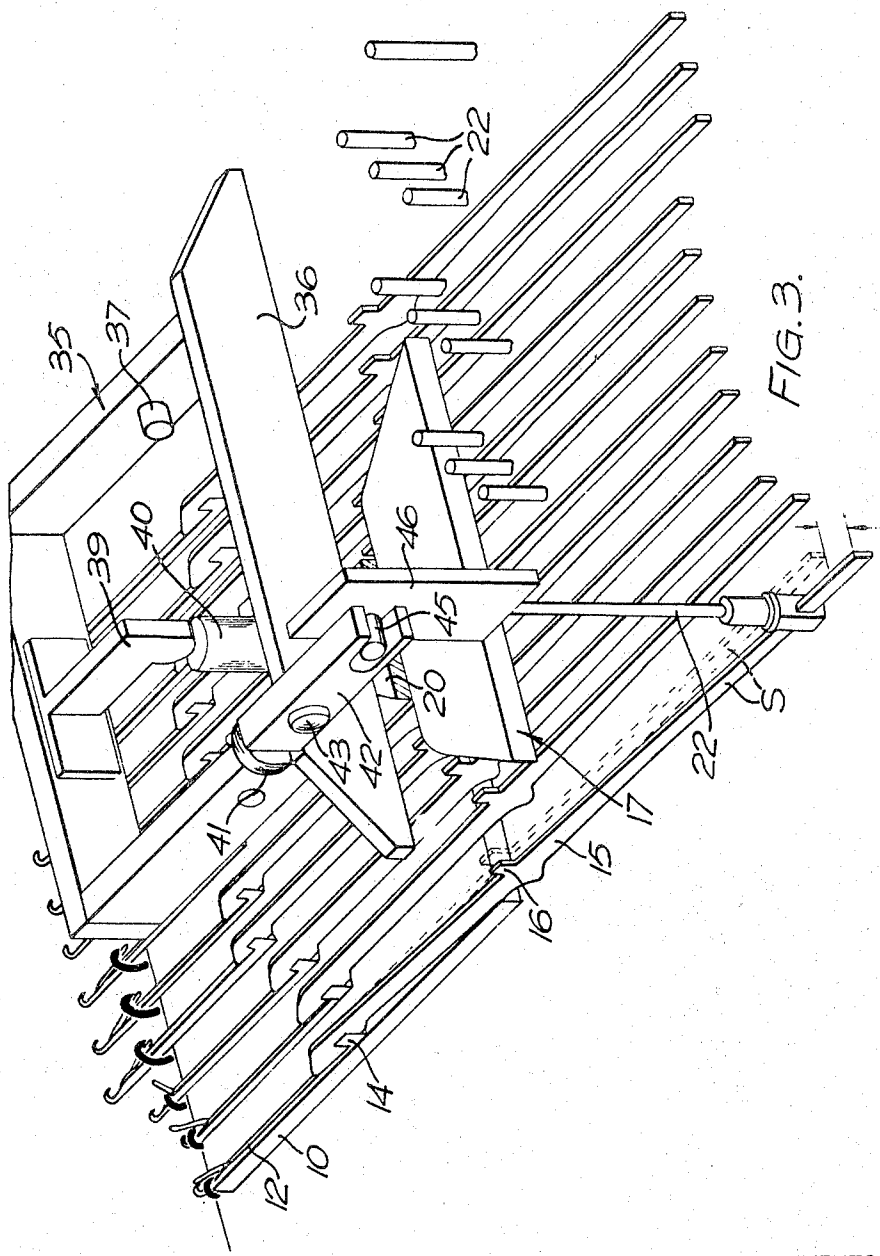

FIG. 3.

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FLAT BED KNITTING MACHINES AND METHOD OF KNITTING

Filed July 26, 1965 5 Sheets-Sheet 5

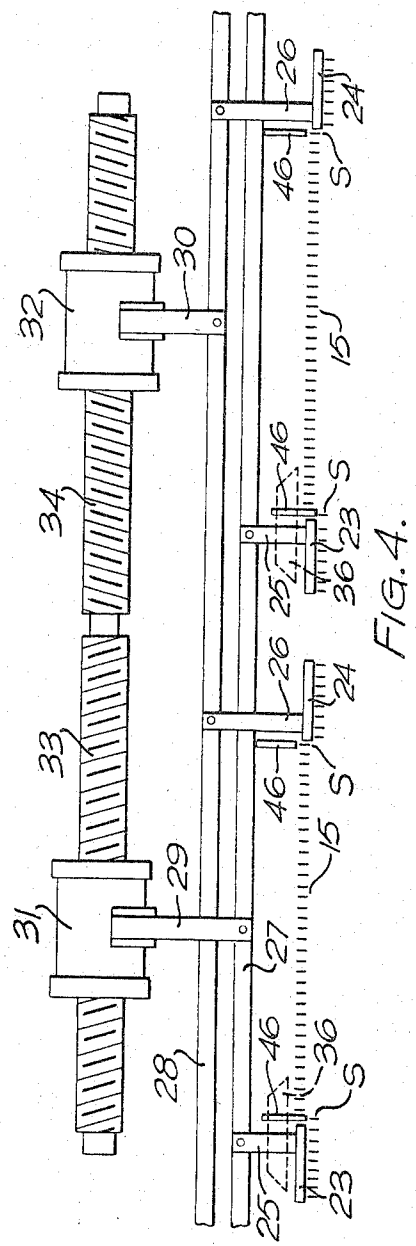

FIG. 4.

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United States Patent Office 3,375,681 Patented Apr. 2, 1968

3,375,681

FLAT BED KNITTING MACHINES AND METHOD OF KNITTING

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Claims priority, application Great Britain, July 29, 1964, 30,086/64
5 Claims. (Cl. 66—70)

ABSTRACT OF THE DISCLOSURE

A method and apparatus to improve the quality of the selvedges of fabrics involving tuck loops, such as cardigan and half cardigan fabrics, knitted on a flat bed knitting machine of the kind having two cooperating needle beds. Means operatively associated with the cam boxes of each needle bed are made effective to cause the last tucking needle in the knitting width to become inoperative so that a selvedge loop is formed on a needle which is knitting and not on a needle which is tucking.

This invention relates to flat bed knitting machines and is concerned particularly with a method and means for improving the quality of the selvedge of full or half cardigan fabrics, or any fabric involving tuck loops where all the needles of the machine, within a given knitting width, are operating, and especially when the knitting of such fabrics includes a widening operation.

The method and means of this invention are applicable particularly to flat bed machines of the kind having a pair of co-operating needle beds arranged at an angle to one another, each needle bed having a series of latched needles which are movable individually in tricks formed therein, a series of needle arms hingedly connected to the needles, said needle arms forming part of a needle selection mechanism and being held selectively in an operative position by resilient means (for example pneumatic or hydraulic means), a cam box arranged to be traversed over each needle bed to actuate the or selected needles, and a plate or bar arranged at each end of each needle bed to control the knitting width by causing those needles which are outside a predetermined width to remain inoperative irrespective of the action of the needle selection means.

It is well known in the art that, when forming a course of tuck loops, there is a tendency for loops to be incorrectly formed on the selvedge needles due to the fact that they are not knocked over which results, when the direction of the yarn feeder is reversed, in either the yarn being pulled off the selvedge needles altogether or in it being only partially held by the needles, for example, in the case of latched needles, it is looped over the latch thereof and not over the hook. The resulting selvedge is uneven and ragged.

The above disadvantage becomes even more apparent during widening of the fabrics since any loops which are dropped at the selvedge have less chance of being picked up and this of course increases the raggedness of the selvedge.

This problem has been overcome on hand operated machines by utilizing a very complicated sequence of widening. However, in order to mechanize the sequence of operations carried out on hand machines it would entail the use of complicated mechanisms and necessitate complicated operational instructions which, at the same time, would require a great deal of time and labour to set up the machine for different fabrics. Thus, this answer to the problem would be uneconomical.

The present applicant has already proposed, in order to overcome the present problem, that the selvedge needles should always be made to knit irrespective of the action of the remaining needles in a course. This is effected by arranging the cams in the cam boxes in such manner that when the machine is operating to form a course of tuck loops the last needle in the bed is caused to move its full stroke to full height instead of a lesser stroke to half height which is the case with the remainder of the needles.

The system already proposed by the present applicant is particularly suited to machines where the needle arms are actuated by positive and non-resilient means, whereas it is an object of the present invention to provide a method and means which are particularly suited for machines where the needle arms are actuated by resilient means, for example pneumatic or hydraulic means as described in the copending U.S. application for patent of Samuel Anthony Monk and Brian Arthur Monk, Serial No. 431,803, filed February 11, 1965, now U.S. Patent No. 3,318,110, dated May 9, 1967.

According to the present invention, in a knitting machine of the kind described there is provided a method of improving the quality of the selvedge of cardigan or half cardigan fabrics, or any other fabric involving tuck loops, which comprises causing the last needle in each tuck course to become inoperative so that, on reversal of the yarn carrier, a loop will be formed on a needle which is knitting and not tucking.

It will be appreciated that the needle referred to may be the selvedge needle, or, where the selvedge needle is not a tucking needle, it may be the needle next to the selvedge needle. Thus, it will be appreciated that in machines having two co-operating needle beds where the needles of one bed are arranged alternately with the needles of the other bed, it is the practice that the needles of one bed will always knit and the needles of the other bed will always tuck when knitting such fabrics as cardigan or half cardigan. Due to the arrangement of the needles, therefore, the selvedge needles in one course along one edge of the fabric will be a tucking needle whereas the selvedge needle in the next course along the same edge of the fabric will be a knitting needle. Therefore, where the selvedge needle is a tucking needle the loop will be formed on the needle which is next to the selvedge needle and, where the selvedge needle is a knitting needle, the loop will be formed on the selvedge needle, it being understood that in the latter case, since the last tucking needle is made inoperative, the last two needles in the tucking course are caused to knit.

According to the invention furthermore, in a knitting machine of the kind described, there is provided means for improving the quality of the selvedge of cardigan or half cardigan fabrics, or any other fabric involving tuck loops, said means comprising in combination a rockable cam attached to each cam box to co-operate with, and be actuated by, the tucking cams in the cam boxes, and a plate or other plunger means mounted on, or associated with, each knitting width control bar which means is, during the knitting of a tuck course, actuated by the said rockable cams to move the needle arm associated with the last tucking needle in the knitting width out of the path of the cams of the cam boxes so that the said last tucking needle is inoperative.

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

FIGURE 1*a* is a plan view in part of a pair of co-operating needle beds forming one knitting head of a multi-head knitting machine incorporating the means according to the invention,

FIGURE 1*b* is a plan view in part showing a knitting

machine incorporating means according to the invention, FIGURES 1*a* and 1*b* being intended to be viewed together as joined along the dot-dash lines respectively at the right and left of these figures,

FIGURE 2 is a sectional view in the direction of the arrow **2** of FIGURE 1*a*,

FIGURE 3 is a perspective view corresponding in part to FIGURE 1*b*, and

FIGURE 4 is a view, on a smaller scale, showing the knitting width control means of a multi-head knitting machine.

It will be realised that, for the sake of clarity, the drawings include the minimum number of parts, it being considered that the construction of the machine generally, which does not form part of the present invention, is well known to those skilled in the art.

Referring to the drawings, there is shown a pair of co-operating needle beds **10** and **11** (FIGURE 1*a*) provided respectively with a series of latched needles **12** and **13** (FIGURE 1*a*) which are slidable in tricks formed in the needle beds.

Each needle has hingedly connected thereto at **14** a needle arm **15** (FIGURE 3) formed with an upstanding butt **16** (FIGURES 1*b*, 2, and 3), said butt being arranged to be engaged by cams, generally indicated at **17** in FIGURES 1*b* and 2, arranged in a cam box **18** which is adapted to be reciprocated, in guides **19** (FIGURE 2), over the needle bed to cause operation of the needles. The cam box **18** also includes a tuck cam **20** (FIGURE 1*b*) which is movable, in known manner, between an operative position and an inoperative position. In one position of the tuck cam **20** the needles are moved their full strokes to full height to form a knitted course and in the other position the needles are moved to half height to form a tucked course.

The knitting machine also includes hydraulic or pneumatic needle selection means, for example as described and claimed in the aforesaid U.S. Patent No. 3,318,110. These fluid actuated needle selection means, which are shown in part in FIGURES 1*b* and 2, comprise a block **21** having a spring loaded plunger **22** associated with each needle arm **15**, the action of the plungers **22** being to bias the needle arms of the needles into an inoperative position. Needle selection is effected by pistons **22***a* arranged in a cylinder block **22***b*, which pistons move the needle arms of selected needles upwardly against the action of the plungers so that the needle arms are resiliently held in an operative position in which their butts **16** are acted upon by the cam box **18**.

The machine further includes yarn carriers indicated at **50** in FIGURES 1*a* and 2 which carriers are arranged, in known manner, to move lengthwise of the needle beds **10**, **11** to lay the yarn across the hooks of the cooperating needles.

As shown in FIGURE 4, the machine further includes, in respect of each series of needle beds, LH and RH knitting width control bars **23** and **24** which are in engagement with the ends of the plungers **22** of the needle arms **15** and are adjustable lengthwise of the needle beds to cause depression of the needle arms of the needles outside a predetermined knitting width so that the needles become inoperative. The knitting width control bars **23** and **24** of all the knitting heads are coupled, via brackets **25** and **26** to control rods **27** and **28**. The control rods **27**, **28** are connected, in the control division of the machine, to brackets **29** and **30** provided on nut housings **31**, **32** movably mounted on LH and RH fashioning screws **33** and **34**. In use, rotation of the fashioning screws cause movement of the nut housings and thus also movement of the knitting width control bars **23** and **24**. The fashioning screws **33**, **34** also control the positions of fashioning mechanisms of known construction which are not shown in the drawings.

The foregoing description covers all the known features of a flat bed knitting machine which are considered necessary for a clear understanding of the invention.

According to the present invention there is provided, as shown in FIGURES 1*b*, 2 and 3, on each cam box **18** of at least one needle bed of each knitting division, a frame **35** which includes a cam **36**, the frame **35** being pivotally mounted on hinge pins **37** provided in support brackets **38** fixed to the cam box **18**.

The frame **35** further includes a projecting arm **39** which is arranged to be engaged by an actuating pin **40**, which is adjustable in length for setting purposes, and which is fixed to the upper face of the tuck cam **20**.

Operatively associated with the cam **36** is a roller **41** which is mounted on one end of a lever **42**, said lever being hingedly mounted on a hinge pin **43** secured to a bracket **44** which is fixed to the knitting width control bar **23**.

The other end of the hingedly mounted lever **42** is bifurcated to receive a pin **45** fixed to a plate **46** which is arranged to slide vertically in a channel provided in the bracket **44**, the plate **46** being positioned to engage the plunger **22** associated with selvedge needles (i.e. the last needle in the predetermined knitting width).

It will of course be understood that the latter mechanism (i.e. the roller **41**, the lever **42** and the plate **46**) is provided in association with the knitting width control bars **23**, **24** at each end of each needle bed and is actuated by the rocking cam **36** of the cam box **18** as the latter reaches the end of its stroke in each direction of movement.

In operation, when knitting a knitted course, movement of the cam box **18** causes the butts **16** of the needle arms **15** to follow the cam track indicated at **48** so that the needles are moved to full height. During this time, the tuck cam **20** is in its depressed or operative position and the frame **35** and roller **41** are in an inoperative position, indicated in dotted lines in FIGURE 2, where they are out of engagement with one another. The frame **35** and roller **41** are biassed into the inoperative position by spring means which are not shown in the drawings.

In order to knit a course of tuck stitches, the tuck cam **20** is moved upwardly to the position indicated in FIGURES 2 and 3 of the drawings where it is above the level of the needle arm butts **16**. In this case the butts **16** will follow the cam track indicated at **49** so that the needles are only moved to half height.

Movement of the tuck cam **20** causes the frame **35** to be rocked about its pivot **37** to the position, indicated in solid lines in FIGURE 2, where the cam **36** is operative to engage the roller **41**. As the cam box **18** nears the end of its stroke, the roller **41** is caused to ride up on the cam **36**. This action causes pivotal movement of the lever **42** and moves the plate **46** downwards to depress the plunger **22** associated with the needle arm **15** of the selvedge needle indicated at S. Depression of the needle arm of the selvedge needle moves the needle arm butt **16** out of the path of the cam box **18** and the selvedge needle therefore remains inoperative. On the return stroke of the cam box it will be seen that, since the last tucking needle was inoperative and did not receive yarn fed by the carrier **50** during the forward stroke, a loop will be formed on the selvedge needle, or the needle next to the selvedge needle, whichever is appropriate and which is operated to knit, and thereby prevent the loss or dropping of loops along the selvedge of the fabric.

It will be appreciated that, since resilient (i.e. pneumatic or hydraulic) needle selection means, for example, of the kind shown in the aforesaid U.S. Patent No. 3,318,110, are used, the action of the rocking cam **36** can override the action of the selection means. It will further be seen that, since the needle selection means are resilient, the selvedge needle arms will return to their original positions in readiness for the next course as soon as the cam box **18** moves towards the opposite end of the needle bed.

The method and means according to the present invention operate with particular advantage in fully automatic multi-head knitting machines where a plurality of knitting heads are operated from a single control bay arranged centrally with respect to the knitting bays.

What I claim is:

1. A flat bed knitting machine of the kind which has two cooperating needle beds each of which has a series of individually movable needles, a series of needle arms each formed with an upstanding butt and hingedly connected to said needles, a cam box mounted to be traversed over said needle bed to engage said butts to actuate said needles, a tucking cam in said cam box, fluid actuated needle selection means operatively associated with said needle arms, and a pair of knitting width control devices operatively associated with said needle arms, characterised in that said machine includes means for improving the quality of the selvedge of fabrics involving tuck loops when knitted thereon, said means comprising a rockable cam operatively associated with said cam box to cooperate with, and be actuated by, said tucking cam in said cam box, and plunger means mounted on each of said knitting width control devices and operatively associated with said rockable cam, said plunger means being actuated, during the knitting of a tuck course, by said rockable cam whereby to move the needle arm associated with the last tucking needle in the knitting width out of the path of the cams of said cam box so that said last needle is rendered inoperative.

2. A flat bed knitting machine of the kind which has two cooperating needle beds each of which has a series of individually movable needles, a series of needle arms each formed with an upstanding butt and hingedly connected to said needles, a cam box mounted to be traversed over each needle bed to engage said butts to actuate said needles, a tucking cam in said cam box, fluid actuated needle selection means operatively associated with said needle arms, and a pair of knitting width control devices operatively associated with said needle arms, characterized in that said machine includes means for improving the quality of the selvedge of fabrics involving tuck loops when knitted thereon, said means comprising a rockable cam, a frame hingedly mounted on said cam box and supporting said rockable cam, an actuating pin secured to said tucking cam and being engageable with said frame for rocking the latter and said rockable cam, and plunger means mounted on each of said knitting width control devices and operatively associated with said rockable cam, said plunger means being actuated, during the knitting of a tuck course, by said rockable cam whereby to move the needle arm associated with the last tucking needle in the knitting width out of the path of said cams of said cam box so that said last needle is rendered inoperative.

3. A flat bed knitting machine of the kind which has two cooperating needle beds each of which has a series of individually movable needles, a series of needle arms each formed with an upstanding butt and hingedly connected to said needles, a cam box mounted to be traversed over each needle bed to engage said butts to actuate said needles, a tucking cam in said cam box, fluid actuated needle selection means operatively associated with said needle arms, and a pair of knitting width control devices operatively associated with said needle arms, characterized in that said machine includes means for improving the quality of the selvedge of fabrics involving tuck loops when knitted thereon, said means comprising a rockable cam operatively associated with said cam box to cooperate with, and be actuated by, said tucking cam in said cam box, plunger means comprising a bracket fixed to each of said knitting width control devices and a plate-like plunger member slidably mounted in each of said

brackets, one end of said plunger means being in operative engagement with said needle bars, and a pivotally mounted lever formed at one end with a roller for engagement by said rockable cam and at its other end being hingedly connected to the other end of said plunger member, said plunger means being actuated during the knitting of a tuck course, by said rockable cam whereby to move the needle arm associated with the last tucking needle in the knitting width out of the path of the cams of said cam box so that said last needle is rendered inoperative.

4. A flat bed knitting machine of the kind which has two cooperating needle beds each of which has a series of individually movable needles, a series of needle arms each formed with an upstanding butt and hingedly connected to said needles, a cam box mounted to be traversed over each needle bed to engage said butts to actuate said needles, a tucking cam in said cam box, fluid actuated needle selection means operatively associated with said needle arms, and a pair of knitting width control devices operatively associated with said needle arms, characterized in that said machine includes means for improving the quality of the selvedge of fabrics involving tuck loops when knitted thereon, said means comprising a rockable cam, a frame hingedly mounted on said cam box and supporting said rockable cam, an actuating pin secured to said tucking cam and being engageable with said frame for rocking the latter and said rockable cam, a pivotally mounted lever formed at one end with a roller which engages said rockable cam and at its other end is of bifurcated formation, a bracket fixed to each of said knitting width control devices, and a plunger plate slidably mounted on each of said brackets one end of said plunger plate entering into engagement with the needle arm of the last needle in the knitting width, the other end of said plunger plate being provided with a projection which is received in the bifurcated end of said lever, whereby, during the knitting of a tuck course, movement of said rockable cam into an operative position causes the needle arm associated with the last tucking needle in the knitting width to be moved out of the path of the cams of said cam box so that said last needle is rendered inoperative.

5. A method of knitting fabrics involving tuck loops such as cardigan and half cardigan fabrics with improved selvedges, on a flat bed knitting machine having two cooperating needle beds one of which is operable to form tuck loops and the other of which is operable to form knitted loops, cam boxes, and a yarn carrier which feeds yarn to said needles, said method being characterized by operating the needles of one of said needle beds to knit and operating the needles of the other of said needle beds to tuck by moving the cam boxes together with the yarn carrier lengthwise of said needle beds; and rendering the last needle in said needle bed forming tuck loops inoperative, whereby said last needle is not fed with yarn by said yarn carrier and a loop forming the fabric selvedge is formed on one of said needles which is knitting and not on one of said needles which is tucking.

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