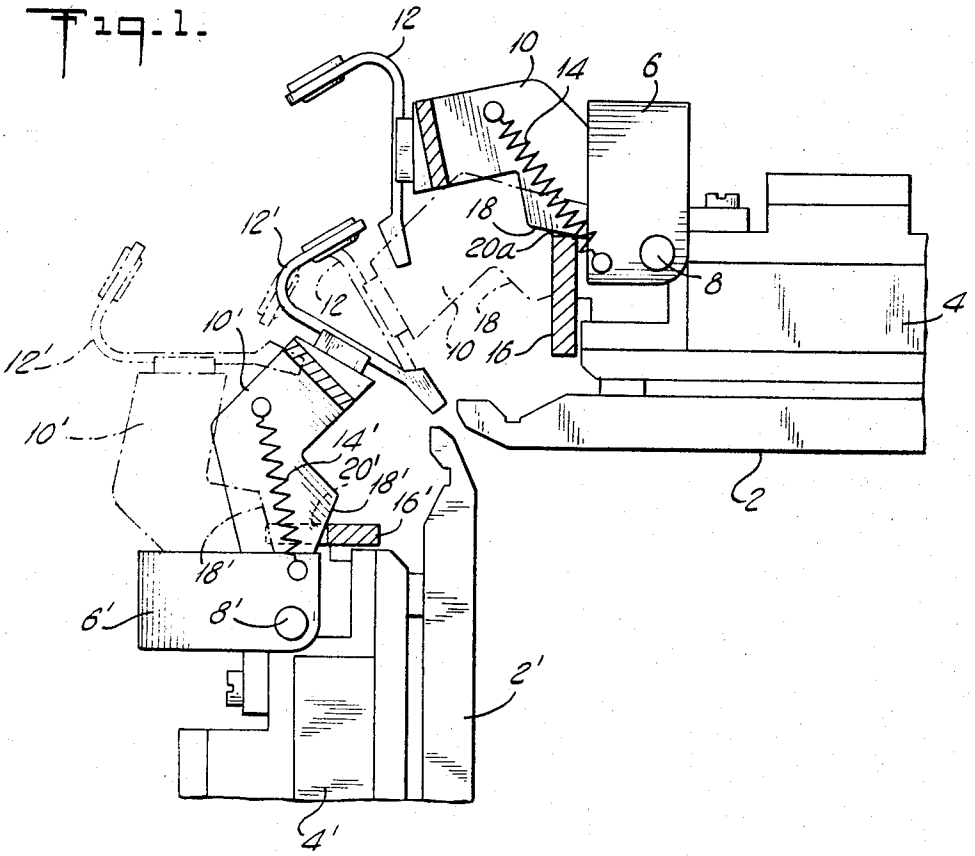
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THREAD ALTERNATING DEVICE FOR FLAT KNITTING MACHINES

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Fig. 1.



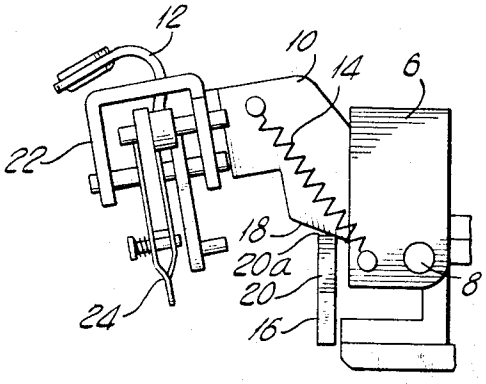




Fig. 2.

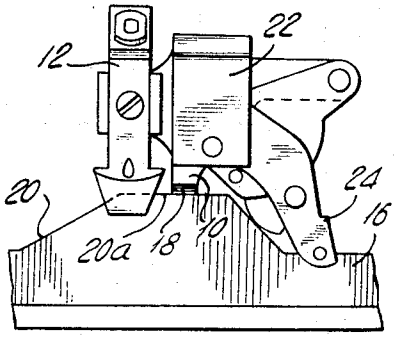



Fig. 3.

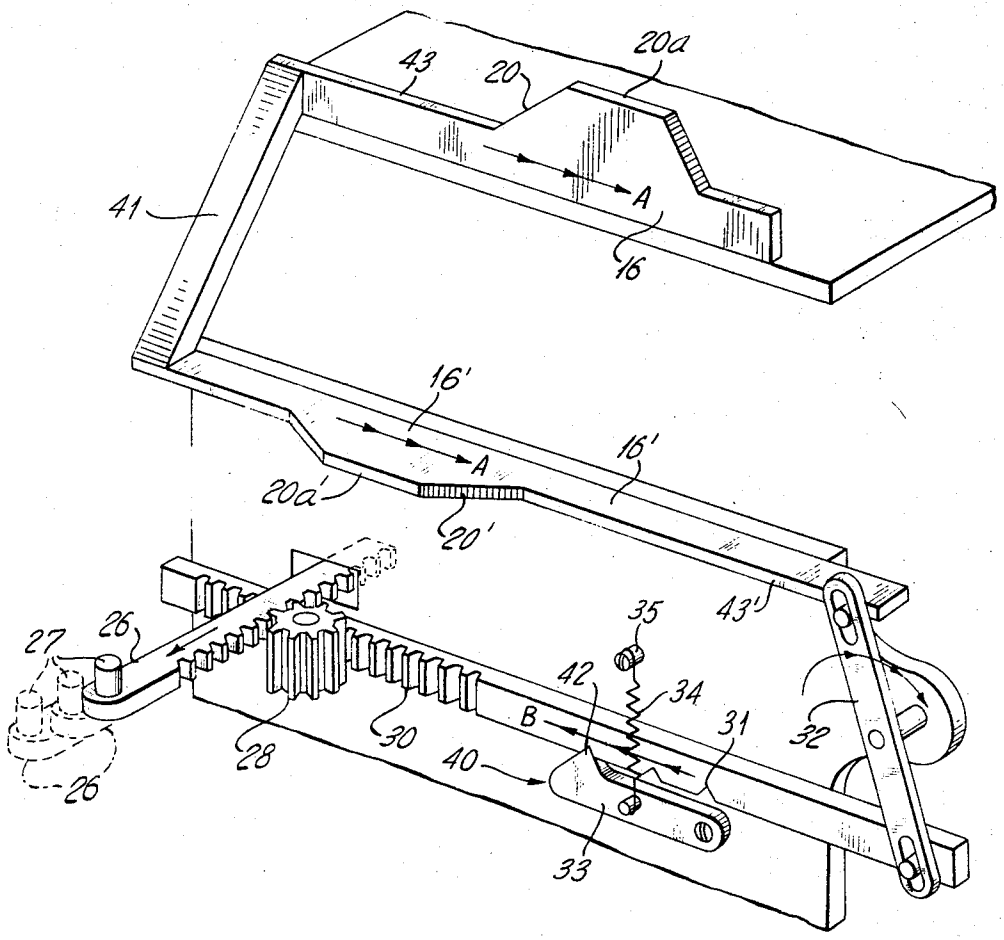
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Fig. 4.




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# THREAD ALTERNATING DEVICE FOR FLAT KNITTING MACHINES

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Int. Cl. D04b 7/04

U.S. Cl. 66—64 5 Claims

## ABSTRACT OF THE DISCLOSURE

In a flat bed knitting machine having a succession of needle bed pairs and a plurality of cam carriages guided above the pairs of needle beds in a continuous path similarly as in U.S. Patent No. 2,705,408, at least a pair of thread guides together with their fixedly secured thread grippers are mounted on each carriage, and a camming means for selectively bringing respective thread guides together with the associated thread grippers into operative and inoperative positions.

This application is a continuation-in-part of my copending application Ser. No. 415,269, filed Dec. 2, 1964, entitled Thread Alternating Device for Flat Knitting Machines and now abandoned.

The invention relates to flat knitting machines, and more particularly to machines equipped with two needle bed pairs and with a plurality of cam carriages guided above the pairs of needle beds, wherein each carriage is provided with a plurality of thread guides, each being fitted with a thread gripper guided above the needle bed pairs.

In previously known flat knitting machines of this kind, each cam carriage has a thread guide with pertaining yarn bobbins and a thread gripper. After one course of stitches has been completed, the thread is severed between the knitted fabric and the thread guide by an appropriate device. The thread end at the guide is received or taken up by a gripper, preventing the thread from being pulled out of the thread guide through the resilience of the thread tensioner or through other effects such as vibrations during manipulation of the machine. The thread gripper holds the thread until it is inserted into the extreme or selvage needle of one of the needle beds for the purpose of forming a new course of stitches.

In the production of knitted fabrics having a multicolor character or when use is made of yarns of different quality or thickness, only a portion of the cam carriages can work while they pass over the needle beds. For example, in the case of a two-color knitting, some of the operating cam carriages must carry bobbins which contain material of the one color while the remaining ones carry bobbins with the material of the other color, whereupon a certain number of the cam carriages are always out of action until the particular color is called for by the pattern control mechanism.

It was hitherto impossible to arrange a plurality of thread guides for each cam carriage since the thread gripping device thereon was mounted on a bolt made fast with the carriage. In its working position, the gripping device must be situated exactly between the needle beds. Owing to the fixed arrangement of the thread gripping device on the carriage. In its working position, the gripping device interchangeable thread guides since one gripping device is required for each thread guide.

The consequences of the restricted ability of use of the cam carriage is a low production output when making, for example, multi-color knittings.



It is one of the major objects of the invention to obviate this disadvantage and to increase the efficiency of such flat knitting machines.

It is another object of the invention to provide a plurality of thread guides for each cam carriage, each guide having a thread gripper associated therewith.

It is also an object of the present invention to provide means, in a flat knitting machine of the kind described, to bring the thread guides together with their fixedly supported grippers selectively into and out of operation.

According to the inventive features of the present invention, a flat knitting machine with two needle bed pairs is fitted with a plurality of cam carriages guided above said needle bed pairs, each carriage being provided with several thread guides, and each guide having a thread gripper connected therto.

Another important feature of the invention provides means for bringing said thread guides together with their associated thread grippers selectively, into and out of operational position.

By virtue of the inventive arrangement the production of multi-color knitting is greatly improved, even when using different grades or thicknesses of yarn.

Objects and advantages of the invention will be appreciated and more fully understood with reference to the following detailed description, when considered with the accompanying drawings, wherein

FIG. 1 is a somewhat schematic cross-sectional view of one of the bed pairs of the flat knitting machine according to the invention, showing the working positions of two operable thread guides;

FIG. 2 is a side elevation of a thread guiding device, connected with a thread gripper;

FIG. 3 is a front elevation of the structure shown in FIG. 2; and

FIG. 4 is a somewhat schematic perspective view of the mechanism for operating the control cams, forming part of FIGS. 1–3 but not illustrated therein.

Some parts of the flat knitting machine illustrated herein have been omitted for the sake of clarity. Thus, for example, only one needle bed pair and two thread guides, have been illustrated. Some of the structural details omitted herein are more clearly shown and described in coassigned U.S. Patents Nos. 2,705,408 and 2,821,073 of Walter V. Mehnert, respectively entitled "Flat Knitting Machine With 2 Pairs of Needle Beds" and "Flat Knitting Machine for Producing Two or More Double Pieces of Fabrics Independent From Each Other," to which further reference will be had as the description proceeds.

In FIG. 1, a pair of needle beds **2**, **2'** is shown in co-operation with respective cam carriage portions **4**, **4'**. These portions are rigidly coupled one with the other to form a single cam carriage unit corresponding to slide **3** of the U.S. Patent No. 2,705,408, which is driven by means of rollers and an endless drive chain above a plurality of successively arranged pairs of the needle beds (not shown). Fixed bearings **6**, **6'** are disposed on respective cam carriage portions. Bearing bolts, **8**, **8'** pass through the bearings for pivotably carrying thread guide carriers **10**, **10'**. From a plurality of thread guides **12**, **12'** operating at the entire knittink machine, only one has been illustrated for each cam carriage portion; the guides being rigidly secured to the respective carriers **10**, **10'**.

Tension springs **14**, **14'** urge the respective thread guide carriers **10**, **10'** toward appropriately shaped control cams **16**, **16'** slidably associated with the respective carriage portions **4**, **4'**; peripheral carrier portions, **18**, **18'** make contact with the cam contours **20**, **20'**, as illustrated. The operation of the arrangement will later be more fully described with reference to FIG. 4.

The thread guide carriers **10**, **10'** have also attached thereto holders for thread grippers, only one of the holders, **22**, and one gripper, **24**, being shown in FIGS. 2 and 3, the grippers **24** each being rigidly secured to their associated thread guide carriers **10**, **10'** and are movable together with their thread guides upon actuation of the carriers **10**, **10'** by the respective contours **20**, **20'** and **20***a*, **20***a'* as hereinafter described.

As has been disclosed in the above-mentioned U.S. Patents 2,705,408 and 2,821,073, the cam carriages of these knitting machines (termed "slides **3**" in the two patents referred to) move along an andless, substantially elliptical path. Each cam carriage first passes along one needle bed in a straight path, is then reversed along a semi-circular path, and then passes along the other needle bed of the pair, only to return to the first bed after another semi-circular passage.

To more fully understand the operation of the improved knitting machine of the present invention reference should be had to Patent No. 2,705,408 mentioned above, particularly to FIG. 2, thereof, in which it is seen that at one reversing end of the machine a control mechanism including elements **12–15** is provided, which control mechanism affects the actuation of the thread guide carries **10**, **10'** with the thread guides and the thread grippers thereon in the following manner. Each carriage comprising portion **4**, **4'** has to its associated cam assembly **16**, **16'**, as seen in FIG. 4 of the present application, a slider **26** operably connected thereto which slider is identified by the reference character **11** in FIG. 2 of Patent No. 2,705,408. Upon passage of the carriage **4**, **4'** over the controlling curve of the semicircular path, its slider **11** will be set by the curve of the semicircular path, which in turn is positioned by a controlling device **13** driven by sprockets **14**, **15** in accordance with the predetermined pattern of the desired fabric. The sprocket **14** shown in U.S. Patent No. 2,705,408 is connected with the axis of wheel **9** through a gear not shown. The sprockets **14** and **15** are connected by an endless chain and the axis of sprocket **15** is in direct connection with the control device **13**, therefore, the control device is driven directly from the shaft of sprocket **15**. The respective shaft connections from sprockets **14** and **15** to sprocket wheel **9** and controlling curve at the turning point of the path are shown by the broken-off shaft portions. The control device **13** carries a pattern which reflects the desired color or yarn pattern and which accordingly controls the position of the control curve. The position of the control curve in turn when engaged by pin **27** of slider **26**, controls the position to be attained by slider **26**. That is, it can be displaced in various positions as shown by the arrow in FIG. 2 of the aforementioned U.S. patent in order to attain the three distinct positions of slider **26**. The slider **26**, which is the same as slider **11** of the above-mentioned patent, is reciprocable with respect to a pinion **28** which, in turn, actuates a rack member **30**. A pivot at the end of said rack member engages in a longitudinal slot of a pivotable double-arm lever **32**, while the other end of the lever has another slot in which it is, in turn, engaged by a pivot of the control cams **16** and **16'**, which cams, in dependence of the position of their contours **20**, **20'**, and **20***a*, **20***a'*, actuate the carrier portions **18**, **18'** of the respective thread guide carriers **10**, **10'**, as hereinafter described.

The control cams **16**, **16'** can be arrested by locking means **40** in three distinct positions.

It is seen in FIG. 4 that control cams **16** and **16'** are formed as part of a rigid frame of cam assembly **41** which is adapted to move in the direction of the arrows A when the rack member moves in the direction of arrow B, but the latter resulting in the clockwise rotation of lever member **32**. When the individual carriages pass the control curve, the control curve is already in a position as desired by the pattern of the fabric being



knit, and pin **27** of slider **26** engaging the guiding surfaces as shown in FIG. 2 of the aforementioned patent gives a pushing or pulling force to slider **26** through its pins **27** or remains in its position if no new position was desired by the knitting pattern. Every carriage passing in front of the control curve **12** can be given a different thread guide combination as the pattern of the fabric may require. The slider and pin arrangement of the present invention corresponds to the arm identified by the reference character **11** in the aforementioned U.S. patent. After slider **26** is set into one of three different positions by the above-described controlling curve **12** (Patent No. 2,705,408) in accordance with the fabric pattern, in which different positions as described below, the thread guides **12**, **12'** assume individually operating or non-operating, or mutually non-operating positions, the entire cam assembly **41** is locked in such position by locking means **40**. A pair of thread guides **12** and **12'** are driven by a single came assembly **41**, the operation of which is shown in FIG. 1. Therefore, only a single slide **26** is required to operate at least a pair of thread guides **12**, **12'** disposed as shown in FIG. 1 and consequently, only a single pattern control is provided for both sets and is able to impart the three different combinations of the thread guides with respect to each other. When slider **26** is pulled forward, then through pinion **28** rack **30** is moved into the direction of the arrow B. Then pawl **33** enters the next recess **31** whereupon the double-armed lever **32** rotates in the clockwise direction which imparts to frame of cam assembly **41** a motion in the direction of the arrows A. Such movement of the camming surfaces **20**, **20'** and **20***a*, **20***a'* causes then the thread guides **12** and **12'**, through their carriers, **10**, **10'** to assume an inoperative position. The slider **26** can be either pushed or pulled by the pattern mechanism inasmuch as the pattern of the fabric to be knitted may require positioning of the thread guides into any of the combinations described hereinafter, which in turn requires the movement of the frame of cam assembly **41** in either to the left or right of the arrow A. The locking means includes a pawl **33** which by spring **34** is urged to engage into recesses **31** formed in rack member **30**. The recesses **31** are shaped so that the lateral movement of rack member **30** in the direction of B or vice versa permits disengagement of pawl **33** and its transfer to another locking position in accordance with the selection by the controlling device **13**.

The spring **34** is designed to be able to lock pawl **33** into any one of the recesses to secure same against the vibrational effect of the entire knitting machine during the period when on change is desired in the position of the thread guides. However, it is designed to be weak enough to respond to a push or pull movement of slider **26** to release rack **30** from the locking position.

The contours **20***a* and **20***a'* which respectively actuate thread guides **12'** and **12**, are offset with respect to each other as seen in FIG. 4 by their respective distances from the end of frame **41**. Such offset positioning of cams **16** and **16'** enables the oppositely disposed thread guides **12** and **12'** to assume the following three distinct positions when rack member **30** is moved to the three different locking positions shown in FIG. 4, and in which:

(1) Thread guide **12'** is activated and simultaneously thread guide **12** is deactivated as shown in FIG. 1 with the solid lines, and in which the peripheral carrier portions **18'**, **18** of thread guide carriers **10'** and **10**, respectively rest on surfaces **43'** and **20***a* or,

(2) Both thread guides **12'** and **12** are deactivated and in which portions **18'** and **18** are on the slant surfaces **20'** and **20**, respectively, or

(3) Thread guide **12'** is deactivated and simultaneously thread guide **12** is activated as shown with dashed lines FIG. 1, and in which carrier portions **18'** and **18** respectively rest on surfaces **20***a'* and **43**.

It is obvious from the drawing that the rack member is advancing in the direction of the arrow B while the thread guides go through the above described three positions. The setting of the positions is random and solely depends on the selection by control device **13**.

With reference to Patent No. 2,705,408, is it seen in FIGS. 2–7 thereof that a projection **18** called a contour curve is provided at the end of each needle bed pair at which each carriage leaves the particular needle bed pair, along with scissors **28** which upon coming into engagement with the appropriate projections on the thread gripper assembly as described in detail therein, cause the thread gripper **24** to hold the thread before it is cut by the scissors **28** and until it is introduced into the thread guides of the bed pairs to be passed next by the carriage. The thread gripper **24** is securely connected to the corresponding thread guide carrier and moves therewith.

I claim:

**1.** In a flat knitting machine having at least a succession of needle bed pairs, a plurality of cam carriages guided above said succession of the pairs of needle beds in a continuous path, drive means for driving said cam carriages on said path, and pattern control means at a selected location adjacent the path of movement of said cam carriages, the improvement comprising at least a pair of thread guides pivotally associated with each cam carriage to take an operative and inoperative position with respect to said pairs of needle beds, a thread gripper fixedly secured to each thread guide, control cams operatively disposed on each cam carriage for selectively bringing respective thread guides together with the associated thread grippers into said operative and inoperative positions, and means for actuating said control cams as determined by the pattern control means.

**2.** In a flat knitting machine, the improvement according to claim **1**, further comprising bearings disposed on said carriages, bearing bolts passing through said bearings, and carriers for said thread guides pivotably supported by said bearings for enabling said thread guides to move into said operative and inoperative positions.



**3.** In a flat knitting machine, the improvement according to claim **2**, wherein the number of control cams corresponds to that of said thread guide carriers, and a tension spring for urging each carrier towards a respective control cam.

**4.** In a flat knitting machine, the improvement according to claim **1**, wherein said means for actuating the thread guides and the associated thread grippers thereon into said operative and inoperative positions includes a rack and a pinion mechanism for actuating said control cams.

**5.** In a flat knitting machine, the improvement according to claim **4**, wherein said rack and pinion mechanism includes a reciprocable pivot member, at least one of said control cams having a similar pivot member spaced from the aforementioned member, and a double-armed lever being in operative engagement with said pivot members at one end thereof, whereby said control cams may be moved into a first operative position where one of the thread guides is activated while the other thread guide is deactivated, a second operative position where said one thread guide is deactivated and said other thread guide is activated, and a third position in which both of said thread guides are deactivated.

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