United States Patent [19]

Kohler

[11] **3,717,014**

[45] **Feb. 20, 1973**

[54] **JACQUARD RECTILINEAR KNITTING MACHINES**

[75] Inventor: **Fritz Kohler**, Couvet, Switzerland

[73] Assignee: **Edouard Dubied Et Cie (Societe Anonyme)**

[22] Filed: **Sept. 13, 1971**

[21] Appl. No.: **179,815**

[52] **U.S. Cl.** **66/75**

[51] **Int. Cl.** **D04b 7/00**, D04b 15/66

[58] **Field of Search** 66/60, 64, 62, 63, 75

[56] **References Cited**

UNITED STATES PATENTS

3,605,448	5/1969	Ribler	66/75 X

FOREIGN PATENTS OR APPLICATIONS

479,738	10/1969	Switzerland	66/75
488,837	5/1970	Switzerland	66/75
1,061,439	4/1954	France	66/75
1,170,257	11/1969	Great Britain	60/75

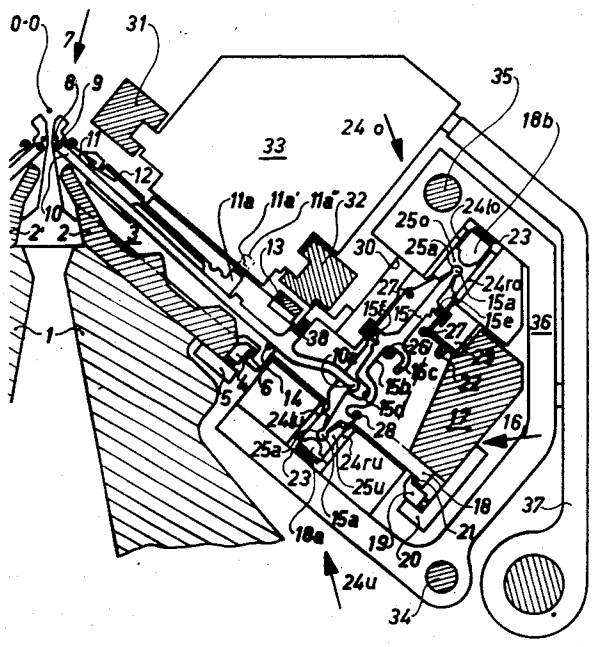
Primary Examiner—Ronald Feldbaum

Attorney—James P. Hume et al.

[57] **ABSTRACT**

A Jacquard rectilinear knitting machine with loop transfer and roof shaped multiple machine beds is equipped with a needle selecting device in which the commands from a knitting program are transmitted to the performing needles by means of electro-magnetic heads activating selection plates in order for the selection plates to assume a position selected from three discrete positions.

11 Claims, 2 Drawing Figures



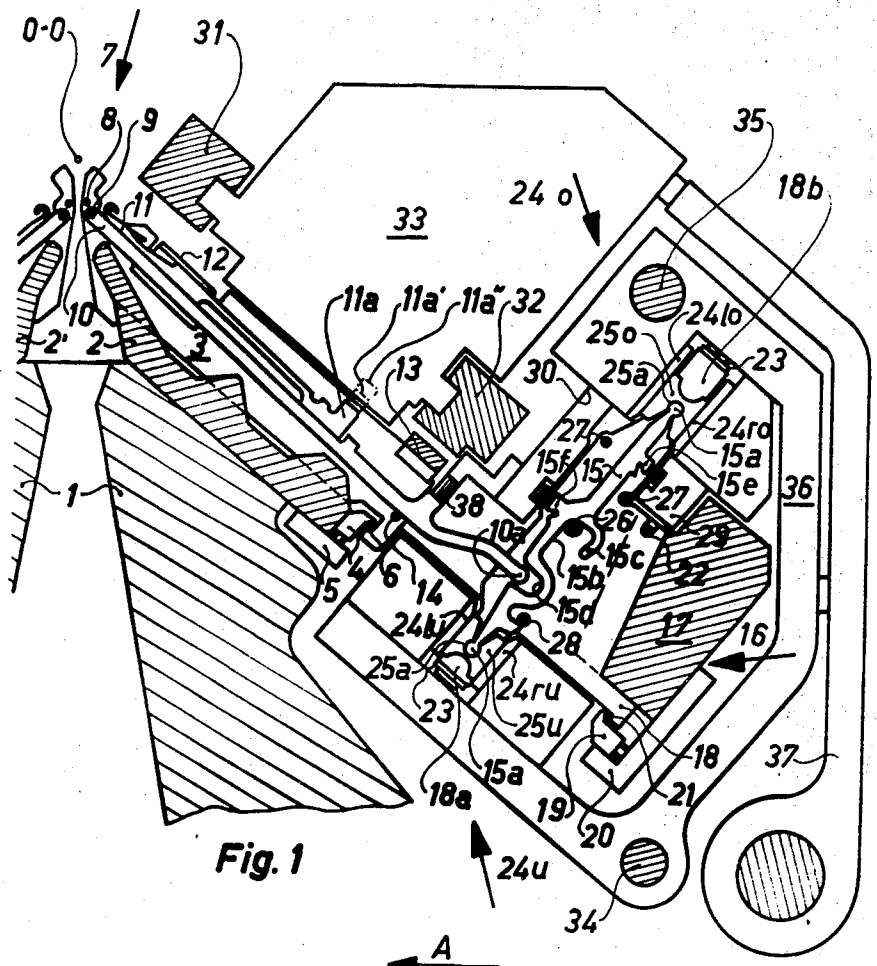

0-0
7
31
8
9
11
12
10
2'
2
3
1
33
24 o
35
18b
11a
11a'
11a"
32
13
30
25o
25a
24lo
23
24ro
15a
15e
36
27
15f
15
38
10a
26
15c
15b
15d
28
29
22
17
16
4
5
6
14
24lu
25a
23
24ru
25u
18
37
15a
18a
19
20
21
24u
34

Fig. 1

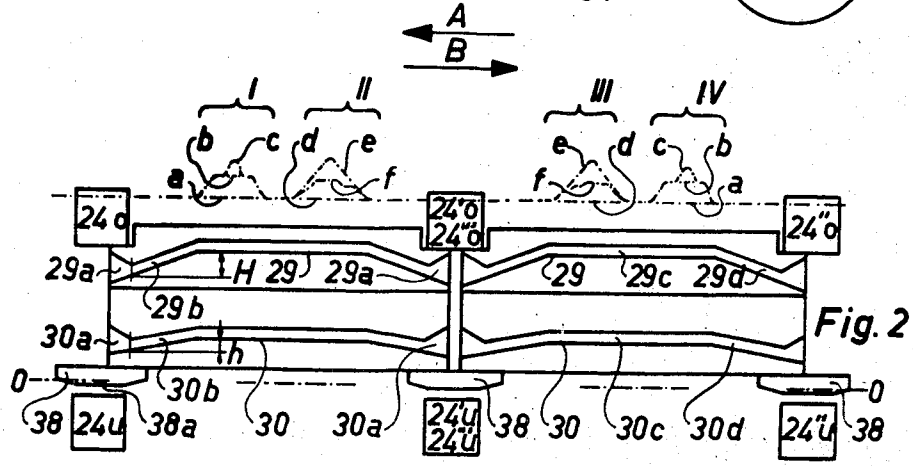

A
B
I
II
III
IV
b
c
d
e
a
f
24 o
24'o
24"o
29a
H 29
29
29c
29d
29b
30a
h
0
30b
38
24u
38a
30
24'u
24"u

Fig. 2

JACQUARD RECTILINEAR KNITTING MACHINES

The present invention relates to a device for the command and positioning of needles according to a knitting program for a Jacquard rectilinear knitting machine.

BACKGROUND OF THE INVENTION

French Pat. No. 1.428.923 applied for Mar. 25, 1965, by Societe Morat describes a circular knitting machine in which pushers are activated by electro-magnets, and guided by ramps in three selective positions. At least two successive electromagnets following one another in the direction of rotation of the machine are necessary for each station. Application of such a device to a rectilinear machine, equipped with a carriage supporting knitting locks and loop transfer locks would be extremely cumbersome due to the fact that such a carriage would have to be equipped with selecting electro-magnets and guiding channels, both of which would have to be located outside the locks thus increasing substantially the length of the carriage.

Application of this device to a rectilinear machine equipped with double locks would increase the length of the carriage even more by the fact that a guiding channel would be required for each travelling direction of the carriage (for example **120***a* of FIG. 1 of the aforementioned French patent) and by the fact that the paths of the two guiding channels could not cross one another.

Obviously any lengthening of the carriage would necessitate an increase of its travelling distance which would result in a reduced productivity of the machine.

Further disadvantages of less obvious nature would also have to be considered, such as, increased weight of the carriage, increased overall length of the machine, added complexity of programming resulting from the fact that some of the needles would have to be put out of work at various and precise instances for "tuck" knitting and the like.

SUMMARY OF THE INVENTION

The object of the present invention is to circumvent the above-mentioned disadvantages.

In the selecting device of the present invention, each lock is provided with two pairs of selecting heads of which one pair is located at the entrance of guiding channels while the other pair is located at their exit. Both pairs of heads have been oriented at right angle with respect to axis (0–0) of the machine and operate simultaneously on a selecting plate in order to rotate it in one direction, in the opposite direction or to displace it transversely to reach one of three discrete positions, thus presenting one or the other of its protruding heels **15***a* and **15***f*, respectively, at the entrance of guiding channels **29**, **30**, respectively, in which one of the heels will follow an ascending, horizontal, and descending path.

The ramps of the guiding channels are extended smoothly and continuously from entrance to exit and reach different heights. A selecting plate located in two of the three discrete positions will be raised by one of the guiding channels at a different height H – *h*, depending upon which of its heel is engaged in which guiding channel.

The selecting plate in its ascending motion is provided with a guiding channel to carry its corresponding needle jacks **10**, which in turn will raise its supported needle in such a way that its heel **11***a* will be located mid-way up or substantially above the upper level of the needle bed, according to the selected position corresponding to two of the three discrete positions assumed by a selecting plate **15**.

In the third position the selecting plate **15** will not engage or be raised by either of the guiding channels, and, consequently, the heel of the needle will remain flush with the upper level of the needle bed.

The selecting plates are not necessarily activated directly by the electro-magnets. Intermediate floating plates **25** can be provided with freedom of motion between the electromagnets, connected through articulated joints with the selecting plate at either ends, displaced and positioned by energized electro-magnetic heads. Said floating plate carries along in its motion, and locates the selecting plate in the selected position.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-sectional view through the machine beds showing the selecting device of the invention.

FIG. 2 is a schematic representation of a machine equipped with a double lock.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, FIG. 1 shows a machine bed **1**, supporting two needle beds **2** and **2'** having transverse and parallel grooves in which locating partitions **3** are held in place by a spacing rod **6** and a wedge **4**, backed by a support **5**.

Parallel to axis (0—0) of the machine, a knocking over comb **7** is held by a knocking over rod **8** at the extremities of partitions **3**.

Parallel to knocking over rod **8** through the partitions **3**, an axis **9** serves as a pivoting point for the needle jacks **10**. Needles **11**, resting on their respective needle jacks are secured by an L shaped bracket **12**.

Parallel to axis (0–0) of the machine, a spacing comb **13** secures the partitions **3**. Downward travel of needle jacks **10** is limited by stop rod **14**.

A selecting plate bed **16** is positioned parallel with needle bed **2**, comprising a rigid support **17** secured at both ends to the machine bed. Transverse and parallel grooves are provided in rigid support **17** to locate and hold partitions **18** between which selecting plates **15** are guided.

Partitions **18** are maintained on support **17** by means of a wedge **19**, backed up by an l shaped plate **20**, with a spacing rod **21** between wedge **19** and the partitions, and a tension rod **22**.

It has been found advantageous to support the extremities **18**a and **18**b of partition **18** with springs **23**, the diameter of which is equal to the space between partitions **18**. It would also be an advantage, as an alternate, to secure partitions **18** by means of a spacing comb similar to comb **13**. Partitions **3** and partitions **18** are positioned in line with each other.

The selection of selecting plates **15** is accomplished by means of electro-magnetic heads **24** and the plates are held in their selected position by means of permanent magnets.

Details of the performing of such electro-magnetic heads are described in FIGS. 2 and 3 of German patent application No. 1,920,531, dated Mar. 24, 1969, made in the name of Edouard Dubied et Cie S.A.

Each electro-magnetic selecting head is built into a tapered channel, the narrow section of which maintains parallel walls where the selection of ferro-magnetic elements passing through the channel takes place according to the program.

Those elements are attracted toward one or the other walls of the channel by two electro-magnets opposing each other on either walls of the channel.

The displacement of the elements within the parallel section of the channel is limited to a few hundredths of a milimeter, allowing a rapid selection with a small electro-magnetic force.

The tips of the pole pieces of the electro-magnets are provided with at least one permanent magnet piece. The latter are flush with the walls of the channel, which from this point forward, increases in width.

According to the invention, a rectilinear knitting machine is equipped with two selecting heads **24***o* and **24***u* operating simultaneously. In order to accomplish this, both selection heads are placed on the same plane, and oriented at right angle with respect to axis (0—0) of the machine.

Two selecting heads **24***o* and **24***u* assembled in this manner are referred to as "a pair" of selection heads, which pair is oriented at right angles with respect to the axis (0—0) of the machine.

While passing from the parallel section through the tapered section of the channel **24***ro*, **24***ru*, **2410**, **241***u*, the ferro-magnetic elements are further displaced by a few milimeters from their position, by following one of the diverging walls, to reach their final position at the end of the channel.

In order to insure optimum results and efficiency of the system, the ferro-magnetic elements can be other than the selecting plates **15** themselves. Instead, the latter can be displaced by connected floating plates **25**. To accomplish this, a substantially round shape is provided at either end of the selecting plate **15**, said round shape engaging a matching round hole in each of the floating plates **25***o* and **25***u*.

In non-operative position, as well as during the instance immediately preceding the selection, all selecting plates are resting on an axis **26** which consists of a rod running parallel to axis (0—0) of the machine, through the partitions **18**.

The selecting plates can rotate around axis **26** as far as stop wire **27** will allow, or move laterally by a distance corresponding to the gap between face **15***b* and nose **15***c*.

Theoretically, the selecting plates can assume any of four discrete positions, while for all practical purposes only three positions are sufficient. More specifically, first position corresponds to needles "out of work", second position to "stitch formation" and third position corresponds to "tuck." In loop transfer condition of the machine, the respective positions are corresponding to: first, "out of work," second, "stitch transfer," and third, "stitch formation."

All positions are reached shortly before the end of the diverging section of the selection channel.

To reach first position, the selecting plate **15** rotates in a counterclockwise direction. Its floating plate **25***o* will be on wall **24** **1***o* of the channel, and floating plate **25***u* will be on wall **24** *ru*.

In the second position, after a clockwise rotation of the selecting plate, its floating plate **25***o* will be one wall **24** *ro* and floating plate **25***u* will be on wall **241***u*.

In third position, resulting from a lateral displacement of the selecting plate, floating plate **25***o* will be on wall **241***o* and floating plate **25***u* will be on wall **24** **1***u*.

Lateral displacement of the selecting plate in the opposite direction is prevented by contact of the face **15***b*, of the selecting plate with axis **26**.

In first position, upward displacement of the selecting plate **15** is limited by a stop rod **28**.

In the second position, the heel **15***e* of the selecting plate engages channel **29**, while in third position the heel **15***f* engages channel **30**.

Two runners **31** and **32** are supports and guide the knitting carriage **33** while sliding rods **34** and **35** support and guide the selection carriage **36**.

All runners **31**, **32** and sliding rods **34**, **35** are oriented in parallel relationship with the axis (0—0) of the machine and fastened to its chassis at their extremities.

The motion of both carriages **33** and **36** are controlled by a bridge **37**, in a conventional and known manner not further described here.

The knitting carriage is provided with the necessary elements, for knitting and loop transfer, known and not further described here. The distance between the various elements and the needle bed can be set to correspond to specific knitting programs in such a way that needle heels **11**a can be activated by the carriage channels. Obviously the needle heels positioned flush with the upper level of the needle bed will not be activated by the locks and consequently their corresponding needles will by "out of work."

Detail operation of the various carriage elements is well known and will not be further described here.

The selection carriage **36** is equipped with two pairs of selecting heads **24** for each lock and guiding channel **29** – **30**.

FIG. 2 represents schematically a system with double locks in which the paths followed by needle heels are illustrated in dotted lines.

Lines I and IV are representing knitting functions in which line a shows an "out of work" position, while line *b* shows a "tuck position, and line *c* shows a "stitch forming" position.

Lines II and III represent in "stitch transfer" position for line *d* "out of work," for line *e* "stitch transfer," and for line *f* "stitch formation."

Lines I and II are related to one of the locks while lines III and IV relate to the other.

When carriage is travelling in direction A, the selecting heads **24***o*, **24***u*, activate the selection plate **15** on locks I/II, and the selecting heads **24'***o*, **24'***u* activate the selection plate on locks III/IV.

When the carriage is travelling in direction B, the selecting heads **24''***o*, **24''***u*, activate locks III/IV and the selecting heads **24'''***o*, **24'''***u* activate locks I/II.

Consequently, a pair of selecting heads are operating on each lock.

Selection heads 24'*o* and 24'''*o* can be arranged in a different way, for example, when 24'*o* and 24'''*o* are facing the same selection head.

To accomplish this, both selection heads are placed symmetrically, according to an axis symmetrical to their pole pieces.

In a lock observed in the direction A of travel of the carriage, the stitch formation channels 29 and 30 are preceded by funnel shaped entrances 29*a* and 30*a*, raising the horizontal section of the channel above its entrance and exit sections 29*b* and 30*b*.

The horizontal sections 29 and 30 have to extend to at least the fully length of the lock.

The horizontal section 29*c* of the channel is placed above its entrance 29*a* by a distance corresponding to H, while the horizontal section 30*c* of the other channel is placed above its entrance 30*a* by a distance corresponding to *h*, which is smaller than H. H and *h*, respectively, determine the height of needle heels 11a in selected position.

The selection plates 15 are 15*e* and 15*f*. Corresponding to the second position, reached after a clockwise rotation of the selecting plate, its protruding heel 15*e* engages the channel 29 at its entrance 29*a*. *provided with protruding wheels 15*

A selection plate so engaged will be raised by a distance corresponding to H.

The selection plates 15 are connected with their respective needle jacks 10 by a joint consisting in a rounded end of needle jacks 10 engaging a socket 15d of the selection plate 15.

Upward motion of selection plate 15 will also raise the connected needle jack 10 which in turn will raise the heel 11*a* of its supported needle to its highest position 11*a*'' thus penetrating deep into the lock channel to be reached by cams raised half way only.

Lateral displacement of the selection plate 15, corresponding to the third position will engage its protruding heel 15*f* into ramp 30*a* of the channel 30.

Through the channel, the selection plate will be raised by its heel to a height corresponding to *h*, the needle jack supporting a needle will raise its heel 11*a* mid-way up, so that it will penetrate into the lock channel only half way in depth, and be reached only by cams closest to the needle bed 2.

It has been found advantageous to provide a relief ramp 38 for each of the selection heads, the horizontal section of which extends beyond the beginning and the end of the tapered part of the channel, its distance to stop rod 14 being equal to the height of the needle jack 10.

The purpose of relief ramp 38, together with stop rod 14 is to locate needle jack 10 in such a way that all undue pressure on selection plate 15 is eliminated thus insuring its freedom during the selection, and increasing its functional effectiveness.

In a maching fitting the above description, the opposite needle bed 2' is equipped in the same manner as needle bed 2.

In a Jacquard knitting machine without loop transfer, one of the needle beds can be equipped with the above described device while it can be omitted on the other needle bed.

Summarized, the device works in the following manner. With a carriage travelling in direction A, the electro-magnets of a pair of selecting heads 24*o* – 24*u* and 24'*o* – 24'*u*, being excited, will activate simultaneously floating plates 25*o* and 25*u*.

The latter will leave their neutral positions and assume a selected position, carrying with them the selecting plate 15.

Depending on the selected position, one of the protruding heels 15*a* or 15*f* will engage one of the channels 29 or 30, respectively, either of which will raise the selecting plate 15.

Should, as a result of the selection, neither of the heels 15*a* or 15*f* engage in its corresponding channel, the selecting plate will remain at the same level.

When raised, the selecting plate 15 also raises the needle through its supporting jack, and the needle heel 11*a* can engage in the lock channel and be reached by its cams.

When reaching the end of a guiding channel, the selecting plate 15 will be lowered by its protruding heel, following ramps 29*d*, 30*d*, respectively.

It will be obvious to those skilled in the art that various changes may be made without departing from the spirit of the invention and, therefore, the invention is not limited to what is shown in the drawings and described in the specification but only as indicated in the appended claims.

What is claimed is:

1. In a Jacquard rectilinear knitting machine having loop transfer and roof shaped multiple machine beds, the combination comprising:
knitting needles,
needle jacks for supporting the knitting needles;
a needle selecting device for activating said needle jacks;
said needle selecting device activated by selecting plates guided through ramps forming guiding channels;
said selecting plates being mobile;
two pairs of electro-magnetic selecting head means controlling and displacing each of said selecting plates, one pair of which is located at the entrance and the other pair of which is located at the exit of said guiding channels;
said electro-magnetic selecting head means oriented at right angles with respect to the axis of said knitting machine and operating simultaneously on said selecting plates for rotation of said selecting plates counterclockwise around their center, for rotation of said selecting plates in the opposite direction, and for displacement of said selection plates laterally, in order for said selecting plates to assume a position selected from three discrete positions to obtain adequate orientation and positioning of said selecting plates at the entrance of said guiding channels.

2. A Jacquard rectilinear knitting machine according to claim 1 in which said selecting plates are provided with protruding heels either of which can engage in the corresponding guiding channel and follow the ascending, level and descending paths thereof.

3. A Jacquard rectilinear knitting machine according to claim 1 in which said guiding channels are provided with elevations of different height from one another.

4. A Jacquard rectilinear knitting machine according to claim 2 in which said selecting plate is raised at dif-

ferent heights by channels, depending upon which protruding heel is engaged in which corresponding channel.

5. A Jacquard rectilinear knitting machine according to claim 3 in which two guiding channels are provided with ramps extending smoothly and continuously from entrance to exit.

6. A Jacquard rectilinear knitting machine according to claim 1 in which a selecting plate carries in its ascending motion a needle jack for lifting a needle in such a way that a heel of said plate is located flush with, mid-way up, or substantially above the upper level of the needle bed, depending on the selected position, and corresponding to one of the three discrete positions assumed by the selection plate.

7. A Jacquard rectilinear knitting machine according to claim 1 in which said selecting plates are displaced, located and maintained in selected position by said floating plates at each of their extremities.

8. A Jacquard rectilinear knitting machine according to claim 1 in which said floating plates controlling the selecting plates are themselves controlled and displaced to a selected position by said electro-magnetic head means.

9. A Jacquard rectilinear knitting machine according to claim 1 in which said floating plates controlled and displaced by electro-magnetic head means are further displaced to their final selected position and maintained in that position by permanent magnets.

10. A Jacquard rectilinear knitting machine according to claim 1 in which said selecting plates are provided at each of their extremities with a substantially round shape engaging a matching round hole provided in said floating plates.

11. A Jacquard rectilinear knitting machine according to claim 1, in which each of said selecting head means is equipped with a relief ramp extending beyond the beginning and beyond the end of the tapered section of said channels.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,717,014 Dated Feb. 20, 1973

Inventor(s) FRITZ KOHLER

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 54, "1 shaped" should read -- L shaped.

Column 4, line 6, "one" should be-on--

Column 5, line 22, after "are" insert provided with protruding heels 15.

Column 5, lines 25 and 26, delete "provided with protruding wheels 15"

Signed and sealed this 17th day of September 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.