July 12, 1966 F. SEILER 3,260,073

PATTERNING MECHANISM FOR JACQUARD CIRCULAR KNITTING MACHINES

Filed Sept. 30, 1963 2 Sheets-Sheet 1

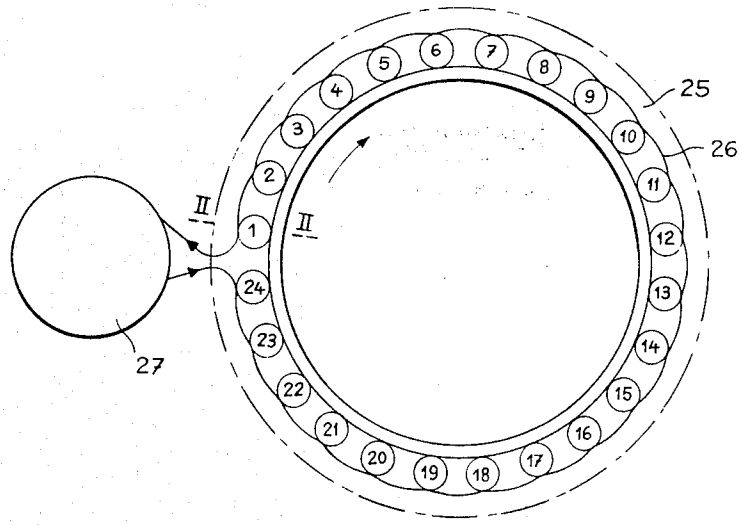


Fig. 1

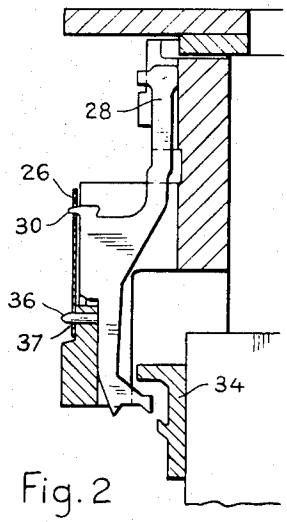


Fig. 2

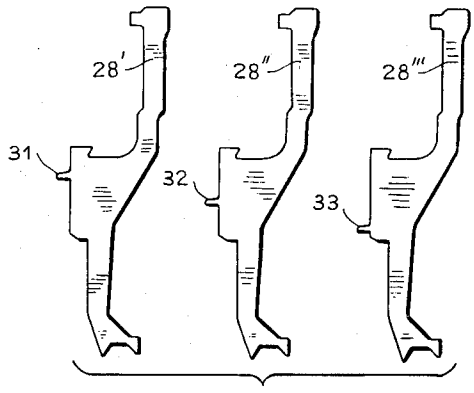


Fig. 3

INVENTOR
FRITZ SEILER
BY Kenyon & Kenyon
ATTORNEYS

July 12, 1966 F. SEILER 3,260,073

PATTERNING MECHANISM FOR JACQUARD CIRCULAR KNITTING MACHINES

Filed Sept. 30, 1963 2 Sheets-Sheet 2

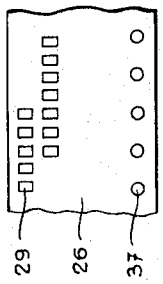


Fig. 4

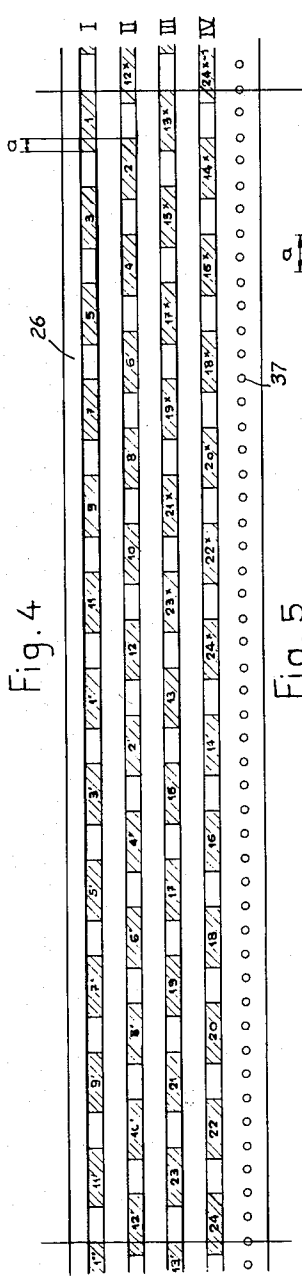


Fig. 5

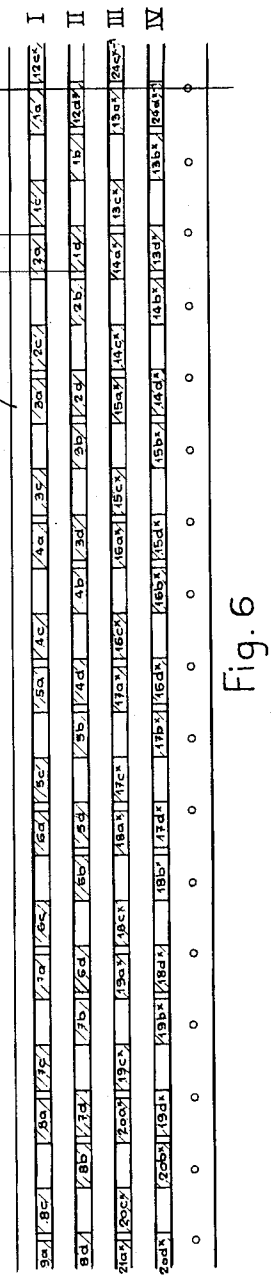


Fig. 6

INVENTOR
FRITZ SEILER
BY
Kenyon & Kenyon
ATTORNEYS

United States Patent Office 3,260,073 Patented July 12, 1966

3,260,073

PATTERNING MECHANISM FOR JACQUARD CIRCULAR KNITTING MACHINES

Fritz Seiler, Corcelles, Neuchatel, Switzerland, assignor to Edouard Dubied et Cie. (Société Anonyme), Couvet, Neuchatel, Switzerland

Filed Sept. 30, 1963, Ser. No. 312,518
Claims priority, application Switzerland, Sept. 28, 1962, 11,463/62
8 Claims. (Cl. 66—50)

The present invention relates to patterning mechanism for Jacquard type circular knitting machines in which the recording means for the pattern is formed by an endless tape.

Patterned knitted fabrics can be manufactured on multi-feed circular knitting machines using various equipment, such as pattern wheels, pattern drums or endless pattern tapes or films. Such devices are arranged either on each of the knitting systems as partial selection and storing mechanism, or as a sole collective selection apparatus which is common to all knitting systems.

Stationary pattern wheels or small drums are preferably arranged on circular knitting machines having rotatable needle cylinders from which they are usually driven by means of a common gear wheel meshing with individual pinions. Such pattern wheels or drums are usually provided for a predetermined invariable pattern and serve first of all for the manufacture of simple displaced or shifted patterns. The possibility of variation of the pattern in such devices is limited, on the one hand by the size of the wheel and consequently by the number of divisions, and on the other hand by the rigidity of the adjusted selection. An electromagnetic selection control of pattern wheels, which was proposed recently, has advantageously enlarged the relatively small pattern limits, inherent in these wheels, without however reaching the practically unlimited range of patterns offered by other selection systems.

The arrangement of known big pattern drums is particularly suitable for circular knitting machines having stationary needle cylinders and revolving cams. The common stationary drum which rotates step by step forms in this case the central control station from which the selection and transmission elements of the different knitting systems which successively pass this station, receive each its respective selection. Such patterning mechanism enable the production of patterns of considerable size, but they are mechanically quite complicated and accordingly expensive and do not allow a rapid and simple change of pattern.

The use of pattern tapes serving as selection carriers on circular knitting machines having rotatable needle cylinders has also been proposed already. These tapes which are preferably endless, are made of tempered band steel, plastic or paper and the like, of high sensible strength. A separate tape may be provided for each knitting system of the machine, and it is possible to effect the selection in each system by a single, common pattern tape.

All these patterning devices of known type tend to realize the greatest possible pattern size with regard to the height and the width of the area, while obtaining the greatest possible production, independently of the gauge of the machine. In the case of patterning wheels or small drums, the limits already mentioned will intervene, while in the case of a big common selection drum the number of holes and of rows of holes arranged one above the other, as well as of the bores on its circumference determine the greatest possible pattern area. Since the dimensions of the drum cannot exceed a certain maximum value for practical reasons, the pattern size is still limited.

Though partial selection mechanism having individual endless Jacquard or pattern tapes (films) allow the manufacture of considerable pattern sizes, they have the disadvantage of reducing the accessibility and the easy handling and operation of the machine, and, in addition they are very expensive.

A single endless pattern tape, also cooperating with partial selecting and storing mechanism, as for example described in British Patents Nos. 591,269 and 744,128, also allows almost unlimited area heights, which are practically only limited by the greatest possible tape or film length which in turn depends on the capacity of the tape storing box.

In all known patterning systems, with the exception of the selection devices using Jacquard pattern cards which are not considered in the present specification, there exist relatively narrow limits for the width of the design which depends, for a given diameter of the machine, on the one hand, on the gauge of the machine and, on the other hand, on the number of knitting systems. The greater is the gauge of the machine for a given number of systems, or the greater is the number of systems for the same gauge, the smaller, relatively spoken, is the width of the design. However, due to aesthetic and fashion reasons, this width should be of a certain minimum dimension, dependent on the gauge. For this reason it is not possible, for greater gauges, to be satisfied with the same width of design, expressed for example in centimeters as for fine gauges.

As applied to pattern devices operating with a single endless tape, the above rule expresses the following: For a given number of knitting systems, for which the maximum will be chosen, taking into account the production of the machine, it is not easily possible to exceed a certain gauge size without creating a conflict between two groups of successive patterns following each other along the same track of the pattern tape. In other words: the length of the tape section between two successive feeding stations, would not allow accommodation of pattern groups of greater extension than those whose end just coincides with the beginning of the next group. If longer pattern groups would be accommodated, there would result a mutual overlapping, which is practically impossible. The following concrete example illustrates this difficulty: On a 30" Jacquard circular knitting machine (diameter 750 mm.) having 24 knitting systems, it has not been possible until now, considering the patterning mechanism, to carry out a coarser gauge than No. 14 (14 needles per inch), if the desired large design width proportioned to the gauge was to be made.

Such a limitation of the gauge was not considered to be inconvenient for a long period of time, because the tendency of fashion required rather fine gauges. However, owing to the growing vogue in recent years of large gauge knitted fabrics, particularly for upper garments, the above mentioned drawbacks and inconveniences of the existing pattern mechanisms have been recognized more and more.

It is an object of the invention to avoid the mentioned limitations of the pattern size, the gauge and the number of feeding stations and to provide a patterning mechanism for Jacquard circular knitting machines, in which a common endless pattern tape effects the selection and positioning of selecting members which are arranged in a series of partial selection and storing devices, and which are adapted to act on the needles or jacks of the machine. According to the invention, the successive groups for recording the pattern on the pattern tape, which are required for reproducing a complete design, are arranged in overlapping relationship along several tracks on the band.

This new arrangement of the pattern tracks allows at the same time the provision of more divisions in one pattern group than there are selecting members in a partial selection device. Furthermore, the pattern groups may have different lengths, or may be differently spaced from each other on the same track.

Multiple track arrangements of pattern groups on a Jacquard tape is known e.g. from U.S.A. Patent No. 2,611,253 but the object to be attained by this known pattern device was quite different, namely to ensure a reliable selection of the selectors. This double track arrangement was a mechanical condition, required by the opposite rotational movement of the needle cylinder and the pattern tape, respectively, absolutely independently of the diameter of the machine, of the gauge and of the number of knitting systems. This double track principle will be found unaltered in this invention, but, as described later, each of the two main tracks is subdivided into two correlated individual tracks.

The accompanying drawings illustrate a preferred example of a patterning mechanism according to the invention.

In the drawings:

FIGURE 1 is a diagrammatic plan view of a circular knitting machine having a series of partial patterning devices and a common endless pattern tape.

FIGURE 2 is a vertical section through one half of a partial pattern device having a selector member and a pattern tape at the place of selection;

FIGURE 3 shows three differently shaped selector mmebers;

FIGURE 4 represents a fragment of a pattern tape;

FIGURE 5 is a diagrammatic representation of a length of pattern tape with recorded pattern groups arranged along several tracks, but continuous on the same track.

FIGURE 6 also shows diagrammatically a length of pattern tape with recorded pattern groups arranged along several tracks, but discontinuous and subdivided on alternate tracks.

Partial patterning devices **1** to **24** (FIG. 1) are fixed on a table plate **25** and uniformly spaced along the circumference of the circular knitting machine. The common endless pattern tape **26** which passes along all partial patterning devices, is rolled on and off in a tape storage box **27** in known manner.

The uniformly spaced partial patterning devices **1** to **24** are formed as pattern wheels, in known manner, having each the same diameter and containing selectors **28** (FIG. 2) which contact the pattern tape **26** at the place of selection.

The pattern tape **26** is provided with apertures **29** punched out in accordance with the design (FIG. 4) and which may be engaged by the projections **30**, **31**, **32** or **33** of the selectors **28** (FIGS. 2 and 3).

A movable driver composed of several parts operates in known manner to lead the selected elements **28** into the appropriate position for actuation of the needles or the jacks of the needle cylinder.

The pins **36** in the pattern wheels coacting with the conveyer holes **37** (FIG. 4) in the pattern tape advance the tape in longitudinal direction, opposite to the direction of circular movement of the cylinder.

The pattern groups in the tape **26** which belong to each pattern wheel **1** to **24** (FIG. 1) are also designated with the same numbers **1** to **24** as the wheels to which they correspond (FIG. 5). The length of one pattern group corresponds generally with the number of selectors in one wheel.

Now, the arrangement of the pattern groups is such that at least two successive pattern groups are alternatively displaced in two tracks so that there is no limitation of their length, distance and number. The pattern group **2** (FIG. 5) is displaced with respect to group **1**, whereby an overlapping "*a*" of apertures is obtained. The pattern group **2**, belonging to the pattern wheel **2**, thus begins to act before the action of pattern group **1** is finished.

Due to the already mentioned principle of opposite movements of the pattern tape and of the needle cylinder, the second half of the pattern groups has to be arranged on further tracks of the tape; these groups also may be displaced one with respect to the other, in the same manner as the pattern groups of the first half. In this manner four parallel superposed tracks of pattern are obtained, which, in reality represent two double tracks.

In order that each of the pattern wheels **1** to **24** can correctly cooperate with its corresponding pattern group, the wheels must be equipped with suitably formed selectors, which are provided with selector projections arranged on different levels. For this reason the pattern wheels **1**, **3**, **5**, **7**, **9** and **11** associated with the track I of the tape, for example, comprise selectors **28** having a projection **30**, the wheels **2**, **4**, **6**, **8**, **10** and **12** associated with the track II comprise selectors **28'** having a projection **31**, the wheels **13**, **15**, **17**, **19**, **21** and **23** associated with the track III comprise selectors **28''** having a projection **32**, and the wheels **14**, **16**, **18**, **20**, **22** and **24** associated with the track IV comprise selectors **28'''** having a projection **33**.

On the diagram of the pattern tape **26** (FIG. 5), the pattern groups **1'** to **24'** correspond to the second revolution of the needle cylinder, and the groups 1^x to 24^x to the last revolution for the execution of a complete Jacquard pattern.

The described arrangement of the pattern groups on the common pattern tape also allows the provision of more apertures for a pattern group than there are selectors in the corresponding pattern wheel.

It is thus possible, for example, to multiply the number of apertures by "*n*" for obtaining a width of the pattern group which is "*n*" times greater, "*n*" being an integer or a fractional number. Also in this case, the limit of enlargement is determined by the meeting of two successive patterns groups on the tape. This possibility is utilized among others when a thread changing device is provided and, for catching the thread at the place of the change, another needle selection shall become effective than that just corresponding with the respective pattern track. In fact, it may happen that the design to be reproduced does not contain any selected needles (in operation), while for a correct insertion of the thread, at least one of them is necessary. In this case, the first part of such an enlarged pattern group produces the special needle selection with at least one thread-seizing needle, whilst the second part selects the proper Jacquard pattern which then can be locked in the pattern wheel.

In another case, pattern wheels of different diameters may cooperate with the common pattern tape, which therefore will be provided with pattern groups of different lengths.

Moreover, it is possible to provide unequally spaced pattern wheels, resulting in pattern groups on the tape which are also unequally spaced.

Generally, each pattern group on the pattern tape is continuously disposed on the same track, i.e. on the same level without subdivisions; consequently each one of the totality of pattern wheels distributed all around the machine, contains only one type of selector.

However, in order to still further extend the use of the pattern tape it is possible to repeatedly subdivide each pattern group and arrange the sections thus obtained along alternate tracks. This obviously requires an appropriate distribution of the different types of selectors in the pattern wheels, so that during the selection procedure of the selectors by means of the tape, i.e. during the time of contact between a section of the divided pattern group and the corresponding section of the wheel, always the correct type of projections **30**, **31**, **32** or **33** will be selected.

As shown in FIGURE 6, each pattern group on pat-

tern tape 26*a* can be subdivided in four sections 1*a*, 1*b*, 1*c*, 1*d* or 2*a*, 2*b*, 2*c*, 2*d*, and so on, which will be arranged on different tracks in the tape, in zigzag disposition. In the illustrated example, the sections 1*a* and 1*c* of pattern group I are on the track I, the sections 1*b* and 1*d* on the track II, the sections 2*a* and 2*c* on the track I, and the sections 2*b* and 2*d* on the track II, and so on.

Consequently, the pattern wheels 1 to 12 cooperating with the tracks I and II, must be equipped with selectors in such manner that in each wheel the first and the third section of its circumference extending angularly each over one quarter of a circle, comprises selectors 28 having projections 30, and the second and fourth sections comprise selectors 28′ with projections 31. On the other hand, the wheels 13 and 24 which cooperate with the tracks III and IV, are equipped in analogous manner, i.e. the sections one and three have selectors 28″ with projections 32, and the sections two and four have selectors 28‴ with projections 33.

The subdivision of each pattern group in four sections is herein described and illustrated by way of example. Other subdivisions, however, are possible, such as 3/3, 5/5 or 6/6, and so on; it is clear that a corresponding subdivision of the pattern wheels has to be provided.

In the described embodiment, the pattern tape has been shown as comprising two double tracks, i.e. a total of four parallel superposed recording tracks. It is obvious that the number of double rows may be increased, which obviously requires to correspondingly adapt the number and gradation of the projections of the selectors 28, 28′, 28″ and 28‴.

I claim:

1. A patterning mechanism for Jacquard circular knitting machines comprising a common endless pattern band, selector means including a series of partial selection and storage devices each such device being in the form of a selection wheel, knitting elements which said wheels control, said band having at least four superposed tracks, partial pattern groups on respective tracks, the partial pattern groups of said tracks being disposed in overlapping relationship with the groups of one pair of said tracks controlling odd numbered selector means, and the groups on a second pair of tracks controlling even numbered selector means, and said partial pattern groups providing a complete pattern.

2. A patterning mechanism according to claim 1, in which any of the pattern groups in the said band may comprise more subdivisions than there are selector means in a partial patterning device.

3. A patterning mechanism for Jacquard circular knitting machines in which a common endless pattern band effects the selection and positioning of selecting members which latter are arranged in a series of partial selection and storing devices which are adapted to act on the needle jacks of the machine, said pattern band comprising successive pattern groups for recording the pattern thereon which are required for reproducing a complete design, said groups being arranged in overlapping relationship along a plurality of tracks on said band and said selecting members having projections engageable in respective of the pattern groups, with projections of chosen selectors at a level to engage only in pattern groups of a track at one level, projections of other chosen selectors at a level to engage only in pattern groups of a track at yet another level, projections of still other chosen selectors at yet another level to engage only in pattern groups of a track at still a different level and projections of further chosen selectors at a still different level to engage only in pattern groups of a further track at yet another level.

4. A patterning mechanism according to claim 3 wherein any of said pattern groups are arranged in more subdivisions than there are selectors in a partial selection and storing device.

5. A patterning mechanism according to claim 3 in which various of said pattern groups have differing lengths.

6. A patterning device according to claim 3 in which the pattern groups on the same track are differently spaced from each other.

7. A patterning mechanism according to claim 3 in which each pattern group is subdivided into sections disposed on alternate tracks in zig-zag manner.

8. A patterning mechanism for Jacquard circular knitting machines in which a common endless pattern band effects the selection and positioning of selecting members which latter are arranged in a series of partial selection and storing devices which are adapted to act on the needle jacks of the machine, said pattern band comprising successive pattern groups for recording the pattern thereon which are required for reproducing a complete design, said pattern groups being arranged in overlapping relationship along a plurality of tracks at different levels on said band, each of said partial selecting and storing devices including a plurality of selectors and each selector having a projection so disposed as to be engageable in a pattern group of a track at one level only, a selected number of the partial selection and storing devices being adapted to cooperate only with pattern groups in tracks at first and second levels, with projections of chosen of the selectors of said selected number of partial selection and storing devices disposed to engage only in pattern groups in the first of said track levels and with projections of other chosen of the selectors of said selected number of partial selection and storing devices disposed to engage only in pattern groups in the second of said track levels, and a second selected number of the partial selection and storing devices being adapted to cooperate only with pattern groups in tracks at third and fourth levels with projections of chosen of the selectors of said second selected number of partial selection and storing devices disposed to engage only in pattern groups in the third of said track levels and with selectors of other chosen of the selectors of said second selected number of the partial selection and storing devices disposed to engage only in pattern groups in the fourth of said track levels.

References Cited by the Examiner

UNITED STATES PATENTS

2,611,253	6/1947	Diem	66—50
3,079,775	3/1963	Schaeder et al.	66—156
3,167,937	2/1965	Carroll	66—50

FOREIGN PATENTS

697,886	11/1930	France.

DONALD W. PARKER, *Primary Examiner.*

R. FELDBAUM, *Assistant Examiner.*