United States Patent [19]

Takigawa et al.

[54] **ELECTRONIC PATTERNING PROCESS FOR A KNITTING MACHINE**

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[51] **Int. Cl.²**... **D04B 15/78**
[58] **Field of Search** .... 66/50 R, 75, 25; 310/80

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[57] **ABSTRACT**

A knitting machine provided with electronic patterning processing. Information for different patterns is memorised by a memory storage means in binary digit or other form. In time with knitting action of individually operable knitting needles the pattern information is distributed for each pattern knitted for selective needle actuation. A stepping motor is used for such actuation as an electro-mechanical transducer in the patterning units of the knitting machine. The mechanical patterning unit may be used for the knitting of simple patterns and the electronic patterning unit for the knitting of more complex patterns or both units may be used simultaniously.
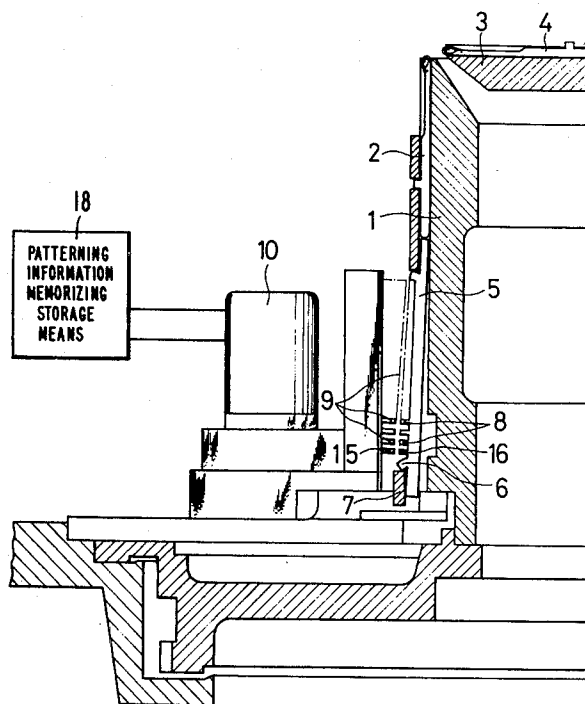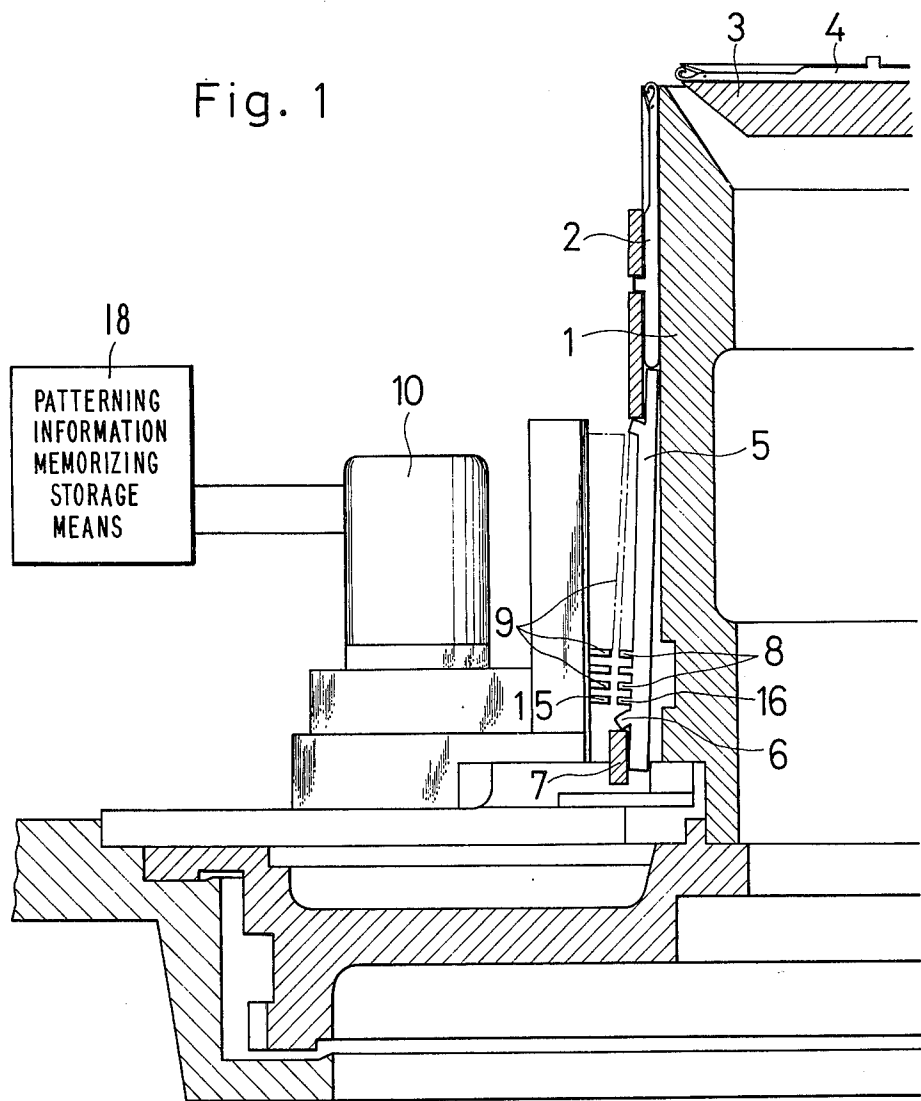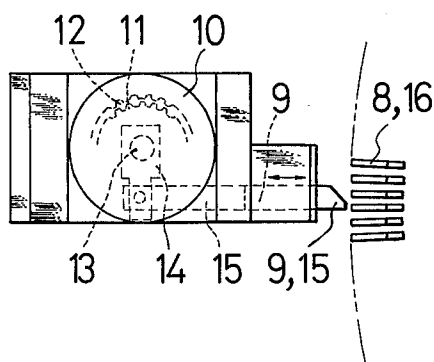
1 Claim, 3 Drawing Figures

Fig. 1

18

PATTERNING
INFORMATION
MEMORIZING
STORAGE
MEANS

Fig. 2

12 11 10

13 14 15 9,15

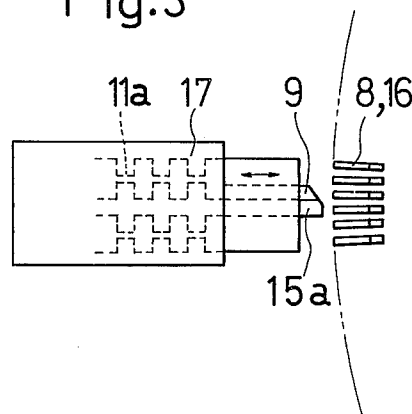8,16

Fig.3

11a 17   9 8,16

15a

ELECTRONIC PATTERNING PROCESS FOR A KNITTING MACHINE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a knitting machine provided with electronic patterning processes in which pattern information is signaled and distributed electronically to each patterning unit.

2. Description of the Prior Art

In machines of this type, it is conventionally known that extraordinairly large pattern areas and quicker pattern changing are available in comparison with ordinary mechanical knitting machines. Pattern signals represented by binary digits or other representations and patterning performed electronically by such pattern signals is also known.

The most difficult point in a machine of this type is a needle selecting unit, eg. in case of a circular knitting machine provided with an 18 gauged 30 inches diameter cylinder revolving at 20 RPM., each patterning unit may require 600 responses per second for the needle selecting of pattern knitting. If the conventional fulcrumed selector method is employed in such an electrically controlled circular knitting machine, a selector which is accomodated in a groove of the cylinder, has to be pushed into the groove with a pressure of 120 grams and has a stroke of 3 millimeters, so that to utilize this method is extremery difficult without employing a special electromechanical transducer.

SUMMARY OF THE INVENTION

The invention is aimed to resolve such aforementioned difficulty by providing a patterning unit including a stepping motor for the electrically controlled knitting machine which performes reliable needle selection with patterning mechanism similar to that of the ordinary mechanical knitting machine.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a vertical sectional view of an embodiment of the invention.

FIG. 2 is a fragmentary plain view of FIG. 1.

FIG. 3 is a fragmentary plain view of another embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1 and FIG. 2, 1 is a revolving cylinder formed with axially extending grooves on the peripheral surface. Individually slidable latch needles 2 are shown sliding in the axial direction of the cylinder in the grooves. 3 is a revolving dial formed with radial extending grooves and individually slidable latch needles 4 in the grooves. 5 is a selector jack. A jack raising cam 7 in a cam box elevates the selector jack by its knitting butt 6 so that the cylinder needle 2 which is accomodated above the selector jack in the same groove is raised into the knitting position.

The aforementioned patterning mechanism comprising needles and selector jack in a cylinder is completely the same as known mechanical circular knitting machines.

8 is a patterning butt of the selector jack 5. The several kinds of stepped patterning butt of the selector jack are operated by manually patterned selector levers

9 for the known mechanical needle selection. 10 is a stepping motor (a pulse motor). The selector lever extends substantially perpendicularly to the crank arm and spindle. When a salient pole of stator 11 in the stepping motor is magnetized by an electronic pulse being input from a computer memory bank such as the patterning information memorizing storage means 18 or other memory storages having preprogramed pattern information, a rotor 12 of the stepping motor rotates either in a clockwise or counterclockwise direction with a certain fixed angle which is decided by the number of the salient motor poles. 13 is a spindle of the rotor perpendicularly 12 to which a crank arm 14 is fixed. The crank arm moves a selector lever 15 which has a beveled outer edge and is pivoted on the crank arm, in the direction of the arrow as shown in the drawing. When the selector lever 15 protrudes, an operating butt 16 of the selector jack is pushed into the groove so that the knitting butt of the selector jack will miss the jack raising cam 7, and the cylinder needle will remain in the nonknitting position.

FIG. 3 is an embodiment of a linear stepping motor 17 being used for the patterning unit. A slider 15a of the linear stepping motor 17 being used for the patterning unit.

A slider 15a of the linear stepping motor is used instead of the selector lever directly for the needle selection. The slider 15a is operated in the direction of the arrow illustrated on FIG. 3 by means of the magnetization of the salient pole of stator 11a which is magnetized by pulsed pattern signals from the computer memory bank or other memory storage. The slider 15a pushes the operating butt 16 of the selector jack 5 to prevent the cylinder needle from being raised into the knitting position. Thus the linear stepping motor can control directly the patterning of the knitting machine.

In the embodiment of FIG. 1 forementioned, the electronic patterning units having the selector lever 15 of the stepping motor and a mechanical patterning unit having the ordinary selector levers 9 are set on the same machine.

Not only can both of two units can be operated simultaneously but also the electronic patterning unit can be operated and the mechanical unit can be canceled, and vice versa when a small pattern is required.

As formentioned, the invention is based on the using of the stepping motor as an electromechanical transducer so that the special selector which is being used in the conventional electro-magnetic controled circular knitting machine is not required. Thus the patterning mechanism including the stepping motor can be set on the conventional mechanical knitting machine. Therefore special high expense is not demanded on the cost of the machine.

Moreover the stepping motor can control at extremely high speed and can provide high response so that the knitting machine can run at comparatively high speed.

In spite of such high speed running of the machine, the stepping motor accurately actuates so that reliable needle selection for patterning can be obtained. The invention is based on the combination of the electronic patterning unit including the stepping motor and the ordinary mechanical patterning unit, in order to save complex works which are made as all kind of patterning can be carried out by the electronic patterning unit. The mechanical patterning unit is employed when small or simple patterns are be required. For big and

complex patterns the electronic patterning unit is employed.

Thus the pattern preparation for the mechanical patterning unit requires less time and complexity than the ordinary mechanical machines, and moreover the patterning unit of the invention is able to be the merits of both electronic and mechanical patterning units.

We claim:

1. A circular knitting machine comprising a rotatable cylinder having a plurality of longitudinally extending circumferential grooves therein, latch needles positioned in said grooves adjacent the top of the cylinder, selector jacks positioned in the grooves at the bottom of said cylinder each having patterning butts, an operating butt and a knitting butt thereon with the knitting butt being in engagement with the latch needles whereby on raising each of the individual selector jacks the individual latch needle associated therewith will be raised into a knitting position, cam means positioned adjacent the selector jacks engageable with the knitting butts of the selector jacks for moving the selector jacks up on rotation of the cylinder in accordance with the configuration of the cam means, and structure for electronic patterning processing including storage means for memorizing pattern information, a rotary stepping motor responsive to the storage means in accordance with the pattern memorized for bi-directional rotation in two angular directions a predetermined amount, a spindle secured to the rotary stepping motor for rotation into and out of the two angular directions in accordance with actuation of the stepping motor, a crank arm secured to the spindle extending perpendicular to

the spindle and a selector lever extending substantially perpendicularly to the crank arm and spindle and radially of the cylinder pivotally secured at one end to the crank arm for rotation about a fixed pivot axis with respect to the crank arm, the other end of which is positioned adjacent the operating butts of the selector jacks on rotation of the cylinder, said other end having a beveled edge for engagement with the operating butts of individual selector jacks as they rotate toward the selector lever whereby on actuation of the rotary stepping motor to turn the crank arm through a predetermined arc toward the cylinder the selector lever is moved toward the cylinder to sequentially engage the operating butts of selector jacks moved past the selector lever whereby the selector jacks are pivoted toward the cylinder to prevent engagement of the knitting butts with the cam means and thus prevent movement of the selector jacks and latch needles into a knitting position and a plurality of manually patterned additional selector levers positioned radially outward from and adjacent the cylinder which are adapted to engage the patterning butts of the selector jacks to selectively cause the selector jacks to pivot inwardly of the cylinder and prevent movement of the latch needles into a knitting position in accordance with the manual patterning of the additional selector levers whereby both manual and electronic patterning to produce actuation of the selector jacks is possible simultaneously to improve the patterning possibilities of the knitting machine.

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