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(54) Selector of bimorphous piezoelectric cell type for needles of textile machine.

(57) A selector for use in textile machines, in particular for forming hosiery and knitwork and comprising a series of needles (1) disposed peripherally on a rotary drum (2) or on a fixed bed and arranged, when selected, to intercept textile yarns in order to obtain an article with particular patterns and/or colours. The selector comprises a bimorphous piezoelectric cell (8) of known type clamped at one end (12) between support elements of insulating material and carrying at its free end an arm (17) operating on an oscillating cam (21) which, following the passage of current within said piezoelectric cell (8) and its consequent deflection, acts on said needles (1) to cause their selection and/or deselection and obtain the particular pattern and/or colour required on the finished fabric.

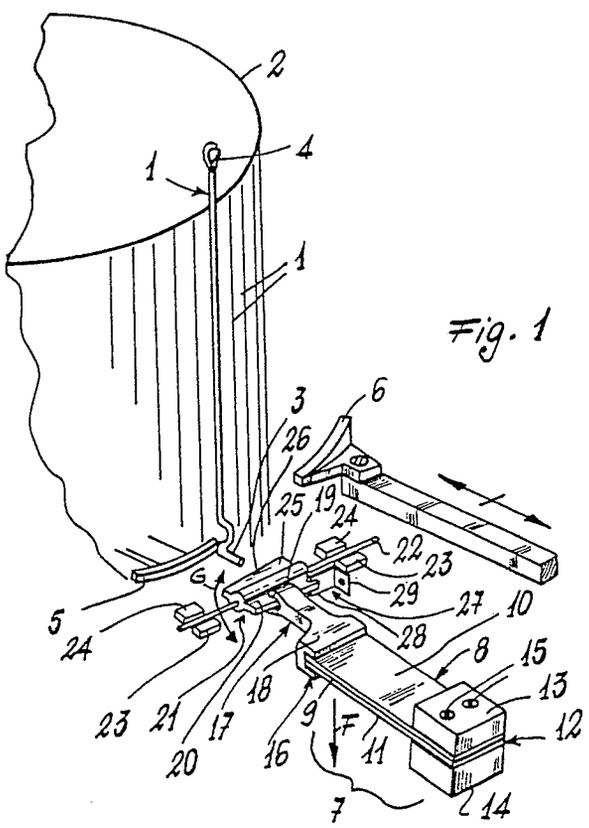

Fig. 1

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SELECTOR OF BIMORPHOUS PIEZOELECTRIC CELL TYPE FOR NEEDLES OF TEXTILE MACHINES

This invention relates to a needle selector for textile machines, in particular for machines used for forming hosiery and knitwear.

Various machines of the aforesaid types are known. For example, linear knitting machines are known, the essential part of which is a carriage driven with reciprocating motion and carrying electromagnets to upwardly or downwardly urge bars which engage the butts of needles lying in a fixed bed facing the carriage. These bars are moved by the action of oscillating cams which cause the bars to rise, and with them the needles so that they grip the yarn.

Another example of the aforesaid type of machine comprises a series of needles disposed peripherally on a rotary drum and arranged to intercept in known manner the appropriate textile yarns which are carried by known members positioned in the vicinity of said drum. To produce this interception, the needles are moved to a variable height in predetermined sequence to cooperate with the appropriate yarns and thus obtain the required patterns with different stitches and/or colours.

The needles are moved by a system of cams which act consecutively on the ends of said needles to lift them and so enable a pointed part carried by each needle to intercept the yarns. To allow selection of the required needles for a particular pattern, a selector device is provided which acts on said ends to prevent the cams operating on those needles which are not required for the chosen pattern, such needles therefore not undergoing any vertical movement.

The selector device or more simply selector consists substantially of an oscillating cam of ferrous material pivoted on a pivot and having at the end facing the needle ends or butts a face inclined at a certain angle so that an angular movement of the cam causes the butt to touch the inclined face and become urged inwards so as not to be subjected to the action of the previously stated lifting cams. When a butt is to be exposed to the action of the lifting cams the oscillating cam is moved upwards or downwards so that the butt does not touch said inclined face. The angular movement of the cam is obtained by electromagnets which when powered by an electric current act on said oscillating cam (moved by an arm pivoted to the centre of the two electromagnets) to cause it to rotate.

As a result of this rotation said inclined face is raised and the needle butt which in that moment is lying in front of said inclined face is made to retract towards the drum to prevent the needle being subjected to the action of said lifting cams.

However, such a selector device has various drawbacks including the fact that the operating time of the device is usually relatively high (greater than 6 milliseconds). To increase its speed high starting currents can be fed to the electromagnets, but this results in considerable heating of the electromagnets, which is an obvious disadvantage.

A further drawback is that in a selector of the said construction the oscillating cam can have only two working positions. Moreover there is the possibility that any metal residues produced by the rubbing of the butts against the inclined surface can be attracted by the electromagnets, so falsifying their operation.

An object of the present invention is therefore to provide a selector device for the needles of textile machines of the aforesaid type which obviates the problems connected with known selectors.

This and further objects which will be apparent to an expert of the art are attained by a selector for use in textile machines, in particular for forming hosiery and knitwork and comprising a series of needles disposed peripherally on a rotary drum or on a fixed bed and arranged, when selected, to intercept textile yarns in order to obtain particular patterns and/or colours, characterised by comprising a bimorphous piezoelectric cell of known type clamped at one end between support elements of insulating material and carrying at its free end an arm operating on an oscillating cam which, following the passage of current within said piezoelectric cell and its consequent deflection, acts on said needles to cause their selection and/or deselection to obtain the particular pattern and/or colour required on the finished fabric.

The present invention will be more apparent from the accompanying drawing which is given by way of non-limiting example and in which:

Figure 1 is a diagrammatic perspective view of one example of application of a selector of the present invention to a textile machine of the rotary drum type;

Figure 2 is a diagrammatic view of a second embodiment of the selector of Figure 1 applied to a linear knitting machine.

With reference to said figures, Figure 1 shows diagrammatically a hosiery and knitwork machine comprising a series of needles 1 disposed peripherally on a rotary drum 2 and having at one end a butt 3 and at their other end a gripper member 4 for the yarns (not shown) which are carried in known manner by a member (also not shown) positioned in proximity to the drum 2.

In proximity to the drum 2 there are provided a

first and second cam 5, 6 of known type, disposed in any known manner consecutively in the direction of rotation of said drum. Specifically, the first cam 5 withdraws from the drum 2 all the needles 1 without distinction when the butt 3 of these latter slides along said cam 5. The butts 3 which are thus moved outwards for each revolution of the drum 2 are then brought, by the rotation of this latter, into correspondence with the second cam 6 which acts on said butts to raise the needles 1 to the scheduled height at which the gripper member 4 of said needles hooks the textile yarns.

To obtain an article with particular patterns and/or colours, between the cams 5 and 6 there is provided a selector 7 which, as explained hereinafter, causes the butts 3 of those needles 1 which are not to be used for the particular pattern and/or colour to retract towards the drum 2.

The selector 7 according to the present invention incorporates a bimorphous piezoelectric cell 8 comprising a ceramic bar 9 carrying two current conductors 10 and 11, upperly and lowerly respectively.

One end 12 of the cell 8 is inserted between two blocks 13 and 14 of insulating material which are secured to the cell for example by screws 15. Said blocks 13 and 14 act as the support for the cell 8 and are fixed in any known manner (not shown) to a part of the textile machine concerned.

On that end 16 of the cell 8 distant from the end 12 clamped between the blocks 13 and 14, there is mounted an arm 17 comprising for this purpose a fork-shaped end 18. Said arm 17 has that end 19 distant from the end 18 also fork-shaped and cooperating with a fin 20 of an oscillating cam 21 mounted on a shaft 22 supported by members 23 and 24 fixed onto the textile machines. Said cam also comprises a further fin 25 opposite the fin 20 about the shaft 22 and having an inclined face 26 facing the butts 3 of the needles 1.

Finally, there is provided a stop member 27, the function of which is described hereinafter and which has a fork-shaped free end 28 acting on the fin 20 of the oscillating cam 21 and its other end 29 fixed to the textile machine.

As stated, the purpose of the selector 7 is to cause the butts 3 of those needles 1 which are not to be used for the required pattern and/or colour on the finished fabric, and must therefore not cooperate with the cams 5 and 6 and be raised by the second cam 6, to retract towards the rotary drum 2.

This is done by feeding current to the conductor 10 so that the bimorphous piezoelectric cell 8 deflects in known manner (arrow F of Figure 1). As a result of this, the arm 17 acts by its end 19 on the fin 21 of the cam 20 to rotate said cam 21 (arrow G of Figure 1) so that the inclined face 26 of the fin 25 moves to the level of the butt 3 of the needle 1 which at that given moment is in front of the selector 7. This movement of the cell 8 plus the subsequent movement of the oscillating cam 21 causes the butt 3 of said needle 1 to retract towards the rotary drum 2 to prevent said butt 3 cooperating with the second cam 6. If voltage is now removed from the conductor 10 the bimorphous cell 8 returns to its rest position to move the cam 21 outside the range of the butt 3 of the needle 1.

In addition, to prevent excessive deflection of the bimorphous piezoelectric cell 8, the fin 20 of the oscillating cam 21 is associated with the stop member which acts by its free end 28 on said fin 20 to limit the rotation of said cam and thus limit the movement of the arm 17 and bimorphous cell 8.

Figure 2 shows the selector 7 applied to a different known textile machine of linear type. In this figure parts identical to those described in Figure 1 are indicated by the same reference numerals.

The use of the selector on said linear machine is similar to that heretofore described. In this case however, the fin 25 of the oscillating cam 21 cooperates with a recess 30 in a bar 31 slidable between fixed guides 32 and having one end 33 substantially of C-shape into which a projecting part 34 of the needle 1 is inserted. With this embodiment, deflection of the bimorphous cell 8 (arrow W) causes the cam 21 to rotate about the shaft 22 (arrow Z) to thus pull the bar 31 upwards (arrow X) with consequent raising of the needle 1.

Likewise, on removing voltage from the conductor 10 the cam 21 returns to its rest position and the needle 1 returns downwards.

The response of the piezoelectric ceramics used in the selector 7 of the present invention is from 2 to 4 times faster than the response of actuators comprising electromagnets, where response signifies the time between the giving of the command and the obtaining of the movement.

This increased speed means that the drum can be theoretically rotated 2 to 4 times faster with consequently increased machine production, which depends directly on the drum speed. If the drum speed cannot be increased because of limitations posed by other machine members, the greater operating speed of the oscillating cam 21 enables the number of selectors to be reduced by making the same selector operate several needles successively.

The force which the ceramic bars can exert by virtue of their deflection is of the order of only a few grams, and therefore two or more bars 9 can be superposed on each other.

The proposed arrangement does not produce

heat because the ceramics remain cold, and in addition are not affected by vibration or metal residues arising from contact between the fin 25 and the butts 3 of the needles 1. In addition, by varying the applied voltage the angular displacement obtained can be used in programming the radial movement of the butts. For this purpose a microprocessor can be provided to control the operation of the selector.

Claims

1. A selector for use in textile machines, in particular for forming hosiery and knitwork and comprising a series of needles (1) disposed peripherally on a rotary drum (2) or on a fixed bed and arranged, when selected, to intercept textile yarns in order to obtain an article with particular patterns and/or colours, characterised by comprising a bimorphous piezoelectric cell (8) of known type clamped at one end (12) between support elements (13, 14) of insulating material and carrying at its free end (16) an arm (17) operating on an oscillating cam (21) which, following the passage of current within said piezoelectric cell (8) and its consequent deflection, acts on said needles (1) to cause their selection and/or deselection and obtain a particular pattern and/or colour required on the finished fabric.

2. A selector as claimed in claim 1, characterised in that the bimorphous piezoelectric cell comprises at least one pair of ceramic bars (9) to which current conductors (10, 11) are upperly and lowerly applied.

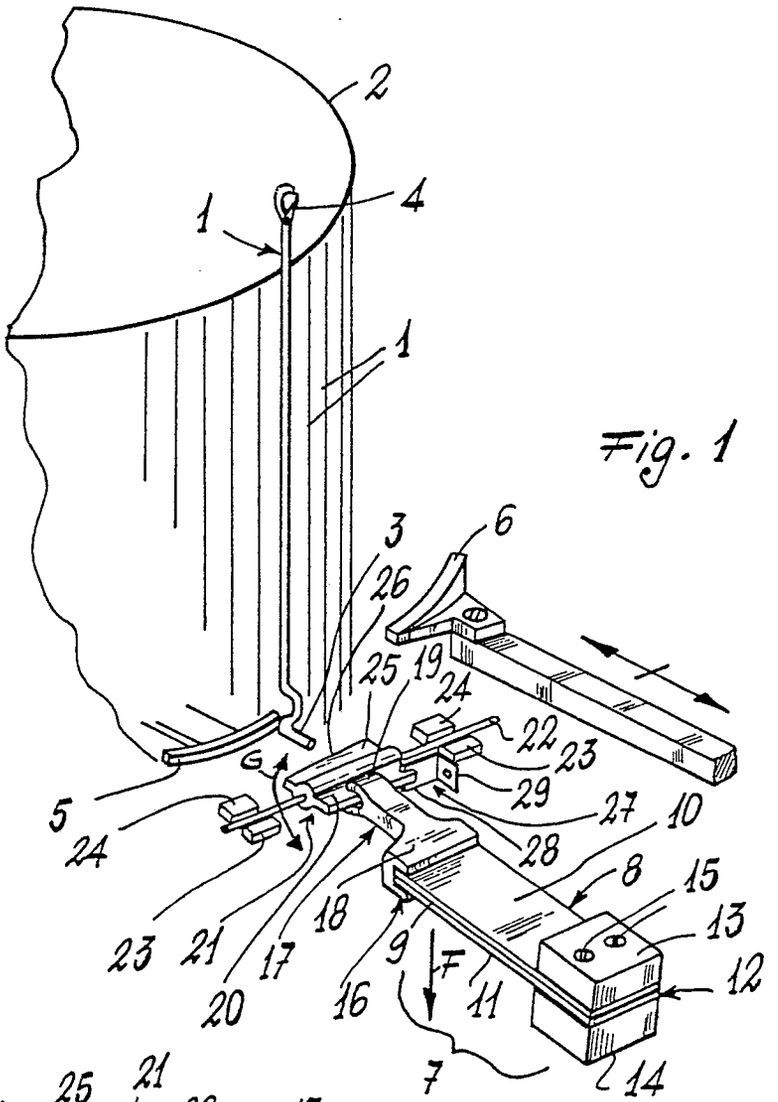
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Fig. 1

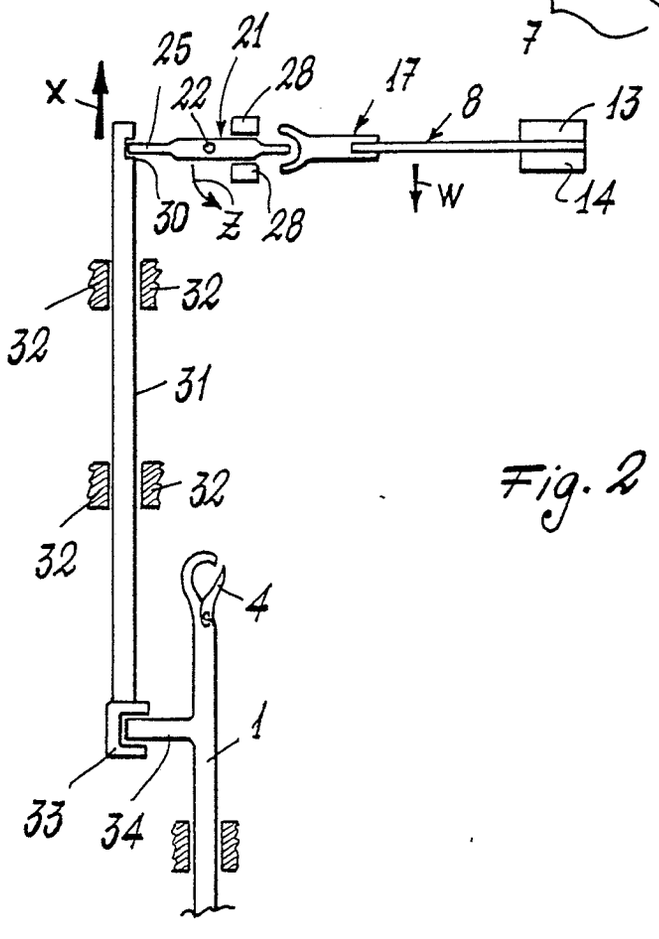
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Fig. 2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 89 10 2929

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	EP-A-0210790 (WATANABE KUTSUSHITA KOGYO CO. LTD.) * column 9, line 17 - column 11, line 36; figures 1-12 *	1, 2	D04B15/78
A	US-A-3995451 (VINNEMANN)		
A	EP-A-0235068 (JUMBERCA S.A.)		
A	EP-A-0219029 (LONATI S.P.A.)		

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

D04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	21 JUNE 1989	VAN GELDER P.A.

CATEGORY OF CITED DOCUMENTS

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