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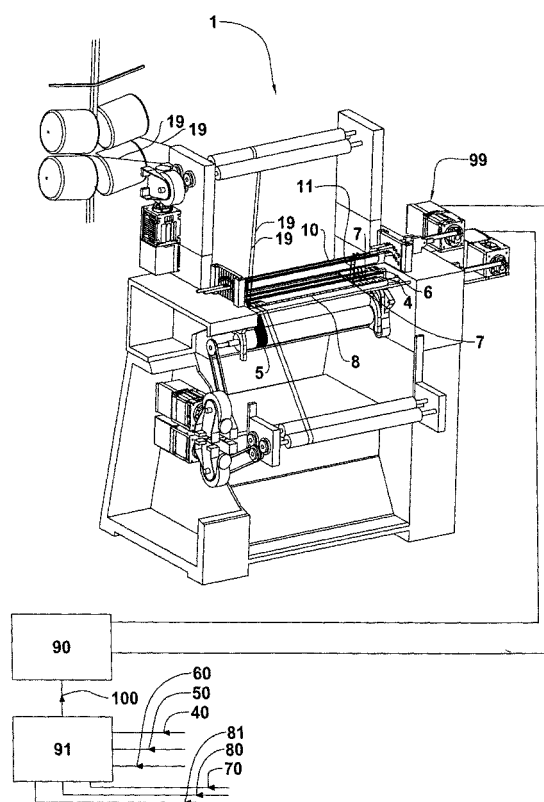
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(54) Control method for textile machines

(57) A control method for textile machines, in particular crocheting machines, comprises the steps of selecting in a memory (30), depending on a first selection command (60), first base parameters (PB1) associated with a first weft movement, and processing the first base parameters (PB1), based on a first application parameter representative of a starting position of the first weft movement, thereby obtaining corresponding first final parameters (PF1). The method further comprises outputting a signal (100) incorporating at least the first final parameters (PF1) and designed to a controller of a textile machine (1) for the controlled movement of a weft bar (10) depending on the first final parameters (PF1).

FIG.1



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Description

[0001] The present invention relates to a control method for textile machines, and in particular crocheting machines.

[0002] It is known that crocheting machines are provided with a plurality of knitting members (needle bars, guide bars, carrier slide bars) cooperating in a synchronised manner to interlace the weft and warp yarns with each other and obtain a fabric.

[0003] By suitably adjusting movement of the weft bars, decorations and ornamental designs within the textile product being made can be obtained; in particular, by the weft yarns driven in such a manner as to carry out particular displacement successions (the so-called "figure eight bars" or "turn eight bars" and "supplementary-warp guide bars" (hereinafter referred to as "bpos", from the Italian acronym), together with use of an auxiliary device called "piker/R", it is possible to obtain such effects as eyelets, arcs, etc., to improve the aesthetical quality of the product.

[0004] Bars of the "figure eight" or "bpos" type differ from the other weft bars for two main reasons: within each individual weft movement, each bar can take two different positions, and the "figure eight" and "bpos" weft bars are driven both in translation in a direction parallel to their longitudinal extension and in rotation around their longitudinal axis.

[0005] Therefore, the numeric chain that is inputted to the actuator causing the bar movements will have two distinct values for each weft row; these values can be the same, if the bar keeps its position within this weft row constant, or they can be different from each other if said "figure eight bar" or "bpos" bar takes two different positions within the same row.

[0006] Presently, the numeric chains to be supplied to actuators to define the movements of the "figure eight" and "bpos" bars are manually inserted by the operators in charge that, after conceiving the particular pattern to be made in the fabric, deduce the corresponding numeric chains therefrom and input them to the machine.

[0007] Obviously, such a procedure has many operating drawbacks. First of all, obtaining the different command parameters in a substantially manual manner calls for very high processing times for the operators that, for each weft row, must recognise the typology and amount of the displacement of each bar and produce the corresponding numeric-chain rows.

[0008] In addition, it is apparent that an operation carried out manually can be prone to errors and inaccuracies, which will clearly bring about inexactitudes in the calculated parameters and poor quality of the obtained fabric.

[0009] Accordingly, it is an aim of the present invention to make available a control method for textile machines, in particular for crocheting machines, capable of automatically obtaining command parameters for "figure eight" and/or "bpos" bars starting from a graphic rep-

resentation in electronic format of the fabric that is wished to be obtained.

[0010] In more detail, it is an aim of the present invention to provide a control method for textile machines that is able to recognise, starting from a pattern made with the aid of a mouse, an optical pen or similar device, the individual movements that the "figure eight" or "bpos" bar must carry out.

[0011] The foregoing and further aims are substantially achieved by the control method for textile machines in accordance with the features recited in the appended claims. Further features and advantages will become more apparent from the detailed description of a preferred but not exclusive embodiment of the control method for textile machines in accordance with the present invention. This description will be set out hereinafter with reference to the accompanying drawings, given by way of non-limiting example, in which:

- Fig. 1 shows a textile machine for carrying out the method in accordance with the present invention;
- Fig. 2 shows a pattern design and a diagrammatic representation of some knitting members employed in the method of the invention;
- Figs. 3a, 3b and 4 diagrammatically show the contents of a memory associated with the textile machine in Fig. 1;
- Figs. 5a, 5b, 5c, 6a, 6b diagrammatically show some steps of the method in accordance with the invention.

[0012] With reference to the drawings, a textile machine to which the method of the present invention is applied has been generally identified by reference numeral 1.

[0013] Such a textile machine, preferably a crocheting machine, is provided with a needle bar 6, on which a plurality of needles 7 is mounted, a guide bar 8 carrying a plurality of eye-pointed needles 9, and a carrier slide bar 10 (also referred to a weft bar), on which at least one threading tube 11 is mounted.

[0014] Said bars cooperate with each other, in known manner, following predetermined synchronised movements, to manufacture a textile product 5.

[0015] A controller 90 supervises operation of machine 1 and, in particular, it is active on an electromechanical actuator 99 carrying out movement of the weft bar 10 depending on the command signals received by said controller 90.

[0016] Structure and operation of a textile machine of the crocheting type is described in detail in patents EP0708190, EP0684331 and EP1013812.

[0017] In particular, the method in accordance with the present invention is addressed to movement control of the weft bar 10 of the "figure eight" type (also referred to as "turn eight" bar) or of the "supplementary-warp guide bar" type (called as stated even if they are practically made as weft bars); for the sake of simplicity, as

already said, the latter will be herein referred to as "bpos".

[0018] These bars can take within each weft row of said textile product, two distinct positions; these positions are identified by respective operating parameters to be better described in the following.

[0019] In addition, for obtaining particular geometries and ornaments in the fabric, the machine 1 further has a retaining device (that can be a "piker" or a "piker/R") having the task of retaining the weft yarn 19 to pre-

etermined positions while the threading tube 11 is carrying out its movements.

[0020] Therefore, for each weft row, the machine 1 will need at least two parameters for defining the threading tube 11 movement and possibly an additional parameter for regulating movement of the piker or piker/R.

[0021] Said command parameters for the carrier slide bar 10 are obtained, in accordance with the invention, through use of an electronic computer capable of receiving as input the information necessary for defining the geometries of the desired textile product and correspondingly outputting the numeric chain to be supplied to the controller supervising operation of the actuators present in machine 1.

[0022] In more detail, a memory 30 (generally of the optical or electronic type) is first set, in which suitable parameters for each possible movement of the threading tube 11 are stored.

[0023] It is to be pointed out in fact that the movements that tube 11 can carry out are limited and for each of them, memory 30 holds at least one pair of parameters adapted to identify the starting and final positions corresponding to such a movement.

[0024] In the present context by "weft movement" it is intended a trajectory defined on one or more weft rows and travelled over by a tube 11 to obtain a specific geometry on the fabric to be made.

[0025] Figs. 3a, 3b and 4 show how to each movement corresponding base parameters PB are associated.

[0026] As will be more apparent in the following, said base parameters PB will be suitably processed to obtain corresponding final parameters PF, for the machine 1 and, in particular, for controller 90, so that actuator 99 connected with the weft bar 10 shall impose the desired movement to the latter.

[0027] In order to output said final parameters PF, a graphic representation is arranged, preferably in an electronic format, of a pattern design 20 (Fig. 2) on which the fabric that is wished to be obtained is drawn.

[0028] The pattern design 20 is defined by an orderly succession of rows 20a, each representative of a corresponding weft row, and by a succession of columns 20b; each column 20b is delimited by two needle positions 21 adjacent to each other. In other words, the needle bar 6 is set to support a plurality of needles 7 and is therefore provided with a predetermined number of seats for housing said needles 7; each seat identifies a

"needle position" 21; practically, for operation of the machine 1, some seats can be left free whereas others are filled with a respective needle 7.

[0029] Irrespective of whether they are filled with a needle 7 or not, each pair of needle positions 21 adjacent to each other delimits a column 20b of said pattern design 20.

[0030] The distance between two needle positions 21 is further employed as a measure unit for displacements and distances to be better described in the following.

[0031] Preferably rows 20a in the pattern design 20 are put in order (by associating a progressive number with each of them, for example) from a lower end to an upper end of the pattern design 20, and likewise columns 20b are put in order (again by means of a progressive numbering) from a side end to the opposite side end.

[0032] In order to identify the true position of needles 7 in the machine 1, a first positioning signal 40 is received which incorporates a predetermined number of main parameters 41; each of these parameters identifies, in the pattern design 20, a respective position of a corresponding needle 7; practically, the user, through use of a mouse and the respective buttons, or a similar device, indicates the position of each needle 7 of the machine 1 on a screen associated with the electronic computer 91.

[0033] A second positioning signal 50 is also received that contains an auxiliary positioning parameter 51; the latter identifies the position of the threading tube 11 within the pattern design 20.

[0034] Practically, in a manner quite similar to that described with reference to the first positioning signal 40, the user inserts (typically by means of a mouse) in the diagrammatic representation of the pattern design 20, the position that is taken by the threading tube 11 on bar 10.

[0035] Simultaneously, the user selects the type of bar ("figure eight" or "bpos") in relation to which the work parameters will be calculated; this selection advantageously takes place with the indication of the threading tube 11 position.

[0036] In fact, the position of tube 11 on the pattern design is defined by two coordinates: a first coordinate identifying at which needle position 21 the threading tube 11 is, and a second coordinate identifying a "figure eight" or "bpos" bar.

[0037] Practically, on the screen associated with said computer 91 at least one "figure eight bar" 10a and at least one "bpos" bar 10b are displayed; by positioning tube 11 on either of them the bar of the machine 1 to be driven is selected.

[0038] It is apparent that cases can occur in which the machine 1 is provided with only "figure eight" or only "bpos" weft bars; these cases are at all events immediately referable to the general treatment with the only difference that the user, on the pattern design, will be able to position the threading tube 11 only on bars of the type

present in the machine 1.

[0039] Once the arrangement of the knitting members has been defined, there is a step of selecting the type of weft movement to be carried out. For the purpose a first selection command 60 is received; following this first selection command 60, the base parameters PB from which it is necessary to start for obtaining the final parameters to be transmitted to the controller, are selected within memory 30.

[0040] The selection command 60 can be inputted by the user according to two distinct modalities.

[0041] According to a first modality, on the screen of computer 91 a plurality of icons are shown, each of them representing a corresponding weft movement; the user by dragging the icon representing the movement of interest, sets the same within the pattern design 20, at the point where this movement is wished to be performed.

[0042] Depending on the selected icon, then in memory 30 the base parameters PB associated with the weft movement represented by said icon are selected. In order to allow the user to select the desired movement, said memory 30 is provided with a first and a second registers 31, 32.

[0043] In the first register 31 the movements concerning a "figure eight" bar 10a are contained, whereas in the second register 32 the movements that a "bpos" bar 10b can carry out are contained.

[0044] In more detail, in the first register 31 the following fundamental movements are present:

- a simple-loop movement 31a, defined by a trajectory consisting of an annular portion and two connection portions extending externally of said annular portion; a first identification parameter P1 is associated with this movement;
- a double-loop movement 31b, defined by a trajectory consisting of a first annular portion, a second annular portion internal to said first annular portion, and two connection portions extending externally of the first annular portion; a second identification parameter P2 is associated with this movement;
- a triple-loop movement 31c defined by a trajectory consisting of a first annular portion, a second annular portion internal to said first portion, a third portion internal to said second portion, and two connection portions, extending externally of the first annular portion; a third identification parameter P3 is associated with this movement;
- an open "figure eight" movement 31d, defined by a trajectory consisting of a first and a second vertical arched portions, and a transverse connection portion, joining a lower end of the first portion and an upper end of the second portion; a fourth identification parameter P4 is associated with this movement.

[0045] In the second register 32 of memory 30 the movements provided for a bar of the "bpos" type 10b

are contained; these movements are:

- a hook movement 32a defined by a trajectory consisting of a first portion parallel to columns 20b of the pattern design 20 and an arched portion adjacent to said first portion and transverse to said columns 20b; a fifth identification parameter P5 is associated with this movement;
- a vertical arched movement 32b defined by a trajectory consisting of an arched portion substantially transverse to the rows 20a of said pattern design 20; a sixth identification parameter P6 is associated with this movement;
- an oblique movement 32c defined by a trajectory consisting of a first portion transverse to rows 20a and columns 20b of said pattern design 20, and an arched portion having a side end in contact with an upper end of said first portion; a seventh identification parameter P7 is associated with this movement,
- a simple-loop movement 32d defined by a trajectory consisting of an annular portion and two connection portions extending externally of said annular portion; an eighth identification parameter P8 is associated with this movement.

[0046] The above stated movements are the fundamental ones that, combined with each other and/or repeated, can give origin to a great number of different weft patterns; to facilitate the composition of these ornaments, it is also provided that some auxiliary movements should be made available for the user, which movements derive from the preceding ones in terms of symmetry, coupling, etc.

[0047] In the preferred embodiment of the invention the pre-stored movements made available for the user through said icons are those shown in Fig. 4.

[0048] The second modality of inputting the selection command 50 contemplates that the user may freely draw the movement to be performed (through a mouse, an optical pen or equivalent data pointing devices); computer 91, by employing the steps that are hereinafter described in detail, carries out recognition of this movement.

[0049] To carry out this recognition first of all the points of the trajectory described by the mouse or optical pen that are suitably moved by the user are acquired (Fig. 5a); a pair of coordinates x, y is allocated to each point P to identify the position of this point P on the screen and, more particularly, on the pattern design 20.

[0050] In more detail, associated with each point P is a first coordinate x evaluated along an axis parallel to rows 20a of the pattern design 20 (practically an abscissa) as well as a second coordinate y evaluated along an axis parallel to columns 20b of the pattern design 20 (practically an ordinate).

[0051] Subsequently, through a comparison between the coordinates x, y of the different points P acquired,

recognition of the movement therein drawn is made and therefore the base parameters PB associated therewith are identified.

[0052] In order to be able to carry out this recognition, the typology of the weft bar 10 that is intended to be driven must be identified; in fact, the "figure eight" bars and "bpos" bars are set to perform movements different from each other (even if some movements can be graphically similar to each other) and the correct selection of the command parameters cannot be done without knowing which bar has been taken into consideration.

[0053] As mentioned above, the user is able to identify the bar typology when the second positioning signal 50 is received; in fact, by indicating the position of the threading tube 11 on the respective bar 10, the bar to be driven is simultaneously selected.

[0054] If the bar is of the "figure eight" type, one or more main points PP (Fig. 5b) are selected within the trajectory; a main point PP is a point the first coordinate x (abscissa) of which is greater than the first coordinate x of the points adjacent thereto, or is smaller than the first coordinate x of the points adjacent thereto; in other words, a main point PP is the innermost or outermost point of an arc extending in a direction substantially parallel to columns 20b of the pattern design 20.

[0055] Then the extension direction of each arc is evaluated: if this direction is opposite to the direction of the increasing progression of rows 20a in the pattern design 20, then the trajectory will be of the "open" type and the movement will be recognised as an open chain 31d and the fourth identification parameter P4 will be selected in the first register 31 of memory 30, together with the base parameters associated therewith.

[0056] Vice versa, should the extension direction of the arc be the same as the direction of the increasing progression of rows 20a in the pattern design 20, then it is a closed loop and the analysis is to be further studied in depth.

[0057] In fact, the possible feasible closed trajectories with a "figure eight" bar are of the simple-loop 31a, double-loop 31b, and triple-loop 31c type.

[0058] In order to be able to recognise which of the above stated possibilities has been selected by the user, it is necessary to evaluate the height of the arc where the previously selected main point PP is; obviously, the arc limits are defined at the points where the trajectory changes its increase/decrease, for example by comparing the second coordinates y of the different points of the trajectory with each other and selecting the maximum point and minimum point between which said main point PP is.

[0059] If the height of the arc is substantially the same as the height of a row 20a of the pattern design 20 (clearly small tolerances are allowed for evaluating this equality), then the trajectory is recognised as a simple loop 31a trajectory; if the height is equal to two rows, the loop is considered a double loop 31b, whereas if the height corresponds to three rows, the trajectory is a triple loop

31c trajectory.

[0060] Consequently, the first, second or third identification parameter P1, P2, P3 respectively will be selected in the first register 31 of memory 30, together with the base parameters PB associated therewith.

[0061] Therefore, after classifying the movement typology inserted by the user, the base parameters PB associated with this movement are selected in memory 30.

[0062] If on the contrary the bar is of the "bpos" type, the following steps are carried out for the purpose of recognising the trajectory.

[0063] A main point PP is selected within the trajectory, i.e. a point the first coordinate x of which is greater than the first coordinates x of the points adjacent thereto, or is smaller than the first coordinates x of the points adjacent thereto; in the same manner as described in connection with the "figure eight" bar, a main point PP in a "bpos" trajectory is the outermost point of a substantially vertical arc.

[0064] Also in this situation two cases may occur. The arc to which the main point PP belongs extends in a direction going in the same way as the direction of the increasing progression of rows 20a in the pattern design 20, or the arc extension is in a direction opposite to the direction of the increasing progression of these rows 20a.

[0065] In the first case another verification is carried out and the possible presence of auxiliary points PA is detected (Fig. 5c). i.e. of points having the second coordinate y greater than the second coordinate y of the points adjacent thereto, or smaller than the second coordinate y of the points adjacent thereto; if these auxiliary points PA are not detected in the trajectory under examination, then the movement is considered as a vertical arched movement 32b and the sixth identification parameter P6 and the base parameters associated therewith are selected in the second register 32.

[0066] If on the contrary the presence of at least one auxiliary point PA is verified (i.e. a maximum point and a minimum point in a substantially horizontal arc) in the same trajectory to which said main point PP belongs, a further control is carried out: if the main point PP is in the same column 20b in which the point of application of the concerned movement is, then the movement is recognised as a hook movement 32a; otherwise, if the main point PP is in a different column 20b with respect to the application point, and in particular in a column 20b adjacent to that in which the application point is, the trajectory is considered as an oblique movement 32c.

[0067] In the two last-mentioned cases the fifth or seventh identification parameters P5, P7 respectively are selected together with the base parameters PB associated to each of them.

[0068] If the arc to which the main point PP belongs extends in a direction opposite to the direction of the increasing progression of rows 20 in the pattern design 20, the trajectory is identified as a closed loop 32d and

therefore the eighth identification parameter P8 and the base parameters PB associated in the second register 32 with this typology of trajectory are selected.

[0069] In connection with the last-mentioned situation, it is possible to carry out a further control to avoid a trajectory drawn by the user in an imprecise manner being interpreted in a wrong way. This control consists in verifying that the above selected main point PP be included between two auxiliary points PA, and that the extension direction of the arcs to which these auxiliary points PA belong be opposite to each other.

[0070] If on the contrary the directions of the two horizontal arcs go in the same way, the trajectory is considered as a succession of hook movements 32a, and the considered parameters will be the fifth identification parameter P5 together with the base parameters PB associated therewith in the second register 32.

[0071] It is important to emphasise that preferably the trajectory must be drawn by the user on the pattern design 20 following a progressive direction corresponding to progression of the movement that the threading tube 11 really follows when the machine 1 is operated; in this way the software is allowed to correctly recognise the inserted movements.

[0072] It will be appreciated that the above described recognition steps substantially perform the function of distinguishing a weft movement with respect to another (an open chain with respect to a double loop, for example); auxiliary steps are also provided in which, once the movement typology has been selected, it is recognised whether such a movement (e.g. a simple loop) is oriented to the right or to the left, by evaluating the direction followed by the user in drawing the different arcs, typically the horizontal ones. Therefore, present in the memory, in each of the two registers, are pairs of base parameters in mirror image relationship capable of also representing symmetrical variations of the fundamental trajectories (Fig. 4).

[0073] Once the first weft movement that the user wishes to insert in the product has been identified, it is necessary to adapt, depending on the mutual positions of needles 7, tube 11 and first application point, the base parameters PB associated with such a movement to obtain the final parameters PF to be transmitted to controller 90.

[0074] The base parameters PB associated with each weft movement in memory 30 are parameters of the relative type; i.e. these parameters represent the displacements carried out by tube 11 starting from a predetermined reference point.

[0075] The reference point will be then coincident either with the position of tube 11 identified by the auxiliary parameter (in the case of movements starting in the first weft row), or with the last point of a previously inserted movement; in other words, the reference point will be coincident with the application point of the weft movement.

[0076] Consequently, the relative displacements rep-

resented by the weft movements, identify the displacements that the threading tube 11 will have to carry out starting from the application point selected by the user.

[0077] In Figs. 3a, 3b, the position of the reference point is denoted at "A", the position of needle 7 which is the closest to position "A" (selected to the right, by way of example) is denoted at "B".

[0078] As can be seen, associated with each weft row of each movement are two base parameters PB; as above said, the "figure eight" and "bpos" bars can take two different longitudinal positions to make the same weft row. Each of the two base parameters PB associated with a weft row therefore identifies a position taken by tube 11 for carrying out a predetermined weft movement with particular reference to this first weft row.

[0079] If the simple-loop movement 31a (turned to the right) identified by the first identification parameter P1 is taken by way of example, in order to make the first row of such a movement (Fig. 6a), the threading tube must carry out a displacement "A-B": i.e. the tube must start from the reference position "A" and move to position "B" so as to step over needle 7 that is at position "B".

[0080] In accordance with the preceding indication, in the second weft row of this movement, the tube must go back to the reference position "A" (parameters "A-A").

[0081] The indicated displacements for each of the weft movements present in the first and second register 31, 32 of memory 30 are to be interpreted in exactly the same manner.

[0082] It is to be noted that all base parameters PB of the fundamental displacements shown in Figs. 3a, 3b only take two values: some parameters are equal to "A", the others are equal to "B"; processing of these base parameters PB substantially consists in a replacement of same by final parameters PF determined depending on the position of the threading tube 11, needles 7 and point of movement application.

[0083] Once the first weft movement has been identified, through the first selection command 60 in accordance with the above described modalities, it is selected in memory 30 the identification parameter PI associated with such a movement; for example, if the selection command relates to a loop turned to the right for a "figure eight" bar, it is selected the first identification parameter P1.

[0084] Then the first base parameters PB1 associated with the selected identification parameter PI are selected in memory 30; taking into account the case of a right-hand loop for a "figure eight" bar, these first base parameters PB1 are "A-B" for the first row and "A-A" for the second row.

[0085] Through a third positioning signal 70, the user indicates the position from which the first weft movement is to be started; this third positioning signal 70 is practically inserted when the user sets the icon to the desired point of the pattern design 20 (in the case of insertion from a library), or when the first movement is drawn through a mouse or an optical pen (in the case

of a manual insertion).

[0086] Therefore, in the insertion modalities through pre-stored icons, the third positioning signal 70 is defined by the user's action at the moment said user sets the preestablished icon to the point where the weft movement must take place; in the insertion modality through a mouse or optical pen, the third positioning signal 70 on the contrary consists in identifying the point where the trajectory being drawn is started by the user. The third positioning signal 70 incorporates a first application parameter exactly identifying the position at which the first weft movement must be started.

[0087] Should the first weft movement start on the first weft row 20a of the pattern design 20, the first application point is automatically shifted to the starting position of the threading tube indicated by said auxiliary parameter.

[0088] In the other cases, i.e. when other movements have been inserted before said first weft movement, the application point is shifted to the last point belonging to the preceding movement.

[0089] Then a verification step is carried out, to verify whether the first base parameters PB1 of the first movement are all equal to each other or not (such as, for example, in the case of the vertical arched movement 32b associated with the sixth identification parameter P6).

[0090] If so, all first final parameters PF1 associated with the first base parameters PB1 are set equal to said auxiliary parameter, i.e. the parameter identifying the position of tube 11 on the weft bar 10; since movement of tube 11 is substantially parallel to columns 20b of the pattern design 20, variations in a direction orthogonal to such columns are not provided.

[0091] If not so, a further analysis is carried out.

[0092] It is verified that the first base parameters PB1 show a first value and a second value; in other words, it is verified that, among all the first base parameters PB1, there are at least two having values different from each other (e.g., "A" and "B").

[0093] Then a first group of first base parameters PB1, all having the same first value (e.g. "A") is selected; a second group of first base parameters PB1 is also selected in which all parameters have the same second value, different from said first value (e.g. "B").

[0094] As diagrammatically shown in Figs. 3a, 3b, value "A" is associated with the starting point of the trajectory, whereas point "B" is associated with a side end of the trajectory itself.

[0095] In order to determine the values to be given to the first final parameters PF1 corresponding to said first base parameters PB1, the following steps are carried out.

[0096] The first application parameter is compared with the main parameters representative of the positions where needles 7 are on the pattern design; then a first needle defined as the needle that is the closest to said first application point is selected.

[0097] The position of this first needle is defined by a

first main parameter. Subsequently a first supplementary position, symmetrical to the auxiliary position with respect to the first main position is identified; practically the position symmetric to tube 11 with respect to the first needle is identified.

[0098] This first supplementary position is defined by a first supplementary parameter.

[0099] At this point it is possible to determine the values of the first final parameters PF1 associated with said first base parameters PB1.

[0100] The first final parameters PF1 corresponding to the first base parameters PB1 belonging to the first group are given the value defined by the auxiliary parameter; the first final parameters PF1 corresponding to the first base parameters PB1 belonging to the second group are given the value defined by the first supplementary parameter.

[0101] Practically, to pass from the first base parameters PB1 to the first final parameters PF1, the auxiliary parameter is substituted for "A" and the first supplementary parameter is substituted for "B".

[0102] For particular movements such as those obtained from a repetition of a fundamental movement for example, or from combination of a fundamental movement with the symmetric movement thereof, the values taken by the first base parameters PB1 can be three in number: for example a value "C" is added to said "A" and "B" and is associated with a side end of the opposite trajectory with respect to the one associated with value "B".

[0103] In this case, a third group of first base parameters PB1 is selected which have a third value which is different from said first and second values.

[0104] Following a comparison between the first application parameter and the main parameters, a second needle is selected; the latter is the needle that is the closest to tube 11 on the opposite side from the first needle.

[0105] The position of the second needle, defined as the second main position, is identified by a second main parameter.

[0106] Then a second supplementary position is identified which is symmetric to the auxiliary position with respect to the second main position; this second main position is identified by a second supplementary parameter.

[0107] Practically, the position symmetric to tube 11 with respect to the second needle is defined (the second supplementary position).

[0108] The first final parameters PF1 associated with the first base parameters PB1 of the third group are therefore set equal to said second supplementary parameter.

[0109] It is to be noted that determination of the first and second supplementary positions is useful to identify the so-called "theoretical" path followed by tube 11 to carry out the first weft movement; this "theoretical" path is the path physically described by motion of tube 11.

[0110] The "theoretical" path is differentiated from the "real" path that on the contrary describes the trajectory defined by the weft yarn (19) following a movement in relation to the first weft movement; the above mentioned "theoretical" and "real" path can be non coincident, since irrespective of the amount of the displacement of tube 11, the weft yarn (19) practically remains fixed at needles 7 and, in particular, at said first and second needles. For example, if it is considered a needle at position "3" and a threading tube moving on either side of such a needle until reaching position "5", in spite of the fact that during movement of the tube the weft yarn (19) reaches position "5" (theoretical path), the yarn itself is not retained to such a position, but is fixed at the needle which is at position "3" (real path) during the return stroke of the tube.

[0111] Subsequently a correction step is provided to carry out correction of the first final parameters PF1 calculated as above described.

[0112] This correction step is carried out by verifying the presence of a first additional needle between the first needle and the first supplementary position (or, in a similar manner, between the second needle and the second supplementary position); the position of said first additional needle is identified by a first additional parameter.

[0113] The first final parameters PF1 associated with the first base parameters PB1 of the second group (or the third group) are set equal to said first additional parameter. Said correction step is required if between the position of the first needle and the first supplementary position (i.e. the position identified in order to determine the "theoretical" path) there is the first additional needle, that would prevent the tube from reaching said first supplementary position; the tube stroke for such a weft-movement portion is therefore limited by setting the first final parameters PF1 associated with the first base parameters PB1 of the second group, equal to the first additional parameter.

[0114] A quite similar evaluation is valid for the first final parameters PF1 associated with the first base parameters PB1 of the third group, should the first additional needle be interposed between the second needle and the second supplementary position.

[0115] The steps performed for insertion of a second weft movement are hereinafter described.

[0116] First of all a second selection command 80 is received, to identify the second weft movement; this second selection command 80 can be inserted both by employing said pre-stored library, and by moving a mouse or optical pen for manual definition of the desired trajectory.

[0117] Further a fourth positioning signal 81 is received which incorporates a second application parameter representative of the second application point, i.e. the point of the pattern design where the user wishes to insert the second movement.

[0118] Once the typology of the second weft movement has been identified, the identification parameter

representative of this second movement is selected in the memory; also selected are second base parameters PB2 associated with the selected identification parameter.

[0119] Through steps quite similar to those described above in connection with the first base parameters PB1, processing of the second base parameters PB2 occurs, based on the second application parameter, in order to obtain corresponding second final parameters PF2 for said controller 90.

[0120] The case first taken into account is that in which all the second base parameters PB2 are equal to each other; in this case all the second final parameters PF2 are set equal to the last one of the first final parameters PF1. It is to say that the movement is vertically continued (with a slightly arched trajectory) starting from the last point of the first movement.

[0121] If on the contrary the second base parameters PB2 are not all equal to each other, selection takes place of a first group of second base parameters PB2, all having a fourth value, and of a second group of second base parameters PB2, all having a fifth value.

[0122] The fourth value is representative of the position of the point at which the second movement is started, whereas the fifth value indicates a side end of the trajectory described by the second movement.

[0123] Then the second application parameter is compared with the main parameters, to identify a third needle, which needle is the closest to the second application point in the pattern design; the third needle occupies a third main position identified by a third main parameter.

[0124] Subsequently a third supplementary position identified by a third supplementary parameter is defined; the third supplementary position is advantageously symmetrical to the secondary position relative to the third main position.

[0125] The second final parameters PF2 associated with the second base parameters PB2 belonging to the first group are set equal to the last one of said first final parameters PF1; the second final parameters PF2 corresponding to the second base parameters PB2 belonging to the second group are set equal to the third supplementary parameter.

[0126] Should between the second base parameters PB2 be also present a sixth value different from said fourth and fifth values, a third group of second base parameters PB2 which have said sixth value is selected; the latter is representative of the side end opposite to the side end identified by said fifth value.

[0127] Then the second application parameter is compared with the main parameters to select a fourth needle; said needle is the closest to the second application point on the opposite side from the third needle.

[0128] The fourth needle occupies a fourth main position identified by a fourth main parameter.

[0129] Subsequently a fourth supplementary position, symmetrical to the secondary position with respect to

the fourth main position is identified; the fourth supplementary position is defined by a fourth supplementary parameter.

[0130] The second final parameters PF2 corresponding to the second base parameters PB2 of the third group are set equal to the fourth supplementary parameter calculated as above described.

[0131] The second final parameters PF2 too can be the subject of a correction step taking into account the presence of further needles between the third needle and the third supplementary position, or between the fourth needle and the fourth supplementary position.

[0132] In fact a verification is carried out which aims at detecting the presence of a second additional needle between the third needle and the third supplementary position or between the fourth needle and the fourth supplementary position.

[0133] Once the presence of this second additional needle filling a position defined by a second additional parameter has been verified, the second final parameters PF2 associated with the second base parameters PB2 of said second group (or said third group) are set equal to said second additional parameter.

[0134] Once both the first and second final parameters PF1, PF2 have been calculated, a final correction step is carried out.

[0135] This final correction consists in comparing all the calculated final parameters PF with each other, irrespective of whether they are associated with the first or the second weft movement; then the smallest of all said final parameters PF is found.

[0136] Depending on this smallest parameter, all the other final parameters different from said smallest parameter are processed; in particular for reasons to be clarified in the following, it is subtracted 1 from the smallest parameter thereby obtaining a corresponding correction parameter.

[0137] The correction parameter is subtracted from all the calculated final parameters PF (first and second final parameters PF1, PF2).

[0138] When also this correction step has been carried out, the updated final parameters PF can be incorporated into the output signal 100 and be transmitted to controller 90 of the textile machine 1.

[0139] Data transfer to controller 90 can take place through a telematic network, with a connection of the telematic type between computer 91 putting into practice the method in accordance with the invention and controller 90; alternatively the output signal 100 can be directed to a portable storage medium that is transported to the controller by an operator.

[0140] It is to be noted that the main parameters, auxiliary parameter, supplementary parameters, application parameters and additional parameter are initially referred to the needle positions 21 defined on the needle bar; in fact, as above said, the housing seats in which needles 7 can be positioned are numbered (from the right to the left, or from the left to the right, depending

on the used conventions) in a progressive manner.

[0141] This numbering is therefore also used to express the above listed different parameters; for example, an auxiliary parameter equal to 14 indicates that the threading tube 11 is positioned on the weft bar 10 at the needle position 14.

[0142] By the above described last correction step for the final parameters PF, said final parameters PF are then expressed taking the smallest of these final parameters PF as the reference, i.e. the parameter identifying the extreme side position (to the right or to the left depending on the used convention) that tube 11 must reach in manufacturing the whole textile product to which the above mentioned pattern design 20 refers.

[0143] Associated with this extreme position is number 1 and all the other final parameters PF are calculated again (more specifically, translated) in accordance with a correction parameter defined by the difference between the smallest of the final parameters and 1, i.e. the difference between the starting value and the final value associated with said extreme side position; in any case the distance between two adjacent needle positions is maintained as the measure unit.

[0144] As an alternative to the above, any system of the relative type can be employed to temporarily define the final parameters PF; for example, the starting position of tube 11 can be considered as the 0 (zero) position, and all final parameters can take positive or negative values, depending on whether the position they identify is on one side or on the opposite side with respect to the tube position.

[0145] At the end, in any case, all values are translated so as to obtain positive values, starting from a value equal to 1 defining the extreme side position (to the right or to the left) taken as the reference.

[0146] It is to be noted that in the case of an open "figure eight" movement obtained with a "figure eight" bar, a further correction step of at least one of the base parameters PB (or the corresponding final parameter PF) previously defined is provided.

[0147] In fact, if by way of example the trajectory in Fig. 6a is taken into account, associated with this trajectory will be the parameters indicated to the side of each row.

[0148] If subsequently the trajectory goes on as shown in Fig. 6b, the second parameter of the third row must be varied since it is exactly at this row that the tube takes two different positions and does not remain at position "1" as initially stated.

[0149] Therefore, generally, when a trajectory of the open "figure eight" type is recognised, an updating step for the last final parameter PF associated with the last weft row taken into account before recognising this movement can be carried out.

[0150] The same reasoning is valid, more generally, also for all movements carried out by the "bpos" bar and the parameters associated therewith; these movements, in fact, are not performed at the inside of each

row 20a of the pattern design, but between one row and the other, i.e. practically on either side of the line separating each pair of adjacent weft rows.

[0151] Therefore, in this case too a correction step concerning the last final parameter PF associated with the first movement is provided depending on the typology and position of the second weft movement inserted.

[0152] It is important to point out that the base PB and final PF parameters herein described are not sufficient by themselves to control the machine 1 in order to obtain the above mentioned aesthetic effects.

[0153] As above said, it is also necessary that a retaining device, called "piker/R" should be suitably activated for retaining the weft yarn 19 during movement of the threading tube 11, in order to obtain the above mentioned effects such as double loop 31b, triple loop 31c, open "figure eight" 31d; in Fig. 2, by way of example, denoted at PR are the command parameters of the "piker/R" device for making a double loop through a "figure eight" bar, and denoted at 28 are the positions at which this "piker/R" operates. However, adjustment of the movement of said piker/R is carried out in a manner known by itself that is not therefore described in detail.

[0154] In other words, in the method in accordance with the invention the final parameters PF for the weft bars are obtained which, combined with command parameters for the retaining device that are calculated and inserted in known manner, allow accomplishment of the desired textile product.

[0155] While reference has been hitherto explicitly made exclusively to the textile machine 1 and the method of controlling the same, the invention further extends to software programs, in particular programs for computer, stored on a suitable medium for putting the invention into practice.

[0156] The program can be in the form of a source code, object code, partly source code and partly object code, as well as in the partly compiled formats, or in any other form that can be employed for implementing the method in accordance with the present invention.

[0157] For example, the medium may comprise storage means such as a ROM memory (a CD-ROM, a semiconductor ROM), a memory of the rewritable type (a flash EPROM) or magnetic storage means (floppy disks or hard disks, for example).

[0158] In addition, the medium may be a carrier set for transmission such as an electric or optical signal that can be transmitted through electric or optical cables or radio signals.

[0159] When the program is incorporated in a signal that can be directly transmitted through a cable or device or equivalent means, the medium may consist of such a cable, device or equivalent means.

[0160] Alternatively, the medium may be an integrated circuit in which the program is incorporated, this integrated circuit being arranged to carry out or employ said method in accordance with the present invention.

[0161] The invention achieves important advantages.

[0162] First of all, the control method in accordance with the invention enables the command parameters for "figure eight" and/or "bpos" bars to be automatically obtained starting from a graphic representation in an electronic format of the fabric that is wished to be obtained, without particular processing activity being required from the user.

[0163] In other words, by simple insertion of an electronic representation of a pattern design showing the desired weft typology, the values are determined that are to be transmitted to the controller associated with the textile machine for controlled movement of the "figure eight" and/or "bpos" bars.

[0164] It is therefore apparent that a method as the described one and the relevant software implementation also enable operators that are not particularly experienced to correctly set the machine so as to obtain the particular aesthetic effects made available by the "figure eight" and "bpos" bars.

[0165] At all events, the method in accordance with the invention enables operation of the textile machine to be set in a very quick and at the same time precise manner, since it is the computer that is tasked with the more complicated computational part.

Claims

1. A control method for textile machines, in particular crocheting machines, **characterized in that** it comprises the following steps:

- setting a textile machine (1) preferably a crocheting machine, provided with:
 - . at least one needle bar (6) bearing a plurality of needles (7) ;
 - . at least one carrier slide bar (10) bearing at least one threading tube (11);
 - . at least one electromechanical actuator (99), active on said carrier slide bar (10) for movement of the same;
 - . a controller (90) connected with at least said actuator (99) to regulate operation thereof;
- storing a predetermined number of identification parameters (PI) on a memory (30) associated with said machine (1), each of said parameters being representative of a corresponding weft movement of said threading tube;
- associating, in said memory (30), each of said identification parameters (PI) with a predetermined number of base parameters (PB), set in a predetermined order, each of said base parameters (PB) being representative of a position taken by said tube (11) to perform said weft movement;

- arranging a pattern design (20) preferably in an electronic format, defined by an orderly succession of rows (20a), each representative of a corresponding weft row of a textile product to be made, and by an orderly succession of columns (20b), each included between a pair of adjacent needle positions (21) of said needle bar (6); 5
- receiving a first positioning signal (40), incorporating a predetermined number of main positioning parameters, each adapted to identify in said pattern design (20), a respective main position representative of a corresponding needle (7) of said needle bar (6); 10
- receiving a second positioning signal (50) incorporating at least one auxiliary positioning parameter adapted to identify in said pattern design (20), a respective auxiliary position representative of a corresponding threading tube (11) of said carrier slide bar (10); 15
- receiving a first selection command (60) to identify a first weft movement of said tube (11); 20
- selecting in said memory (30), the identification parameter (PI) associated with said first weft movement;
- selecting in said memory (30), first base parameters (PB1) associated with the selected identification parameter (PI) associated with the first weft movement; 25
- receiving a third positioning signal (70) incorporating a first application parameter adapted to identify in said pattern design, a first application point representative of a position at which said first weft movement is carried out; 30
- processing, depending on said first application parameter, said first base parameters (PB1), thereby obtaining corresponding first final parameters (PF1); 35
- generating an output signal (100) incorporating at least said first final parameters (PF1) and designed for said controller (90) for a controlled movement of said weft bar (10) in accordance with said first final parameters (PF1). 40

2. A method as claimed in claim 1, characterised in that said step of processing said first base parameters (PB1) comprises: 45

- verifying that the first base parameters (PB1) are all equal to each other;
- setting all the first final parameters (PF1) equal to said auxiliary parameter. 50

3. A method as claimed in claim 1, characterised in that said step of processing said first base parameters (PB1) comprises: 55

- selecting a first group of first base parameters (PB1) having a first value;

- selecting a second group of first base parameters (PB1) having a second value;
- comparing said first application parameter with said main parameters;
- selecting a first needle depending on said comparison, said first needle being preferably the closest needle to said first application point in said pattern design, said first needle having a position defined by a first main parameter;
- identifying a first supplementary position symmetric to said auxiliary position with respect to said first main position, said first supplementary position being defined by a first supplementary parameter;
- setting the first final parameters (PF1) corresponding to the first base parameters (PB1) of said first group, equal to said auxiliary parameter;
- setting the first final parameters (PF1) corresponding to the first base parameters (PB1) of said second group, equal to said first supplementary parameter.

4. A method as claimed in claim 1, characterised in that it further comprises:

- selecting a third group of first base parameters (PB1) having a third value;
- comparing said first application parameter with said main parameters to select a second needle, the latter preferably being the closest needle to said threading tube on the opposite side from said first needle, said second needle having a second main position defined by a second main parameter;
- identifying a second supplementary position symmetric to said auxiliary position with respect to said second main position, said second auxiliary position being defined by a second supplementary parameter;
- setting the first final parameters (PF1) corresponding to the first base parameters (PB1) of said third group, equal to said second supplementary parameter.

5. A method as claimed in claim 3 or 4, characterised in that it further comprises a first step of correcting said first final parameters (PF1), comprising:

- verifying the presence of a first additional needle between said first needle and supplementary position, the position of said first additional needle being defined by a corresponding first additional parameter;
- setting the first final parameters (PF1) corresponding to the first base parameters (PB1) selected through said second selection, equal to said first additional parameter.

6. A method as claimed in anyone of the preceding claims, **characterised in that** it further comprises:

- receiving a second selection command (80) to identify a second weft movement of said threading tube (11); 5
- selecting in said memory (30), the identification parameter (PI) associated with said second weft movement;
- selecting in said memory (30), second base parameters (PB2) associated with the selected identification parameter associated with said second weft movement; 10
- receiving a fourth positioning signal (81) incorporating a second application parameter adapted to identify in said pattern design (20), a second application point representative of a position at which said second weft movement is carried out; 15
- processing, depending on said second application parameter, said second base parameters (PB2) thereby obtaining corresponding second final parameters (PF2); 20
- incorporating said second final parameters (PF2) in said output signal (100) designed for said controller (90) for a controlled movement of said weft bar (10) in accordance with said second final parameters (PF2). 25

7. A method as claimed in claim 6, **characterized in that** said step of processing said second base parameters (PB2) comprises: 30

- verifying that the second base parameters (PB2) are all equal to each other; 35
- setting all the second final parameters (PF2) equal to the last one of said first final parameters (PF1), the last of said first final parameters (PF1) identifying a secondary position defined by the last position taken by the threading tube (11) for performing said first weft movement. 40

8. A method as claimed in claim 6, **characterised in that** said step of processing said second base parameters comprises: 45

- selecting a first group of second base parameters (PB2) having a fourth value;
- selecting a second group of second base parameters (PB2) having a fifth value; 50
- comparing said second application parameter with said main parameters;
- selecting a third needle depending on said comparison, said third needle preferably being the closest needle to said second application point in said pattern design, said third needle having a third main position defined by a third main parameter; 55

- identifying a third supplementary position symmetric to said secondary position with respect to said third main position, said third supplementary position being defined by a third supplementary parameter;
- setting the second final parameters (PF2) corresponding to the second base parameters (PB2) of said first group, equal to the last of said first parameters;
- setting the second final parameters (PF2) corresponding to the second base parameters (PB2) of said second group, equal to said third supplementary parameter.

9. A method as claimed in claim 8, **characterised in that** it further comprises:

- selecting a third group of second base parameters (PB2) having a sixth value;
- comparing said second application parameter with said main parameters to select a fourth needle, the latter preferably being the closest needle to said second application point on the opposite side from said third needle, said fourth needle having a position defined by a fourth main parameter;
- identifying a fourth supplementary position symmetric to said secondary position with respect to said fourth main position, said fourth supplementary position being defined by a fourth supplementary parameter;
- setting the second final parameters (PF2) corresponding to the second base parameters (PB2) of said third group, equal to said fourth supplementary parameter.

10. A method as claimed in anyone of claims 6 to 9, **characterised in that** it further comprises a second step of correcting said second final parameters (PF2) comprising:

- verifying the presence of a second additional needle between said third needle and third supplementary position, the position of said second additional needle being identified by a corresponding second additional parameter;
- setting the second final parameters (PF2) corresponding to the second base parameters (PB2) belonging to said second group, equal to said second additional parameter.

11. A method as claimed in anyone of the preceding claims, **characterised in that** it further comprises a final correction step comprising:

- comparing said first and second final parameters (PF2) with each other;
- selecting the smallest of said final parameters;

- processing the final parameters different from said smallest parameter depending on said smallest parameter, and in particular:

- subtracting 1 from said smallest parameter, thereby obtaining a corresponding correction parameter;
- subtracting said correction parameter from the final parameters different from said smallest parameter,

said final correction step preferably being performed before said step of generating said output signal.

12. A method as claimed in anyone of the preceding claims, **characterised in that** said step of storing said base parameters on said memory comprises a step of associating a predetermined number of pairs of base parameters with each identification parameter (PI), each pair being associated with a corresponding weft row, the two base parameters of each pair identifying two positions taken by said threading tube (11) to perform said weft movement at said weft row.

13. A method as claimed in claim 1, **characterised in that** the step of storing said identification parameters (PI) on said memory comprises a sub-step of storing in a first register (31) of said memory (30), preferably associated with a bar of the "figure eight" type:

- a first identification parameter (P1) representative of a simple-loop movement (31a), defined by a trajectory consisting of an annular portion and two connection portions extending externally of said annular portion;
- a second identification parameter (P2) representative of a double-loop movement (31b), defined by a trajectory consisting of a first annular portion, a second annular portion internal to said first annular portion and two connection portions extending externally of the first annular portion;
- a third identification parameter (P3) representative of a triple-loop movement (31c), defined by a trajectory consisting of a first annular portion, a second annular portion internal to said first portion, a third portion internal to said second portion, and two connection portions extending externally of the first annular portion;
- a fourth identification parameter (P4) representative of an open-chain movement (31d), defined by a trajectory consisting of a first and a second vertical arched portions and a transverse connection portion, joining a lower end of the first portion to an upper end of the second

portion.

14. A method as claimed in claim 1 or 13, **characterised in that** the step of storing said identification parameters (PI) on said memory (30) further comprises a sub-step of storing in a second register (32) of said memory (30), preferably associated with a bar of the "bpos" type:

- a fifth identification parameter (P5) representative of a hook movement (32a) defined by a trajectory consisting of a first portion parallel to the columns of the pattern design and an arched portion adjacent to said first portion and transverse to said columns;
- a sixth identification parameter (P6) representative of a vertical arched movement (32b) defined by a trajectory consisting of an arched portion substantially transverse to the rows of said pattern design;
- a seventh identification parameter (P7) representative of an oblique movement (32c) defined by a trajectory consisting of a first portion transverse to the rows and columns of said pattern design, and an arched portion having a side end in contact with an upper end of said first portion;
- an eighth identification parameter (P8) representative of a simple-loop movement (32d) defined by a trajectory consisting of an annular portion and two connection portions extending externally of said annular portion.

15. A method as claimed in anyone of the preceding claims, **characterised in that** said step of receiving said first selection command (60) comprises:

- detecting a movement of a data adding device, said movement defining a corresponding trajectory in said pattern design, said trajectory being defined by an orderly succession of points (P);
- associating with each point (P) of said trajectory, a first coordinate (x) measured along an axis parallel to the rows (20a) of said pattern design (20), and a second coordinate (y) measured along an axis parallel to the columns (20b) of said pattern design (20), to identify a position of said point (P) on said pattern design (20);
- comparing the coordinates (x, y) of the points (P) of said trajectory with each other, to recognise a pre-established weft movement in said trajectory and select the identification parameter (PI) associated with said pre-established weft movement;
- selecting in said memory (20), the base parameters associated with the selected identification parameter.

16. A method as claimed in claim 15, **characterised in that** said comparing step comprises:

- verifying that said threading tube (11) is on a "figure eight" bar; 5
- selecting one or more main points (PP) from the points (P) of said trajectory, said main points (PP) having a first coordinate (x) greater than the first coordinate (x) of the points adjacent thereto, or smaller of the first coordinate (x) of the points adjacent thereto, each of said main points (PP) belonging to a corresponding trajectory arc; 10
- verifying the extension direction of each arc containing one of said main points (PP); 15
- if at least one of said arcs has an opposite direction with respect to the progression direction of the rows (20a) of said pattern design (20), selecting said fourth identification parameter (P4). 20

17. A method as claimed in claim 15, **characterised in that** it further comprises:

- verifying that the extension direction of each of said corresponding arcs is the same as the progression direction of the rows (20a) of said pattern design (20); 25
- evaluating a height in each arc;
- if the height of said arc is substantially the same as the height of one of said rows (20a) of said pattern design (20), selecting said first identification parameter (P1); 30
- if the height of said arc is substantially the same as the height of two rows (20a) of said pattern design (20), selecting said second identification parameter (P2); 35
- if the height of said arc is substantially the same as the height of three rows (20a) of said pattern design (20), selecting said third identification parameter (P3). 40

18. A method as claimed in claim 15, **characterised in that** it further comprises:

- verifying that said threading tube (11) is on a "bpos" bar; 45
- selecting at least one main point (PP) from the points (P) of said trajectory, said at least one main point having a first coordinate (x) greater than the first coordinate (x) of the points (P) adjacent thereto, or smaller than the first coordinate (x) of the points (P) adjacent thereto, said main point (PP) belonging to a corresponding trajectory arc. 50 55

19. A method as claimed in claim 18, **characterised in that** it further comprises:

- verifying that the extension direction of said arc is opposite to the progression direction of the rows (20a) of said pattern design (20);
- selecting said eighth identification parameter.

20. A method as claimed in claim 19, **characterised in that** it further comprises:

- selecting at least one first and one second auxiliary points (PA) in said trajectory, each of said points having its second coordinate (y) greater than the second coordinate (y) of the points (P) adjacent thereto, or smaller than the second coordinate (y) of the points (P) adjacent thereto;
- verifying that said main point (PP) is included between said first and second auxiliary points (PA), said first auxiliary point (PA) belonging to an arc having a pre-established extension direction with respect to the progression direction of said columns (20b), said second auxiliary point (PA) belonging to an arc having an extension direction opposite to said pre-established extension direction.

21. A method as claimed in claim 18, **characterised in that** it further comprises:

- verifying that the extension direction of said arc is the same as the progression direction of the rows (20a) in said pattern design (20);
- selecting at least one auxiliary point (PA) having the second coordinate (y) greater than the second coordinate (y) of the points (P) adjacent thereto, or smaller than the second coordinate (y) of the points (P) adjacent thereto.

22. A method as claimed in claim 21, **characterised in that** it further comprises:

- verifying that said main point (PP) is in the same column (20b) as that of the application point;
- selecting said fifth identification parameter (P5).

23. A method as claimed in claim 21, **characterised in that** it further comprises:

- verifying that said main point (PP) is in a column (20b) different from that of said application point and, preferably, in a column (20b) adjacent to the column (20b) in which said application point is;
- selecting said seventh identification parameter (P7).

24. A method as claimed in claim 18, **characterised in that** it further comprises:

- verifying a substantial absence, in said trajectory, of auxiliary points (PA) having the second coordinate (y) greater than the second coordinate (y) of the points (P) adjacent thereto, or smaller than the second coordinate (y) of the points (P) adjacent thereto; 5
- selecting said sixth identification parameter (P6).

25. A method as claimed in claim 15, **characterised in that** it further comprises: 10

- verifying that said threading tube (11) is mounted on a "bpos" bar;
- verifying an absence, in said trajectory, of main points (PP) having the first coordinate (x) greater than the first coordinate (x) of the points (P) adjacent thereto, or smaller than the first coordinate (x) of the points (P) adjacent thereto; 15
- selecting at least one auxiliary point (PA) having the second coordinate (y) greater than the second coordinate (y) of the points (P) adjacent thereto, or smaller than the second coordinate (y) of the points (P) adjacent thereto; 20
- selecting said fifth identification parameter (P5). 25

27. A computer program comprising program instructions to make a computer execute the method as claimed in anyone of the preceding claims. 30

28. A computer program as claimed in claim 27, incorporated in a portable storage medium and/or stored on a computer memory, and/or stored on a memory of the ROM type, and/or incorporated in a electromagnetic carrier signal. 35

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FIG.1

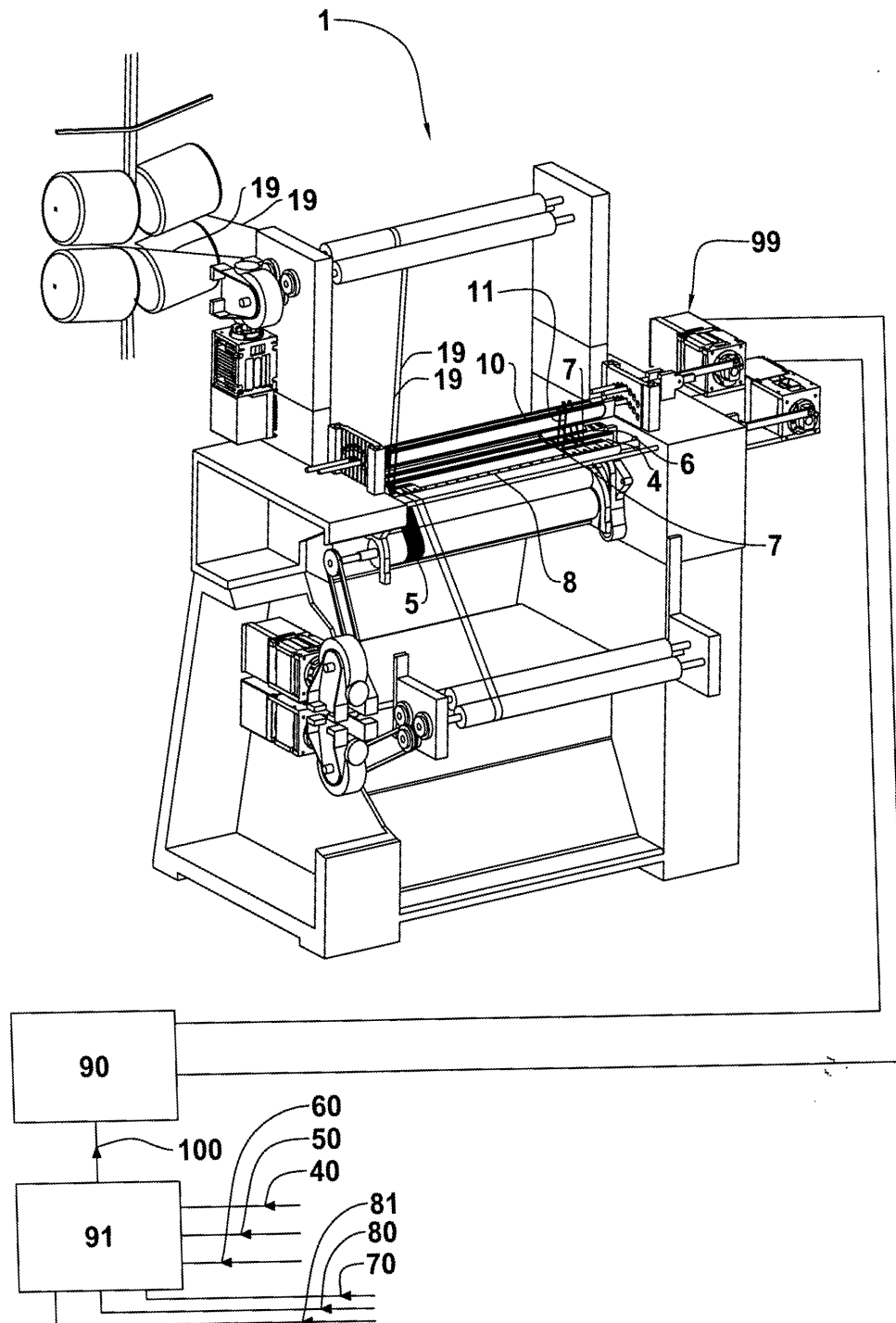
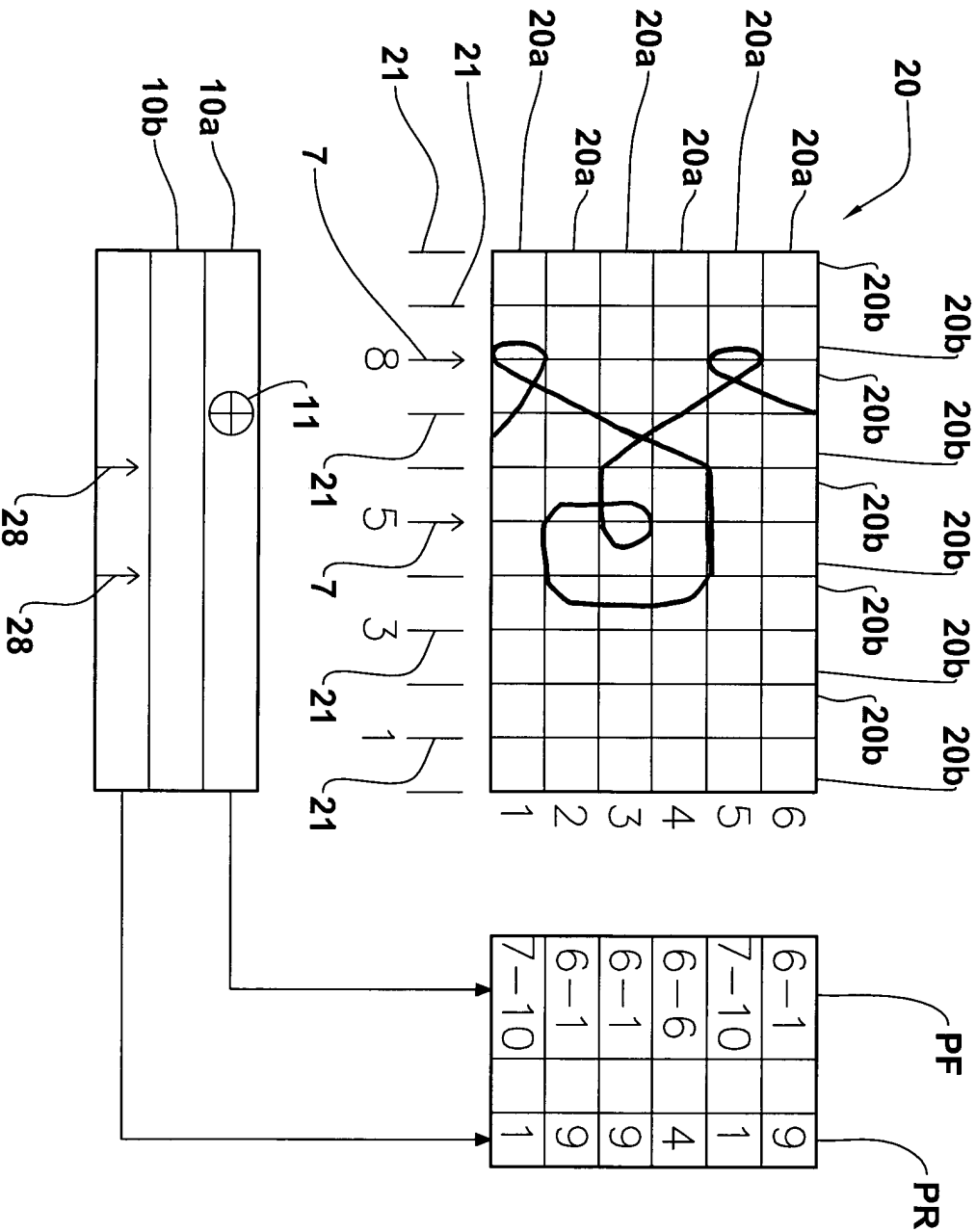


FIG.2



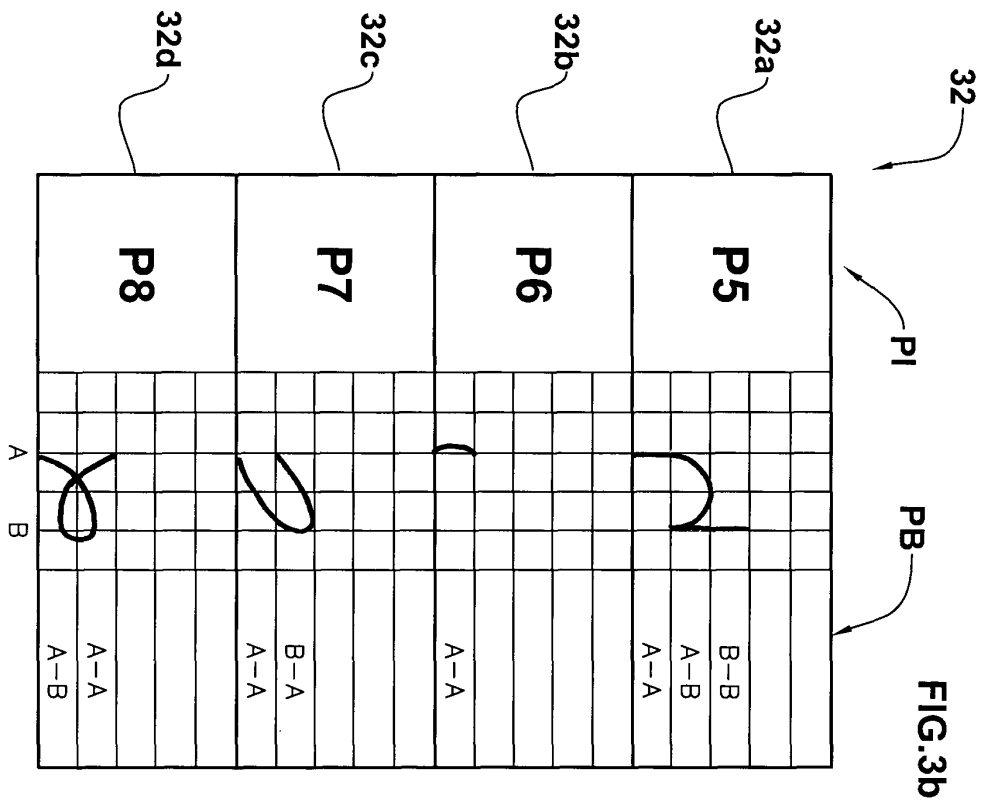
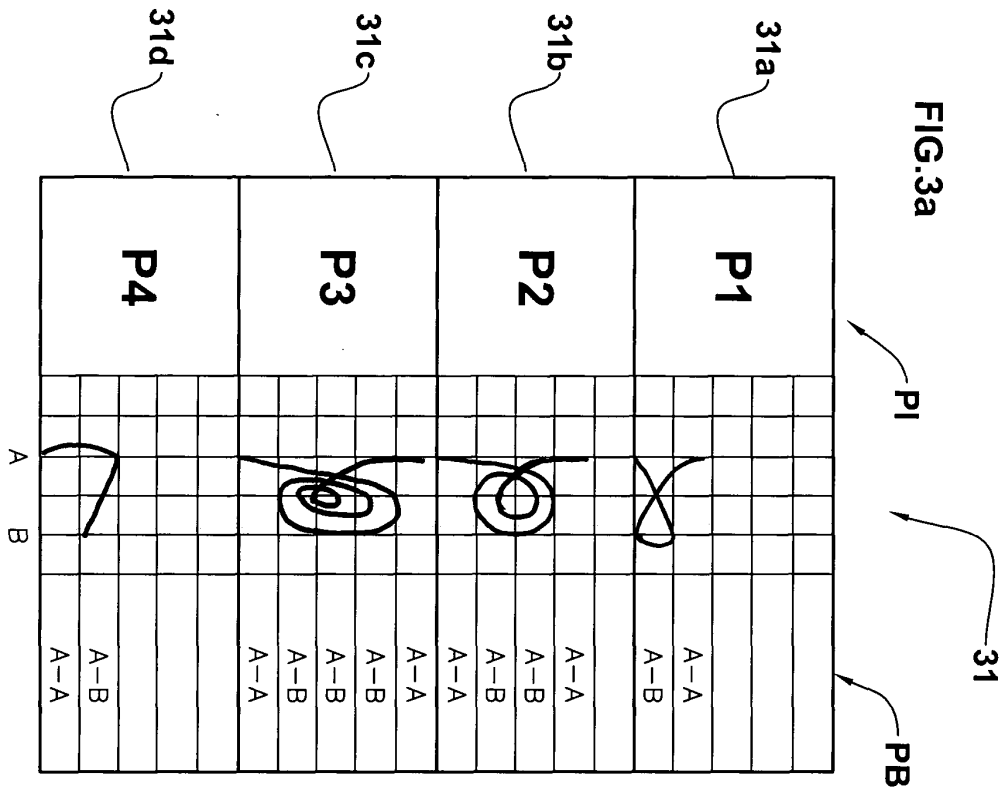


FIG.5a

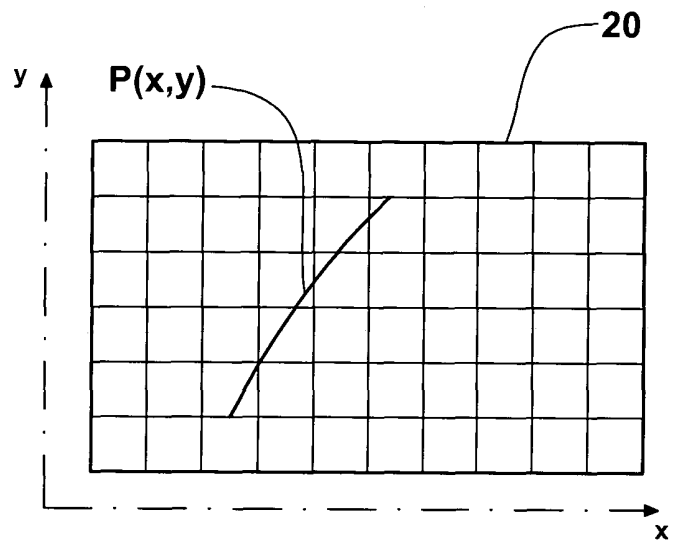


FIG.5b

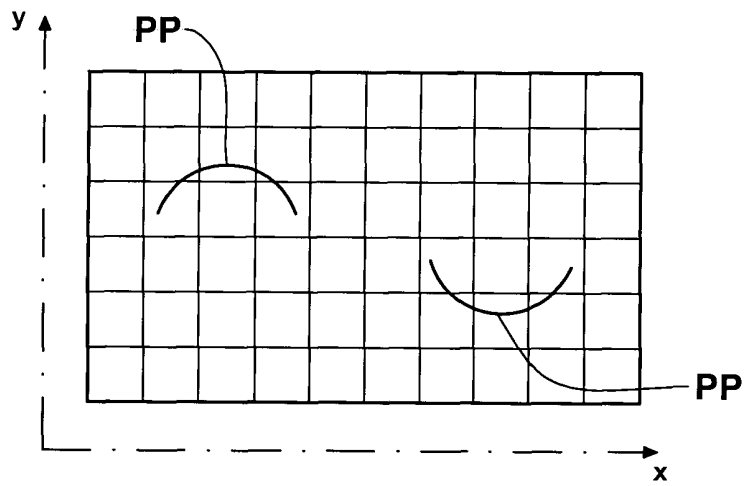


FIG.5c

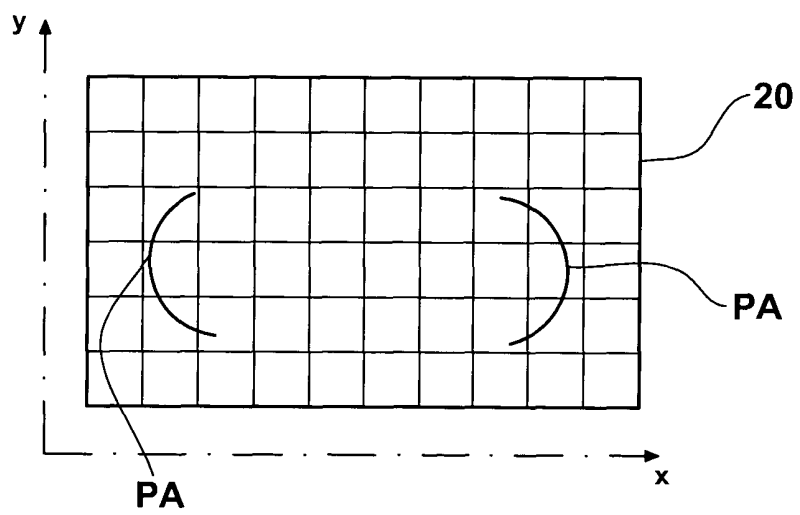


FIG.6a

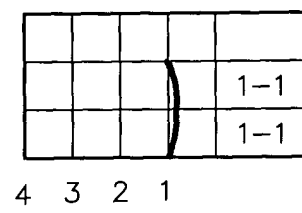
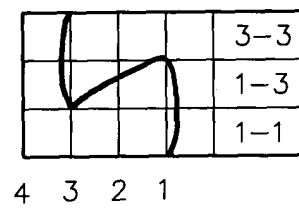


FIG.6b





European Patent
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PARTIAL EUROPEAN SEARCH REPORT

Application Number

which under Rule 45 of the European Patent Convention EP 03 42 5688 shall be considered, for the purposes of subsequent proceedings, as the European search report

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INCOMPLETE SEARCH			
The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC to such an extent that a meaningful search into the state of the art cannot be carried out, or can only be carried out partially, for these claims. Claims searched completely : 1-26 Claims searched incompletely : Claims not searched : 27, 28 Reason for the limitation of the search: Computer programs are excluded from patentability by Article 52(2)(c) EPC.			
Place of search		Date of completion of the search	Examiner
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CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
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