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(54) **Knit design apparatus and knit design method**

(57)   Data regarding the design of a knit product input by an operator is converted into design data of the knit product, and the arrangement and the connection of stitches are displayed on a color monitor (6). If an instruction to insert or delete a wale or course of stitches is input, whether or not functional data is included in the input range is detected, and an insert or delete position is shifted so as not to include functional data if functional data is included in the input range.

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Description

Technical Field

[0001] The present invention relates to designs of knit products such as gloves.

Background Art

[0002] The present applicant produces knit design apparatuses for designing knit products on a computer screen. In knit design apparatuses, the arrangement of stitches and the connection between stitches are displayed on a screen using color codes or the like, and the design of knit products is edited by an operator on the screen (Japanese Patent No. 2916990). If widening, narrowing, or the like is performed in a knit product, the orientation of a wale, which is a row of stitches in the height direction, changes at the position of the widening or narrowing. If this state is displayed as it is, the wale is displayed as a curved line, and, thus, display is performed such that the wale is displayed as a straight line, and the gap formed by the narrowing or the like is displayed as a "dart color". The dart color indicates that there is no stitch, stitches on both of the left and right sides of the dart are to be connected to each other, and whether the stitches on the right side of the dart are pulled to the left or the stitches on the left side are pulled to the right. In a similar manner, for example, a color code for each type of processing is displayed at locations where knitting processing such as flechage, stitch shift, or C-knitting in a tubular knitted fabric is to be performed.

[0003] Wales may be inserted or deleted at some point in the design. For example, a wale insert line may be designated by an operator, and a designated number of wales may be inserted to the designated line. In this state, if the insert line is designated so as to pass through an area to which a dart color or the like is allocated, the design of knit products is disturbed. It is natural to copy a wale around the insert line as a wale to be inserted, but, if a wale to which a dart color is allocated is copied, the number of wales inserted becomes smaller than operator's expectations. Furthermore, if stitches for which flechage, turning, C-knitting, or the like is designated are carelessly copied, the design is disturbed. Thus, it is necessary to carefully check the position for wale insertion and the like. Such a problem occurs not only in wale insertion but also in wale deletion, as well as in insertion and deletion of a course, which is a row of stitches in the knitting width direction. Moreover, in the case of a tubular knit product, if a wale is, for example, inserted to or deleted from one of the faces of the product, a wale has to be, for example, inserted to or deleted from the corresponding point on the other face in a similar manner. It requires effort to find proper positions for, for example, inserting or deleting a wale on both faces of a knit product.

[0004] Patent Document 1 : Japanese Patent No. 2916990

Summary of the Invention

Problem to be Solved by the Invention

[0005] It is an object of the present invention to make it possible to easily edit the design of a knit product by automatically determining an insert or delete position without disturbing the design of the knit product, when inserting or deleting a wale.

Means for Solving Problem

[0006] The present invention is directed to a knit design apparatus having: input means by which an operator can input a design of a knit product; an input processor that converts data input by the operator into design data of the knit product; a memory for the design data; and a color monitor that displays the design data so as to express an arrangement and connection of stitches, characterized by comprising: detection means for detecting whether or not functional data is included in an input range, in a case where an instruction to insert or delete a wale or course of stitches is input from the input means, wherein the input processor shifts an insert or delete position so as not to include functional data in a case where functional data is included in the input range.

[0007] Also, the present invention is directed to a knit design method in which input means accepts input of a design of a knit product that is input by an operator, an input processor converts the input into design data of the knit product, a memory stores the design data, and a color monitor displays the design data as an arrangement and connection of stitches, characterized by comprising: a step of detecting, by detection means, whether or not functional data is included in an input range, in a case where an instruction to insert or delete a wale or course of stitches is input from the input means; and a step of shifting, by the input processor, an insert or delete position so as not to include functional data, in a case where functional data is included in the input range.

[0008] According to the present invention, the detection means detects whether or not functional data is included in an input range, and the input processor shifts an insert or delete position if included. Thus, the structure of a knitted fabric is not disturbed by insertion or deletion of a wale or course, and an operator can easily input instructions to insert and delete wales and courses.

[0009] It is preferable that, in a case where a knit product to be designed includes front and back knitted fabrics, and the operator inputs an instruction to insert or delete a wale or course to or from one of the front and back knitted fabrics, the input processor receives the instruction as including to insert or delete a wale or course to or from a second input range at an opposing position in another knitted fabric, the detection means detects whether or not functional data is included in the second input range, and the input processor shifts an insert or delete position so as not to include functional data in a

case where functional data is included in the second input range. Accordingly, if an instruction to perform insertion to or deletion from one of front and back knitted fabrics is input, insertion to or deletion from the opposing position can be performed in the other knitted fabric as well. Furthermore, an insert or delete position can be shifted so as to avoid functional data also in the other knitted fabric.

[0010] It is preferable that the input processor enables the operator to directly input an insert or delete position on a display of an arrangement and connection of stitches displayed on the color monitor, and to input the insert or delete position through designation of a region in the knit product. Accordingly, the degree of freedom in input increases, and, if it is important to perform insertion or deletion at a specific position, that position can be directly input. Furthermore, if it is important to perform insertion or deletion in a designated region, the detection means and the input processor can select appropriate positions through designation of a region and perform insertion or deletion. Moreover, the operator can designate whether the insertion or deletion is to be carried out at a center of the region or at an end of the region, and, thus, it is possible to select whether insertion or deletion is to be performed at the center in order to avoid an end where functional data tends to be concentrated, or at the end in order to avoid the center where knitted fabric pattern portions tend to be concentrated.

[0011] It is preferable that, in a case where an insert or delete position is input through the designation of the region, the input processor displays on the color monitor a plurality of design data sets with different insert or delete positions on which insertion or deletion of a wale or course of stitches has been performed, and overwrites design data based on the insert or delete position selected by the operator. Accordingly, an appropriate position can be selected as an insert or delete position.

[0012] It is preferable that, when designating a wale or course insert position, it is possible to designate which of a wale or course on a left side of the insert position or a wale or course on a right side is to be copied, and the input processor reverses a copy direction in a case where the wale or course to be copied reaches a contour of the knitted fabric, and copies the wale or course so as to skip functional data in a case where a range of the wale or course to be copied includes functional data. Accordingly, even if a copy range is designated so as to extend outside the contour of the knitted fabric, copy can be performed without causing errors. Furthermore, even if functional data exists within the designated copy range, copy can be performed so as not to overlap the functional data.

Brief Description of the Drawings

[0013]

FIG. 1 is a block diagram of a knit design apparatus according to an embodiment.
FIG. 2 is a flowchart illustrating a wale insertion/de-

letion method according to the embodiment.
FIG. 3 is a view showing a design screen on the back side of a glove.
FIG. 4 is a view showing a design screen on the palm side of the glove.
FIG. 5 is a view illustrating processing performed when a wale insert line and a copy range interfering with functional data have been designated.

Mode for Carrying out the Invention

[0014] Hereinafter, an optimal embodiment for carrying out the present invention will be described. The scope of the invention should be construed in view of the description of the claims together with the possibility of changes according to well known techniques.

Embodiment

[0015] FIGS. 1 to 5 show an embodiment. In the drawings, 2 denotes a knit design apparatus, or a design apparatus for short, that is configured with a computer, 4 denotes a bus, 6 denotes a color monitor, and 8 denotes a color printer. Also, 10 denotes a network interface, 12 denotes an external memory drive, 14 denotes a keyboard, and 16 denotes a pen, but it also may be a mouse, a joystick, a track ball, or the like. The design of a knit product is input by an operator using the constituent components from the network interface 10 to the pen 16, an image representing the input design data, that is, a design image is displayed on the color monitor 6, and the design data is output from the network interface 10, the external memory drive 12, or the like.

[0016] Also, 18 denotes a CPU, and 20 denotes an input processor that processes the input by the operator so as to convert it into design data of the knit product. The input processor 20 converts the design data into color codes, yarn structure data indicating yarn connection and stitch type, or the like, and stores the obtained data in a memory 26. In the design data expressed in color codes, which will be hereinafter referred to as color code data, for example, the outward form of a knit product is expressed as the number of stitches in the course direction and the wale direction. Furthermore, the functional data is data indicating flechage, stitch shift, dart (position having no stitch due to narrowing), widening, C-knitting, or the like. In addition to the above, the color code data may include data indicating, for example, stitch type such as face stitch or back stitch and yarn carrier allocation (color coordination). The color code data includes at least the arrangement and the connection of stitches, and the functional data indicating dart, widening, flechage, or the like. These data sets are used to specify the shape and the structure of the knit product. Furthermore, the color code data is stored, for example, as image data in the memory 26.

[0017] A functional data detector 22 and a preview processor 24 are arranged under the input processor 20.

The functional data detector 22 detects functional data in the design data, and the preview processor creates a preview image of the design data of the knit product edited according to the input by the operator, and displays the created image on the color monitor 6. Also, 28 denotes a converter that converts the design data into knitting data of the knit product.

[0018] Hereinafter, an example of the functional data will be described. In order to make a knit product three-dimensional, flechage may be performed, and a specific color code is allocated as functional data to a location where flechage is to be performed. If the number of wales decreases due to narrowing or the like, an eliminated wale is taken as a "dart", and a specific color code is allocated to it as the functional data. The color code "dart" is data indicating that there is no stitch in that location, and whether stitches on the right side of the dart are drawn to the left or stitches on the left side are drawn to the right. In this embodiment, the design of a glove, which is a tubular knit product, will be shown as an example. A wrist portion of a glove may be provided with a slit formed by C-knitting. A color code indicating that a knitted fabric is to be provided with ends instead of being knitted in a tubular shape is allocated to a location where C-knitting is to be performed. A color code for functional data other than the above may be provided as well.

[0019] During editing of the design data of a knit product after input by the operator, a wale may be inserted or deleted, or a course may be inserted or deleted. Hereinafter, insertion/deletion of a wale will be described, but insertion/deletion of a course can be performed in a similar manner.

[0020] As shown in Step 1 of FIG. 2, a wale insert line or a delete range is designated. In the case of insertion, the number of wales to be inserted is designated, and which wale is to be copied is also designated. Here, insertion refers to processing of pasting a copied wale to an insert line between wales. Deletion refers to processing of deleting a wale or course in a designated range on one side or both sides of a delete line, and connecting both sides of the delete range at the position of the delete line. An instruction regarding the wale insertion and deletion may be directly input to a color code screen for design data by designating, for example, the insert line and the range of wales to be copied, or the range of wales to be deleted, using a pen or the like. Alternatively, a middle finger portion, a ring finger portion, and the like may be designated, and positions in these portions may be determined by the input processor 20 so as not to include functional data. This input is referred to as "region designating input", and regions, positions in the regions, and the like may be designated in detail, or only regions may be designated and positions in the regions may be selected in the subsequent preview image stage. In the region designating input, the number of wales to be inserted or deleted is input in numbers, for example, as "three wales". In the case of wale deletion, the range of wales to be deleted may be directly input using a pen or

the like, or may be designated through the region designating input, for example, as "three wales at the center of a middle finger portion" or "two wales at the left end of a middle finger portion".

[0021] There are many knit products configured with front and back knitted fabrics, such as gloves, sweaters, and socks. If an instruction to insert or delete a wale or course to or from one of front and back knitted fabrics is input, the input processor 20 considers that an instruction to perform insertion or deletion to or from the opposing position in the other knitted fabric has been input. Since an instruction to perform insertion or deletion can be input while viewing a design screen of one of front and back knitted fabrics instead of viewing both design screens of front and back knitted fabrics, the input of instructions to perform insertion and deletion can be easily performed.

[0022] In Step 2 of FIG. 2, functional data relating to an insert or delete line, that is, data relating to the structure of a knit product is detected. If it is detected that functional data exists on both sides of the insert or delete line, the insert or delete line is shifted in the course direction (knitting width direction of the knit product) such that the functional data exists only on one side of the insert or delete line. Also, if a position having no stitch, such as a position between finger portions, is designated as an insert or delete line, the insert or delete line is shifted as in the case of the functional data. For example, if a wale insert or delete line extends outside the contour of the knit product, is included in a dart, or overlaps a location where stitch shift, C-knitting, or the like is to be performed, the insert or delete line is shifted.

[0023] When inserting or deleting a wale, if a stitch to which the functional data is allocated is included in a copy or delete range, a stitch in its next wale is copied or deleted so as to skip that stitch. When the insert or delete range reaches the contour of the knitted fabric, the copy or delete direction is reversed, and the remaining wales are copied or deleted (Step 3). Next, in the case of designation of a region, a plurality of images (design images in color codes) obtained by editing design data according to the input by the operator are displayed on the color monitor 6 as preview images with different copy or delete positions. For example, if a middle finger portion is designated as a wale insert position, an image in which the insertion has been performed at the center of the middle finger portion, an image in which the insertion has been performed at the left end of the middle finger portion, and an image in which the insertion has been performed at the right end of the middle finger portion are displayed (Step 4). If the operator selects an appropriate image from among the displayed images (Step 5), the design data in the memory 26 is overwritten with knitting data corresponding to the image selected by the operator (Step 6). Since the operator can select an insert or delete position, the insert or delete position can be determined so as to avoid a pattern and the like.

[0024] Furthermore, if an instruction to insert or delete a wale or course to or from one of front and back knitted

fabrics is input, Steps 2 to 6 are performed also on the other knitted fabric in a similar manner. If an insert or delete position in one of knitted fabrics is shifted in order to avoid functional data, an insert or delete position in the other knitted fabric does not have to be shifted.

[0025]   FIGS. 3 and 4 show the design of a plain glove that is assumed to have a three-dimensional shape in this example. Here, 30 denotes a design image of the back side of the glove, and 50 denotes a design image of the palm side of the glove, both of which are expressed in color codes. Also, 32 denotes a flechage code indicating that, after the first course (not displayed in the design image because it always exists) of a fingertip portion is knitted, no stitch is knitted at the code 32 position. Narrowing is performed at a finger base portion, and a dart code is allocated to an eliminated wale such that which wale in the finger portion has been eliminated is shown and the wale is displayed as a vertical straight line. Also, 34 denotes a dart code with movement towards right with respect to the drawing, and 36 denotes a dart code with movement towards left with respect to the drawing. The code 34 means to fill the gap accompanying the dart by moving the left portion towards right, and the code 36 means to fill the gap by moving the right portion towards left.

[0026]   In order to make the glove three-dimensional, a dart code with movement towards right 44 and a dart code with movement towards left 46 are allocated to the bases of a thumb portion and an index finger portion on the palm side. Moreover, a 2-stitch-wide C-knitting code 42 is allocated to the wrist side, and the knitted fabric is divided into left and right portions along the center line of the code 42.

[0027]   The above-described codes 32 to 46 are an example of functional data, or special codes. When portions to which the codes 32 to 46 are allocated change, the knitting structure for defining the outward form of the glove changes, and, in many cases, the design becomes unnatural. Thus, in the case of wale insertion, the insert line is shifted so as not to overlap an area to which a special code is allocated, and the copy range is shifted so as not to include a stitch to which a special code is allocated. In the case of deletion, the delete range is shifted so as not to include a stitch to which a special code is allocated.

[0028]   FIG. 5 shows an example in which a wale insert line or the like is modified. Here, 52 denotes an insert line initially input by an operator through direct input, which overlaps an area to which the dart code 34 is allocated. Furthermore, if an insert range for three wales is designated on the right of the insert line 52, this range extends into a portion in which no knitted fabric exists between finger portions. Thus, the insert line 52 is shifted, for example, to the right at a position that overlaps the dart 34, and an insert line 54 is obtained. If the copy range is for three wales on the right of the insert line 54, only two wales can exist on the right of the insert line in a finger pocket portion. Thus, two wales on the right of the

insert line 54 are added to an insert range 56, and the direction for searching for the insert range is reversed because the third wale is positioned outside the contour of the finger portion, and one wale on the left of the insert line 54 is added to the insert range 56. Here, also in the case of course insertion or deletion, it is preferable to determine an insert line and a copy range, and a delete range so as to avoid a course having functional data. When searching for the wale insert range 56 near a fingertip portion, if the flechage code 32 is skipped because the flechage code 32 exists, the range extends beyond the contour of the finger portion. Thus, the direction for searching for the insert range is reversed.

[0029]   In the forgoing embodiment, a plain glove has been shown, but, if a pattern by knit structure, an intarsia pattern, a jacquard pattern, and the like are included, it is preferable to determine an insert line and a copy range, and a delete range so as to avoid a range to which the pattern by knit structure, the intarsia pattern, and the jacquard pattern are included. In this case, if insertion or deletion is performed at an end of the portion, interference with patterns such as a pattern by knit structure can be reduced. In this embodiment, design data is expressed in color codes. However, the embodiment can be applied to displays not using color codes, if a screen displaying the arrangement and the connection of stitches is displayed using a method other than color codes, and an insert line and a copy range, and a delete range are shifted when functional data such as dart, widening, flechage, stitch shift, C-knitting, or the like is detected.

[0030]   In the foregoing embodiment, the input of wale insertion and deletion performed by an operator is edited by a design apparatus such that dart, widening, stitch shift, C-knitting, flechage, and the like are avoided, and, thus, wale insertion and deletion can be easily performed, and the design of knit products are not disturbed.

Claims

1.   A knit design apparatus (2) having: input means (10 - 16) by which an operator can input a design of a knit product; an input processor (20) that converts data input by the operator into design data of the knit product; a memory (26) for the design data; and a color monitor (6) that displays the design data so as to express an arrangement and connection of stitches, **characterized by** comprising:

     detection means (22) for detecting whether or not functional data is included in an input range, in a case where an instruction to insert or delete a wale or course of stitches is input from the input means (10 to 16),
     wherein the input processor (20) shifts an insert or delete position so as not to include functional data, in a case where functional data is included in the input range.

2. The knit design apparatus (2) according to claim 1, **characterized in that**:

> in a case where a knit product to be designed includes front and back knitted fabrics, and the operator inputs an instruction to insert or delete a wale or course to or from one of the front and back knitted fabrics,
> the input processor (20) receives the instruction as including to insert or delete a wale or course to or from a second input range at an opposing position in another knitted fabric, the detection means (22) detects whether or not functional data is included in the second input range, and the input processor (20) shifts an insert or delete position so as not to include functional data in a case where functional data is included in the second input range.

3. The knit design apparatus (2) according to claim 1 or 2, **characterized in that**: the input processor (20) enables the operator to directly input an insert or delete position on a display of an arrangement and connection of stitches displayed on the color monitor (6), and to input the insert or delete position through designation of a region in the knit product.

4. The knit design apparatus (2) according to claim 3, **characterized in that**: in a case where an insert or delete position is input through the designation of the region, the input processor (20) displays on the color monitor (6) a plurality of design data sets with different insert or delete positions on which insertion or deletion of a wale or course of stitches has been performed, and overwrites design data based on the insert or delete position selected by the operator.

5. The knit design apparatus (2) according to claim 4, **characterized in that**: the operator can designate whether the insertion or deletion is to be carried out at a center of the region or at an end of the region.

6. The knit design apparatus (2) according to any one of claims 1 to 5, **characterized in that**:

> when designating a wale or course insert position, it is possible to designate which of a wale or course on a left side of the insert position or a wale or course on a right side is to be copied, and
> the input processor (20) reverses a copy direction in a case where the wale or course to be copied reaches a contour of the knitted fabric, and copies the wale or course so as to skip functional data in a case where a range of the wale or course to be copied includes functional data.

7. A knit design method in which input means (10 to 16) accepts input of a design of a knit product that is input by an operator, an input processor (20) converts the input into design data of the knit product, a memory (26) stores the design data, and a color monitor (6) displays the design data as an arrangement and connection of stitches, **characterized by** comprising:

> a step of detecting, by detection means (22), whether or not functional data is included in an input range, in a case where an instruction to insert or delete a wale or course of stitches is input from the input means (10 to 16); and
> a step of shifting, by the input processor (20), an insert or delete position so as not to include functional data, in a case where functional data is included in the input range.
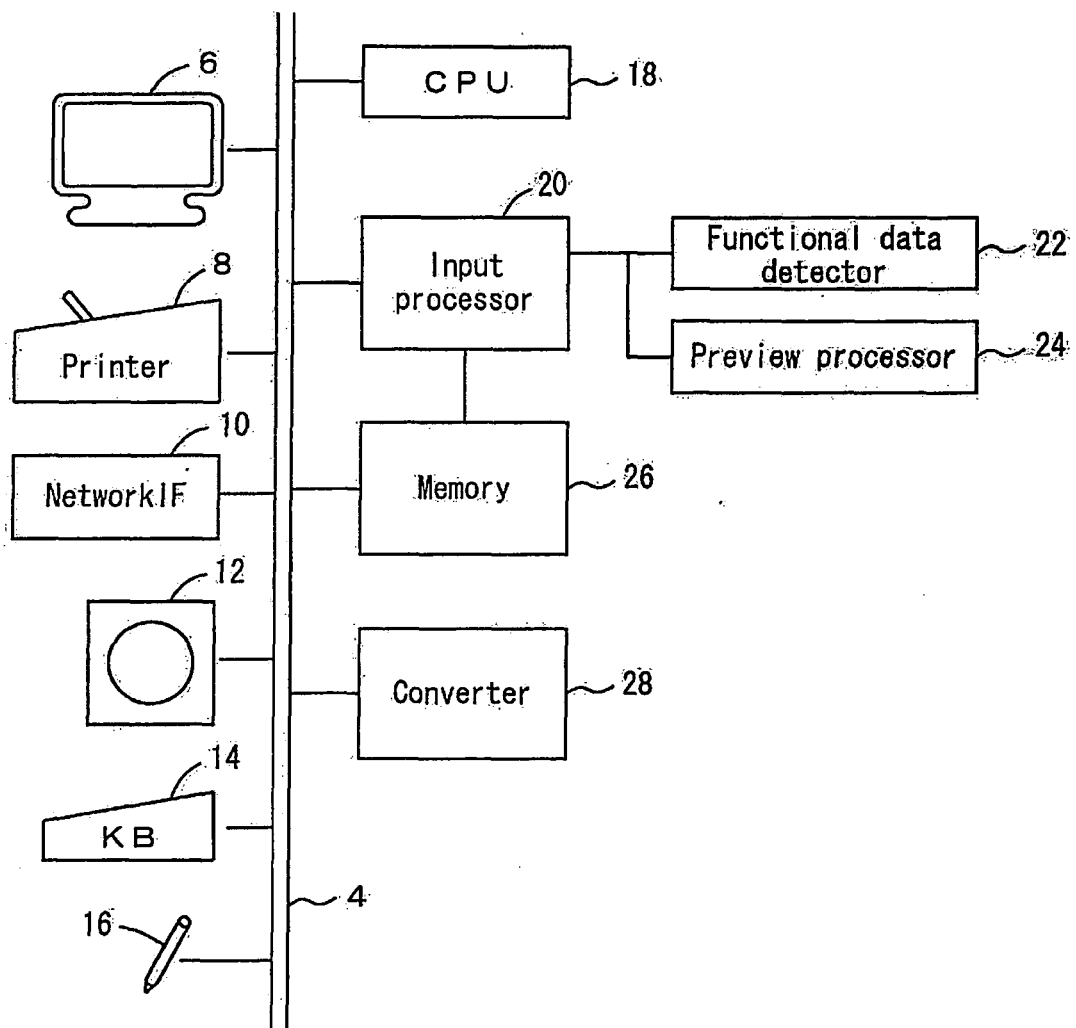
F I G. 1

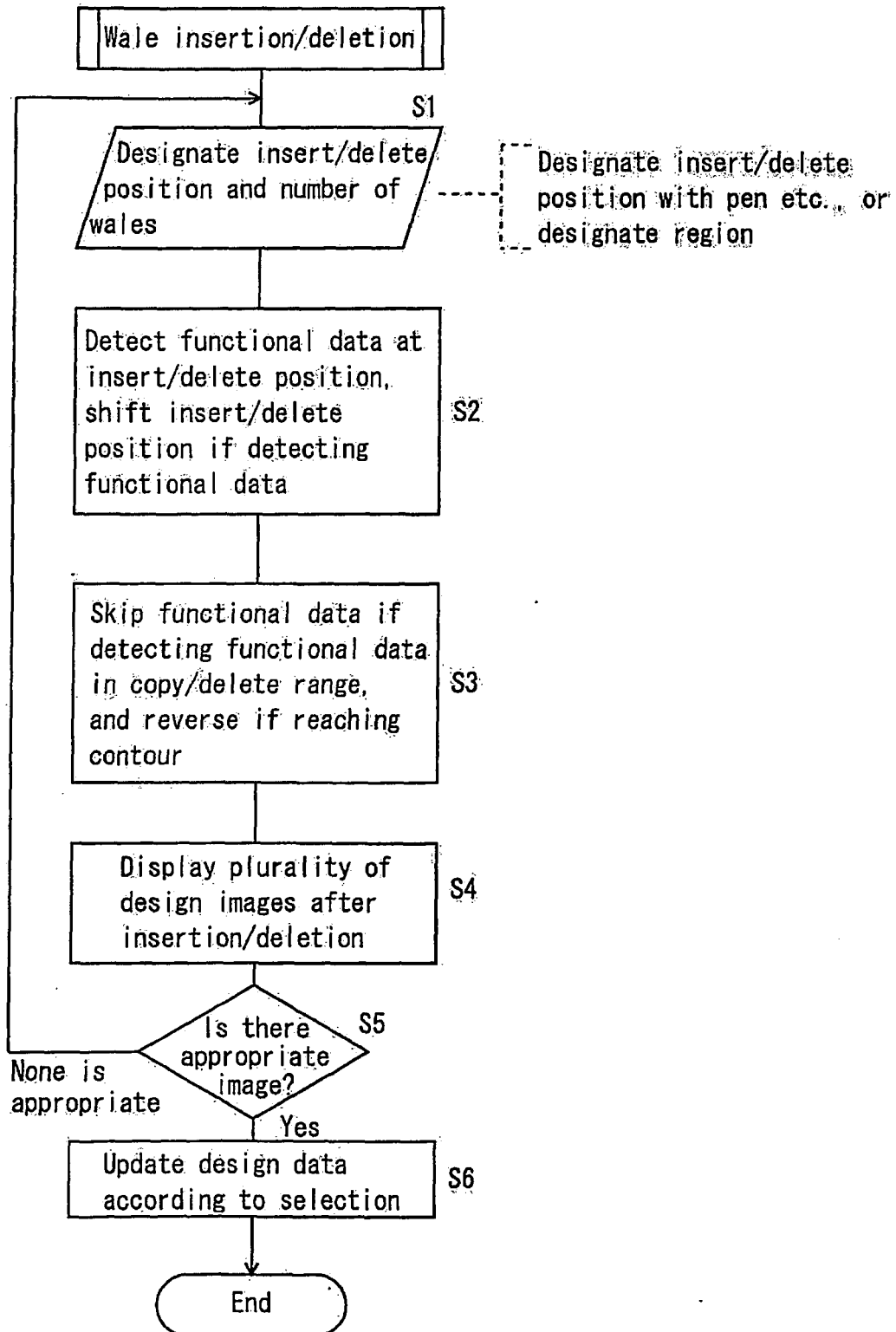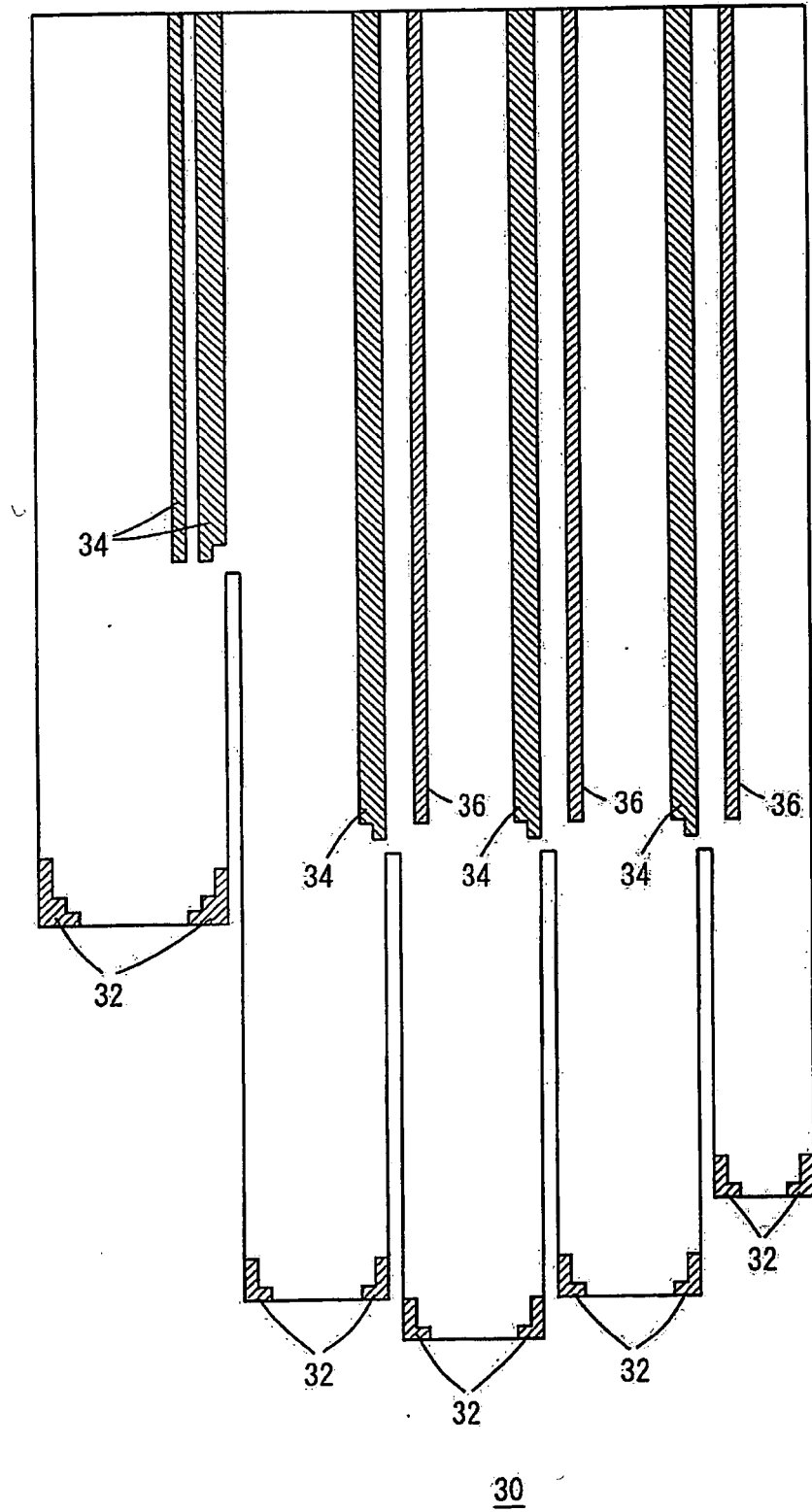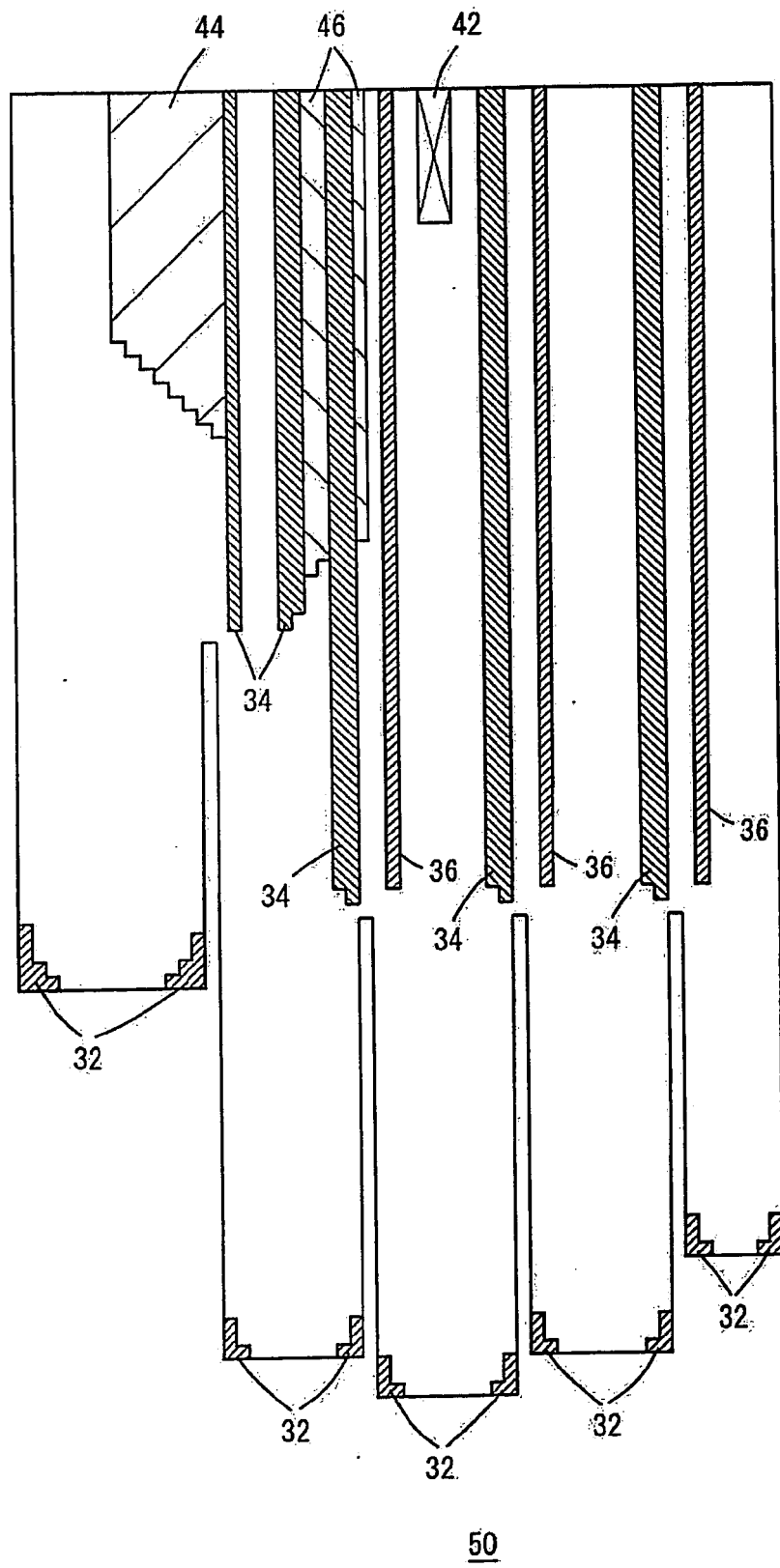
CPU ~18

Input processor 20

Functional data detector ~22

Preview processor ~24

Memory ~26

Converter ~28

6

8 Printer

10 NetworkIF

12

14 KB

16

4

2

F I G. 2

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┌─────────────────────────┐
│║ Wale insertion/deletion ║│
└─────────────────────────┘
            │
            ▼                    S1
    ╱─────────────────────╱
   ╱ Designate insert/delete╱      ┌─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─
  ╱ position and number of ╱ ─ ─ ─ ─ Designate insert/delete
 ╱ wales                  ╱       ╎ position with pen etc., or
 ╱───────────────────────╱        └ ─ designate region
            │
            ▼
  ┌────────────────────────┐
  │ Detect functional data at│
  │ insert/delete position,  │
  │ shift insert/delete      │    S2
  │ position if detecting    │
  │ functional data          │
  └────────────────────────┘
            │
            ▼
  ┌────────────────────────┐
  │ Skip functional data if  │
  │ detecting functional data│
  │ in copy/delete range,    │    S3
  │ and reverse if reaching  │
  │ contour                  │
  └────────────────────────┘
            │
            ▼
  ┌────────────────────────┐
  │ Display plurality of     │   S4
  │ design images after      │
  │ insertion/deletion       │
  └────────────────────────┘
            │
            ▼
          ╱╲  S5
        ╱ Is there ╲
  ─────╱ appropriate ╲
None is ╲   image?   ╱
appropriate ╲      ╱
            ╲╱
            │ Yes
            ▼
  ┌────────────────────────┐
  │ Update design data       │   S6
  │ according to selection   │
  └────────────────────────┘
            │
            ▼
       ╭──────────╮
       │   End    │
       ╰──────────╯
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F I G. 3

30

F I G . 4

50

F I G. 5

REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

- JP 2916990 B **[0002] [0004]**