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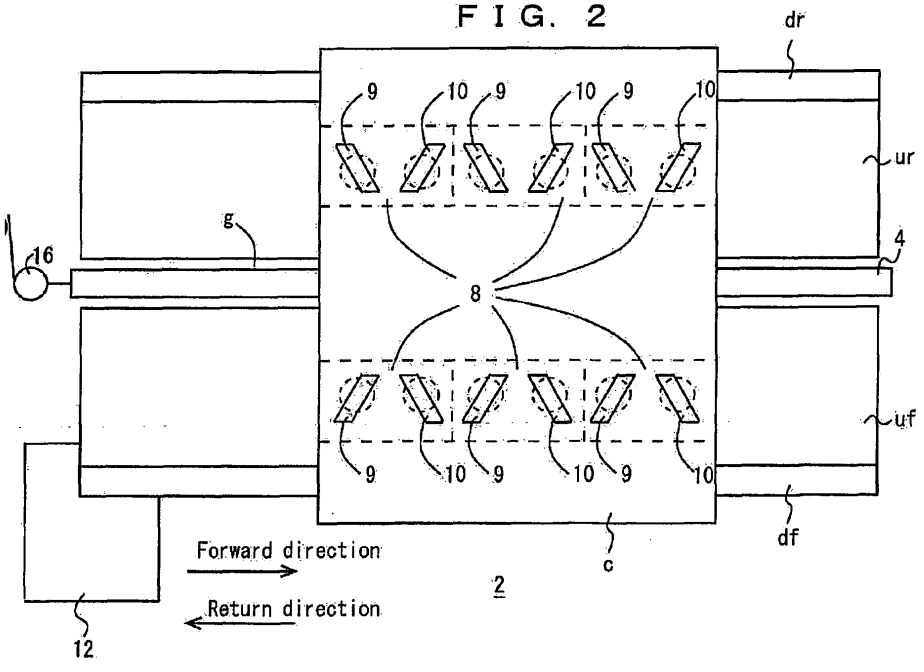
(54) Yarn length control device and control method in a flat knitting machine

(57) Stitch cams (9, 10) of each needle bed, in a flat knitting machine (2) provided with at least a pair of front and rear needle beds are controlled in accordance with a stitch cam correction value, and the stitch cam correction value is updated in accordance with a difference between loop length of stitches formed in the flat knitting machine (2) and a target value of loop length of the stitches. Setting is made as to whether to update the stitch cam correction value by a common change amount for each needle bed, or to update the stitch cam correction value by a dissimilar change amount varied depending on the needle bed, and the stitch cam correction value of each needle bed is updated according to the setting.

FIG. 2



EP 2 439 322 A1

Description

[0001] The present invention relates to yam length control in a flat knitting machine.

[0002] Flat knitting machines comprise ordinarily two needle beds, at the front and the rear, and there are also flat knitting machines that comprise a total of four needle beds, front, rear, up and down. In known technologies, a measurement of consumed yam length is compared with a target value, in other words, the loop length of actual stitches is compared with a loop length target value, and the result is fed back to a stitch cam correction value, so as to prevent variability in the size of the knitted fabric that is knitted in the flat knitting machine (Patent document 1: JP 3085638 B). In Patent document 1, a consumed yam length is measured by way of a rotary encoder or the like, and the stitch cam correction value is updated in accordance with a difference vis-à-vis the target value. Stitch cams, which are cams in a carriage of a flat knitting machine, are cams that control the loop length of the stitches, i.e. the yam length per one stitch. The stitch cam is controlled by an actuator such as a stitch cam motor or the like.

[0003] In Patent document 1, a stitch cam correction value is stored for each combination of stitch cam and yarn. The stitch cam correction value is modified by the same change amount at the front and rear needle beds. Upon update of the stitch cam correction value while knitting is performed at the front needle bed, for instance, the stitch cam correction value of the rear needle bed is updated by the same change amount, as a result of which the stitch cam correction value of the rear needle bed becomes updated to an appropriate value beforehand.

[0004] The inventors focused on the feature wherein the change amount of the stitch cam correction value for modifying loop length by a same amount is dissimilar for different needle beds. In the case, for instance, of a flat knitting machine having four needle beds, front, rear, up and down, the angles of the needle beds with respect to the horizontal plane are different between the upper and lower needle beds. As a result, the loop length of stitches formed at the upper needle bed tends to change gently in response to changes in the stitch cam correction value, whereas the loop length of stitches formed at the lower needle bed tends to change abruptly in response to changes in the stitch cam correction value. If the stitch cam correction values of the upper and lower needle beds are modified jointly, the loop length for knitting at the lower needle bed changes excessively, while the loop length of knitting at the upper needle bed changes little. As a result, the stitch cam correction value fails to be updated to an appropriate value. In such a case, the stitch cam correction value is unstable, and the loop length is likewise unstable. Also, the stitch cam correction value of the upper needle bed may in some cases decrease after the stitch cam correction value of the lower needle bed has reached a lower limit on account of tight stitching or the like. In that case, the stitch cam correction value of the lower needle bed becomes smaller than the lower limit, and an error occurs. Differences in the change of loop length per change amount of the stitch cam correction value are significant between the upper and lower needle beds, but exist also between the front and rear needle beds.

[0005] Other problems are as follows. In knitting of rib fabric, the consumed yarn length may change abruptly in response to changes in the rib pattern, for instance modification of the rib pattern from 2x2 to 3x3. The consumed yam length may also change abruptly through changes in yam tension during rib knitting. The texture of the knitted fabric is likely to vary when the stitch cam correction value is updated to deal with the foregoing occurrences. If the stitch cam correction value is not updated, however, the loop length deviates from the target, and the length and so forth of the knitted fabric is readily upset. In garter knitting performed in a four-bed machine, the optimal stitch cam correction values of the upper and lower beds are dissimilar when garter knitting of the front knitted fabric is performed at the front lower bed and rear upper bed and garter knitting of the rear knitted fabric is performed at the rear lower bed, and the front upper bed. Therefore, stitch size may become dissimilar between face stitch courses and rear stitch courses, which gives rise to striping.

[0006] It is an object of the present invention to allow knitting stitches at a target loop length even when changes in loop length per amount of change of stitch cam correction value vary depending on the needle bed.

It is another object of the present invention to prevent variability in knitted fabric length and so forth while preserving a constant texture in rib knitting.

[0007] The present invention is a yam length control device, in a flat knitting machine, for controlling a stitch cam of each needle bed in a flat knitting machine provided with at least a pair of front and rear needle beds in accordance with a stitch cam correction value, and for updating the stitch cam correction value in accordance with a difference between loop length of stitches formed in the flat knitting machine and a target value of loop length of the stitches, the yam length control device comprising:

> a stitch cam correction unit by which setting can be made as to whether to update the stitch cam correction value by a common change amount for each needle bed, or to update the stitch cam correction value by a dissimilar change amount varied depending on the needle bed,
> the stitch cam correction unit further updating the stitch cam correction value of each needle bed according to the setting.

[0008] The present invention is also a yam length control method in a flat knitting machine, for controlling a stitch cam of each needle bed in a flat knitting machine provided with at least a pair of front and rear needle beds in accordance with a stitch cam correction value, and

updating the stitch cam correction value in accordance with a difference between loop length of stitches formed in the flat knitting machine and a target value of loop length of the stitches, the method executing:

a step of setting whether to update the stitch cam correction value by a common change amount for each needle bed, or to update the stitch cam correction value by a dissimilar change amount varied depending on the needle bed; and
a step of updating the stitch cam correction value of each needle bed according to the setting.

[0009] The present invention allows setting whether to update the stitch cam correction value by a common change amount for each needle bed, or to update the stitch cam correction value by a dissimilar change amount varied depending on the needle bed. Upon update of a stitch cam correction value by a common change amount it becomes therefore possible to update a stitch cam correction value also for stitch cams of needle beds that are not being used for knitting. Upon update of a stitch cam correction value by a dissimilar change amount, it becomes possible to prevent stitch loop lengths from being dissimilar, or failure to match a target loop length, and to prevent the stitch cam correction value from becoming unstable. It becomes further possible to prevent variability in knitted fabric length or the like, while maintaining a constant texture of rib knitting, by setting a dissimilar change amount of stitch cam correction value at a needle bed where rib fabric face stitches are knitted and at a needle bed where rear stitches are knitted. In the present description, the disclosure relating to the yam length control device applies as-is also to the yam length control method, and the disclosure relating to the yam length control method applies as-is also to the yam length control device.

[0010] In the setting of updating a stitch cam correction value by a dissimilar change amount varied depending on the needle bed, preferably, the stitch cam correction unit updates, for rib knitting, the stitch cam correction value of a needle bed, where rib rear stitches are knitted, by a relatively large change amount, and updates the stitch cam correction value of a needle bed, where rib face stitches are knitted, by a relatively small change amount. A relatively small change amount includes a change amount of 0. For instance, the stitch cam correction value of a needle bed at which rib face stitches are knitted is fixed during rib knitting. A relatively small value may be for instance 3/4 or less, preferably 1/2 or less, of a relatively large change amount of stitch cam correction value. Rib face stitches are more conspicuous than rear stitches, and changes in loop length in the face stitches can be readily felt in the form of changes in the texture of the knitted fabric. Therefore, the texture is rendered stable by reducing the change of stitch cam correction value of needle beds at which face stitches are knitted. The consumed yam length of rib fabric deviates from a target value upon reduction of the change of the stitch cam correction value of a needle bed where face stitches are knitted. This deviation is corrected by significantly modifying the stitch cam correction value of a needle bed where rib rear stitches are knitted. Therefore, the entire rib fabric is knitted at the target consumed yam length. Rib rear stitches are inconspicuous, and hence changes in texture are not noticeable, even upon significant changes in the stitch cam correction value. Also, the consumed yam length of rib fabric is controlled so as to match a target value, and hence the size of the knitted fabric, in terms of length or the like, exhibits no variability.

[0011] In the setting of updating the stitch cam correction value by a dissimilar change amount varied depending on the needle bed, preferably, the stitch cam correction value is updated such that the loop lengths of stitches formed in each needle bed are identical. That is, in case of a dissimilar change amount of stitch cam correction value for forming stitches of identical loop length according to the needle bed, the stitch cam correction value is updated by a dissimilar change amount, so that the loop lengths of stitches formed at each needle bed are rendered uniform.

More preferably, the stitch cam correction unit obtains a proportion of change of loop length of stitches with respect to the change amount of the stitch cam correction value, for a plurality of needle beds, and the obtained proportion is stored in a storage unit; and in the setting of updating the stitch cam correction value by a dissimilar change amount varied depending on the needle bed, the stitch cam correction unit updates the stitch cam correction value by a change amount according to the proportion. Herein, obtaining a proportion for a plurality of needle beds refers to, for instance, obtaining a proportion for each needle bed, or obtaining a proportion for one of the lower needle beds and one of the upper needle beds. The change amount of the stitch cam correction value for modifying a loop length by a same amount varies depending on the needle bed. Accordingly, there is stored a proportion of the change of the loop length of stitches with respect to the change amount of the stitch cam correction value, and the stitch cam correction value is updated according to the stored proportion. Thereupon, a small change amount is used in needle bed where loop length changes sharply with respect to changes in stitch cam correction value, and a large change amount is used in needle beds where loop length changes only slightly with respect to changes in the stitch cam correction value. The stitch cam correction value can be updated thereby to an optimal value.

[0012] Particularly preferably, the flat knitting machine comprises front, rear, up and down needle beds, and, in the setting of updating the stitch cam correction value by a dissimilar change amount varied depending on the needle bed, the stitch cam correction value of at least the upper front and rear needle beds and the stitch cam correction value of the lower front and rear needle beds are updated by a dissimilar change amount. In a flat knitting

machine provided with four needle beds, front, rear, up and down, for instance, the inclinations of the upper needle beds and of the lower needle beds are dissimilar, and changes in the loop length of the stitches, upon changes of the stitch cam correction value by a same amount, are likewise dissimilar. As a result, this allows correcting the influence of the difference between upper and lower needle beds upon update, by dissimilar change amounts, of the stitch cam correction value of the upper needle beds and the stitch cam correction value of the lower front and rear needle beds.

[0013]

Fig. 1 is a diagram illustrating schematically the arrangement of front, rear, up and down needle beds and a carriage in a flat knitting machine;
Fig. 2 is a diagram illustrating schematically stitch cams in each needle bed on a carriage;
Fig. 3 is a block diagram of a yam length control device in an example;
Fig. 4 is a diagram illustrating schematically a stitch cam correction table;
Fig. 5 is a flowchart illustrating a loop length routine in an example;
Fig. 6 is a flowchart of a stitch cam correction subroutine A in an example;
Fig. 7 is a flowchart of a stitch cam correction subroutine B in an example; and
Fig. 8 is a flowchart of a stitch cam correction subroutine C in an example.

[0014] Best modes for carrying out the invention are explained next. It should be understood that the scope of the invention contemplates the possibility of modifications, based on known technologies, of the subject matter set forth in the claims.

Examples

[0015] Fig. 1 to Fig. 8 illustrate examples and variations of the examples. Fig. 1 and Fig. 2 illustrate the structure of a flat knitting machine 2. The flat knitting machine 2 comprises four needle beds, namely a lower front needle bed df, a lower rear needle bed dr, an upper front needle bed uf and an upper rear needle bed ur. The flat knitting machine may be provided with two needle beds that comprise only the lower needle beds df, dr. The needle beds df to ur have a rail 4 at the top. A plurality of yam feeders 6 move along the rail 4, to supply yam to needles, not shown, in the needle beds df to ur. A carriage c moves over the needle beds df to ur, to operate the needles of the needle beds. Herein, g denotes a trick gap, being a site at which stitches are formed by the needles of the needle beds df to ur. In the flat knitting machine 2, front, rear, up and down are defined as illustrated in Fig. 1. Front is the side of the front needle beds df, uf, and rear is the side of the rear needle beds dr, ur. Also, up is defined in the customary sense as the upper side, and down is defined in the customary sense as the lower side.

[0016] The carriage c comprises a plurality of cam systems 8 that operate the needles of the respective needle beds df to ur. Stitch cams 9, 10 in each cam system 8 are cams that control the loop length of stitches, i.e. that control stitch size. Herein, loop length denotes yam length per one stitch, and stitch size denotes the longitudinal and transversal size of the stitch. The stitch cams 9, 10 control the extent of rise and descent of the yarn-holding needles. The stitch cams 9, 10 are controlled by stitch cam motors M1 to M24 (Fig. 3) that are provided for each stitch cam. The stitch cams 9 are stitch cams in the forward direction and the stitch cams 10 are stitch cams in the return direction. In the examples, the needle beds df to ur are four beds, front, rear, up and down, with, for instance, three cam systems 8 provided per needle bed. There are thus a total of 24 stitch cams 9, 10.

[0017] The reference numeral 12 denotes a controller of the flat knitting machine 2, and the reference numeral 16 denotes an encoder, for instance a rotary encoder, that measures the length of yarn that is supplied to the yarn feeder 6. The yarn length control device 14 is provided within the controller 12, except for the encoder 16 and the stitch cam motors M1 to M24. As illustrated in Fig. 3, the yam length measured by the encoder 16 and the target yam length are compared, in the comparator 18, for instance for every course that is knitted. The stitch cam correction unit 20 updates the stitch cam correction table 22 using the comparison results of the comparator 18. The stitch cam motors M1 to M24 are controlled, for instance during reversal of the carriage c at the end of each course, on the basis of the stitch cam correction values stored in the stitch cam correction table 22.

[0018] The setting unit 24 performs setting relating to stitch cam correction. Specifically, the setting unit 24 inputs whether there is performed

- update of stitch cam correction values by respective individual change amounts for each needle bed, front, rear, up and down; or
- update of all the stitch cam correction values of the needle beds by a common change amount; or
- update of the stitch cam correction value of the lower two needle beds by a common change amount, and update of the stitch cam correction value of the upper two needle beds by a common change amount. In the last case, the change amount of the stitch cam correction value differs between the lower needle bed and the upper needle bed. The setting unit 24, for instance, receives user inputs via the controller 12 of the flat knitting machine 2, or discriminates settings relating to stitch cam correction on the basis of knitting data. A conversion table 26 stores a change amount of the stitch cam correction value for modifying loop length by a same amount, for each of the front, rear, up and down needle beds df to ur. The stored values in the conversion table 26 may be a change amount in itself for modifying loop length by

a constant value, or may be relative values of change amount referred to any of the needle beds. Instead of the change amount of the stitch cam correction value there may be stored, for instance, a reciprocal number of the change amount, i.e. the change of loop length upon modification of the stitch cam correction value by a given amount, or a relative value of the change of loop length.

[0019] Fig. 4 illustrates the configuration of the stitch cam correction table 22. One respective stitch cam correction table 22 is provided for each of the four needle beds, front, rear, up and down. In each stitch cam correction table 22 there is stored a stitch cam correction value for the forward-direction stitch cams 9 and the return-direction stitch cams 10, for each cam system C1, C2, C3. In the examples, for instance, there can be used seven types of yarn, such that a stitch cam correction value is stored for each yarn. The stitch cam correction values have an upper limit and a lower limit.

[0020] Fig. 5 illustrates an algorithm of a loop length routine. The loop length routine, for instance, is executed once daily upon startup of the flat knitting machine 2, but may be executed at other frequencies, for instance once weekly or the like. In step 1, the stitch cam correction value for knitting stitches at a target loop length is obtained for each of the stitch cams 9, 10 of each needle bed. In the case of a plurality of yarns, the process is executed for instance for each yarn. The process in step 1 is identical to conventional processes. The particulars of step 1 are arbitrary.

[0021] In the process where step 1 is executed, there is found out the consumed yam length, i.e. to what extent the stitch loop length varies, upon change of the stitch cam correction value by a given amount. Therefore, a change amount of the stitch cam correction value for changing the loop length by a same amount is written in the conversion table 26 (step 2). Step 2 may be executed for each yarn. Alternatively, yarn differences may be ignored. For instance, step 2 may be executed for each needle bed front, rear, up and down. The rates of change of loop length per change amount of the stitch cam correction value of the lower needle beds df, dr may be set to be identical. The rates of change of loop length per change amount of the stitch cam correction value of the upper needle beds uf, ur may be also set to be approximately identical. In such an approximation, step 2 must be executed for at least two needle beds, up and down. Step 2 is a process for executing steps 11 and 12 of Fig. 7. Step 2 may be omitted if stitch cam corrections A, C of Fig. 6 and Fig. 8 are executed.

[0022] Fig. 6 illustrates an initial example (stitch cam correction A). The stitch cam correction A is executed by interrupting knitting of the knitted fabric. The interruption is ended once step 3 to step 7 are executed. In step 3 the consumed yam length and the target yam length are compared, and there is obtained the change amount of the stitch cam correction value for correcting this difference. In step 4, the setting of the setting unit 24 is checked, and the front, rear, up and down stitch cam correction tables are updated by a common change amount in the case of a setting such that the stitch cam correction value is updated by a common change amount for the four needle beds, front, rear, up and down df to ur (step 5). In this case, the stitch cam correction value is updated by a common change amount also for stitch cams of needle beds that are not being used for knitting.

[0023] A common change amount of the stitch cam correction value is set for the lower front and rear needle beds df, dr, and a common change amount of the correction value is set for the upper front and rear needle beds uf, ur. In the case of a setting such that the change amount of the correction value is not common for the upper and lower needle beds, for instance, the stitch cam correction value of the lower front needle bed df and the lower rear needle bed dr, or the stitch cam correction value of the upper front and rear needle beds uf, ur, are updated by a common change amount (step 6). The stitch cam correction value to be updated corresponds to the needle bed for which consumed yarn length is measured in step 3, as well as other front and rear needle beds having the same up and down relationship as that of the needle bed for which consumed yam length is measured in step 3. This setting is particularly effective in the case of garter knitting. In the case of garter knitting at the front and rear of a tubular knitted fabric using a four-bed flat knitting machine, the front knitted fabric has face stitches formed in the lower front needle bed df and rear stitches formed in the upper rear needle bed ur, while the rear knitted fabric has face stitches formed in the lower rear needle bed dr and rear stitches formed in the upper front needle bed uf. If a common change amount of the stitch cam correction value is used in the upper front and rear needle beds, the stitch cam correction value for knitting of face stitch courses is update by a change amount that is identical in the front and rear needle beds, and the stitch cam correction value for knitting of rear stitch courses is updated by a change amount that is identical in the front and rear needle beds.

[0024] The setting may be such that stitch cam correction tables are updated individually for the front, rear, up and down needle beds, i.e. for each needle bed independently from the others. In such a setting, the stitch cam correction table is updated only for the needle bed whose consumed yam length is measured in step 3 (step 7).

[0025] Stitch cam correction B in Fig. 7 illustrates another example of stitch cam correction, wherein steps 3 and 5 are identical to steps 3 and 5 in Fig. 6. Fig. 7 illustrates two types of setting, namely modification of the stitch cam correction value of all needle beds by a same change amount (joint modification), or individual modification of each needle bed (update of the stitch cam correction value by an individual change amount for each needle bed). The setting is checked in step 10. In a case where the stitch cam correction value is updated individ-

ually for each needle bed, the change amount of the stitch cam correction value is decided in accordance with the conversion table 26 of Fig. 3 for needle beds other than the needle beds in which consumed yam length is measured in step 3. In a case where, for instance, the conversion table 26 includes a change amount of the stitch cam correction value per change of loop length, the stitch cam correction value may be modified in accordance with the ratio of the change amount of the stitch cam correction value. For instance, a consumed yam length is measured in a needle bed A, the change amount of the stitch cam correction values is obtained, for a needle bed B, by multiplying the change amount of the stitch cam correction value at needle bed A by (b/a), wherein a denotes the stored value in conversion table 26 for needle bed A and b denotes that for needle bed B (step 11). In step 12, the stitch cam correction table of each needle bed is updated in accordance with the obtained change amount. In a case where the stitch cam correction values can be updated only discretely, preferably, a fraction generated by conversion is stored, and is added at the next update.

[0026] Steps 3, 5 identical to those of Fig. 6 are executed in a stitch cam correction C of Fig. 8. The stitch cam correction C is used for knitting of rib fabrics. In a setting check of step 10, it is checked whether the front, rear, up and down needle beds are to be updated jointly, or individually. In the case of a setting such that the stitch cam values of the front, rear, up and down needle beds are to be updated jointly, and knitting in step 20 is other than rib fabric, there is executed step 5 of Fig. 6. If the stitch cam correction values of the needle beds are updated individually, and the type of knitted fabric during knitting is a rib fabric, then the stitch cam correction values are updated only for a needle bed where rib rear stitches are knitted, while the stitch cam correction values of other needle beds, for instance needle beds where rib face stitches are knitted, are not updated (step 21). The stitch cam correction value of a needle bed at which rib face stitches are knitted may be updated by a change amount that is smaller than that of a needle bed at which rib rear stitches are knitted, for instance by a change amount that is 3/4 or less, preferably 1/2 or less, of that of the needle bed at which rib rear stitches are knitted.

[0027] In step 21 of Fig. 8, the stitch cam correction value is fixed for a needle bed at which rib face stitches are knitted, such that the texture of the rib fabric is essentially determined by the face stitches. The rib fabric texture is kept constant as a result. When the consumed yam length in rib fabric knitting deviates from a target value, the stitch cam correction value of a needle bed at which rear stitches are knitted is updated so as to cancel that deviation. The consumed yam length for the entire rib fabric is caused to match thereby a target value. Size variability, for instance length variability, can be prevented as a result in the knitted fabric. It becomes thus possible to knit a rib fabric having constant texture and desired size throughout the fabric.

[0028] A flat knitting machine 2 having four needle beds, front, rear, up and down, has been explained in the examples, but the flat knitting machine may comprise front and rear needle beds alone. In this case, there is corrected the occurrence whereby changes in loop length are not equal between the front needle beds and the rear needle beds, even when the stitch cam correction values are updated by a same change amount. In four needle beds, front, rear, up and down, the largest difference in changes of loop length with respect to changes in the stitch cam correction value are found between the upper and lower needle beds. Therefore, the lower front needle bed df and lower rear needle bed dr are updated by a common stitch cam correction value, the upper front needle bed uf and the upper rear needle bed ur are updated by a common change amount, and the stitch cam correction values of the lower front and rear needle beds df, dr, and the stitch cam correction values of the upper front and rear needle beds uf, ur are updated by dissimilar change amounts. Doing so allows knitting a knitted fabric having substantially a target loop length.

[0029]

2	flat knitting machine
4	rail
6	yam feeder
8	cam system
9,	10 stitch cam
12	controller
14	yam length control device
16	encoder
18	comparator
20	stitch cam correction unit
22	stitch cam correction table
24	setting unit
26	conversion table
df	lower front needle bed
dr	lower rear needle bed
uf	upper front needle bed
ur	upper rear needle bed
c	carriage

g trip gap

M1 to M24 stitch cam motor

Claims

1. A yam length control device (14) in a flat knitting machine (2), for controlling a stitch cam (9, 10) of each needle bed in a flat knitting machine (2) provided with at least a pair of front and rear needle beds in accordance with a stitch cam correction value, and for updating the stitch cam correction value in accordance with a difference between loop length of stitches formed in the flat knitting machine (2) and a target value of loop length of the stitches,
the yam length control device (14) **characterized by** comprising :

   a stitch cam correction unit (20) by which setting can be made as to whether to update the stitch cam correction value by a common change amount for each needle bed, or to update the stitch cam correction value by a dissimilar change amount varied depending on the needle bed, and by which the stitch cam correction value of each needle bed is updated according to the setting.

2. The yam length control device (14) in a flat knitting machine (2) according to claim 1, **characterized in that** in the setting of updating the stitch cam correction value by a dissimilar change amount varied depending on the needle bed, the stitch cam correction unit (20) updates, for rib knitting, the stitch cam correction value of a needle bed, where rib rear stitches are knitted, by a relatively large change amount, and updates the stitch cam correction value of a needle bed, where rib face stitches are knitted, by a relatively small change amount.

3. The yam length control device (14) in a flat knitting machine (2) according to claim 1, **characterized in that** in the setting of updating the stitch cam correction value by a dissimilar change amount varied depending on the needle bed, the stitch cam correction value is updated such that the loop lengths of stitches formed in each needle bed are identical.

4. The yam length control device (14) in a flat knitting machine (2) according to claim 3, **characterized in that**
the stitch cam correction unit (20) obtains a proportion of change of loop length of stitches with respect to the change amount of the stitch cam correction value, for a plurality of needle beds, and the obtained proportion is stored in a storage unit; and
in the setting of updating the stitch cam correction value by a dissimilar change amount varied depending on the needle bed, the stitch cam correction unit (20) updates the stitch cam correction value by a change amount according to the proportion.

5. The yam length control device (14) in a flat knitting machine (2) according to any of claims 1 to 4, **characterized in that** the flat knitting machine (2) comprises front, rear, up and down (df , dr, uf, ur) needle beds, and in the setting of updating the stitch cam correction value by a dissimilar change amount varied depending on the needle bed, the stitch cam correction value of at least the upper front and rear needle beds and the stitch cam correction value of the lower front and rear needle beds are updated by a dissimilar change amount.

6. A yam length control method in a flat knitting machine (2), for controlling a stitch cam (9, 10) of each needle bed in a flat knitting machine (2) provided with at least a pair of front and rear needle beds in accordance with a stitch cam correction value, and for updating the stitch cam correction value in accordance with a difference between loop length of stitches formed in the flat knitting machine (2) and a target value of loop length of the stitches,
the method being **characterized by** executing:

   a step of setting whether to update the stitch cam correction value by a common change amount for each needle bed, or to update the stitch cam correction value by a dissimilar change amount varied depending on the needle bed; and
   a step of updating the stitch cam correction value of each needle bed according to the setting.

FIG. 1

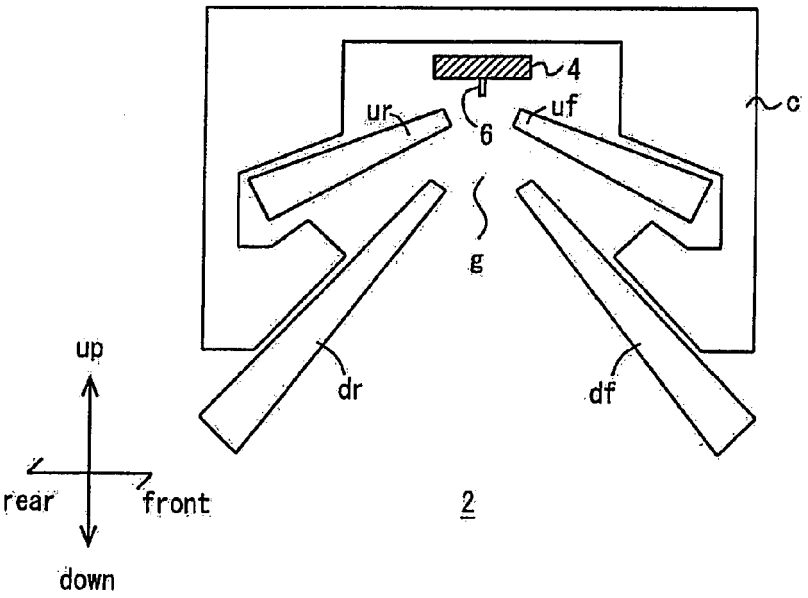
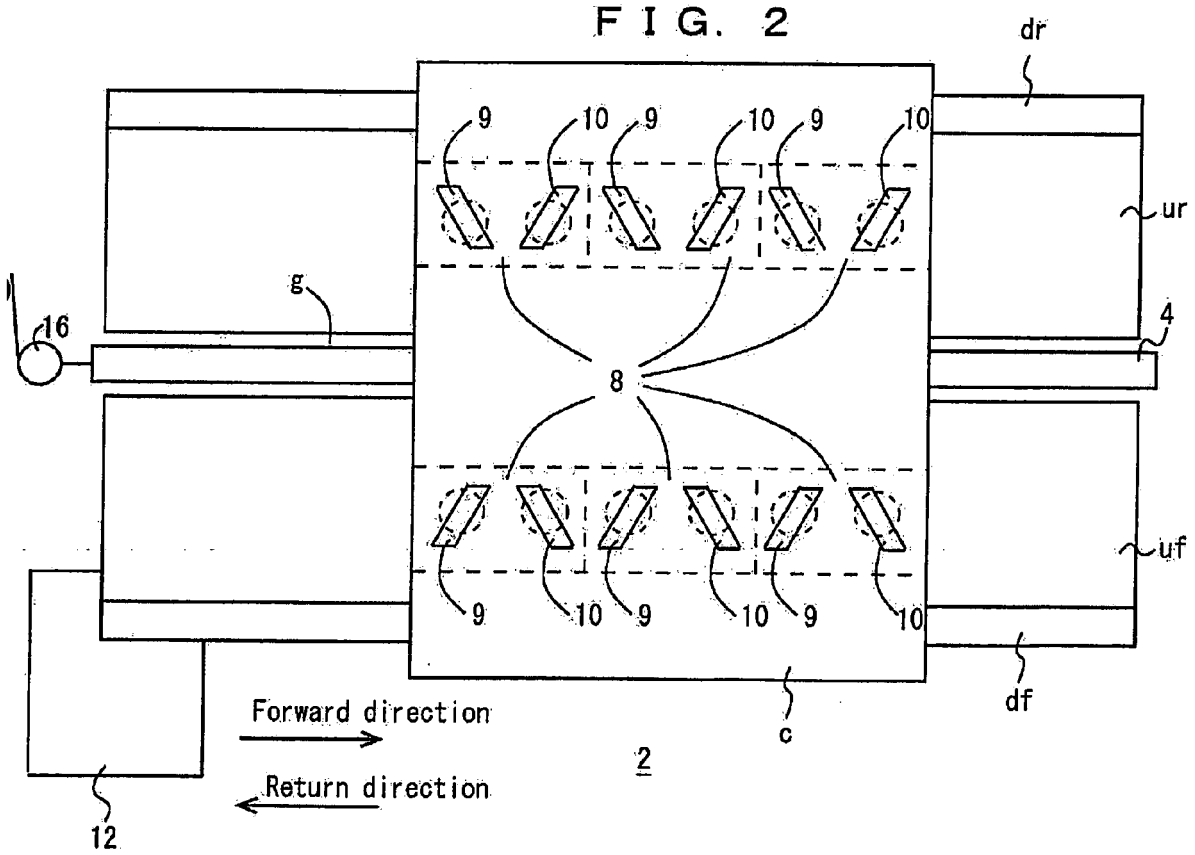

4
ur
uf
6
c
g
dr
df
up
rear
front
down
2

FIG. 2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10
ur
g
16
4
8
uf
df
c
Forward direction
Return direction
12
2

FIG. 3

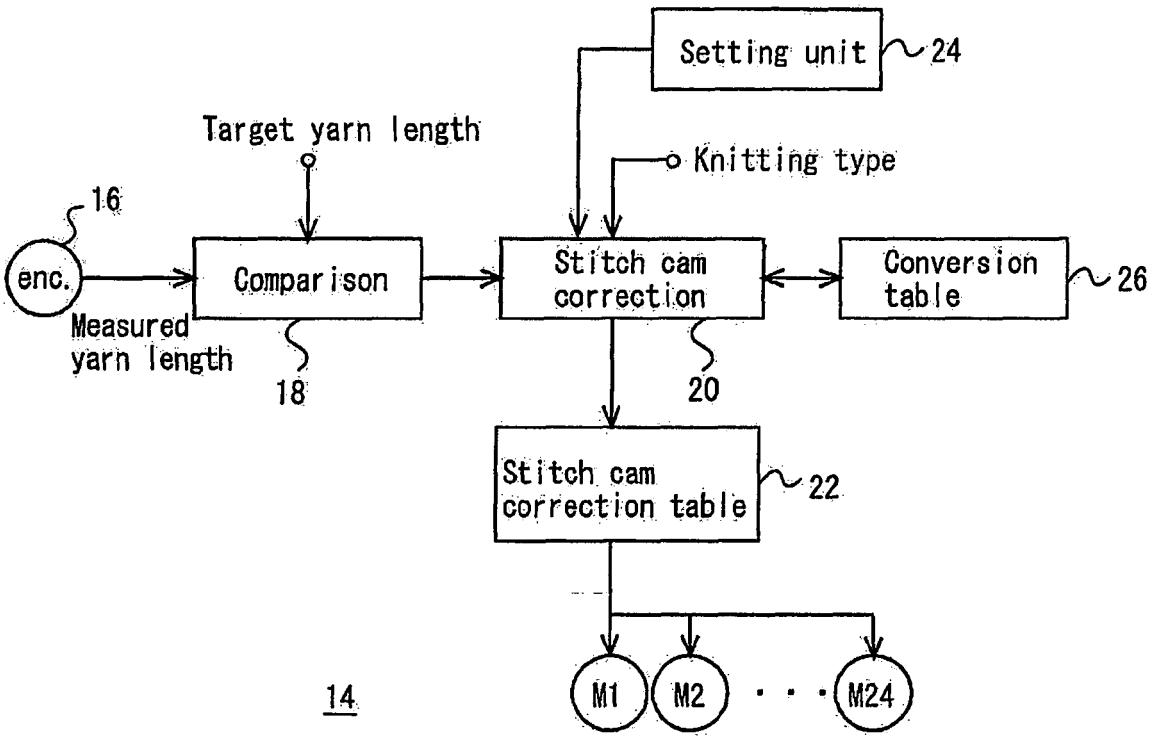
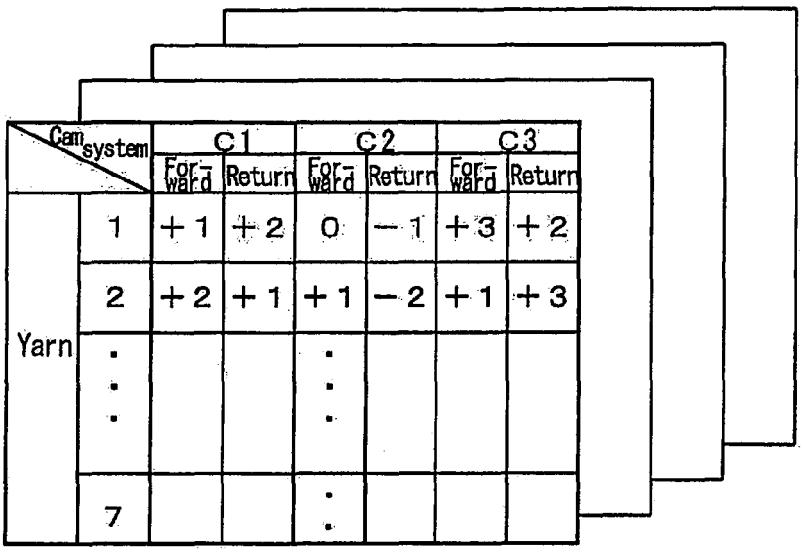

Setting unit
24
Target yarn length
Knitting type
16
enc.
Comparison
Stitch cam correction
Conversion table
26
Measured yarn length
18
20
Stitch cam correction table
22
14
M1
M2
M24

FIG. 4


Cam system
C1
C2
C3
Forward
Return
Forward
Return
Forward
Return
Yarn
1
+1
+2
0
−1
+3
+2
2
+2
+1
+1
−2
+1
+3
7

22

FIG. 5

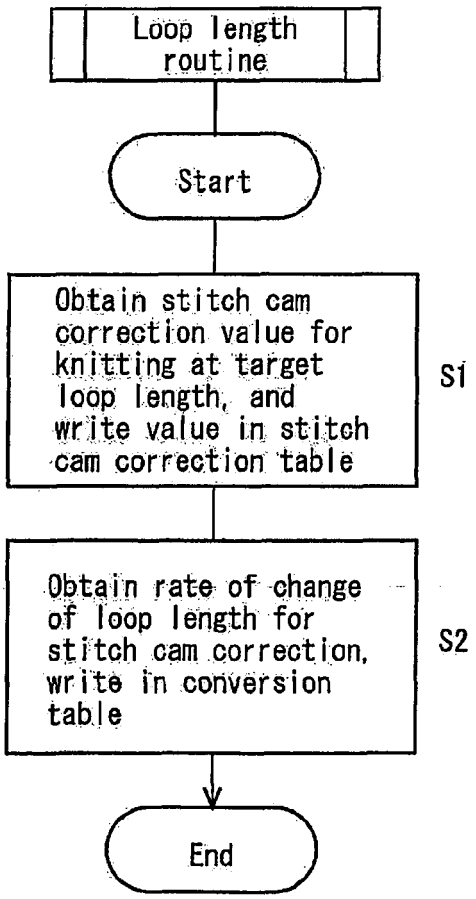

Loop length routine
Start
Obtain stitch cam correction value for knitting at target loop length, and write value in stitch cam correction table
S1
Obtain rate of change of loop length for stitch cam correction, write in conversion table
S2
End

FIG. 6

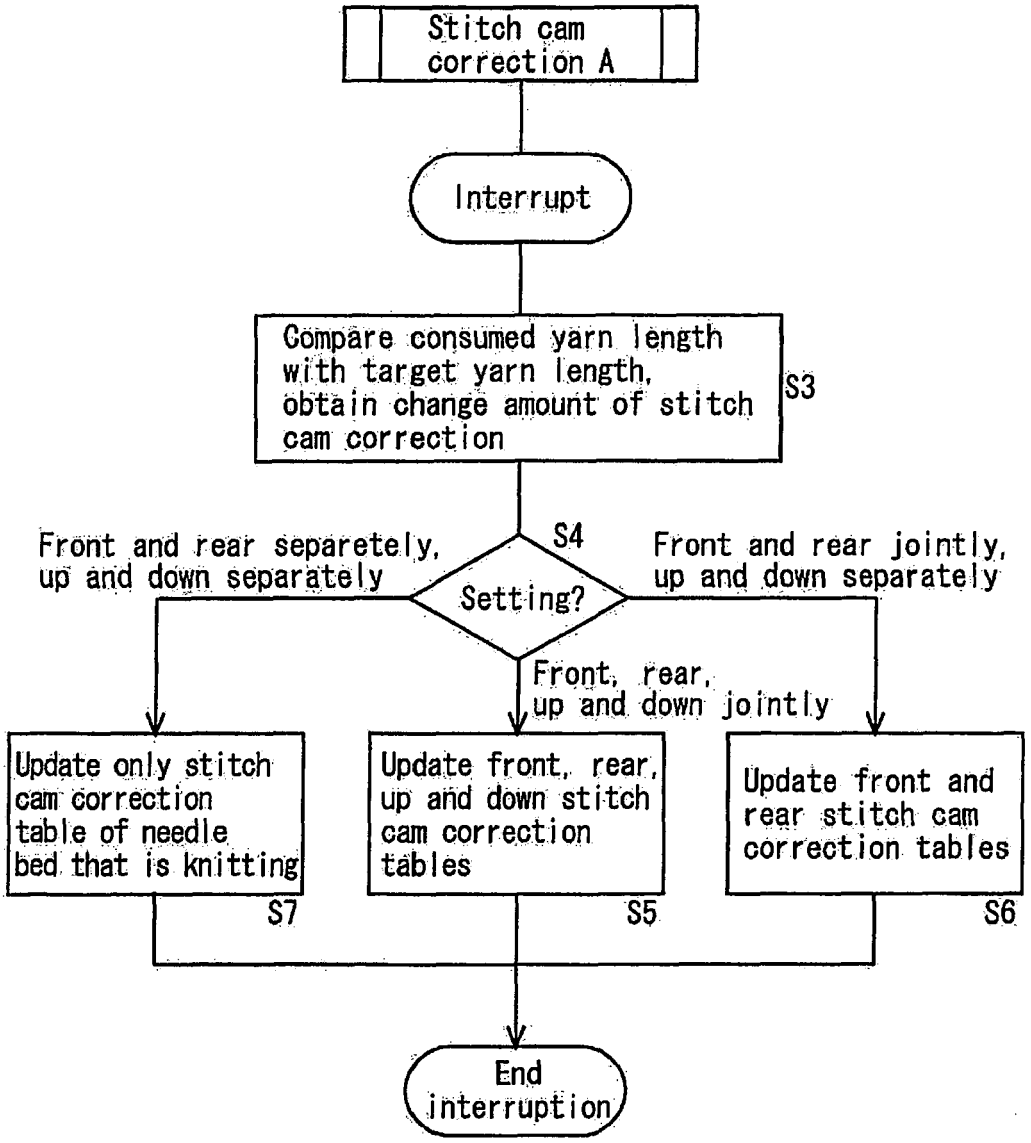

Stitch cam correction A
Interrupt
Compare consumed yarn length with target yarn length, obtain change amount of stitch cam correction
S3
S4
Setting?
Front and rear separetely, up and down separately
Front and rear jointly, up and down separately
Front, rear, up and down jointly
Update only stitch cam correction table of needle bed that is knitting
S7
Update front, rear, up and down stitch cam correction tables
S5
Update front and rear stitch cam correction tables
S6
End interruption

FIG. 7

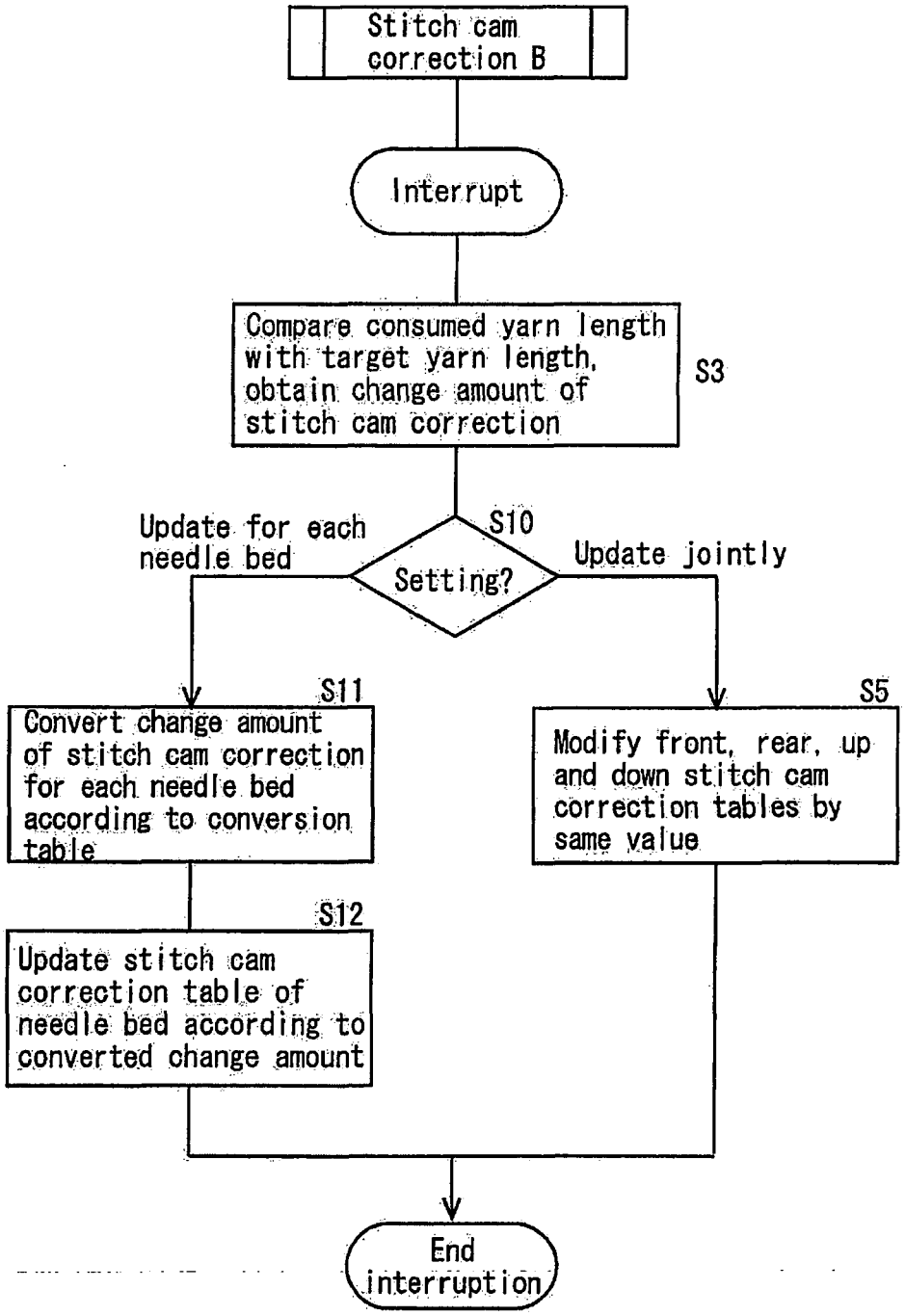
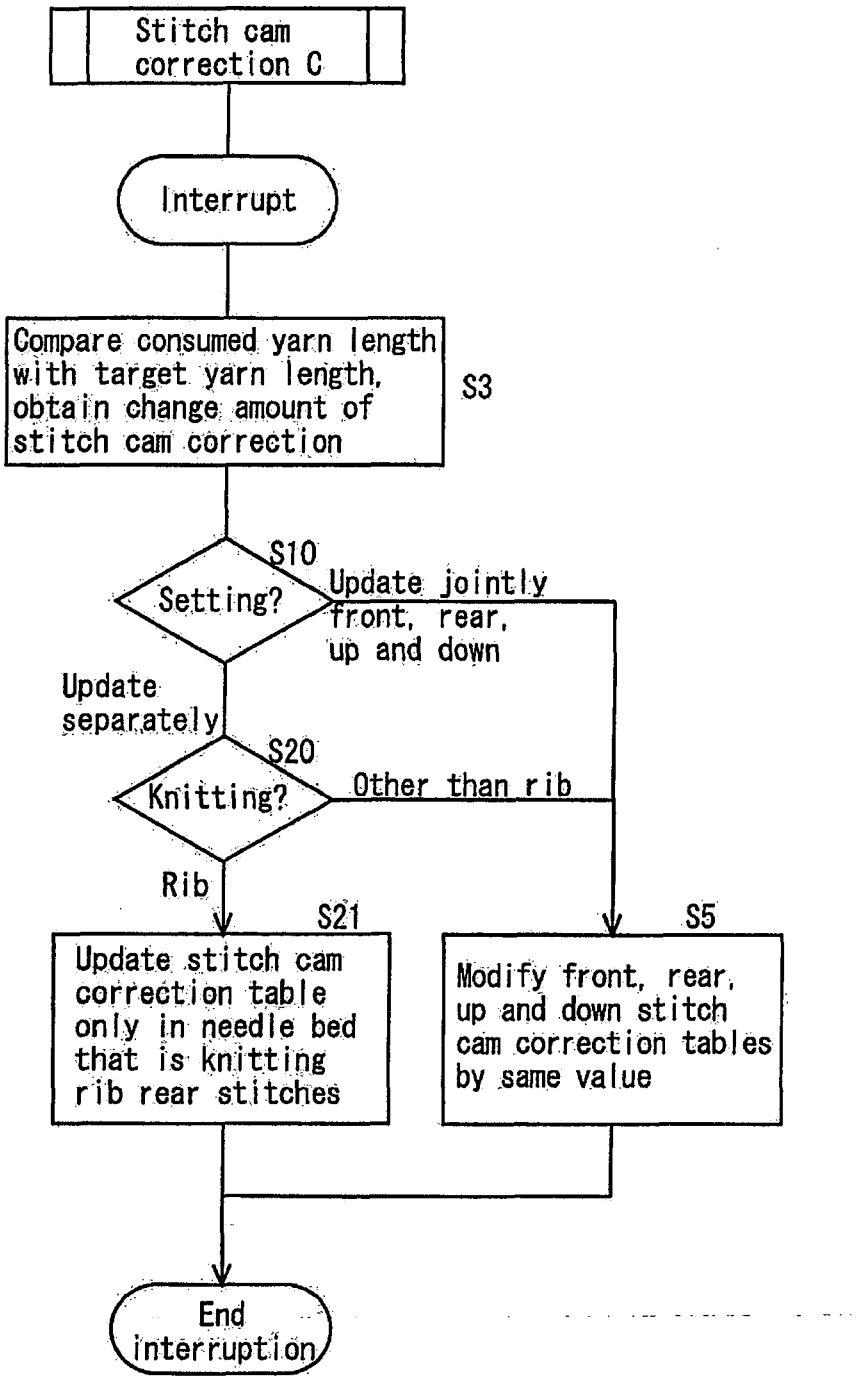

Stitch cam correction B
Interrupt
Compare consumed yarn length with target yarn length, obtain change amount of stitch cam correction
S3
S10
Setting?
Update for each needle bed
Update jointly
S11
Convert change amount of stitch cam correction for each needle bed according to conversion table
S12
Update stitch cam correction table of needle bed according to converted change amount
S5
Modify front, rear, up and down stitch cam correction tables by same value
End interruption

FIG. 8


Stitch cam correction C
Interrupt
Compare consumed yarn length with target yarn length, obtain change amount of stitch cam correction
S3
S10
Setting?
Update jointly front, rear, up and down
Update separately
S20
Knitting?
Other than rib
Rib
S21
Update stitch cam correction table only in needle bed that is knitting rib rear stitches
S5
Modify front, rear, up and down stitch cam correction tables by same value
End interruption

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EUROPEAN SEARCH REPORT

Application Number
EP 11 00 8102

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	EP 1 605 084 A1 (SHIMA SEIKI MFG [JP]) 14 December 2005 (2005-12-14) * paragraphs [0013], [0014] * * paragraph [0023] - paragraph [0029]; figures 2-7 * -----	1-6 1-4,6	INV. D04B7/04 D04B15/32 D04B15/36
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TECHNICAL FIELDS SEARCHED (IPC)

D04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	5 March 2012	Zirkler, Stefanie

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