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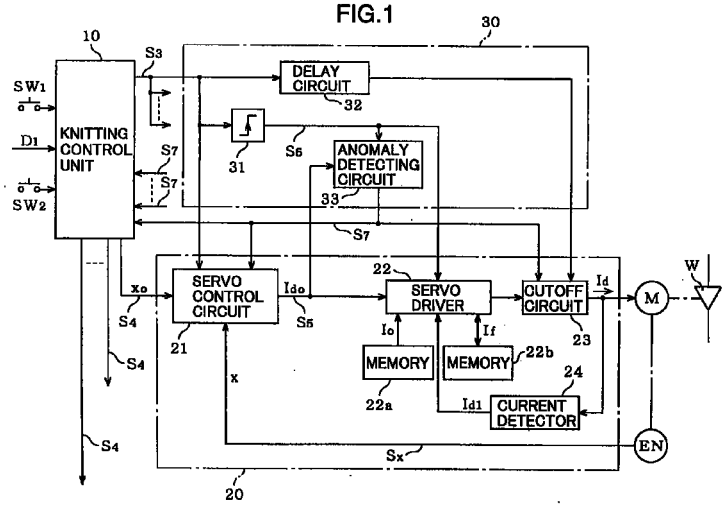
(54) Servo control unit for flat knitting machine and knitting control device for flat knitting machine using servo control unit

(57) A servo control unit (20) including a servo control circuit (21), a servo driver (22) and a cutoff circuit (23) and an operation control unit (30) are combined together and connected to a knitting control unit (10). When a start switch (SW1) is operated, the knitting control unit (10) outputs an operation signal (S3) and the servo driver (22) updates an offset value (If) for a current detector (24) immediately before a cutoff circuit (23) is closed by operation signal (S3).

FIG.1



EP 1 063 331 A1

Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] This invention relates to a servo control unit for a flat knitting machine which serves to prevent knitting a defective fabric and enable quick restart of the knitting machine after interruption of knitting operation, as well as to a knitting control device for a flat knitting machine using the servo control unit.

Description of the Prior Art

[0002] A known example of a conventional flat knitting machine is found in Japanese Examined Patent Publication No. 1-12855, in which positions of knitting head components, such as a plurality of feeders and knitting needles, are individually controlled by servomotors.

[0003] The individual servomotors are combined with servo drivers and controlled by target position signals fed from a common knitting control unit. Each servo driver has a current detector for monitoring driving current supplied to the corresponding servomotor. The current detector memorizes a current value it detects when the driving current is not actually supplied to the servomotor at power-up as an offset value for the current detector. This knitting machine can produce a desired fabric by driving the servomotors so that the individual knitting head components are set in proper positions, wherein each servo driver determines the driving current fed into the relevant servomotor by correcting the current value obtained by the current detector with its offset value, making it possible to correctly drive the servomotors. The servomotors used in this flat knitting machine are servomotors of any type including linear motors.

[0004] One important thing for a flat knitting machine is that in the event of anomalies such as clinging of lint to knitting head components or damages to the knitting head components, it should be possible to restore the flat knitting machine from such anomalies as soon as possible. If the machine is run without removing the anomalies, drop stitches, wale streaks or other defects in a knitted fabric may occur, potentially producing a low-quality fabric in large quantities.

[0005] To cope with this problem, Japanese Unexamined Patent Publication No. 9-302559 proposes a control device which automatically stops a flat knitting machine when an abnormal condition occurs in its knitting head components. When overload conditions occur in servomotors, this control device produces a warning signal and interrupts fabric knitting operation, making it possible to remove causes of the overload conditions. Then, when the flat knitting machine which has once been powered off is powered on again to restart it, the control device causes the flat knitting machine to resume the knitting operation upon reinitializing all of machine controllers including a knitting control unit and individual servo drivers.

[0006] In the aforementioned flat knitting machine of the prior art disclosed in Japanese Examined Patent Publication No. 1-12855, each current detector can not correctly detect the driving current supplied to the relevant servomotor if ambient temperature fluctuates during operation of the machine, due to variations in the property of the current detector. Should this occur, it becomes impossible to properly control the driving current of the individual servomotors. Consequently, the servomotors would vibrate in a slight, rapid movement when they attempt to keep the knitting head components in a stationary condition, or the servomotors would not turn smoothly, making it difficult to achieve precision position control of the knitting head components. Thus, this flat knitting machine has had a problem that it could produce such defects as drop stitches and wale streaks in a finished fabric.

[0007] On the other hand, the control device of the flat knitting machine of Japanese Unexamined Patent Publication No. 9-302559 has had a problem that it tends to require an unduly long period of time for resuming the knitting operation even when the cause of overload is of little significance and the cause can be instantly removed, because it is necessary to start up the machine again and go through a complete sequence of system initialization.

SUMMARY OF THE INVENTION

[0008] In view of the foregoing problems of the prior art, it is an object of the present invention to provide a servo control unit for a flat knitting machine which makes it possible to constantly control positions of knitting head components with precision by updating memorized offset values for current detectors through servo drivers each time an operation signal is transmitted from a knitting control unit, resume knitting operation in a minimum period of time and continuously knit a fabric. It is another object of the invention to provide a knitting control device for a flat knitting machine using such a servo control unit.

[0009] According to the invention, a servo control unit for a flat knitting machine comprises a servo control circuit which detects a positioning deviation of a servomotor for driving a knitting head component and outputs a current command signal, a servo driver which supplies driving current to the servomotor according to the current command signal fed from the servo control circuit, and a cutoff circuit provided on an output side of the servo control circuit, wherein the servo driver updates an offset value for a current detector for detecting the driving current supplied to the servomotor immediately before the cutoff circuit is closed by an operation signal fed from a knitting control unit.

[0010] In one form of the invention, the cutoff circuit is opened when the operation signal is eliminated and it is closed with a specific delay after a rise timing of the operation signal, and the servo driver updates the offset value for the current detector at the rise timing of the operation signal.

[0011] In another form of the invention, a holding current for keeping the servomotor in a stationary state is set for the servo driver.

[0012] In still another form of the invention, the servo control circuit constantly monitors the current position of the servomotor regardless of the presence or absence of the operation signal.

[0013] According to the servo control unit thus constructed, the servo driver updates the offset value for the current detector immediately before the cutoff circuit is closed by the operation signal each time the operation signal is transmitted from the knitting control unit. In this construction, the servo driver can always detect the driving current supplied to the servomotor with high accuracy using the latest offset value regardless of the length of operating time of the flat knitting machine, even when the property of the current detector varies due to temperature changes. As a result, the servomotor can be controlled in such a way that the knitting head component is smoothly set in correct position. This in turn makes it possible to knit a high-quality fabric. Moreover, even when the flat knitting machine is stopped in the event of an emergency, it is possible to restart the machine and resume fabric knitting operation with a minimum loss of time with no need to power on the machine again from the beginning or performing a system initialization sequence.

[0014] In this servo control unit, the cutoff circuit is closed immediately after the knitting control unit has produced the operation signal and the offset value has been updated by the servo driver. The knitting control unit produces the operation signal when a start switch is operated upon completion of the system initialization sequence after the flat knitting machine has been powered on. The knitting control unit temporarily eliminates the operation signal and produces it again when the flat knitting machine is restarted by operating the start switch after it has been automatically stopped upon completion of knitting a specific quantity of fabric (one or more webs), or after it has been manually stopped by operating a stop switch.

[0015] On the other hand, the servo control circuit compares a target position specified in a target position signal entered from the knitting control unit with the current position of the servomotor, determines its positioning deviation based on externally entered knitting data and outputs the current command signal. It is to be noted that the target position varies with time up to a final target position in order to move the knitting head component according to a specific velocity pattern.

[0016] The servo driver which updates the offset value for the current detector at the rise timing of the operation signal is combined in its operation with the cutoff circuit which is opened when the operation signal is eliminated and closed with a specific delay after the rise timing of the operation signal. As the operation signal is temporarily eliminated and output again, the servo driver reads the value of driving current from the current detector while the cutoff circuit is opened and no driving current is actually supplied to the servomotor, so that it is possible to update the offset value for the current detector with high accuracy.

[0017] If a holding current for keeping the servomotor in a stationary state is set in the above construction, the servo driver can output the specific holding current to the servomotor when the current command signal is not entered from the servo control circuit, so that the knitting head component can be held stationary at a correct position despite tensile forces of a yarn and gravity.

[0018] If the servo control circuit constantly monitors the current position of the servomotor in the above construction, the servo control circuit can control the servomotor even more smoothly even when the knitting head component has been manually moved under non-operating conditions of the flat knitting machine, because the servo control circuit determines the positioning deviation of the servomotor and outputs the current command signal as soon as the flat knitting machine is restarted, and because the offset value for the current detector is updated to the latest value.

[0019] According to the invention, a knitting control device for a flat knitting machine comprises a common knitting control unit, and a plurality of the aforementioned servo control units which are provided for individual knitting head components, wherein each of the servo control units controllably drives the servomotor according to a target position signal fed from the knitting control unit, and wherein the knitting control unit temporarily eliminates the operation signal and outputs it again to all the servo control units when knitting of a specific quantity of fabric has been finished.

[0020] In this construction, the knitting control unit may temporarily eliminate the operation signal and output it again to such servo control units that drive those knitting head components which are currently at rest during fabric knitting operation.

[0021] The servo control circuit of each servo control unit may eliminate the current command signal when an alarm signal has been received from an anomaly detecting circuit for detecting an abnormal condition of the servomotor. Furthermore, the knitting control unit may hold the target position signal supplied to each servo control unit when the alarm signal has been produced.

[0022] According to the knitting control device thus constructed, the knitting control unit temporarily eliminates the operation signal and outputs it again to all the servo control units when knitting of a specific quantity of fabric has been finished. This enables the servo drivers

of the individual servo control units to updates offset values for the respective current detectors. The specific quantity of fabric referred to above could mean a single web of the fabric when only one web is produced, one or multiple webs of the fabric when more than one web is produced, or the number of courses, or rows of loops, in the fabric rather than the number of webs.

[0023] If the knitting control unit temporarily eliminates the operation signal and outputs it again to such servo control units that drive those knitting head components which are currently at rest, it is possible to cause the servo drivers of the pertinent servo control units to update the offset values for the respective current detectors.

[0024] If the servo control circuit of each servo control unit eliminates the current command signal when an alarm signal is received, it is possible to prevent the servo drivers from outputting large driving current in the event of an emergency and eliminate the risk of causing excessive shocks on the servomotors and knitting head components when the fabric knitting operation is resumed subsequently.

[0025] If the knitting control unit holds the target position signal supplied to each servo control unit the moment that the alarm signal is produced, it is possible to cause the servomotors to smoothly move the knitting head components from their current positions to final target positions and thereby ensure continuity of the fabric.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026]

FIG. 1 is a general block diagram of a knitting control device for a flat knitting machine according to a preferred embodiment of the invention;

FIG. 2 is a program flowchart showing the flow of operation of a servo driver; and

FIG. 3 is a diagram depicting the operation of the flat knitting machine.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT OF THE INVENTION

[0027] A preferred embodiment of the invention is now described with reference to the accompanying drawings.

[0028] Referring to FIG. 1, a knitting control device for a flat knitting machine comprises a common knitting control unit 10 and a plurality of servo control units 20 which are provided individually to knitting head assemblies W. The servo control units 20 each includes a servo control circuit 21, a servo driver 22 and a cutoff circuit 23 which are connected in series. Each servo control unit 20 is combined with one each knitting head assembly W, servomotor M and operation control unit 30. FIG. 1 shows only a set of one each servo control unit 20 and operation control unit 30, wherein the knitting head assembly W is a group of knitting action components of the flat knitting machine, such as a feeder and a knitting needle which are driven by the relevant servomotor M.

[0029] The knitting control unit 10 is associated with a start switch SW1 and a stop switch SW2, and knitting data D1 is entered to the knitting control unit 10 from a data unit which is not illustrated. An operation signal S3 output from the knitting control unit 10 is entered to the individual operation control units 30 and servo control circuits 21 while target position signals S4 also output from the knitting control unit 10 are entered to the individual servo control circuits 21.

[0030] The target position signal S4 and the operation signal S3 from the knitting control unit 10 are entered together into the servo control circuit 21 of each servo control unit 20, while a position signal Sx is entered from an encoder EN, which is provided to the servomotor M, to the servo control circuit 21. An output of the servo control circuit 21 is entered as a current command signal S5 separately to the servo driver 22 and to an anomaly detecting circuit 33 of the pertinent operation control unit 30. The servo driver 22 of each servo control unit 20 is associated with memories 22a and 22b. An output of the servo driver 22 is connected to the servomotor M which drives the pertinent knitting head assembly W via the cutoff circuit 23. On the output side of the servo driver 22, a current detector 24 employing a Hall-effect element, for instance, is connected between the cutoff circuit 23 and the servomotor M, and an output of the current detector 24 is connected to the servo driver 22.

[0031] Each operation control unit 30 is formed of a combination of a rise timing detecting circuit 31, a delay circuit 32 and the anomaly detecting circuit 33. The operation signal S3 from the knitting control unit 10 is entered separately to the rise timing detecting circuit 31 and the delay circuit 32. An output of the rise timing detecting circuit 31 is entered as a reset signal S6 separately to the anomaly detecting circuit 33 and the servo driver 22. Further, an output of the delay circuit 32 is entered to the cutoff circuit 23 and an output of the anomaly detecting circuit 33 is entered as an alarm signal S7 separately to the knitting control unit 10, the servo control circuit 21 and the cutoff circuit 23.

[0032] When the flat knitting machine is powered on, all the servo control units 20 and the operation control units 30 are initialized and the knitting data D1 is entered from the unillustrated data unit to the knitting control unit 10. When the start switch SW1 is turned on at this point, the knitting control unit 10 outputs the target position signals S4 to the individual servo control units 20 based on the knitting data D1. These target position signals S4 specify target positions xo for the individual knitting head assemblies W that vary with the lapse of time.

[0033] When the start switch SW1 is operated, the

knitting control unit 10 also outputs the operation signal S3 to the individual servo control units 20 and operation control units 30. Then, the servo control circuit 21 of each servo control unit 20 begins to operate while the rise timing detecting circuit 31 of each operation control unit 30 outputs the reset signal S6 to both the anomaly detecting circuit 33 and the servo driver 22, and the delay circuit 32 causes the cutoff circuit 23 to close a connection between the servo driver 22 and the servomotor M.

[0034] The servo control circuit 21 compares current position x indicated by the position signal Sx from the encoder EN with the target positions indicated in the target position signals S4 entered from the knitting control unit 10, calculates a positioning deviation

$$\Delta x = x - xo$$

of the servomotor M, and outputs the current command signal S5 based on the positioning deviation Δx . This current command signal S5 indicates the value of driving current Ido required for the servomotor M to cancel out the positioning deviation Δx.

[0035] On the other hand, the servo driver 22 of each servo control unit 20 operates, upon receiving the reset signal S6 from the operation control unit 30, according to a program flowchart shown in FIG. 2.

[0036] When a program is initiated by the reset signal S6, the servo driver 22 reads the value of driving current Id fed into the servomotor M as driving current Id1 through the current detector 24 in step (1) of FIG. 2 and updates a previously stored offset value If for the current detector 24 in step (2), wherein a new offset value If = Id1 is stored in the memory 22b. It is to be noted here that the cutoff circuit 23 is in an open state at this point in time although the operation signal S3 from the knitting control unit 10 is entered and, therefore, the actual driving current Id fed into the servomotor M is zero (Id = 0). Thus the term "offset value If" used in this detailed explanation is defined as a current value detected by the current detector 24 when the current detector 24 is supposed to indicate "0" value. In other words, the offset value If is the value by which the current detector 24 should be calibrated for more accurate measurement. Subsequently, the program waits until a set wait time for the delay circuit 32 elapses and the operation signal S3 causes the cutoff circuit 23 to close the connection between the servo driver 22 and the servomotor M in step (3). The above steps of the program make it possible to update the offset value If for the current detector 24 stored in the memory 22b.

[0037] When the set wait time elapses and the cutoff circuit 23 is closed in step (3), the program reads the value of the driving current Ido indicated in the current command signal S5 fed from the servo control circuit 21 in step (4). If the driving current Ido is approximately equal to zero (Ido ≒ 0) in step (5), the servo driver 22 supplies driving current Id = Io to the servomotor M using a holding current Io stored in the memory 22a in steps (6), (7). The pertinent knitting head assembly W can then be held stationary by the servomotor M at a specified position. If the driving current Ido is not approximately equal to zero (not Ido ≒ 0) in step (5), the program reads the driving current Id fed into the servomotor M through the current detector 24 in step (8). Then, after finely adjusting the value of the driving current Id depending on whether Id ≒ do , the program outputs a proper driving current Id to the servomotor M in steps (10), (11), (7).

[0038] The amount of fine adjustment δ I used in step (11) is a function of current deviation

$$\Delta I = Id - Ido.$$

Since the program sets Id = Id1 - If in step (8), reflecting the offset value If for the current detector 24 stored in the memory 22b, it is possible to correctly detect the driving current Id supplied to the servomotor M. Thereafter, the program repetitively executes steps (4) through (7), whereby the proper driving current Id is supplied to the servomotor M. As a consequence, the servomotor M drives the pertinent knitting head assembly W in such a way that it correctly follows the specified target position xo, making it possible to produce a desired fabric.

[0039] In the above-described steps (4) to (7) repetitively executed by the program, the frequency of executing steps (5) to (7) may be made higher than the frequency of executing step (4). For example, if the program is set to execute step (4) at 1 ms intervals while executing steps (5) to (7) at 0.1 ms intervals, it would be possible to configure an efficient current control minor loop for the servomotor M.

[0040] When knitting of a particular quantity of fabric specified in the knitting data D1 has been finished, the knitting control unit 10 temporarily eliminates the operation signal S3 and outputs it again. When the operation signal S3 is eliminated, the servo control circuit 21 of each servo control unit 20 stops its operation and the cutoff circuit 23 temporarily opens the output side of the servo driver 22. Before eliminating the operation signal S3, however, the knitting control unit 10 brings the individual servomotors M and knitting head assemblies W at specified standby positions using the target position signals S4 and automatically stops the flat knitting machine. Even when the operation signal S3 has been eliminated and the flat knitting machine has stopped, the servo control circuit 21 of each servo control unit 20 continues to monitor the current position x of the servomotor M using the position signal Sx from the encoder EN. Also when the operation signal S3 has been eliminated, the cutoff circuit 23 of each servo control unit 20, which receives the output of the delay circuit 32, immediately opens the connection between the

servo driver 22 and the servomotor M, and then closes when the operation signal S3 is entered again with some delay from its rise timing.

[0041] The servo driver 22 executes the program of FIG. 2 upon receiving the reset signal S6 generated at the rise timing of the operation signal S3 as it is output again, whereby the offset value If for the current detector 24 can be updated. Since each of the knitting head assemblies W is held at the specified standby position by the servomotor M thereafter, it is possible to ensure that the fabric is finished to a prescribed shape. When the start switch SW1 is operated to resume knitting operation subsequently, the knitting control unit 10 again eliminates the operation signal S3 temporarily and outputs it again. Again, the offset value If for the current detector 24 is updated so that the servo driver 22 can properly perform subsequent knitting operation. In one alternative, the knitting control unit 10 may control the flat knitting machine to knit a next part of the fabric without interruption without waiting for the start switch SW1 to be operated. In another alternative, the knitting control unit 10 may temporarily eliminate the operation signal S3, output it again, and continue to knit the fabric, each time a specified number of courses, or rows of loops, have been produced.

[0042] If the stop switch SW2 is operated while the fabric is being knit, the knitting control unit 10 holds the target position signals S4 without interrupting the operation signal S3, so that the target position xo is fixed to a value xo1 ($xo = xo1$) which is valid at time $t = t1$ when the stop switch SW2 is operated, as depicted in FIG. 3. In FIG. 3, broken lines show how the target position xo varies with time up to a final target position xo2 if the knitting operation is continued in a normal fashion without operating the stop switch SW2. If the start switch SW1 is operated at time $t = t2$, the knitting control unit 10 temporarily eliminates the operation signal S3 and outputs it again and, then, stops to hold the target position signals S4, allowing the target position xo to vary again. Consequently, the servo driver 22 can update the offset value If for the current detector 24 and the servo control unit 20 can properly perform the knitting operation again.

[0043] If any knitting head assembly W is damaged or its normal movement is hindered due to an anomaly of the servomotor M, for instance, during the fabric knitting operation, the positioning deviation Δx calculated by the pertinent servo control circuit 21 and the driving current Ido indicated in the current command signal S5 become excessively large. Should this situation occur, the anomaly detecting circuit 33 detects the abnormally high value of the driving current Ido and outputs an alarm signal S7, and the flat knitting machine stops. This is because, when the alarm signal S7 is generated, the cutoff circuit 23 opens immediately and the servo control circuit 21 eliminates the current command signal S5 to forcibly zero the value of the driving current ($Ido = 0$), and the knitting control unit 10, on the other hand, holds the target position signals S4 such that the target position xo is fixed to the value which is valid at a point in time the alarm signal S7 is generated. Whichever servomotor M of the flat knitting machine goes wrong, the knitting control unit 10 can stop the whole of the flat knitting machine by receiving the alarm signal S7 from the pertinent anomaly detecting circuit 33.

[0044] As the flat knitting machine is stopped in the event of an emergency in the above-described fashion, an operator can remove the cause of the emergency and restart the knitting operation by operating the start switch SW1. This is because, when the start switch SW1 is operated, the knitting control unit 10 temporarily eliminates the operation signal S3 and outputs it again, causes the servo driver 22 to update the offset value If for the current detector 24, and stops to hold the target position signals S4. The anomaly detecting circuit 33 of each operation control unit 30 resets the alarm signal S7 upon receiving the reset signal S6.

VARIATIONS OF THE EMBODIMENT

[0045] The cutoff circuit 23 need not necessarily be opened upon receiving the alarm signal S7 from the anomaly detecting circuit 33. This is because, even when the alarm signal S7 is generated, it is often more advantageous to hold each knitting head assembly W stationary at a specified position and continue to knit the fabric to a prescribed shape unless there is the risk of developing a serious damage such as burning of the servomotor M. In this alternative arrangement, the servo control circuit 21 of each servo control unit 20 should continue its normal operation without eliminating the current command signal S5. In this alternative, the anomaly detecting circuit 33 may output two kinds of alarm signals, that is, a high-level alarm signal which causes the cutoff circuit 23 to be opened and eliminates the current command signal S5 from the servo control circuit 21, and a low-level alarm signal which keeps the cutoff circuit 23 in a closed state and allows the servo control circuit 21 to continue its normal operation.

[0046] Although the common operation signal S3 is output from the knitting control unit 10 to the servo control units 20 and the operation control units 30 of the individual knitting head assemblies W in the knitting control device of FIG. 1, it may be modified such that operation signals are output individually to the servo control units 20 and the operation control units 30.

[0047] In this modified form of the invention, if the knitting control unit 10 determines that a sufficiently long non-operating time is expected to occur for a particular knitting head assembly W during fabric knitting operation based on an analysis of the knitting data D1, it is possible to selectively update the offset value If for the current detector 24 of the servo control unit 20 connected to the knitting head assembly W in question by temporarily eliminating and outputting again the operation signal S3 for the relevant knitting head assembly W. In a case where the non-operating time of the knitting head assembly W is fairly much longer, the offset value

If for the current detector 24 for the relevant knitting head assembly W may be updated more than once at specific time intervals, for instance, during the non-operating time of the knitting head assembly W, and the updating of the offset value If may be performed at the end of the non-operating time as well.

[0048] Such selective updating of the offset value If for the current detector 24 for the specific knitting head assembly W may be performed in addition to the earlier-described simultaneous updating of the offset values If for the current detectors 24 for the entire knitting head assemblies W that is performed when knitting of a particular quantity of fabric has been finished. Alternatively, either the selective updating or the simultaneous updating may be performed alone.

[0049] A major reason why the value of the driving current Ido fed from the servo control circuit 21 is zeroed (Ido = 0) by the alarm signal S7 in the foregoing discussion is that shocks potentially imposed on the servomotor M and the knitting head assembly W when the fabric knitting operation is resumed can be minimized by doing so. In one alternative, the servo control circuit 21 may control the value of the driving current Ido in such a way that it smoothly increases or decreases with time regardless of the amount of positioning deviation Äx. In another alternative, the servo driver 22 may control the driving current Id fed into the servomotor M in such a way that it smoothly increases or decreases with time regardless of the value of the driving current Ido entered from the servo control circuit 21.

[0050] Although the present invention has been fully described by way of example with reference to the accompanying drawings, it is to be understood that various changes and modifications will be apparent to those skilled in the art. Therefore, unless otherwise such changes and modifications depart from the scope of the present invention hereinafter defined, they should be construed as being included therein.

Claims

1. A servo control unit for a flat knitting machine, said servo control unit comprising:

   a servo control circuit (21) which detects a positioning deviation of a servomotor (M) for driving a knitting head component (W) and outputs a current command signal (Ido);
   a servo driver (22) which supplies driving current (Id) to the servomotor (M) according to the current command signal (Ido) fed from the servo control circuit (21);
   a cutoff circuit (23) provided on an output side of the servo driver (22); and
   a current detector (24) for detecting the driving current (Id) supplied to the servomotor (M);
   wherein the servo driver (22) updates an offset value for the current detector (24) immediately before the cutoff circuit (23) is closed by an operation signal fed from a knitting control unit.

2. A servo control unit for a flat knitting machine according to claim 1, wherein the cutoff circuit is opened when the operation signal is eliminated and the cutoff circuit is closed with a specific delay after a rise timing of the operation signal, and wherein the servo driver updates the offset value for the current detector at the rise timing of the operation signal.

3. A servo control unit for a flat knitting machine according to claim 1 or 2, wherein the servo driver sets a holding current for keeping the servomotor in a stationary state.

4. A servo control unit for a flat knitting machine according to claim 1, 2 or 3, wherein the servo control circuit constantly monitors the current position of the servomotor regardless of the presence of the operation signal.

5. A knitting control device for a flat knitting machine comprising:

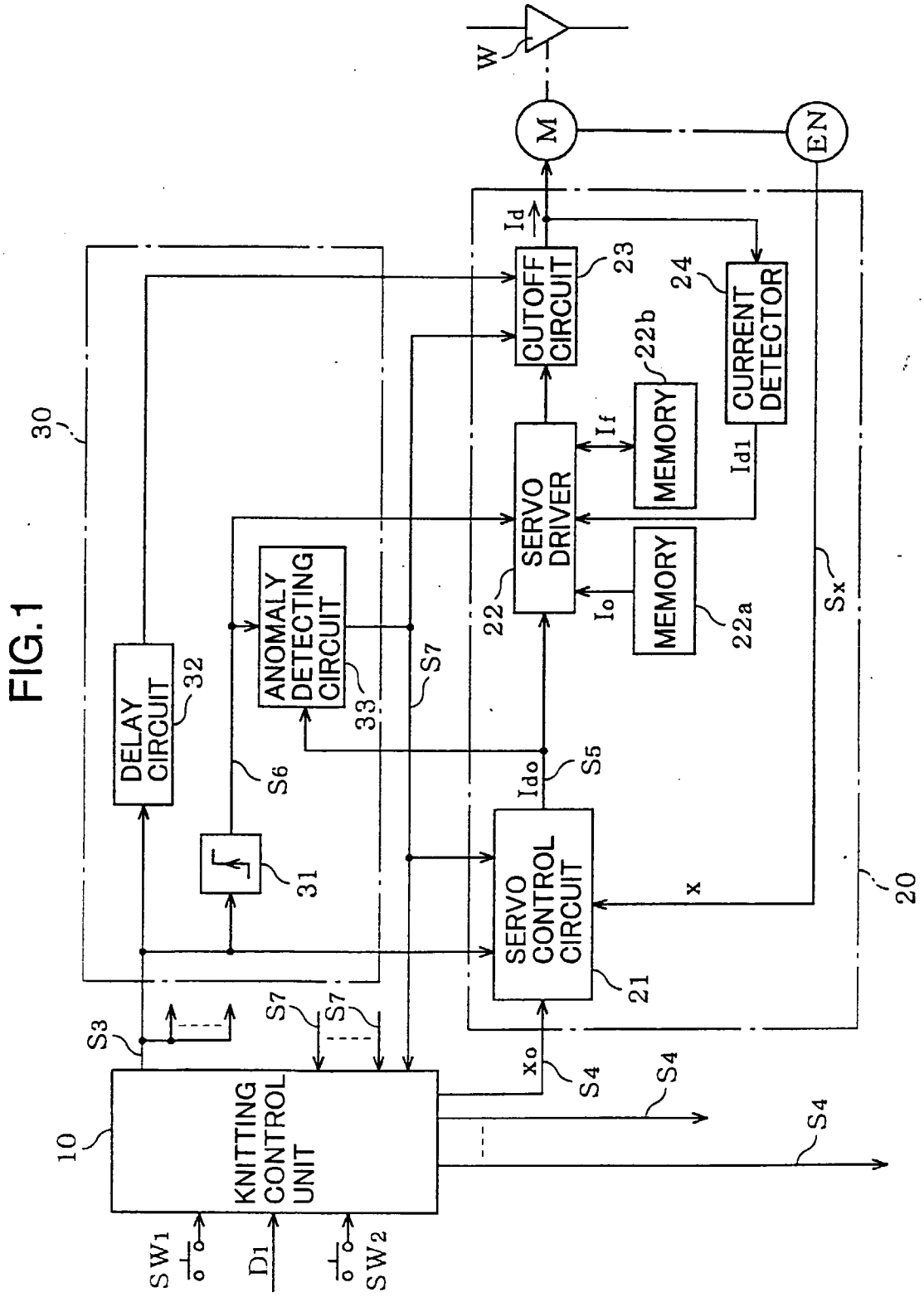
   a common knitting control unit; and
   a plurality of servo control units as claimed in claim 1, 2, 3 or 4 which are provided for individual knitting head components, wherein each of the servo control units controllably drives the servomotor according to a target position signal fed from the knitting control unit; and
   wherein the knitting control unit temporarily eliminates the operation signal and outputs it again to all the servo control units when knitting of a specific quantity of fabric has been finished.

6. A knitting control device for a flat knitting machine according to claim 5, wherein the knitting control unit temporarily eliminates the operation signal and outputs it again to such servo control units that drive those knitting head components which are currently at rest during fabric knitting operation.

7. A knitting control device for a flat knitting machine according to claim 5 or 6, wherein the servo control circuit of each servo control unit eliminates the current command signal when an alarm signal is received from an anomaly detecting circuit for detecting an abnormal condition of the servomotor.

8. A knitting control device for a flat knitting machine according to claim 7, wherein the knitting control unit holds the target position signal supplied to each servo control unit by the alarm signal.

FIG.1


W
M
EN
Id
CUTOFF CIRCUIT
23
24
CURRENT DETECTOR
22b
MEMORY
If
Id1
SERVO DRIVER
22
Io
MEMORY
22a
Sx
30
ANOMALY DETECTING CIRCUIT
33
S7
DELAY CIRCUIT
32
S6
31
Ido
S5
SERVO CONTROL CIRCUIT
21
x
20
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xo
S4
S4
S4
10
KNITTING CONTROL UNIT
SW1
D1
SW2

FIG.2

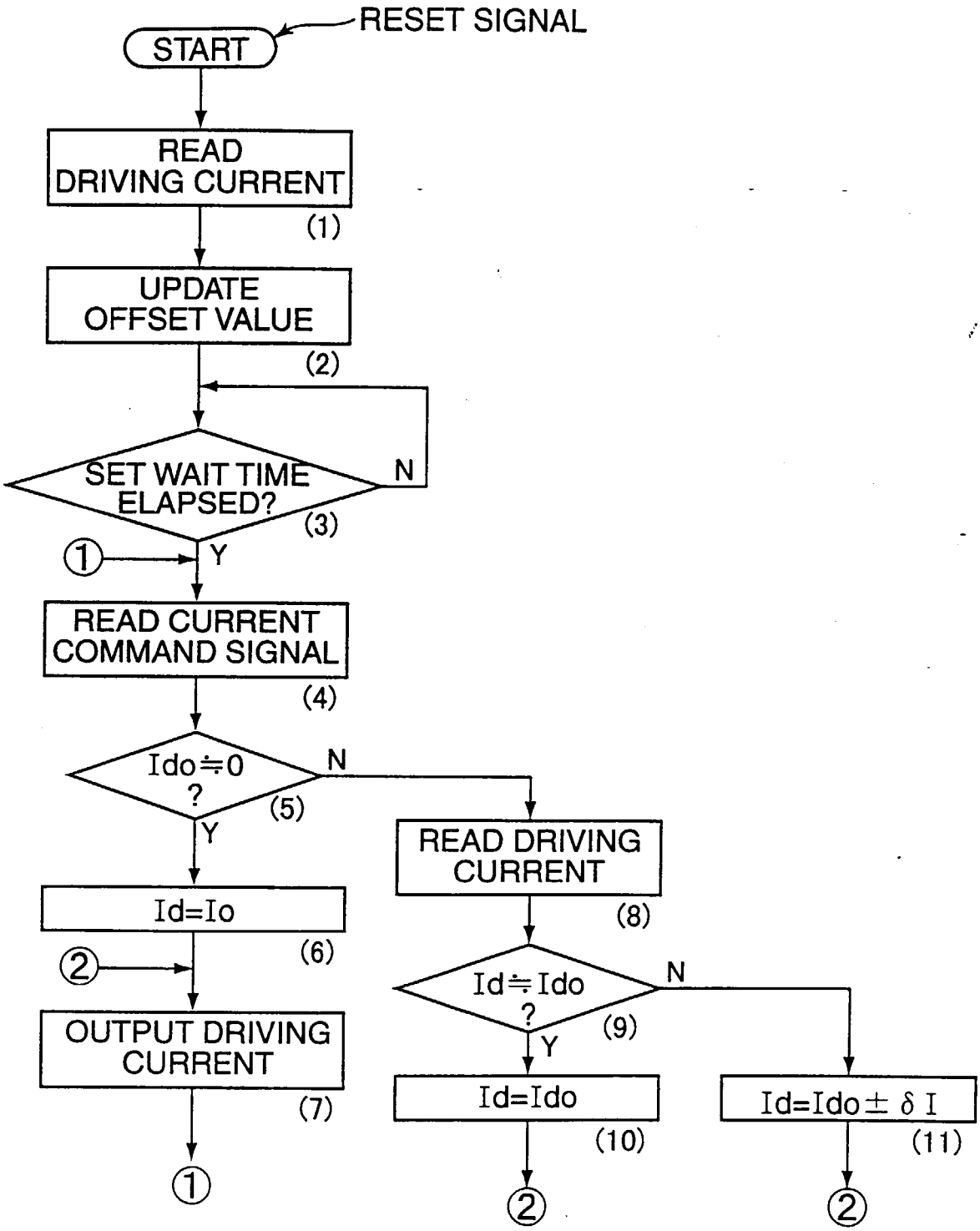
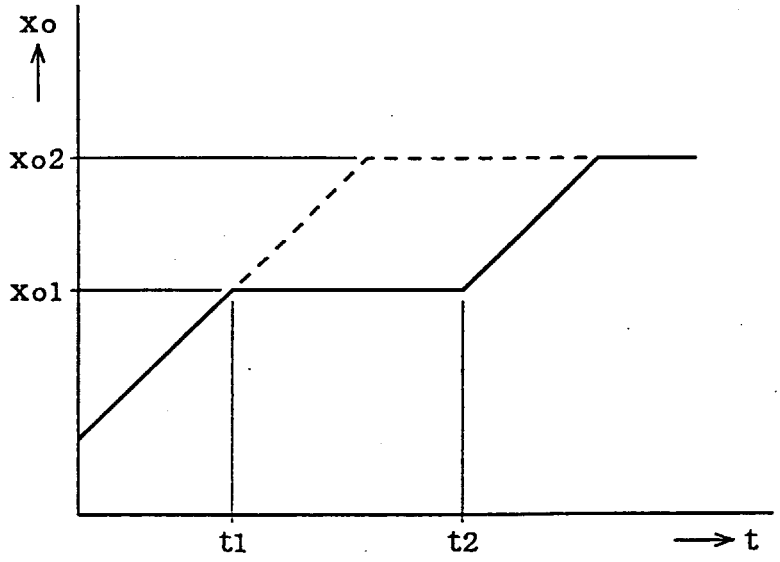

RESET SIGNAL
START
READ DRIVING CURRENT
(1)
UPDATE OFFSET VALUE
(2)
SET WAIT TIME ELAPSED?
(3)
N
Y
①
READ CURRENT COMMAND SIGNAL
(4)
Ido≒0 ?
(5)
N
Y
Id=Io
(6)
②
OUTPUT DRIVING CURRENT
(7)
①
READ DRIVING CURRENT
(8)
Id≒Ido ?
(9)
N
Y
Id=Ido
(10)
②
Id=Ido± δ I
(11)
②

FIG.3



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Application Number
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Place of search	Date of completion of the search	Examiner
THE HAGUE	16 August 2000	Van Gelder, P

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