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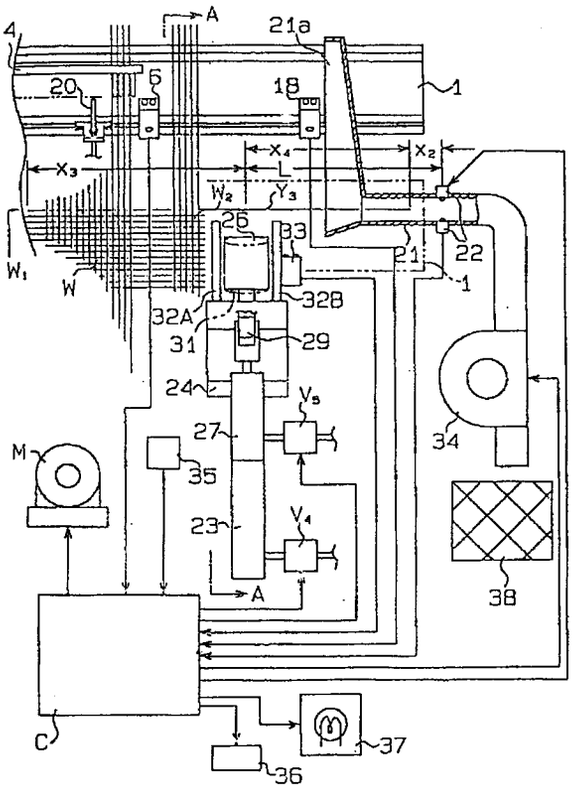
(54) **Weft handling apparatus in a jet loom.**

(57) The faulty weft removing device for a jet loom, comprises a weft breakage detecting means (18) disposed on the weft receiving side of the jet loom. A weft extracting means provided preferably with a pair of extraction rollers (26, 31) grips a broken weft that is broken from a weft extending from the weft feed package. The weft extracting means is capable of moving the pair of extraction rollers (26, 31) from a position near the cloth fell (W_1) of the fabric toward the reed (4) of the jet loom, as to separate the broken weft from the cloth fell (W_1). When rotating the pair of extraction rollers (26, 31) the broken weft is pulled toward the weft receiving side and the broken weft is extractd from the shed. A yarn removing suction device (21a, 21, 34) having a suction opening extending over the range of swing motion of the reed includes a first yarn detecting means (33) interposed between the yarn removing suction means and the gripping range in which the pair of rollers (26 ,31) grip the broken weft. A second yarn detecting means (22) is disposed on the suction passage of the yarn removing suction device (21a, 21, 34). A rotation detecting means (25) like e.g. a step motor provides for detecting the rotation of the pair of extraction rollers (21, 34) and a the computer (C) determines the yarn length broken weft on the basis of yarn detection information provided by the first and second yarn detecting means (22, 33) and information provided by the rotation detecting means (25). The device provides for restarting the loom only after removal of the entire lenght of the broken weft from the shed.

EP 0 492 745 A1

Fig. 1


A
21a
4
6
20
18
1
X4
X2
X3
W2
Y3
26
B3
21
22
W1
W
1
328
32A
31
29
24
V5
27
34
M
35
V4
23
A
38
C
37
36

The present invention relates to a faulty weft removing device for a jet loom for extracting a faulty weft from the cloth fell to remove the faulty weft from the fabric being woven on the jet loom.

Faulty weft removing devices for removing a faulty weft from the cloth fell of the fabrie being woven on a jet loom have been disclosed in Japanese Patent Laid-open (Kokai) Nos. Sho 62-215047 and Sho 62-177257. Both the prior art faulty weft removing devices leave a faultily inserted portion of a weft continuous with the successive portion of the weft, and pull the successive portion of the weft toward the picking side of the jet loom to removed the faultily inserted portion of the weft from the shed. The prior art faulty weft removing devices are provided with a pair of pulling rollers disposed on the weft receiving side of the jet loom to extract a broken weft remaining in the shed from the shed.

Although it is possible that the broken weft remaining in the shed cannot be removed completely, the prior art faulty weft removing devices are unable to detect incomplete removal of the broken weft. Therefore, if the broken weft cannot be removed completely, the broken weft will be woven into the fabric if the loom is restarted automatically after the completion of faulty weft removing operation.

Accordingly, it is an object of the present invention to provide a faulty weft removing device that enables the loom to be restarted automatically, eliminating the possibility of weaving a broken weft into the fabric.

To achieve the object, the present invention provides a faulty weft removing device comprising: a weft breakage detecting means disposed on the weft receiving side of the jet loom; a weft extracting means provided with a pair of extraction rollers for gripping a broken weft broken from a weft extending from a weft feed package, and capable of moving the pair of extraction rollers from a position near the cloth fell of the fabric toward the reed of the jet loom to separate the broken weft from the cloth fell and of rotating the pair of extraction rollers so that the broken weft is pulled toward the weft receiving side to extract the broken weft from the shed; a yarn removing suction means having a suction opening extending over the range of swing motion of the reed; a first yarn detecting means interposed be■ween the yarn removing suction means and a gripping range in which the pair of extraction rollers grip the broken weft; a second yarn detecting means disposed on the suction passage of the yarn removing suction means; a rotation detecting means for detecting the rotation of the pair of extraction rollers; and a yarn length determining means for determining the length of the broken weft on the basis of yarn detection information provided by the first and second yarn detecting means and information provided by the rotation detecting means.

The pair of extraction rollers grip the broken weft broken from a faultily inserted weft, and then the pair of extraction rollers move from a position near the cloth fell toward the reed to separate the broken weft partially from the cloth fell. Then, the pair of extraction rollers are rotated so as to pull the broken weft toward the weft receiving side to extract the broken weft from the shed. The first yarn detecting means interposed between the weft removing suction means and the gripping range in which the pair of extraction rollers grip the broken weft detects the passage of the trailing end of the broken weft past a position corresponding thereto while the broken weft is being extracted from the shed. The second yarn detecting means disposed on the suction path of the weft removing suction means detects the passage of the leading end of the broken weft past a position corresponding thereto. Accordingly, the length of a portion of the broken weft extending before the pair or extraction rollers can be determined from the duration of detection of the broken weft by the first yarn detecting means and the rotation of the pair of extraction rollers during time corresponding to the duration of detection of the broken weft by the first yarn detecting means, and the length of a portion of the broken weft extending after the pair of extraction rollers can be determined from the duration of detection of the broken weft by the second yarn detecting means and the rotation of the pair of extraction rollers during time corresponding to the duration of detection of the broken weft by the second yarn detecting means. Thus, the lerigth of the broken weft can be determined.

It is evident, that instead of the extraction rollers any other suitable gripping and extraction device may be used. In the same way a yarn removing blowing device may be used in stead of the yarn removing suction device

A faulty weft removing device in a preferred embodiment according to the present invention will be described hereinafter with reference to Figs. 1 to 13.

- Fig. 1 is a schematic plan view of a faulty weft removing device in a preferred embodiment according to the present invention;
- Fig. 2 is a plan view of a first weft extracting mechanism disposed on the picking side of a jet loom;
- Fig. 3 is a sectional view taken on line A-A in Fig.1;
- Fig. 4 is a perspective view o■the first weft extracting mechanism disposed on the picking side of a jet loom;
- Fig. 5 is a partially sectional plan view of an essential portion in a broken weft extracting state;
- Fig. 6 is a sectional view taken on line B-B in Fig.5;

Fig. 7 is a partially sectional plan view of the picking side in a faulty weft extracting state;
Fig. 8 is a partially sectional plan view of an essential portion in a state where broken weft extracting operation has been completed;
Fig. 9 is a graph of assistance in explaining modes of travel of picked weft;
Fig. 10 is a flow chart of a faulty weft removing procedure;
Fig. 11 is a flow chart of a faulty weft removing procedure;
Fig. 12 is a flow chart of a faulty weft removing procedure; and
Fig. 13 is a flow chart of a faulty weft removing procedure.

Referring to Fig. 2, a main picking nozzle 2 is mounted on one end of the sley 1 of a jet loom, and a weft measured by and stored on a weft measuring/storing device 3 of a winding drum type is fed to the main picking nozzle 1. The main picking nozzle 2 picks the weft into the weft passage 4a of a modified reed 4 set upright on the sley 1 at a picking angle in a weaving cycle. The feed of the weft stored on the weft storage suxface 3a of the weft measuring/storing device 3 controlled by engaging a holding pin 5a with the weft storage surface 3a and disengaging the holding pin 5a from the weft storage surface 3a by a so■enoid actuator 5.

The weft picked by the main picking nozzle 2 is assisted for running through the weft passage 4a by the jetting action of sequentially arranged auxiliary picking nozzles 20. A weft detector 6 disposed at a predetermined position on the weft receiving side as shown in Fig. 1 detects whether or not the picked weft has arrived at a predetermined position in a predetermined angular range in the weaving cycle. the output signal of the weft detector 6 is given to a control computer C, and then the control computer C stops the main motor M of the jet loom or continues the operation of the main motor M according to the output signal of the weft detector 6. When the weft is inserted normally, the weft is beaten up with the modified reed 4 into the cloth fell W_1 of the fabric W, the inserted weft is cut from the weft extending from the weft measuring/storing device 3 with an electromagnetic cutter 7, and then the weaving operation is continued.

If the picked weft does not reach a position corresponding to the weft detector 6, the control computer C provides a signal to stop the main motor M. The main shaft of the jet loom turns about one full turn before the jet loom stops after a picking failure detection signal has been provided. The picking failure detection signal is provided while the sley 1 advances from the rearmost position toward the fabric W, beats up the faultily inserted weft, moves backward, and then advances again to a position indicated by alternate long and two short dashes lines immediately before the beat-up position as shown in Figs. 1 and 2. When the picking failure detection signal is provided, the electromagnetic cutter 7 is set to an inoperative state to maintain the faultily inserted weft beaten up to the cloth fell W_1 of the fabric W connected to the weft extending from the main picking nozzle 2.

As shown in Fig. 4, a blow nozzle 8 is disposed directly below the main picking nozzle 2, and a weft guide duct 9 is disposed directly above the main picking nozzle 2 opposite to the blow nozzle 8. The outlet opening 8a of the blow nozzle 8, and the inlet opening 9a of the weft guide duct 9 are disposed opposite to each other respectively on the opposite sides of the jetting region of the main picking nozzle 2. A fixed cutting blade 10 is interposed between the tip of the main picking nozzle 2 and the inlet opening 9a of the weft guide duct 9.

An air guide 11 and a suction pipe 12 are provided behind the outlet opening 9b of the weft guide duct 9 on the sley 1 for swing motion together with the sley 1. The inlet and outlet openings of the air guide 11 and the inlet opening of the suction pipe 12 are on an ejection path along which the weft is ejected from the weft guide duct 9. A weft detector 19, i.e., a transmission photoelectric sensor, is provided within the air guide 11. The outlet end of the suction pipe 12 is bent toward a waste box, riot shown, disposed in front of the range of swing motion of the sley 1, and a blow nozzle 13 is connected to the bend in the suction pipe 12.

A stepping motor 14 is disposed behind the range of swing motion of the sley 1, a driving roller 15 is connected operatively to the stepping motor 14, and a driven roller 17 is attached to the operating rod of a pneumatic cylinder actuator 16 so as to be brought into contact with the driving roller 15.

As shown in Fig. 1, a weft breakage detector 18 is disposed behind the weft detector 6 with respect to the pickinq direction. When the weft is inserted normally, the leading end of the inserted weft does not reach a position corresponding to the weft breakage detector 18. When the inserted weft is broken, its leading end reaches the position corresponding to the weft breakage detector 18. Upon the detection of weft breakage, the weft breakage detector 18 gives a weft breakage detection signal to the control computer C, and then the control computer C stops the jet loom. A suction pipe 21 is disposed behind the weft breakage detector 18 with respect to the picking direction and is connected to the suction port of a blower 34. The expanded suction opening 21a of the suction pipe 21 has a width corresponding to the range of swing motion of the modified reed 4 so that a broken weft running through the weft passage 4a can surely

be sucked through the suction opening 21a into the suction pipe 21. A yarn detector 22, i.e., a transmission photoelectric sensor, is provided within the suction pipe 21. As shown in Fig. 1, a pneumatic cylinder actuator 23 is disposed near a false selvage W_2 with its longitudinal axis extended along the warps, and a support frame 24 is attached to the operating rod of the pneumatic cylinder actuator 23. A driving roller 26 is mounted on the output shaft of a stepping motor 25 supported on the support frame 24. A pneumatic cylinder actuator 27 is supported pivotally for tilting motion by a shaft 28 on the upper portion of the support frame 24. A lever 29 is supported pivotally for swing motion by a shaft 30 on the middle portion of the support frame 24. The lever 29 has one end connected to the operating rod of the pneumatic cylinder actuator 27 and the other end supporting a driven roller 31. The driven roller 31 is brought into contact with the driving roller 26 by projecting the operating rod of the pneumatic cylinder actuator 27 from the cylinder.

Yarn guides 32A and 32B are projected from the support frame 24 respectively to the opposite sides of the operating range of the driving roller 26 and the driven roller 31. Guide grooves 32a are formed in the front portions of the yarn guides 32A and 32B, respectively. A yarn detector 33, i.e., a reflection photoelectric sensor, is attached to the outer side surface of the yarn guide 32B.

The blow nozzles 8 and 13, and the pneumatic cylinder actuators 16, 23 and 27 are connected respectively through solenoid valves V_1, V_2, V_3, V_4 and V_5 to a compressed air supply source, not shown. The solenoid valves V_1 to V_5 and the stepping motors 14 and 25 are controlled by the control computer C. The control computer C controls the solenoid valves V_1 to V_5 and the stepping motors 14 and 25 according to the output signals of the weft breakage detector 18 and the yarn detectors 22 and 33.

Upon the occurrence of picking failure, the control computer C executes a faulty weft removing program represented by flow charts in Figs. 10 to 13.

If the weft does not reach the position corresponding to the weft detector 6, the weft detector 6 provides a picking failure signal, and then the electromagnetic cutter 7 is set to an inoperative state, the main motor M is stopped and the solenoid valves V_1 and V_2 are opened to blow air from the blow nozzles 8 and 13; consequently, a picking obstructing air current to obstruct picking is produced between the blow nozzle 8 and the weft guide duct 9, and a suction air current is produced through the inlet opening of the suction pipe 12.

These air currents are maintained while the electromagnetic cutter 7 is held inoperative and the sley reaches the position indicated by alternate long and two short dashes lines in Fig. 1. The picking obstructing action of the picking obstructing air current enables the faultily inserted weft Y_1 continuous with the weft Y_2 extending from the main picking nozzle 2 to be beaten up to the cloth fell W_1 pulls out the weft Y_2 from the weft measuring/storing device 3 while the jet loom is operating by inertia and blows the weft Y_2 into the weft guide duct 9. The weft Y_2 is sucked through the air guide 11 into the suction pipe 12.

After the jet loom has stopped, the control computer C reverses the jet loom by a predetermined angle on the basis of an angle detection signal provided by a rotary encoder 35 for detecting the angle of the jet loom in the weaving cycle to move the sley 1 to the rearmost position as shown in Fig. 1. With the sley 1 located at its rearmost position, the warps T are opened in a maximum shed, so that the faultily inserted weft Y_1 is released from the warps T. At the same time, a portion of the weft Y_2 extending between the weft guide duct 9 and the air guide 11 is located in a gripping region between the driving roller 15 and the driven roller 17.

After the jet loom has thus been reversed, the solenoid valve V1 is closed to stop the picking obstructing air current. The weft Y_2 extending in the air guide 11 is detected by the weft detector 19, and then the weft detector 19 provides a weft detection signal. Then, the solenoid valve V_3 is opened to press the driven roller 17 against the driving roller 15.

After the driven roller 17 has been pressed against the driving roller 15, the stepping motor 14 is actuated to rotate the rollers 15 and 17 gripping the weft Y_2 therebetween to pull the weft Y_2. Consequently, the weft Y_2 is stretched tight, the weft Y_2 is cut with the fixed cutting blade 10 to separate the same from the main picking nozzle 2, and the faultily inserted weft Y_1 is separated from the cloth fell W_1.

As the rollers 15 and 17 pulls the faultily inserted weft Y_1 separated from the cloth fell W_1, the faultily inserted weft Y_1 is sucked into the suction pipe 12. The weft detector 19 continues to provide the weft detection signal while the faultily inserted weft Y_1 is held between the rollers 15 and 17. When the weft detection signal is stopped, the stepping motor 14 is stopped and the solenoid valves V_2 and V_3 are closed to separate the driven roller 17 from the driving roller 15 and to stop blowing air from the blow nozzle 13. Then, the control computer C calculates the length x_1 of the faultily inserted weft Y_1 pulled out from the shed on the basis of the number of actuating pulses given to the stepping motor 14 during the duration of the weft detection signal provided by the weft detector 19.

In the case of picking failure in which the picked weft does not reach the position corresponding to the weft detector 6, the control computer C restarts the jet loom if the calculated length x_1 of the faultily

inserted weft Y_1 is not smaller than a predetermined length x_0 corresponding to a predetermined picking length. If the length x_1 is less than the predetermined length x_0, the control computer C indicates "$x_1 < X_0$" on a display 36 and actuates an alarm device 37.

In case the faultily inserted weft Y_1 is broken, a broken weft Y_3 is detected by the yarn breakage detector 18. In such a case, the control computer C executes, prior to the execution of the step for detecting picking failure to the step for stopping the jet loom, an operation to stop picking the weft Y_2 continuous with the faultily inserted weft Y_1 upon the reception of the yarn breakage detection signal from the yarn breakage detector 18, and then stops the jet loom. Then, the control computer C controls the first weft extracting mechanism provided on the picking side including the stepping motor 14, the pneumatic cylinder actuator 16 and the rollers 15 and 17 for faulty weft removing operation.

Upon the completion of the faulty weft removing operation of the first weft extracting mechanism provided on the picking side of the jet loom, the control computer C operates the second weft extracting mechanism provided on the weft receiving side of the jet loom, comprising the pneumatic cylinder actuator 23 and 27, the stepping motor 25, the rollers 26 and 31, and the blower 34. The second weft extracting mechanism carries out the following operations.

The blower 34 is started to produce a suction air current through the suction opening 21a of the suction pipe 21 to suck the leading end of the broken weft Y_3 beaten up to the cloth fell W_1 by the modified reed 4 into the suction pipe 21 as shown in Fig. 1.

Then, the solenoid valve V_4 is opened for a predetermined time and the operating rod of the pneumatic cylinder actuator 23 is projected by a predetermined length. Then, the solenoid valve V_5 is opened to press the driven roller 31 against the driving roller 26 by the pneumatic cylinder actuator 27, so that the broken weft Y_3 is gripped between the rollers 26 and 31. Then, the solenoid valve V_4 is opened again to project the operating rod of the pneumatic cylinder actuator 23 to a position shown in Fig. 5. Consequently, the rollers 26 and 31 gripping the broken weft Y_3 are moved toward the modified reed 4 to separate the broken weft Y_3 partially from the cloth fell W_1.

After the rollers 26 and 31 have been moved to a position shown in Fig. 5, the stepping motor 25 is actuated to rotate the rollers 26 and 31, and thereby the broken weft Y_3 is pulled toward the suction pipe 21. Thus, the broken weft Y_3 is extracted completely by the rollers 26 and 31 and is ejected into a waste box 38.

Fig. 9 is a graph that shows a position reached by the leading end of a picked weft in case of picking failure without entailing weft breakage and a position reached by the leading end of a picked weft in case of picking failure entailing weft breakage. In Fig. 9, angle indicating the angular position of the jet loom in a weaving cycle is measured on the horizontal axis and distance traveled by the picked weft is measured on the vertical axis. An angle θ_1 is a picking angle at which picking is started, an angle θ_2 is an arriving angle at which the leading end of a picked weft arrives at a predetermined position and an angle θ_3 is a shed closing angle at which the shed is closed. A line segment D_1 indicates a position at which the leading end of a normally inserted weft arrives, a line segment D_2 indicates the distance traveled by the broken weft Y_3 and a line segment D_0 indicates a distance traveled by both the normally inserted weft and the broken weft Y_3. Accordingly, the broken weft Y_3 travels a distance L_1 beyond a position y_1 at which the leading end of a normally inserted weft arrives. The distance L between the gripping region of the rollers 26 and 31 shown in Fig. 1 and the yarn detector 22 is greater than the distance L_1 so that a position y_2 at which the leading end of the broken weft Y■arrives is before the position corresponding to the yarn detector 22 with respect to the picking direction. Weft breakage occurs frequently in the vicinity of the main picking nozzle 2. If a picked weft is broken in the vicinity of the main picking nozzle 2 when the angle of the jet loom is in the range of ($\theta_1 + \theta_3 - \theta_2$) and θ_2, the leading end of the broken weft Y_3 never reaches the position corresponding to the yarn detector 22.

In case the picked weft is broken in the vicinity of the main picking nozzle 2 when the angle of the jet loom is in the range of ($\theta_1 + \theta_3 - \theta_2$) and θ_3, the trailing portion of the broken weft Y_3 is beaten up to the cloth fell W_1 and the leading end of the same reaches a position between the yarn detectors 33 and 22. The control computer C determines a distance x_2 shown in Fig. 1 on the basis of the number of operating pulses applied to the stepping motor 25 during a period from the start of the stepping motor 25 to the reception of a yarn detection signal from the yarn detector 22, and determines a length x_3 shown in Fig. 1, i.e., the length of the broken weft pulled out from the shed, on the basis of the number of operating pulses applied to the stepping motor 25 in a period from the start of the stepping motor 25 to the termination of a yarn detection signal provided by the yarn detector 33. The length of the broken weft Y_3 is $x_4 + x_3$ ($x_4 = L - x_2$). The control computer C provides an operation restart command signal when the sum of the length of the weft extracted by the first weft extracting mechanism and the length x_1 of the broken weft Y_3 extractedby the second weft extracting mechanism, i.e., $x_1 + x_4 + x_3$, is equal to or greater than the length

X_0 corresponding to the predetermined picking length or actuates the alarm device 37 when the sum is less than the length X_0.

The sum $x_1 + x_4 + x_3 < X_0$, for example, when the faultily inserted weft Y_1 or the broken weft Y_3 is broken during extraction. If the jet loom is restarted under such a condition, a portion of the faultily inserted weft Y_1 or a portion of the broken weft Y_3 will be woven into the fabric W. fiowever, since it is possible to see if the faultily inserted weft Y_1 or the broken weft Y_3 remains on the fabric from the measurement of the length of the extracted faultily inserted weft Y_1 or the length of the extracted broken weft Y_3, the jet loom is never restarted with a portion of the faultily inserted weft Y_1 or a portion of the broken weft Y_3 remaining on the fabric.

The present invention is not limited in its practical application to the foregoing embodiment. For example, the length X_0 may be determined from the number of coils of weft unwound from the weft storage surface 3a.

In a modification, it is possible to decide whether or not the weft has completely been extracted from Table 1 to discriminate between a condition where the measurement of the weft is impossible and a condition where the weft is broken during extraction, because the measurement of the weft is impossible if the broken weft does not remain on the fabric or when the length of the broken weft is less than the distance L.

Table 1

Removal	Weak yarns		Strong yarns	
	Complete	Incomplete	Complete	Incomplete
State 1	$X_0 \leqq x_1 + x_4 + x_3$	$X_0 > x_1 + x_4 + x_3$	$X_0 \leqq x_1 + x_4 + x_3$	$X_0 > x1 + x_4 + x_3$
State 2	No weft	All cases	$X_0 > x_1 + L$	$X_0 > x_1 + L$
State 3	$X_0 \leqq x_1 + x_3$	$X_0 > x_1 + x_3$	$X_0 \leqq x_1 + L$	$X_0 > x_1 + L$

In Table 1, the state 1 is brought about when the total length of the weft can be measured on both the picking side and the weft receiving side, the state 2 is brought about when any portion of the broken weft remains on the fabric, and the state 3 is brought about when a portion of the broken weft remains on the fabric and only the length x_3 can be measured.

As is apparent from the foregoing description, the present invention determines the length of the broken weft on the basis of the output signals of the two yarn detectors disposed on the weft receiving side of the jet loom and the data representing the rotation of the pair of rollers for extracting the broken weft. Accordingly, the length of the broken weft can accurately be determined while the broken weft is being extracted from the shed.

The weft removing device for a jet loom, comprises a weft breakage detecting means 18 disposed on the weft receiving side of the jet loom. A weft extracting means provided preferably with a pair of extraction rollers 26, 31 grips a broken weft that is broken from a weft extending from the weft feed package. The weft extracting means is capable of moving the pair of extraction rollers 26, 31 from a position near the cloth fell W_1 of the fabric toward the reed 4 of the jet loom, as to separate the broken weft from the cloth fell W_1. When rotating the pair of extraction rollers 26, 31 the broken weft is pulled toward the weft receiving side and the broken weft is extractd from the shed. A yarn removing suction device 21a, 21, 34 having a suction opening extending over the range of swing motion of the reed includes a first yarn detecting means 33 interposed between the yarn removing suction means and the gripping range in which the pair of rollers 26 ,31 grip the broken weft. A second yarn detecting means 22 is disposed on the suction passage of the yarn removing suction device 21a, 21, 34. A rotation detecting means 25 like e.g. a step motor provides for detecting the rotation of the pair of extraction rollers 21, 34 and a the computer C determines the yarn length broken weft on the basis of yarn detection information provided by the first and second yarn detecting means 22, 33 and information provided by the rotation detecting means 25. The device provides for restarting the loom only after removal of the entire lenght of the broken weft from the shed.

LIST OF REFERENCE CHARACTERS

21 ... Suction pipe (Broken weft sucking and removing means), 21a ... Suction opening, 22 ... Second yarn detector, 23 ... Pneumatic cylinder actuator (Weft extracting means), 25 ... Stepping motor (Rotation detecting means), 26 ... Driving roller, 31 ... Driven roller, 33 ... First yarn detector, 34 ... Blower (Broken

weft sucking and removing means), C ... Control computer (Length determining means)

Claims

1. A faulty weft removing device for a jet loom, comprising:
   a weft breakage detecting means (18) disposed on the weft receiving side of the jet loom;
   a weft extracting means provided with a pair of extraction rollers (26, 31) for gripping a broken weft broken from a weft extending from the weft feed package, and capable of moving the pair of extraction rollers (26, 31) from a position near the cloth fell (W_1) of the fabric toward the reed (4) of the jet loom to separate the broken weft from the cloth fell (W_1) and of rotating the pair of extraction rollers (26, 31) so that the broken weft is pulled toward the weft receiving side to extract the broken weft from the shed;
   a yarn removing suction means (21a, 21, 34) having a suction opening extending over the range of swing motion of the reed;
   a first yarn detecting means (33) interposed between the yarn removing suction means and a gripping range in which the pair of rollers (26 ,31) grip the broken weft;
   a second yarn detecting means (22) disposed on the suction passage of the yarn removing suction means (21a, 21, 34);
   a rotation detecting means (25) for detecting the rotation of the pair of extraction rollers (21, 34); and
   a yarn length determining means (C) for determining the length of the broken weft on the basis of yarn detection information provided by the first and second yarn detecting means (22, 33) and information provided by the rotation detecting means (25).

2. A faulty weft removing device for a jet loom, comprising:
   a weft breakage detecting means (18) disposed on the weft receiving side of the jet loom;
   a weft extracting means for gripping a broken weft broken from a weft extending from the weft feed package, and capable of moving the gripping means from a position near the cloth fell (W_1) of the fabric toward the reed (4) of the jet loom to separate the broken weft from the cloth fell (W_1) and of moving the gripping means in a way that the broken weft is pulled toward the weft receiving side to extract the broken weft from the shed;
   a pneumatic yarn removing means having an opening extending over the range of swing motion of the reed;
   a first yarn detecting means (33) interposed between the pneumatic yarn removing means and the gripping range in which the gripping means grip the broken weft;
   a second yarn detecting means (22) disposed on the passage of the pneumatic yarn removing means;
   a movement detecting means (25) for detecting the movement of the gripping means; and
   a yarn length determining means (C) for determining the length of the broken weft on the basis of yarn detection information provided by the first and second yarn detecting means (22, 33) and information provided by the movement detecting means (25).

3. A faulty weft removing device as claimed in claim 2, wherein the pneumatic yarn removing means is of the blowing type.

4. A faulty weft removing device as claimed in claim 2 or claim 3, with a pair of gripping rollers (21, 34) as weft extracting means for gripping.

5. A loom, in particular a jet loom, with a faulty weft removing device as claimed in any of claims 1 to 4.

Fig. 1

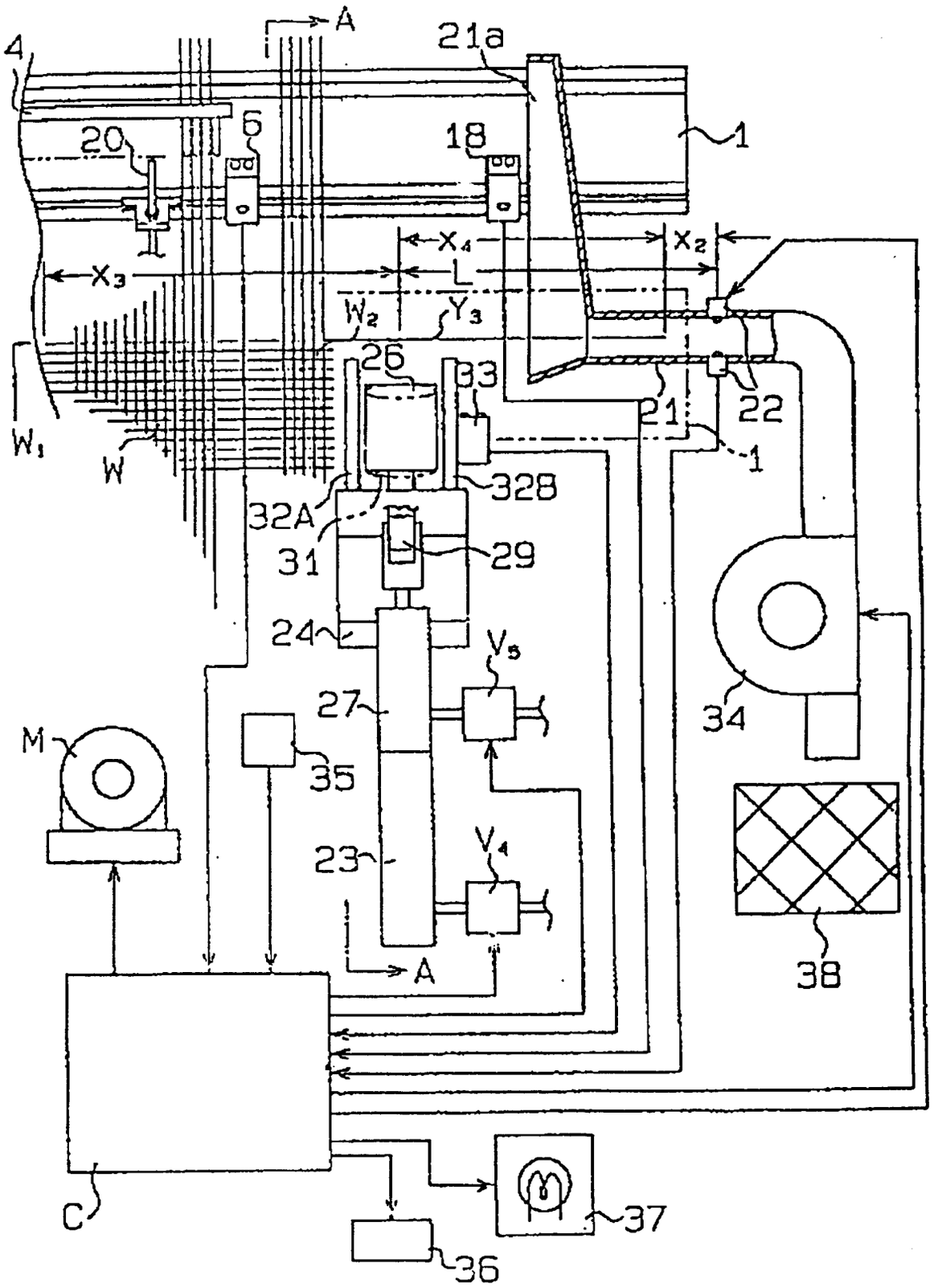

A
4
21a
20
6
18
1
X4
X2
X3
L
W2
Y3
26
33
21
22
W1
W
1
328
32A
31
29
24
V5
27
34
M
35
23
V4
A
38
C
37
36

Fig. 2

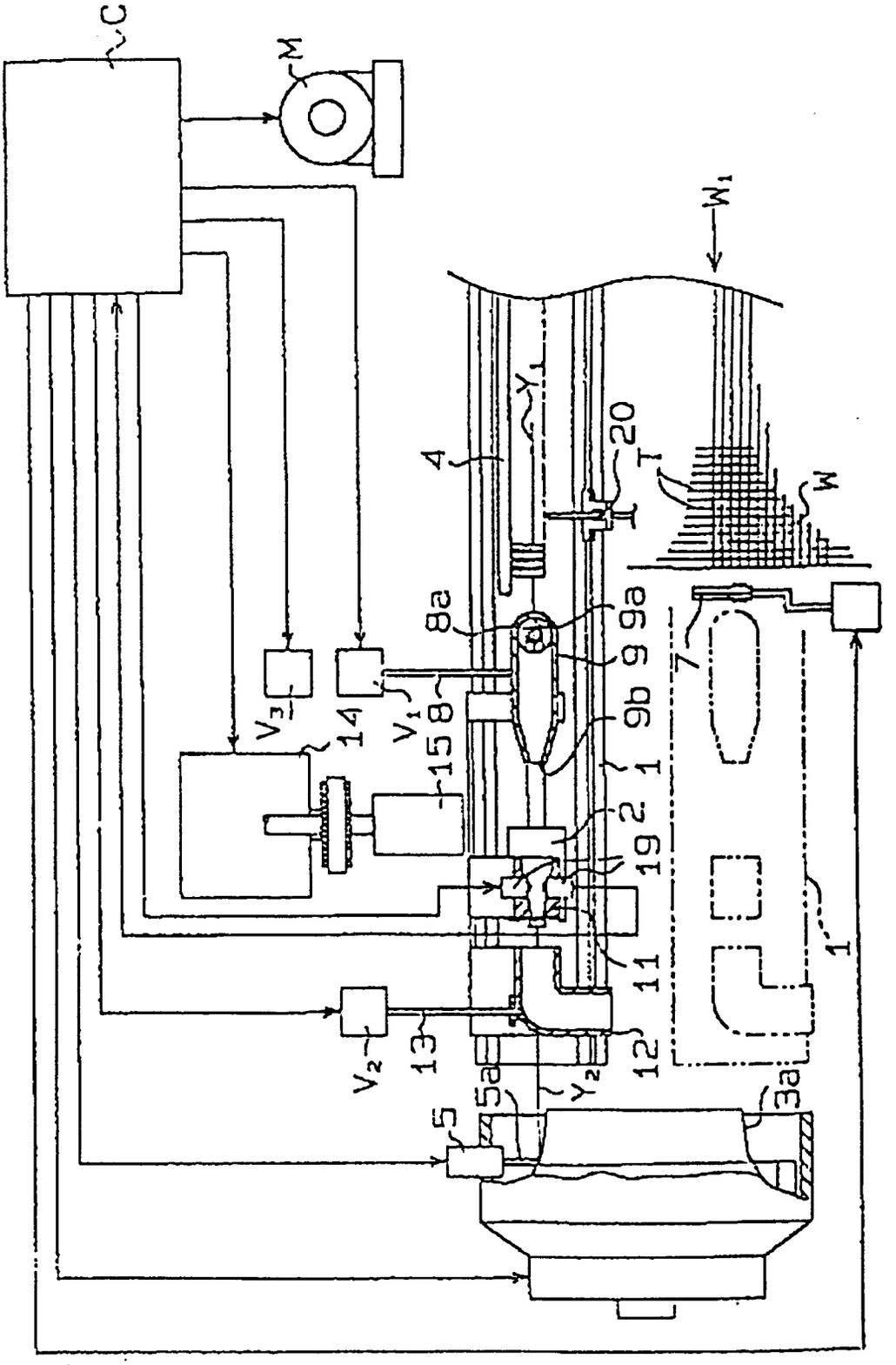


Fig. 3

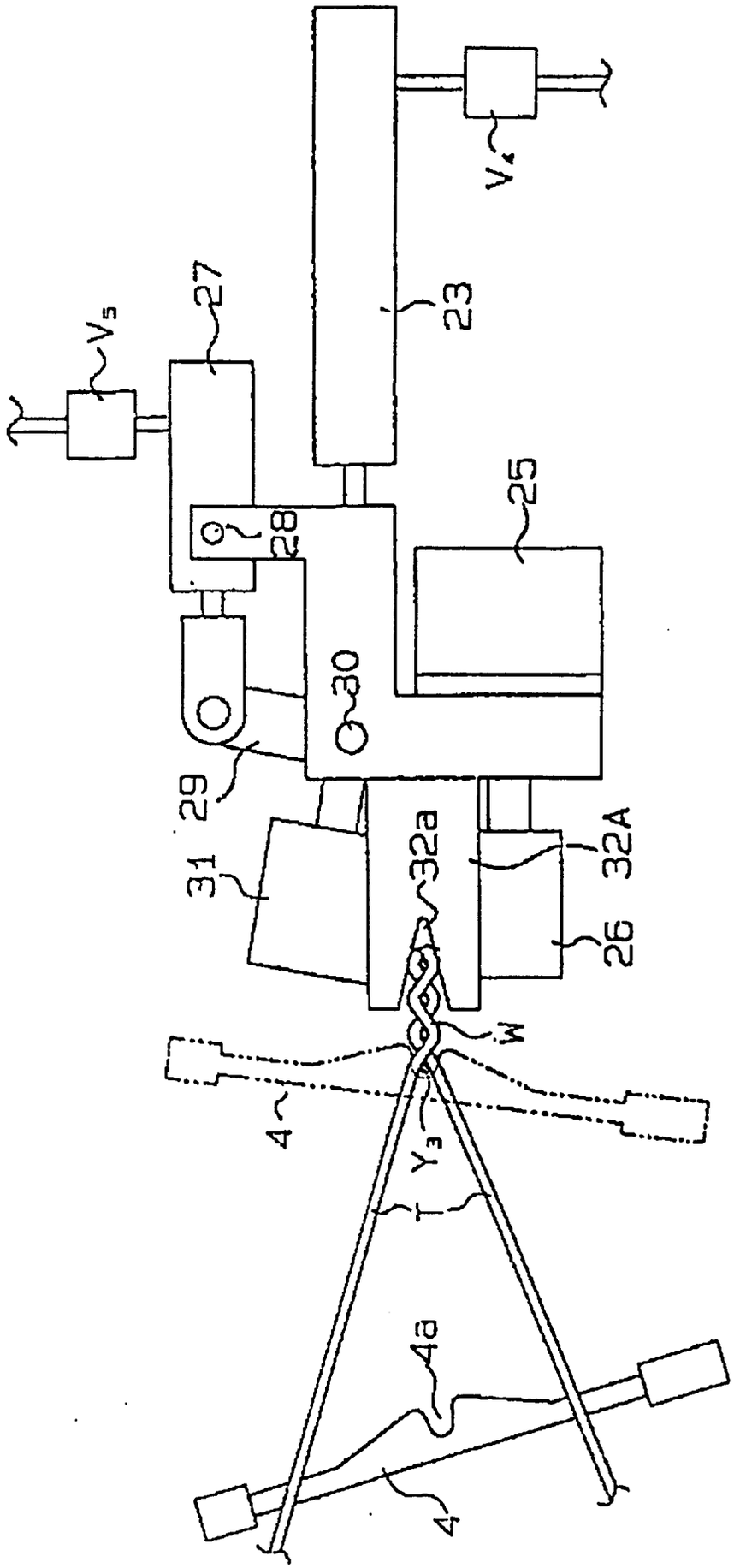


Fig. 4

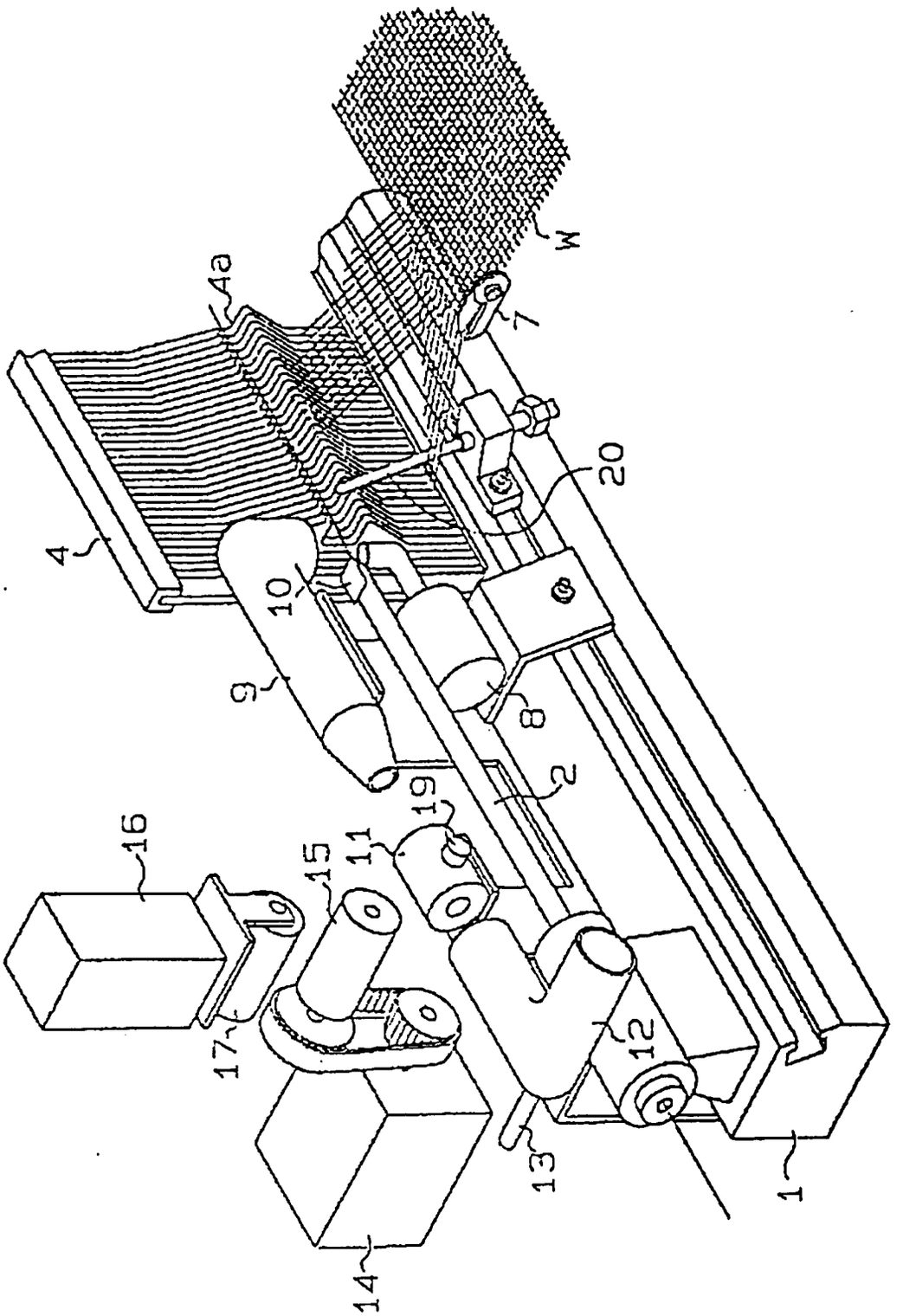


Fig. 5

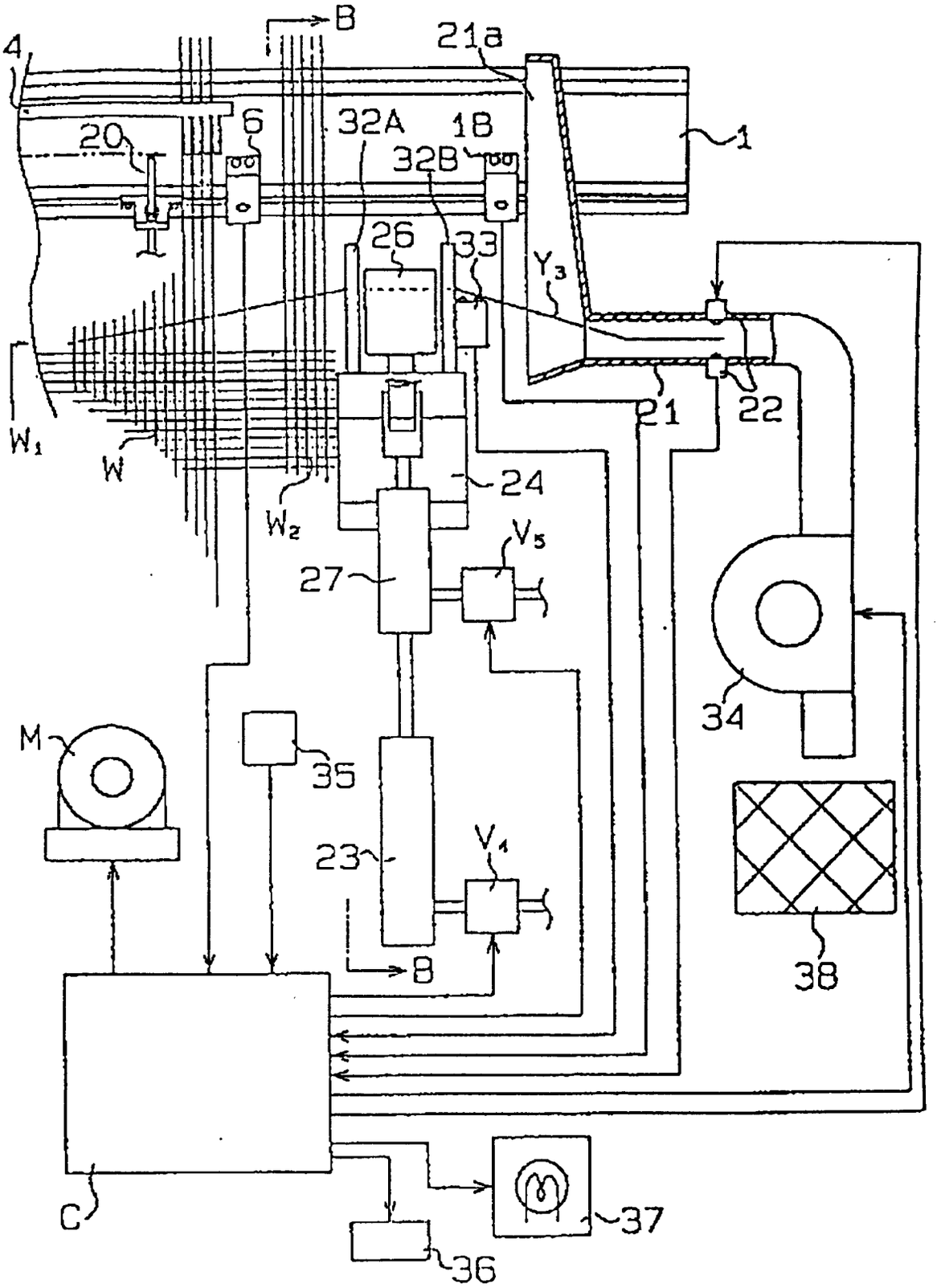

B
21a
4
20
6
32A
1B
32B
1
26
33
Y_3
W_1
W
W_2
21
22
24
V_5
27
34
M
35
23
V_1
8
38
C
37
36

Fig. 6

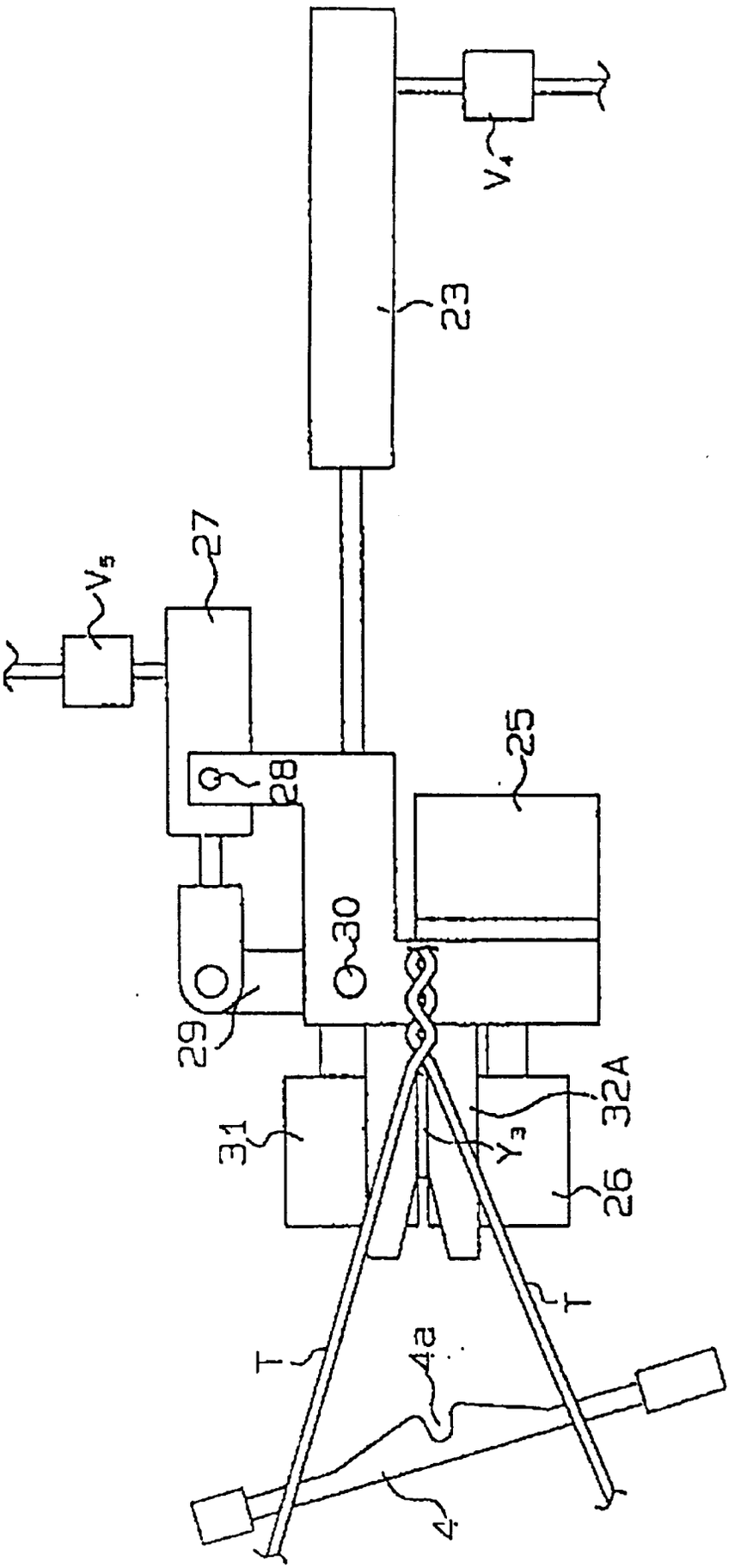


Fig. 7

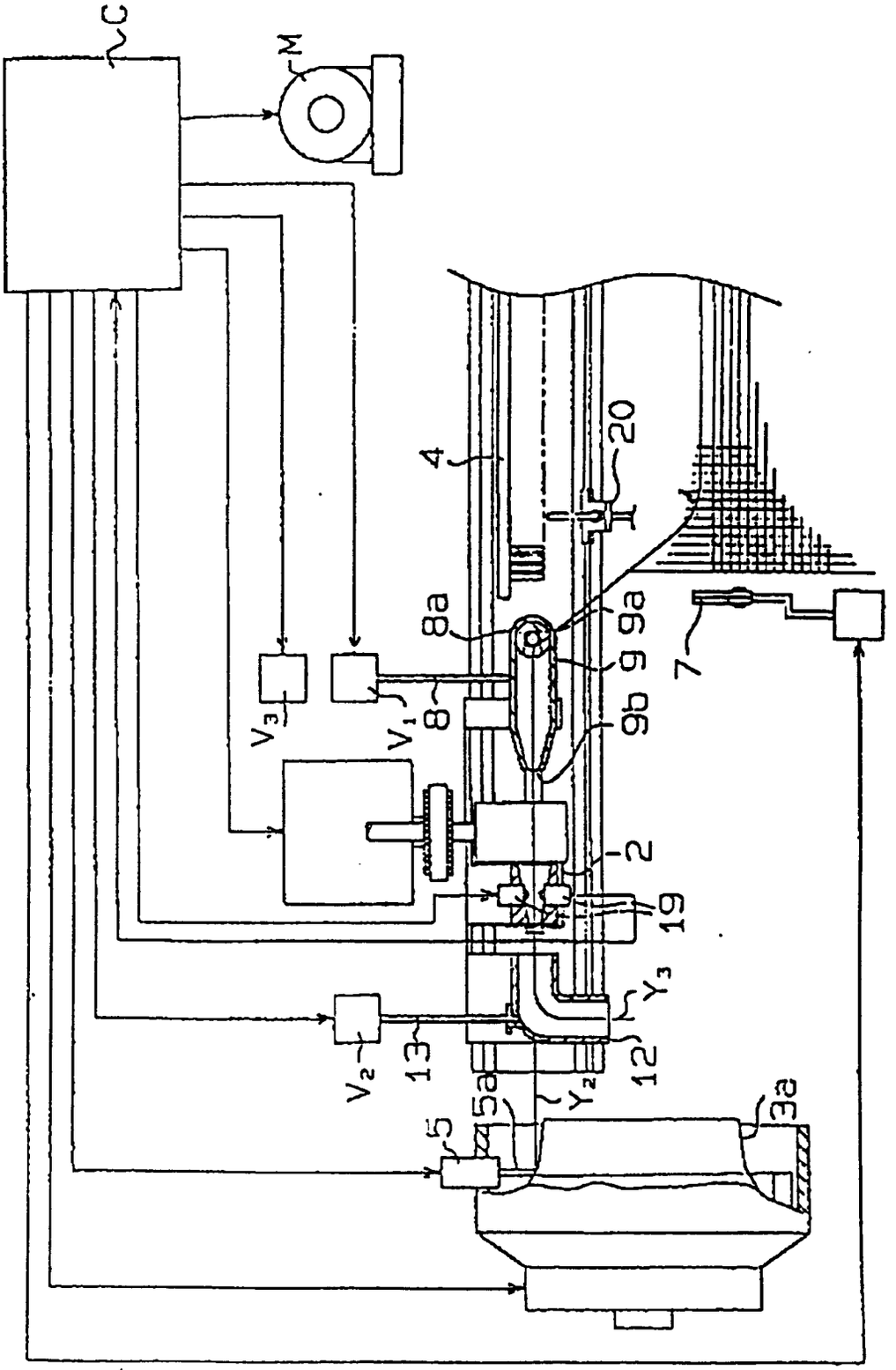


Fig. 8

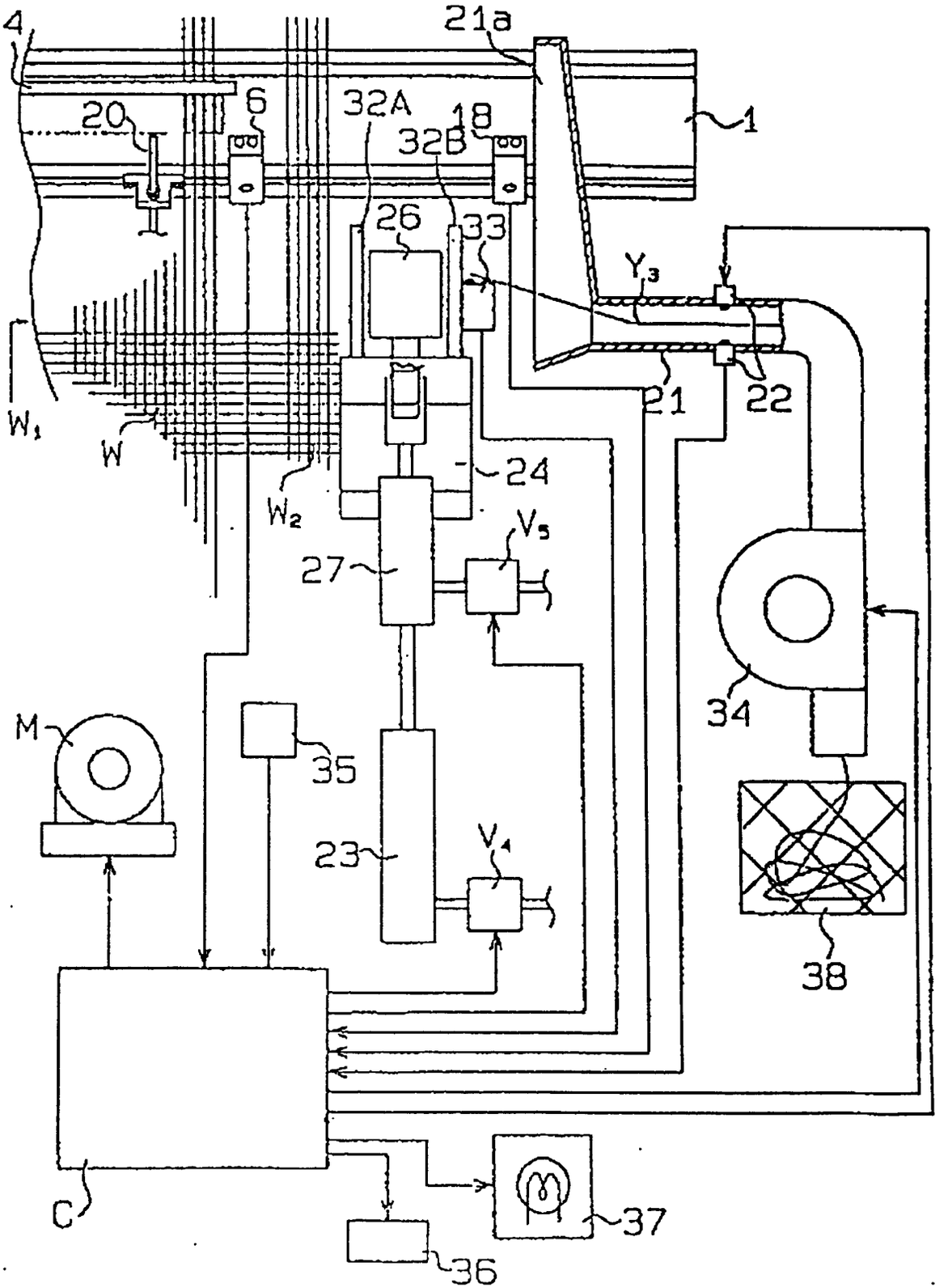

4
21a
20
6
32A
18
32B
1
26
33
Y_3
W_1
W
21
22
W_2
24
V_5
27
34
M
35
23
V_4
38
C
37
36

Fig. 9

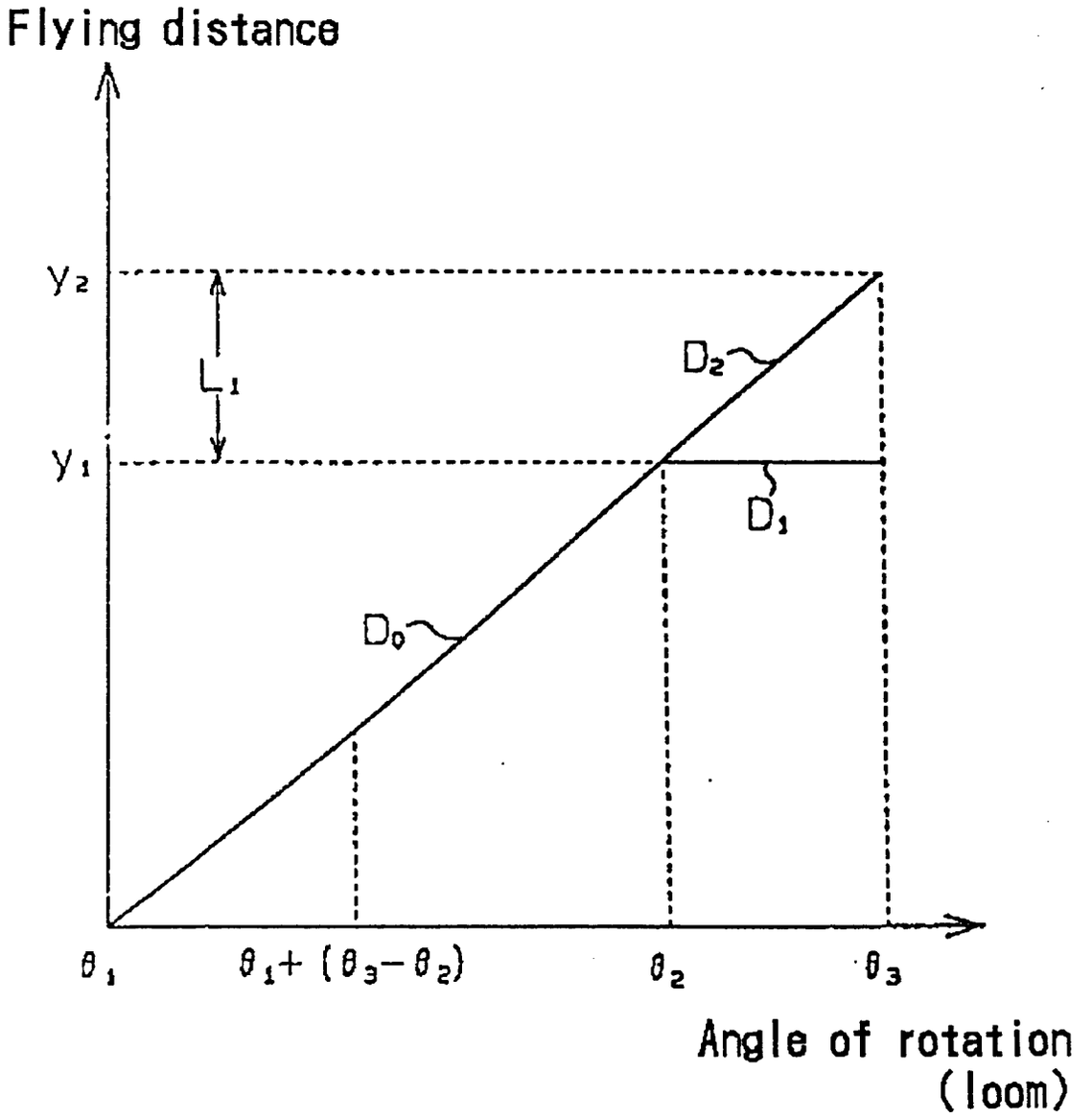

Flying distance
y2
y1
L1
D2
D1
D0
θ1
θ1+(θ3−θ2)
θ2
θ3
Angle of rotation
(loom)

Fig. 10

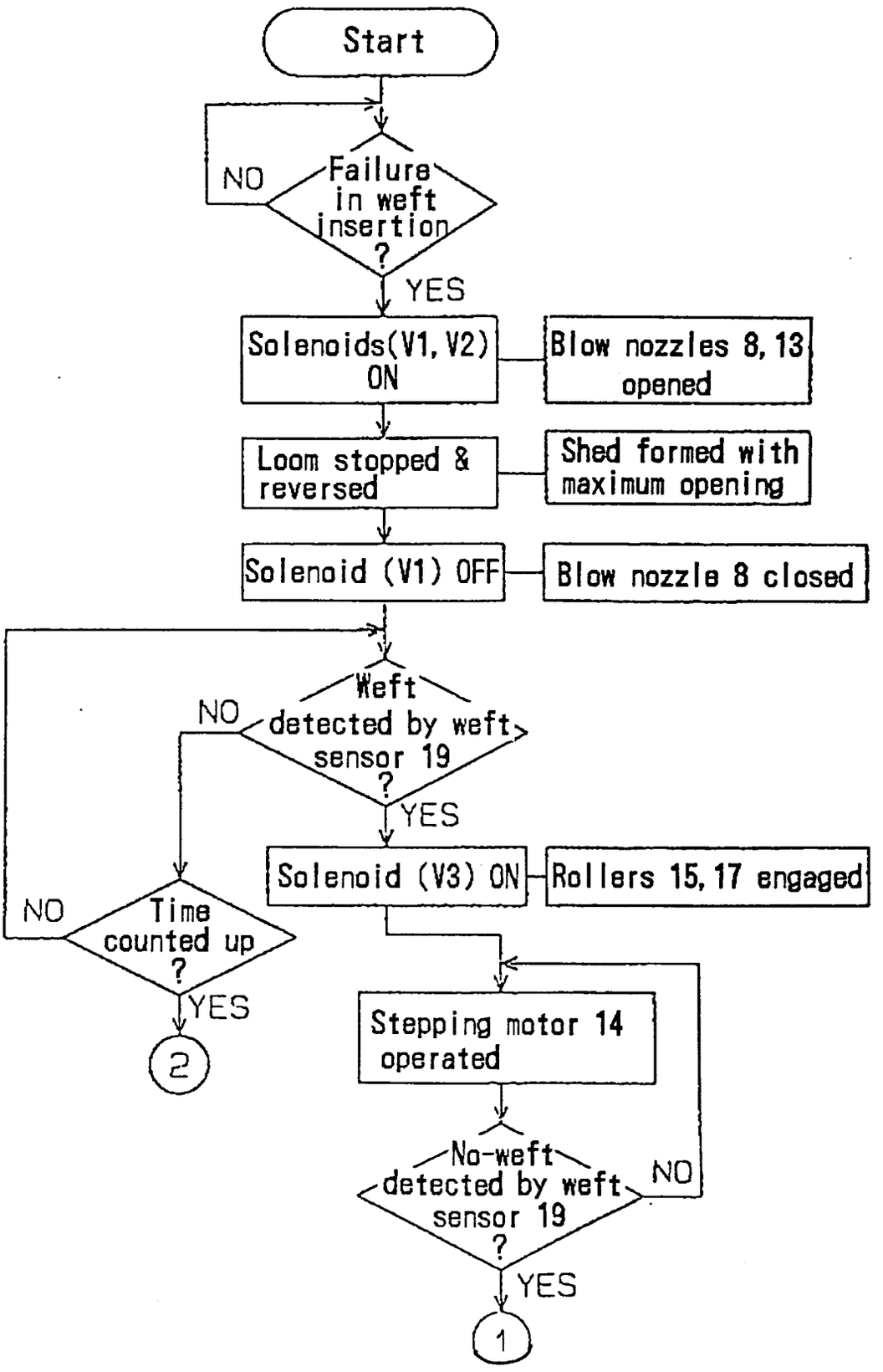

Start
Failure in weft insertion ?
NO
YES
Solenoids(V1, V2) ON
Blow nozzles 8, 13 opened
Loom stopped & reversed
Shed formed with maximum opening
Solenoid (V1) OFF
Blow nozzle 8 closed
Weft detected by weft sensor 19 ?
NO
YES
Solenoid (V3) ON
Rollers 15, 17 engaged
Time counted up ?
NO
YES
2
Stepping motor 14 operated
No-weft detected by weft sensor 19 ?
NO
YES
1

Fig. 11

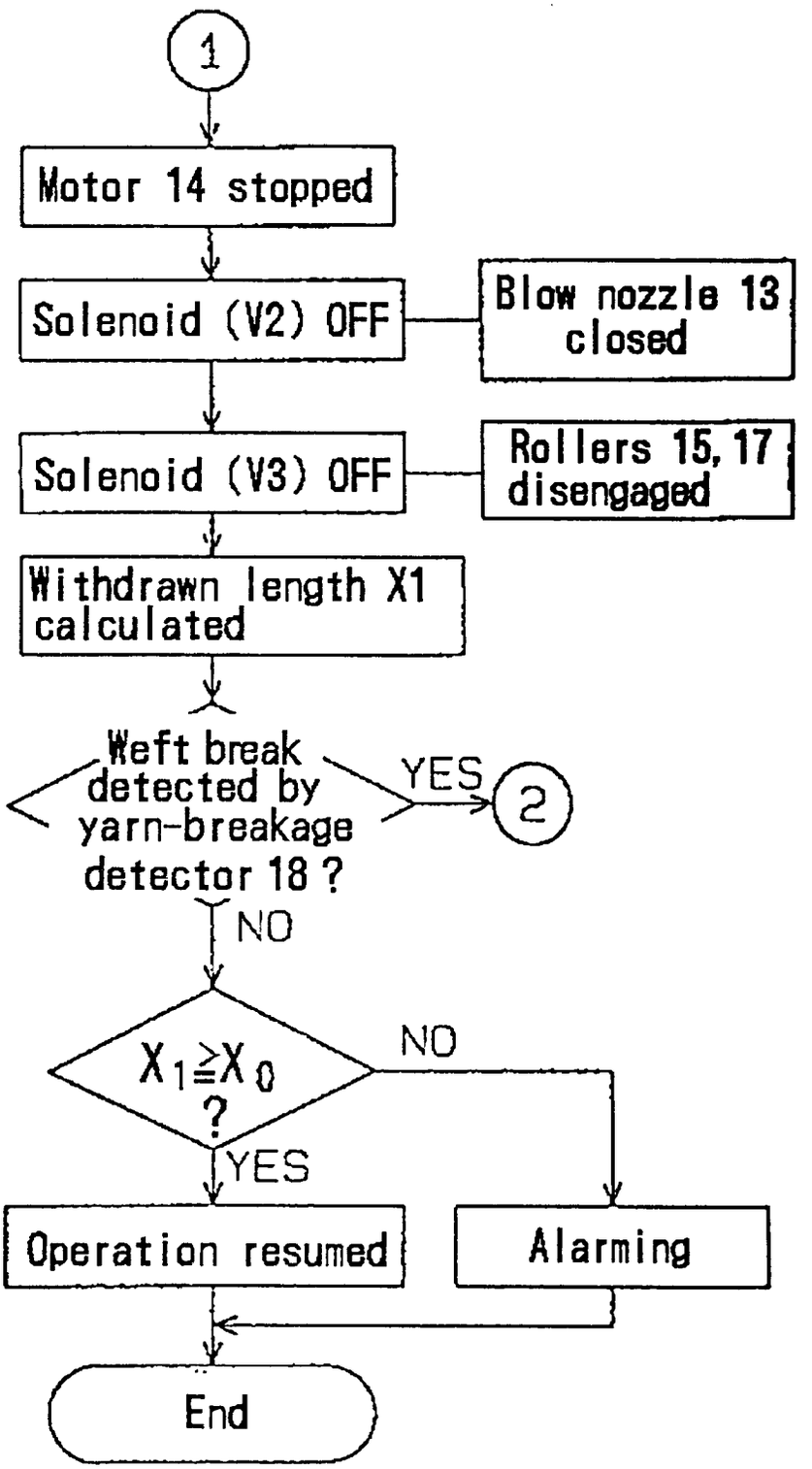

1
Motor 14 stopped
Solenoid (V2) OFF
Blow nozzle 13 closed
Solenoid (V3) OFF
Rollers 15, 17 disengaged
Withdrawn length X1 calculated
Weft break detected by yarn-breakage detector 18 ?
YES
2
NO
X1≧X0 ?
NO
YES
Operation resumed
Alarming
End

Fig. 12

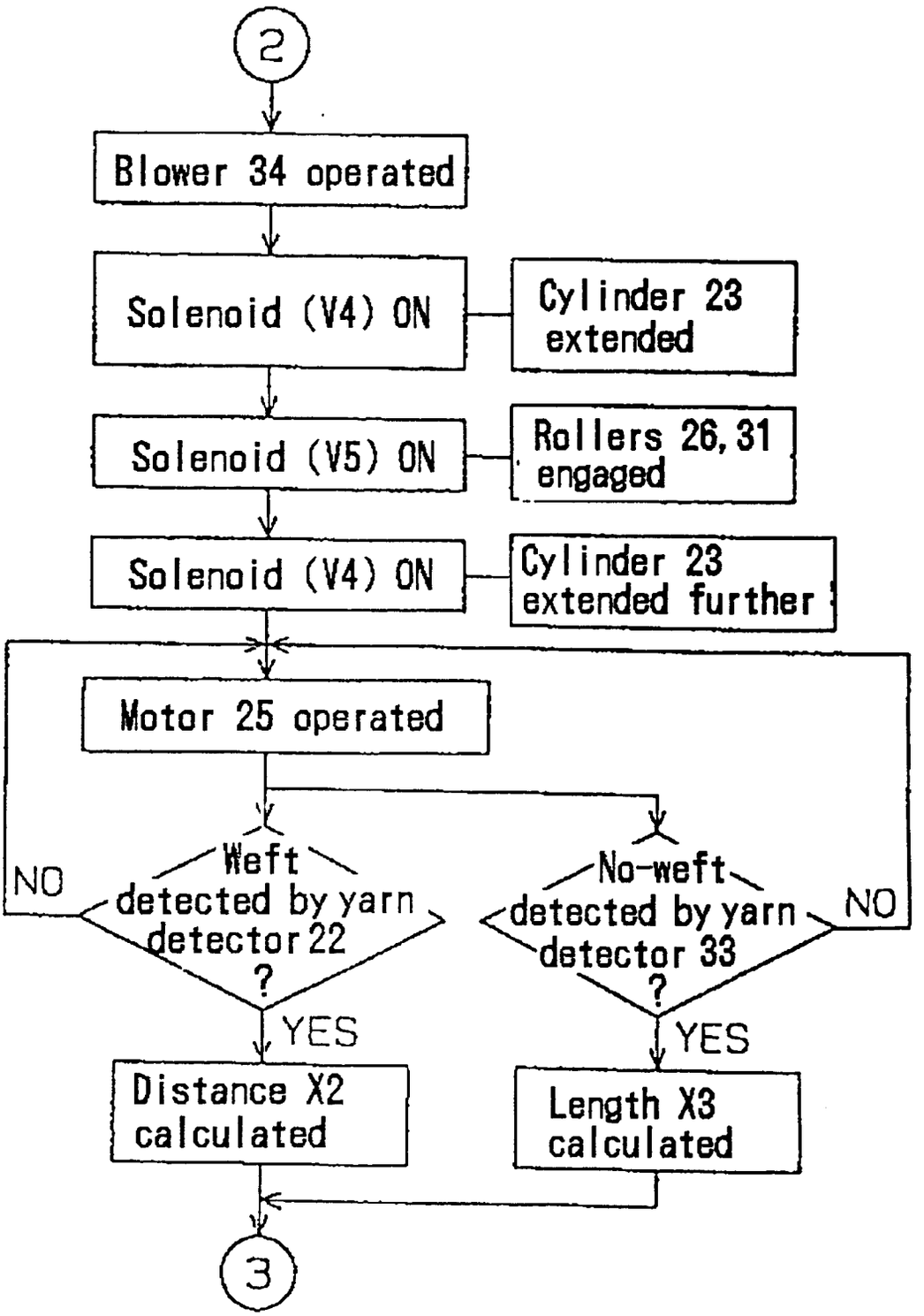
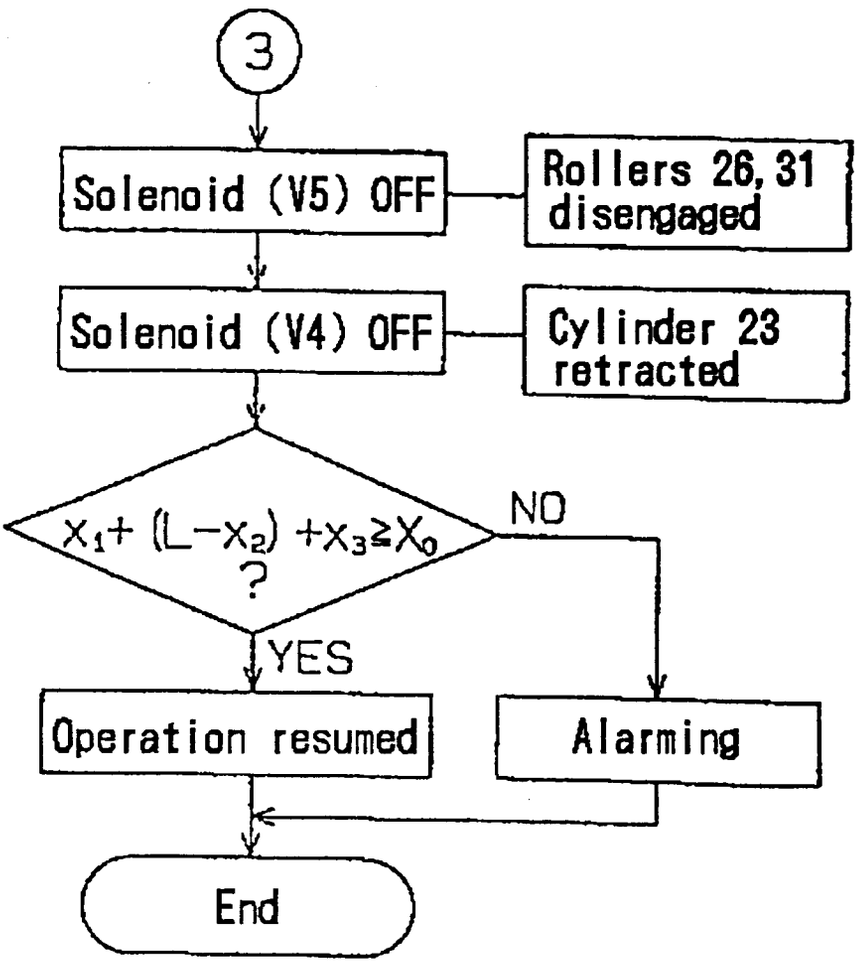

2
Blower 34 operated
Solenoid (V4) ON
Cylinder 23 extended
Solenoid (V5) ON
Rollers 26, 31 engaged
Solenoid (V4) ON
Cylinder 23 extended further
Motor 25 operated
Weft detected by yarn detector 22 ?
NO
YES
Distance X2 calculated
No-weft detected by yarn detector 33 ?
NO
YES
Length X3 calculated
3

Fig. 13


3
Solenoid (V5) OFF
Rollers 26, 31 disengaged
Solenoid (V4) OFF
Cylinder 23 retracted
$X_1 + (L - X_2) + X_3 \geq X_0$?
NO
YES
Operation resumed
Alarming
End

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 20 3417

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	US-A-4 890 650 (MITSUYA) * the whole document * ---	1-5	D03D51/08 D03D51/34
A D	EP-A-0 236 597 (TSUDAKOMA) * the whole document * * page 2, line 37 - line 47 * & JP-A-62 215 047 (...) -----	1-5	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			D03D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	06 APRIL 1992	BOUTELEGIER C.H.H.

CATEGORY OF CITED DOCUMENTS

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