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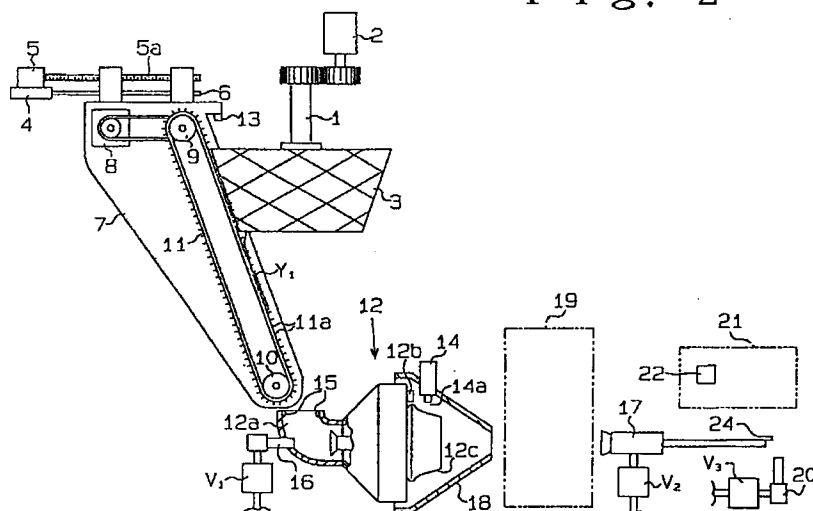
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**EUROPEAN PATENT APPLICATION**(21) Application number: **91203418.8**(51) Int. Cl.<sup>5</sup>: **D03D 47/34**(22) Date of filing: **28.12.91**(30) Priority: **28.12.90 JP 417352/90**(43) Date of publication of application:  
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CH-8401 Winterthur(CH)**(54) **Faulty weft removing device for a jet loom.**

(57) The present invention provides a yarn transfer device, in particular a weft transfer device, having a simple construction capable of surely pulling out the leading end of the weft of a weft package (3) and of surely threading the leading end through a weft measuring/storing device (12) of a storage drum type when a weft being fed is broken between the weft package 3 and the weft measuring/storing device 12.

A friction belt 11 with a fuzzy working surface for

separating the leading end of the weft (Y) of the weft package (3) and for transferring the leading end to the inlet opening (12a) of the weft measuring/storing device is shifted between a standby position and an operating position. A motor (5) is driven for rotation in the normal direction and in the reverse direction to shift the friction belt (11) between the standby position and the operating position. The friction belt (11) is turned by a motor (8).

**F i g . 2**

The present invention relates to a yarn transfer device for transferring a yarn from a yarn package to another device when the yarn being fed from a feed package to a take up device is broken between the feed package and the take up device or when an exhausted feed package is changed for a full feed package. In particular the invention relates to a weft transfer device for transferring a weft from a weft package to a weft measuring/storing device when a weft being fed from a feed package to the weft measuring/storing device is broken between the feed package and the weft measuring/storing device or when an exhausted feed package is changed for a full feed package.

Weft transfer devices for such a purpose are disclosed in Japanese Patent Laid-open (Kokai) Nos. Sho 63-264949 and Hei 1-92452 and Japanese Utility Model Laid-open No. Hei 1-62375. These prior art weft transfer devices pull out the leading end of the weft of a feed package by suction and transport the leading end of the weft to a weft measuring/storing device of a winding drum type.

The leading end of the weft of a weft package is in close adhesion to the circumference of the weft package, and the area of the leading end subjected to suction is very small. Therefore, it is difficult to separate the leading end of the weft from the circumference of the weft package only by suction, and hence the reliability of the prior art weft transfer devices in feeding the leading end of the weft to the weft measuring/storing device is not satisfactory.

The design of an air passage and the determination of air flow rate for smoothly transporting the weft are more difficult than one imagines, and the smooth transportation of the weft requires unavoidably complicated mechanisms. It is an object of the present invention to provide a weft transfer device of a simple construction capable of surely separating the warp of a weft package from the circumference of the weft package.

To achieve the object, the present invention provides a weft transfer device comprising a friction belt with a fuzzy working surface, capable of being located alternately at a weft separating position where a portion of the fuzzy working surface of the friction belt is in contact with the circumference of the weft package and at a standby position where the fuzzy working surface of the friction belt is separated from the circumference of the weft package.

Normally, the friction belt is held at the standby position, and the friction belt is shifted to the weft separating position when the weft being fed is broken between the weft package and the weft measuring/storing device or when an exhausted weft package is changed for a full weft package.

After being set at the weft separating position, the friction belt is turned to rub the circumference of the weft package with the fuzzy working surface. Consequently, the leading end of the weft adhering to the circumference of the weft package is separated from the circumference by the rubbing action of the fuzzy working surface of the friction belt, and then the leading end of the weft is transported to the inlet of the weft measuring/storing device as the friction belt is turned.

A yarn transfer device in a preferred embodiment as a weft transfer device according to the present invention will be described hereinafter with reference to Figs. 1 to 12.

- 15 Fig. 1 is a partially sectional front view of a weft transfer device in a preferred embodiment according to the present invention located at a standby position;
- 20 Fig. 2 is a partially sectional front view of the weft transfer device located at an operating position;
- Fig. 3 is a partially sectional front view of the weft transfer device, in which a leading end of the weft of a weft package has been pulled out from the weft package;
- 25 Fig. 4 is a partially sectional front view of the weft transfer device, in which the weft has been threaded through the main picking nozzle of a loom;
- 30 Fig. 5 is a block diagram showing the control system of the weft transfer device;
- 35 Fig. 6 is a flow chart of a weft transfer procedure;
- Fig. 7 is a flow chart of a weft transfer procedure;
- Fig. 8 is a flow chart of a weft transfer procedure;
- 40 Fig. 9 is a flow chart of a weft transfer procedure;
- Fig. 10 is a flow chart of a weft transfer procedure;
- 45 Fig. 11 is a flow chart of a weft transfer procedure;
- Fig. 12 is a flow chart of a weft transfer procedure;
- Fig. 13 is a partially sectional front view of a weft transfer device in another embodiment according to the present invention; and
- 50 Fig. 14 is a perspective view of a friction belt with a fuzzy working surface.

55 A weft package holding peg 1 supported for rotation has a base end operatively connected through a gearing to a motor 2 for rotating the weft package holding peg 1 in an unwinding direction

to unwind the weft of a weft package 3 held on the weft package holding peg 1.

A motor 5 mounted on a fixed base 4 has a driving screw shaft 5a and a guide rod 6 extends from the fixed base 4. A support plate 7 is suspended on the driving screw shaft 5a and the guide rod 6. The driving screw shaft 5a rotates to move the support frame 7 radially of the weft package 3.

A motor 8, a driving pulley 9 and a guide pulley 10 are attached to the side surface of the support plate 7. The driving pulley 9 is operatively connected to the motor 8. A friction belt 11 with a fuzzy working surface coated with fuzz 11a is extended between the driving pulley 9 and the guide pulley 10. The friction belt 11 is set so that the fuzzy working surface moves along a path parallel to the circumference of the weft package 3, and the guide pulley 10 is disposed near the inlet 12a of a weft measuring/storing device 12.

A weft package detector 13 is attached to the support plate 7 to detect the circumference of the weft package 3 when the support plate 7 is advanced toward the weft package 3.

The yarn winding pipe 12b of the weft measuring/storing device 12 is driven for revolution by a motor M separate from the main motor, not shown, of the loom. The weft is wound on the yarn storage surface 12c of the storage drum of the weft measuring/storing device 12. A stop pin 14a is advanced to or retracted from the yarn storage surface 12c by a solenoid actuator 14 to allow or to inhibit the unwinding of the weft wound on the yarn storage surface 12c. A yarn breakage detector 15 and a blow nozzle 16 are disposed near an inlet opening 12a. The blow nozzle 16 is connected through a two-way solenoid valve V1 to a compressed air tank, not shown. Air blown from the blow nozzle 16 into the weft measuring/storing device 12 jets out from the yarn winding pipe 12b communicating with the inlet opening 12a. The air jetting out from the yarn winding pipe 12b is converged by a convergent guide member 18 and flows in a stream toward a threading device 19 disposed between the weft measuring/storing device 12 and a main picking nozzle 17. The threading device is such as disclosed in Japanese Patent Laid-open No. Hei 2-251637. This threading device 19 holds the leading end of the weft jetted out from the convergent guide member 18 by an air current, cuts the leading end of the weft in an appropriate length and inserts the leading end of the weft in the main picking nozzle 17.

A picking obstructing blow nozzle 20 is disposed directly below the main picking nozzle 17, and a faulty weft removing device 21 is disposed directly above the main picking nozzle 17. The faulty weft removing device 21 is of the same

system as that of a faulty weft removing device disclosed in Japanese Patent Laid-open (Kokai) No. Hei 2-251637. When picking failure occurs, air is blown from the blow nozzle 20 to obstruct the insertion of the weft continuously with a faultily inserted weft, and then the faulty weft removing device 21 pulls the weft to extract the faultily inserted weft from the cloth fell. The faulty weft removing device 21 is provided internally with a weft detector 22, and the operation of the faulty weft removing device 21 is controlled according to the output signal of the weft detector 22.

The main picking nozzle 17 and the blow nozzle 20 are connected respectively through two-way solenoid valves V2 and V3 to the compressed air tank. As shown in Fig. 5, the solenoid valves V1 to V3, the motors 5, 8 and M, the solenoid actuator 14, the threading device 19 and the faulty weft removing device 21 are controlled by a control computer C separate from a loom control computer for controlling the jet loom. The control computer C controls the solenoid valves V1 to V3, the solenoid actuator 14 and the motors 5, 8 and M according to the output detection signals of the weft package detector 13, the yarn breakage detector 15 and the weft detector 22.

Figs. 6 to 12 are flow charts of weft transfer procedures to be executed by the control computer C when the weft is broken between the weft package 3 and the weft measuring/storing device 12.

Fig. 1 shows a threading path along which a weft Y is fed during weaving operation. Upon the detection of the weft Y between the weft package 3 and the weft measuring/storing device, the yarn breakage detector 15 gives a weft breakage signal to the control computer C. Upon the reception of the weft breakage signal, the control computer C gives a loom stop signal to the loom control computer. Then, the main picking nozzle 17 mounted on the sley of the loom is stopped near the cloth fell of the fabric on the loom. After the loom has stopped, the loom control computer provides a command to reverse the loom at a low speed by a predetermined angle to shift the main picking nozzle 17 to and locate the same at a threading position.

After the loom has thus been reversed, the solenoid actuator 14 is actuated and the solenoid valves V2 and V3 are opened to retract the stop pin 14a from the yarn storage surface 12c and to blow air from the main picking nozzle 17 and the blow nozzle 20. The residual weft remaining on the yarn storage surface 12c and released from the stop pin 14a is jetted out through the main picking nozzle 17 and is blown by the air blown from the blow nozzle 20 into the faulty weft removing device 21. The weft detector 22 detects the residual weft transferred to the faulty weft removing device 21

and provides a weft detection signal. When, the faulty weft removing device 21 starts its faulty weft removing operation. Upon the confirmation of the completion of the faulty weft removing operation from the termination of the weft detection signal provided by the weft detector 22, the faulty weft removing device 21 is restored to its initial state. The faulty weft removing operation of the faulty weft removing device 21 for removing the residual weft must be completed prior to threading the weft from the weft measuring/storing device 12 to the main picking nozzle 17.

Referring to Fig. 2, after the completion of the residual weft removing operation, the motor 5 is driven for rotation in the normal direction to advance the support plate 7 toward the circumference of the weft package. Upon the detection of the circumference of the weft package 3 by the weft package detector 13 during the advancement of the support plate 7 toward the weft package 3, the motor 5 is stopped. In this state, the fuzzy working surface coated with the fuzz 11a of the friction belt 11 extends along the circumference of the weft package 3.

After the motor 5 has been stopped, the solenoid valve  $V_1$  is opened to blow air from the blow nozzle 16, so that a suction air current is produced in the inlet opening 12a of the weft measuring/storing device 12.

Then, the motors 2 and 8 are actuated to rotate the weft package 3 and to turn the friction belt 11. The circumference of the rotating weft package 3 is rubbed with the fuzz 11a of the friction belt 11, so that the leading end of the weft of the weft package 3 is caught by the fuzz 11a and is separated from the circumference of the weft package 3.

The positive separation of the leading end of the weft of the weft package 3 by the rubbing action of the fuzz 11a is far more reliable than the separation of the same by suction. Particularly, the separation of the leading end  $Y_1$  sticking to the circumference of the weft package by suction is scarcely possible. even if the leading end  $Y_1$  is sticking to the circumference of the weft package, the leading end  $Y_1$  can be caught by the fuzz 11a by the rubbing action of the same. Once the leading end  $Y_1$  is caught by the fuzz 11a, the leading end  $Y_1$  sticks to the fuzz 11a and the weft can smoothly be pulled out from the weft package as the friction belt is turned. The rubbing action of the friction belt 11 enables successful leading end separation at a high success probability.

The leading end  $Y_1$  separated from the weft package 3 sticks to the fuzz 11a of the friction belt 11 and is transported toward the inlet opening 12a of the weft measuring/storing device 12. Since the degree of freedom of arrangement of the friction belt 11 is high, a compact transportation path that

may not interfere with the devices arranged near the friction belt 11 can be formed. Since the leading end of the weft is securely caught by the fuzz 11a during transportation, this leading end transporting mechanism employing the fuzz 11a is simple as compared with a leading end transporting mechanism employing air currents in transporting the leading end.

The leading end  $Y_1$  transported near to the inlet opening 12a is transferred from the friction belt 11 to the inlet opening 12a by the suction current prevailing around the inlet opening 12a, and then the leading end  $Y_1$  is blown into the yarn winding pipe 12b. Upon the entrance of the leading end  $Y_1$  into the inlet opening 12a, the yarn breakage detector 15 provides a yarn detection signal. then, the motors 2 and 8 are stopped to stop the rotating weft package 3 and to stop the turning friction belt 11, and the motor 5 is reversed to retract the support plate 7 to its standby position shown in Fig. 1.

When the leading end  $Y_1$  is not detected by the yarn breakage detector 15, an alarm device 23 is actuated.

After the leading end  $Y_1$  has successfully been threaded through the weft measuring/storing device 12, the solenoid valves  $V_2$  and  $V_3$  are opened to jet air from the main picking nozzle 17 and the blow nozzle 20. then, the threading device 19 is actuated to insert the leading end  $Y_1$  blown out from the yarn winding pipe 12b is inserted in the main picking nozzle 17. During the operation of the threading device 19, the motor M revolves the yarn winding pipe 12b by a predetermined number of turns to reserve a predetermined length of weft on the yarn storage surface 12c, and the weft wound on the yarn storage surface 12c is transferred to the faulty weft removing device 21 by the picking obstructing action of the air blown from the blow nozzle 21. Thus, the predetermined length of weft is wound on the yarn storage surface 12c during the operation of the threading device 19 to enable the leading end  $Y_1$  to reach the faulty weft removing device 21.

Upon the arrival of the leading end  $Y_1$  at a position corresponding to the weft detector 22 of the faulty weft removing device 21 as shown in Fig. 4, the weft detector 22 provides a weft detection signal, and then a predetermined length of weft is wound on the yarn storage surface 12c for the subsequent picking operation. Subsequently, the leading end  $Y_1$  is cut off with a fixed cutting blade 24 provided at the tip of the main picking nozzle 17 to complete the threading operation. If the threading operation for threading the weft through the main picking nozzle 17 is unsuccessful, the threading device 19 is restored to its initial state and the alarm device 23 is actuated.

Naturally, the present invention is not limited in its practical application to the foregoing embodiment. For example, the present invention may be embodied in a weft transfer device as shown in Figs. 13 and 14. Referring to Figs. 13 and 14, the weft transfer device is provided with a pair of guide pulleys 26 and 27 guiding a friction belt 25 with a fuzzy working surface. A blow nozzle 28 is disposed between the guide pulleys 26 and 27 so as to blow air through the friction belt 25 into the inlet opening 12a of a weft measuring/storing device 21. As shown in Fig. 14, the friction belt 25 has a netlike construction to enable the air blown from the blow nozzle 28 to flow through the friction belt 25 into the inlet opening 12a. The component threads 25a of the friction belt 25 are coated with fuzz 25b. A leading end  $Y_1$  transported to a position between the guide pulleys 26 and 27 is inserted positively into the inlet opening 12a by the blowing action of the blow nozzle 28.

As is apparent from the foregoing description, according to the present invention, the leading end of the weft of a weft package is separated from the circumference of the weft package by the fuzzy working surface of the friction belt. Accordingly, the leading end which is difficult to be separated from the circumference of the weft package by suction can be separated from the circumference of the weft package at a high success probability, the reliability of threading operation for threading the leading end through the faulty weft removing device is improved, and the weft transfer device can be formed in a simple construction.

The present invention provides a weft transfer device having a simple construction capable of surely pulling out the leading end of the weft of a weft package 3 and of surely threading the leading end through a weft measuring/storing device 12 of a storage drum type when a weft being fed is broken between the weft package 3 and the weft measuring/storing device 12.

A friction belt 11 with a fuzzy working surface for separating the leading end of the weft of the weft package 3 and for transferring the leading end to the inlet opening 12a of the weft measuring/storing device is shifted between a standby position and an operating position. A motor 5 is driven for rotation in the normal direction and in the reverse direction to shift the friction belt 11 between the standby position and the operating position. The friction belt 11 is turned by a motor 8.

#### LIST OF REFERENCE CHARACTERS

3 ... Weft package, 5 ... Motor (Shifting means), 8 ... Motor (Rotative driving means), 11 ... Friction belt with a fuzzy working surface, 11a ... Fuzz, 12 ... Weft measuring/storing device, 12a ... Inlet open-

ing

#### Claims

- 5 1. A weft transfer device for a jet loom that measures and stores a weft pulled out from a feed package by a weft measuring/storing device (12) of a winding drum type and picks the measured and stored weft by a main picking nozzle (17), said weft transfer device comprising:
  - 10 a friction belt (11) with a fuzzy working surface (11a) for rubbing the circumference of the feed package (3) to pull out the leading end of the weft of the feed package (3) and for transporting the leading end of the weft (Y) to the inlet of the weft measuring/storing device (12);
  - 15 rotative driving means (8, 9, 10) for driving the friction belt (11) for turning; and
  - 20 shifting means (4, 5, 5a, 6, 7) for shifting the friction belt (11) between an operating position (Fig. 2) where a portion of the fuzzy working surface (11a) of the friction belt (11) is in contact with the circumference of the feed package (3), and a standby position (Fig. 1) where the fuzzy working surface (11a) of the friction belt (11) is separated from the surface of the feed package (3).
  - 25
  - 30
- 35 2. A yarn transfer device comprising;
  - 40 a friction belt (11) with a fuzzy working surface (11a) for rubbing the circumference of the feed package (3) to pull out the leading end of the yarn ( $Y_1$ ) of the feed package and for transporting the leading end of the yarn ( $Y_1$ ) to a take up device (12, 17);
  - 45 rotative driving means (8, 9, 10) for driving the friction belt (11); and
  - 50 shifting means (4, 5, 5a, 6, 7) for shifting the friction belt (11) between an operating position (Fig. 2) where a portion of the fuzzy working surface (11a) of the friction belt (11) is in contact with the circumference of the yarn feed package (3), and a standby position (Fig. 1) where the fuzzy working surface (11a) of the friction belt (11) is separated from the surface of the yarn feed package (3).
- 55 3. A yarn transfer device as claimed in claim 1 or claim 2, further including means (16) for pneumatically transferring the leading end of the yarn to the take up device (12)
4. A loom with a weft yarn transfer device as claimed in any of claims 1 to 3.

Fig. 1

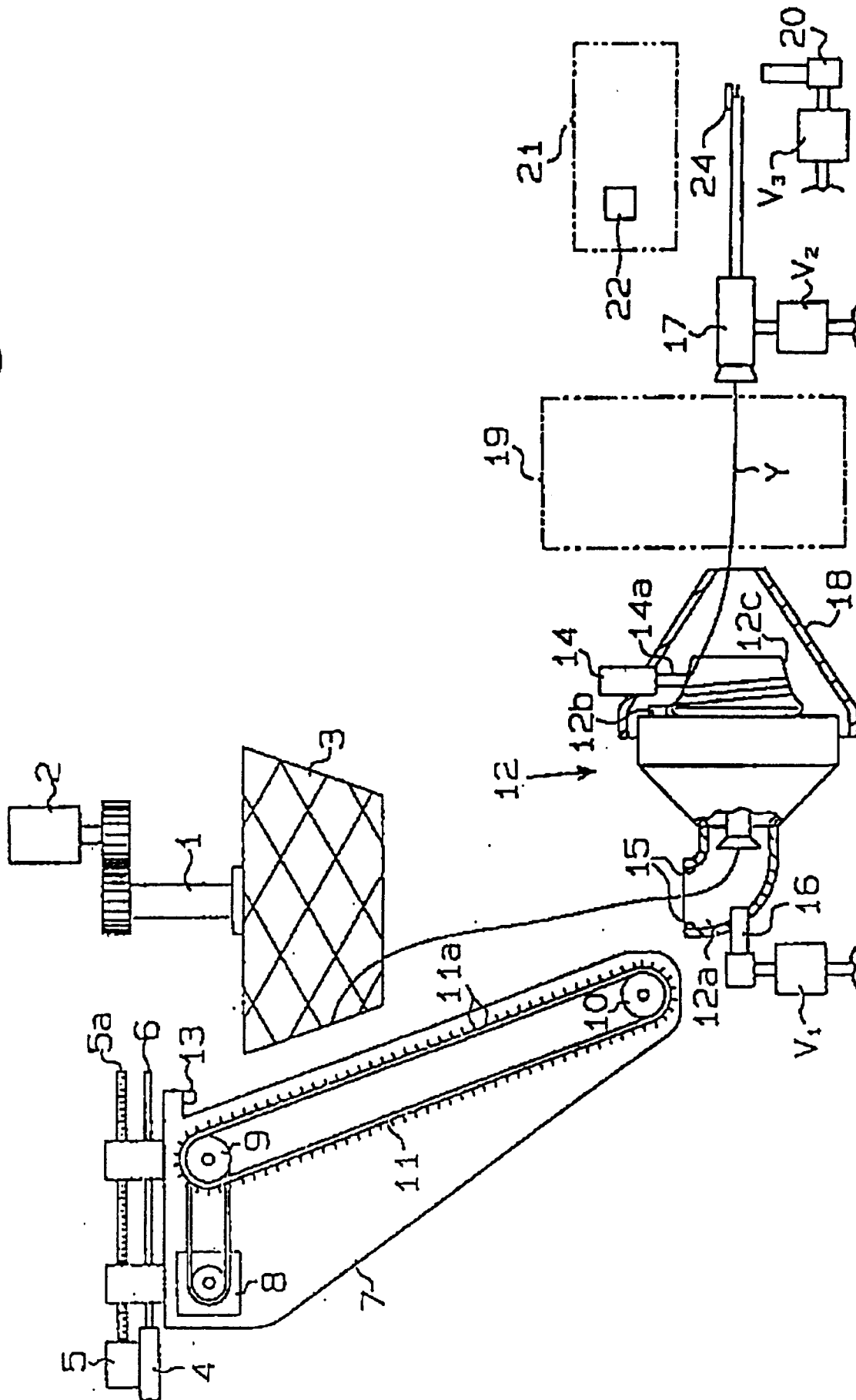


Fig. 2

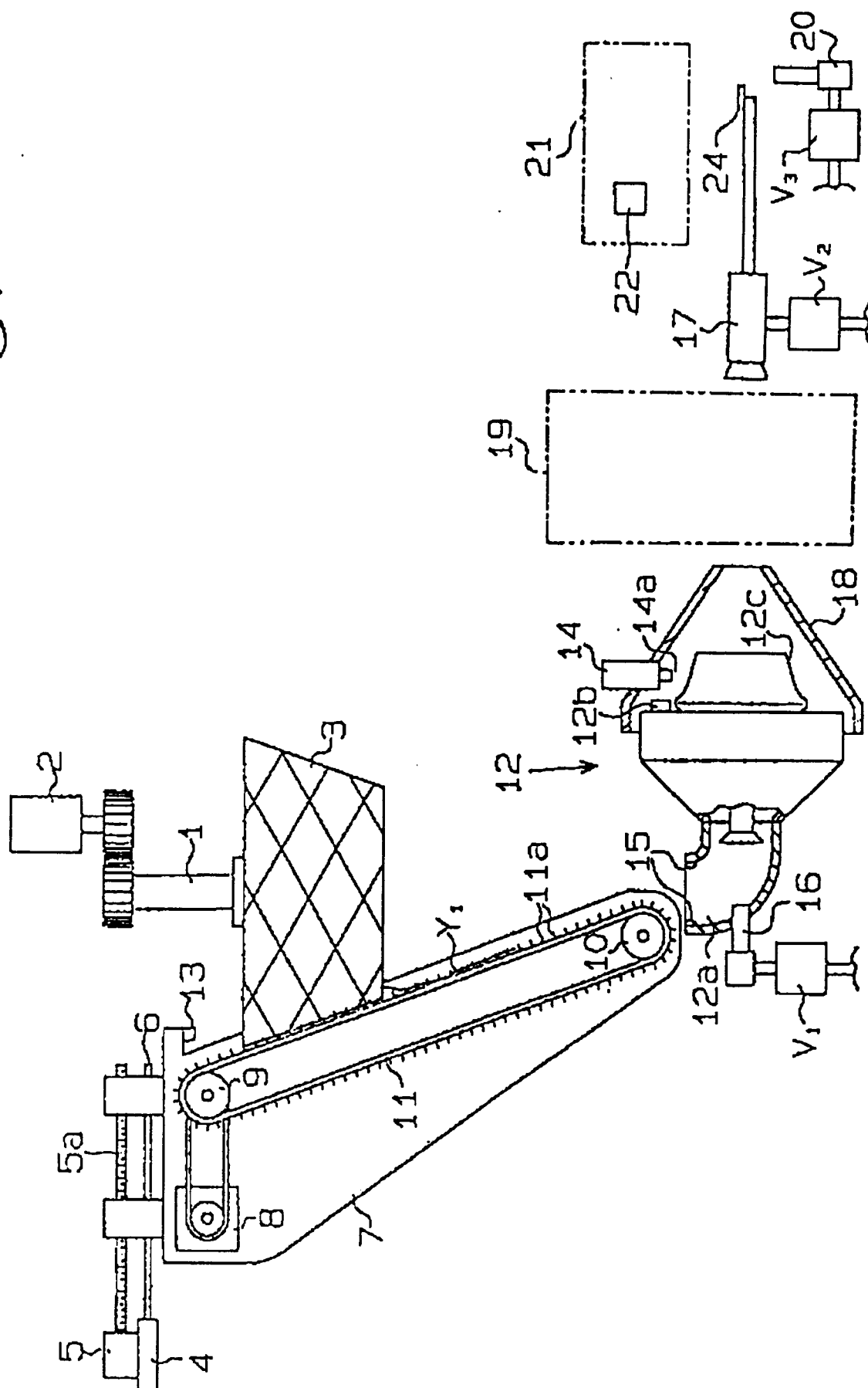


Fig. 3

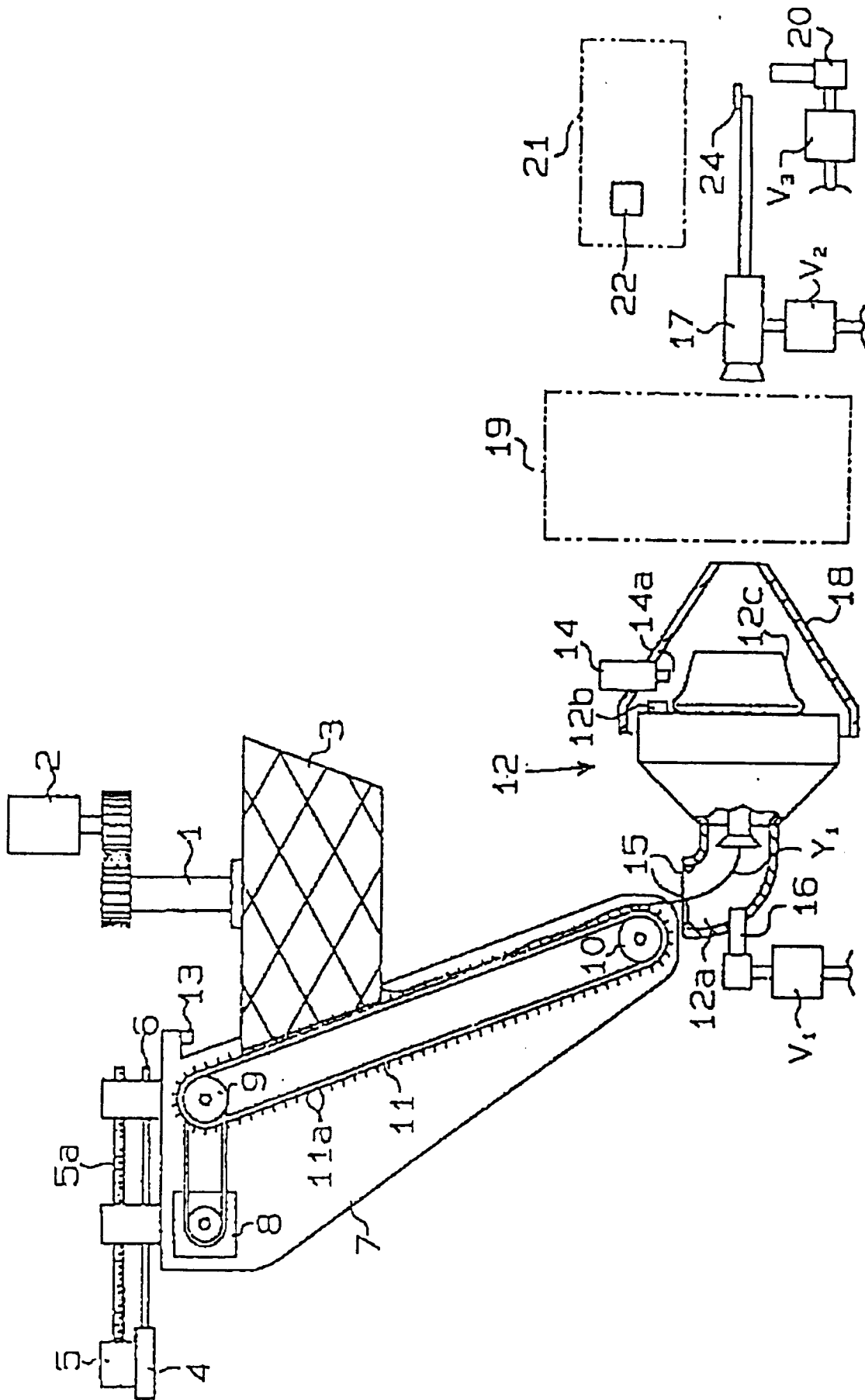
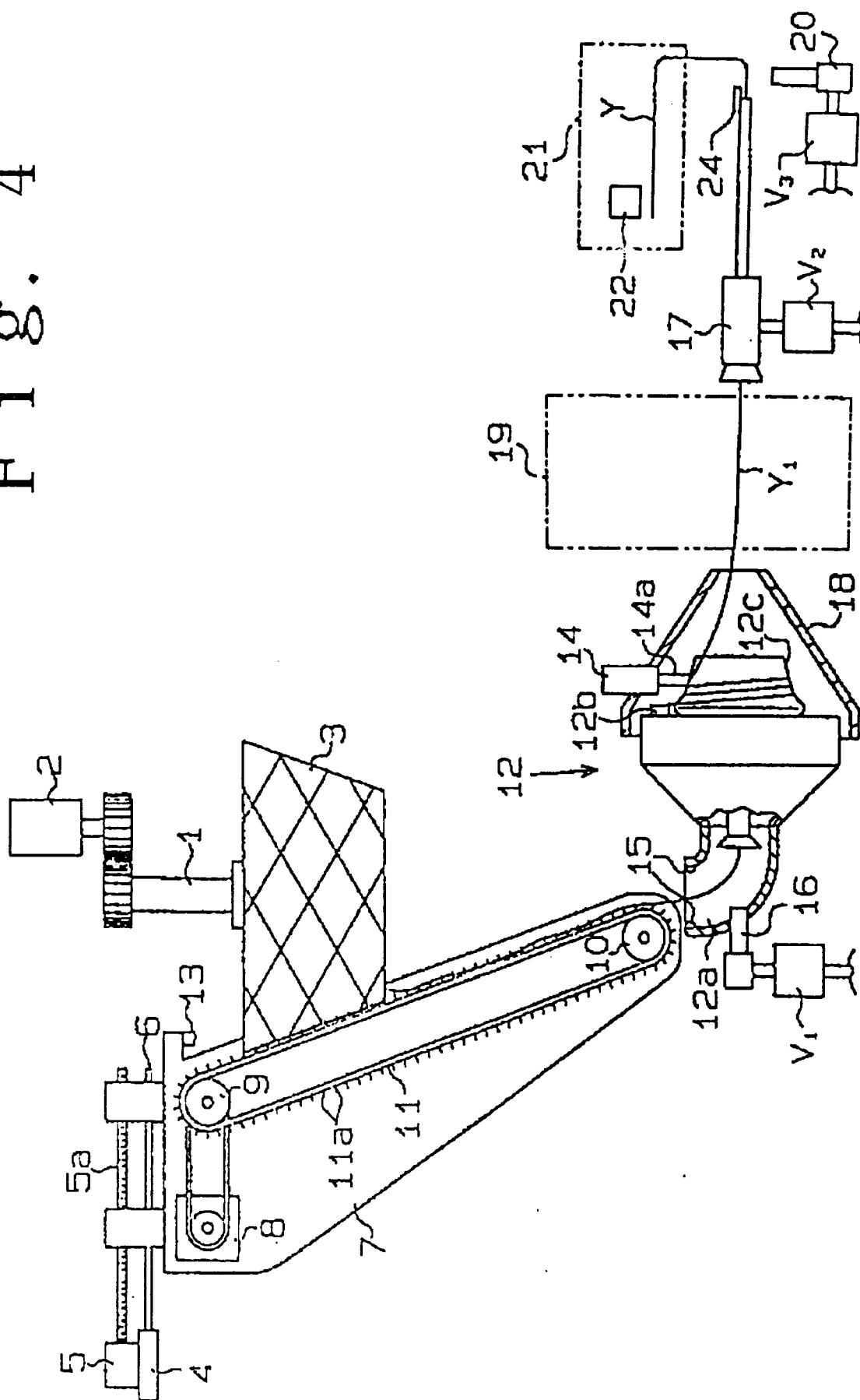
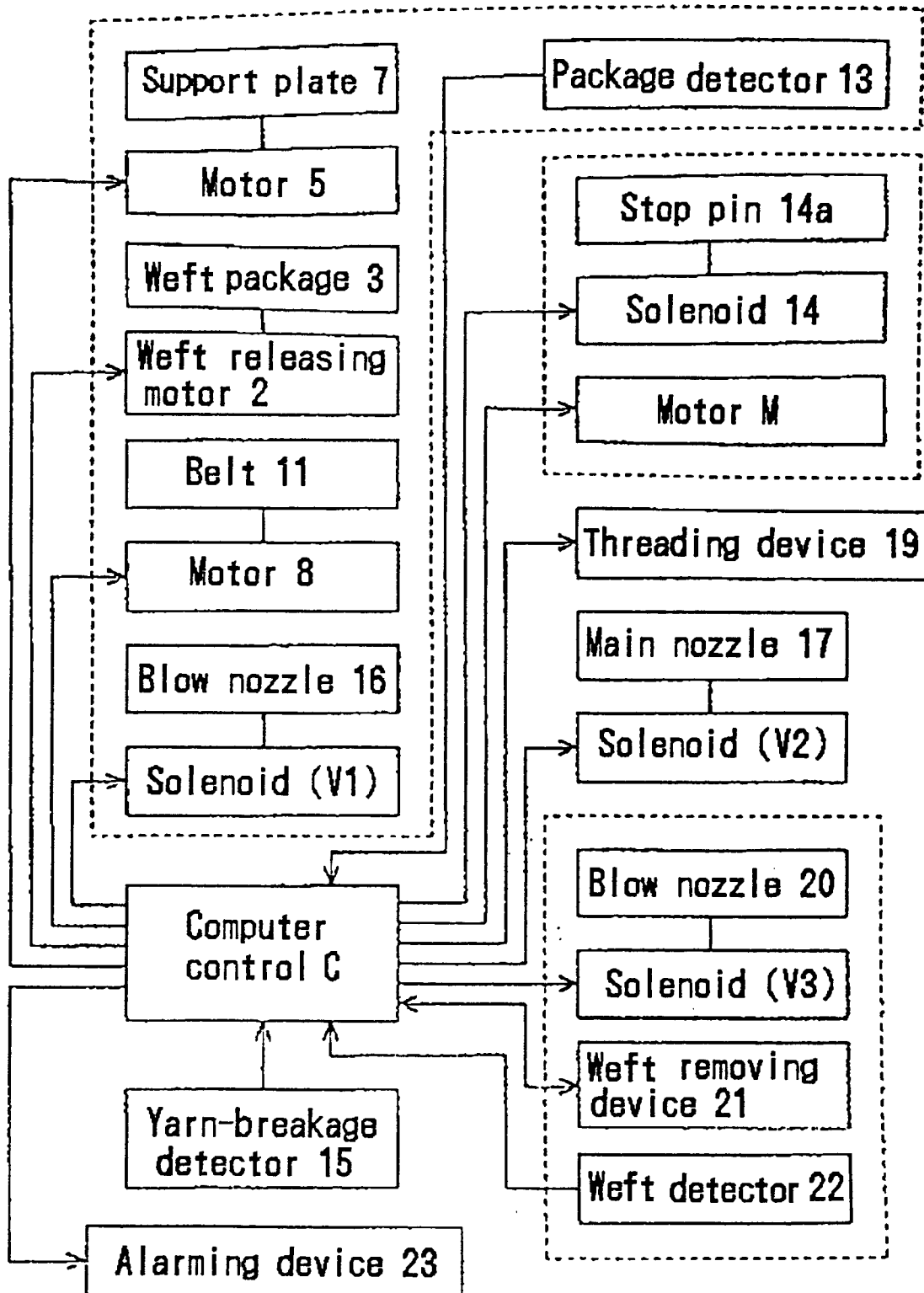


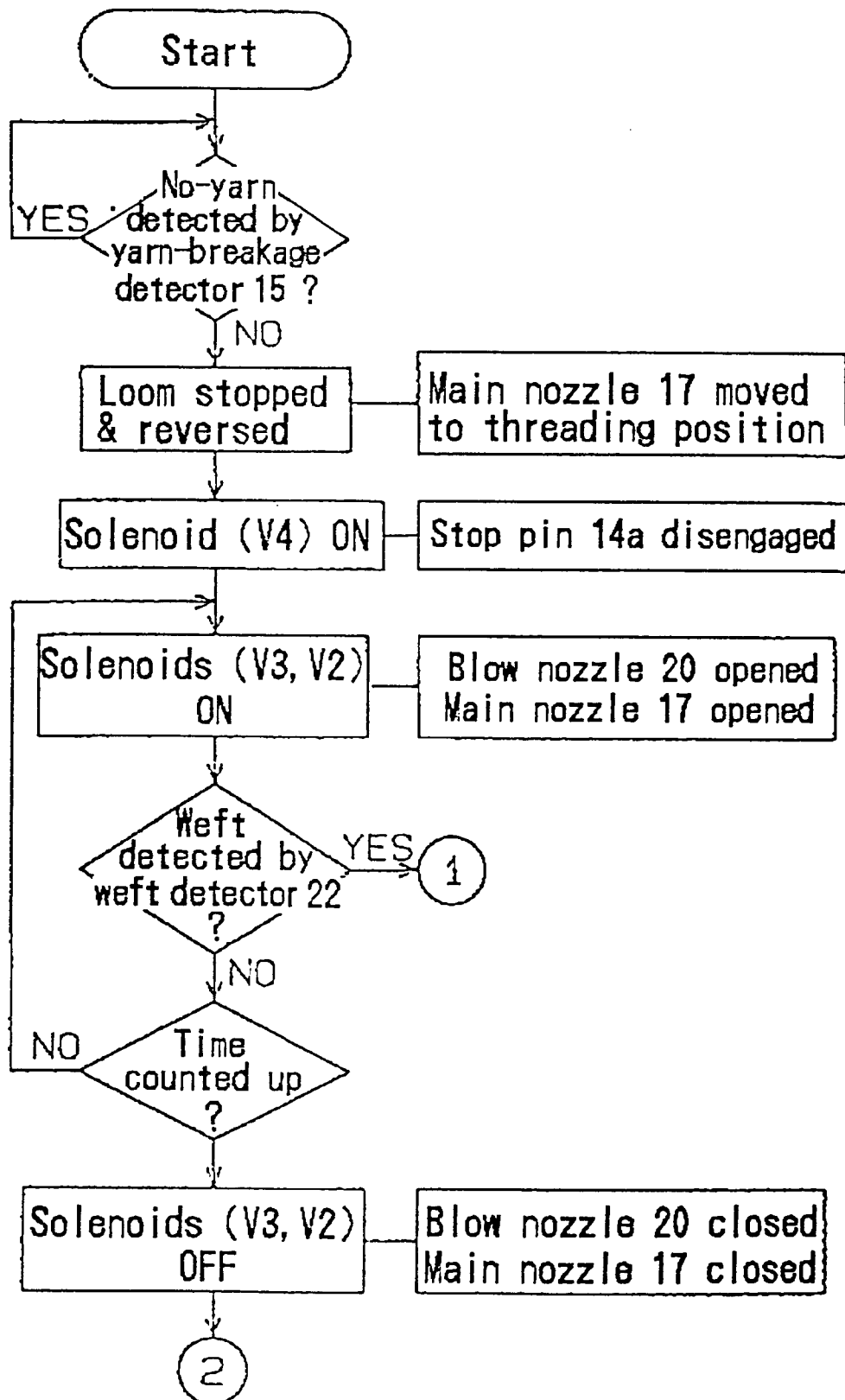
Fig. 4



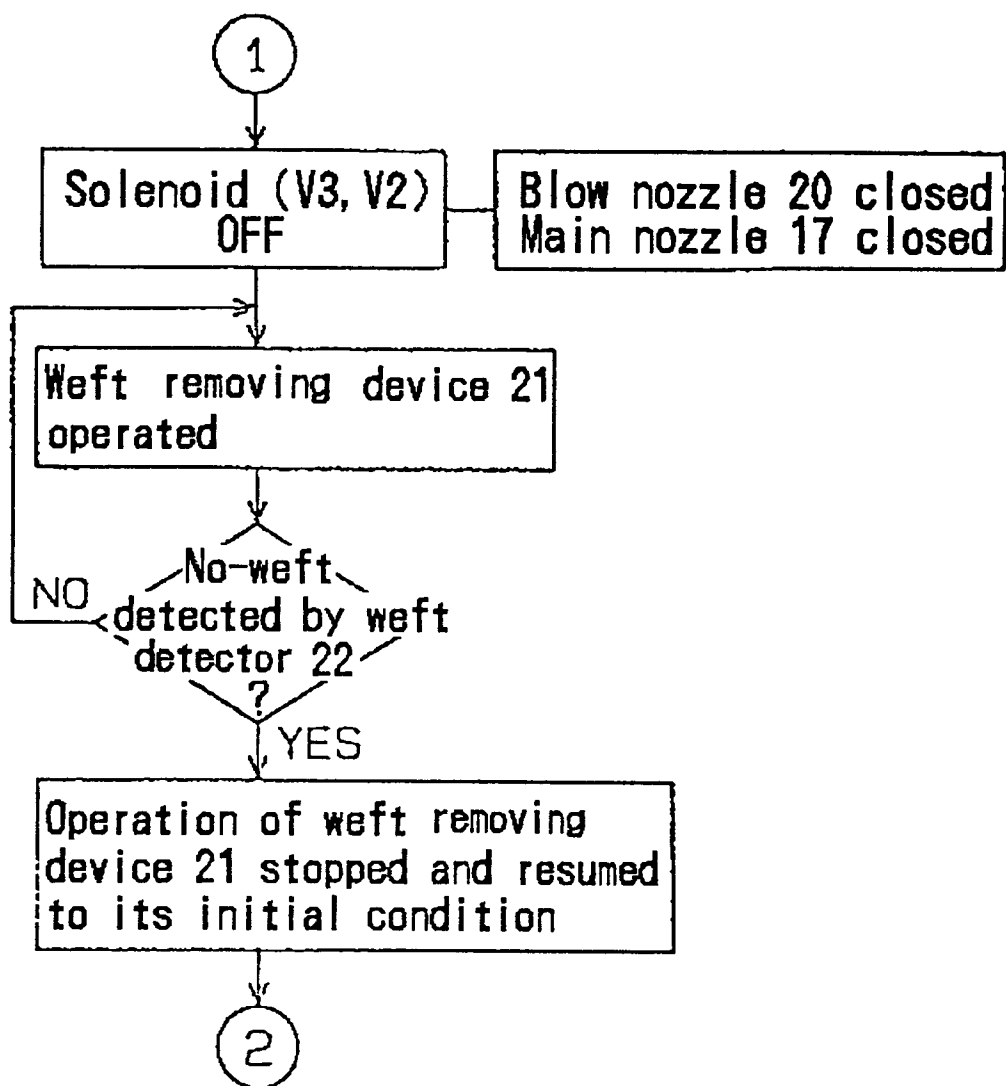
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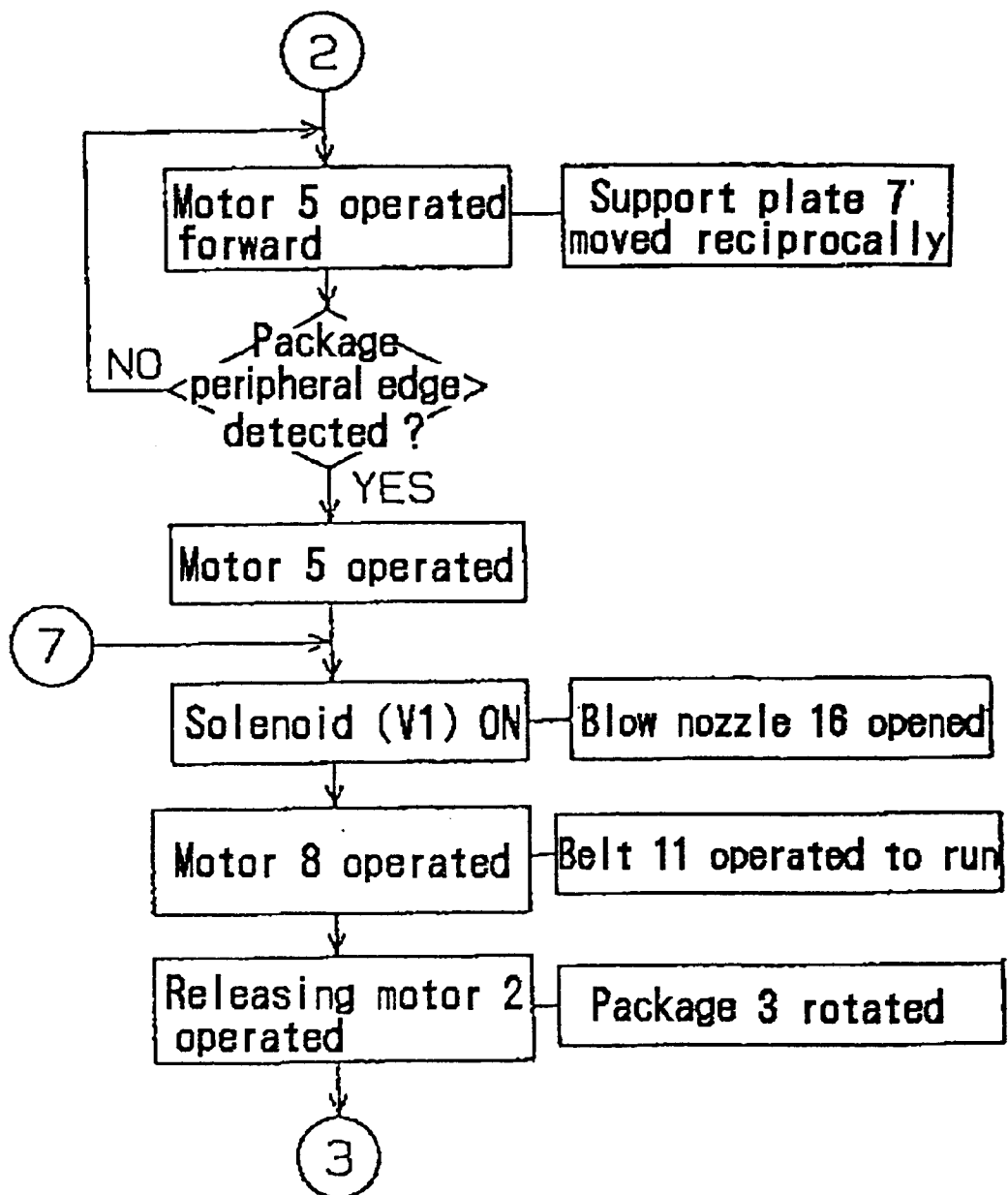
F i g. 6



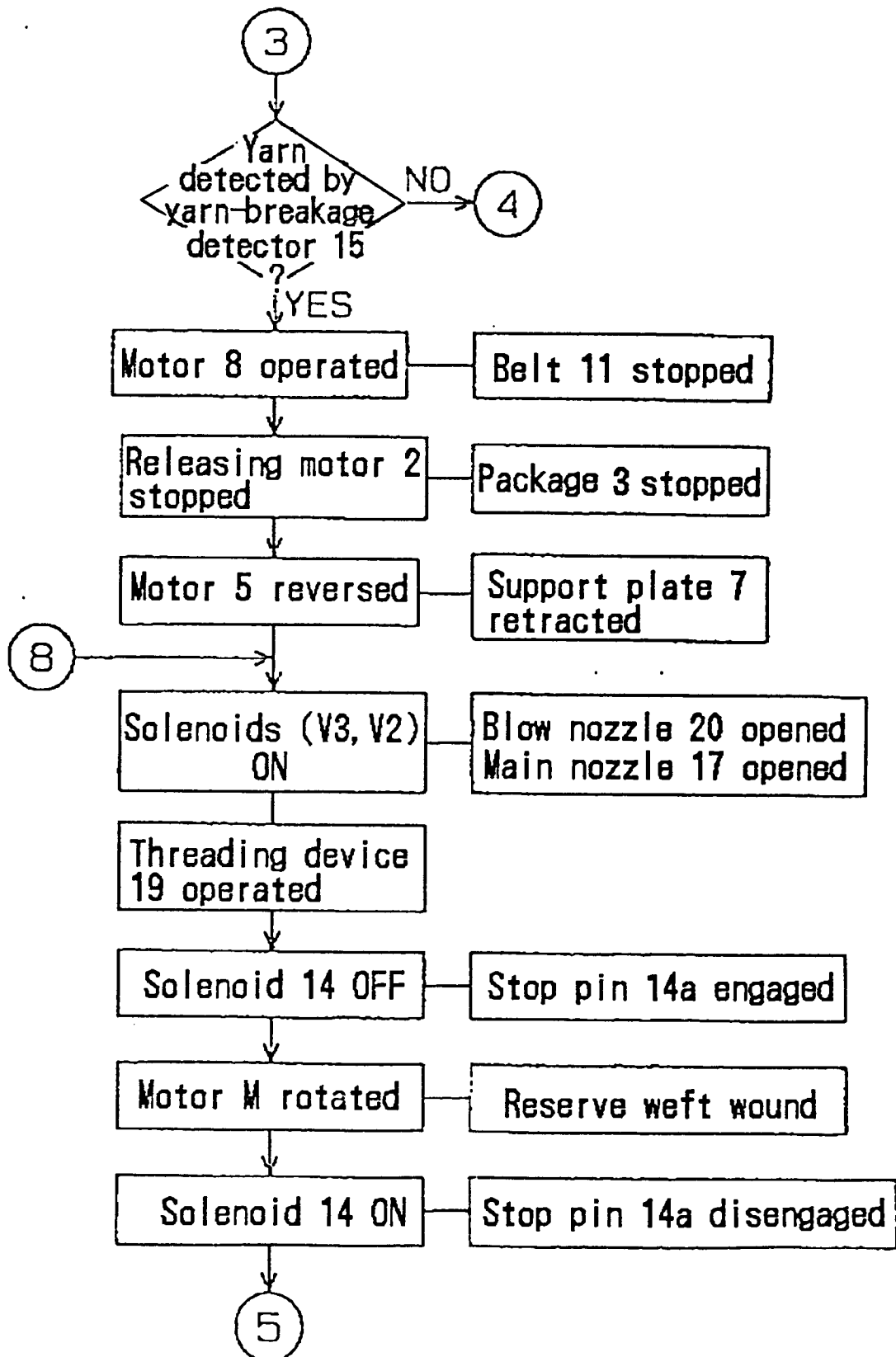
F i g. 7



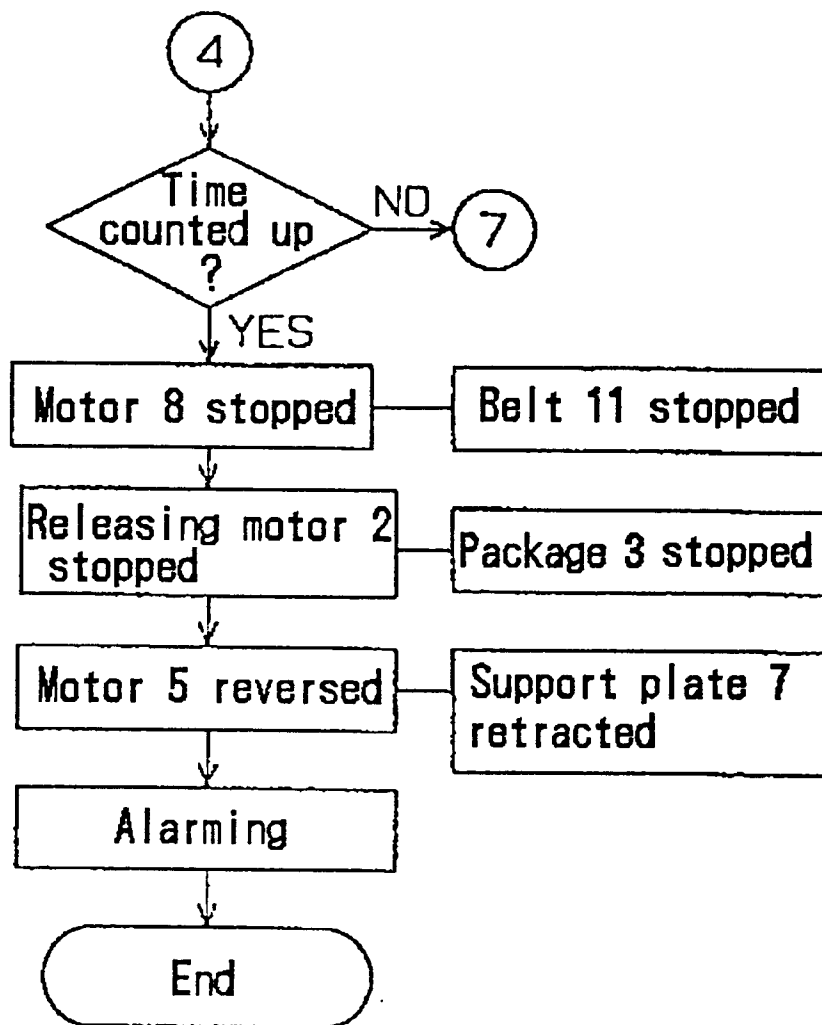
F i g . 8



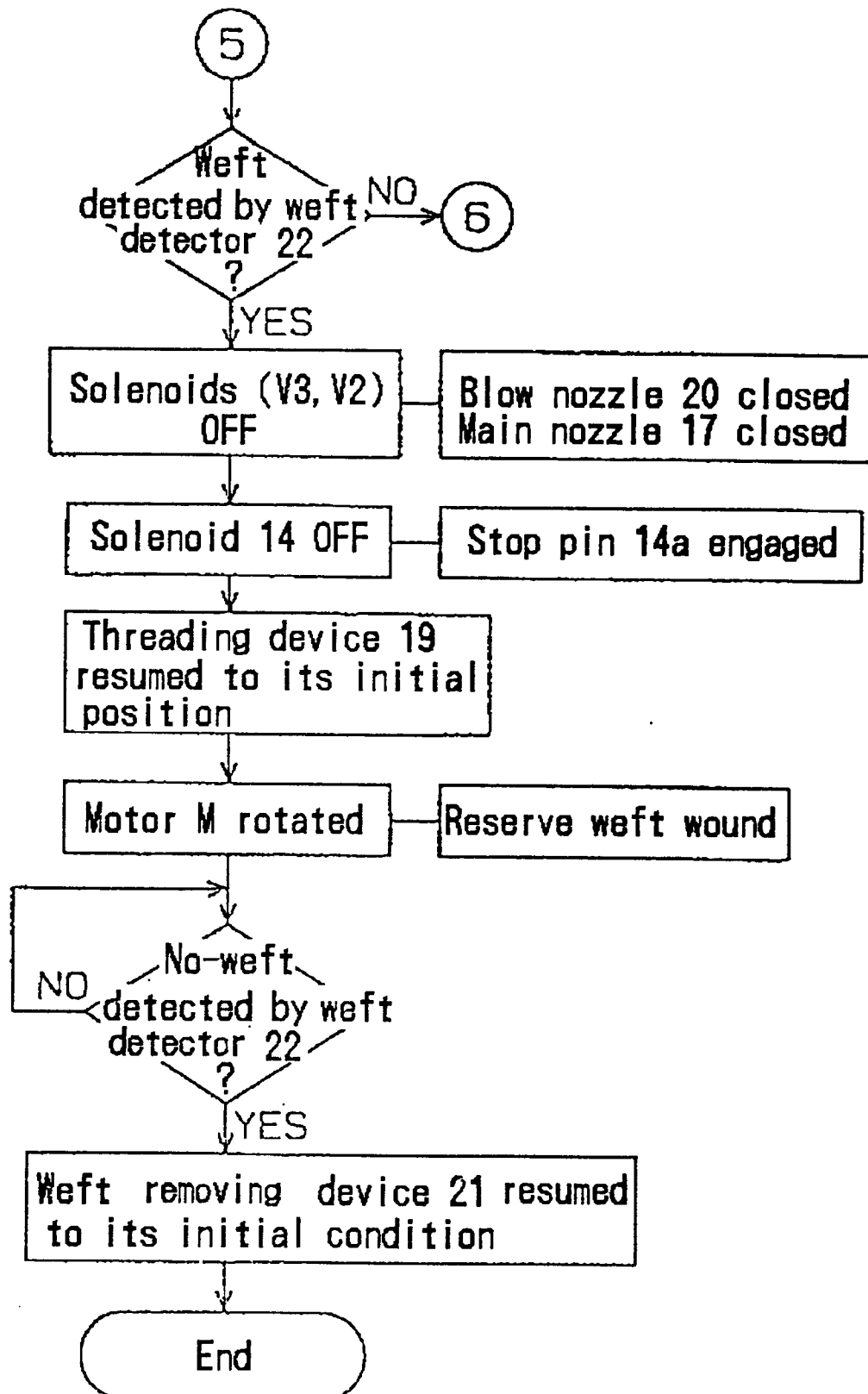
F i g . 9



F i g. 10



## F i g. 1 1



## F i g. 1 2

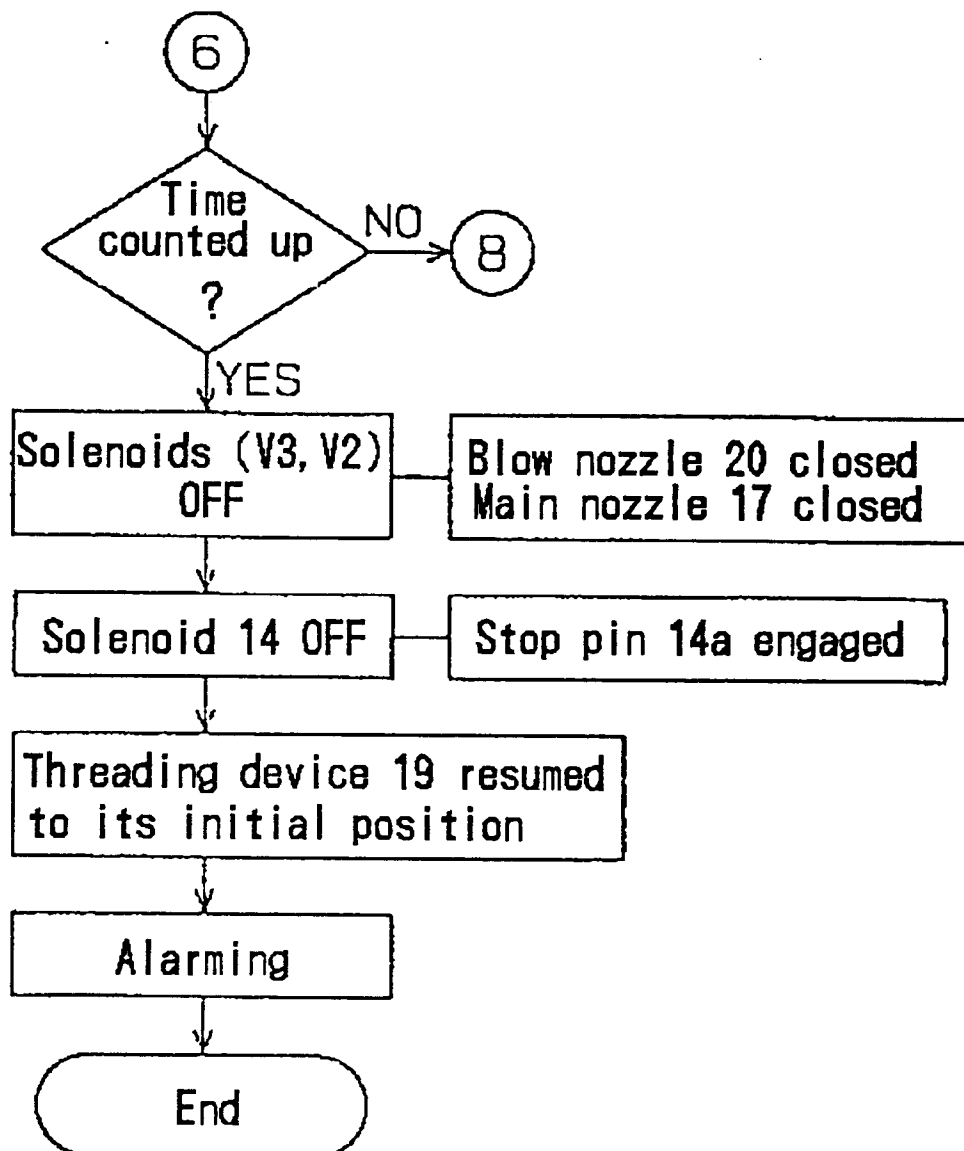


Fig. 13

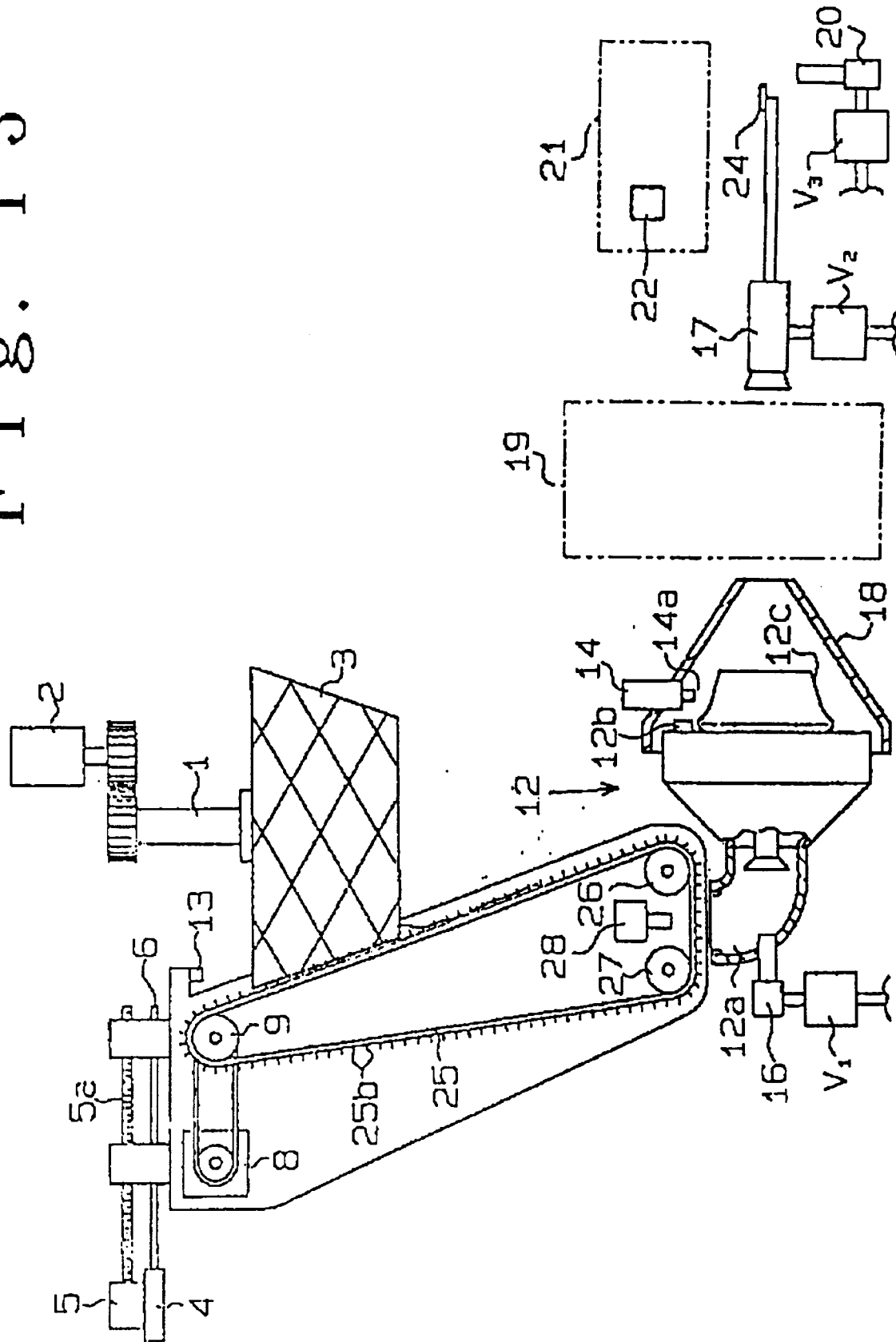
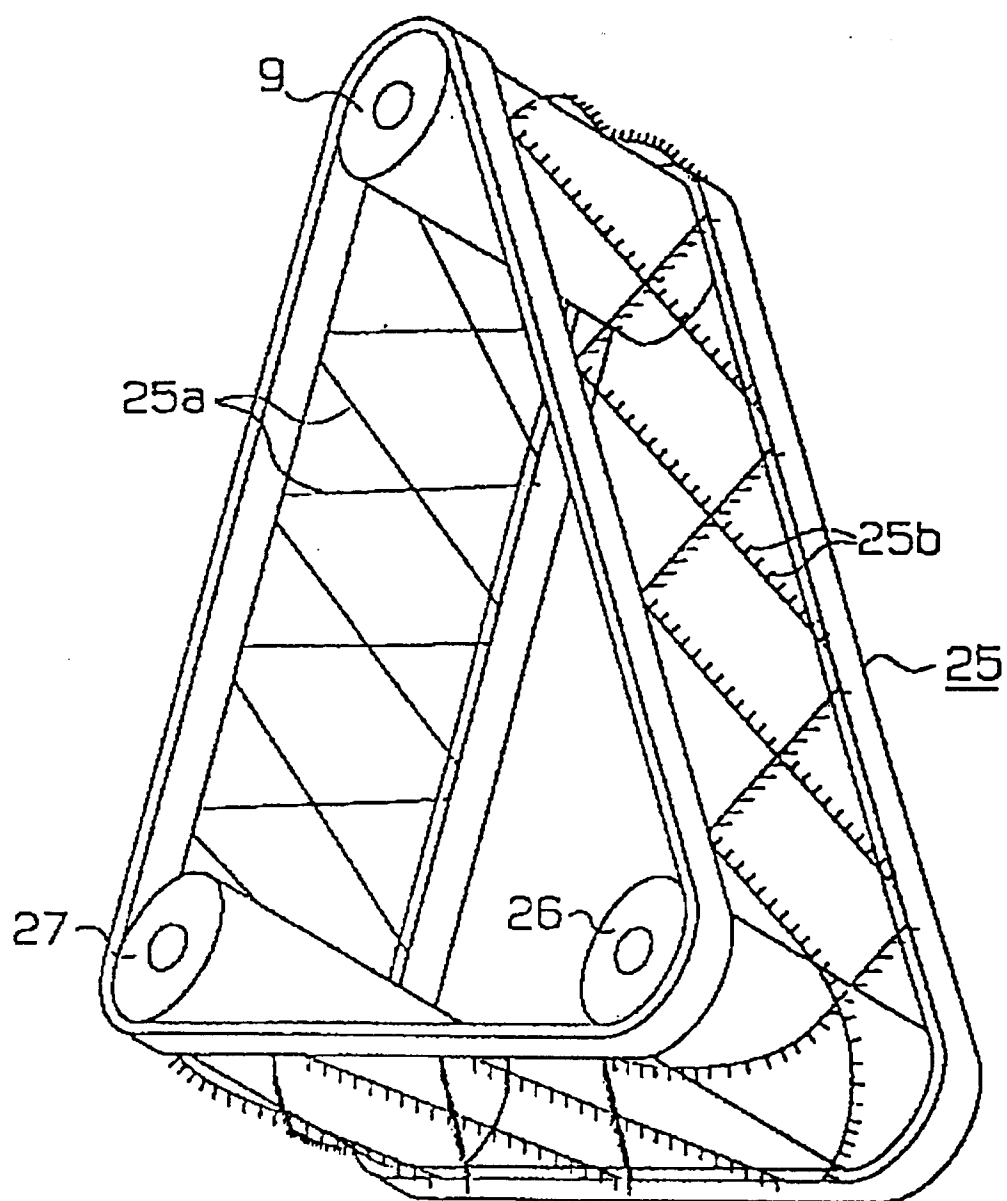


Fig. 14





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## EUROPEAN SEARCH REPORT

Application Number

EP 91 20 3418

| 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | EP-A-0 388 680 (TOYODA JIDOSHOKKI)<br>* page 12, column 20, line 3 - line 24; figures 1-18 * | 1-4                                               | D03D47/34                                     |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | US-A-4 784 191 (TOYODA JIDOSHOKKI)<br>* column 6, line 2 - line 59; figures 1-25 *           | 1-4                                               |                                               |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | EP-A-0 306 079 (PICANOL N. V.)<br>* claims 1-8; figures 1-4 *                                | 1-4                                               |                                               |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | EP-A-0 365 472 (GEBRÜDER SULZER)<br>* figures 1-13 *                                         | 1-4                                               |                                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                              |                                                   | TECHNICAL FIELDS SEARCHED (Int. Cl.5)         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                              |                                                   | D03D                                          |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                              |                                                   |                                               |
| Place of search<br>THE HAGUE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                              | Date of completion of the search<br>10 APRIL 1992 | Examiner<br>HENNINGSEN O.                     |
| <b>CATEGORY OF CITED DOCUMENTS</b><br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document<br>T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>.....<br>& : member of the same patent family, corresponding document |                                                                                              |                                                   |                                               |