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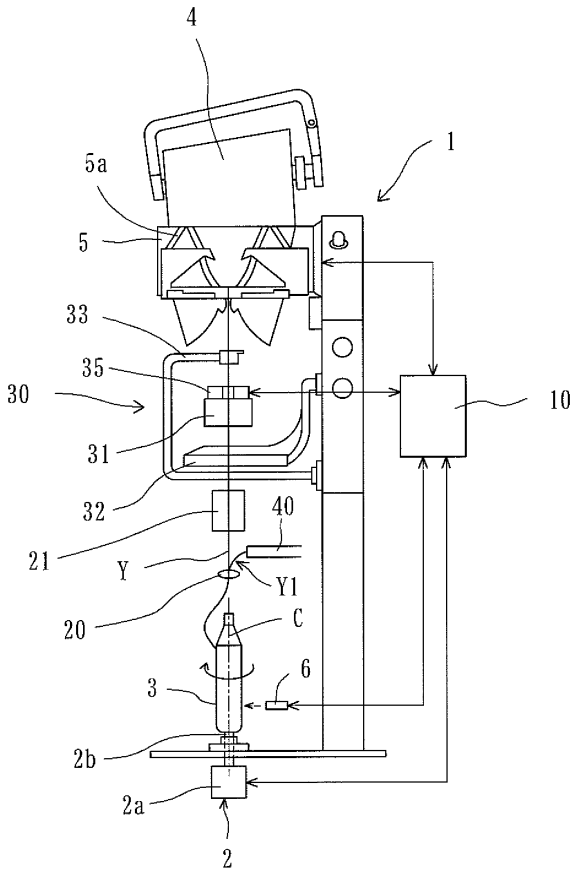
## (54) Automatic winder

(57) The present invention provides an automatic winder capable of suppressing sloughing and fluffing even when used with yarn supply bobbins for various counts and types of yarn, including fine count yarns. The automatic winder unwinds a yarn Y from a yarn supply bobbin 3, and winds the yarn onto a package 4. The automatic winder includes rotational drive means 2 for rotationally driving the yarn supply bobbin 3 about its central axis C in the yarn unwinding direction to positively unwind the yarn Y.

FIG. 1

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## Description

### BACKGROUND OF THE INVENTION

#### Field of the Invention

**[0001]** The present invention relates to an automatic winder for unwinding yarns from yarn supply bobbins to rewind the yarns onto packages.

#### Description of the Background Art

**[0002]** Automatic winders unwind a number of spun yarns from yarn supply bobbins produced by a ring spinner or the like, and splice the unwound yarns before rewinding them onto packages. Since package productivity largely depends on winding speed, there is a need for automatic winders that can achieve high-speed winding. High-speed winding, however, involves unwinding yarns from yarn supply bobbins at high speed, and the high-speed unwinding causes yarn unwinding tension to vary significantly. The variation in the unwinding tension results in, for example, sloughing of yarns (i.e., the yarns being entangled and unwound together at a stretch as in slipping off) or fluffing caused by contact of unwound yarns.

**[0003]** In order to suppress sloughing, etc., automatic winders with an unwinding assist device have been proposed, as disclosed in Japanese Patent Nos. 3033370 and 2936917, for example. The automatic winders control tension of balloons around yarn supply bobbins and tension of traveling yarns, thereby reducing sloughing and fluffing. In the case of unwinding spinning bobbins, in particular, for fine count yarns, however, even such automatic winders have limitations on their capability and cannot prevent, for example, occurrence of yarn breaks due to sloughing, or occurrence of fluffing, as the amount of yarn on the yarn supply bobbins decreases.

### SUMMARY OF THE INVENTION

**[0004]** Therefore, a problem sought to be solved by the present invention is to provide an automatic winder capable of suppressing sloughing, fluffing, etc., even when used with yarn supply bobbins for various counts and types of yarn, including fine count yarns.

**[0005]** An automatic winder according to the present invention unwinds a yarn from a yarn supply bobbin to rewind the yarn onto a package, and comprises rotational drive means for rotationally driving the yarn supply bobbin about its central axis in a yarn unwinding direction, thereby positively unwinding the yarn.

**[0006]** Preferably, the automatic winder further comprises a drum that is brought into contact with the package to rotationally drive the package, and the rotational drive means rotates the yarn supply bobbin at a speed higher than a rotational speed of the drum.

**[0007]** Further preferably, the automatic winder further comprises control means for controlling the rotational drive means, and detection means for detecting an amount of yarn remaining on the supply bobbin, and the control means changes the rotational speed of the yarn supply bobbin in accordance with the amount of yarn remaining on the yarn supply bobbin detected by the detection means.

**[0008]** As described above, the automatic winder according to the present invention includes the means for rotationally driving the yarn supply bobbin about its central axis at high-speed in the direction opposite to the yarn winding direction. The rotational drive means makes it possible to positively unwind the yarn from the yarn supply bobbin, thereby significantly reducing tension variation of the yarn during high-speed unwinding, and therefore even when a yarn supply bobbin for a fine count yarn is used, it is possible to substantially eliminate occurrence of yarn breaks due to sloughing and occurrence of fluffing.

### BRIEF DESCRIPTION OF THE DRAWINGS

**[0009]**

FIG. 1 is a front view illustrating an automatic winder according to the present invention.

FIG. 2 is a diagram for explaining a rotational direction of a yarn supply bobbin.

FIG. 3 is a package rotational speed chart.

FIG. 4 is a bobbin rotational speed chart illustrating an example of controlling the rotation of the yarn supply bobbin.

FIG. 5 is a bobbin rotational speed chart illustrating another example of controlling the rotation of the yarn supply bobbin.

FIG. 6 is a chart illustrating an example of controlling the package rotational speed.

FIG. 7 is a bobbin rotational speed chart illustrating still another example of controlling the rotation of the yarn supply bobbin.

### DESCRIPTION OF THE PREFERRED EMBODIMENTS

**[0010]** Hereinafter, an automatic winder according to the present invention will be described in detail with reference to the accompanying drawings.

**[0011]** FIG. 1 is a front view illustrating the automatic winder according to the present invention. The automatic winder includes a number of winding units 1 provided in parallel, and control devices 10 for controlling the winding units 1. The winding units 1 each include a yarn supply bobbin 3 produced by a ring spinner or the like, and a package 4 formed by rewinding a spun yarn Y from the yarn supply bobbin 3.

**[0012]** The package 4 is in surface contact with a traverse drum 5 under an appropriate contact pressure. The traverse drum 5 is rotationally driven by, for example, a motor (not shown), so that the package 4 is rotated

following the rotational drive of the traverse drum 5.
The rotational speed of the traverse drum 5 is controlled by the control device 10. The traverse drum 5 is formed therein a spiral groove 53a for guiding and traversing the yarn Y from the yarn supply bobbin 3. The winding unit 1 rotationally drives the traverse drum 5 to traverse and unwind the yarn Y from the yarn supply bobbin 3, so that the unwound yarn Y is rewound onto the package 4. At this time, the yarn Y passes through a yarn guide 20, which stabilizes an unwound balloon, and a tension device 21, which controls winding tension.

**[0013]** The winding unit 1 further includes yarn splicing means 30 between the yarn supply bobbin 3 and the package 4. The yarn splicing means 30 includes a yarn splicing device 31 such as a splicer; a suction mouth 32 for guiding an upper yarn on the package 4 side to the yarn splicing device 31; and a suction pipe 33 for guiding a lower yarn on the yarn supply bobbin 3 side to the yarn splicing device 31. The winding unit 1 further includes a clearer 35 for detecting and cutting a yarn fault, such as a slub, in the traveling yarn Y. The yarn splicing means 30 and the clearer 35 are connected to the control device 10, and after the clearer 35 detects and cuts the yarn fault, the yarn splicing means 30 splices the upper and lower yarns together and restarts winding.

**[0014]** The winding unit 1 further includes rotational drive means 2 for rotationally driving the yarn supply bobbin 3 about its central axis C at high speed. The rotational drive means 2 in the present embodiment directly rotates and drives the yarn supply bobbin 3 attached to a drive shaft 2b of a motor 2a. However, the yarn supply bobbin 3 may be indirectly driven through belts, for example. The rotational drive means 2 rotationally drives the yarn supply bobbin 3 in a yarn unwinding direction. Specifically, as shown in FIG. 2, the rotational drive means 2 rotationally drives the yarn supply bobbin 3 in the yarn unwinding direction opposite to the winding direction 3a of the yarn Y around the yarn supply bobbin 3 (in the example of FIG. 2, the yarn Y is wound clockwise, and therefore the bobbin 3 is rotated in the direction of an arrow; if the yarn Y is wound counterclockwise, the bobbin 3 is rotated in the direction opposite to the arrow), thereby positively unwinding the yarn Y from the yarn supply bobbin 3.

**[0015]** The rotational drive means 2 is provided for each winding unit, and connected to the control device 10 provided in the winding unit, so that the rotational speed of the yarn supply bobbin 3 is controlled by the control device 10, independently of the other winding units. In addition, the rotational speed of the yarn supply bobbin 3 is controlled so as to be higher than the rotational speed of the traverse drum 5. Specifically, the rotational speeds of the drum 5 and the bobbin 3 are controlled in such a manner that the amount of yarn unwound per unit of time is greater than the amount of yarn wound onto the package per unit of time (i.e., the yarn is slightly overfed). As a result, tension variation of the yarn Y from the yarn supply bobbin 3 during high-speed unwinding is reduced, resulting in a significant reduction in occurrence of tension-related breaks, sloughing-related breaks, fluffing, etc.

**[0016]** In other embodiments, the winding unit 1 includes detection means 6 for detecting the amount of yarn remaining on the yarn supply bobbin 3. The detection means 6 is composed of a distance sensor. The distance sensor 6 is connected to the control device 10. The distance sensor 6 is provided at a predetermined position from the bottom of the yarn supply bobbin 3 (at a height of about one-third of the length of the bobbin from the bottom). The unwinding tension of the yarn Y varies in accordance with the amount of yarn remaining on the yarn supply bobbin 3. In particular, from the time the yarn is reduced to a "one-third ball", i.e., the amount of yarn remaining on the yarn supply bobbin 3 is one-third of the original amount, the unwinding tension is sharply increased, resulting in significantly frequent occurrence of yarn breaks and sloughing.

**[0017]** The distance sensor 6 constantly detects the distance to the yarn supply bobbin 3 from the predetermined position. The distance sensor 6 detects a change in the distance, thereby determining that the amount of yarn remaining on the yarn supply bobbin 3 is one-third of the original amount. It is possible that the control device 10 controls the rotational drive means 2 so as to remain inactive from the beginning of winding until the amount of yarn is reduced to the vicinity of one-third of the original amount, and upon detection by the distance sensor 6, the control device 10 drives the rotational drive means 2 to rotate the yarn supply bobbin 3 at high speed, thereby preventing sloughing, etc. The detection means 6 may be a weight sensor for detecting the weight of the yarn Y to determine the remaining amount of yarn. In addition, the rotational speed of the yarn supply bobbin 3 may be changed in accordance with the amount of yarn remaining on the yarn supply bobbin 3 to correct tension variation.

**[0018]** When the winding unit 1 includes a length measurement device for managing the length of yarn to be wound by counting rotation pulses of the drum 5, it is possible to use the length measurement device as means for detecting the remaining amount of yarn. In this case, it is possible that after a bobbin 3 is emptied and ejected upon termination of winding, and another bobbin 3 filled with yarn is supplied anew to restart winding, when a cumulative count of drum pulses since the restart of winding reaches a predetermined value, the remaining amount of yarn is determined to be in the vicinity of one-third of the original amount, and the control device 10 drives the rotational drive means 2 to rotate the yarn supply bobbin 3 at high speed, thereby preventing sloughing, etc.

**[0019]** In addition, it is possible to control the rotational speed of the rotational drive means 2 so as to follow changes in the rotational speed of the drum 5. Specifically, at the time of redriving after a change of bobbins, yarn splicing, etc., by controlling the rotational drive

means 2 so as to follow a change in speed from a low speed at the time of starting the rotation of the drum 5 to a predetermined winding speed, it becomes possible to maintain a substantially constant amount of overfeeding from the yarn supply bobbin 3, thereby avoiding yarn slack due to over-unwinding, and tension variation. An increase in the amount of yarn on the package 4 increases the possibility that slippage might occur between the package 4 and the drum 5 when the drum 5 abruptly starts rotating at the time of starting the rotation of the package 4, so that the package 4 does not rotate in synchronization with the rotation of the yarn supply bobbin 3 with a lesser amount of yarn, resulting in over-unwinding on the yarn supply bobbin 3 side.

**[0020]** Next, three examples will be described in relation to a control method for driving and stopping of the rotational drive means 2.

**[0021]** Example 1 is directed to the case of rotating the yarn supply bobbin 3 from the beginning to end of unwinding of the yarn supply bobbin 3.

FIG. 3 is a drive timing chart of the drum 5, and FIG. 4 is a drive timing chart of the bobbin rotation means 2. In this case, after the winding unit 1 is supplied with a new bobbin 3 (a change of bobbins; t0), a yarn from the bobbing 3 is spliced to a yarn from the package 4 to restart winding (t1). The drum 5 is rotated at a winding speed V1, and the yarn supply bobbin rotation means 2 is also rotated at an unwinding speed v1.

**[0022]** When the clearer 35 detects a yarn fault such as a slub, the traveling yarn is forcibly cut by a cutter (not shown) provided in the clearer 35 or a separately provided cutter (not shown) in accordance with a yarn fault detection signal. When the yarn is cut, the clearer 35 turns off a yarn traveling signal (FW signal), so that the drive of the drum 5 is stopped (t2)- At this time, if the rotational drive means 2 for the yarn supply bobbin 3 keeps rotating, the yarn unwound from the bobbin 3 might twine around a nearby element, disturbing a yarn splicing operation. Therefore, it is necessary to quickly stop the rotation of the yarn supply bobbin 3 by providing a stop signal or a stop/brake signal to the rotational drive means 2 approximately at the same time the clearer 35 generates the yarn fault detection signal or turns off the yarn traveling signal (FW signal).

**[0023]** Note that as means for absorbing slack in the yarn being unwound during inertial rotation of the yarn supply bobbin, for example, a suction pipe 40 as shown in FIG. 1 is preferably provided at a position facing a yarn guide. Also, it is necessary that the suction pipe 40 is configured to suction a certain length of the yarn and stop the suctioning operation in synchronization with stopping of the bobbin rotation.

**[0024]** Upon completion of yarn fault removal involved in the yarn splicing operation, the winding is restarted (t3). When a whole bobbin 3 is unwound, the drum 5 stops operating and the bobbin rotation means 2 also stops driving (t5).

**[0025]** Note that the winding speed V1 is typically determined in accordance with the rotational speed of the drum 5, but even if the drum 5 is rotationally driven at a constant rotational speed, the traveling speed of the yarn being wound onto the package varies between the ends and the middle of the package during the traversing movement of the yarn, and the traveling speed of the yarn is constantly changed in accordance with, for example, depth variation of the traverse groove 5a formed in the drum 5 surface. This makes it difficult to control the bobbin rotational drive means 2 so as to follow the yarn traveling speed, and therefore the rotational speed v1 of the bobbin rotation means 3 may be controlled so as to be approximately the same as the rotational speed of the drum 5.

**[0026]** Example 2 is directed to the case where the rotational drive means 2 remains inactive from the beginning of winding until the remaining amount of yarn reaches the vicinity of one-third of the original amount, and upon detection by the distance sensor 6, the rotational drive means 2 is driven to rotate the yarn supply bobbin 3 at high speed. For example, in FIG. 5, even when yarn cutting or yarn splicing occurs during a period from the beginning of winding (t0) until the reduction of the amount of yarn to the vicinity of one-third of the original amount, the rotational drive means 2 remains inactive, and when the amount of yarn is reduced to approximately one-third of the original amount (t4), the rotational drive means 2 is driven to rotate the bobbin 3 in the unwinding direction.

The amount of yarn remaining on the bobbin is detected by the sensor 6 (FIG. 1) or the like.

**[0027]** Example 3 is directed to the case of controlling the rotational speed of the bobbin in relation to an increase in winding diameter of the package.

An increase in the package diameter increases the possibility that the package 4, which is rotated by surface contact with the driven drum 5, might slip without following the rotation of the drum 5 at the time of restart of winding after yarn splicing, so that the yarn layer surface is damaged. In order to prevent this, the initial rotational speed of the package 4 may be controlled in accordance with the package diameter. In such a case, in order not to make the yarn slack, it is also necessary to change the rotational speed of the yarn supply bobbin 3 in relation to the package diameter.

**[0028]** FIG. 6 is a package rotational speed chart, and FIG. 7 is a bobbin rotational speed chart corresponding to FIG. 6.

In FIG. 6, because the layer of yarn is thin, the package 4 satisfactorily follows the drum 5 at the beginning of winding onto a new paper core (t10), resulting in a steep initial gradient. When the package diameter is increased with the progress of winding, the rotation of the drum 5 is controlled such that the initial gradient (t12) after yarn splicing subsequent to yarn cutting (t11) is gentle compared to the gradient at the beginning of winding (t10), and when the package diameter is further increased, the initial gradient (t14) after restart of winding is further gen-

tler.

**[0029]** Therefore, as shown in FIG. 7, the bobbin rotational drive means 2 is controlled such that the initial rotational speed of the yarn supply bobbin (t10, t11, t14) is changed in accordance with the gradient of the package's initial rotational speed. By doing so, it becomes possible to avoid over-unwinding from the yarn supply bobbin 3, regardless of a change in the package diameter, thereby producing a satisfactory package without any yarn slack.

## Claims

1. An automatic winder for unwinding a yarn (Y) from a yarn supply bobbin (3) to rewind the yarn (Y) onto a package (4), **characterized by** comprising rotational drive means (2) for rotationally driving the yarn supply bobbin (3) about its central axis (C) in a yarn unwinding direction (3a), thereby positively unwinding the yarn (Y).

2. The automatic winder according to claim 1, **characterized by** further comprising a drum (5) that is brought into contact with the package (4) to rotationally drive the package (4), the rotational drive means (2) rotating the yarn supply bobbin (3) at a speed higher than a rotational speed of the drum (5).

3. The automatic winder according to claim 1 or 2, **characterized by** further comprising control means (10) for controlling the rotational drive means (2), and detection means (6) for detecting an amount of yarn remaining on the supply bobbin (3), the control means (10) changing the rotational speed of the yarn supply bobbin (3) in accordance with the amount of yarn remaining on the yarn supply bobbin (3) detected by the detection means (6).

4. The automatic winder according to claim 1, **characterized by** further comprising control means (10) for controlling the rotational drive means (2), the control means (10) changing the rotational speed of the yarn supply bobbin (3) so as to follow an initial rotational speed of the package (4) at the time of restart of winding, the initial rotational speed changing in accordance with an increase in a package diameter.

5. The automatic winder according to any of claims 1 through 4, **characterized by** further comprising: yarn fault detection means (35); yarn cutting means being activated in accordance with a yarn fault detection signal from the yarn fault detection means (35); and yarn slack absorption means (40) for absorbing slack in the yarn (Y1) cut on the yarn supply bobbin (3) side by the yarn cutting means, and retaining the yarn being unwound from the yarn supply bobbin (3) at the time of yarn cutting.

FIG. 1

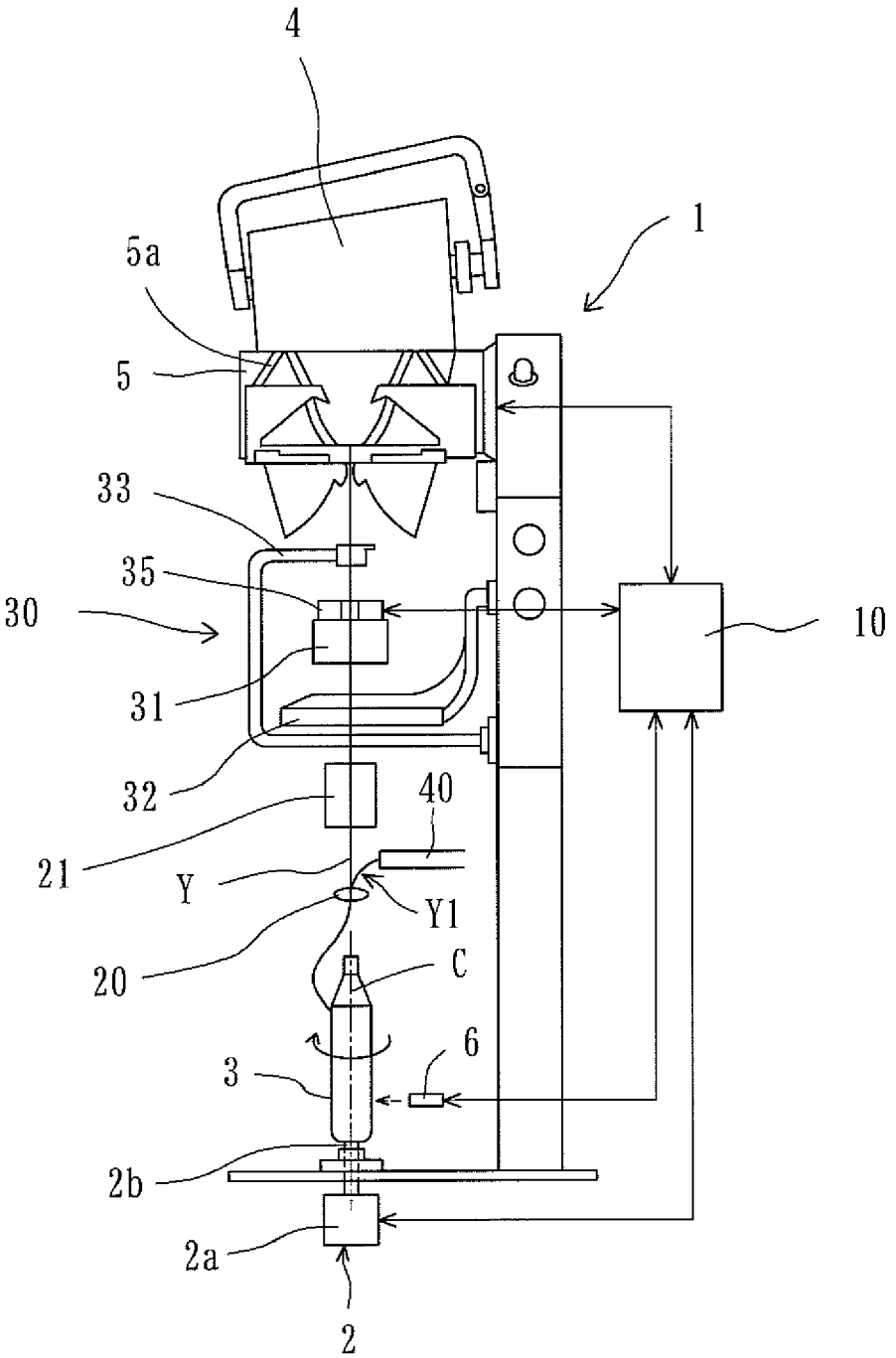


FIG. 2

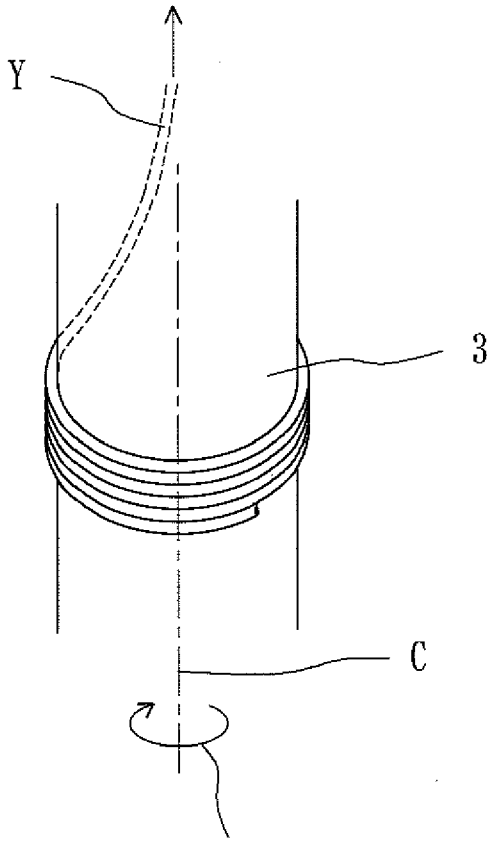


FIG. 3

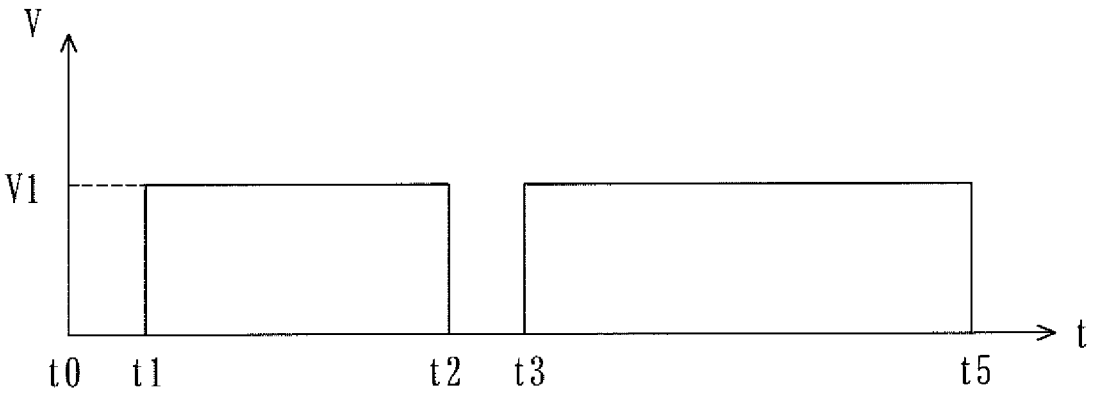



FIG. 4

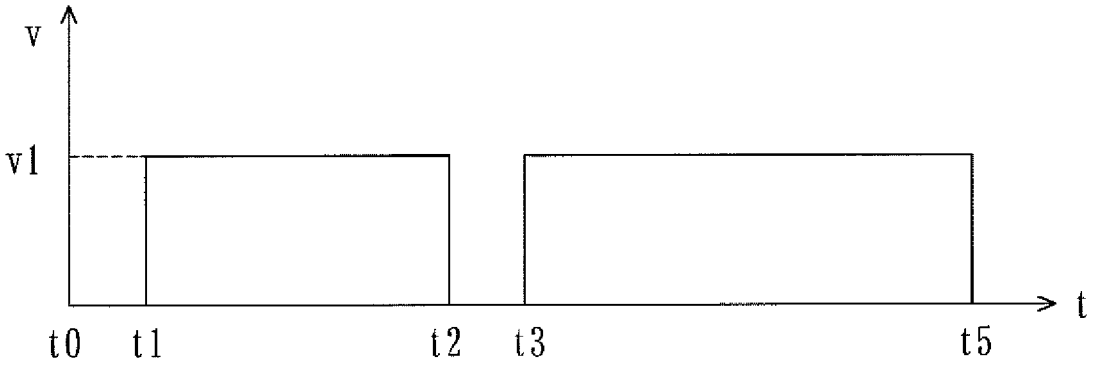



FIG. 5

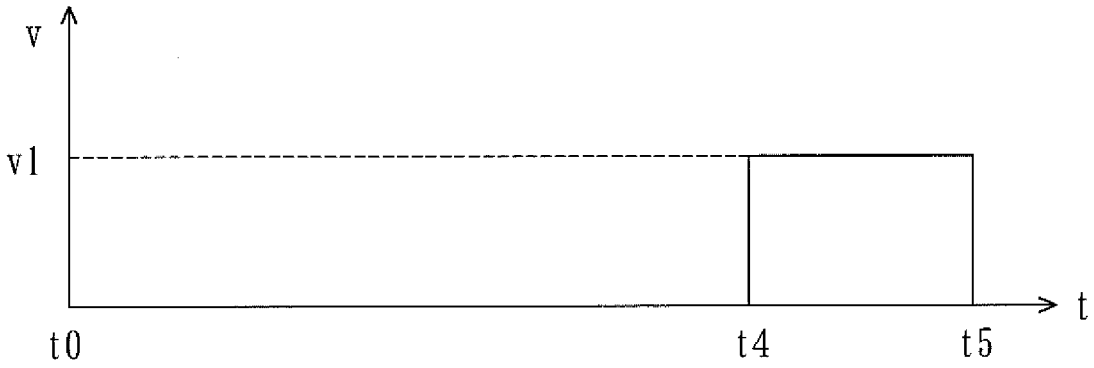


FIG. 6

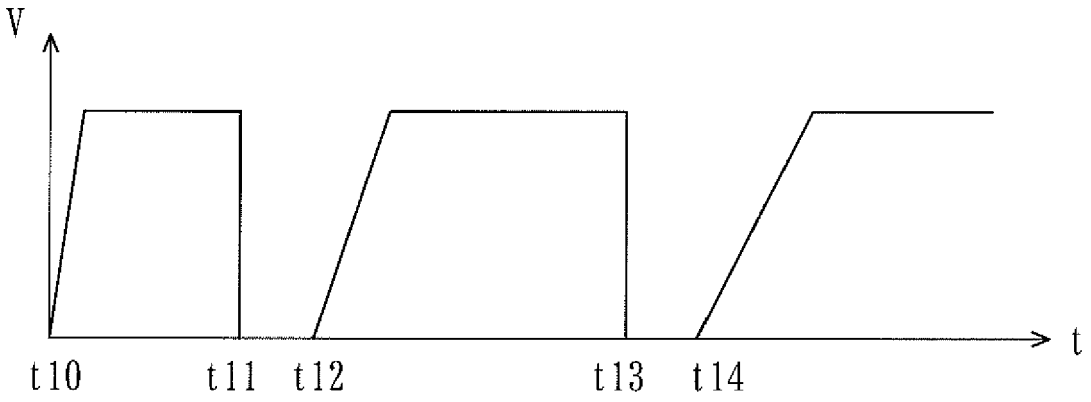
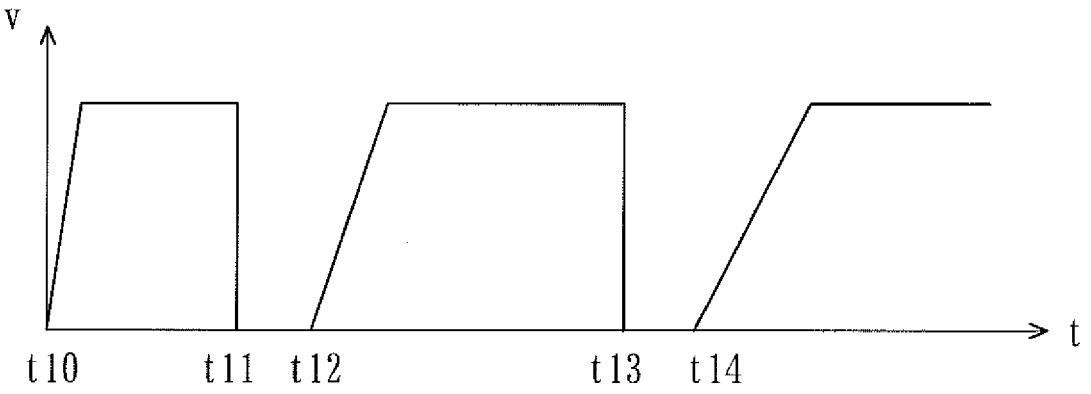



FIG. 7



## REFERENCES CITED IN THE DESCRIPTION

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### Patent documents cited in the description


- JP 3033370 B **[0003]**
- JP 2936917 B **[0003]**