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(11) **EP 1 256 540 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication: **13.11.2002 Bulletin 2002/46** (51) Int Cl.7: **B65H 54/42, B65H 54/38, B65H 54/52**

(21) Application number: **02007669.1**

(22) Date of filing: **04.04.2002**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

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(30) Priority: **11.05.2001 JP 2001140924**
06.02.2002 JP 2002029438

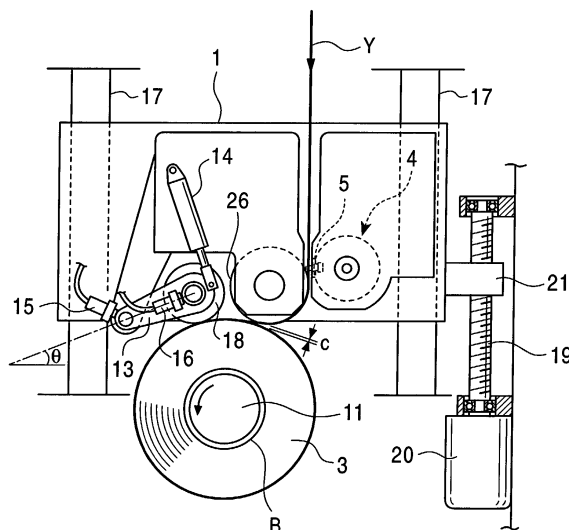
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(54) **Yarn winding machine and yarn winding method**

(57) Conventionally, in a yarn winding machine having a yarn feed roller wherein a contact roller is capable of being displaced relative to a roller supporting member, no consideration was made to the space between the yarn feed roller and the package formed leading to the problem that the winding form of the package was unsatisfactory.

The yarn winding machine comprises a contact roller (18) which rotates by contacting to the peripheral surface of the package (3), a yarn feed roller (26) which is provided to the upstream side of the contact roller (18) with a space (c) from the peripheral surface of the package (3), and rotates while contacting the yarn (Y) to the peripheral surface to supply the yarn (Y) to the package (3), a roller supporting member (1) for supporting the contact roller (18) and the yarn feed roller (26), and a roller supporting member position adjusting means for adjusting the position of the roller supporting member (1) in the direction the space (c) changes. In the yarn winding machine, contact roller (18) is supported capable of being displaced relative to the roller supporting member (1) in the direction the space (c) changes. The contact roller (18) is supported capable of being displaced relative to the roller supporting member (1), and a control means (30) is provided for controlling the roller supporting member position adjusting means so that the space (c) is to be constant irrespective of the package diameter (Fig. 2).

FIG. 2



EP 1 256 540 A2

Description

Field of the Invention

[0001] The present invention relates to a configuration of a yarn winding machine for winding a yarn (filament yarn) to a bobbin to form a package.

Background of the Invention

[0002] Conventionally, for a yarn winding machine comprising a traverse device and a contact roller, wherein the contact roller is pressed against a bobbin, and a yarn is supplied continuously to the bobbin while being traversed by the traverse device, and the yarn is wound at the same time to the bobbin that is being rotated, it is known of a so-called yarn winding machine with a yarn feed roller wherein by the yarn feed roller being provided between the traverse device and the contact roller, the winding tension of the yarn to be wound on the package is made adjustable.

[0003] For a modified yarn winding machine, for example, the Japanese Unexamined Patent Application Publication (Tokkai-sho) 52-37846 is publicly known. The modified yarn winding machine is contrived in the manner that the contact roller is capable of being displaced relative to a roller supporting member which supports the contact roller, and the load of the roller supporting member and the resistance at the transfer of the roller supporting member are not applied to the peripheral surface of the package via the contact roller.

[0004] Thus, the modified yarn winding machine has an advantage in that there is no change in a contact pressure of the contact roller, and the yarn can be wound under low contact pressure.

[0005] However, for the abovementioned yarn winding machine, no consideration was made to the space between the yarn feed roller and the peripheral surface of the package, in other words, a free length of the yarn between the yarn feed roller and the peripheral surface of the package. Therefore, the abovementioned yarn winding machine had a problem that a winding form of the package was prone to deteriorate due to a question of the setting of the space.

[0006] Thus, it is the object of the present invention to provide a yarn winding machine wherein there is no change in a contact pressure, the winding can be carried out under low contact pressure, and a good winding form of the package can be obtained.

Summary of the Invention

[0007] The object of the present invention is as in the manner stated above, and next, the means for solving the object will be described.

[0008] According to the first invention, the yarn winding machine comprises a contact roller rotating by contacting against a peripheral surface of a package that is

formed by winding a yarn on a bobbin, a yarn feed roller that is provided to the upstream side of the contact roller with a predetermined space from the peripheral surface of the package, rotating while contacting the yarn to be wound on the bobbin to supply the yarn to the package, a roller supporting member for supporting the contact roller and the yarn feed roller, and a roller supporting member position adjusting means for adjusting the position of the roller supporting member in the direction the predetermined space is varied. In addition, the contact roller is supported capable of being displaced relative to the roller supporting member, and the yarn winding machine is also provided with a control means for controlling the roller supporting member position adjusting means so that the space is kept constant irrespective of a package diameter.

[0009] According to the second invention, the yarn winding machine based on the first invention comprises a package diameter detecting means, and a storing means that is stored in advance with a relation between the package diameter and the position of the roller supporting member wherein the space is kept constant irrespective of the package diameter. Moreover, the control means controls the roller supporting member position adjusting means in accordance with the package diameter detected by the package diameter detecting means, and the relation between the package diameter and the position of the roller supporting member, wherein the relation is stored in the storing means.

[0010] According to the third invention, the yarn winding machine comprises a contact roller rotating by contacting against a peripheral surface of a package that is formed by winding a yarn on a bobbin, a yarn feed roller that is provided to the upstream side of the contact roller with a predetermined space from the peripheral surface of the package, rotating while contacting the yarn to be wound on the bobbin to supply the yarn to the package, a roller supporting member for supporting the contact roller and the yarn feed roller, and a roller supporting member position adjusting means for adjusting the position of the roller supporting member in the direction the predetermined space is varied. In addition, the contact roller is supported capable of being displaced relative to the roller supporting member. Furthermore, the yarn winding machine comprises a package diameter detecting means for detecting the package diameter, a roller position detecting means for detecting the relative position of the contact roller to the roller supporting member, and a storing means for storing in advance the relation between the package diameter and the relative position of the contact roller to the roller supporting member of which the space is to be constant irrespective of the package diameter. In addition, the yarn winding machine comprises a control means for controlling the roller supporting member position adjusting means in accordance with the package diameter detected by the package diameter detecting means and the relation that is stored in the storing means, so that the space is kept

constant irrespective of the package diameter.

[0011] In the fourth invention according to any one of the first invention through the third invention, the space is within the range of 0.5mm~3mm.

[0012] According to the fifth invention, the yarn winding machine comprises a contact roller rotating by contacting against a peripheral surface of a package that is formed by winding a yarn on a bobbin, a yarn feed roller that is provided to the upstream side of the contact roller with a predetermined space from the peripheral surface of the package, rotating while contacting the yarn to be wound on the bobbin to supply the yarn to the package, a roller supporting member for supporting the contact roller and the yarn feed roller, and a roller supporting member position adjusting means for adjusting the position of the roller supporting member in the direction the predetermined space is varied. In addition, the contact roller is supported capable of being displaced relative to the roller supporting member, and the yarn winding machine comprises a control means for controlling the roller supporting member position adjusting means so that the space is within the range of 0.5mm~3mm.

[0013] In the yarn winding machine of the six invention according to any one of the first invention through the fifth invention, the control means controls the roller supporting member position adjusting means so that the space between the peripheral surface of the yarn feed roller and the peripheral surface of the package increases more than the predetermined range in a part of a winding process.

[0014] In the yarn winding machine of the seventh invention according to the sixth invention, the part of the winding process is the time less than twenty percent of the entire winding process for one package from the start of the winding until the full wind is accomplished.

[0015] According to the eighth invention, a yarn feed roller, which is provided to the upstream side of the contact roller that rotates by contacting to the peripheral surface of the package that is formed by the yarn being wound on the bobbin, rotates while contacting the yarn to be wound on the bobbin to supply the yarn to the package. Such yarn feed roller is arranged to have a predetermined space from the peripheral surface of the package, and a yarn winding method is applied for winding the package while controlling the space to be constant irrespective of the package diameter.

Brief Description of the Drawings

[0016]

Figure 1 is an entire front view of the yarn winding machine for winding the elastic yarn having elasticity, such as the urethane rubber.

Figure 2 is an enlarged front view showing the relevant part of the structure of the slide box.

Figure 3 is a control system view of the yarn winding machine.

Figure 4 is a view showing the relation between the package diameter and the space, and the contact roller position.

Figure 5 is a view showing the relation between the space amount formed between the yarn feed roller and the package, and the free length until the yarn drew out from the yarn feed roller is wound to the package.

Figure 6 is a view showing the relation between the package diameter and the space, in the case the space amount is controlled for the basic operation to be carried out in the small space and for the large space to emerge intermittently.

Figure 7 is a view showing the relation between the package diameter and the space, and the contact roller position when the position of the contact roller is controlled to be constant in relation to the slide box.

Figure 8 is a front view of the slide box part showing the relation between the package diameter and the space.

Detailed Description of the Preferred Embodiments

[0017] Next, the embodiment of the present invention will be described.

[0018] A yarn winding machine M shown in Figure 1 is provided with a machine body frame 7, and a slide box 1 is provided capable of elevating and descending as a roller supporting member in the machine body frame 7. A rotatable turret plate 2 is further provided in the machine body frame 7, and is capable of swinging with a rotating shaft 6 as the center by a rotation drive device (not shown in the drawing). Moreover, a fixed frame 8 is provided in a front surface of the machine body frame 7, and an operation board 9 is provided in the fixed frame 8.

[0019] Two bobbin holders 11, 12 are projected from the turret plate 2, and each bobbin holder is rotatable. The two bobbin holders 11, 12 are provided at positions 180 degrees different in phase from one another, and one bobbin holder 11 is provided at an upper winding position, and the other bobbin holder 12 is provided at a lower standby position. Further, by the swinging of the turret plate 2 by the rotation drive device, the position of the bobbin holder 11, and the position of the bobbin holder 12 can be changed. A bobbin B is set on each of the bobbin holder 11 and the bobbin holder 12.

[0020] As shown in Figure 1 and Figure 2, the slide box 1 is provided with a traverse device 4, and a traverse guide 5 is provided in the traverse device 4.

[0021] The traverse guide 5 engages with a yarn Y being supplied continuously from a filament yarn spinning machine (not shown in the drawings), and by the traverse guide 5 running within a traverse range, a traverse operation of the yarn Y fed in the lower direction is carried out.

[0022] Meanwhile, the slide box 1 further comprises

a contact roller 18. Specifically, the contact roller 18 is supported rotatable by an arm 13 that is provided freely swinging on the slide box 1, and the contact roller 18 is capable of changing the position relative to the slide box 1. By the vertical swing of the arm 13, the contact roller 18 is capable of changing the relative position in relation to the slide box 1, in the direction to approach the bobbin B which is located at the winding position (lower direction) and the direction departing from the bobbin B (upper direction).

[0023] An air cylinder 14 as a contact pressure adjusting means is provided between the arm 13 which supports the contact roller 18, and the slide box 1. The air cylinder 14 supports part of the weight of the contact roller 18, and accordingly, the contact roller 18 contacts to the peripheral surface of the package 3 under a small contact pressure. As in the manner stated above, since the contact pressure is excessive when the weight of the contact roller 18 is applied as the contact pressure to the package 3 directly, the contact pressure is adjusted by supporting part of the weight of the contact roller 18 by the air cylinder 14. In the case it is desirable to set the contact pressure to be high to some extent, the air cylinder 14 can be removed, or the air cylinder 14 can be constructed such that the contact roller 18 is pressed against the bobbin B side. As in the manner, the contact roller 18 contacting on the peripheral surface of the package 3 is driven and rotated by receiving the rotation of the package 3.

[0024] The traverse device 4 is provided greatly away to the upstream side (upstream side of yarn path) from the contact roller 18. A yarn feed roller 26 is provided in the upstream side of the contact roller 18, and the yarn feed roller 26 is attached fixed to the slide box 1. The yarn feed roller 26 is provided closely in the downstream of the traverse guide 5 of the traverse device 4, and is provided above the peripheral surface of the package 3.

[0025] However, the yarn feed roller 26 does not contact to the peripheral surface of the package 3, and is located with a small space (c) as shown in Figure 2. Therefore, the yarn feed roller 26 is not driven and rotated by receiving the rotation of the package 3, however, the yarn feed roller 26 rotates by receiving a power directly from a driving motor (yarn feed roller driving means) 27 shown in Figure 3.

[0026] The yarn feed roller 26 receives on its peripheral surface, the yarn Y traversed by the traverse device 4, feeds the yarn Y to the downstream side, and supplies the yarn Y to the package 3. On the other hand, since the contact roller 18 is only contacting to the peripheral surface of the package 3, the contact roller 18 does not receive the yarn Y and does not supply the yarn Y to the package 3.

[0027] Moreover, a contact roller position detecting sensor 15 is provided in the slide box 1. By detecting a displacement (angle relative to horizontal line of arm 13) θ of an arm 13 that is supporting the contact roller 18 contacting to the peripheral surface of the package 3,

the contact roller position detecting sensor 15 can detect the relative position of the contact roller 18 to the slide box 1, in other words, to the yarn feed roller 26.

[0028] Furthermore, a rotation sensor 16 is provided on the arm 13, and the rotation speed of the contact roller 18 can be detected by the rotation sensor 16. By searching the rotation speed of the contact roller 18 that rotates while contacting against the peripheral surface of the package 3, the peripheral speed of the package 3 can be learnt. The contact roller position detecting sensor 15, and the rotation sensor 16 as the rotation speed detecting means, are connected electrically to a controller 30 to be described hereinafter.

[0029] As shown in Figure 2, the slide box 1 is guided to rails 17, 17 which are arranged in the vertical direction, and is capable of transferring vertically along the rails 17, 17. The greater part of the weight of the slide box 1 is supported by an air cylinder (not shown in the drawings), however, the vertical elevation and descent driving of the slide box 1 is carried out by a ball screw mechanism to be described later on. The own weight of the slide box 1 itself is supported completely by the abovementioned air cylinder and the ball screw mechanism, and excluding the contact roller 18, the own weight is not used as the contact pressure to the package 3. However, the abovementioned air cylinder can be abbreviated and the weight of the slide box 1 can be supported only by the ball screw mechanism (supporting member driving means).

[0030] A screw rod 19 is provided in the vertical direction to the side of the slide box 1, and is supported rotatable by the machine body frame 7. The lower end of the screw rod 19 is interlocked to an ascent/descent driving motor 20, and the screw rod 19 is rotated and driven by the ascent/descent driving motor 20.

[0031] A ball nut 21 is provided on the side of the slide box 1, and is interlocked to the screw rod 19. By the rotation and driving of the screw rod 19 by the ascent/descent driving motor 20, the slide box 1 carries out a vertical movement. The ascent/descent driving motor 20 is connected electrically to a controller 30, and its drive is controlled by the controller 30.

[0032] The abovementioned screw rod 19, the ball nut 21, and the ascent/descent driving motor 20 forms a ball screw mechanism which is a roller supporting member position adjusting means.

[0033] Moreover, as shown in Figure 3, the controller 30 is provided in the yarn winding machine M. In addition, a motor 22 is provided for driving a traverse cam of the traverse device 4 and is connected electrically to the controller 30.

[0034] Furthermore, motors (bobbin driving means) 23, 24 for driving each of the two bobbin holders 11, 12 are connected electrically to the controller 30. In addition, a rotation sensor 25 is provided relative to the bobbin holder 11 which is located at the winding position, and the information of the rotation speed of the bobbin holder 11 at the winding position can be supplied to the

controller 30 by the rotation sensor 25.

[0035] The rotation sensor 25 is used for carrying out a feedback control to the rotation speed of the bobbin holder driving motor 23 as to be described in the followings, and is also used as a winding diameter detecting means for detecting the winding diameter of the package 3.

[0036] Moreover, the yarn feed roller driving motor 27 for rotating and driving the yarn feed roller 26 is also connected electrically to the controller 30.

[0037] Further, for the traverse device 4, other than the traverse device of cam type shown in the present embodiment, known devices, for example, the publicly known traverse device of rotary type using a rotary blade, can be applied.

[0038] Next, it will be described of the elevation and descending control of the slide box 1 relating to the increase in the winding diameter of the package 3 during the winding process.

[0039] First, a relational expression (relation table shown in Figure 4) is geometrically calculated in advance for the package diameter and the contact roller position (relative position of the contact roller 18 to the yarn feed roller 26) θ . In the relational expression, the space between the peripheral surface of the package 3 and the peripheral surface of the yarn feed roller 26 remains constant irrespective of the package winding diameter. Then, the relational expression (relation table) is stored in a storing means 30a provided within the controller 30.

[0040] Next, during the winding, the winding diameter of the package 3 is calculated from the detected value of the rotation sensor 16, the radius of the contact roller 18, and the detected value of the rotation sensor 25.

[0041] In addition, in accordance with the calculated winding diameter, the contact roller position corresponding to the winding diameter is found from the relational expression (relation table) stored in the storing means 30a.

[0042] Then, the ascent/descent driving motor 20 is controlled and the height (vertical position) of the slide box 1 (yarn feed roller 26) is adjusted so that the detected value of the contact roller position detecting sensor 15 reaches the found contact roller position.

[0043] Accordingly, the space can be kept constant between the peripheral surface of the package 3 and the peripheral surface of the yarn feed roller 26 irrespective of the winding diameter of the package.

[0044] As in the manner stated above, by controlling so that the relative position of the contact roller 18 to the slide box 1 (to the yarn feed roller 26) is kept constant at all times irrespective of the package diameter, the space amount (c) between the peripheral surface of the package 3 and the peripheral surface of the yarn feed roller 26, can be neared infinitely to the space (co) which is required at minimum. As a result, a distance (free length) where the yarn Y becomes free between the peripheral surface of the yarn feed roller 26 and the pe-

ripheral surface of the package 3 can be kept at minimum at all times.

[0045] Accordingly, the package 3 with satisfactory form can be formed.

[0046] Further, the space (co) is the space which is at least required to be provided for preventing the yarn feed roller 26 and the package 3 from contacting against one another, for example, due to the vibration of the yarn feed roller 26 or the package 3 during the winding process.

[0047] Moreover, the control to maintain the space amount (c) constant is carried out in accordance with the data showing the relation between the package diameter and the relative position of the contact roller 18, for example, an equation or a table being stored in the controller 30 in advance. Therefore, the space amount (c) can be maintained constant reliably and precisely by a simple control.

[0048] Meanwhile, for example, in the case the vertical position of the slide box 1 is controlled so that the slide box 1 is elevated by the distance corresponding to the increased radius due to the increase in the winding diameter of the package 3, in other words, in the case the relative position of the contact roller 18 to the slide box 1 is controlled to be constant, as shown in Figure 7 and Figure 8, the space between the peripheral surface of the yarn feed roller 26 and the peripheral surface of the package 3 changes according to the package diameter. For example, in the case the package diameter is (r1), the space between the peripheral surface of the yarn feed roller 26 and the peripheral surface of the package 3 is (cp), and when the package diameter becomes (r2) which is larger than (r1), the space (c) between the peripheral surface of the yarn feed roller 26 and the peripheral surface of the package 3 decreases and becomes (cq).

[0049] As in the manner stated above, under the control in which the position of the contact roller 18 is kept constant in relation to the slide box 1, the space (c) between the peripheral surface of the yarn feed roller 26 and the peripheral surface of the package 3 changes according to the package diameter. Therefore, it becomes difficult "to form the space (c) between the peripheral surface of the yarn feed roller 26 and the peripheral surface of the package 3 to be constant and minimum at all times irrespective of the package diameter" which is necessary for improving the winding form of the package 3.

[0050] Moreover, in the present embodiment, the space amount (c) provided between the peripheral surface of the package 3 and the peripheral surface of the yarn feed roller 26 is controlled to fit within the range of 0.5mm~3mm, preferably within the range of 0.5mm~1mm.

[0051] When the space (c) is smaller than 0.5mm, the space (co) cannot be obtained which is at least necessary for preventing the yarn feed roller 26 and the package 3 from contacting against one another, and as a re-

sult, there is a possibility for the yarn feed roller 26 and the package 3 to contact against one another, due to the vibration of the yarn feed roller 26 or the package 3 during the winding process.

[0052] Moreover, in the case the space amount (c) is larger than 3 mm, the free length L (shown in Figure 2), which is the length between the point that the yarn Y traversed at the traverse device 4 departs from the yarn feed roller 26 and the point that the yarn Y contacts to the peripheral surface of the package 3, becomes excessive, and the winding form of the package 3 deteriorates.

[0053] Therefore, by controlling the space amount (c) to be within the range of 0.5mm~3mm, the yarn Y can be wound stably without the yarn feed roller 26 and the package 3 contacting against one another, and without the free length between the yarn departure point on the yarn feed roller 26 and the yarn contact point on the peripheral surface of the package 3 being excessive, the package 3 can be formed with a satisfactory form.

[0054] It is desirable to control the space amount (c) at a fixed value within the range of 0.5mm~3mm, preferably within the range of 0.5mm~1mm, however, the space amount (c) may change slightly within the above-mentioned range.

[0055] Moreover, in the yarn winding machine M wherein the yarn feed roller 26 is provided in the upstream side of the contact roller 18 to be driven positively, different from the case in which only the contact roller 18 is provided, the peripheral velocity of the package 3 and the peripheral velocity of the yarn feed roller 26 that supplies the yarn Y to the package 3 can be differed, and the tension of the yarn Y between the yarn feed roller 26 and the package 3 can be adjusted.

[0056] Further, according to the present embodiment, the rotation speed sensor 16 detects the rotation speed of the contact roller 18, and the motor 23 for driving the bobbin holder 11 is controlled so that the rotation speed detected by the rotation sensor 16 becomes constant.

[0057] Specifically, in the case the detected value of the rotation sensor 16 falls short of the predetermined value corresponding to the winding speed, the rotation speed of the motor 23 is controlled to be increased. In the case the detected value of the rotation sensor 16 exceeds the predetermined value, the rotation speed of the motor 23 is controlled to be decreased.

[0058] Moreover, a bobbin holder rotation sensor 25 is provided on the machine body frame 7 for detecting the rotation speed of the bobbin holder 11, and is used for the feedback control of the rotation speed of the motor 23.

[0059] Furthermore, according to the present embodiment, the increase in the winding diameter of the package 3 is detected by calculating the peripheral speed of the package 3 from the detected value of the rotation sensor 16 and the radius of the contact roller 18, and by calculating the package diameter from the calculated peripheral speed of the package 3 and the detected val-

ue of the bobbin holder rotation sensor 25. In accordance with this change in the package diameter, the slide box 1 is controlled to elevate and descend.

[0060] According to the present embodiment, a method for detecting the package diameter indirectly is adopted, however, the package diameter can be detected directly by the sensor of non-contacting type that is provided separately.

[0061] Moreover, according to the abovementioned embodiment, the control of the space amount (c) is carried out indirectly by the position control of the contact roller 18, however, the space amount (c) can be controlled to be constant by the following method.

[0062] That is, a vertical position detecting sensor (for example, vertical position gauge) for detecting the vertical position of the slide box 1 can be provided, and the relation between the package winding diameter and the side box vertical position wherein the space amount (c) is to be constant, can be obtained geometrically in advance. The vertical position of the slide box 1 is adjusted so that the detected result of the slide box vertical position detecting sensor reaches the slide box vertical position which is found from the detected value of the winding diameter detecting sensor and the abovementioned relation.

[0063] Moreover, as a different method, the following method can be adopted.

[0064] A sensor (for example, a distance sensor attached to the slide box 1 for measuring the distance to the peripheral surface of the package) for directly detecting the space amount (c) can be provided, and the position of the slide box 1 is adjusted so that the detected space amount (c) is constant.

[0065] As in the manner stated above, according to the yarn winding machine of the present invention, the space amount (c) is controlled to be maintained at a constant value in the winding process of the yarn Y, however, a creeping function can be provided which carries out the control to change the space amount (c) arbitrarily in part of the process of the winding process. In other words, the controller 30 drives the ascent/descent driving motor 20 in the winding process under predetermined timing, the slide box 1 is elevated and descended, and the space amount (c) is varied.

[0066] As it is evident by comparing the upper drawing and the lower drawing in Figure 5, to increase the space amount (c) means the increase in the free length L which is the length of the yarn Y to be fed from the yarn departing point at the peripheral surface of the yarn feed roller 26 until the yarn reaching point (being wound) at the peripheral surface of the package 3. The increase in the free length L means the increase in the difference (traverse delay) between the position in the axis direction the yarn Y is traversed by the traverse device 4, and the position in the axis direction the yarn Y is wound to the package 3 actually. Due to the traverse delay, even when the traverse guide 5 of the traverse device 4 reaches the stroke end position, the yarn Y is actually

wound to the package 3 at the position to the center in the axis direction for the amount of the traverse delay. In the end, the increase in the traverse delay leads to the narrowing of the winding width in the axis direction when winding the yarn Y to the package 3.

[0067] As in the manner stated above, by changing the space amount (c), the winding width in the axis direction can be changed when winding the yarn Y to the package 3. The control of the present invention uses this theory.

[0068] For the control in the change of the space amount (c), for example, as shown in Figure 6, the basic operation is carried out in the small space (c1), and the large spaces (c2), (c3) can be emerged intermittently.

[0069] As a result of such control, the condition in which both edges of the package 3 in the axis direction becomes high (saddle bag), can be resolved, and the final form of the package can be made satisfactory.

[0070] However, in this case, it is necessary to keep the small space (c1) within the range of 0.5mm~3mm, and it is necessary for the percentage of the process maintaining the small space within the range of 0.5mm~3mm to the entire winding process to be equal to or more than 80% (the percentage of the process falling off from the range is less than 20%), preferably to be within the percentage of 80%~95%.

[0071] When the percentage for maintaining the space of the range of 0.5mm~3mm becomes less than 80%, the percentage for the space amount being displaced from the range of 0.5mm~3mm in the process increases, and there is a possibility for bad influence to be exerted to the winding form of the package 3.

[0072] Further, the present invention was made to be used under low contact pressure as the main aim, and it is needless to say that the present invention works great effect in this case, however, the present invention can also be applied for the used under high contact pressure. Even in the case of high contact pressure, for example, when a guide resistance of a roller supporting member guiding means is large, or when the guide resistance varies greatly during the transferring of the roller supporting member, the present invention is capable of losing the contact pressure change, and it is effective.

[0073] Since the present invention is constructed in the manner stated above, it has following effects.

[0074] In other words, as shown in the first invention, the yarn winding machine comprises the contact roller rotating by contacting against the peripheral surface of the package that is formed by winding the yarn on the bobbin, the yarn feed roller that is provided to the upstream side of the contact roller with the predetermined space from the peripheral surface of the package, rotating while contacting the yarn to be wound on the bobbin to supply the yarn to the package, the roller supporting member for supporting the contact roller and the yarn feed roller, and the roller supporting member position adjusting means for adjusting the position of the roller supporting member in the direction the predetermined

space is varied. In addition, the contact roller is supported capable of being displaced relative to the roller supporting member, and the yarn winding machine is also provided with the control means for controlling the roller supporting member position adjusting means so that the space is kept constant irrespective of a package diameter. Therefore, by reducing the change in the contact pressure of the contact roller to the package, the package with satisfactory shape can be obtained.

[0075] Furthermore, the contact pressure of the contact roller to the package can also be reduced. Moreover, the space amount between the peripheral surface of the package and the peripheral surface of the yarn feed roller can be neared infinitely to the space of the amount which is required at minimum, and as a result, the length where the yarn becomes free between the peripheral surface of the yarn feed roller and the peripheral surface of the package can always be made at minimum. Accordingly, the package with even more satisfactory shape can be formed.

[0076] As shown in the second invention, the yarn winding machine comprises the package diameter detecting means, and the storing means that is stored in advance with the relation between the package diameter and the position of the roller supporting member wherein the space is kept constant irrespective of the package diameter. Moreover, the control means controls the roller supporting member position adjusting means in accordance with the package diameter detected by the package diameter detecting means, and the relation between the package diameter and the position of the roller supporting member which is stored in the storing means. Therefore, the effect same as the effect of the first invention can be obtained reliably.

[0077] As shown in the third invention, the yarn winding machine comprises the contact roller rotating by contacting against the peripheral surface of the package that is formed by winding the yarn on the bobbin, the yarn feed roller that is provided to the upstream side of the contact roller with a predetermined space from the peripheral surface of the package, rotating while contacting the yarn to be wound on the bobbin to supply the yarn to the package, the roller supporting member for supporting the contact roller and the yarn feed roller, and the roller supporting member position adjusting means for adjusting the position of the roller supporting member in the direction the predetermined space is varied. In addition, the contact roller is supported capable of being displaced relative to the roller supporting member. Furthermore, the yarn winding machine comprises the package diameter detecting means for detecting the package diameter, the roller position detecting means for detecting the relative position of the contact roller to the roller supporting member, and the storing means for storing in advance the relation between the package diameter and the relative position of the contact roller to the roller supporting member, wherein for the relation, the space is to be constant irrespective of the package

diameter. In addition, the yarn winding machine comprises the control means for controlling the roller supporting member position adjusting means in accordance with the package diameter detected by the package diameter detecting means, and the relation between the package diameter and the relative position of the contact roller to the roller supporting member, wherein the relation is stored in the storing means, so that the space is kept constant irrespective of the package diameter. Therefore, the effect same as the effect of the first invention can be obtained reliably.

[0078] As shown in the fourth invention, the space is within the range of 0.5mm~ 3mm. Therefore, the yarn can be wound stably without the yarn feed roller and the package contacting against one another, and the free length of the yarn from the yarn feed roller to the package can be shortened, and the package with satisfactory shape can be formed.

[0079] As shown in the fifth invention, the yarn winding machine comprises a contact roller rotating by contacting against a peripheral surface of a package that is formed by winding a yarn on a bobbin, a yarn feed roller that is provided to the upstream side of the contact roller with a predetermined space from the peripheral surface of the package, rotating while contacting the yarn to be wound on the bobbin to supply the yarn to the package, a roller supporting member for supporting the contact roller and the yarn feed roller, and a roller supporting member position adjusting means for adjusting the position of the roller supporting member in the direction the predetermined space is varied. In addition, the contact roller is supported capable of being displaced relative to the roller supporting member, and the yarn winding machine comprises a control means for controlling the roller supporting member position adjusting means so that the space is within the range of 0.5mm~3mm. Therefore, the yarn can be wound stably without the yarn feed roller and the package contacting against one another, and the free length of the yarn from the yarn feed roller to the package can be shortened, and the package with satisfactory shape can be formed. In addition, the change in the contact pressure of the contact roller to the package can be reduced.

[0080] As shown in the sixth invention, the control means controls the roller supporting member position adjusting means so that the space between the yarn feed roller and the package increases more than the predetermined range in a part of a process of a winding process. As a result, the condition in which both edges of the package in the axis direction become high (saddle bag) is resolved, and the final shape of the package can be made satisfactory.

[0081] As shown in the seventh invention, the part of the process is the time less than twenty percent of the winding process from the start of the winding until the full wind is accomplished for one package. Therefore, the bad influence due to the increase in the percentage of the time in the process when the space is large, is

prevented from being exerted to the winding form of the package, the condition in which both edges of the package in the axis direction become high (saddle bag) is resolved, and the final form of the package can be made satisfactory.

[0082] As shown in the eighth invention, the yarn feed roller is provided to the upstream side of the contact roller that rotates by contacting to the peripheral surface of the package that is formed by the yarn being wound on the bobbin, rotates while contacting the yarn to be wound on the bobbin to supply the yarn to the package. Such yarn feed roller is arranged to have a predetermined space from the peripheral surface of the package, and a yarn winding method is applied for winding the package by controlling the space to be constant irrespective of the package diameter. As a result, the effect same as the effect of the first invention can be obtained.

Claims

1. A yarn winding machine comprising:

a contact roller rotating by contacting to a peripheral surface of a package that is formed by winding a yarn on a bobbin;
a yarn feed roller that is provided to an upstream side of the contact roller with a predetermined space from the peripheral surface of the package, and that rotates while contacting the yarn to be wound on the bobbin to supply the yarn to the package;
a roller supporting member for supporting the contact roller and the yarn feed roller; and
a roller supporting member position adjusting means for adjusting a position of the roller supporting member in a direction the predetermined space is varied;

wherein the contact roller is supported capable of being displaced relative to the roller supporting member;

characterized in that the yarn winding machine comprises a control means for controlling the roller supporting member position adjusting means so that the space is kept constant irrespective of the package diameter.

2. A yarn winding machine according to claim 1 comprising:

a package diameter detecting means; and
a storing means for storing in advance a relation between the package diameter and the position of the roller supporting member so that the space is to be constant irrespective of the package diameter;

wherein the control means controls the roller supporting member position adjusting means in accordance with the package diameter detected by the package diameter detecting means, and the relation between the package diameter and the position of the roller supporting member, wherein the relation is stored in the storing means.

3. A yarn winding machine comprising:

a contact roller rotating by contacting to a peripheral surface of a package that is formed by winding a yarn on a bobbin;
 a yarn feed roller that is provided to an upstream side of the contact roller with a predetermined space from the peripheral surface of the package, and that rotates while contacting the yarn to be wound on the bobbin to supply the yarn to the package;
 a roller supporting member for supporting the contact roller and the yarn feed roller; and
 a roller supporting member position adjusting means for adjusting a position of the roller supporting member in a direction the predetermined space is varied;

wherein the contact roller is supported capable of being displaced relative to the roller supporting member;

characterized in that the yarn winding machine comprises a package diameter detecting means for detecting the package diameter, a roller position detecting means for detecting the relative position of the contact roller to the roller supporting member, a storing means for storing in advance a relation between the package diameter and the relative position of the contact roller to the roller supporting member so that the space is to be constant irrespective of the package diameter, and a control means for controlling the roller supporting member position adjusting means in accordance with the package diameter detected by the package diameter detecting means and the relation that is stored in the storing means, so that the space is to be constant irrespective of the package diameter.

4. A yarn winding machine according to any one of claim 1 through claim 3 wherein the space is within a range of 0.5mm~3mm.

5. A yarn winding machine comprising:

a contact roller rotating by contacting to a peripheral surface of a package that is formed by winding a yarn on a bobbin;
 a yarn feed roller that is provided to an upstream side of the contact roller with a predetermined space from the peripheral surface of

the package, and that rotates while contacting the yarn to be wound on the bobbin to supply the yarn to the package;

a roller supporting member for supporting the contact roller and the yarn feed roller; and
 a roller supporting member position adjusting means for adjusting a position of the roller supporting member in a direction the predetermined space is varied;

wherein the contact roller is supported capable of being displaced relative to the roller supporting member;

characterized in that the yarn winding machine comprises a control means for controlling the roller supporting member position adjusting means so that the space is within the range of 0.5mm~3mm.

6. A yarn winding machine according to any one of claim 1 through claim 5 wherein the control means controls the roller supporting member position adjusting means so that the space between the peripheral surface of the yarn feed roller and the peripheral surface of the package changes to be larger than the predetermined range in part of the winding process.

7. A yarn winding machine according to claim 6 wherein the part of the winding process is a time less than twenty percent of the entire winding process for one package from a start of the winding until a full wind is accomplished.

8. A yarn winding method wherein the yarn feed roller is provided to the upstream side of the contact roller which rotates by contacting to the peripheral surface of the package that is formed by the yarn being wound on the bobbin, rotates while contacting the yarn to be wound on the bobbin to supply the yarn to the package, such yarn feed roller is arranged with a predetermined space from the peripheral surface of the package, and the winding of the yarn is carried out by controlling the space to be constant irrespective of the package diameter.

FIG. 1

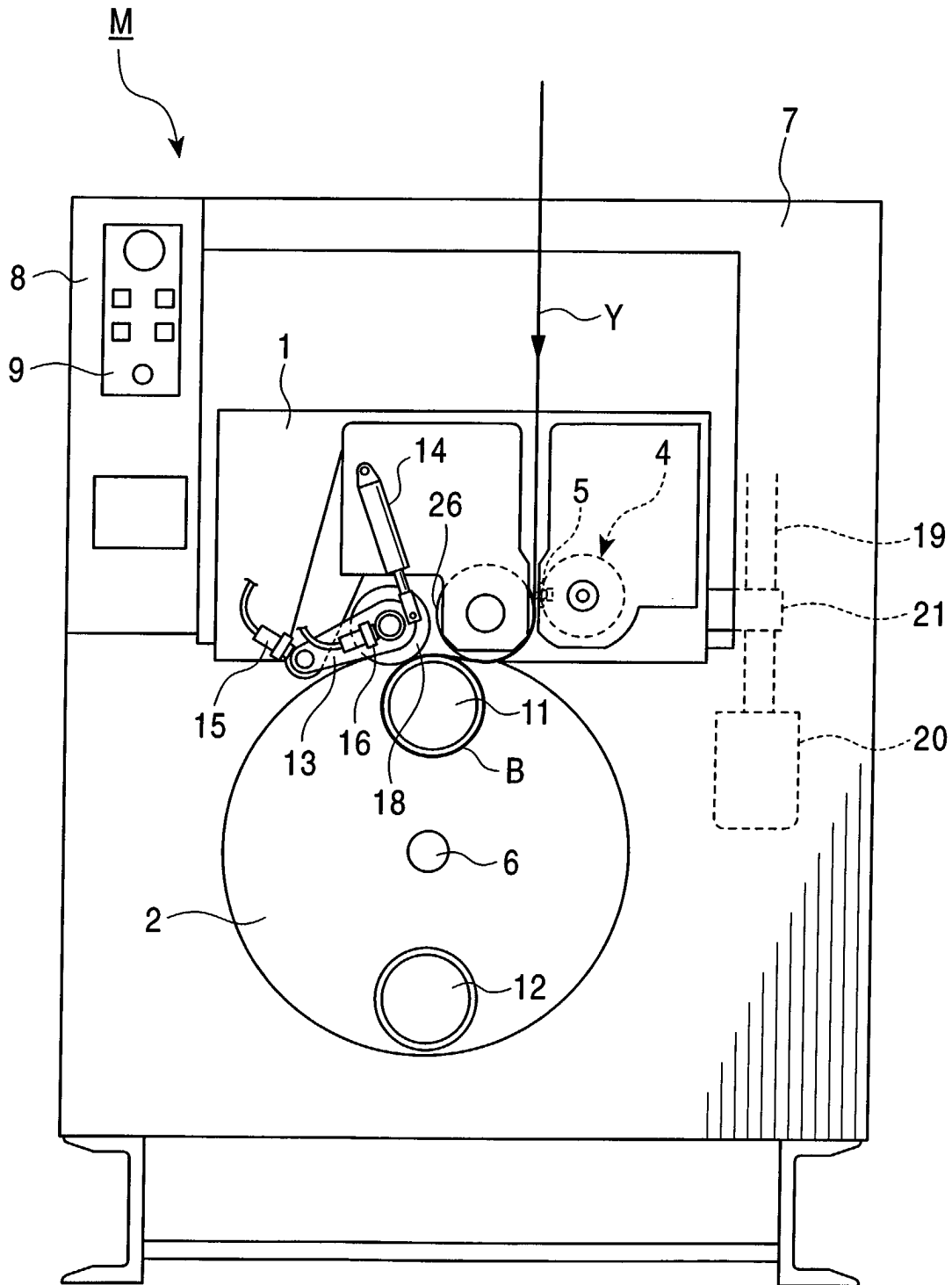


FIG. 2

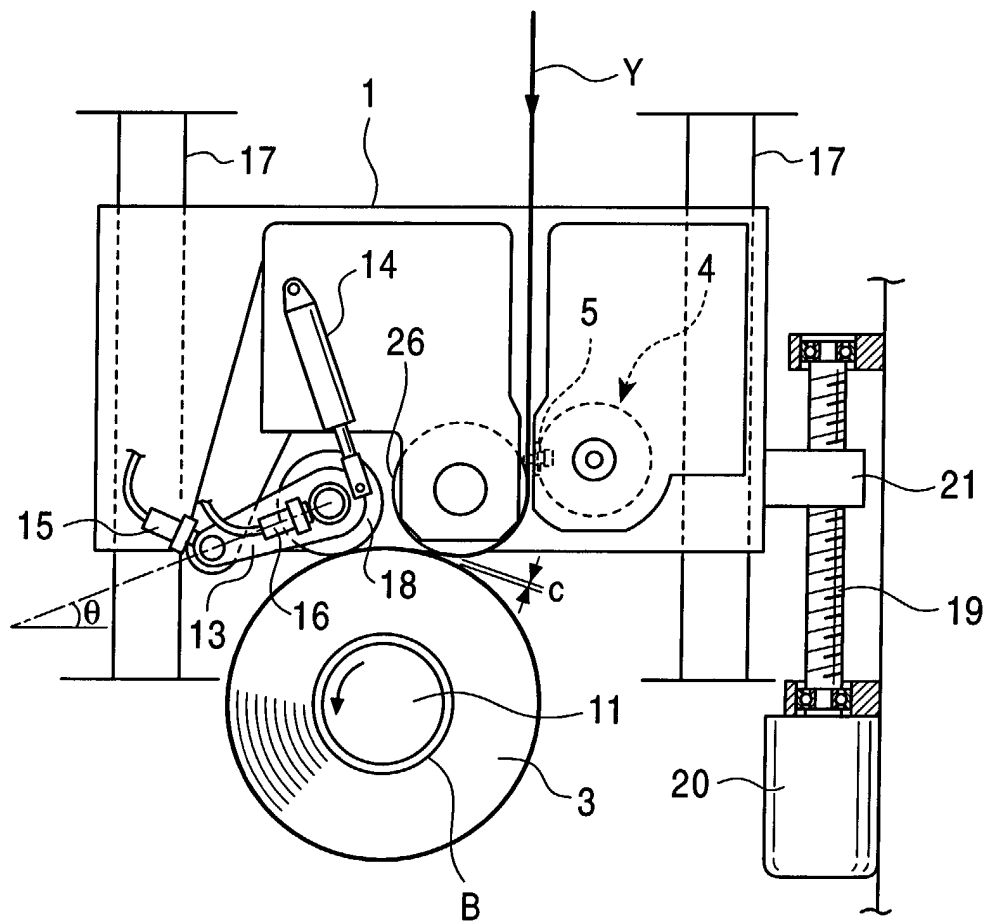


FIG. 3

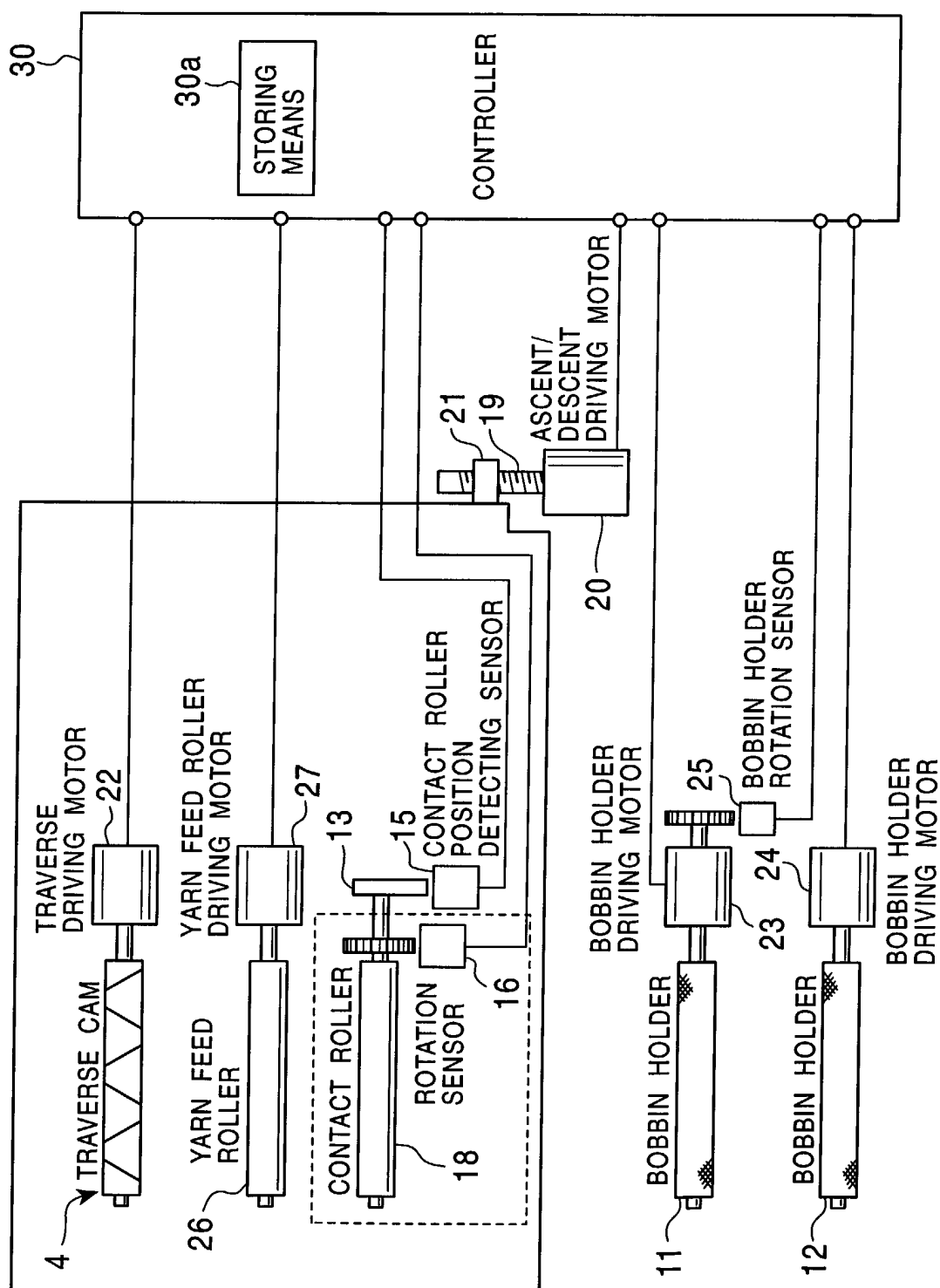


FIG. 4

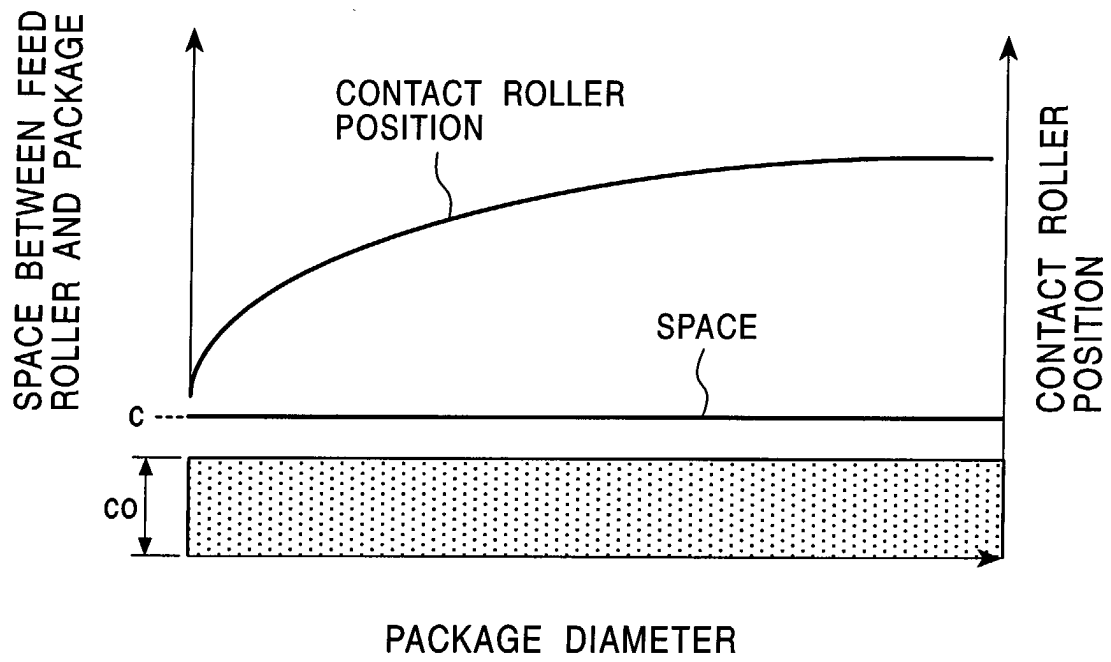


FIG. 5

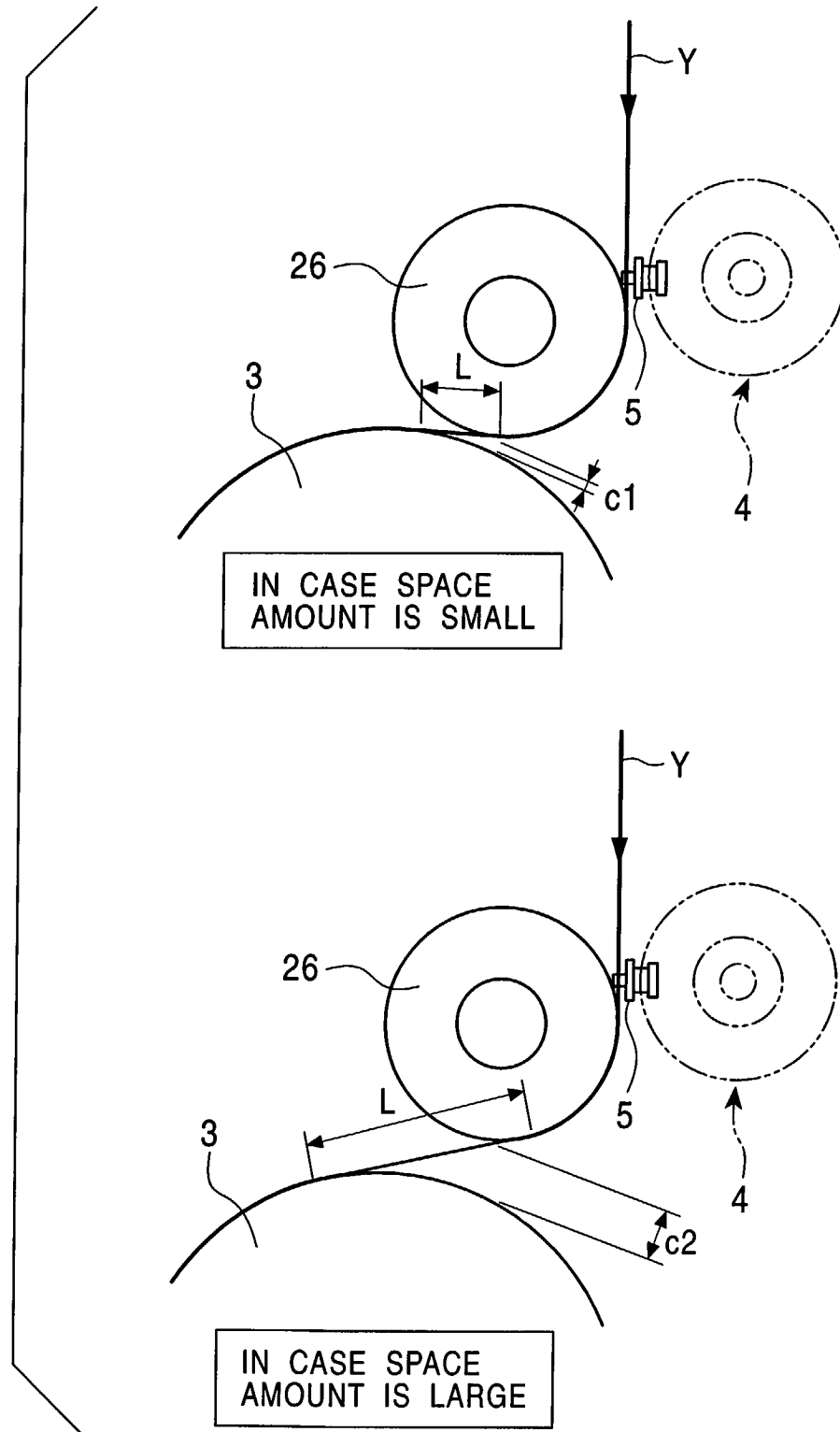


FIG. 6

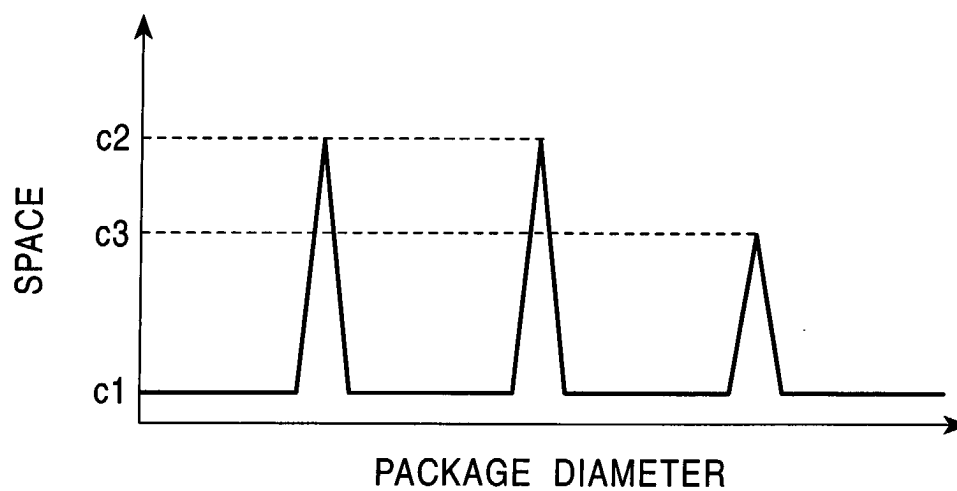


FIG. 7

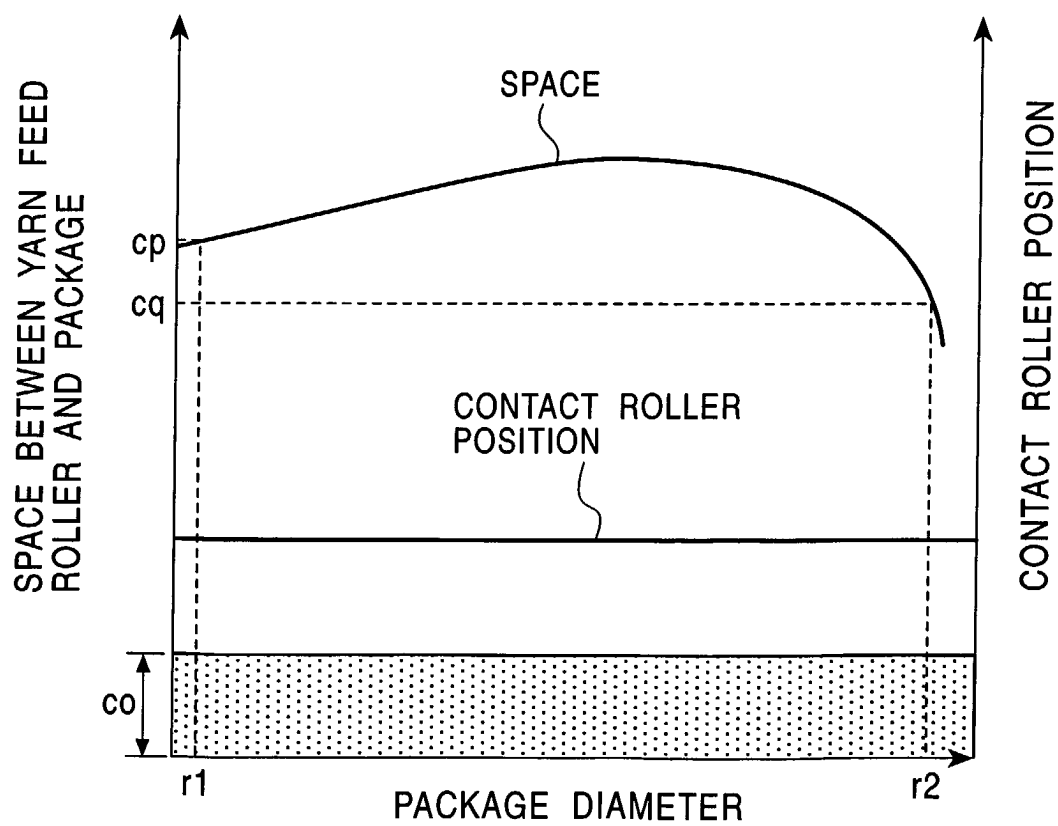


FIG. 8

