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(54) **Unpacking device and method**

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(56) References cited:
**EP-A1- 1 334 931 EP-A1- 1 810 925
WO-A2-2011/070037 JP-A- 3 085 238
JP-A- 11 091 746 JP-A- 61 009 274
JP-A- 2005 047 571 JP-A- 2007 204 048
US-A1- 2008 159 830**

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to an unpacking method for unpacking a package and taking out contents; and, more particularly, to a technology for restraining scraps of a packing material from being mixed in contents when a package is unpacked.

Description of the Related Art

[0002] A material put into a production line is usually received in a packed state. A packed material is manually unpacked by a worker and is put into a production line. Most of unpacking works are repeatedly performed and are automated in many cases.

[0003] Unpacking devices for taking out contents by cutting a packing material with an edged tool are disclosed in Japanese Patent Application Publication Nos. 2002-002638 and 2002-249116. In the unpacking device of JP2002-002638A, contents (old newspapers) are cut simultaneously with cutting a packing material. In the unpacking device of JP2002-249116A, the upper wall of a box is cut out with a slanting cutter.

[0004] JP 2005-047571A also discloses an unpacking device and method according to preamble of claim 1.

[0005] When a packing material is cut with the unpacking device, it is highly likely that scraps are mixed in the contents in the course of cutting the packing material. In case where the contents are old newspapers as in the unpacking device of JP2002-002638A, no serious problems may be caused even if some scraps of a cardboard box as a packing material are mixed in the old newspapers. However, if the contents are foodstuff, it is not desirable that scraps of a packing material are mixed in the contents.

[0006] If the contents are relatively small ones such as vegetable or flour, it is sometimes the case that a part of the contents remains within the packing material in an unpacking process. For that reason, it is demanded to keep, as far as possible, the contents from remaining within the packing material in an unpacking process.

SUMMARY OF THE INVENTION

[0007] It is an object of the present invention to provide an unpacking method capable of unpacking a package so that scraps of a packing material are not mixed in the contents. According to the present invention, an unpacking method as defined in claim is provided. The dependent claims define some examples of such a method.

[0008] The primary packing material may be a flexible bag, and the control unit may be configured to control the robot such that the robot grips the primary packing material of the primary package, lifts up the primary pack-

ing material and takes out the content from the bag by own weight of the contents.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The objects and features of the present invention will become apparent from the following description of embodiments, given in conjunction with the accompanying drawings, in which:

Fig. 1 and Fig. 2 are a view schematically showing a packing process of a foodstuff;

Fig. 3 is a plan view showing a process layout according to an embodiment of the present invention; Fig. 4 is a block diagram schematically showing an unpacking device according to the embodiment;

Fig. 5 is a view for explaining the function of a primary taking-out control unit;

Fig. 6 is a view for explaining the function of a secondary taking-out control unit;

Fig. 7 is a block diagram schematically showing an unpacking device according to a first modified example of the embodiment;

Fig. 8 is a view for explaining the function of a preparatory grip operation control unit;

Fig. 9 is a view for explaining the functions of an up-down operation control unit and a main grip operation control unit;

Fig. 10 is a block diagram schematically showing an unpacking device according to a second modified example of the embodiment; and

Fig. 11 is a block diagram schematically showing an unpacking device according to a third modified example of the embodiment.

DESCRIPTION OF THE EMBODIMENTS

[0010] There is provided an unpacking device for taking out a plastic bag from a package formed of an incised cardboard box, lifting up the plastic bag and taking out contents from the plastic bag through the use of an articulated robot.

[0011] In the present embodiment, it is supposed that a foodstuff as a material is put into a snack food production line. A packing state available when a foodstuff is received will be described herein below.

[0012] Figs. 1 and 2 are a view schematically showing a packing process of a foodstuff. As shown in Fig. 1, a foodstuff 1 as contents (see the left view in Fig. 1) is contained in a plastic bag 2 as a primary packing material (see the central view in Fig. 1). A taking-out mouth (bag opening) 6 is folded to form a primary package 3 (see the right view in Fig. 1). As shown in Fig. 2, the primary package 3 is packed into a cardboard box 4 as a secondary packing material (see the left view in Fig. 2), thereby forming a secondary package 5 (see the right view in Fig. 2). In this regard, the primary packing material is a flexible bag like the plastic bag 2 and has the taking-out

mouth 6. The secondary packing material is a container like the cardboard box 4, the shape of which is kept unchanged unless a certain level of external force is applied thereto. In the present embodiment, an incision enough to take out the primary package 3 therethrough can be formed in the secondary package 5 by cutting the secondary packing material itself or the packing tape 7 adhering to the secondary packing material through the use of an edged tool.

[0013] Fig. 3 is a plan view showing a process layout according to the present embodiment. Referring to Fig. 3, there are shown a dual arm robot 10, a package conveying unit 11, a packing material cutting unit 12, a scrap removal unit 13, a content unloading conveyor 14, a cardboard unloading conveyor 15, a cardboard storage device 16, a plastic bag recovery device 17 and a plastic bag storage box 18.

[0014] The dual arm robot 10 is an articulated robot having fifteen axes in total and is provided with two seven-axes articulated robots which are mounted to a common shaft rotating in a substantially horizontal direction. Then, geometric terms such as "horizontal" in the present disclosure do not require the strict mathematical sense. It is intended to allow an error during implementation. The package conveying unit 11 conveys the secondary package 5 at least from the packing material cutting unit 12 to the operation region of the dual arm robot 10. The package conveying unit 11 includes a package loading conveyor 19 and a cross feed device 20.

[0015] The package loading conveyor 19 conveys the secondary package 5 from an upstream-side unloading station to the start point of the cross feed device 20 (see an arrow A in Fig. 3).

[0016] The packing material cutting unit 12 is a cutting device installed in a conveying route along which the secondary package 5 is conveyed by the package loading conveyor 19. The packing material cutting unit 12 forms an incision in the cardboard box 4 of the secondary package 5 using an edged tool or the like. In this connection, the packing material cutting unit 12 forms an incision in the portion of the cardboard box 4 other than the lower surface thereof. Preferably, the packing material may be cut by the packing material cutting unit 12 in any location other than the location where the primary package 3 is taken out by the dual arm robot 10 and the location where the foodstuff 1 is taken out by the dual arm robot 10. Alternatively, an incision may be formed on the lower surface of the cardboard box 4 by the packing material cutting unit 12, and then the secondary package 5 may be rotated so that the incision can lie at the lateral side or the upper side.

[0017] The scrap removal unit 13 is a cleaning device installed between the packing material cutting unit 12 and the cross feed device 20. The scrap removal unit 13 removes the scraps generated in the packing material cutting process from the secondary package 5 by blowing the scraps away with a compressed air or by sucking the scraps. The scraps are removed by the scrap removal

unit 13 in a location between the packing material cutting unit 12 and the operation region of the dual arm robot 10. Preferably, the scraps may be removed by the scrap removal unit 13 in any location other than the location where the primary package 3 is taken out by the dual arm robot 10 and the location where the foodstuff 1 is taken out by the dual arm robot 10.

[0018] The cross feed device 20 conveys the secondary package 5 by parallel-moving the secondary package 5 from the end point of the package loading conveyor 19 to the start point of the content unloading conveyor 14 (see an arrow B in Fig. 3). Fig. 4 is a block diagram schematically showing an unpacking device 100 according to the present embodiment. As shown in Fig. 4, the unpacking device 100 includes the dual arm robot 10, a primary taking-out control unit 110 and a secondary taking-out control unit 120. In the present embodiment, the primary taking-out control unit 110 and the secondary taking-out control unit 120 serve as a control unit.

[0019] The primary taking-out control unit 110 and the secondary taking-out control unit 120 control the dual arm robot 10 to unpack a package and take out contents.

[0020] Fig. 5 is a view for explaining the function of the primary taking-out control unit 110. As shown in Fig. 5, the primary taking-out control unit 110 controls the dual arm robot 10 to take out the primary package 3 through the incision 8 formed by the packing material cutting unit 12. More specifically, the primary taking-out control unit 110 first controls the dual arm robot 10 to hold the cardboard box 4 of the secondary package 5 at the start point of the content unloading conveyor 14 and can lift up the secondary package 5 (see the upper view in Fig. 5).

[0021] Next, the primary taking-out control unit 110 controls the dual arm robot 10 to rotate the secondary package 5 to have the incision 8 face downward so that the primary package 3 can be taken out through the incision 8 onto the content unloading conveyor 14 under the own weight of the primary package 3 (see the lower view in Fig. 5). For example, if the incision 8 is formed at the upper side of the cardboard box 4, the primary taking-out control unit 110 controls the dual arm robot 10 to rotate the secondary package 5 by 180 degrees. Moreover, the primary taking-out control unit 110 controls the dual arm robot 10 to rotate (see an arrow C in Fig. 3) while holding the cardboard box 4 and carry the cardboard box 4 onto the cardboard unloading conveyor 15. After the cardboard box 4 is carried by the dual arm robot 10, the cardboard unloading conveyor 15 conveys the cardboard box 4 to the cardboard storage device 16 (see an arrow D in Fig. 3). The cardboard storage device 16 stores the cardboard box 4 conveyed by the cardboard unloading conveyor 15.

[0022] Fig. 6 is a view for explaining the function of the secondary taking-out control unit 120. As shown in Fig. 6, the secondary taking-out control unit 120 controls the dual arm robot 10 to come back to the content unloading conveyor 14 and take out the foodstuff 1 from the primary package 3. More specifically, the secondary taking-out

control unit 120 controls the dual arm robot 10 to grip the plastic bag 2 of the primary package 3 (see the left view in Fig. 6) and lift up the plastic bag 2 so that the foodstuff 1 can be taken out through the taking-out mouth 6 onto the content unloading conveyor 14 under the own weight of the foodstuff 1 (see the right view in Fig. 6).

[0023] In this regard, when the dual arm robot 10 grips the plastic bag 2 of the primary package 3, the secondary taking-out control unit 120 confirms the gripping position through the use of a sensor (not shown). After the foodstuff 1 is taken out onto the content unloading conveyor 14, the secondary taking-out control unit 120 controls the dual arm robot 10 to rotate (see an arrow C in Fig. 3) while gripping the plastic bag 2 and carry the plastic bag 2 onto the plastic bag recovery device 17.

[0024] When lifting up the plastic bag 2, the dual arm robot 10 may operate at a relatively low speed until the foodstuff 1 comes out from the plastic bag 2, so that the plastic bag 2 should not be torn by an operation impact. After the foodstuff 1 comes out from the plastic bag 2, the dual arm robot 10 may operate at a relatively high speed. In this connection, the secondary taking-out control unit 120 can use the sensitivity of a servo motor of the dual arm robot 10 to detect whether the foodstuff 1 has come out from the plastic bag 2. Instead of detecting whether the foodstuff 1 has come out from the plastic bag 2, the secondary taking-out control unit 120 may control the dual arm robot 10 to operate by a specified distance at a relatively low speed, and then the secondary taking-out control unit 120 may control the dual arm robot 10 to operate at a relatively high speed. In this regard, it is preferred that the specified distance be substantially equal to the length of the plastic bag 2.

[0025] The plastic bag recovery device 17 sends the plastic bag 2 to the plastic bag storage box 18 (see an arrow E in Fig. 3). The plastic bag storage box 18 stores the plastic bag 2 sent from the plastic bag recovery device 17. After the foodstuff 1 is taken out by the dual arm robot 10, the content unloading conveyor 14 conveys the foodstuff 1 to the next station (see an arrow F in Fig. 3).

[0026] In order to take out the contents (the foodstuff 1) from the secondary package 5 using the conventional unpacking devices disclosed in JP2002-002638A and JP2002-249116A, the secondary packing material (the cardboard box 4) and the primary packing material (the plastic bag 2) are simultaneously cut with an edged tool. In that case, however, it is highly likely that the scraps of the secondary packing material (the cardboard box 4) and the primary packing material (the plastic bag 2) are mixed in the contents.

[0027] On the other hand, with the unpacking device 100 and the unpacking method according to the present embodiment, the primary package 3 is first taken out from the secondary package 5 and then the contents (the foodstuff 1) are taken out without having to form an incision in the primary packing material (the plastic bag 2). This makes it difficult for the scraps of the primary packing material (plastic bag 2) and the secondary packing ma-

terial (the cardboard box 4) to be mixed in the contents (foodstuff 1). With the unpacking device 100 according to the present embodiment, the location where the incision is formed in the secondary packing material (the cardboard box 4) differs from the location where the primary package 3 is taken out and the location where the contents (the foodstuff 1) are taken out. This makes it particularly difficult for the scraps of the secondary packing material (the cardboard box 4) to be mixed in the contents (the foodstuff 1).

(First Modified Example)

[0028] In a first modified example of the above-described embodiment, description will be made on in instance where an operation for creating a grip margin is added to the unpacking device 100 of the above-described embodiment.

[0029] In this regard, the term "operation for creating a grip margin" means a preparatory grip operation of gripping a specified portion of the plastic bag 2, lifting up the plastic bag 2 and releasing the plastic bag 2.

[0030] Fig. 7 is a block diagram schematically showing an unpacking device 200 according to the first modified example. As shown in Fig. 7, the unpacking device 200 includes the dual arm robot 10, the primary taking-out control unit 110 and a secondary taking-out control unit 220. In the first modified example, the primary taking-out control unit 110 and the secondary taking-out control unit 220 serve as a control unit. The same components as those of the above-described embodiment will be designated by like reference symbols and redundant description thereof will be omitted.

[0031] Just like the secondary taking-out control unit 120 of the unpacking device 100 of the above-described embodiment, the secondary taking-out control unit 220 controls the dual arm robot 10 to take out the foodstuff 1 from the primary package 3. The secondary taking-out control unit 220 differs from the secondary taking-out control unit 120 in that the secondary taking-out control unit 220 has an operation for creating a grip margin. The secondary taking-out control unit 220 includes a preparatory grip operation control unit 221, an up-down operation control unit 222 and a main grip operation control unit 223.

[0032] Fig. 8 is a view for explaining the function of the preparatory grip operation control unit 221. The preparatory grip operation control unit 221 controls the dual arm robot 10 to grip a specified portion of the plastic bag 2 of the primary package 3 (see the left view in Fig. 8), lift up the primary package 3 by a specified displacement amount (see the central view in Fig. 8) and release the primary package 3 (see the right view in Fig. 8), prior to taking out the foodstuff 1 from the taking-out mouth 6.

[0033] Fig. 9 is a view for explaining the functions of the up-down operation control unit 222 and the main grip operation control unit 223. The up-down operation control unit 222 operates the dual arm robot 10 to move upward

or downward in a state that the dual arm robot 10 has released the primary package 3 under the control of the preparatory grip operation control unit 221. Thus the up-down operation control unit 222 shifts the position where the dual arm robot 10 grips the primary package 3 in a main grip operation (see the left view in Fig. 9). In the first modified example, the up-down operation control unit 222 operates the dual arm robot 10 to move upward by about 30 cm to 50 cm. The main grip operation control unit 223 causes the dual arm robot 10 to grip a specified portion of the primary package 3 or the vicinity of the specified portion (see the right view in Fig. 9).

[0034] In the control performed by the up-down operation control unit 222, the distance of upward movement or downward movement of the dual arm robot 10 and the number of the preparatory grip operations may be set by a user. For example, a screen for setting the position of the grip margin and the number of the preparatory grip operations may be displayed on a touch panel so as to receive the selection of "high", "middle" and "low" options and the number of the preparatory grip operations inputted by a user. Since the movement distance of the dual arm robot 10 controlled by the up-down operation control unit 222 may be zero, the secondary taking-out control unit 220 may be configured not to include the up-down operation control unit 222.

[0035] As described above, with the unpacking device 200 according to the first modified example, the dual arm robot 10 performs the operation of creating the grip margin, whereby the amount of the contents (the foodstuff 1) gripped during the main grip operation can be made smaller than the amount of the contents (the foodstuff 1) gripped during the preparatory grip operation. This makes it difficult for the contents (the foodstuff 1) to remain within the primary packing material (the plastic bag 2) when the dual arm robot 10 of the unpacking device 200 grips the primary packing material (the plastic bag 2) and takes out the contents (the foodstuff 1) without forming an incision in the primary packing material (the plastic bag 2).

(Second Modified Example)

[0036] In a second modified example of the above-described embodiment, description will be made on an unpacking device in which an articulated robot takes out a sealed plastic bag from a package formed of an incised cardboard box, grips the plastic bag, makes an incision in the plastic bag and takes out contents through the incision.

[0037] In the second modified example, just like the above-described embodiment, it is supposed that a foodstuff as a raw material is put into a snack food production line. The second modified example differs from the above-described embodiment in terms of the foodstuff packing state. In the above-described embodiment, a foodstuff 1 as contents is contained in the plastic bag 2 as the primary packing material. The primary package 3

is formed by folding the taking-out mouth 6. In the second modified example, a primary package 23 (not shown) is formed by putting a foodstuff 1 as contents into a plastic bag 22 (not shown) as a primary packing material in a sealed state. As in the above-described embodiment, a secondary package 25 (not shown) is formed by packing the primary package 23 with a cardboard box 4 as a secondary packing material.

[0038] The foodstuff packing state is substantially the same as the foodstuff packing state available in the embodiment shown in Figs. 1 and 2. The plastic bag 22 of the second modified example corresponds to the plastic bag 2 of the above-described embodiment. The plastic bag 22 of the second modified example differs from the plastic bag 2 of the above-described embodiment in that the mouth of the plastic bag 22 is closed by thermal welding. The primary package 23 of the second modified example corresponds to the primary package 3 of the above-described embodiment. While the contents are not sealed in the primary package 3 of the above-described embodiment, the contents are kept sealed in the primary package 23 of the second modified example. The secondary package 25 of the second modified example corresponds to the secondary package 5 of the above-described embodiment. While the primary package 23 is packed by the secondary package 25 of the second modified example, the primary package 3 is packed by the secondary package 5 of the above-described embodiment.

[0039] Fig. 10 is a block diagram schematically showing an unpacking device 300 according to the second modified example. As shown in Fig. 10, the unpacking device 300 includes the dual arm robot 10, the primary taking-out control unit 110 and a secondary taking-out control unit 320. In the second modified example, the primary taking-out control unit 110 and the secondary taking-out control unit 320 serve as a control unit. The same components as those of the above-described embodiment will be designated by like reference symbols and redundant description thereof will be omitted.

[0040] Just like the secondary taking-out control unit 120 of the unpacking device 100 of the above-described embodiment, the secondary taking-out control unit 320 controls the dual arm robot 10 to can take out the foodstuff 1 from the primary package 23. The secondary taking-out control unit 320 differs from the secondary taking-out control unit 120 in that the secondary taking-out control unit 320 controls the dual arm robot 10 to perform an incising operation for making an incision in the plastic bag. The secondary taking-out control unit 320 includes an incising operation control unit 324.

[0041] The incising operation control unit 324 controls the dual arm robot 10 to perform an incising operation in which the plastic bag 22 of the primary package 23 is gripped by one robot arm of the dual arm robot 10 and is incised by the other robot arm of the dual arm robot 10.

[0042] As described above, with the unpacking device 300 according to the second modified example, the dual

arm robot 10 first takes out the primary package 23 from the secondary package 25, then makes an incision in the primary packing material (the plastic bag 2) and then takes out the contents (the foodstuff 1) from the incision. This makes it difficult for the scraps of the primary packing material (the plastic bag 22) and the secondary packing material (the cardboard box 4) to be mixed in the contents (the foodstuff 1).

[0043] For example, if the contents are not so good for a human body, it is undesirable to manually perform an unpacking operation. The unpacking device 300 according to the second modified example is very useful in this situation. In case where the contents are not so good for a human body, the primary package 23 is formed by, e.g., putting the contents into the primary packing material (the plastic bag 22) in a sealed state as in the second modified example. For example, the secondary package 25 is formed by packing the primary package 23 with a secondary packing material stronger than the cardboard box 4. The secondary packing material stronger than the cardboard box 4 refers to a container, e.g., a drum can, which is not readily deformed even if a considerable external force is applied thereto. In case of a strong container such as a drum can or the like, however, it is difficult to form an incision by the cutting operation as applied to the cardboard box. For that reason, instead of the packing material cutting unit 12, a lid opening device for opening a lid of a container needs to be employed in the process layout of the above-described embodiment.

(Third Modified Example)

[0044] In a third modified example of the above-described embodiment, description will be made on an instance where an operation for creating a cutting margin is added to the unpacking device 300 of the second modified example. In this regard, the term "operation for creating a cutting margin" means a preparatory grip operation of gripping a specified portion of the plastic bag 2, lifting up the plastic bag 2 and releasing the plastic bag 2, just like the grip margin creating operation of the first modified example.

[0045] Fig. 11 is a block diagram schematically showing an unpacking device 400 according to the third modified example. As shown in Fig. 11, the unpacking device 400 includes a dual arm robot 10, a primary taking-out control unit 110 and a secondary taking-out control unit 420. In the third modified example, the primary taking-out control unit 110 and the secondary taking-out control unit 420 serve as a control unit. The same components as those of the above-described embodiment, the first modified example and the second modified example will be designated by like reference symbols and redundant description thereof will be omitted.

[0046] Just like the secondary taking-out control unit 320 of the unpacking device 300 of the second modified example, the secondary taking-out control unit 420 controls the dual arm robot 10 so that the dual arm robot 10

can take out the foodstuff 1 from the primary package 23. The secondary taking-out control unit 420 differs from the secondary taking-out control unit 320 in that the secondary taking-out control unit 420 has an operation for creating a cutting margin. The secondary taking-out control unit 420 includes a preparatory grip operation control unit 221, an operation pause control unit 421, an up-down operation control unit 222, a main grip operation control unit 223 and an incising operation control unit 324.

[0047] The operation pause control unit 421 controls the dual arm robot 10 so that the dual arm robot 10 can cease to operate for a specified time while gripping a specified portion of the plastic bag 22 under the control of the preparatory grip operation control unit 221. In the third modified example, the specified time is approximately several seconds or several tens of seconds.

[0048] The pause control for pausing the operation of the dual arm robot 10 for the specified time under the control of the operation pause control unit 421 is performed in anticipation of an effect that the contents having a relatively small particle size, such as flour or the like, are dropped downward so as to increase the cutting margin. The pause control may be applied to the first modified example. If the particle size of the contents is larger than a specified size, it is difficult to expect the pause control effect. This means that the operation pause control unit 421 is not an essential element.

[0049] As described above, with the unpacking device 400 according to the third modified example, the dual arm robot 10 performs the operation for creating the cutting margin. This makes it possible to restrain the contents (the foodstuff 1) from scattering when an incision is formed in the primary packing material (the plastic bag 22).

[0050] The unpacking devices 100, 200, 300 and 400 described above are capable of unpacking a package formed of a previously-incised cardboard box 4. If the package conveying unit 11, the packing material cutting unit 12 and the scrap removal unit 13 are added to the respective unpacking devices, it becomes possible to realize an unpacking device capable of unpacking a package formed of a cardboard box 4 having no incision (which corresponds to the area indicated by a broken line G in Fig. 3).

[0051] The present invention can find its application in all kinds of unpacking devices for unpacking a package and taking out contents. With the present invention, it is possible to perform an unpacking operation so that the scraps of a packing material should not be mixed in the contents. Therefore, the present invention is very high in industrial applicability.

[0052] While the invention has been shown and described with respect to the embodiments, it will be understood by those skilled in the art that various changes and modification may be made without departing from the scope of the invention as defined in the following claims.

Claims

- 1. An unpacking method for unpacking a package and taking out content (1) by a robot (10) having two arms, wherein the content (1) is packed with a primary packing material (2) to form a primary package (3), and the primary package (3) is packed with a secondary packing material (4) to form a secondary package (5),
characterized in that the unpacking method comprises:

holding the secondary packing material (4) with the two arms of the robot (10);
 taking out the primary package (3) through an incision of the secondary packing material (4) by the own weight of the primary package (3);
 carrying the secondary packing material (4) to a predetermined location by rotating the robot (10); and then,
 gripping the primary packing material (2) with the two arms of the robot (10);
 taking out the content (1) from the primary package (3) by the own weight of the content (1) by lifting up the primary packing material (2); and
 carrying the primary packing material (2) to another predetermined location by rotating the robot (10).

- 2. The method of claim 1, wherein the primary packing material (2) is a flexible bag.
- 3. The method of claim 2, wherein said gripping the primary packing material (2) with the two arms of the robot (10) comprises, prior to taking out the content (1), performing, by the robot (10), a preparatory grip operation of gripping a specified portion of the primary packing material (2), lifting up the primary package (3) by a specified displacement amount and releasing the primary packing material (2) and a main grip operation of gripping the specified portion or the vicinity of the specified portion.
- 4. The method of claim 3, wherein said gripping the primary packing material (2) with the two arms of the robot (10) further comprises performing an up-down operation between said releasing the primary packing material (2) and the main grip operation and, in the up-down operation, the robot (1) moves upward or downward so that position where the robot (10) grips the primary packing material (2) in the main grip operation is shifted.
- 5. The method of claim 1, wherein the primary packing material is a flexible bag and the content (1) is sealed within the primary packing material (2), and wherein the method further comprises gripping the primary packing material (2) and forming an incision

in the primary packing material (2) between said carrying the secondary packing material (4) and said gripping the primary packing material (2) with the two arms of the robot (10).

- 6. The method of claim 5, wherein the method further comprises, prior to forming the incision in the primary packing material (2) performing, by the robot (10), a preparatory grip operation of gripping a specified portion of the primary packing material (2), lifting up the primary package (3) by a specified displacement amount and releasing the primary packing material (2) and a main grip operation of gripping the specified portion or the vicinity of the specified portion.
- 7. The method of claim 6, wherein the method further comprises performing an up-down operation between said releasing the primary packing material (2) and the main grip operation and, in the up-down operation, the robot (10) moves upward or downward so that the position where the robot (10) grips the primary packing material (2) in the main grip operation is shifted.
- 8. The method of any one of claims 1 to 7, wherein the method further comprises stopping the robot (10) for a specified time while gripping the specified portion of the primary packing material (2) in the preparatory grip operation.
- 9. The method of any one of claims 1 to 8, further comprising:
 forming the incision in the secondary packing material (4) by cutting the secondary packing material (4) in a first location other than a second location where the primary package (3) is taken out by the robot (10) and other than a third location where the content (1) is taken out by the robot (10);
 conveying the secondary package (5) from the first location to the second location; and
 removing scraps generated while cutting the secondary package (5) in a location between the first location and the second location, other than the second location and the third location.
- 10. The method of any one of claims 1 to 9, wherein when lifting up the primary packing material (2), the robot (10) operates at a first speed until the content (1) comes out from the primary packing material (2), and after the content (1) comes out from the primary packing material (2), the robot (10) operates at a second speed which is greater than the first speed.
- 11. The method of any one of claims 1 to 10, wherein the primary packing material (2), a gripping position is confirmed through the use of a sensor.

12. The method of any one of claims 1 to 8, wherein the method further comprises forming the incision in the secondary packing material (4).
13. The method of any one of claims 5 to 7, wherein the content (1) is taken out from the primary package (3) through the incision of the primary packing material (2).

Patentansprüche

1. Auspackverfahren zum Auspacken einer Verpackung und Herausnehmen eines Inhalts (1) durch einen Roboter (10), der zwei Arme hat, wobei der Inhalt (1) mit einem Primärverpackungsmaterial (2) verpackt ist, um eine Primärverpackung (3) zu bilden, und die Primärverpackung (3) mit einem Sekundärverpackungsmaterial (4) verpackt ist, um eine Sekundärverpackung (5) zu bilden, **dadurch gekennzeichnet, dass** das Auspackverfahren aufweist:

Halten des Sekundärverpackungsmaterials (4) mit den beiden Armen des Roboters (10);
 Herausnehmen der Primärverpackung (3) über einen Einschnitt des Sekundärverpackungsmaterials (4) durch das Eigengewicht der Primärverpackung (3);
 Tragen des Sekundärverpackungsmaterials (4) an eine vorbestimmte Stelle durch Drehen des Roboters (10); und dann
 Greifen des Primärverpackungsmaterials (2) mit den beiden Armen des Roboters (10);
 Herausnehmen des Inhalts (1) aus der Primärverpackung (3) durch das Eigengewicht des Inhalts (1) durch Anheben des Primärverpackungsmaterials (2); und
 Tragen des Primärverpackungsmaterials (2) an eine andere vorbestimmte Stelle durch Drehen des Roboters (10).

2. Verfahren nach Anspruch 1, wobei das Primärverpackungsmaterial (2) ein flexibler Beutel ist.
3. Verfahren nach Anspruch 2, wobei das Greifen des Primärverpackungsmaterials (2) mit den beiden Armen des Roboters (10) vor dem Herausnehmen des Inhalts (1) das Durchführen eines vorbereitenden Greifvorgangs des Greifens eines bestimmten Abschnitts des Primärverpackungsmaterials (2), des Anhebens der Primärverpackung (3) um ein bestimmtes Verlagerungsmaß und des Freigebens des Primärverpackungsmaterials (2) durch den Roboter (10) und eines Hauptgreifvorgangs des Greifens des bestimmten Abschnitts oder der Umgebung des bestimmten Abschnitts aufweist.

4. Verfahren nach Anspruch 3, wobei das Greifen des Primärverpackungsmaterials (2) mit den beiden Armen des Roboters (10) ferner das Durchführen eines Auf-Ab-Vorgangs zwischen dem Freigeben des Primärverpackungsmaterials (2) und dem Hauptgreifvorgang aufweist, und bei dem Auf-Ab-Vorgang der Roboter (10) sich aufwärts oder abwärts bewegt, so dass die Position, wo der Roboter (10) das Primärverpackungsmaterial (2) bei dem Hauptgreifvorgang greift, verlagert wird.

5. Verfahren nach Anspruch 1, wobei das Primärverpackungsmaterial ein flexibler Beutel ist, und der Inhalt (1) innerhalb des Primärverpackungsmaterials (2) abgedichtet ist, und wobei das Verfahren ferner das Greifen des Primärverpackungsmaterials (2) und Bilden eines Einschnitts in dem Primärverpackungsmaterial (2) zwischen dem Tragen des Sekundärverpackungsmaterials (4) und dem Greifen des Primärverpackungsmaterials (2) mit den beiden Armen des Roboters (10) aufweist.

6. Verfahren nach Anspruch 5, wobei das Verfahren ferner vor dem Bilden des Einschnitts in dem Primärverpackungsmaterial (2) das Durchführen eines vorbereitenden Greifvorgangs des Greifens eines bestimmten Abschnitts des Primärverpackungsmaterials (2), des Anhebens der Primärverpackung (3) um ein bestimmtes Verlagerungsmaß und des Freigebens des Primärverpackungsmaterials (2) durch den Roboter (10) und eines Hauptgreifvorgangs des Greifens des bestimmten Abschnitts oder der Umgebung des bestimmten Abschnitts aufweist.

7. Verfahren nach Anspruch 6, wobei das Verfahren ferner das Durchführen eines Auf-Ab-Vorgangs zwischen dem Freigeben des Primärverpackungsmaterials (2) und dem Hauptgreifvorgang aufweist, und bei dem Auf-Ab-Vorgang der Roboter (10) sich aufwärts oder abwärts bewegt, so dass die Position, wo der Roboter (10) das Primärverpackungsmaterial (2) bei dem Hauptgreifvorgang greift, verlagert wird.

8. Verfahren nach einem der Ansprüche 1 bis 7, wobei das Verfahren ferner das Stoppen des Roboters (10) für eine bestimmte Zeit während des Greifens des bestimmten Abschnitts des Primärverpackungsmaterials (2) bei dem vorbereitenden Greifvorgang aufweist.

9. Verfahren nach einem der Ansprüche 1 bis 8, ferner aufweisend:

Bilden des Einschnitts in dem Sekundärverpackungsmaterial (4) durch Schneiden des Sekundärverpackungsmaterials (4) an einer ersten Stelle abweichend von einer zweiten Stelle, wo

- die Primärverpackung (3) durch den Roboter (10) herausgenommen wird, und abweichend von einer dritten Stelle, wo der Inhalt (1) durch den Roboter (10) herausgenommen wird; 5
Tragen der Sekundärverpackung (5) von der ersten Stelle an die zweite Stelle; und
Beseitigen von Abfällen, die während des Schneidens der Sekundärverpackung (5) erzeugt werden, an einer Stelle zwischen der ersten Stelle und der zweiten Stelle abweichend von der zweiten Stelle und der dritten Stelle. 10
10. Verfahren nach einem der Ansprüche 1 bis 9, wobei beim Anheben des Primärverpackungsmaterials (2) der Roboter (10) mit einer ersten Geschwindigkeit arbeitet, bis der Inhalt (1) aus dem Primärverpackungsmaterial (2) herausgelangt, und nachdem der Inhalt (1) aus dem Primärverpackungsmaterial (2) herausgelangt, der Roboter (10) mit einer zweiten Geschwindigkeit arbeitet, welche größer als die erste Geschwindigkeit ist. 15 20
11. Verfahren nach einem der Ansprüche 1 bis 10, wobei eine Greifposition des Primärverpackungsmaterials (2) durch die Verwendung eines Sensors bestätigt wird. 25
12. Verfahren nach einem der Ansprüche 1 bis 8, wobei das Verfahren ferner das Bilden des Einschnitts in dem Sekundärverpackungsmaterial (4) aufweist. 30
13. Verfahren nach einem der Ansprüche 5 bis 7, wobei der Inhalt (1) über den Einschnitt des Primärverpackungsmaterials (2) aus der Primärverpackung (3) herausgenommen wird. 35

Revendications

1. Procédé de déballage destiné à déballer un paquet et à en sortir le contenu (1) à l'aide d'un robot (10) qui présente deux bras, dans lequel le contenu (1) est emballé avec un matériau d'emballage primaire (2) de façon à former un paquet primaire (3), et le paquet primaire (3) est emballé avec un matériau d'emballage secondaire (4) de façon à former un paquet secondaire (5); 40
caractérisé en ce que le procédé de déballage comprend les étapes consistant à :
45
tenir le matériau d'emballage secondaire (4) avec les deux bras du robot (10);
sortir le paquet primaire (3) à travers une incision du matériau d'emballage secondaire (4) grâce au propre poids du paquet primaire (3); 50
transporter le matériau d'emballage secondaire (4) vers un emplacement prédéterminé en faisant tourner le robot (10); et ensuite : 55
2. Procédé selon la revendication 1, dans lequel le matériau d'emballage primaire (2) est un sac souple.
3. Procédé selon la revendication 2, dans lequel ladite saisie du matériau d'emballage primaire (2) avec les deux bras du robot (10) comprend, avant la sortie du contenu (1), l'exécution, par le robot (10), d'une opération de saisie préparatoire consistant à saisir une partie spécifiée du matériau d'emballage primaire (2), à lever le paquet primaire (3) d'une quantité de déplacement spécifiée, et à libérer le matériau d'emballage primaire (2), et une opération de saisie principale consistant à saisir la partie spécifiée ou une partie proche de la partie spécifiée.
4. Procédé selon la revendication 3, dans lequel ladite saisie du matériau d'emballage primaire (2) avec les deux bras du robot (10), comprend en outre l'exécution d'une opération de haut en bas entre ladite libération du matériau d'emballage primaire (2) et ladite opération de saisie principale et, dans l'opération de haut en bas, le robot (1) se déplace vers le haut ou vers le bas de telle sorte que la position où le robot (10) saisit le matériau d'emballage primaire (2) dans l'opération de saisie principale, soit décalée.
5. Procédé selon la revendication 1, dans lequel le matériau d'emballage primaire est un sac souple et le contenu (1) est scellé à l'intérieur du matériau d'emballage primaire (2); et dans lequel le procédé comprend en outre la saisie du matériau d'emballage primaire (2) et la réalisation d'une incision dans le matériau d'emballage primaire (2) entre ledit transport du matériau d'emballage secondaire (4) et ladite saisie du matériau d'emballage primaire (2) avec les deux bras du robot (10).
6. Procédé selon la revendication 5, dans lequel le procédé comprend en outre, avant la réalisation de l'incision dans le matériau d'emballage primaire (2), l'exécution, par le robot (10), d'une opération de saisie préparatoire consistant à saisir une partie spécifiée du matériau d'emballage primaire (2), à lever le paquet primaire (3) d'une quantité de déplacement spécifiée, et à libérer le matériau d'emballage primaire (2), et une opération de saisie principale consistant à saisir la partie spécifiée ou une partie proche de la partie spécifiée.

7. Procédé selon la revendication 6, dans lequel le procédé comprend en outre l'exécution d'une opération de montée-descente entre ladite libération du matériau d'emballage primaire (2) et ladite opération de saisie principale et, dans l'opération de haut en bas, le robot (10) se déplace vers le haut ou vers le bas de telle sorte que la position où le robot (10) saisit le matériau d'emballage primaire (2) dans l'opération de saisie principale, soit décalée.
8. Procédé selon l'une quelconque des revendications 1 à 7, dans lequel le procédé comprend en outre l'arrêt du robot (10) pendant une période de temps spécifiée tout en saisissant la partie spécifiée du matériau d'emballage primaire (2) dans l'opération de saisie préparatoire.
9. Procédé selon l'une quelconque des revendications 1 à 8, comprenant en outre les étapes consistant à :
- réaliser l'incision dans le matériau d'emballage secondaire (4) en découpant le matériau d'emballage secondaire (4) à un premier emplacement différent d'un deuxième emplacement où le paquet primaire (3) est sorti par le robot (10), et différent d'un troisième emplacement où le contenu (1) est sorti par le robot (10) ;
- acheminer le paquet secondaire (5) à partir du premier emplacement vers le deuxième emplacement ; et
- éliminer les débris générés lors de la découpe du paquet secondaire (5) à un emplacement situé entre le premier emplacement et le deuxième emplacement, différent du deuxième emplacement et du troisième emplacement.
10. Procédé selon l'une quelconque des revendications 1 à 9, dans lequel, lors du levage du matériau d'emballage primaire (2), le robot (10) fonctionne à une première vitesse jusqu'à ce que le contenu (1) sorte du matériau d'emballage primaire (2), et une fois que le contenu (1) est sorti du matériau d'emballage primaire (2), le robot (10) fonctionne à une seconde vitesse qui est supérieure à la première vitesse.
11. Procédé selon l'une quelconque des revendications 1 à 10, dans lequel la position de préhension du matériau d'emballage primaire (2) est confirmée grâce à l'utilisation d'un détecteur.
12. Procédé selon l'une quelconque des revendications 1 à 8, dans lequel le procédé comprend en outre la réalisation de l'incision dans le matériau d'emballage secondaire (4).
13. Procédé selon l'une quelconque des revendications 5 à 7, dans lequel le contenu (1) est sorti du paquet primaire (3) à travers l'incision du matériau d'emballage primaire (2).

FIG. 1

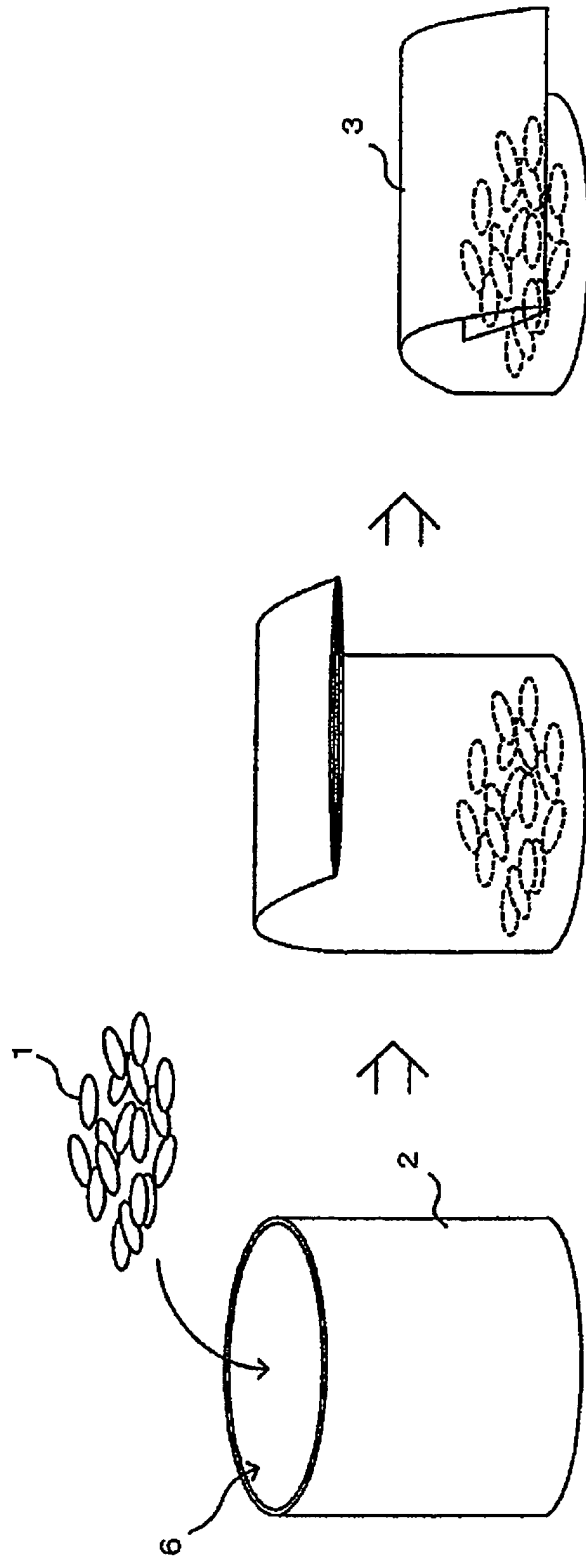


FIG. 2

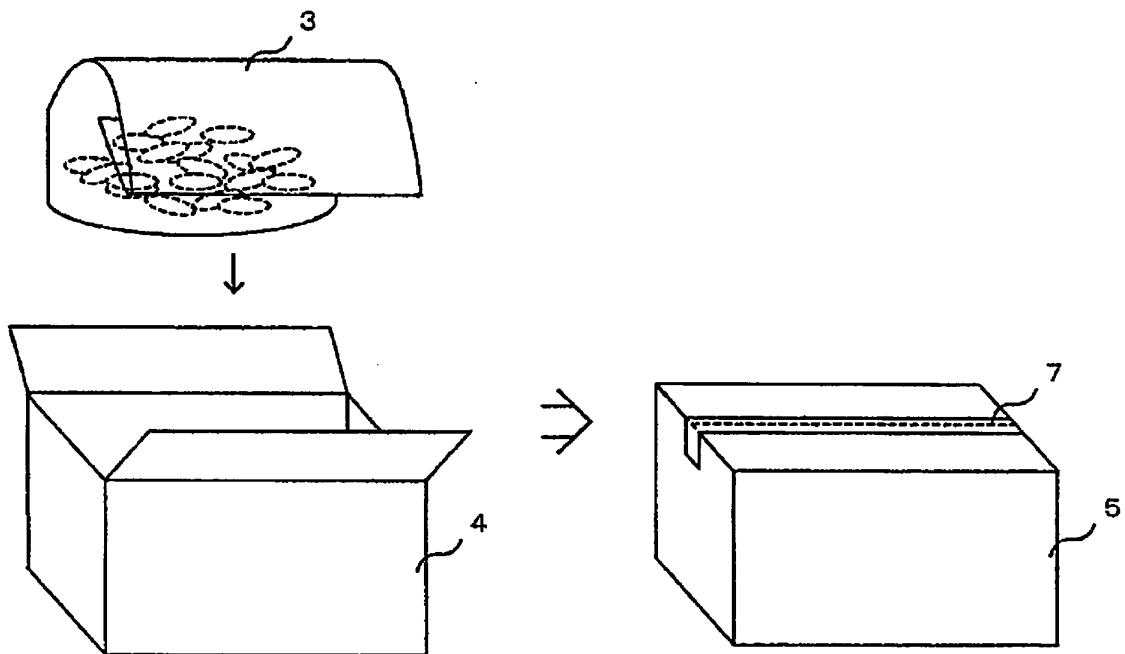


FIG. 3

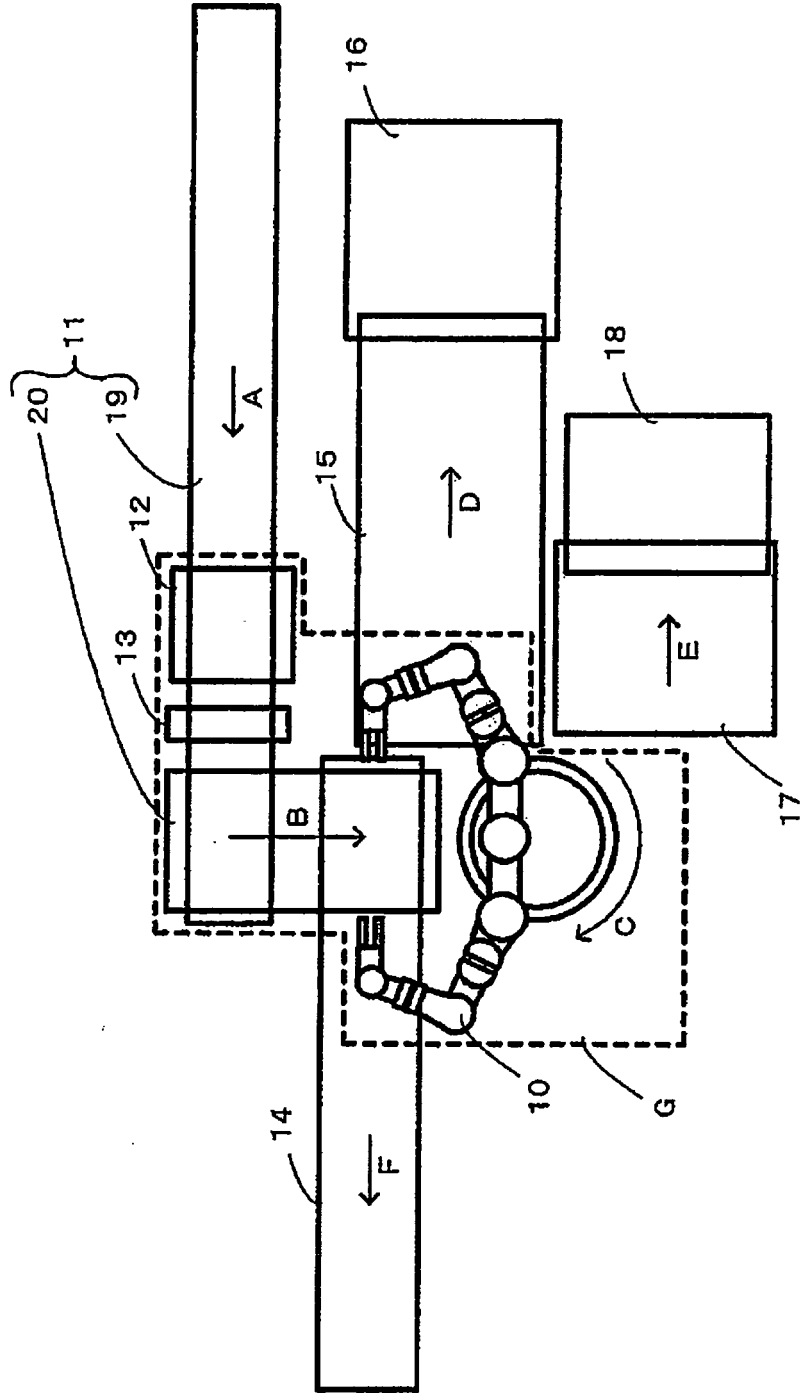


FIG. 4

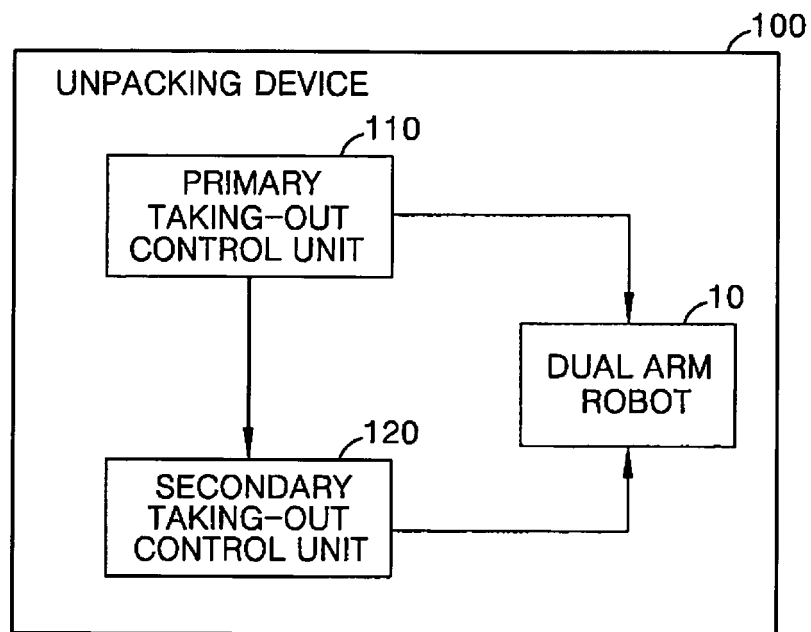


FIG. 5

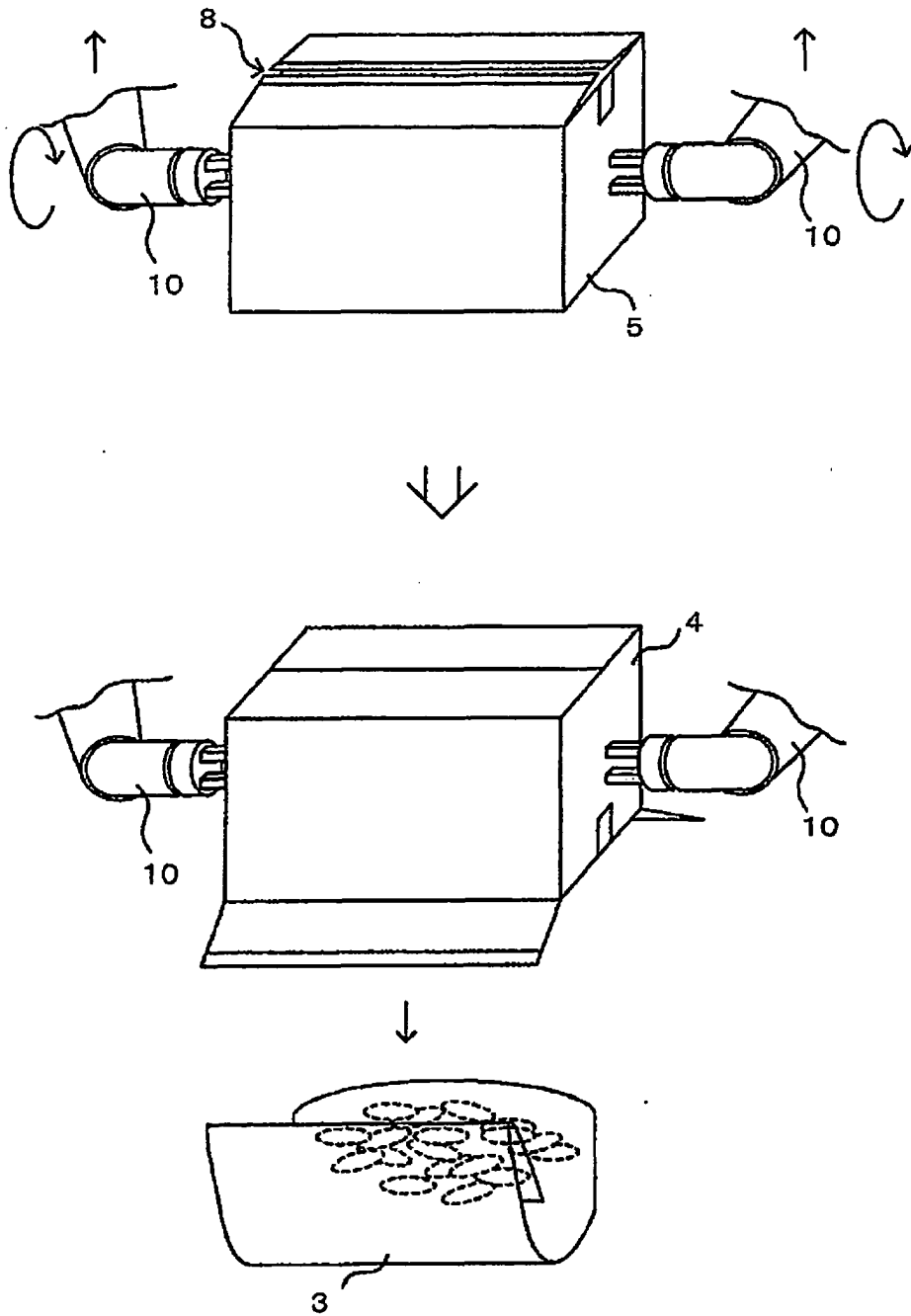


FIG. 6

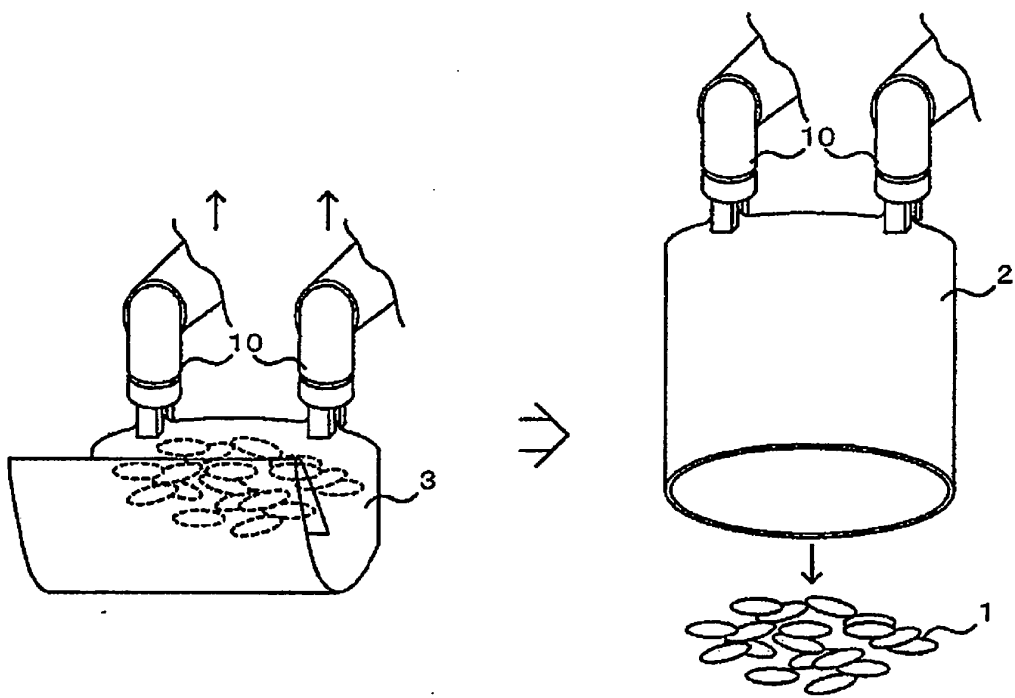


FIG. 7

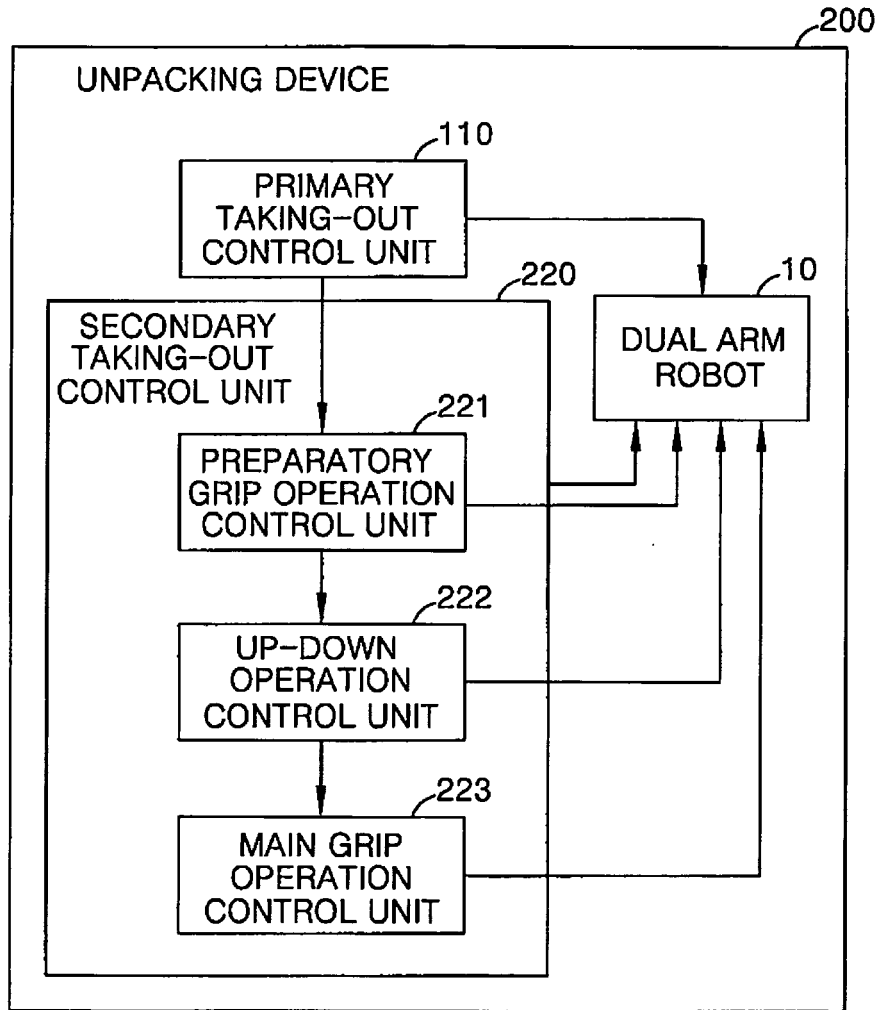


FIG. 8

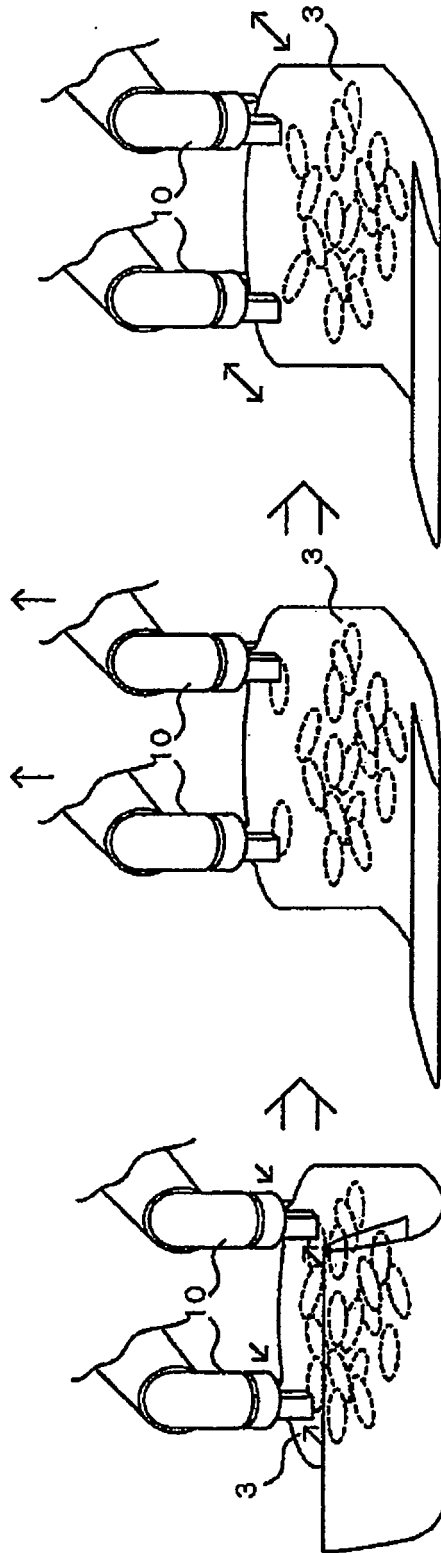


FIG. 9

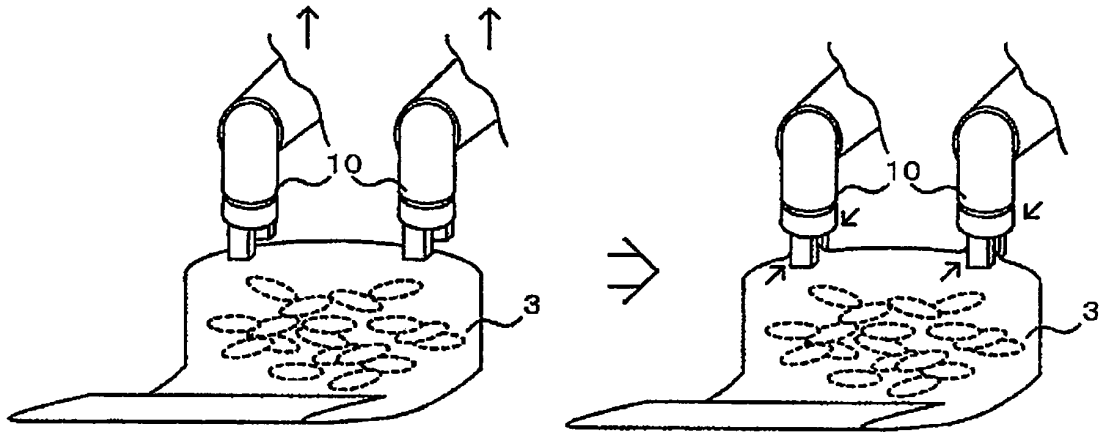


FIG. 10

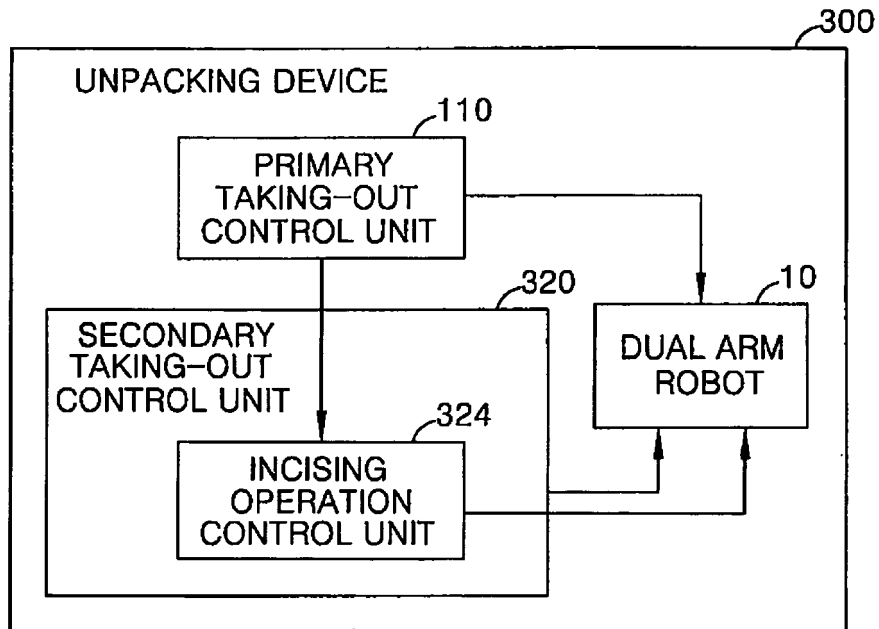
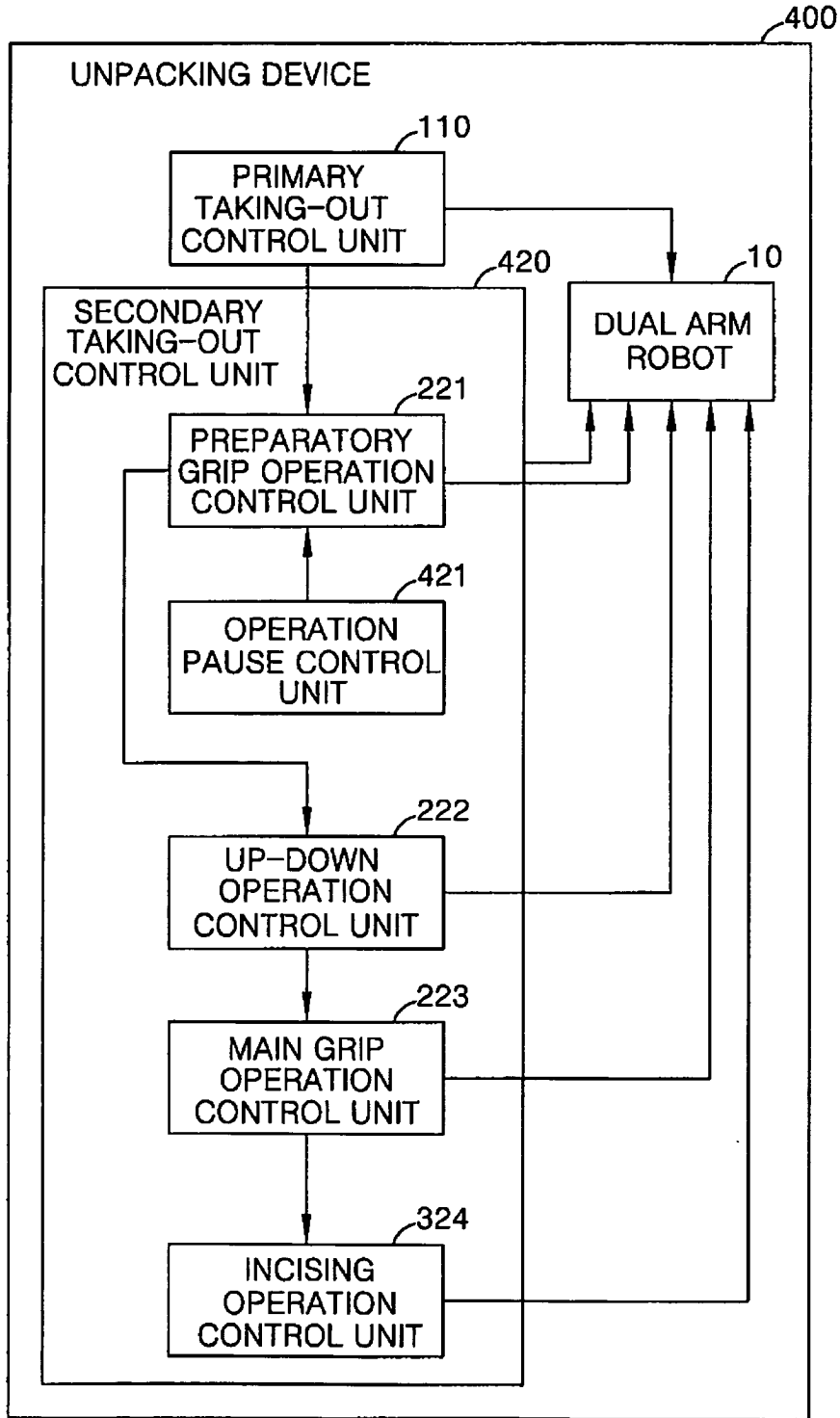


FIG. 11



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2002002638 A [0003] [0005] [0026]
- JP 2002249116 A [0003] [0026]
- JP 2005047571 A [0004]