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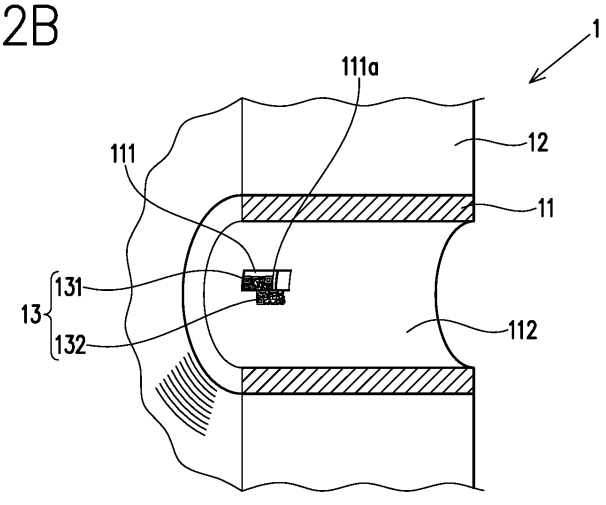
## (54) SHEET MATERIAL DEPLETION DETECTION MECHANISM, ROLL, AND ROLL PRODUCTION METHOD

(57) Provided is a sheet material end detection mechanism including: a sheet material information part indicating information on a sheet material wound around a core member in which a through hole is formed; a reader configured to optically read the sheet material information part; and a detection unit configured to detect that the sheet material is used up, wherein the sheet material information part is formed to extend from a portion corresponding to the through hole at an end of the sheet material wound around the core member to a portion adjacent to the through hole on an inner surface of the core member, and the detection unit is configured to detect that the sheet material is present when a read signal of the sheet material information part read by the reader is received and that the sheet material is used up when the read signal disappears, during the operation of withdrawing the sheet material.

Fig . 2B

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## Description

### CROSS-REFERENCE TO RELATED APPLICATION

**[0001]** This application claims priority to Japanese Patent Application No. 2015-080085, the disclosure of which is incorporated herein by reference in its entirety.

### FIELD

**[0002]** The present invention relates to a sheet material end detection mechanism used, for example, for a sheet-using device that withdraws a sheet material from a roll body for use, the roll body, and a method for producing the roll body.

### BACKGROUND

**[0003]** Examples of the sheet-using device include a medicine packaging device that obtains information on the sheet material and operates based on this information. The information on the sheet material is provided in a core member around which the sheet material is wound (see Patent Literature 1, for example).

**[0004]** Conventionally, in such a medicine packaging device, a configuration for detecting that the sheet material is used up is provided separately from the configuration for obtaining the information on the sheet material. Patent Literature 1 employs a mechanical configuration using a "paper end detection pin". In the case where such a mechanical configuration is separately provided, malfunction may possibly occur due to wear of parts or the like.

### CITATION LIST

#### Patent Literature

**[0005]** Patent Literature 1: JP 2009-227469 A

### SUMMARY

#### Technical Problem

**[0006]** It is therefore an object of the present invention to provide a sheet material end detection mechanism, a roll body, and a method for producing the roll body, which enable convenient detection of using up of the sheet material.

#### Solution to Problem

**[0007]** The present invention is a sheet material end detection mechanism including: a roll body constituted by winding a sheet material around a tubular core member; a holding unit configured to hold the roll body so as to allow the sheet material to be withdrawn; a sheet material information part provided in the roll body and indicating information on the sheet material; a reader configured to optically read the sheet material information part of the roll body held by the holding unit; and a detection unit configured to detect that the sheet material is used up based on results of the reading by the reader, wherein a through hole is formed in the core member to pass therethrough in an inward-outward direction, the sheet material information part is formed is formed to extend from a portion corresponding to the through hole at an end of the sheet material wound around the core member to a portion adjacent to the through hole on an inner surface of the core member, and the detection unit is configured to detect that the sheet material is present when a read signal of the sheet material information part read by the reader is received and that the sheet material is used up when the read signal disappears, during the withdrawing action to withdraw the sheet material from the roll body held by the holding unit.

**[0008]** Further, the present invention is a roll body including: a tubular core member; and a sheet material wound around the core member, wherein a through hole is formed in the core member to pass therethrough in an inward-outward direction, and a sheet material information part indicating information on the sheet material is formed to extend from a portion corresponding to the through hole at an end of the sheet material wound around the core member to a portion adjacent to the through hole on an inner surface of the core member.

**[0009]** Further, the through hole can have a smaller area than the sheet material information part.

**[0010]** Further, the present invention is a method for producing a roll body by winding a sheet material around a tubular core member, a through hole being formed in the core member to pass therethrough in an inward-outward direction, the method including: a step of winding the sheet material around the core member; and a step of forming a sheet material information part indicating information on the sheet material to extend from a portion corresponding to the through hole at an end of the sheet material wound around the core member to a portion adjacent to the through hole on an inner surface of the core member.

### BRIEF DESCRIPTION OF DRAWINGS

**[0011]**

Fig. 1 is a perspective view simply showing a mechanism for packaging medicine using a roll body according to an embodiment of the present invention.

Fig. 2A is a perspective view showing the appearance of a roll body according to an embodiment of the present invention.

Fig. 2B is an enlarged perspective view showing a main part of the radial cross section of a roll body according to an embodiment of the present invention.

Fig. 3 is a schematic perspective view showing the

relationship between a roll body according to an embodiment of the present invention and a holding unit of a medicine packaging device.

## DESCRIPTION OF EMBODIMENT

**[0012]** The present invention will be described below with reference to an embodiment. Fig. 1 is a view showing peripheral portions of a roll body 1 in a medicine packaging device including a packaging material end detection mechanism. The roll body 1 is constituted by winding a packaging material 12 that is an elongated sheet material around a core member 11. The medicine packaging device that is a sheet-using device is used by withdrawing the packaging material 12 from the roll body 1. The medicine packaging device is used for packaging solid medicine.

**[0013]** The medicine packaging device includes: a holding unit 2 configured to hold the roll body 1 so as to allow the packaging material 12 to be withdrawn; a hopper 4 configured to put medicine into the packaging material 12 withdrawn from the roll body 1 held by the holding unit 2; a sealing unit 5 configured to seal the medicine put into the packaging material 12 via the hopper 4 within the packaging material 12; and a control unit 7 configured to control the sealing unit 5.

**[0014]** As shown in Fig. 3, the holding unit 2 has a shaft 21. The shaft 21 is provided rotatably about the axis of the shaft 21. The core member 11 of the roll body 1 is externally fitted to the shaft 21 of the holding unit 2.

**[0015]** A half folding mechanism 3 is provided between the holding unit 2 and the hopper 4. The half folding mechanism 3 folds the packaging material 12 withdrawn from the roll body 1 in half in the width direction. As shown in Fig. 1, the hopper 4 is inserted into the half-folded portion of the packaging material 12.

**[0016]** The sealing unit 5 functions as an action unit that acts on the packaging material 12 withdrawn from the roll body 1 held by the holding unit 2. The sealing unit 5 seals medicine within the half-folded packaging material 12 by thermocompression bonding of the packaging material 12. That is, the action of the sealing unit 5 serving as the action unit is exerted onto the packaging material 12 and is sealing of the packaging material 12 by thermocompression bonding.

**[0017]** Fig. 2A and Fig. 2B are views for explaining the roll body 1, where Fig. 2A is a perspective view showing the appearance of the roll body 1, and Fig. 2B is a perspective view showing a main part of the radial cross section of the roll body 1. The roll body 1 includes the core member 11 and the packaging material 12 wound around the core member 11.

**[0018]** The core member 11 is tubular and is cylindrical in this embodiment. The core member 11 of this embodiment is made of resin. However, the material of the core member 11 is not limited to resin. The core member 11 can be formed using various materials as long as it can be formed to have a shape retention that allows the packaging material 12 to be wound therearound.

**[0019]** A through window 111 is formed in the core member 11. The through window 111 is a through hole passing through the core member 11 in a direction intersecting the axis of the core member 11. In this embodiment, the through window 111 is formed to pass through the core member 11 in the inward-outward direction, that is, in the radial direction of the core member 11. The through window 111 is, for example, rectangular, as viewed in the radial direction. However, the shape of the through window 111 is not limited to the rectangular shape, and can be various shapes such as circular and polygonal shapes. As shown in Fig. 2B, the through window 111 is formed in a portion close to one end in the axial direction of the core member 11.

**[0020]** It is desirable that the through window 111 be formed to be as small as possible as compared with the total area of the inner surface 112 of the core member 11 (see Fig. 2B). The influence of the through window 111 on the packaging material 12 can be reduced by reducing the area of the through window 111. Specifically, the occurrence of recesses in a portion corresponding to the through window 111 in the packaging material 12 wound around the core member 11 can be reduced by the degree of the reduction in area of the through window 111. Therefore, the occurrence of wrinkles or traces of the through window 111 in the packaging material 12 can be reduced.

**[0021]** In this embodiment, the through window 111 has a smaller area than a packaging material information part 13, which will be described below, serving as a sheet material information part. Thus, the influence of the through window 111 on the packaging material 12 can be reduced by reducing the area of the through window 111 to be smaller than the area of the packaging material information part 13.

**[0022]** In the roll body 1, the packaging material information part 13 indicating information on the packaging material 12 is formed. Examples of the information on the packaging material 12 include the type of the packaging material 12 (such as material and thickness). Further, examples of the information on the packaging material 12 include information on traceability, such as information on the production lot number and factory of the packaging material 12.

**[0023]** The packaging material information part 13 is optically readable. The light used for optically reading the packaging material information part 13 is not limited to visible light and may be infrared rays or ultraviolet rays, for example. The packaging material information part 13 is formed by printing.

**[0024]** The packaging material information part 13 physically (optically or visually) integrates a plurality of elements into one. The packaging material information part 13 indicates the information on the packaging material 12 by the entirety of the packaging material information part 13 (that is, a unit of the plurality of elements). In other words, the packaging material information part

13 cannot indicate the information on the packaging material 12 if a part of the packaging material information part 13 (that is, one or more of the plurality of elements) is missing. The packaging material information part 13 is formed by coding the information on the packaging material 12. In this embodiment, a two-dimensional code ("QR code" which is a registered trademark in Japan) is used as the packaging material information part 13. Accordingly, a general-purpose device can be used as the reader 6, which will be described below.

**[0025]** The packaging material information part 13 is formed to extend from a portion corresponding to the through window 111 at an end of the packaging material 12 wound around the core member 11 to a portion adjacent to the through window 111 on the inner surface 112 of the core member 11. More specifically, the packaging material information part 13 is constituted by a packaging material-side display 131 formed in the portion corresponding to the through window 111 at the end of the packaging material 12 wound around the core member 11, and a core member-side display 132 formed in the portion adjacent to the through window 111 on the inner surface 112 of the core member 11. In this embodiment, the packaging material information part 13 extends over an edge 111a of the through window 111 in the circumferential direction of the core member 11, as shown in Fig. 2B.

**[0026]** When producing the roll body 1, the packaging material 12 is first wound around the core member 11. Thereafter, the packaging material information part 13 is formed by printing. At this time, the packaging material information part 13 is formed to extend from the portion corresponding to the through window 111 at the end of the packaging material 12 wound around the core member 11 to the portion adjacent to the through window 111 on the inner surface 112 of the core member 11. That is, the packaging material information part 13 is formed to have parts separated from each other and being respectively formed in the portion of the packaging material 12 corresponding to the through window 111 and in the portion adjacent to the through window 111 on the inner surface 112 of the core member 11.

**[0027]** The method for producing the roll body 1 by these steps can facilitate the operation of winding the packaging material 12 around the core member 11. In the case where a part of the packaging material information part 13 is formed on the packaging material 12 in advance and the packaging material 12 is then wound around the core member 11, it is necessary to align the part of the packaging material information part 13 with the through window 111 of the core member 11. In contrast, the method for producing the roll body 1 of this embodiment does not need to align the part of the packaging material information part 13 with the through window 111 of the core member 11 and thus can facilitate the operation of winding the packaging material 12 around the core member 11.

**[0028]** Fig. 3 is a schematic perspective view showing the relationship between the roll body 1 and the holding unit 2. Though not shown in the figure, an engaged part is provided in the core member 11, and an engaging part configured to engage the engaged part of the core member 11 is provided in the shaft 21 of the holding unit 2. When the core member 11 of the roll body 1 is externally fitted to the shaft 21, the engaging part of the shaft 21 engages the engaged part of the core member 11. Accordingly, the core member 11 rotates together with the shaft 21.

**[0029]** The reader 6 configured to optically read the packaging material information part 13 of the roll body 1 held by the holding unit 2 is provided in the shaft 21 of the holding unit 2. The reader 6 is arranged inside the core member 11 of the roll body 1 held by the holding unit 2 and is provided so as to correspond to the packaging material information part 13 of the roll body 1.

**[0030]** The reader 6 is connected to a detection unit 8 configured to detect that the packaging material 12 is used up. In this embodiment, the control unit 7 and the detection unit 8 are integrally provided. However, there is no limitation to this configuration, and the control unit 7 and the detection unit 8 can be provided separately from each other.

**[0031]** The control unit 7 sets the temperature of thermocompression bonding by the sealing unit 5 based on the results of reading by the reader 6. Thereby, thermocompression bonding of the packaging material 12 can be performed at a temperature corresponding to the type of the packaging material 12. Further, the detection unit 8 detects that the packaging material 12 is used up based on the results of reading by the reader 6. Specifically, the detection unit 8 detects that the packaging material 12 is present when a read signal of the packaging material information part 13 read by the reader 6 is received during the withdrawing action to withdraw the packaging material 12 from the roll body 1 held by the holding unit 2. Further, the detection unit 8 is configured to detect that the packaging material 12 is used up when the read signal disappears.

**[0032]** When the roll body 1 is mounted on the holding unit 2, the reader 6 reads the packaging material information part 13 of the roll body 1. The control unit 7 sets the temperature of thermocompression bonding by the sealing unit 5 based on the results of reading by the reader 6. The packaging material 12 is withdrawn from the roll body 1 and is folded in half by the half folding mechanism 3 in the case where the half folding mechanism 3 is provided. Medicine is put into the half-folded portion of the packaging material 12 via the hopper 4. The medicine is sealed within the packaging material 12 by the sealing unit 5. At this time, the sealing unit 5 performs thermocompression bonding of the packaging material 12 at the temperature of thermocompression bonding set by the control unit 7. The medicine packaging device repeats the aforementioned operations of putting and sealing of the medicine while withdrawing the packaging material 12 from the roll body 1.

**[0033]** As the packaging material 12 is withdrawn from the roll body 1, the end of the packaging material 12 wound around the core member 11 is also withdrawn finally. Then, the packaging material-side display 131 is displaced from the position corresponding to the through window 111 of the core member 11. Therefore, the packaging material-side display 131 that is a part of the packaging material information part 13 is missing, and the reader 6 cannot read the packaging material information part 13 anymore. The detection unit 8 detects that the packaging material 12 is used up by the fact that the reader 6 cannot read the packaging material information part 13.

**[0034]** Thus, the packaging material end detection mechanism that is a sheet material end detection mechanism is constituted by the roll body 1, the holding part 2, the packaging material information part 13, the reader 6, and the detection part 8.

**[0035]** According to this embodiment as described above, the portions where the packaging material information part 13 is formed are the portion corresponding to the through window 111 at the end of the packaging material 12 wound around the core member 11 and the portion adjacent to the through window 111 on the inner surface 112 of the core member 11. The reader 6 is provided so as to correspond to the packaging material information part 13. Accordingly, the reader 6 can read the packaging material information part 13 until immediately before the packaging material 12 is used up. Then, the control unit 7 can suitably control the sealing part 5.

**[0036]** A part of the packaging material information part 13 is formed in the portion corresponding to the through window 111 at the end of the packaging material 12 wound around the core member 11. Therefore, as the packaging material 12 is withdrawn from the roll body 1, the end of the packaging material 12 wound around the core member 11 is also withdrawn finally. Then, the part of the packaging material information part 13 is displaced from the position corresponding to the through window 111 to be missing. Then, the reader 6 cannot read the packaging material information part 13 anymore.

**[0037]** Based on this point, the detection unit 8 is configured to detect that the packaging material 12 is present when a read signal of the packaging material information part 13 read by the reader 6 is received during the withdrawing action to withdraw the packaging material 12 from the roll body 1 held by the holding unit 2. Further, the detection unit 8 is configured to detect that the packaging material 12 is used up when the read signal disappears. Thus, the detection unit 8 can detect that the packaging material 12 is used up by the fact that the reader 6 cannot read the packaging material information part 13. Accordingly, there is no need to provide a mechanical configuration for detecting that the packaging material 12 is used up (such as the "paper end detection pin" according to Patent Literature 1). Therefore, parts where malfunction may possibly occur can be reduced, and therefore a packaging material end detection mechanism in which malfunction is less likely to occur can be provided.

**[0038]** Moreover, the packaging material information part 13 is formed to extend from the portion corresponding to the through window 111 at the end of the packaging material 12 wound around the core member 11 to the portion adjacent to the through window 111 on the inner surface 112 of the core member 11. Accordingly, the area of the through window 111 can be reduced regardless of the dimension of the packaging material information part 13, so that the influence of the through window 111 on the packaging material 12 can be reduced.

**[0039]** Hereinbefore, an embodiment of the present invention has been described. However, the present invention is not limited to the aforementioned embodiment, and various modifications can be made without departing from the gist of the present invention.

**[0040]** The roll body 1 may be constituted by winding the packaging material 12 that has been folded in half in advance around the core member 11. In this case, the half folding mechanism 3 provided between the holding unit 2 and the hopper 4 in the aforementioned embodiments is not needed.

**[0041]** As the packaging material information part 13, codes other than the two-dimensional code may be used. As the packaging material information part 13, a barcode (one-dimensional code) may be used, for example.

**[0042]** Various means can be employed as the packaging material information part 13 as long as it is optically readable. The packaging material information part 13 may include characters, graphics, or symbols as its components. The packaging material information part 13 may include colors as its components. The packaging material information part 13 may include projections and recesses as its components. Further, the packaging material information part 13 may be constituted by a plurality of elements that are physically (optically or visually) separated from each other.

**[0043]** As the method for forming the packaging material information part 13, methods other than printing may be used. As the method for forming the packaging material information part 13, various methods that do not fall within the concept of printing such as vapor deposition and etching can be employed as long as the methods allow the packaging material information part 13 that is optically readable to be formed. Further, as a method of printing, it is also possible, for example, to print the packaging material information part 13 on a seal formed separately from the core member 11 and the packaging material 12 and to attach the seal to the portion of the packaging material 12 corresponding to the through window 111 and the portion adjacent to the through window 111 on the inner surface 112 of the core member 11.

**[0044]** The packaging material 12 may have a packaging material body and a mounting part attached to the winding start portion of the packaging material body separately from the packaging material body. In this case, the packaging material-side display 131 that is a part of

the packaging material information part 13 is formed in the portion of the mounting part corresponding to the through window 111. As the packaging material 12 is withdrawn from the roll body 1, the mounting part is also withdrawn finally, and the packaging material-side display 131 formed in the mounting part is displaced from the position corresponding to the through window 111 of the core member 11.

**[0045]** As a part of the packaging material information part 13, the color of the portion adjacent to the through window 111 on the inner surface of the core member 11 also can be used. Further, as a part of the packaging material information part 13, the shape of the through window 111 of the core member 11 also can be used.

**[0046]** The medicine packaging device may further include a printing unit configured to print information on medicine that is sealed within the packaging material 12 onto the packaging material 12. The medicine packaging device also uses an ink ribbon that is another sheet material than the packaging material 12 of the aforementioned embodiments. The printing unit serves as an action unit that performs an action of "printing" associated with the ink ribbon. In this case, the ink ribbon is wound around another core member than the core member 11 of the aforementioned embodiments, and another roll body than the roll body 1 of the aforementioned embodiments is formed. Then, an ink ribbon end detection mechanism is formed as a sheet material end detection mechanism.

**[0047]** Finally, the configuration and action of the aforementioned embodiment (including the modifications) will be summarized. The aforementioned embodiment is a packaging material end detection mechanism including: a roll body 1 constituted by winding a packaging material 12 around a tubular core member 11; a holding unit 2 configured to hold the roll body 1 so as to allow the packaging material 12 to be withdrawn; a packaging material information part 13 provided in the roll body 1 and indicating information on the packaging material 12; a reader 6 configured to optically read the packaging material information part 13 of the roll body 1 held by the holding unit 2; and a detection unit 8 configured to detect that the packaging material 12 is used up based on results of the reading by the reader 6, wherein a through hole 111 is formed in the core member 11 to pass therethrough in an inward-outward direction, the packaging material information part 13 is formed to extend from a portion corresponding to the through hole 111 at an end of the packaging material 12 wound around the core member 11 to a portion adjacent to the through hole 111 on an inner surface 112 of the core member 11, and the detection unit 8 is configured to detect that the packaging material 12 is present when a read signal of the packaging material information part 13 read by the reader 6 is received and that the packaging material 12 is used up when the read signal disappears, during the withdrawing action to withdraw the packaging material 12 from the roll body 1 held by the holding unit 2.

**[0048]** According to the aforementioned configuration, the roll body 1 is constituted by winding the packaging material 12 around the tubular core member 11. The packaging material information part 13 indicating information on the packaging material 12 is formed in the roll body 1. The roll body 1 is held by the holding unit 2 so as to allow the packaging material 12 to be withdrawn. When the roll body 1 is held by the holding unit 2, the packaging material information part 13 of the roll body 1 is optically read by the reader 6. The through hole 111 is formed in the core member 11 to pass therethrough in the inward-outward direction. The portions where the packaging material information part 13 is formed are the portion corresponding to the through hole 111 at the end of the packaging material 12 wound around the core member 11 and the portion adjacent to the through hole 111 on the inner surface 112 of the core member 11. Accordingly, the reader 6 can read the packaging material information part 13 until immediately before the packaging material 12 is used up. A part of the packaging material information part 13 is formed in the portion corresponding to the through hole 111 at the end of the packaging material 12 wound around the core member 11. Therefore, as the packaging material 12 is withdrawn from the roll body 1, the end of the packaging material 12 wound around the core member 11 is also withdrawn finally. Then, the part of the packaging material information part 13 is displaced from the position corresponding to the through hole 111 to be missing, and the reader 6 cannot read the packaging material information part 13 anymore. Based on this point, the detection unit 8 is configured to detect that the packaging material 12 is present when a read signal of the packaging material information part 13 read by the reader 6 is received during the withdrawing action to withdraw the packaging material 12 from the roll body 1 held by the holding unit 2. Further, the detection unit 8 is configured to detect that the packaging material 12 is used up when the read signal disappears. Thus, the detection unit 8 can detect that the packaging material 12 is used up by the fact that the reader 6 cannot read the packaging material information part 13. According to Patent Literature 1, the detection is performed using a mechanical configuration by the "paper end detection pin", but the aforementioned configuration does not need to provide a mechanical configuration for detecting that the packaging material 12 is used up. Therefore, a packaging material end detection mechanism in which malfunction is less likely to occur can be given. Moreover, the packaging material information part 13 is formed to extend from the portion corresponding to the through hole 111 at the end of the packaging material 12 wound around the core member 11 to the portion adjacent to the through hole 111 on the inner surface 112 of the core member 11. Accordingly, the area of the through hole 111 can be reduced regardless of the dimension of the packaging material information part 13, so that the influence of the through hole 111 on the packaging material 12 can be reduced.

**[0049]** Further, the aforementioned embodiment is a roll body 1 including: a tubular core member 11; and a packaging material 12 wound around the core member 11, wherein a through hole 111 is formed in the core member 11 to pass therethrough in an inward-outward direction, and a packaging material information part 13 indicating information on the packaging material 12 is formed to extend from a portion corresponding to the through hole 111 at an end of the packaging material 12 wound around the core member 11 to a portion adjacent to the through hole 111 on an inner surface 112 of the core member 11.

**[0050]** According to the aforementioned configuration, the roll body 1 is constituted by winding the packaging material 12 around the tubular core member 11. The packaging material information part 13 indicating information on the packaging material 12 is formed in the roll body 1. The through hole 111 is formed in the core member 11 to pass therethrough in the inward-outward direction. The portions where the packaging material information part 13 is formed are the portion corresponding to the through hole 111 at the end of the packaging material 12 wound around the core member 11 and the portion adjacent to the through hole 111 on the inner surface 112 of the core member 11. Accordingly, the packaging material information part 13 can remain until immediately before the packaging material 12 is used up. A part of the packaging material information part 13 is formed in the portion corresponding to the through hole 111 at the end of the packaging material 12 wound around the core member 11. Therefore, as the packaging material 12 is withdrawn from the roll body 1, the end of the packaging material 12 wound around the core member 11 is also withdrawn finally. Then, the part of the packaging material information part 13 is displaced from the position corresponding to the through hole 111 to be missing. Accordingly, the packaging material information part 13 can be used also for detecting that the packaging material 12 is used up. Moreover, the sheet information display is formed to extend from the portion corresponding to the through hole 111 at the end of the packaging material 12 wound around the core member 11 to the portion adjacent to the through hole 111 on the inner surface 112 of the core member 11. Accordingly, the area of the through hole 111 can be reduced regardless of the dimension of the sheet information display, so that the influence of the through hole 111 on the packaging material 12 can be reduced.

**[0051]** Further, the through hole 111 can have a smaller area than the packaging material information part 13.

**[0052]** According to such a configuration, the influence of the through hole 111 on the packaging material 12 can be reduced by reducing the area of the through hole 111 to be smaller than the area of the packaging material information part 13.

**[0053]** Further, the aforementioned embodiment is a method for producing a roll body 1 by winding a packaging material 12 around a tubular core member 11, a through hole 111 being formed in the core member 11 to pass therethrough in an inward-outward direction, the method including: a step of winding the packaging material 12 around the core member 11; and a step of forming the packaging material information part 13 indicating information on the packaging material 12 to extend from a portion corresponding to the through hole 111 at an end of the packaging material 12 wound around the core member 11 to a portion adjacent to the through hole 111 on an inner surface 112 of the core member 11.

**[0054]** According to the aforementioned configuration, the through hole 111 is formed in the tubular core member 11 to pass therethrough in the inward-outward direction. When producing the roll body 1, the packaging material 12 is first wound around the core member 11. Thereafter, the packaging material information part 13 is formed to extend from the portion corresponding to the through hole 111 at the end of the packaging material 12 wound around the core member 11 to the portion adjacent to the through hole 111 on the inner surface 112 of the core member 11. Accordingly, the operation of winding the packaging material 12 around the core member 11 can be facilitated. In the case where a part of the packaging material information part 13 is formed in the packaging material 12 in advance and the packaging material 12 is then wound around the core member 11, there is a need to align the part of the packaging material information part 13 with the through hole 111 of the core member 11. In contrast, the method as in the present invention does not need to align the part of the packaging material information part 13 with the through hole 111 of the core member 11 and thus can facilitate the operation of winding the packaging material 12 around the core member 11.

**[0055]** As described above, the aforementioned embodiment can eliminate the need to provide a mechanical configuration for detecting the using up of the packaging material 12 and can give a packaging material end detection mechanism in which malfunction is less likely to occur. Therefore, it is possible to conveniently detect that the packaging material 12 is used up without using any mechanical configuration.

REFERENCE SIGNS LIST

**[0056]**

| | |
|---|---|
| 1 | Roll body |
| 11 | Core member |
| 111 | Through hole, Through window |
| 112 | Inner surface |
| 12 | Sheet material, Packaging material |
| 13 | Sheet material information part, Packaging material information part |
| 131 | Packaging material-side display |
| 132 | Core member-side display |
| 2 | Holding unit |
| 5 | Action unit, Sealing unit |

6 Reader
7 Control unit
8 Detection unit

## Claims

**1.** A sheet material end detection mechanism comprising:

a roll body constituted by winding a sheet material around a tubular core member;
a holding unit configured to hold the roll body so as to allow the sheet material to be withdrawn;
a sheet material information part provided in the roll body and indicating information on the sheet material;
a reader configured to optically read the sheet material information part of the roll body held by the holding unit; and
a detection unit configured to detect that the sheet material is used up based on results of the reading by the reader, wherein
a through hole is formed in the core member to pass therethrough in an inward-outward direction,
the sheet material information part is formed to extend from a portion corresponding to the through hole at an end of the sheet material wound around the core member to a portion adjacent to the through hole on an inner surface of the core member, and
the detection unit is configured to detect that the sheet material is present when a read signal of the sheet material information part read by the reader is received and that the sheet material is used up when the read signal disappears, during the withdrawing action to withdraw the sheet material from the roll body held by the holding unit.

**2.** A roll body comprising:

a tubular core member; and
a sheet material wound around the core member, wherein
a through hole is formed in the core member to pass therethrough in an inward-outward direction, and
a sheet material information part indicating information on the sheet material is formed to extend from a portion corresponding to the through hole at an end of the sheet material wound around the core member to a portion adjacent to the through hole on an inner surface of the core member.

**3.** The roll body according to claim 2, wherein
the through hole has a smaller area than the sheet material information part.

**4.** A method for producing a roll body by winding a sheet material around a tubular core member,
a through hole being formed in the core member to pass therethrough in an inward-outward direction, the method comprising:

a step of winding the sheet material around the core member; and
a step of forming a sheet material information part indicating information on the sheet material to extend from a portion corresponding to the through hole at an end of the sheet material wound around the core member to a portion adjacent to the through hole on an inner surface of the core member.

Fig. 1

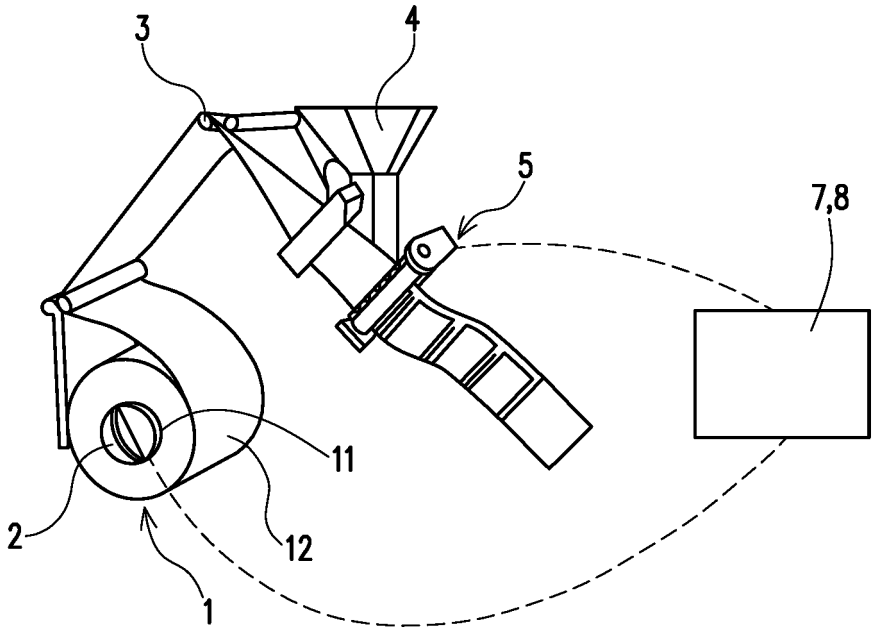


Fig. 2A

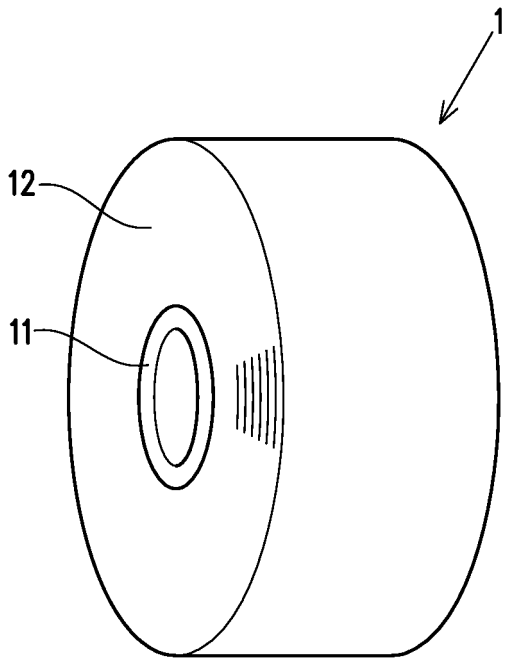



Fig. 2B

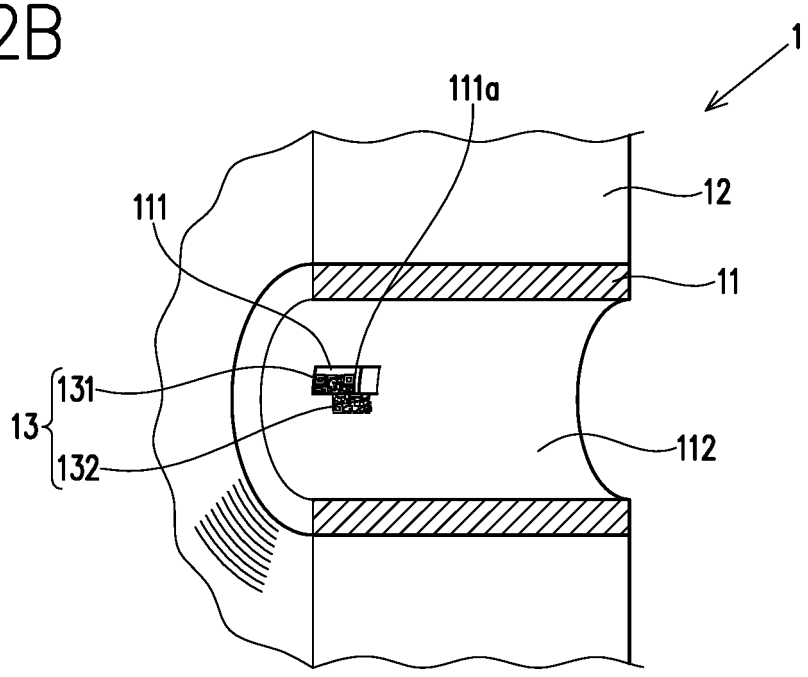
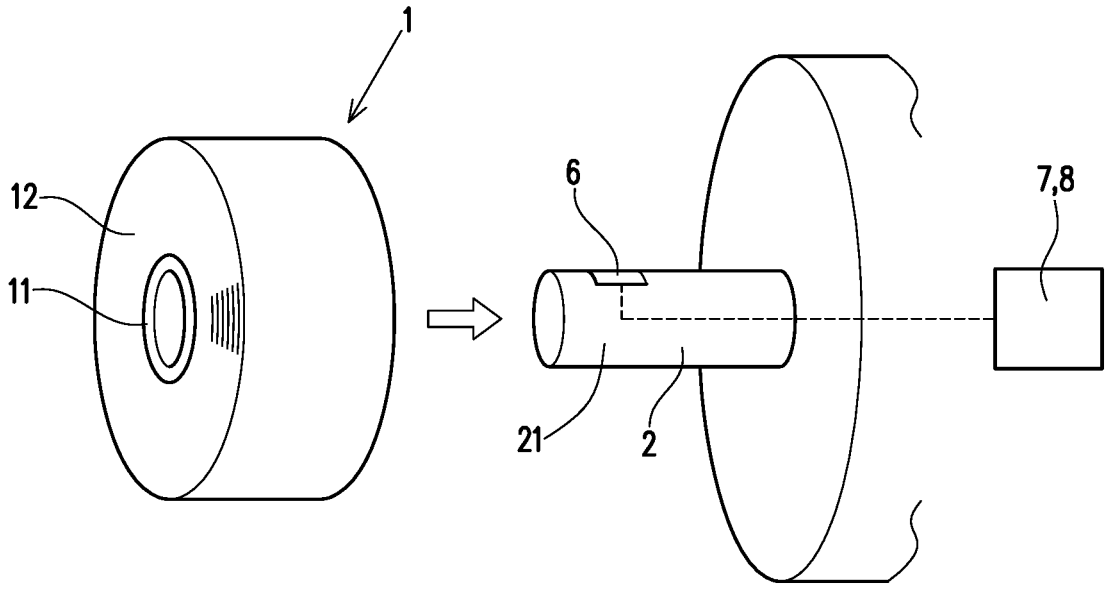


Fig . 3



**INTERNATIONAL SEARCH REPORT**

International application No.
PCT/JP2016/061351

A. CLASSIFICATION OF SUBJECT MATTER
*B65H26/06*(2006.01)i, *B65B41/00*(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65H26/06, B65B41/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2016
Kokai Jitsuyo Shinan Koho 1971-2016 Toroku Jitsuyo Shinan Koho 1994-2016

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | JP 2008-229896 A (Canon Inc.), 02 October 2008 (02.10.2008), paragraphs [0001], [0044] to [0052], [0147]; fig. 4 to 5 & US 2009/0324314 A1 paragraphs [0001], [0089] to [0103]; fig. 4 to 5 & WO 2008/114703 A2 & EP 2079592 A & KR 10-2009-0086270 A & CN 101578181 A & AT 539896 T | 1-4 |

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
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| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 20 April 2016 (20.04.16) | 10 May 2016 (10.05.16) |
| Name and mailing address of the ISA/<br>Japan Patent Office<br>3-4-3,Kasumigaseki,Chiyoda-ku,<br>Tokyo 100-8915,Japan | Authorized officer<br><br>Telephone No. |

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**INTERNATIONAL SEARCH REPORT**

International application No.
PCT/JP2016/061351

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 122399/1989(Laid-open No. 62878/1991) (Nippon Tsushinshi Co., Ltd.), 19 June 1991 (19.06.1991), page 2, lines 5 to 17; page 4, line 12 to page 5, line 18; page 8, lines 1 to 6; fig. 1 to 6 (Family: none) | 1-4 |
| A | JP 60-61283 A (Star Micronics Co., Ltd.), 09 April 1985 (09.04.1985), page 2, lower left column, line 11 to lower right column, line 2; fig. 8 to 9 & US 4612446 A column 3, line 60 to column 4, line 19; fig. 6 | 1-4 |
| A | JP 2004-237489 A (Kobayashi Kirokushi Co., Ltd.), 26 August 2004 (26.08.2004), paragraphs [0018] to [0022], [0034]; fig. 2, 7 (Family: none) | 1-4 |
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| A | JP 2013-145438 A (Kagoshima University), 25 July 2013 (25.07.2013), paragraph [0030]; fig. 24 (Family: none) | 1-4 |

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## REFERENCES CITED IN THE DESCRIPTION

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- JP 2009227469 A **[0005]**