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(54) **CAN CONTAINER**

(57) According to a first aspect of the present invention, there is provided a manufacturing method for a can container including forming a diameter-reduced portion with a die necking tool at one end of a can body whose surface is not formed with a varnish layer, wherein a coefficient of dynamic friction between the die necking tool and the can body is 0.30 or less. **In** addition, according to a second aspect of the present invention, there is provided a can container including a can trunk portion, a bottom portion provided on one end side of the can trunk portion, and a diameter-reduced portion having an outer diameter reduced at the other end side of the can trunk portion, wherein a varnish layer is not formed on an outer surface of at least the diameter-reduced portion.

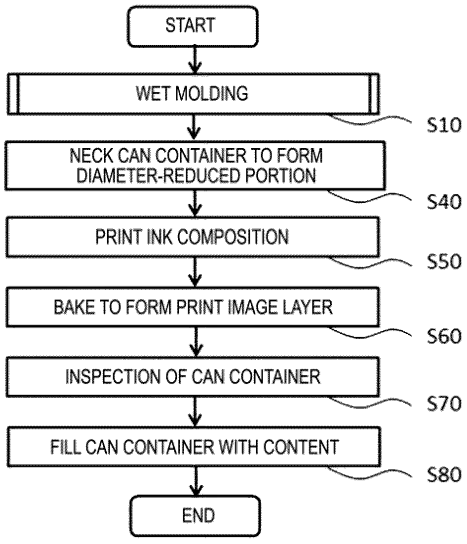

FIG. 9

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Description

Technical Field

[0001] The present invention relates to a can container.

Background Art

[0002] In a can container such as a beverage can, it is known that a surface of a can body is coated with varnish to prevent the can body from being scratched or metal powder from adhering to the can body.

[0003] Patent Document 1 describes that varnish is applied to a neck portion of a can body after drawing to reduce a frictional force between the can body and a die necking tool, thereby suppressing buckling of the can body and damage to a mold.

Citation List

Patent Literature

[0004] Patent Document 1: JP 2019-108138 A

General Disclosure

[0005] A manufacturing method for a can container is disclosed. The manufacturing method may include forming a diameter-reduced portion with a die necking tool at one end of a can body whose surface is not formed with a varnish layer. A coefficient of dynamic friction between the die necking tool and the can body may be 0.30 or less.

[0006] Any one of the above manufacturing methods may include forming a resin layer containing a thermoplastic resin on an outer surface of one end portion of the can body at which at least the diameter-reduced portion is formed, before forming the diameter-reduced portion.

[0007] In any one of the above manufacturing methods, the thermoplastic resin may be a polyester resin.

[0008] Any one of the above manufacturing methods may further include softening the resin layer by heating the can body in which the diameter-reduced portion is formed.

[0009] In any one of the manufacturing methods, a smooth diamond film may be formed on at least a part of a portion of any one of the die necking tools to come into contact with the can body.

[0010] Any one of the die necking tools may include a centering portion to be inserted into the can body and an insert portion to come into contact with the can body from the outside to form the can body. In any one of the die necking tools described above, a surface of at least one of the insert portion and the centering portion to come into contact with the can body may have the smooth diamond film.

[0011] Any one of the above manufacturing methods may include forming a bottom portion and a can trunk portion by drawing a metal plate.

[0012] Any one of the manufacturing methods may include forming a print image layer by printing an ink composition on a surface of the can body in which the diameter-reduced portion is formed.

[0013] A can container is provided. The can container may include a can trunk portion, a bottom portion provided on one end side of the can trunk portion, and a diameter-reduced portion having an outer diameter reduced at the other end side of the can trunk portion. In the can container, a varnish layer need not be formed on an outer surface of at least the diameter-reduced portion.

[0014] In any one of the can containers, a resin layer containing a thermoplastic resin may be formed on a metal base on an outer surface of the diameter-reduced portion.

[0015] In any one of the can containers, the thermoplastic resin may be a polyester resin.

[0016] In any one of the can containers, a print image layer may be formed on the resin layer.

[0017] In any one of the can containers, a print image layer may be directly formed on a metal base.

[0018] Note that the above summary of the invention does not enumerate all features of the present invention. In addition, sub-combinations of groups of these features can also be an invention.

Brief Description of Drawings

[0019]

FIG. 1 illustrates an example of a sketch of a can container before image printing in the present embodiment.

FIG. 2 illustrates an example of a sketch of the can container after image printing in the present embodiment.
FIG. 3 illustrates an example of an overall layer configuration of the can container in the present embodiment.
FIG. 4 illustrates an example of the overall layer configuration of the can container in the present embodiment.
FIG. 5 illustrates an example of the overall layer configuration of the can container in the present embodiment.
FIG. 6 illustrates an example of the overall layer configuration of the can container in the present embodiment.
FIG. 7 illustrates an example of the overall layer configuration of the can container in the present embodiment.
FIG. 8 illustrates an example of the overall layer configuration of the can container in the present embodiment.
FIG. 9 illustrates an example of a flow of a manufacturing method by wet molding for the can container of the present embodiment.
FIG. 10 illustrates an example of a flow of wet molding of S 10 in the present embodiment.
FIG. 11 illustrates an example of a component configuration of a die necking tool used in the present embodiment.
FIG. 12 illustrates an example of a flow of necking of S40 in the present embodiment.
FIG. 13 illustrates an example of a flow of a manufacturing method by dry molding for the can container of the present embodiment.
FIG. 14 illustrates an example of a flow of dry molding of S110 in the present embodiment.
FIG. 15 illustrates an example of a flow of forming a receiving layer in the present embodiment.
FIG. 16 illustrates an example of a flow of forming a base image layer in the present embodiment.

Description of Embodiments

[0020] Hereinafter, although the present invention will be described through embodiments of the present invention, the following embodiments do not limit the present invention according to the claims. In addition, not all combinations of features described in the embodiments are essential for the solution of the invention.

[0021] FIG. 1 illustrates an example of a sketch of a can container 50 before image printing in the present embodiment. The can container 50 according to an embodiment of the present invention can be necked while protecting a surface of the can container 50 even without applying varnish. The can container 50 includes a diameter-reduced portion 100 provided on one end side, a can trunk portion 200, and a bottom portion 250 provided on the other end side.

[0022] The diameter-reduced portion 100 is a portion where an outer diameter of one end of the can container 50 is reduced. The diameter-reduced portion 100 may be provided at an opening portion of the can container 50. By providing the diameter-reduced portion 100 in the can container 50, it is possible to reduce an amount of use of a can lid that is attached to the opening portion of the can container 50.

[0023] The diameter-reduced portion 100 may be formed by performing necking on the can container 50. The diameter-reduced portion 100 may be formed such that an outer diameter thereof gradually decreases toward one end of the can container 50. In addition, the diameter-reduced portion 100 may also have a flange 101 formed at the same time as the necking. The formed flange 101 allows a can lid to be attached.

[0024] The can trunk portion 200 occupies most of the can container 50 except for the diameter-reduced portion 100. The can trunk portion 200 may have a substantially constant outer diameter in a longitudinal direction of the can container 50. Since the can trunk portion 200 has a larger surface area of an outer peripheral surface than the diameter-reduced portion 100 and has the substantially constant outer diameter, the can trunk portion is suitable for performing printing on a surface of the can container 50.

[0025] The bottom portion 250 is a portion provided on the other end side of the can container 50. The bottom portion 250 is a portion that comes into contact with the ground when the can container 50 is made to stand by itself. The bottom portion 250 may have a constant outer diameter or may be reduced in diameter. A shape of the bottom portion 250 is not particularly limited.

[0026] FIG. 2 illustrates an example of a sketch of the can container 50 after image printing in the present embodiment. The can container 50 may include the diameter-reduced portion 100 provided on one end side, the can trunk portion 200, the bottom portion 250 provided on the other end side, and a print portion 300. The print portion 300 is a region printed using an ink composition on at least a part of the outer peripheral surface of the can container 50. The print portion 300 may be provided on the can trunk portion 200 of the can container 50. The print portion 300 may be provided on the diameter-reduced portion 100 of the can container 50 (not shown). The print portion 300 may be provided on the bottom portion 250 of the can container 50 (not shown).

[0027] FIG. 3 illustrates an example of an overall layer configuration of the can container 50 in the present embodiment. The can container 50 may include a can body 1 and a print image layer 3 as a layer structure in the entirety of the diameter-reduced portion 100, the can trunk portion 200, and the bottom portion 250.

[0028] The can body 1 is a main body of the can container 50 and houses most of the contents. The can body 1 is formed in a cylindrical shape and has an outer peripheral surface. The can body 1 may be either a seamless can or a welded can. A material of the can body 1 may be either aluminum or steel, but is not limited thereto.

[0029] The print image layer 3 is a layer of an image that expresses a character, a pattern, or the like on the outer

peripheral surface of the can container 50. The print image layer 3 may be directly formed on all or at least a part of an outer peripheral surface of a metal base of the can body 1. The print image layer 3 may constitute the print portion 300 in the can container 50. The print image layer 3 may be a layer where printing has been performed on all or at least a part of the can body 1 using an ink composition.

[0030] The print image layer 3 may be a layer where printing has been performed on the can container 50 by using an ink composition. The ink composition may be, but is not limited to, an aqueous ink, a solvent ink, an ultraviolet curable ink, or an electron beam curable ink. An image formed on the print image layer 3 may be a color image obtained using ink compositions of a plurality of colors. The image formed on the print image layer 3 may be a monochrome image obtained using an ink composition of one color.

[0031] For example, the print image layer 3 may be provided on the can body 1 by performing inkjet printing. As an example, the print image layer 3 is provided on the can body 1 by performing direct-type inkjet printing. As an example, the print image layer 3 is provided on the can body 1 by performing offset-type inkjet printing. The details of these ink jet printing methods will be described below.

[0032] The can container 50 of the embodiment illustrated in FIG. 3 is a minimum necessary configuration including the can body 1 and the print image layer 3. Usually, a varnish layer is formed between the can body 1 and the print image layer 3 so as to prevent buckling or scratch of the can body 1 during necking, but the can container 50 of the present embodiment does not have a varnish layer. Therefore, the can container 50 of the present embodiment can reduce the number of steps and cost for forming the varnish layer. In addition, since the can container 50 of the present embodiment is not formed with a varnish layer between the can body 1 and the print image layer 3, even when printing is performed on the can body 1 using an ink composition, the can container can have an image with excellent image quality without repelling the ink composition.

[0033] FIG. 4 illustrates an example of the overall layer configuration of the can container 50 in the present embodiment. The can container 50 may include the can body 1, the print image layer 3, and a varnish layer 2 as a layer structure. Unless otherwise specified, the above description may be applied, as it is, to the description of each layer.

[0034] In the present embodiment, the varnish layer 2 protects the print image layer 3 from an external impact or the like. The varnish layer 2 may be provided on at least one of the can trunk portion 200 and the bottom portion 250 of the can container 50. The varnish layer 2 may be provided on all or at least a part of the print image layer 3. The varnish layer 2 need not be provided on an outer surface of at least the diameter-reduced portion 100 of the can container 50.

[0035] A thickness of the varnish layer 2 may be 0.5 μm or greater and 15 μm or less. By the thickness of the varnish layer 2 being within the above range, it is possible to appropriately protect the print image layer 3.

[0036] The varnish layer 2 may have a resin component. The varnish layer 2 may be formed by applying and baking a solution in which a resin component is dissolved in an organic solvent. The solution in which the resin component is dissolved in the organic solvent may be applied to all or at least a part of an outer surface of the print image layer 3. The resin component of the varnish layer 2 may include a thermosetting acrylic-based resin, a thermosetting epoxy-based resin, or a thermosetting polyester-based resin. The baking may be performed by heat, air, ultraviolet radiation, or electron beam radiation.

[0037] By additionally providing the varnish layer 2 on the print image layer 3, the varnish layer 2 can protect the print image of the print image layer 3 from deterioration due to a physical impact, oxygen, moisture, or the like, and can improve durability. In addition, by the varnish layer 2 being provided, it is possible to prevent color transfer of the print image of the print image layer 3. Further, by the varnish layer 2 being provided, the surface of the can container 50 can be made smooth. In addition, since the can container 50 of the present embodiment is not formed with a varnish layer between the can body 1 and the print image layer 3, even when printing is performed on the can body 1 using an ink composition, the can container can have an image with excellent image quality without repelling the ink composition.

[0038] By the varnish layer 2 being provided, the print image of the print image layer 3 is appropriately protected, and thus the can container 50 of the embodiment illustrated in FIG. 4 can have improved durability. Further, the print image of the print image layer 3 is appropriately protected, so that the can container 50 of the embodiment illustrated in FIG. 4 can have an image of the print portion 300 with excellent image quality.

[0039] FIG. 5 illustrates another example of the overall layer configuration of the can container 50 in the present embodiment. The can container 50 may include the can body 1, a resin layer 8, and the print image layer 3.

[0040] The resin layer 8 has a role of improving slipperiness of the can container 50 to prevent the surface of the can container 50 from being scratched when the can container 50 is processed. The resin layer 8 may be provided on all or at least a part of the outer peripheral surface on the metal base of the can body 1. The resin layer 8 may be provided on all or a part of the outer surface of at least the diameter-reduced portion 100 of the can container 50. The print image layer 3 may be provided on all or at least a part of the resin layer 8. The print image layer 3 may be a layer where printing has been performed on all or at least a part of the resin layer 8 using an ink composition.

[0041] The resin contained in the resin layer 8 may include a thermoplastic resin. For example, the resin layer 8 may include a structure made of a polyester resin. For example, the resin layer 8 may include a structure derived from isophthalic acid. For example, the resin layer 8 may contain a polyester resin including a structure derived from isophthalic acid in a unit structure. In addition, the resin contained in the resin layer 8 may include a thermosetting acrylic-based resin,

a thermosetting epoxy-based resin, a thermosetting polyurethane-based resin, or a thermosetting polyester-based resin, instead of the thermoplastic resin. By the resin layer 8 including the above-described structure, the resin layer 8 has appropriate slipperiness and can exhibit characteristics excellent in strength of the resin layer 8 and adhesiveness to the can body 1.

[0042] A thickness of the resin layer 8 may be 0.5 μm or greater and 30 μm or less. By the thickness of the resin layer 8 being within the above-mentioned range, the slipperiness of the can container 50 is improved, making it possible to perform printing with excellent image quality. If the thickness of the resin layer 8 is less than 0.5 μm, it is difficult for the surface of the resin layer 8 to slip, and thus the can container 50 may be scratched when forming the diameter-reduced portion 100 in the can container 50 or metal powder may adhere to a mold for forming the diameter-reduced portion 100 of the can container 50. If the thickness of the resin layer 8 exceeds 30 μm, the resin adhesiveness after necking and after flanging may deteriorate.

[0043] A coefficient of dynamic friction of the surface of the resin layer 8 may be 0.30 or less. The coefficient of dynamic friction can be realized by the resin layer 8. In addition, the coefficient of dynamic friction of the surface of the resin layer 8 may be adjusted to be 0.30 or less by performing surface treatment such as atmospheric pressure plasma treatment or corona treatment on the resin layer 8 as necessary. If the coefficient of dynamic friction of the surface of the resin layer 8 exceeds 0.30, slipperiness with respect to a die necking tool may deteriorate during the necking, and a load during molding may be unevenly applied to a processed portion to cause buckling of the can trunk portion 200. In addition, if the coefficient of dynamic friction of the surface of the resin layer 8 exceeds 0.30, the slipperiness with respect to a conveyance guide or the adjacent can container 50 may deteriorate during conveyance of the can container, and clogging or poor flowing may occur in a production line of the can container 50 or a subsequent content filling line.

[0044] By providing the resin layer 8 on the can body 1, when forming the diameter-reduced portion 100 in the can container 50, it is possible to prevent the can container 50 from being scratched and metal powder from adhering to a mold for forming the diameter-reduced portion 100 of the can container 50. In addition, due to the softness and flexibility of the resin layer 8, an effect of excellent adhesiveness between the can body 1 and the print image layer 3 is obtained.

[0045] By the resin layer 8 being provided, to the can container 50 of the embodiment illustrated in FIG. 5 can prevent the can container 50 from being scratched when the diameter of the can container 50 is reduced and prevent metal powder from adhering to a mold for forming the diameter-reduced portion 100 of the can container 50. Usually, a varnish layer is formed on the can body 1 so as to prevent buckling or scratch of the can body 1 during necking. Therefore, when printing is performed on the can body 1 using an ink composition, the ink composition may be repelled. However, by the resin layer 8 being provided without a varnish layer, when printing is performed on the resin layer 8 using the ink composition, the ink composition is not repelled, and thus the can container 50 of the embodiment illustrated in FIG. 5 can have an image with excellent image quality.

[0046] FIG. 6 illustrates another example of the overall layer configuration of the can container 50 in the present embodiment. The can container 50 may include the can body 1, the resin layer 8, the print image layer 3, and the varnish layer 2.

[0047] The resin layer 8 has a role of improving slipperiness of the can container 50 to prevent the surface of the can container 50 from being scratched when the can container 50 is processed. The resin layer 8 may be provided on all or at least a part of the outer peripheral surface on the metal base of the can body 1. The resin layer 8 may be provided on all or a part of the outer surface of at least the diameter-reduced portion 100 of the can container 50. The print image layer 3 may be provided on all or at least a part of the resin layer 8.

[0048] The varnish layer 2 is a layer for protecting the print image layer 3 from an external impact or the like. The varnish layer 2 may be provided on all or at least a part of the print image layer 3. The varnish layer 2 need not be provided on the outer surface of at least the diameter-reduced portion 100 of the can container 50.

[0049] By the resin layer 8 being provided, the can container 50 of the embodiment illustrated in FIG. 6 can prevent the can container 50 from being scratched when the diameter of the can container 50 is reduced and prevent metal powder from adhering to a mold for forming the diameter-reduced portion 100 of the can container 50. In addition, by the varnish layer 2 being provided, the print image of the print image layer 3 is appropriately protected, and thus the can container 50 of the embodiment illustrated in FIG. 6 can have improved durability. Furthermore, by the resin layer 8 being provided, when printing is performed on the resin layer 8 using the ink composition, the ink composition is not repelled, and thus the can container 50 of the embodiment illustrated in FIG. 6 can have an image with excellent image quality.

[0050] FIG. 7 illustrates another example of the overall layer configuration of the can container 50 in the present embodiment. The can container 50 may include the can body 1, the resin layer 8, a receiving layer 7, and the print image layer 3.

[0051] The receiving layer 7 is a layer that receives the ink composition contained in the print image layer 3. For example, the receiving layer 7 may be a porous layer. The resin layer 8, the receiving layer 7, and the print image layer 3 may be provided on all or at least a part of the outer peripheral surface of the can container 50. The print image layer 3 may be provided on all or at least a part of the receiving layer 7. The resin layer 8 need not be provided in the can container 50.

[0052] When the receiving layer 7 is a porous layer, the ink composition may enter the receiving layer 7 when printing is

performed using the ink composition. Therefore, as illustrated in FIG. 7, the print image layer 3 does not necessarily need to be layered on the receiving layer 7.

[0053] A thickness of the receiving layer 7 may be 0.1 μm or greater and 50 μm or less. By the thickness of the receiving layer 7 being within the above range, it is possible to appropriately receive the ink composition contained in the print image layer 3.

[0054] The receiving layer 7 may be formed by applying and baking a solution in which a resin component is dissolved in an organic solvent. The solution in which the resin component is dissolved in the organic solvent may be applied to all or at least a part of the outer surface of the can body 1 or resin layer 8. The resin component of the receiving layer 7 may include a thermosetting acrylic-based resin, a thermosetting epoxy-based resin, a thermosetting polyurethane-based resin, or a thermosetting polyester-based resin. The baking may be performed by heat, air, ultraviolet radiation, or electron beam radiation.

[0055] By additionally providing the receiving layer 7 on all or at least a part of the can body 1 or resin layer 8, the receiving layer 7 firmly holds and fixes the print image layer 3 provided thereon, and the adhesiveness between the can body 1 and the print image layer 3 or between the resin layer 8 and the print image layer 3 can be enhanced. In addition, by the receiving layer 7 being provided, the can container 50 can have an image with more excellent image quality.

[0056] By the receiving layer 7 being provided, the can container 50 of the embodiment illustrated in FIG. 7 can have an image with more excellent image quality. In addition, since the resin layer 8 has appropriate slipperiness, the can container 50 of the embodiment illustrated in FIG. 7 can prevent the can container 50 from being scratched when the diameter of the can container 50 is reduced and prevent metal powder from adhering to a mold for forming the diameter-reduced portion 100 of the can container 50.

[0057] FIG. 8 illustrates another example of the overall layer configuration of the can container 50 in the present embodiment. The can container 50 may include the can body 1, the resin layer 8, a base image layer 6, and the print image layer 3.

[0058] The base image layer 6 has a role as a base for stacking the print image layer 3. The base image layer 6 may be a layer where a base is formed on all or at least a part of the can body 1 or resin layer 8 and printing is further performed on the base using an ink composition. The resin layer 8, the print image layer 3, and the base image layer 6 may be provided on all or at least a part of the outer peripheral surface of the can container 50. The resin layer 8 need not be provided in the can container 50.

[0059] The base may contain an acrylic-based resin, an epoxy-based resin, a polyurethane-based resin, a rosin-modified phenolic resin, a polyester resin, a petroleum resin, a ketone resin, a rosin-modified maleic acid resin, an amino resin, or a benzoguanamine resin. The print image layer 3 may be provided on all or at least a part of the base image layer 6.

[0060] The base of the base image layer 6 may be formed by applying and baking a solution in which a resin component is dissolved in an organic solvent. The solution in which the resin component is dissolved in the organic solvent may be applied to all or at least a part of the surface of the can body 1 or resin layer 8. The resin component of the base image layer 6 may include a thermosetting acrylic-based resin, a thermosetting epoxy-based resin, or a thermosetting polyurethane-based resin. The baking may be performed by heat, air, ultraviolet radiation, or electron beam radiation.

[0061] The print of the base image layer 6 may be provided by performing solid printing. The base image layer 6 may be provided by performing pattern printing. In printing for forming the base image layer 6, a single color such as white or transparent may be used for the ink composition. In printing for forming the base image layer 6, a plurality of colors may be used for the ink composition.

[0062] By additionally providing the base image layer 6 on the can body 1 or the resin layer 8, an effect that the image of the print image layer 3 becomes clearer is obtained. In addition, by providing the base image layer 6, it is possible to enhance the decorativeness of the can container 50 and the degree of freedom of printing.

[0063] By the base image layer 6 being provided, the can container 50 of the embodiment illustrated in FIG. 8 can have a clearer image of the print image layer 3. In addition, the can container 50 of the embodiment illustrated in FIG. 8 can superimpose the image of the base image layer 6 and the image of the print image layer 3, and thus can have improved decorativeness. In addition, since the resin layer 8 has appropriate slipperiness, the can container 50 of the embodiment illustrated in FIG. 8 can prevent the can container 50 from being scratched when the diameter of the can container 50 is reduced and prevent metal powder from adhering to a mold for forming the diameter-reduced portion 100 of the can container 50.

[0064] FIG. 9 is an example of a flow of manufacturing the can container 50 of the present embodiment by wet molding. The can container 50 according to the present embodiment can be manufactured by performing processing of S10 to S80 in FIG. 9. Note that, although the processing of S10 to S80 will be described in order for convenience of description, at least some processing may be executed in parallel, or each step may be interchanged and executed without departing from the gist of the present invention.

[0065] First, wet molding is performed on a metal plate in S10. In S10, the metal plate is punched into a cup shape, and a side wall is stretched to form a can trunk portion and a bottom portion. In S10, the wet molding includes steps from S11 to S16, as illustrated in FIG. 10.

[0066] FIG. 10 is a diagram illustrating S10 in the flow.

[0067] First, in S11, a step of an uncoiler is performed to unwind and stretch the metal plate wound in a coil shape. The metal may be, but is not limited to, aluminum or steel.

[0068] Next, in S12, a step of a lubricator is performed to apply a lubricant to the metal material. The lubricant may be a lubricating agent. As the lubricating agent, a known lubricating agent can be used.

[0069] Next, in S13, a step of a cupping press is performed to punch the metal material into a cup shape and form a material of a cup shape.

[0070] Next, in S14, a step of a body maker is performed to perform drawing on the material of the cup shape using a coolant, stretch the can trunk thinly, and perform molding of the bottom portion. The coolant may be a lubricating agent. As the lubricating agent, a known lubricating agent can be used.

[0071] Next, in S15, a step of a trimmer is performed to cut out an unnecessary portion from the material of the cup shape and adjust a height.

[0072] Next, in S16, a step of a washer is performed to wash and dry the material of the cup shape and remove the applied coolant or the like. The washed and dried material of the cup shape is referred to as a can body. After S16, processing proceeds to step of S40.

[0073] Note that, before proceeding to S40, a paint may be applied to an inner peripheral surface of the can body and baked. By performing coating of the paint on the inner peripheral surface of the can body, scratches are less likely to occur on the inner peripheral surface. As the paint, a known paint may be used. The paint may be applied using spray painting. The baking can be performed by a known method. For example, the baking may be performed by hot air drying. The step of coating the inner peripheral surface of the can body may be performed without being limited to being performed after S16 is completed.

[0074] Next, in S40, necking is performed on at least one end of the can body to form a diameter-reduced portion. The necking can be performed by a known method. For example, the necking may be performed by a method described in Japanese Patent No. 2748856 or Japanese Patent No. 2705571. The necking may be performed using a die necking tool. The die necking tool may be one described in JP 2018-070181 A.

[0075] FIG. 11 is a cross-sectional view illustrating an example of a component configuration of a die necking tool 40 used in the necking of the present embodiment. The die necking tool 400 includes an insert portion 410, a locating insert portion 420, an adapter portion 430, and a centering portion 440.

[0076] The insert portion 410 has a role as a main molding surface that comes into contact with the can body 1 from the outside of the can body 1 to mold the can body 1. The insert portion 410 has a shape in which a width between the insert portion and the centering portion 440 gradually decreases from a portion in contact with the locating insert portion 420 toward the adapter portion 430. The insert portion 410 includes at least an opening end portion 410a and a bent portion 410b on a surface thereof. The opening end portion 410a forms an opening end portion of the can body 1. The bent portion 410b forms a portion where an outer diameter of the can body 1 gradually decreases. During the necking, the can body 1 comes into contact with the opening end portion 410a and the bent portion 410b of the insert portion 410.

[0077] The locating insert portion 420 has a role centering the can body 1. The adapter portion 430 has a role as a knockout for taking out the can body 1 in which the necking has been performed to form the diameter-reduced portion 100. The centering portion 440 has a role as a core inserted into the can body 1. The centering portion 440 includes at least an opening end portion 440a on a surface. The opening end portion 440a forms an opening end portion of the can body 1. The can body 1 comes into contact with the opening end portion 440a of the centering portion 440 during the necking.

[0078] A smooth diamond film may be formed on all or at least a part of a portion of the die-necking tool 400, which comes into contact with the can body 1. For example, a smooth diamond film may be formed on a surface of at least one of the insert portion 410 and the centering portion 440, which comes into contact with the can body 1. As an example, at least one of the opening end portion 410a of the insert portion 410, the bent portion 410b, or the opening end portion 440a of the centering portion 440 is a smooth surface formed with diamond. By the smooth diamond film being formed on a portion of the die necking tool 400, which comes into contact with the can body 1, the necking can be performed without scratching the can body 1 even when varnish is not applied to the can body 1.

[0079] The diamond film may be formed on a base material of the die necking tool by a plasma CVD method or the like. The smoothness of the diamond film can be enhanced by polishing the surface by a mechanical or chemical method. The surface may be polished so that the surface roughness Ry (JIS B-0601-1994) of the diamond film is 0.4 μm or less, preferably 0.2 μm or less.

[0080] In addition, a coefficient of dynamic friction between the die necking tool 400 and the can body 1 may be 0.30 or less, preferably 0.15 or less. The above coefficient of dynamic friction can be realized by forming a smooth diamond film on all or at least a part of a portion of the die-necking tool 400, which comes into contact with the can body 1. By the coefficient of dynamic friction of between the die necking tool 400 and the can body 1 being 0.30 or less, it is possible to secure good slipperiness between the die necking tool 400 and the can body 1 and to perform the necking without scratching the can body 1, even when the varnish layer 2 is not formed on the surface of the can body 1.

[0081] If the coefficient of dynamic friction exceeds 0.30, the slipperiness between the die necking tool 400 and the can

body 1 may deteriorate during the necking, and a load during molding may be unevenly applied to a processed portion to cause buckling of the can trunk portion 200. In addition, if the coefficient of dynamic friction exceeds 0.30, the slipperiness with respect to a conveyance guide or the adjacent can body 1 may deteriorate during conveyance of the can body 1, and clogging or poor flowing may occur in a production line of the can body 1 or a subsequent content filling line. Note that, in addition to the die necking tool illustrated in FIG. 11, it is possible to use a die necking tool in which a smooth diamond film is formed on all or at least a part of a portion that comes into contact with the can body 1, and which satisfies the above coefficient of dynamic friction.

[0082] FIG. 12 is an example of a flow of necking using the die necking tool 400. First, the opening end of the can body is pushed between the insert portion 410 and the centering portion 440 of the die necking tool ((A) in FIG. 12). The opening end of the can body collides with the locating insert 420 and then the insert portion 410 and is bent ((B) in FIG. 12). Next, the opening end of the can body collides with the centering portion 440 ((C) in FIG. 12) and is bent back ((D) in FIG. 12), and finally the can body is formed with the diameter-reduced portion 100 ((E) in FIG. 12). Simultaneously with or after the necking, the flanging may be performed on the can body to form a flange 101 for attachment of a can lid ((E) in FIG. 12). The can body for which the necking has been performed is referred to as a can container.

[0083] The steps from S10 to S40 may be performed at a can manufacturing factory. After S40, the processing proceeds to step of S50.

[0084] Next, in the S50, the ink composition is printed on all or at least a part (e.g., the diameter-reduced portion 100, the can trunk portion 200, or the bottom portion 250) of the surface of the can container. The printing may be performed on the metal base of the can body. The printing may be performed by inkjet printing. The printing may be performed by plate offset printing. As an example, the inkjet printing may be performed by a method described in Japanese Patent No. 6314468.

[0085] The inkjet printing may be one in which an ink composition is directly ejected from an inkjet head provided in an inkjet printer to a can container. As an example, the inkjet printing may be direct-type inkjet printing in which an ink composition is directly ejected from an inkjet head provided in an inkjet printer to a can container. As an example, the inkjet printing may be offset-type inkjet printing in which an ink composition is ejected from an inkjet head provided in an inkjet printer to a blanket and an inkjet image formed on the blanket is transferred to a can container.

[0086] The ink composition used for the printing may be, but is not limited to, an aqueous ink, a solvent ink, an ultraviolet curable ink, or an electron beam curable ink. An image formed by the printing may be a color image obtained using ink compositions of a plurality of colors. The image formed by the printing may be a monochrome image obtained using an ink composition of one color.

[0087] When printing the ink composition on the can container, the ink composition may be printed while the can container is fixed to a can container holding member. As the can container holding member, a known can container holding member such as a star wheel can be used. For example, the can container may be fixed by a method described in Japanese Patent No. 6124024. For example, for fixing the can container, the bottom portion of the can container may be fixed to the can container holding member by chucking. As an example, for fixing the can container, the bottom portion of the can container may be fixed to the can container holding member by vacuum suction.

[0088] In order to stably fix the can container, a pressing member may be further provided, in addition to the can container holding member. By providing the pressing member, the can container can be fixed more stably. In addition, by providing the pressing member, it is possible to prevent the ink composition from entering the inside of the can container. The pressing member may be arranged at a position where the diameter-reduced portion or the opening portion of the can container is pressed. The pressing member may or may not cover the diameter-reduced portion. When the ink composition has high irritation or sensitization to the skin, by arranging the pressing member so as to cover the diameter-reduced portion, it is possible to prevent the ink composition from being applied to the diameter-reduced portion and to reduce the irritation or sensitization to the skin.

[0089] Next, in S60, baking is performed on the can container, for which the printing has been performed, to form a print image layer. By performing the baking, the print image is fixed on the can container. The baking may be performed by hot air drying. The baking may be performed by ultraviolet irradiation. The baking may be performed by electron beam irradiation.

[0090] Note that, after forming the print image layer, a varnish layer may be formed by applying varnish to all or at least a part of the can container for the purpose of protecting the print image layer. The varnish layer may be formed by applying and baking a solution in which a resin component is dissolved in an organic solvent. The resin component of the varnish layer may include a thermosetting acrylic-based resin, a thermosetting epoxy-based resin, or a thermosetting polyester-based resin. The baking may be performed by heat, air, ultraviolet radiation or electron beam radiation.

[0091] Next, in S70, the can container on which the print image layer has been formed is inspected. For example, the inspection may be to check whether there is not a recess, a hole, or the like on the outer peripheral surface or the inner peripheral surface of the can container. For example, the inspection may be to check whether the print image of the print image layer is clear. For example, the inspection may be to check whether there is not stain or defect on the outer peripheral surface of the can container.

[0092] Next, in S80, the can container for which the inspection has been performed is filled with a content. A can lid is attached to the can container filled with the content. Filling with the content and attachment of the can lid may be performed

by known methods. By performing the flow of FIG. 9, the can container 50 illustrated in the embodiment of FIG. 3 or 4 can be obtained.

[0093] The steps from S10 to S40 may be performed at a can manufacturing factory. The steps from S50 to S80 may be performed by a bottler. When the step S50 and subsequent steps are performed by the bottler, the can manufacturing factory performs the steps from S10 to S40 and stores a can container on which a print image layer is not formed.

[0094] In this case, even when there is a change in the print image of the print image layer, the bottler can print the changed image on the can container, and thus it is possible to reduce the number of can containers to be discarded. In addition, it is possible to perform a change of a design of the print image more agilely with a high degree of freedom. In addition, it is not necessary to store a wide variety of printed can containers at the can manufacturing factory, which is excellent in terms of storage cost and can meet needs for multi-item small lot production.

[0095] Note that the steps from S10 to S70 may be performed at the can manufacturing factory, and the step of S80 may be performed by the bottler. The pattern of sharing the steps between the can manufacturing factory and the bottler is not limited to the above.

[0096] Subsequently, modification examples of the present embodiment will be described. The can container may be manufactured by combining a plurality of configurations of at least some modification examples described below.

First Modification Example

[0097] FIG. 13 is another example of a flow of manufacturing the can container 50 of the present embodiment not by wet molding but by dry molding. The can container 50 according to the present embodiment can be manufactured by performing processing of S110 to S80 in FIG. 13. Note that, for convenience of description, the processing of S110 to S80 will be described in order; however, at least some processing may be executed in parallel, and each step may be interchanged and executed without departing from the gist of the present invention.

[0098] First, in S110, dry molding is performed on a metal coil material. In S110, the metal coil material is coated with a resin film and is punched into a cup shape, and a side wall is stretched to form a can trunk portion and a bottom portion. In S110, the dry molding includes steps from S11 to S15, as illustrated in FIG. 14.

[0099] FIG. 14 is a diagram illustrating S110 in the flow.

[0100] First, in S11, a step of an uncoiler is performed to unwind and stretch the metal coil material wound in a coil shape. The metal may be, but is not limited to, aluminum or steel.

[0101] Next, in S120, a resin film is laminated on both sides or one side of the metal to form a resin layer. For example, a laminator described in JP2004-25640 A may be used for laminating the resin film.

[0102] The resin contained in the resin film may include a thermoplastic resin. For example, the resin film may include a polyester resin. The resin contained in the resin film may include a thermosetting acrylic-based resin, a thermosetting epoxy-based resin, a thermosetting polyurethane-based resin, or a thermosetting polyester-based resin, instead of the thermoplastic resin. By coating the metal coil material with the resin film, the metal coil material has appropriate slipperiness, and even when varnish is not applied, the slipperiness of the can container can be improved to prevent the surface from being scratched during the necking. Further, since the necking can be performed even without applying varnish, the cost and the number of steps for manufacturing the can container can be reduced by eliminating the varnish.

[0103] After the resin film is laminated to form the resin layer, the processing may proceed to the step of S13. In addition, before proceeding to the step of S13, a lubricant may be applied to the outer surface as necessary. For the step S13 and subsequent steps, the same steps as the steps of the wet molding in FIG. 9 may be applied. The can body for which the dry molding has been performed is referred to as a can container.

[0104] After finishing S110, the processing may proceed to the step of S40. In the step of S40, the necking may be performed on the outer surface of the can container, on which at least the resin layer has been formed, to form a diameter-reduced portion. At this time, the resin layer covers at least the diameter-reduced portion and protects the can container from the necking tool. The necking may be performed using a known die necking tool. By providing the can container with the resin layer, the coefficient of dynamic friction between the die necking tool and the resin layer can be controlled to 0.30 or less even when necking is performed using a known die necking tool.

[0105] The necking may be performed using a die necking tool on which the diamond film is formed. By using the die necking tool on which the diamond film is formed, the coefficient of dynamic friction can be adjusted to a smaller value.

[0106] The coefficient of dynamic friction between the die necking tool and the resin layer may be 0.30 or less. By the coefficient of dynamic friction between the die necking tool and the resin layer being 0.30 or less, the necking can be performed without scratching the can container even when a varnish layer is not formed on the surface of the resin layer. Simultaneously with or after the necking, the flanging may be performed on the can body to form a flange for attachment of a can lid.

[0107] The necking may be performed on the can container to form a diameter-reduced portion in S40, and then the processing may proceed to the step of S401.

[0108] In S401, the can container is heated to soften the resin layer. Even in a case where irregularities, scratches, or the

like are formed on the resin layer by the necking, the resin contained in the resin layer is softened by heating the can container, and thus an effect of at least partially repairing or reducing irregularities or scratches formed on the surface of the can container is obtained. Preferably, this heating treatment is generally performed within a temperature range of Tg + 50°C or higher, particularly Tg + 100°C to melting point (Tm) - 5°C, based on glass transition point (Tg) of the resin coating layer. The required heating treatment time is sufficient in a short time, and specifically, it is preferable to perform the heating treatment for 1 minute to 10 minutes. After performing the heating, the processing may proceed to the step of S50. Note that the step of S401 may be skipped and after S40, the processing may proceed to S50 without heating the can container.

[0109] By forming the resin layer on the metal base of the metal coil material, even when varnish is not applied during the necking, the slipperiness of the can container can be improved to prevent the surface from being scratched during the necking of the can container. Further, since the necking can be performed even without applying varnish, the cost for manufacturing the can container can be reduced by eliminating the varnish. By performing the flow of FIG. 13, the can container 50 illustrated in the embodiment of FIG. 5 can be obtained. Note that, after forming the print image layer, a varnish layer may be formed by applying varnish to all or at least a part of the can container for the purpose of protecting the print image layer. In this case, the can container 50 illustrated in the embodiment of FIG. 6 can be obtained.

Second Modification Example

[0110] Although the case where the receiving layer is not formed has been described in the present embodiment, FIG. 15 illustrates a step of forming the receiving layer on all or at least a part of the outer peripheral surface of the can container after performing S40 or S401, before proceeding to the step of S50. The receiving layer may be formed on all or at least a part of the can container.

[0111] In S421, the solution in which the resin component is dissolved in the organic solvent is applied onto all or at least a part of the outer surface of the resin layer.

[0112] Next, in S422, the receiving layer may be formed by performing hot air drying, ultraviolet irradiation, electron beam irradiation, or the like on the can container to which the resin component has been applied. The resin component of the receiving layer may include a thermosetting acrylic-based resin, a thermosetting epoxy-based resin, a thermosetting polyurethane-based resin, or a thermosetting polyester-based resin. The thickness of the receiving layer may be 0.1 μm or greater and 50 μm or less. By additionally performing the steps of S421 and S422, the can container 50 illustrated in the embodiment of FIG. 7 can be obtained. For the can container on which the receiving layer has been formed, the processing proceeds to the step of S60.

[0113] By the receiving layer being provided on the can container, it is possible to have an image with more excellent image quality. By the receiving layer being provided on the can container, it is possible to enhance adhesiveness between the ink and the receiving layer, and to have an image of the print image layer with more excellent image quality.

Third Modification Example

[0114] Although the case where the base image layer is not formed has been described in the present embodiment, FIG. 16 illustrates a step of forming the base image layer on all or at least a part of the outer peripheral surface of the can after performing S40 or S401, before proceeding to the step of S50.

[0115] In S411, the solution in which the resin component is dissolved in the organic solvent may be applied to all or at least a part of the outer peripheral surface of the can container. The resin component of the base image layer may include a thermosetting acrylic-based resin, a thermosetting epoxy-based resin, or a thermosetting polyurethane-based resin. The base image layer may be formed on at least a portion of the can container, which is subsequently reduced in diameter. The baking is performed on the applied resin component to form a base. The baking can be performed by a known method.

[0116] Next, in S412, the printing is performed on the base using the ink composition. The printing may be solid printing. The printing may be pattern printing. The pattern may be a stripe pattern. The pattern may be a gradation pattern. The color of the print may be colorless and transparent. The color of the print may be white. The color of print may be a single color other than white, or may be a plurality of colors.

[0117] Next, in S413, by the printed ink composition being baked, the base image layer is formed. The baking can be performed by a known method. By additionally performing the steps of S411 and S413, the can container 50 illustrated in the embodiment of FIG. 8 can be obtained. After forming the base image layer, the processing proceeds to the S50 step.

[0118] By the base image layer being provided on the can container, the print portion of the can container can have a clearer image. In addition, by the base image layer being provided on the can container, the image of the base image layer and the image of the print image layer can be superimposed, and thus the can container can have improved decorativeness.

Examples

[0119] Hereinafter, a method and a result of an experiment for confirming a relationship between the coefficient of dynamic friction between the can body or the resin layer and the die necking tool and the scratch after necking will be specifically described. Note that the experiment methods described below are merely examples, and the experiment methods are not limited to the examples.

Example 1

[Manufacturing of Can Body]

[0120] The dry molding was performed on an aluminum coil material (plate thickness: 0.24 mm) by the step of S110 (from S11 to S15) in FIG. 13 to manufacture a can body. The can body was a seamless can. The height of the can body was the 120 mm. No resin layer was formed.

[Necking]

[0121] The necking was performed on the can body, for which the dry molding has been performed, using a die necking tool. The die necking tool used had a smooth diamond film formed on the surfaces of both the insert portion and the centering portion, which come into contact with the can body. The surface polishing was performed so that the surface roughness Ry (JIS B-0601-1994) of the diamond film was 0.1 μm. The thickness of the diamond film was 12.5 μm.

[Measurement of Coefficient of Dynamic Friction]

[0122] The coefficient of dynamic friction between the can body and the die necking tool was instead measured by a rotational friction test using a pin-on-disk because direct measurement using the can and the tool was difficult. As the pin, a pin (diamond pin) obtained by forming a diamond film on a cemented carbide pin, which is a die necking tool material, was used. An aluminum material (A3104) was used as the disk.

<Sliding Characteristics>

[0123] A pin-on-disk test was performed under the following conditions to determine the frictional force. The coefficient of friction (frictional force/load) was calculated in a region where the frictional force was stable.

<Pin-On Disk Test Conditions>

[0124]

Pin material: cemented carbide on which a diamond film is formed.
Pin name: diamond pin.
Pin surface roughness: diamond pin Ry = 0.1 μm
Disk material: aluminum material (A3104).
Load: 59N (6kgf)
Rotational speed: 10 rpm
Conveying speed: 20 mm/min
Sliding distance: 2 m
Test temperature: 30°C
Lubricant: None.

[Formation of Print Image Layer]

[0125] A print image layer was formed on the surface of the can body by inkjet printing. The inkjet printing was performed using a head manufactured by Kyocera Corporation. As the ink composition, a solvent-based ink (manufactured by Tomatec Co., Ltd) was used. The ink composition printed by the inkjet printing was baked by hot air drying.

[Evaluation Criteria of Neck Formability]

[0126] An appearance of the can container was determined visually. Results are listed in Table 1.

O: No occurrence of a neck wrinkle, a scratch, or buckling was observed in the can container.
X: One or more of a neck wrinkle, a scratch, and buckling were observed in the can container.

[Evaluation Criteria of Image Quality of Print Image]

[0127] The image quality of the print image of the print image layer was determined visually. Results are listed in Table 1.

◎: The print image including the contour portion was very clear.
O: The print image was clear.
×: The print image was unclear.

Example 2

[0128] A can container was manufactured in the same manner as in Example 1, except that the surface polishing was performed so that the surface roughness Ry of the diamond film was 0.2 μm.

Example 3

[0129] A can container was manufactured in the same manner as in Example 1, except that the surface polishing was performed so that the surface roughness Ry of the diamond film was 0.4 μm.

Example 4

[Manufacturing of Can Body and Formation of Resin Layer]

[0130] The dry molding was performed on an aluminum coil material (plate thickness: 0.24 mm) by, specifically, the steps from S11 to S15 in FIG. 14 to manufacture a can body. The can body was a seamless can. The height of the can body was the 120 mm. The unwound coil material was coated with a resin film to form a resin layer. As the resin film, a polyester resin (ester manufactured by Toyobo Co., Ltd.) was used. The thickness of the resin layer was 10 μm. The coefficient of dynamic friction between the resin layer and the die necking tool was measured in the same manner as in Example 1, except that a cemented carbide pin (pin material: cemented carbide, Ry = 0.28 μm) on which no diamond film was formed was used instead of the diamond pin, and a resin-coated aluminum material was used instead of the aluminum material as the disk material.

[0131] A can container was manufactured in the same manner as in Example 1, except that the resin layer was formed on the can body by the above-described procedure, but the necking was performed using a die necking tool in which the diamond film was not formed on any of surfaces of the insert portion and the centering portion, which come into contact with the can body, and the print image layer was formed on the resin layer.

Example 5

[0132] A can container was manufactured in the same manner as in Example 4, except that after necking, the can container was additionally heated at 200°C for 2 minutes.

Example 6

[0133] A can container was manufactured by forming a resin layer on a can body in the same procedure as in Example 4, forming a print image layer on the resin layer, and using a die necking tool in which a smooth diamond film (surface roughness = 0.2 μm) was formed on the surfaces of both the insert portion and the centering portion, which come into contact with the can body. The coefficient of dynamic friction between the resin layer and the die necking tool was measured in the same manner as in Example 2, except that a resin-coated aluminum material was used instead of the aluminum material as the disk material.

Comparative Example 1

[0134] A can container was manufactured in the same manner as in Example 1, except that the surface polishing was performed so that the surface roughness Ry of the diamond film was 0.6 μm.

Comparative Example 2

[0135] A can container was manufactured in the same manner as in Example 1, except that the surface polishing was performed so that the surface roughness Ry of the diamond film was 0.8 μm.

Comparative Example 3

[0136] A can container was manufactured in the same manner as in Example 1, except that a die necking tool on which a diamond film was not formed was used and the coefficient of dynamic friction between the can body and the die necking tool was measured using a cemented carbide pin (pin material: cemented carbide, Ry = 0.28 μm) on which a diamond film was not formed instead of the diamond pin.

[0137] Test results are listed in Table 1.

[Table 1]

	Resin film	Heating of diameter-reduced portion	Diamond film	Surface roughness Ry (μm) of diamond film	Coefficient of dynamic friction	Neck formability	Evaluation of image quality
Example 1	None	None	Yes	0.1	0.04	O	O
Example 2	None	None	Yes	0.2	0.10	O	O
Example 3	None	None	Yes	0.4	0.15	O	O
Example 4	Yes	None	None	-	0.10	O	O
Example 5	Yes	Yes	None	-	0.10	O	◎
Example 6	Yes	None	Yes	0.2	0.05	O	◎
Comparative Example 1	None	None	Yes	0.6	0.33	×	×
Comparative Example 2	None	None	Yes	0.8	0.45	×	×
Comparative Example 3	None	None	None	-	0.91	×	×

[0138] As shown in the results of Table 1, by the coefficient of dynamic friction between the can body or the resin layer and the die-necking tool being 0.30 or less, it was possible to provide the can container in which a scratch, a wrinkle, or the like did not occur in the diameter-reduced portion, even when varnish was not applied. In addition, by heating the can container after the necking, or by performing the necking on the can container having a resin layer formed thereon using the die necking tool having a smooth diamond film formed, it was possible to provide the can container having an image with further excellent image quality.

[0139] Although the present invention has been described above using the embodiments, the technical scope of the present invention is not limited to the scope described in the above embodiments. It is apparent to one skilled in the art that the above embodiments can be variously changed or modified. It is apparent from the recitation of the claims that the changed or modified embodiments are also included within the technical scope of the present invention.

[0140] It should be noted that the order of execution of each processing such as the operations, the procedures, the steps, and the stages of the can body, the can container and the method described and illustrated in the claims, the specification, and the drawings can be implemented in any order as long as the order is not indicated by "prior to", "before", or the like and as long as the can body or can container from previous processing is not used in subsequent processing. Even when the operation flows in the claims, the specification, and the drawings are described using words such as "first" and "next" for convenience of description, this does not mean that it is essential to perform the operations in this order.

Reference Signs List

[0141]

1 Can body

2 Varnish layer
3 Print image layer
6 Base image layer
7 Receiving layer
8 Resin layer
50 Can container
100 Diameter-reduced portion
101 Flange
200 Can trunk portion
250 Bottom portion
300 Print portion
400 Die necking tool
410 Insert portion
410a Opening end portion
410b Bent portion
420 Locating insert portion
430 Adapter portion
440 Centering portion
440a Opening end portion

Claims

1. A manufacturing method for a can container, comprising:

forming a diameter-reduced portion with a die necking tool at one end of a can body whose surface is not formed with a varnish layer,
wherein a coefficient of dynamic friction between the die necking tool and the can body is 0.30 or less.

2. The manufacturing method for a can container according to claim 1, comprising forming a resin layer containing a thermoplastic resin on an outer surface of one end portion of the can body at which at least the diameter-reduced portion is formed, before forming the diameter-reduced portion.

3. The manufacturing method for a can container according to claim 2, wherein the thermoplastic resin is a polyester resin.

4. The manufacturing method for a can container according to claim 3, further comprising softening the resin layer by heating the can body in which the diameter-reduced portion is formed.

5. The manufacturing method for a can container according to claim 1, wherein a smooth diamond film is formed on at least a part of a portion of the die necking tool to come into contact with the can body.

6. The manufacturing method for a can container according to claim 5, wherein

the die necking tool comprises a centering portion to be inserted into the can body and an insert portion to come into contact with the can body from the outside to form the can body, and
a surface of at least one of the insert portion and the centering portion to come into contact with the can body has the smooth diamond film.

7. The manufacturing method for a can container according to any one of claims 1 to 6, comprising forming a bottom portion and a can trunk portion by drawing a metal plate.

8. The manufacturing method for a can container according to any one of claims 1 to 6, comprising forming a print image layer by printing an ink composition on a surface of the can body in which the diameter-reduced portion is formed.

9. A can container comprising:

a can trunk portion;

a bottom portion provided on one end side of the can trunk portion; and
a diameter-reduced portion having an outer diameter reduced at the other end side of the can trunk portion, wherein a varnish layer is not formed on an outer surface of at least the diameter-reduced portion.

10. The can container according to claim 9, wherein a resin layer containing a thermoplastic resin is formed on a metal base on an outer surface of the diameter-reduced portion.

11. The can container according to claim 10, wherein the thermoplastic resin is a polyester resin.

12. The can container according to claim 10 or 11, wherein a print image layer is formed on the resin layer.

13. The can container according to claim 9, wherein a print image layer is directly formed on a metal base.

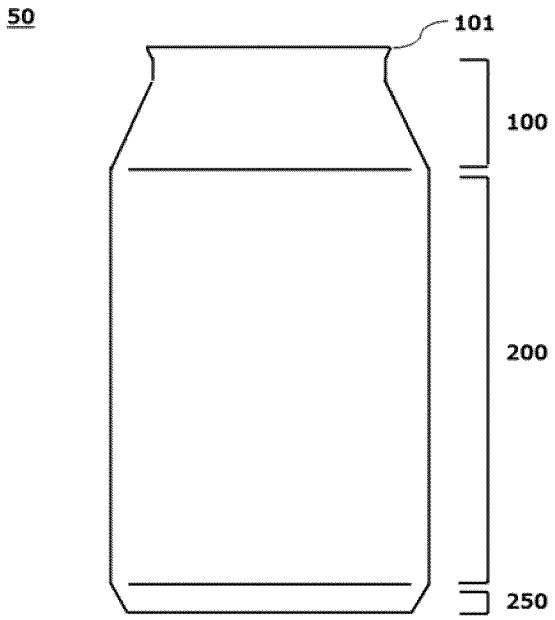

FIG. 1

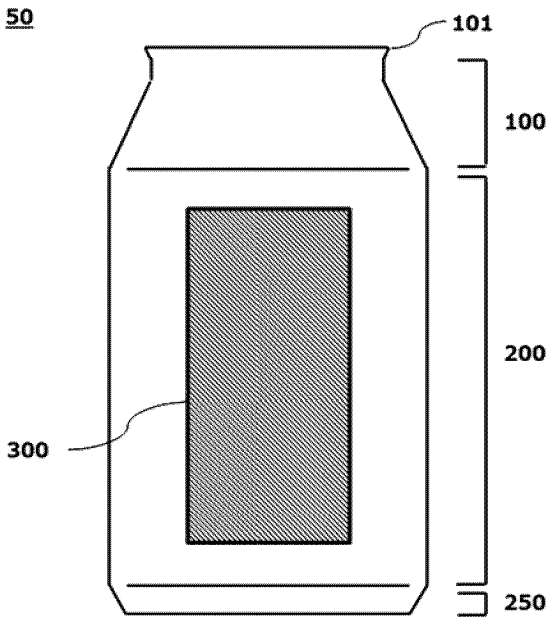

FIG. 2

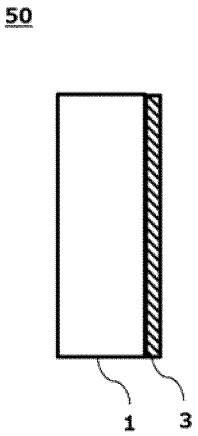

FIG. 3

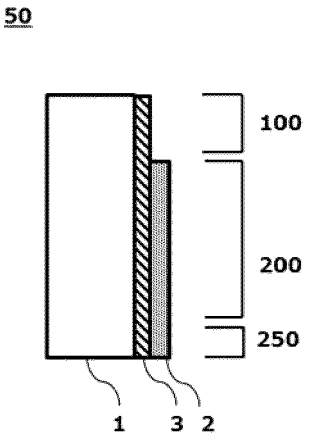

FIG. 4

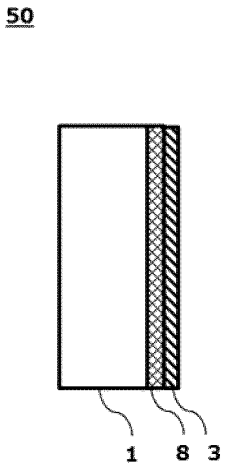

FIG. 5

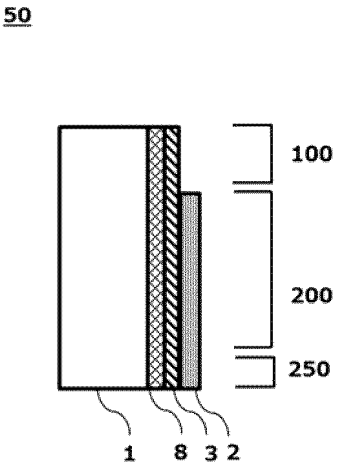

FIG. 6

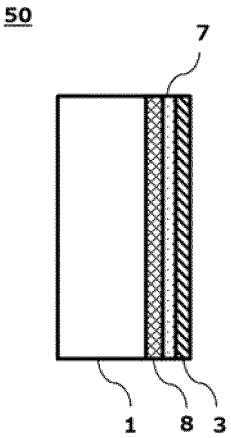

FIG. 7

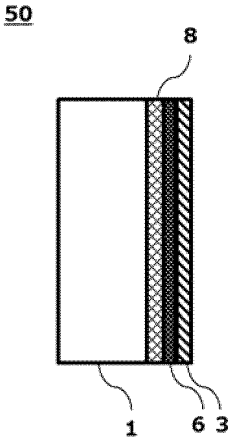

FIG. 8

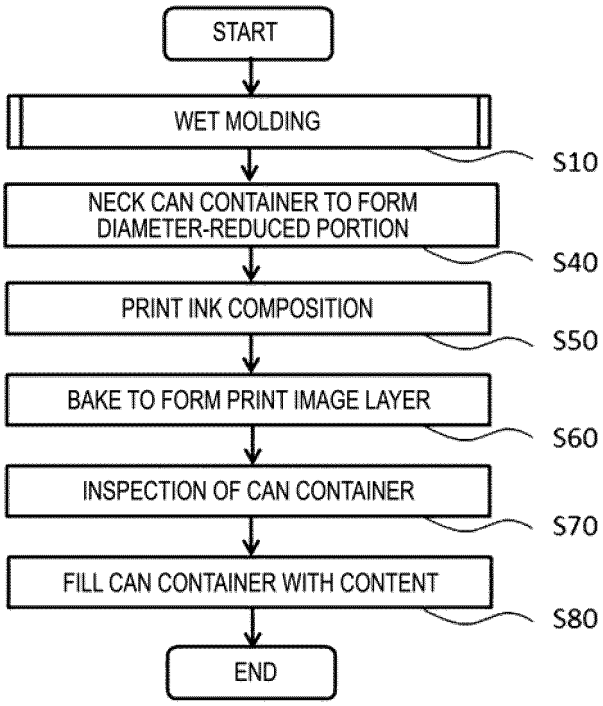
START
WET MOLDING
S10
NECK CAN CONTAINER TO FORM DIAMETER-REDUCED PORTION
S40
PRINT INK COMPOSITION
S50
BAKE TO FORM PRINT IMAGE LAYER
S60
INSPECTION OF CAN CONTAINER
S70
FILL CAN CONTAINER WITH CONTENT
S80
END

FIG. 9

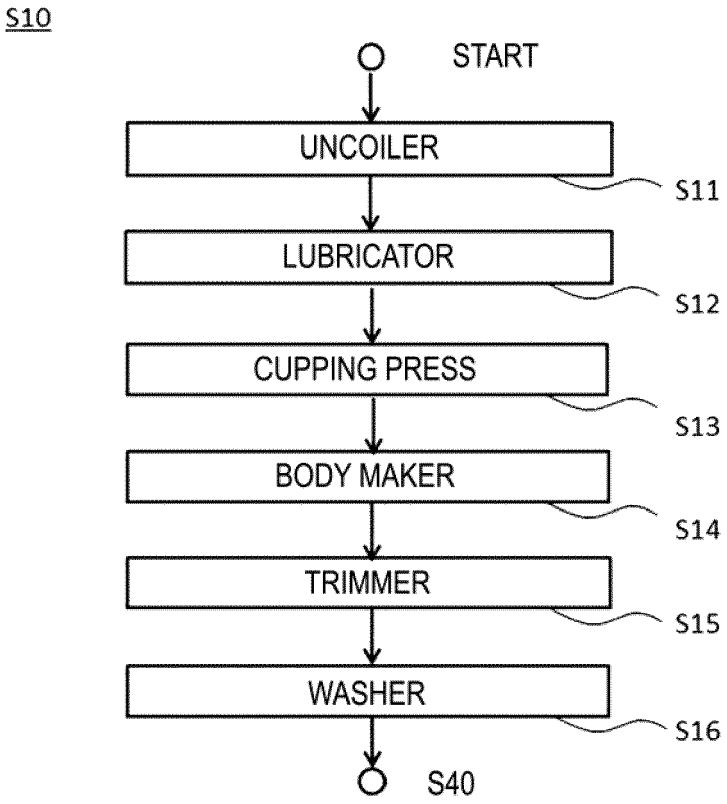
S10
START
UNCOILER
S11
LUBRICATOR
S12
CUPPING PRESS
S13
BODY MAKER
S14
TRIMMER
S15
WASHER
S16
S40

FIG. 10

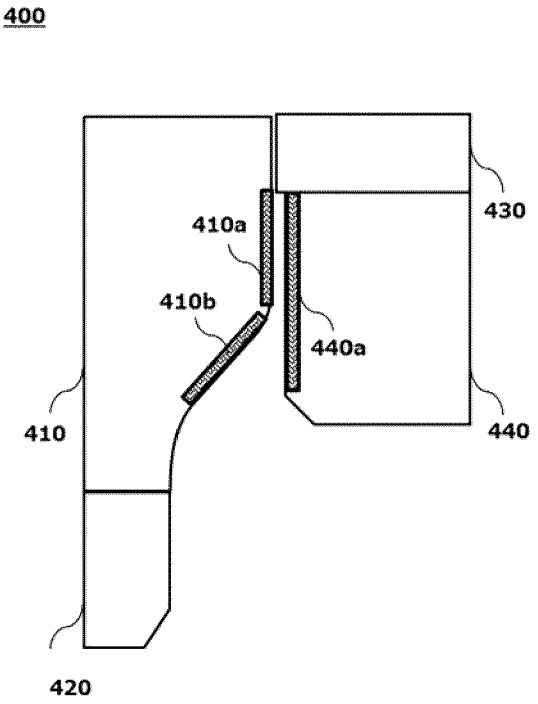

FIG. 11

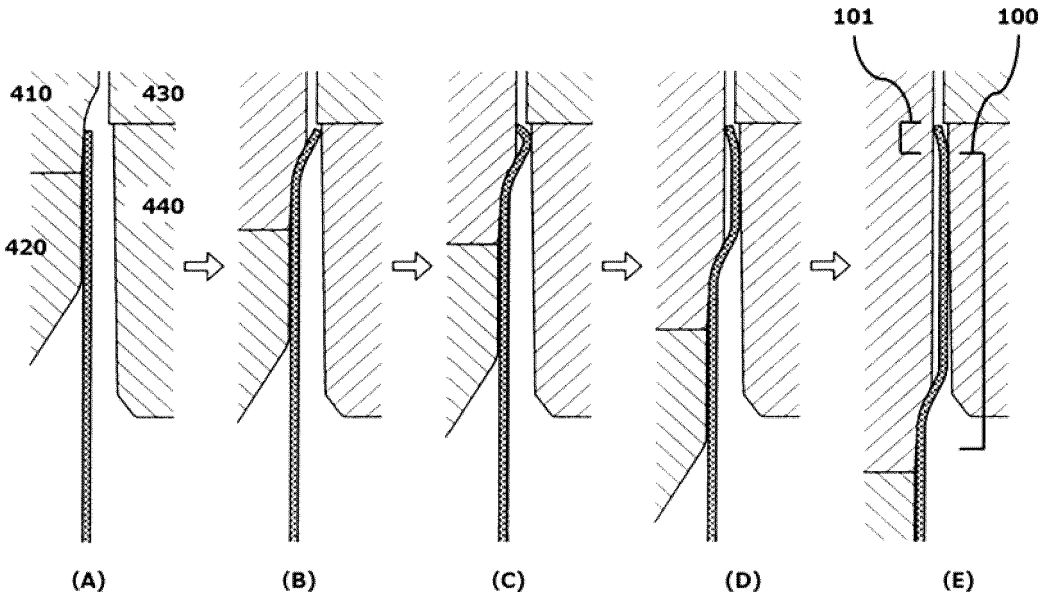

FIG. 12

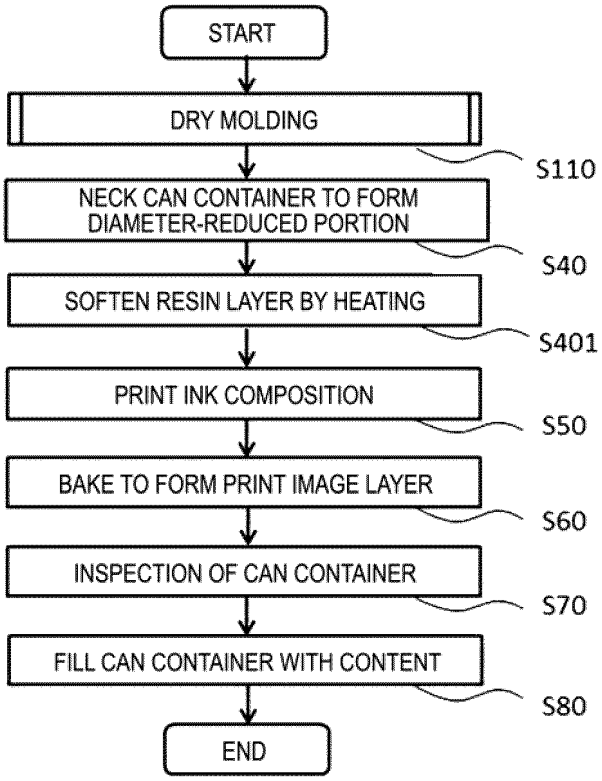
START
DRY MOLDING
S110
NECK CAN CONTAINER TO FORM DIAMETER-REDUCED PORTION
S40
SOFTEN RESIN LAYER BY HEATING
S401
PRINT INK COMPOSITION
S50
BAKE TO FORM PRINT IMAGE LAYER
S60
INSPECTION OF CAN CONTAINER
S70
FILL CAN CONTAINER WITH CONTENT
S80
END

FIG. 13

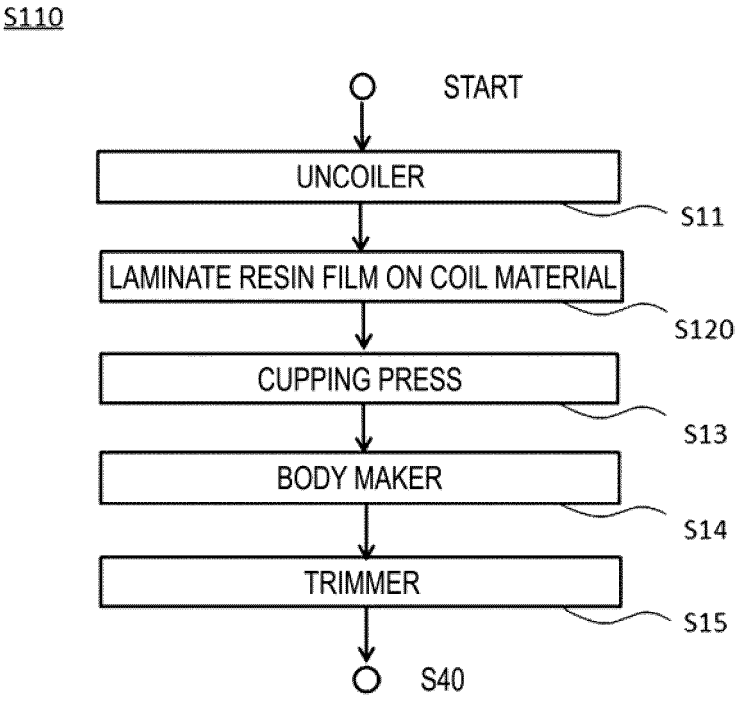
S110
START
UNCOILER
S11
LAMINATE RESIN FILM ON COIL MATERIAL
S120
CUPPING PRESS
S13
BODY MAKER
S14
TRIMMER
S15
S40

FIG. 14

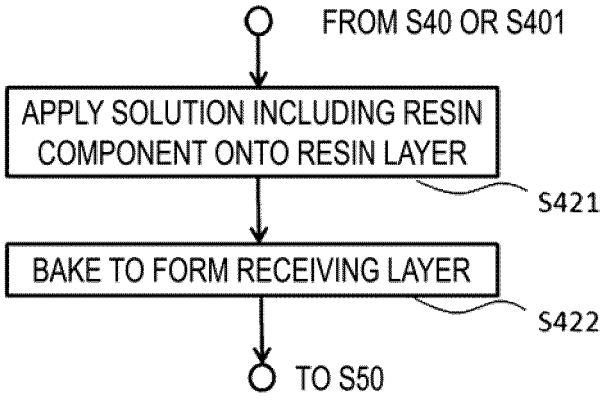
FROM S40 OR S401
APPLY SOLUTION INCLUDING RESIN COMPONENT ONTO RESIN LAYER
S421
BAKE TO FORM RECEIVING LAYER
S422
TO S50

FIG. 15

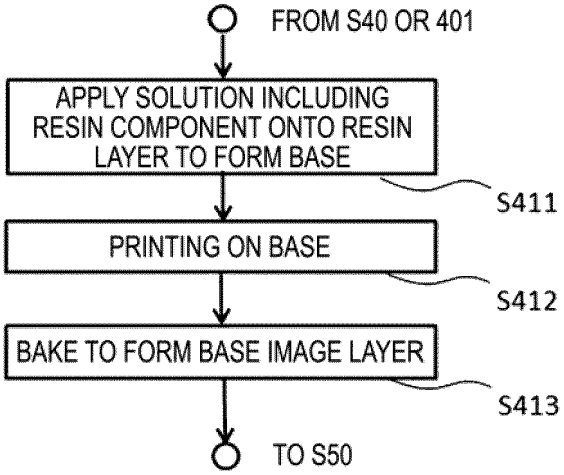
FROM S40 OR 401
APPLY SOLUTION INCLUDING RESIN COMPONENT ONTO RESIN LAYER TO FORM BASE
S411
PRINTING ON BASE
S412
BAKE TO FORM BASE IMAGE LAYER
S413
TO S50

FIG. 16

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2023/022879

A. CLASSIFICATION OF SUBJECT MATTER

B21D 51/26(2006.01)i; ***B65D 8/00***(2006.01)i; ***B65D 25/34***(2006.01)i
FI: B21D51/26 P; B21D51/26 X; B65D8/00 A; B65D25/34 B

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)

B21D51/26; B65D8/00; B65D25/34

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2023
Registered utility model specifications of Japan 1996-2023
Published registered utility model applications of Japan 1994-2023

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.
X	JP 2021-178679 A (TOYO SEIKAN KAISHA LTD.) 18 November 2021 (2021-11-18) paragraphs [0027]-[0030], [0124]-[0130]	1-3, 7-13
Y		4-6
Y	JP 2004-224417 A (DAIWA CAN CO., LTD.) 12 August 2004 (2004-08-12) paragraph [0034]	4
Y	JP 2000-233247 A (NIPPON STEEL CORP.) 29 August 2000 (2000-08-29) paragraph [0019]	4
Y	JP 2021-154355 A (TOYO SEIKAN GROUP HOLDINGS, LTD.) 07 October 2021 (2021-10-07) paragraph [0003]	5-6
Y	JP 2019-181549 A (UNIVERSAL SEIKAN K.K.) 24 October 2019 (2019-10-24) paragraph [0041], fig. 5	6

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

* Special categories of cited documents:
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"E" earlier application or patent but published on or after the international filing date
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 August 2023	**05 September 2023**
Name and mailing address of the ISA/JP **Japan Patent Office (ISA/JP)** **3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915** **Japan**	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2023/022879

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP 2021-178679 A	18 November 2021	US 2022/0402656 A1 paragraphs [0113], [0114], [0242]-[0248] WO 2021/225156 A1 EP 4147794 A1 CN 115103773 A CA 3168205 A1	
JP 2004-224417 A	12 August 2004	US 2005/0218140 A1 paragraph [0132] US 2009/0035096 A1 WO 2003/093121 A1 EP 1500598 A1 CA 2483666 A1	
JP 2000-233247 A	29 August 2000	(Family: none)	
JP 2021-154355 A	07 October 2021	US 2023/0122197 A1 paragraph [0003] WO 2021/193043 A1 EP 4129516 A1 TW 202140164 A CN 115427168 A BR 112022019348 A	
JP 2019-181549 A	24 October 2019	(Family: none)	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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- JP 2019108138 A **[0004]**
- JP 2748856 B **[0074]**
- JP 2705571 B **[0074]**
- JP 2018070181 A **[0074]**
- JP 6314468 B **[0084]**
- JP 6124024 B **[0087]**
- JP 2004025640 A **[0101]**