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United States Patent Application Publication

20250263214

Kind Code

A1

Publication Date

August 21, 2025

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PACKAGED OBJECT AND PACKAGE MEMBER

Abstract

A packaged object includes an electrophotographic photosensitive member and a protective sheet. The electrophotographic photosensitive member is formed in a cylindrical shape. The protective sheet covers at least a portion of an outer circumferential surface of the electrophotographic photosensitive member so that a center position in an axis line direction is aligned with a center position of the electrophotographic photosensitive member in the axis line direction. Provided that a length of the electrophotographic photosensitive member in the axis line direction is denoted by $L1$ (mm) and a length of the protective sheet in the axis line direction is denoted by $L2$ (mm), a relationship expressed by Expression (1) below is established:

[00001] $L2 < L1$. (1)

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Family ID: 1000008496120

Appl. No.: 19/057996

Filed: February 20, 2025

Foreign Application Priority Data

JP 2024-024505 Feb. 21, 2024

Publication Classification

Int. Cl.: B65D65/16 (20060101); B65D85/38 (20060101); G03G15/00 (20060101)

U.S. Cl.:

CPC B65D65/16 (20130101); B65D85/38 (20130101); G03G15/751 (20130101);

Background/Summary

CROSS-REFERENCE TO RELATED PATENT APPLICATION

[0001] This application claims the benefit of Japanese Priority Patent Application JP 2024-024505 filed Feb. 21, 2024, under 35 U.S.C. 119, the entire contents of which are incorporated herein by reference.

FIELD OF THE DISCLOSURE

[0002] The present disclosure relates to a packaged object and a package member.

BACKGROUND OF THE DISCLOSURE

[0003] Japanese Patent Application Laid-open No. 2011-031890 has disclosed an electrophotographic photosensitive member that is installed in an electrophotographic image forming apparatus. The electrophotographic photosensitive member having a cylindrical shape is packaged with a rectangular protective sheet. A length of one side of the protective sheet is set to be larger than an outer circumferential length of the electrophotographic photosensitive member and a length of another side of the protective sheet is set to be equal to or larger than an axial length of the electrophotographic photosensitive member.

SUMMARY OF THE DISCLOSURE

[0004] In accordance with a first aspect of the present disclosure, a packaged object includes an electrophotographic photosensitive member and a protective sheet. The electrophotographic photosensitive member is formed in a cylindrical shape. The protective sheet covers at least a portion of an outer circumferential surface of the electrophotographic photosensitive member so that a center position in an axis line direction is aligned with a center position of the electrophotographic photosensitive member in the axis line direction. Provided that a length of the electrophotographic photosensitive member in the axis line direction is set to $L1$ (mm) and a length of the protective sheet in the axis line direction is set to $L2$ (mm), a relationship expressed by Expression (1) below is established:

[00002] $L2 < L1$. (1)

[0005] In accordance with a second aspect of the present disclosure, a package member includes a plurality of packaged objects and an accommodation container. The plurality of packaged objects is defined in any one of claims 1 to 4. The accommodation container accommodates the plurality of packaged objects so that the plurality of packaged objects is aligned in parallel. The packaged object includes, at an end portion of the packaged object in an axis line direction, a coupling portion capable of being assembled in an image forming apparatus. The accommodation container includes a support portion that supports end portions of the plurality of packaged objects in the axis line direction. The support portion supports the coupling portion or supports an area between an end portion of the electrophotographic photosensitive member in the axis line direction and an end portion of the protective sheet in the axis line direction.

[0006] In accordance with the packaged object and the package member according to the present disclosure, damage of the electrophotographic photosensitive member can be suppressed.

[0007] These and other objects, features and advantages of the present disclosure will become more apparent in light of the following detailed description of best mode embodiments thereof, as illustrated in the accompanying drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1 is a view showing a configuration of an image forming apparatus on which an

electrophotographic photosensitive member according to an embodiment of the present disclosure is installed.

[0009] FIG. 2 is a perspective view showing electrophotographic drums according to the embodiment of the present disclosure.

[0010] FIG. 3 is a perspective view showing the electrophotographic photosensitive member according to the embodiment of the present disclosure.

[0011] FIG. 4 is a perspective view showing a packaged object according to the embodiment of the present disclosure.

[0012] FIG. 5 is a perspective view showing a state of a protective sheet being wrapped around the electrophotographic photosensitive member.

[0013] FIG. 6 is a schematic configuration view showing an example of a package member.

[0014] FIG. 7 is a schematic configuration view showing an example of another package member.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

[0015] Hereinafter, embodiments of the present disclosure will be described with reference to the drawings. Note that in the figures, the same or corresponding portions will be denoted by the same reference signs and the descriptions will not be repeated.

[0016] First of all, an image forming apparatus 1 will be described with reference to FIGS. 1 to 3.

FIG. 1 is a view showing a configuration of the image forming apparatus 1 on which an electrophotographic photosensitive member 11 according to an embodiment of the present disclosure is installed. FIG. 2 is a perspective view showing photosensitive drums 10 according to the embodiment of the present disclosure. FIG. 3 is a perspective view showing an electrophotographic photosensitive member 11 according to the embodiment of the present disclosure.

[0017] The image forming apparatus 1 is, for example, an electrophotographic image forming apparatus. The image forming apparatus 1 forms an image on a sheet P with toner. As shown in FIG. 1, the image forming apparatus 1 includes a first toner container 2, a second toner container 3, a third toner container 4, and a fourth toner container 5. In this embodiment, the first toner container 2 stores yellow toner. The second toner container 3 stores cyan toner. The third toner container 4 stores magenta toner. The fourth toner container 5 stores black toner.

[0018] The image forming apparatus 1 includes, for example, the photosensitive drums 10, charging devices 20, an exposure device 30, developing devices 40, a transferring device 50, a cleaning device (not shown), an ionizing device (not shown), a fixation part 60, and a control unit 70.

[0019] The photosensitive drums 10 form electrostatic latent images on outer circumferential surfaces. As shown in FIG. 2, each of the photosensitive drums 10 includes the electrophotographic photosensitive member 11 and coupling portions 12.

[0020] The electrophotographic photosensitive member 11 includes a photosensitive layer on an outer circumferential surface. As shown in FIG. 3, the electrophotographic photosensitive member 11 is formed in a cylindrical shape. A length of the electrophotographic photosensitive member 11 in an axis line direction D is, for example, a length L1. The electrophotographic photosensitive member 11 is, for example, a selenium drum or organic photoconductor (OPC).

[0021] The coupling portions 12 couple the electrophotographic photosensitive member 11 to the image forming apparatus 1. Specifically, the coupling portions 12 are assembled in the image forming apparatus 1. As shown in FIG. 2, the coupling portions 12 are rotationally driven by a drive unit (not shown), such that the electrophotographic photosensitive member 11 is rotated around an axis line of the electrophotographic photosensitive member 11. The coupling portions 12 are attached to one end portion and the other end portion of the electrophotographic photosensitive member 11 in the axis line direction D.

[0022] As shown in FIG. 1, the charging devices 20 charge photosensitive layers of the photosensitive drums 10 to a predetermined potential. An example of the charging device 20 is a

corona discharge device.

[0023] The exposure device **30** emits laser light to the photosensitive layers of the photosensitive drums **10** to be exposed to light. The exposure device **30** exposes the photosensitive layers of the photosensitive drums **10** to light on the basis of image data. As a result, an electrostatic latent image is formed on the photosensitive drums **10**. An example of the exposure device **30** is a light emitting diode (LED).

[0024] The developing devices **40** accommodate a two-component developer including carrier and toner, which is made of a magnetic material, for example. Then, the developing devices **40** develop electrostatic latent images formed on the photosensitive drums **10** with the toner, such that toner images are formed on the photosensitive drums **10**. A yellow toner image, a cyan toner image, a magenta toner image, and a black toner image are formed as toner images.

[0025] The transferring device **50** transfers each toner image formed on the surface of each photosensitive drum **10** to the sheet P. The transferring device **50** includes an intermediate transferring belt **51**, primary transferring rollers **52**, and a secondary transferring roller **53**.

[0026] The primary transferring rollers **52** are respectively arranged to face the photosensitive drums **10** via the intermediate transferring belt **51** and are respectively pressed toward the photosensitive drums **10**. Each of the photosensitive drums **10** rotates about the axis line via the coupling portions **12**. Therefore, the toner image formed on the surface of each photosensitive drum **10** is transferred to the intermediate transferring belt **51** sequentially. A transferring nip is formed between the secondary transferring roller **53** and a driving roller **54**. When the sheet P passes through the transferring nip, the toner image stacked on the intermediate transferring belt **51** is transferred to the sheet P. The sheet P to which the stacked toner image has been transferred is conveyed toward the fixation part **60** by a conveyance part **80**.

[0027] The cleaning device removes the residual toner remaining on the photosensitive drums **10** after it is transferred. The ionizing device removes charges from the photosensitive drums **10**.

[0028] The fixation part **60** heats and presses the toner image developed on the sheet P and fixes the toner image to the sheet P. The fixation part **60** includes, for example, a fixation roller **61**, a heater (not shown), and a press roller **62**.

[0029] The fixation roller **61** is a hollow roller having a cylindrical shape. The fixation roller **61** is press-fitted to the press roller **62**. The press roller **62** and the fixation roller **61** form a nip part. The press roller **62** is rotationally driven by a drive unit (not shown). The press roller **62** rotates the fixation roller **61**.

[0030] The heater is supplied with electric power from a power supply (not shown) and heats the fixation roller **61**. The heater is arranged in proximity to an inner circumferential surface of the fixation roller **61**. The sheet P conveyed to the fixation part is heated by the heater by passing through the nip part, and the toner images are fixed.

[0031] Next, a packaged object **100** including the electrophotographic photosensitive member **11** will be described with reference to FIGS. **4** and **5**. FIG. **4** is a perspective view showing the packaged object **100** according to the embodiment of the present disclosure. FIG. **5** is a perspective view showing a state of the protective sheet **13** being wrapped around the electrophotographic photosensitive member **11**.

[0032] In the electrophotographic photosensitive member **11**, a photosensitive layer including an inorganic or organic photoconductive matter is formed on an outer circumferential surface of a photoconductive substrate, such as an aluminum alloy. Therefore, the electrophotographic photosensitive member **11** is susceptible to pressure and contamination on the outer circumferential surface. In view of this, the electrophotographic photosensitive member **11** is handled as the packaged object **100** during storage or conveyance. As shown in FIG. **4**, the packaged object **100** includes the electrophotographic photosensitive member **11**, the coupling portions **12**, and the protective sheet **13**.

[0033] The protective sheet **13** covers at least a portion of the outer circumferential surface of the

electrophotographic photosensitive member **11**. The protective sheet **13** is formed in a substantially rectangular shape. As shown in FIG. 5, a center position C2 of the protective sheet **13** in the axis line direction D (see FIG. 4) is arranged overlapping a center position C1 of the electrophotographic photosensitive member **11** in an axis line direction D. Thus, the protective sheet **13** covers a central region of the electrophotographic photosensitive member **11** in the axis line direction D.

[0034] A length of a side of the protective sheet **13** along a direction orthogonal to the axis line direction D is equal to or larger than a length of an outer periphery of the electrophotographic photosensitive member **11**. Provided that a length of a side along the axis line direction D of the electrophotographic photosensitive member **11** is denoted by L1 (mm) and a length of a side along the axis line direction D of the protective sheet **13** is denoted by L2 (mm), a relationship expressed by Expression (1) below is established:

[00003] $L2 < L1$. (1)

[0035] Accordingly, damage of the electrophotographic photosensitive member **11** can be suppressed. Specifically, in a case where the coupling portions **12** are attached to the electrophotographic photosensitive member **11**, end portions of the protective sheet **13** are separated from the coupling portions **12**, so the end portions of the protective sheet **13** are prevented from being in contact with the coupling portions **12** during the conveyance. In a case where the coupling portions **12** are detached from the electrophotographic photosensitive member **11**, the end portions of the protective sheet **13** are separated from wall portions of the container that accommodates the packaged object **100**, so the end portions of the protective sheet **13** are prevented from being in contact with the container during the conveyance. Therefore, the end portions of the protective sheet **13** can be prevented from bending during the conveyance. That is, the end portions of the protective sheet **13** can be prevented from being in contact with the photosensitive layer of the electrophotographic photosensitive member **11**.

[0036] Here, the electrophotographic photosensitive member packaged by the protective sheet is accommodated in an accommodation container and is conveyed as a package member. During the conveyance of the package member, the end portions of the protective sheet may come into contact with the accommodation container and be bent. In a case where an end portion of the protective sheet is bent inwards, the bent portion may damage the photosensitive layer of the electrophotographic photosensitive member packaged with the protective sheet. In a case where an end portion of the protective sheet is bent outwards, the bent portion may damage the photosensitive layer of the adjacent electrophotographic photosensitive member. In contrast, in accordance with the packaged object **100**, damage of the electrophotographic photosensitive member can be suppressed.

[0037] Black light-shielding paper, an opaque synthetic resin film, a synthetic resin-coated film of high-quality paper, opaque kraft paper with a pressed surface, or the like can be applied to the protective sheet **13**. In particular, the black light-shielding paper is favorable. The black light-shielding paper can suppress the deterioration of the electrophotographic photosensitive member **11**. Specifically, the black light-shielding paper improves the photoconductivity of the protective sheet **13**. Thus, the black light-shielding paper can suppress the generation of static electricity in the protective sheet **13** and can suppress the deterioration of the electrophotographic photosensitive member **11** due to static electricity.

[0038] As shown in FIG. 4, the packaged object **100** has an adhesive tape **14**. The adhesive tape **14** fixes, in a central portion of the protective sheet **13** in the axis line direction D, the end portions of the protective sheet **13** in the circumferential direction, which is wrapped around the electrophotographic photosensitive member **11**, to a middle portion of the protective sheet **13**. Accordingly, the protective sheet **13** can be fixed through a small amount of adhesive tape **14**. Note that the adhesive tape **14** may be arranged in a position other than the central portion of the

protective sheet **13** in the axis line direction D. Moreover, the adhesive tape **14** may be an entire region of the protective sheet **13** in the circumferential direction or may be a portion thereof.
[0039] In order to further prevent the end portions of the protective sheet **13** from bending during the conveyance, a relationship expressed by Expression (2) below is favorably met:

$$[00004] \ 0.03 \leq (L1 - L2) / L1. \quad (2)$$

[0040] Accordingly, damage of the electrophotographic photosensitive member **11** can be further suppressed.

[0041] The photosensitive drum **10** is a consumable part. The photosensitive drum **10** is accommodated in the container and conveyed in the state of the packaged object **100**. A serviceman holds the packaged object **100** and performs a replacement task during replacement of the photosensitive drum **10**. To enhance the accommodation workability of the packaged object **100** and the replacement workability of the photosensitive drum **10**, a relationship expressed by Expression (3) below is favorably met:

$$[00005] \ 100 < L2. \quad (3)$$

[0042] Accordingly, the manufacturability can be enhanced. Here, the manufacturability includes the accommodation workability of the packaged object **100** to the image forming apparatus **1** and the replacement workability of the photosensitive drum **10**.

EXAMPLES

[0043] The present disclosure will be described more specifically with reference to FIGS. **6** and **7**. FIG. **6** is a schematic configuration view showing an example of a package member **300A**. FIG. **7** is a schematic configuration view showing an example of another package member **300B**. Hereinafter, Examples 1 to 20 and Comparative Examples 1 and 2 will be described.

Example 1

[0044] As shown in FIG. **3**, an electrophotographic photosensitive member **11**, which was an organic photosensitive member with a length L1 of 245 mm in the axis line direction D and an outer shape of 30.2 mm, was prepared. As shown in FIG. **5**, a protective sheet **13**, which was rectangular black paper with a length L2 of 236 mm in the axis line direction D (see FIG. **3**), a length of 150 mm in the direction orthogonal to the axis line direction D, and paper density of 80 g/m^{sup.2}, was prepared. A center position C2 of the protective sheet **13** in the axis line direction D was aligned with a center position C1 of the electrophotographic photosensitive member **11** in an axis line direction D and the protective sheet **13** was wrapped around the electrophotographic photosensitive member **11** without loosening. An adhesive tape **14** (see FIG. **4**) with a size of 1 cm×6 cm was bonded to the central portion of the protective sheet **13** in the axis line direction D and the protective sheet **13** was fixed to the electrophotographic photosensitive member **11**. As shown in FIG. **4**, coupling portions **12** were attached to one end portion and the other end portion of the electrophotographic photosensitive member **11** in the axis line direction D and a packaged object **100** according to Example 1 was obtained. The packaged object **100** is conveyed in the state of the package member **300A**.

[0045] As shown in FIG. **6**, the package member **300A** includes the packaged object **100** and an accommodation container **200A**. Hereinafter, the description will be given assuming that when the packaged object **100** is accommodated in the accommodation container **200A**, a direction of the packaged object **100** along the axis line direction D (see FIG. **4**) is a left-right direction X, a direction parallel to the horizontal direction and orthogonal to the left-right direction X is a front-back direction Y, and a direction orthogonal to the left-right direction X and the front-back direction Y is an up-down direction Z.

[0046] The accommodation container **200A** accommodates a plurality of packaged objects **100**. The accommodation container **200A** is configured to have a substantially rectangular parallelepiped shape. The accommodation container **200A** is made of, for example, polyethylene terephthalate resin (PET) and accommodates ten packaged objects **100**. Accordingly, the accommodation

container **200A** ensures cold resistance, water resistance, and electrical insulation. The

accommodation container **200A** includes a container part **210A** and a lid part **220A**.

[0047] The container part **210A** accommodates the entire plurality of packaged objects **100** along the front-back direction Y. Specifically, the container part **210A** accommodates the entire plurality of packaged objects **100** so that the plurality of packaged objects **100** is aligned in parallel. The container part **210A** includes support portions **211A**, a bottom wall **212A**, a front wall **213A**, a rear wall **214A**, a left wall **215A**, and a right wall **216A**. Shorter walls of the front, rear, left, and right walls will be sometimes described as the front wall **213A** and the rear wall **214A**. A wall on the left side when facing the rear wall **214A** will be sometimes described as the left wall **215A**.

[0048] The bottom wall **212A** is a substantially rectangular wall portion that faces the lid part **220A** and is orthogonal to the up-down direction Z. The front wall **213A** extends upwards from one end portion of the bottom wall **212A** in the front-back direction Y and is orthogonal to the front-back direction Y. The rear wall **214A** extends upwards from the other end portion of the bottom wall **212A** in the front-back direction Y and faces the front wall **213A**. The left wall **215A** extends upwards from one end portion of the bottom wall **212A** in the left-right direction X and is orthogonal to the left-right direction X. The right wall **216A** extends upwards from the other end portion of the bottom wall **212A** in the left-right direction X and faces the left wall **215A**.

[0049] The support portions **211A** support end portions of the packaged object **100** in the left-right direction X. The left support portions **211A** are arranged on a side of the left wall **215A**, which faces the right wall **216A**, and the right support portions **211A** are arranged on a side of the right wall **216A**, which faces the left wall **215A**. The left support portions **211A** and the right support portions **211A** respectively support one coupling portion **12** and the other coupling portion **12** of the packaged object **100**. Accordingly, the end portions of the protective sheet **13** can be prevented from bending in the package member **300A** that accommodates the plurality of packaged objects **100**.

[0050] The left support portions **211A** have upper surface portions that are substantially arcuate in cross-section. The upper surface portions are capable of being held in face contact with the lower portions of the coupling portions **12**. The left support portions **211A** project toward the right wall **216A** from the left wall **215A**. The length of the left support portions **211A** in the left-right direction X that protrude toward the right wall **216A** is shorter than the length of the coupling portions **12** in the left-right direction X. Accordingly, the end portions of the protective sheet **13** can be further prevented from bending. The right support portions **211A** are similar to the left support portions **211A**.

[0051] The lid part **220A** closes the opening of the container part **210A**. The plate-shaped lid part **220A** closes the opening of the container part **210A** in which the ten packaged objects **100** according to Example 1 are accommodated. A package member **300A** according to Example 1 was thus obtained.

Example 2

[0052] In Example 2, a package member **300A** with similar settings to those in Example 1 was obtained, except that the length L2 of the protective sheet **13** in the axis line direction D was changed to 236 mm to 234 mm.

Example 3

[0053] In Example 3, a package member **300A** with similar settings to those in Example 1 was obtained, except that the length L2 of the protective sheet **13** in the axis line direction D was changed to 236 mm to 232 mm.

Example 4

[0054] In Example 4, a package member **300A** with similar settings to those in Example 1 was obtained, except that the length L2 of the protective sheet **13** in the axis line direction D was changed to 236 mm to 230 mm.

Example 5

[0055] In Example 5, a package member **300A** with similar settings to those in Example 1 was obtained, except that the length L2 of the protective sheet **13** in the axis line direction D was changed to 236 mm to 200 mm.

Example 6

[0056] In Example 6, a package member **300A** with similar settings to those in Example 1 was obtained, except that the length L2 of the protective sheet **13** in the axis line direction D was changed to 236 mm to 150 mm.

Example 7

[0057] In Example 7, a package member **300A** with similar settings to those in Example 1 was obtained, except that the length L2 of the protective sheet **13** in the axis line direction D was changed to 236 mm to 125 mm.

Example 8

[0058] As shown in FIG. 3, an electrophotographic photosensitive member **11**, which was an organic photosensitive member with a length L1 of 343 mm in the axis line direction D and an outer shape of 30.2 mm, was prepared. As shown in FIG. 5, a protective sheet **13**, which was rectangular black paper with a length L2 of 332 mm in the axis line direction D (see FIG. 3), a length of 150 mm in the direction orthogonal to the axis line direction D, and paper density of 80 g/m^{sup.2}, was prepared. A center position C2 of the protective sheet **13** in the axis line direction D was aligned with a center position C1 of the electrophotographic photosensitive member **11** in the axis line direction D and the protective sheet **13** was wrapped around the electrophotographic photosensitive member **11** without loosening. An adhesive tape **14** (see FIG. 4) with a size of 1 cm×6 cm was bonded to the central portion of the protective sheet **13** in the axis line direction D and the protective sheet **13** was fixed to the electrophotographic photosensitive member **11**. As shown in FIG. 4, coupling portions **12** were attached to one end portion and the other end portion of the electrophotographic photosensitive member **11** in the axis line direction D and the packaged object **100** according to Example 8 was obtained. The packaged object **100** is conveyed in the state of the package member **300B**. Hereinafter, when the package member **300A** and the package member **300B** may be collectively referred to as package members **300**.

[0059] As shown in FIG. 7, the package member **300B** includes the packaged object **100** and an accommodation container **200B**.

[0060] The accommodation container **200B** accommodates the plurality of packaged objects **100**. The accommodation container **200B** is made of, for example, polypropylene resin (PP) and accommodates ten packaged objects **100**. Accordingly, even though the accommodation container **200B** is inexpensive, the accommodation container **200B** ensures heat resistance and chemical resistance. The accommodation container **200B** includes a container part **210B** and a lid part **220B**.

[0061] The container part **210B** accommodates lower halves of the plurality of packaged objects **100**. Specifically, the container part **210B** accommodates the lower halves of the plurality of packaged objects **100** so that the plurality of packaged objects **100** is aligned in parallel in the front-back direction Y. The container part **210B** includes support portions **211B**, a front wall **213B**, a rear wall **214B**, a left wall **215B**, and a right wall **216B**.

[0062] The support portions **211B** support end portions of the packaged objects **100** in the left-right direction X. The support portions **211B** are configured to have wavy cross-sections. The support portions **211B** have upper surface portions that are substantially arcuate in cross-section. The upper surface portions are capable of being held in face contact with the lower portions of the coupling portions **12**.

[0063] The front wall **213B** extends upwards from one end portions of the support portions **211B** in the front-back direction Y. The front wall **213B** is orthogonal to the front-back direction Y. The rear wall **214B** extends upwards from the other end portions of the support portions **211B** in the front-back direction Y. The rear wall **214B** faces the front wall **213B**. The left wall **215B** extends upwards from one end portions of the support portions **211B** in the left-right direction X. The left

wall **215B** is orthogonal to the left-right direction X. The right wall **216B** extends upwards from the other end portions of the support portions **211B** in the left-right direction X. The right wall **216B** faces the left wall **215B**.

[0064] The lid part **220B** accommodates upper halves of the plurality of packaged objects **100**. Specifically, the lid part **220B** accommodates the upper halves of the plurality of packaged objects **100** so that the plurality of packaged objects **100** is aligned in parallel toward the front-back direction Y. By aligning the container part **210B** with the lid part **220B**, the accommodation container **200B** accommodates the plurality of packaged objects **100**. A package member **300B** according to Example 8 was thus obtained.

Example 9

[0065] In Example 9, a package member **300B** with settings similar to those of Example 8 was obtained, except that the length L2 of the protective sheet **13** in the axis line direction D was changed to 332 mm to 330 mm.

Example 10

[0066] In Example 10, a package member **300B** with settings similar to those of Example 8 was obtained, except that the length L2 of the protective sheet **13** in the axis line direction D was changed to 332 mm to 328 mm.

Example 11

[0067] In Example 11, a package member **300B** with settings similar to those of Example 8 was obtained, except that the length L2 of the protective sheet **13** in the axis line direction D was changed to 332 mm to 326 mm.

Example 12

[0068] In Example 12, a package member **300B** with settings similar to those of Example 8 was obtained, except that the length L2 of the protective sheet **13** in the axis line direction D was changed to 332 mm to 300 mm.

Example 13

[0069] In Example 13, a package member **300B** with settings similar to those of Example 8 was obtained, except that the length L2 of the protective sheet **13** in the axis line direction D was changed to 332 mm to 250 mm.

Example 14

[0070] In Example 14, a package member **300B** with settings similar to those of Example 8 was obtained, except that the length L2 of the protective sheet **13** in the axis line direction D was changed to 332 mm to 175 mm.

Example 15

[0071] In Example 15, a package member **300A** with similar settings to those in Example 1 was obtained, except that the length L2 of the protective sheet **13** in the axis line direction D was changed to 236 mm to 238 mm.

Example 16

[0072] In Example 16, a package member **300A** with similar settings to those in Example 1 was obtained, except that the length L2 of the protective sheet **13** in the axis line direction D was changed to 236 mm to 50 mm.

Example 17

[0073] In Example 17, a package member **300A** with similar settings to those in Example 1 was obtained, except that the length L2 of the protective sheet **13** in the axis line direction D was changed to 236 mm to 100 mm.

Example 18

[0074] In Example 18, a package member **300B** with settings similar to those of Example 8 was obtained, except that the length L2 of the protective sheet **13** in the axis line direction D was changed to 332 mm to 335 mm.

Example 19

[0075] In Example 19, a package member **300B** with settings similar to those of Example 8 was obtained, except that the length L2 of the protective sheet **13** in the axis line direction D was changed to 332 mm to 50 mm.

Example 20

[0076] In Example 20, a package member **300B** with settings similar to those of Example 8 was obtained, except that the length L2 of the protective sheet **13** in the axis line direction D was changed to 332 mm to 100 mm.

Comparative Example 1

[0077] In Comparative Example 1, a package member **300A** with similar settings to those in Example 1 was obtained, except that the length L2 of the protective sheet **13** in the axis line direction D was changed to 236 mm to 245 mm.

Comparative Example 2

[0078] In Comparative Example 2, a package member **300B** with settings similar to those of Example 8 was obtained, except that the length L2 of the protective sheet **13** in the axis line direction D was changed to 332 mm to 343 mm.

[Light-Shielding Paper Edge Evaluation]

[0079] Under the conditions of frequency: 5 Hz to 100 Hz, sweep time: 1-minute sweep, and vibration acceleration: 1G, using a sine wave sweep vibration test apparatus, each of the package members **300** according to Examples 1 to 20 and Comparative Examples 1 and 2 was vibrated for 30 minutes in each of the left-right direction X, the front-back direction Y, and the up-down direction Z after the package member **300** was fixed to the vibration test apparatus. Then, the end portions of the protective sheets **13** of all the ten packaged objects **100** were observed, the number of folds of the light-shielding paper edges was checked, and light-shielding paper edges were evaluated on the basis of the references below. The obtained results and evaluation are shown in Table 1. [0080] A: No folds of the light-shielding paper edges occurs. [0081] B: The percentage of folds of the light-shielding paper edges is 2 or less of 10. [0082] C: The percentage of folds of the light-shielding paper edges is 3 or more of 10.

[Manufacturability Evaluation]

[0083] Each of the packaged objects **100** according to Examples 1 to 20 and Comparative Examples 1 and 2 was taken out of the package member **300**, and whether or not it was possible to assemble the packaged object **100** in the image forming apparatus **1** without contact with the photosensitive layer of the surface of the electrophotographic photosensitive member **11** was tested. The conditions were that the portion wrapped around the protective sheet **13** was held from the outer surface and the packaged object **100** was stably supported when the packaged object **100** was taken out of the package member **300**. Based on the references below, the manufacturability evaluation was conducted. The obtained results and evaluation are shown in Table 1. [0084] A: The serviceman's hands do not touch the surface of the electrophotographic photosensitive member **11** during the assembling. [0085] B: The serviceman's hands touch the surface of the electrophotographic photosensitive member **11** during the assembling.

TABLE-US-00001 TABLE 1 Protective Light-shielding paper Substrate sheet edge evaluation
Manufacturability length (L1) length (L2) Number evaluation [mm] [mm] (L1 – L2)/L1 of rolls
Result Result Example 1 245 236 0.0367 0 A A Example 2 245 234 0.0449 0 A A Example 3 245
232 0.0531 0 A A Example 4 245 230 0.0612 0 A A Example 5 245 200 0.1837 0 A A Example 6
245 150 0.3878 0 A A Example 7 245 125 0.4898 0 A A Example 8 343 332 0.0321 0 A A Example
9 343 330 0.0379 0 A A Example 10 343 328 0.0437 0 A A Example 11 343 326 0.0496 0 A A
Example 12 343 300 0.1254 0 A A Example 13 343 250 0.2711 0 A A Example 14 343 175 0.4898
0 A A Example 15 245 238 0.0286 2 B A Example 16 245 50 0.7959 0 A C Example 17 245 100
0.5918 0 A C Example 18 343 335 0.0233 1 B A Example 19 343 50 0.8542 0 A C Example 20 343
100 0.7085 0 A C Comparative 245 245 0.0000 9 C A Example 1 Comparative 343 343 0.0000 6 C
A Example 2

[0086] As shown in Table 1, with the packaged objects **100** according to Examples 1 to 20, i.e., the packaged objects **100** meeting Expression (1), no folds of the light-shielding paper edges or only 2 or less of 10 were generated. With the packaged object **100** not meeting Expression (1), folds of the light-shielding paper edges were generated in more than 50% of the cases. With the packaged object **100** meeting Expression (2), no folds of the light-shielding paper edges were generated. With the packaged object **100** meeting Expression (3), the contact with the surface of the electrophotographic photosensitive member **11** occurred when the packaged object **100** were assembled in the image forming apparatus **1**. Thus, in accordance with the present disclosure, damage of the electrophotographic photosensitive member **11** can be suppressed.

[0087] Hereinabove, the embodiment of the present disclosure has been described with reference to the drawings. Note that the present disclosure is not limited to the above-mentioned embodiment, and may be carried out in various aspects without departing from the gist. For easy understanding, the drawings each schematically show configurations of elements mainly, and the thickness, the length, the number of items, and the like of each component shown in the figure are different from the actual ones for the sake of convenience for creating the drawings. Moreover, the material, the shape, the dimensions, and the like of each component shown in the above-mentioned embodiment, and there are no particular limitations and various modifications can be made without substantially departing from the effects of the present disclosure. [0088] (1) As described with reference to

FIGS. **1** to **7**, in this embodiment, the packaged object **100** includes the electrophotographic photosensitive member **11**, the pair of coupling portions **12**, and the protective sheet **13**, though the present disclosure is not limited thereto. The pair of coupling portions **12** can be omitted and the packaged object **100** can provide similar effects even in an aspect in which the packaged object **100** includes the electrophotographic photosensitive member **11** and the protective sheet **13**. In this case, the length of the left support portions **211A** in the left-right direction **X** is set to be shorter than a separation distance between the left end portion of the electrophotographic photosensitive member **11** and the left end portion of the protective sheet **13**. That is, the electrophotographic photosensitive member **11** is placed on the upper surface portions of the support portion **211A**.

[0089] (2) In this embodiment, the ten packaged objects **100** are accommodated in the single package member **300**, though the present disclosure is not limited thereto. The package member **300** only needs to accommodate at least two packaged objects **100** and may accommodate eleven or more packaged objects **100**. [0090] (3) In this embodiment, the protective sheet **13** is fixed

through the single adhesive tape **14** after the protective sheet **13** is wrapped around the electrophotographic photosensitive member **11**, though the present disclosure is not limited thereto. The adhesive tape **14** may be provided at two or more positions. Moreover, the adhesive tape **14** may be provided in the entire outer peripheral region of the protective sheet **13** or may be provided in a part of the outer periphery of the protective sheet **13**.

[0091] It should be understood by those skilled in the art that various modifications, combinations, sub-combinations and alterations may occur depending on design requirements and other factors insofar as they are within the scope of the appended claims or the equivalents thereof.

Claims

1. A packaged object, comprising: an electrophotographic photosensitive member formed in a cylindrical shape; and a protective sheet that covers at least a portion of an outer circumferential surface of the electrophotographic photosensitive member so that a center position in an axis line direction is aligned with a center position of the electrophotographic photosensitive member in the axis line direction, wherein provided that a length of the electrophotographic photosensitive member in the axis line direction is set to $L1$ (mm) and a length of the protective sheet in the axis line direction is set to $L2$ (mm), a relationship expressed by Expression (1) below is established:

$L2 < L1$. (1)

2. The packaged object according to claim 1, wherein a relationship expressed by Expression (2) below is established: $0.03 \leq (L1 - L2) / L1$. (2)

3. The packaged object according to claim 2, wherein, a relationship expressed by Expression (3) below is established: $100 < L2$. (3)

4. The packaged object according to claim 1, wherein the protective sheet is black light-shielding paper.

5. A package member, comprising: a plurality of packaged objects according to claim 1; and an accommodation container that accommodates the plurality of packaged objects so that the plurality of packaged objects is aligned in parallel, wherein the packaged object includes, at an end portion of the packaged object in an axis line direction, a coupling portion capable of being assembled in an image forming apparatus, the accommodation container includes a support portion that supports end portions of the plurality of packaged objects in the axis line direction, and the support portion supports the coupling portion or supports an area between an end portion of the electrophotographic photosensitive member in the axis line direction and an end portion of the protective sheet in the axis line direction.

6. The package member according to claim 5, wherein the accommodation container is polyethylene terephthalate resin or polypropylene resin.
