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Hatano

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(54) **TRANSFER BELT UNIT AND IMAGE FORMING APPARATUS**

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This patent is subject to a terminal disclaimer.

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G03G 15/16 (2006.01)

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(58) **Field of Classification Search**
CPC . G03G 21/168; G03G 21/1652; G03G 15/161
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,198,897 B1 3/2001 Ream
6,363,228 B1 3/2002 Ream
(Continued)

FOREIGN PATENT DOCUMENTS

CN 2762189 Y 3/2006
CN 101075119 A 11/2007
(Continued)

OTHER PUBLICATIONS

Office Action issued in corresponding Japanese Patent Application No. 2018-184031, Oct. 10, 2023.
(Continued)

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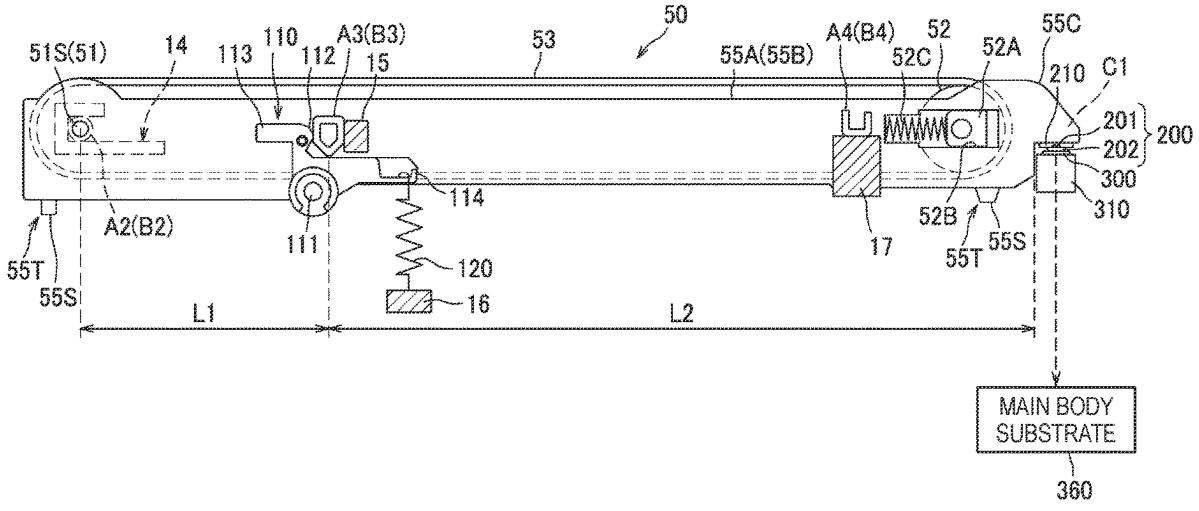
(57) **ABSTRACT**

A transfer belt unit mountable to and demountable from an apparatus main body of an image forming apparatus, the transfer belt unit including: a transfer belt being in contact with a photosensitive drum of a drum cartridge of the image forming apparatus in a state where the transfer belt unit is mounted to the apparatus main body, the transfer belt being configured to transfer a toner image on the photosensitive drum to a sheet conveyed between the photosensitive drum and the transfer belt and to convey the sheet conveyed between the photosensitive drum and the transfer belt toward a fixing unit of the image forming apparatus in the state where the transfer belt unit is mounted to the apparatus main body, and a belt memory in which information about the transfer belt unit is stored.

16 Claims, 9 Drawing Sheets



Related U.S. Application Data

continuation of application No. 16/584,254, filed on Sep. 26, 2019, now Pat. No. 11,079,715.

(56) **References Cited**

U.S. PATENT DOCUMENTS

11,829,097	B2 *	11/2023	Hatano	G03G 15/161
2004/0057737	A1	3/2004	Yokono	
2004/0109704	A1	6/2004	Abe	
2005/0008406	A1 *	1/2005	Nishizaki	G03G 15/0131 399/301
2007/0058992	A1	3/2007	Suzuki et al.	
2007/0177894	A1	8/2007	Nakano et al.	
2007/0286651	A1	12/2007	Takuwa	
2008/0240750	A1	10/2008	Hanamoto et al.	
2009/0285594	A1	11/2009	Kichise et al.	
2011/0052275	A1	3/2011	Masumoto	
2011/0274457	A1	11/2011	Makino	
2012/0134727	A1	5/2012	Yamaguchi et al.	
2015/0037059	A1	2/2015	Yang et al.	
2015/0055963	A1	2/2015	Kanno et al.	
2016/0161904	A1	6/2016	Matsuda et al.	
2017/0090355	A1	3/2017	Onishi	
2018/0150017	A1	5/2018	Matsuda et al.	

FOREIGN PATENT DOCUMENTS

CN	106950808	A	7/2017
JP	9-179474	A	7/1997
JP	10-187002	A	7/1998
JP	11-344875	A	12/1999
JP	2003-223058	A	8/2003
JP	2003-307975	A	10/2003
JP	2004-109880	A	4/2004
JP	2005-91394	A	4/2005
JP	2007-010839	A	1/2007
JP	2007-102137	A	4/2007
JP	2010-2679	A	1/2010
JP	2011-70166	A	4/2011
JP	2012-118175	A	6/2012
JP	2012-238027	A	12/2012
JP	2013-210553	A	10/2013
JP	2015-62053	A	4/2015
JP	2016-110105	A	6/2016
JP	2018-005065	A	1/2018

OTHER PUBLICATIONS

JP_11344875_A-T Machine Translation, Ito et al., Japan, Dec. 1999 (in parent application).

Office Action issued in corresponding Chinese Patent Application No. 201910931164.9, Jan. 28, 2022.

Notice of Reasons for Refusal issued in corresponding Japanese Patent Application No. 2018-184031, mailed Jun. 21, 2022.

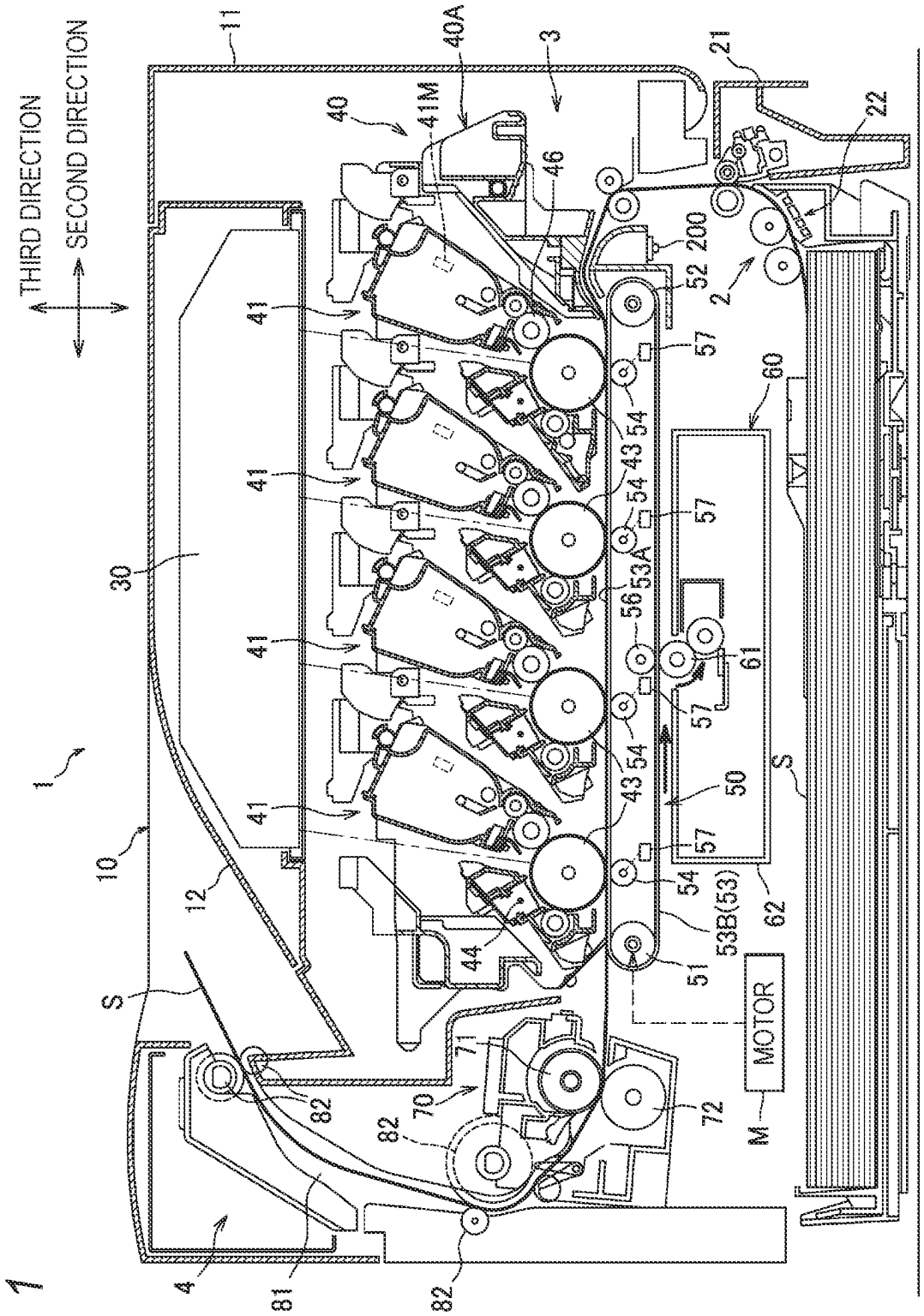
Second Office Action issued in corresponding Chinese Patent Application No. 201910931164.9, mailed Aug. 15, 2022.

Office Action (Decision of Refusal) issued in corresponding Japanese Patent Application No. 2018-184031, Oct. 4, 2022.

JP_11344875_A_I Machine Translation, Japan, Ito, 1999, in parent application.

Office Action issued in corresponding Chinese Patent Application No. 201910931164.9, Mar. 3, 2023.

* cited by examiner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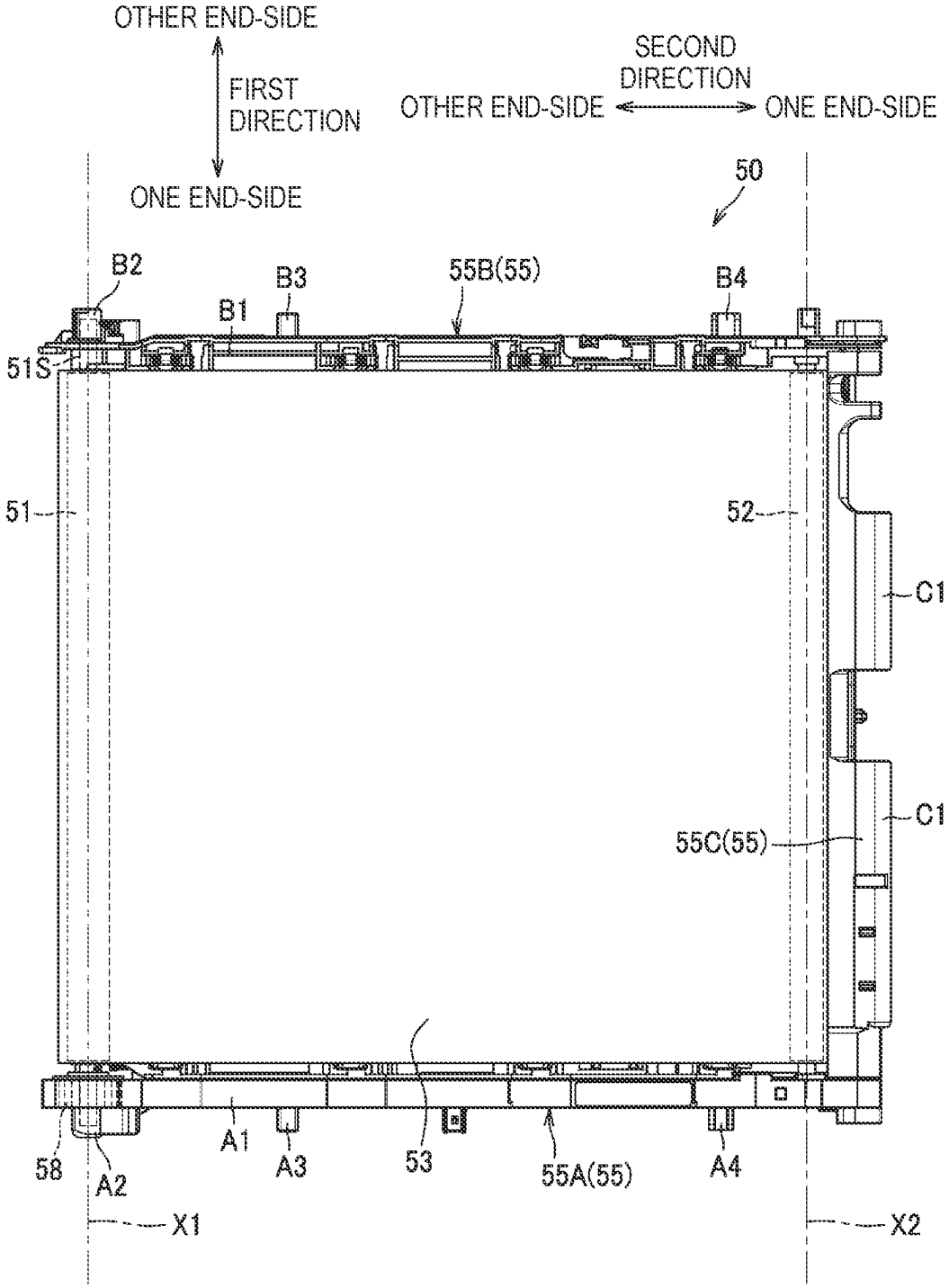
SECOND DIRECTION
1
2
3
4
10
11
12
21
22
30
40
40A
41
41M
43
44
46
50
51
52
53A
53B(53)
54
56
57
60
61
62
70
71
72
81
82
200
S
M
MOTOR

FIG. 1

FIG. 2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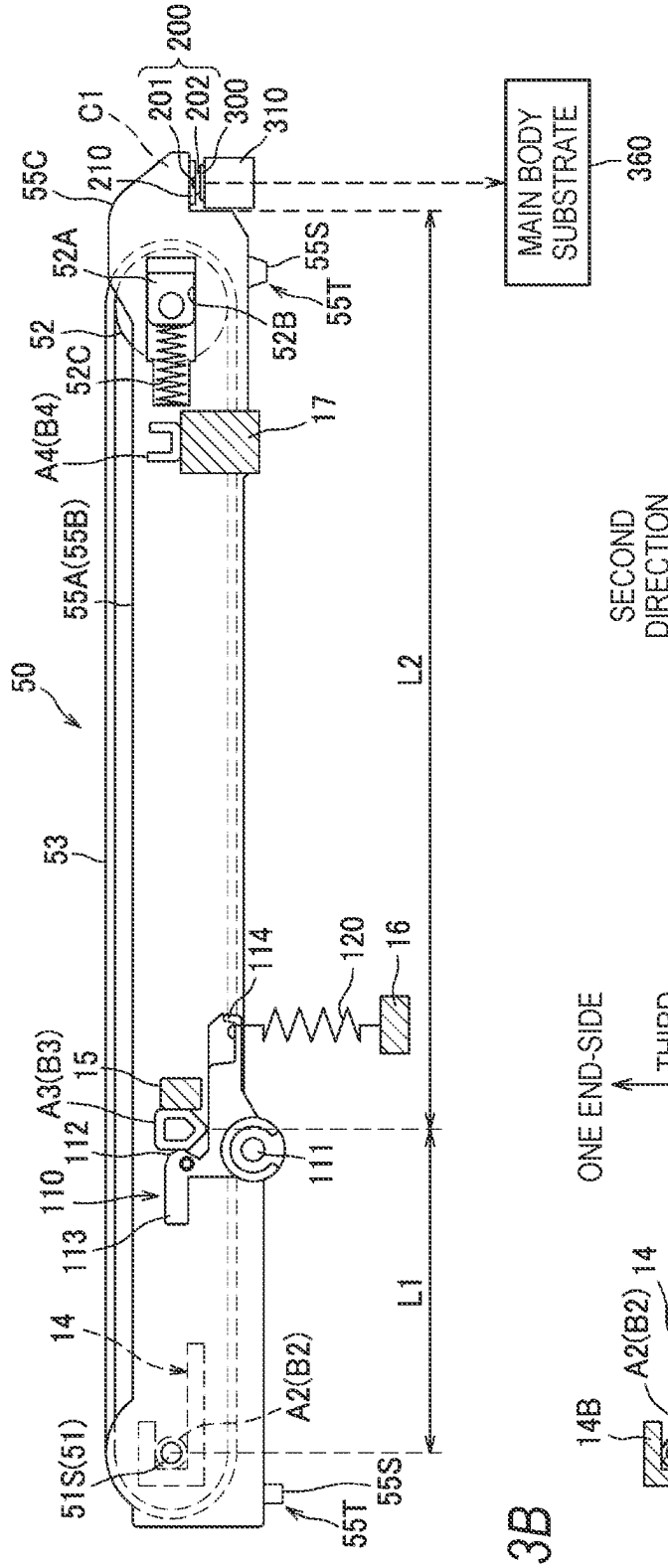
B2
B3
B1
55B(55)
B4
51S
51
52
C1
C1
55C(55)
58
A2
A1
A3
53
55A(55)
A4
X1
X2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201
202
300
310
C1
210
55C
MAIN BODY SUBSTRATE
360
52A
55S
55T
52B
52
52C
17
A4(B4)
55A(55B)
50
53
L2
SECOND DIRECTION
ONE END-SIDE
OTHER END-SIDE
114
120
16
A3(B3)
15
112
111
110
113
14
A2(B2)
51S(51)
L1
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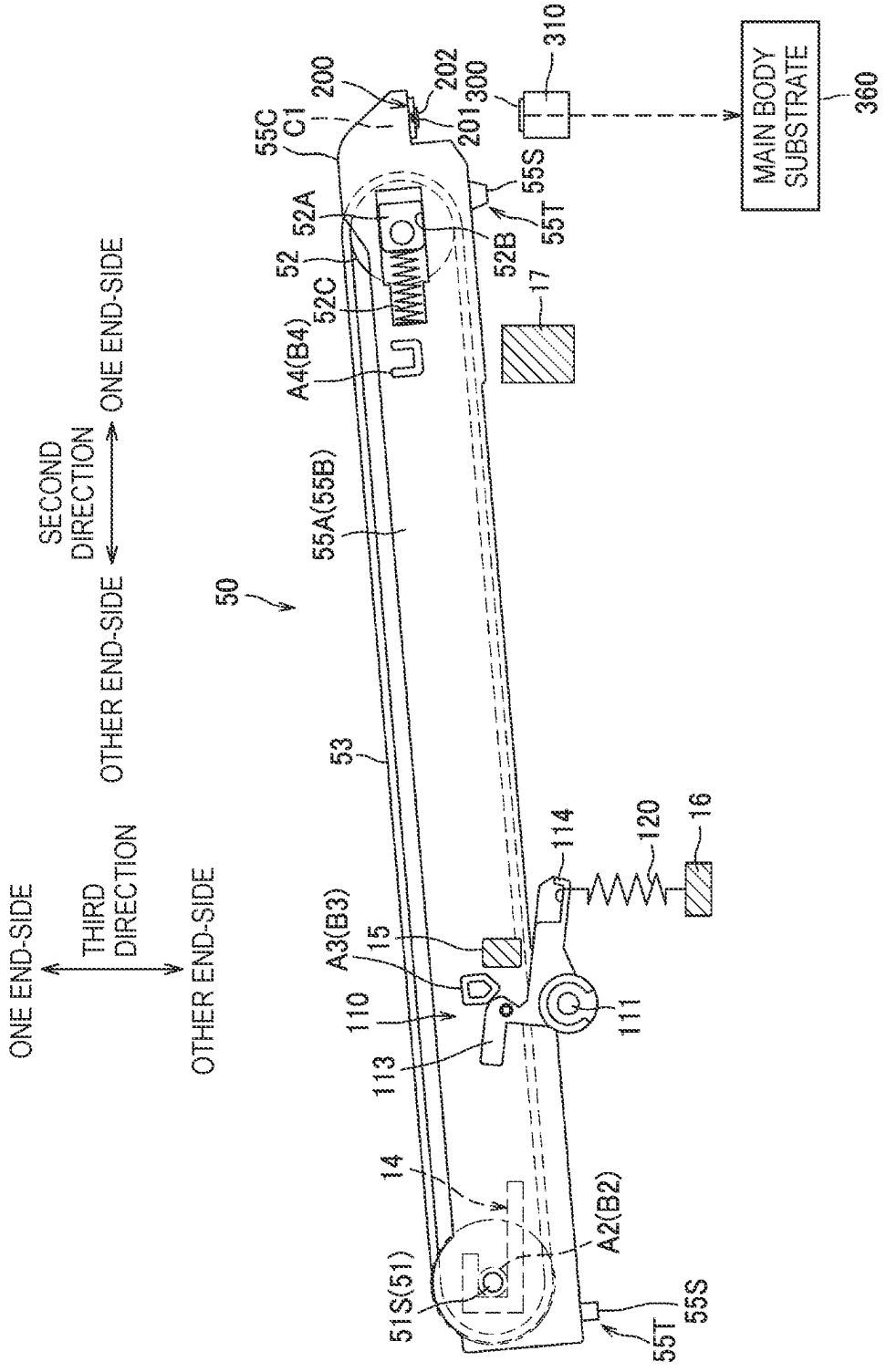
14
A2(B2)
14B
14C
51S
14A

FIG. 3A

FIG. 3B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ONE END-SIDE
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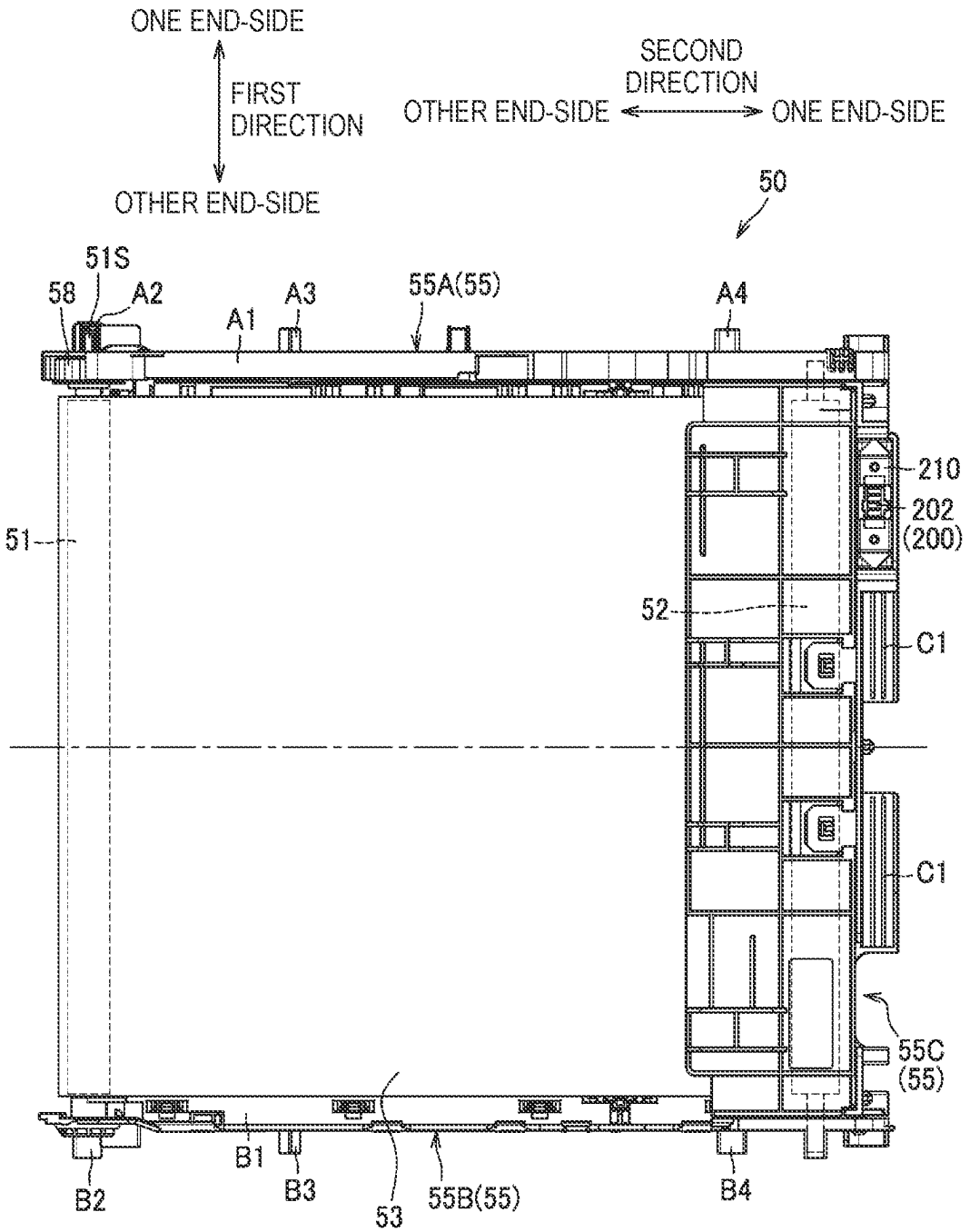
55A(55B)
A4(B4)
52
52A
52B
52C
55C
C1
200
202
201
300
310
55S
55T
17
MAIN BODY SUBSTRATE
360
A3(B3)
15
110
113
114
120
16
111
14
A2(B2)
51S(51)
55S
55T

FIG. 4

FIG. 5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A2
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A3
55A(55)
A4
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B1
B2
B3
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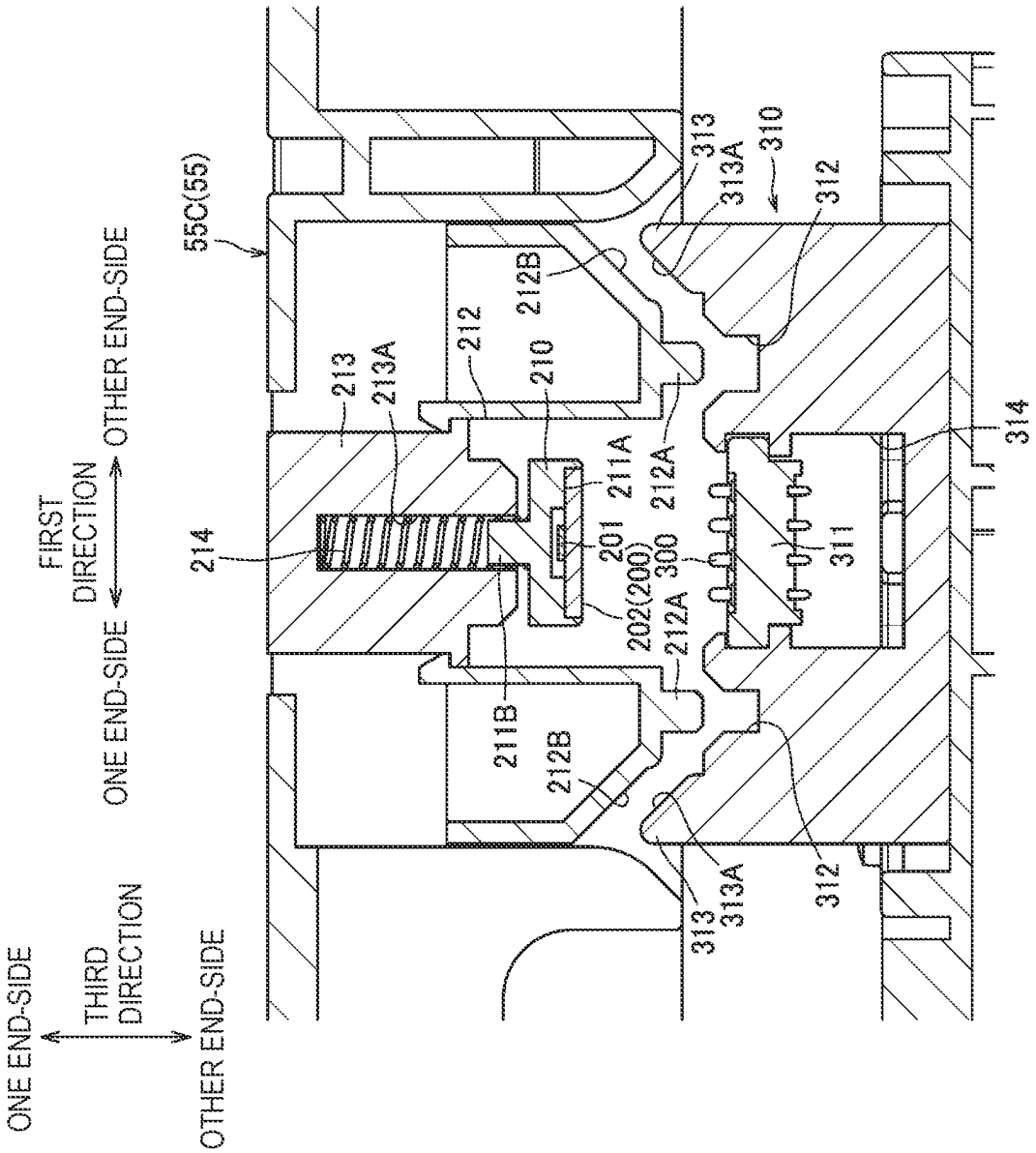
55B(55)
B4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213A
212
212B
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211A
212A
201
202(200)
300
211B
313
313A
310
312
311
314
FIRST DIRECTION
ONE END-SIDE
OTHER END-SIDE
THIRD DIRECTION
ONE END-SIDE
OTHER END-SIDE

FIG. 6

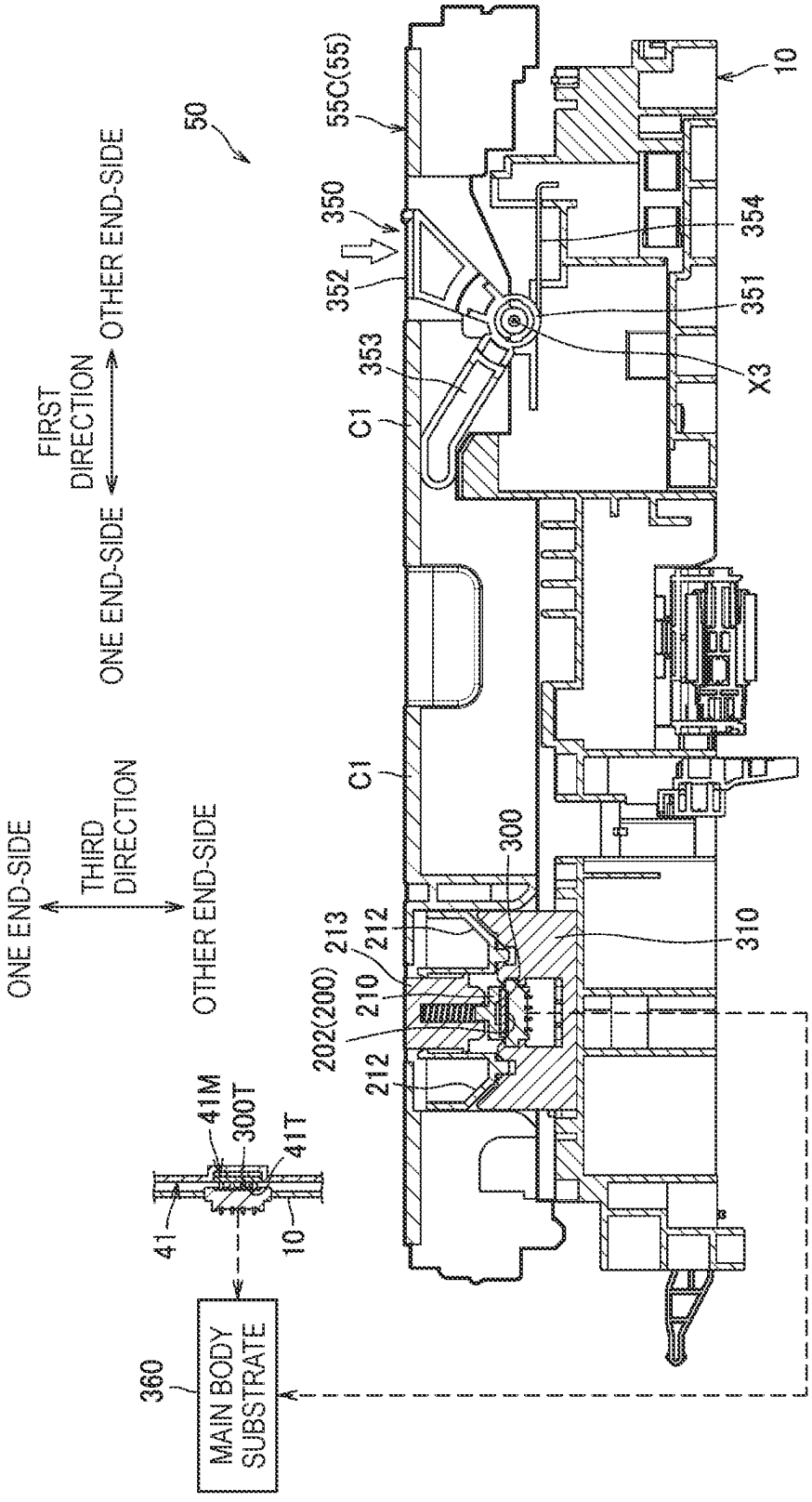
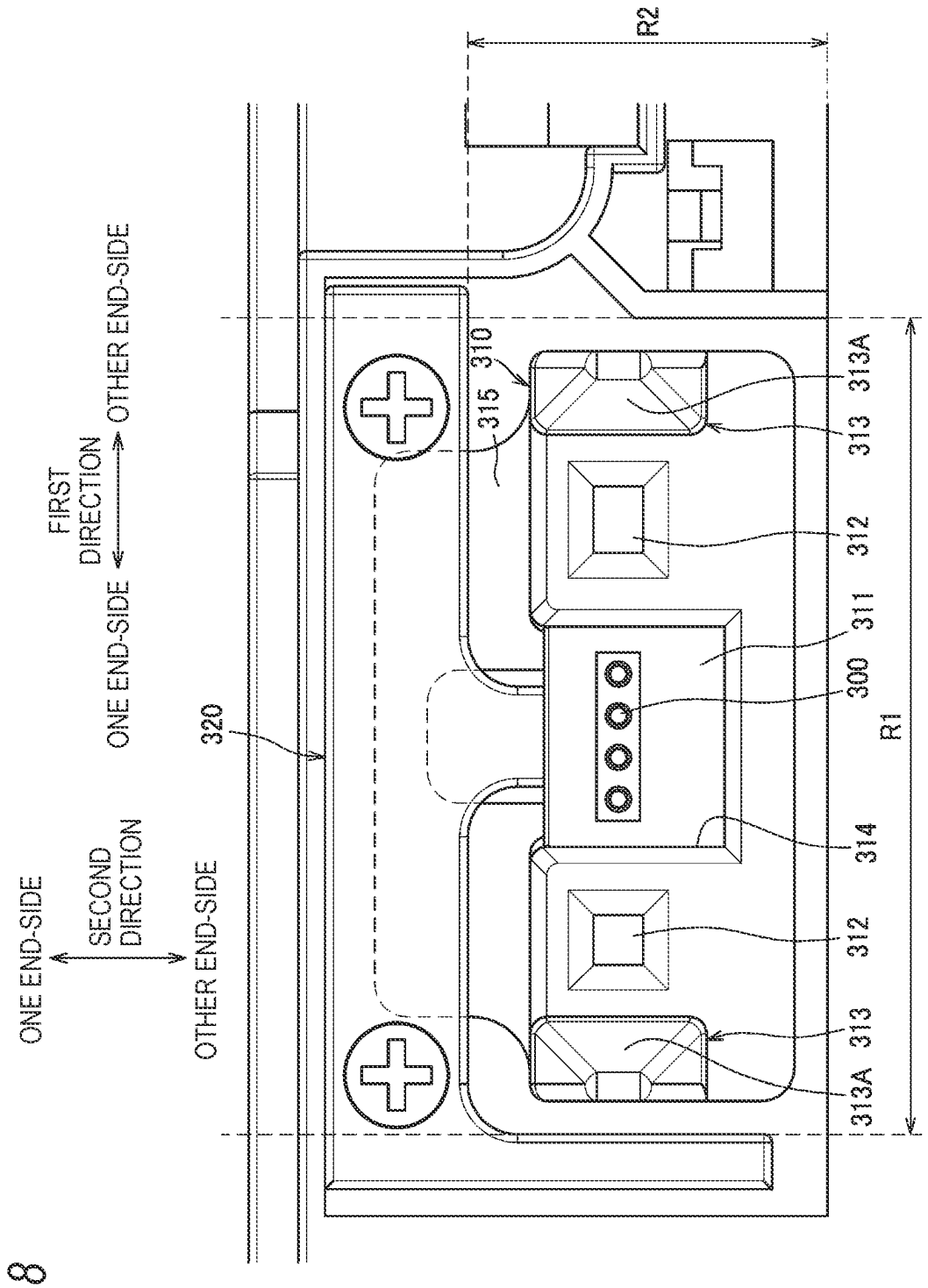

50
55C(55)
10
350
354
352
351
353
X3
C1
C1
300
310
213
212
210
202(200)
212
41M
300T
41T
41
10
360
MAIN BODY SUBSTRATE
FIRST DIRECTION
ONE END-SIDE
OTHER END-SIDE
THIRD DIRECTION
ONE END-SIDE
OTHER END-SIDE

FIG. 7


R2
R1
310
315
313A
313
312
311
300
314
320
FIRST DIRECTION
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OTHER END-SIDE
SECOND DIRECTION
ONE END-SIDE
OTHER END-SIDE

FIG. 8

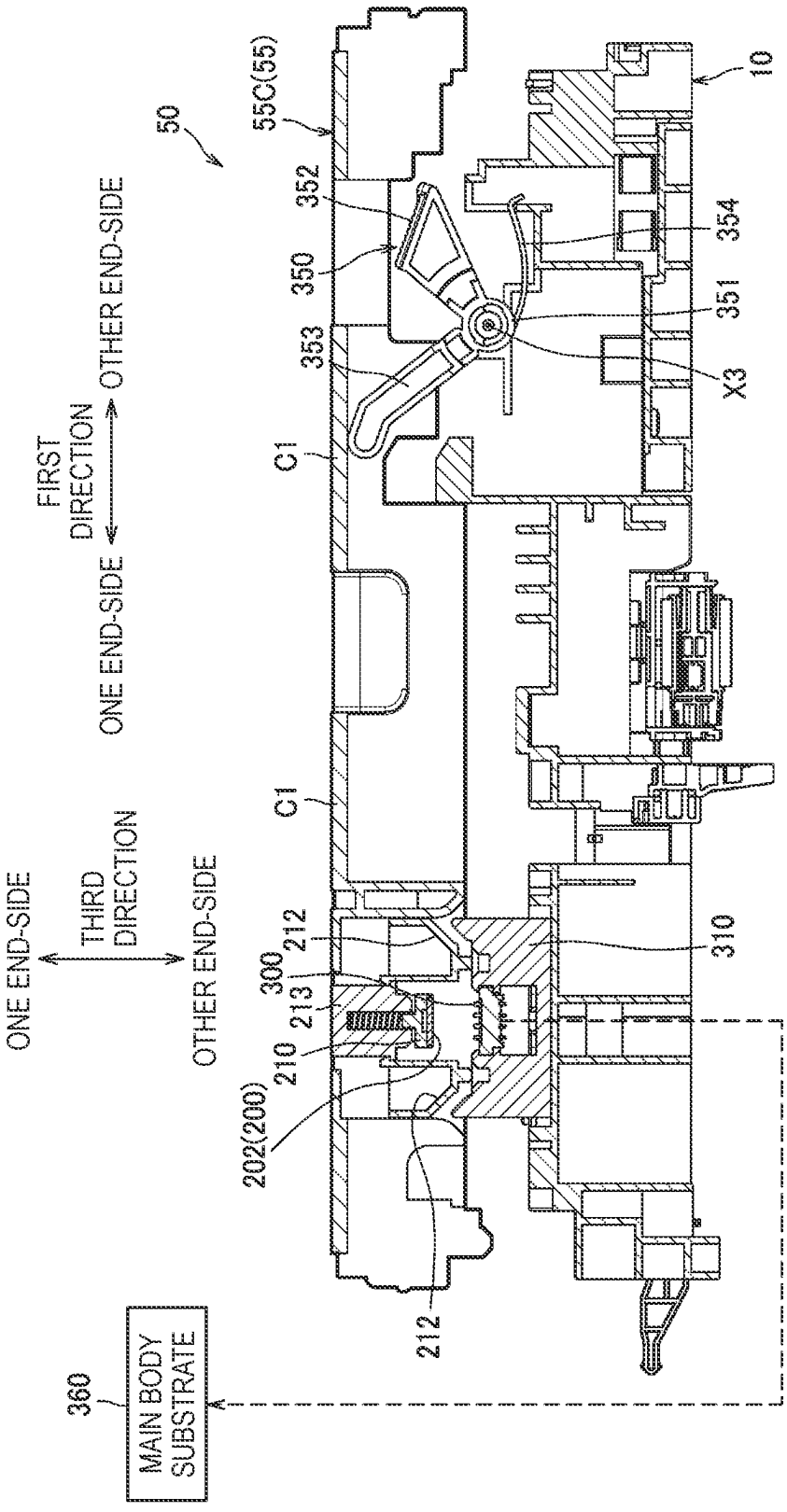
50
55C(55)
10
352
354
350
351
353
X3
C1
FIRST DIRECTION
ONE END-SIDE
OTHER END-SIDE
C1
ONE END-SIDE
THIRD DIRECTION
OTHER END-SIDE
212
310
300
213
210
202(200)
212
360
MAIN BODY SUBSTRATE

FIG. 9

TRANSFER BELT UNIT AND IMAGE FORMING APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 17/391,102, filed Aug. 2, 2021, now U.S. Pat. No. 11,829,097, which is a continuation of U.S. patent application Ser. No. 16/584,254, filed Sep. 26, 2019, now U.S. Pat. No. 11,079,715, which is based upon and claims the benefit of priority from prior Japanese patent application No. 2018-184031, filed on Sep. 28, 2018, the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

The present disclosure relates to a transfer belt unit and an image forming apparatus including the transfer belt unit.

BACKGROUND ART

In the related art, an image forming apparatus including a detachable transfer belt unit has been known. The transfer belt unit is configured to transfer a toner image on a photosensitive drum to a sheet and to convey the sheet between the transfer belt unit and the photosensitive drum.

In order to perform an optimal image processing in correspondence to an exchanged transfer belt unit, it is needed to obtain information about the transfer belt unit.

SUMMARY

An aspect of the present disclosure provides a transfer belt unit storing information about a detachable transfer belt unit.

Another aspect of the present disclosure provides an image forming apparatus including a transfer belt unit storing information about a detachable transfer belt unit.

According to an aspect of the present disclosure, there is provided a transfer belt unit mountable to and demountable from an apparatus main body of an image forming apparatus, the transfer belt unit including: a transfer belt being in contact with a photosensitive drum of a drum cartridge of the image forming apparatus in a state where the transfer belt unit is mounted to the apparatus main body, the transfer belt being configured to transfer a toner image on the photosensitive drum to a sheet conveyed between the photosensitive drum and the transfer belt and to convey the sheet conveyed between the photosensitive drum and the transfer belt toward a fixing unit of the image forming apparatus in the state where the transfer belt unit is mounted to the apparatus main body, and a belt memory in which information about the transfer belt unit is stored.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** depicts a schematic configuration of an image forming apparatus in accordance with an exemplary embodiment of the present disclosure;

FIG. **2** is a plan view of a transfer belt unit;

FIG. **3**A is a side view depicting a simplified relation between the transfer belt unit located at a contact position and a pressing member;

FIG. **3**B is a sectional view depicting a relation between a bearing part and a restraint part;

FIG. **4** is a view depicting a state where the transfer belt unit of FIG. **3**A is located at a spaced position;

FIG. **5** depicts the transfer belt unit, as seen from below;

FIG. **6** is a sectional view of a holder and a contact holder;

FIG. **7** depicts the transfer belt unit located at the contact position, as seen from a user side;

FIG. **8** depicts the contact holder, as seen from above; and

FIG. **9** depicts the transfer belt unit located at the spaced position, as seen from the user side.

DESCRIPTION OF EMBODIMENTS

Hereinafter, an exemplary embodiment of the present disclosure will be described in detail with reference to the drawings. Meanwhile, in the following descriptions, an axial direction of a photosensitive drum **41** is referred to as 'first direction'. Also, a direction in which a plurality of photosensitive drums **41** is aligned is referred to as 'second direction'. The second direction intersects with the first direction. Preferably, the second direction is perpendicular to the first direction. Also, a direction in which a discharge tray **12**, an image forming part **3** and a sheet tray **21** are aligned is referred to as 'third direction'. The third direction intersects with the first direction and the second direction. Preferably, the third direction is perpendicular to the first direction and the second direction. In the exemplary embodiment, the third direction is a vertical direction.

As shown in FIG. **1**, an image forming apparatus **1** is a color laser printer, for example. The image forming apparatus **1** includes an apparatus main body **10**, a feeder unit **2** configured to feed a sheet S, an image forming part **3** configured to form an image on the fed sheet S, and a discharge unit **4** configured to discharge the sheet S having the image formed thereon.

The feeder unit **2** is located at a lower part in the apparatus main body **10**, and includes a feeding tray **21** configured to accommodate therein sheets S, and a feeding mechanism **22** configured to feed the sheet S from the feeding tray **21** to the image forming part **3**. The sheets S in the feeding tray **21** are separated one by one by the feeding mechanism **22**, which is then fed to the image forming part **3**.

The image forming part **3** includes an exposure unit **30**, an image forming unit **40**, a transfer belt unit **50**, a belt cleaner **60**, and a fixing unit **70**.

The exposure unit **30** is located at an upper part in the apparatus main body **10**, and includes a laser light-emitting part, a polygon mirror, a lens and a reflector, which are not shown.

The image forming unit **40** includes a drum cartridge **40**A mountable to and demountable from the apparatus main body **10** and four developing cartridges **41** mountable to and demountable from the drum cartridge **40**A. In a state where the drum cartridge **40**A is mounted to the apparatus main body **10**, the drum cartridge **40**A is located between the feeder unit **2** and the exposure unit **30**. The drum cartridge **40**A is movable between a mounting position (refer to FIG. **1**) inside the apparatus main body **10** and a separation position outside the apparatus main body **10**.

The drum cartridge **40**A includes four photosensitive drums **43** and four chargers **44**. The developing cartridge **41** includes a developing roller **46**. The developing cartridge **41** also includes a supply roller, a layer thickness regulation blade, and a toner accommodation part whose reference numerals are omitted.

The transfer belt unit **50** is mountable to and demountable from the apparatus main body **10**. In a state where the transfer belt unit **50** is mounted to the apparatus main body **10**, the transfer belt unit **50** is arranged between the feeder unit **2** and the image forming unit **40**. The transfer belt unit

50 includes a drive roller 51, a driven roller 52, a transfer belt 53, four transfer rollers 54, four belt electrodes 57, and a backup roller 56.

The drive roller 51 is a roller configured to drive the transfer belt 53. The drive roller 51 is in contact with an inner surface of the transfer belt 53. A drive force that is generated from a motor M of the image forming apparatus 1 is transmitted to the drive roller 51, so that the transfer belt 53 is rotated in an arrow direction (counterclockwise direction) in FIG. 1.

The driven roller 52 is a roller configured to rotate in association with driving of the transfer belt 53. The driven roller 52 is in contact with the inner surface of the transfer belt 53.

The transfer belt 53 (including upper surface 53A) is in contact with the photosensitive drums 43 in the state where the transfer belt unit 50 is mounted to the apparatus main body 10. The transfer belt 53 is configured to transfer toner images on the photosensitive drums 43 to the sheet S conveyed between the photosensitive drums 43 and the transfer belt 53, and to convey the sheet S conveyed between the photosensitive drums 43 and the transfer belt 53 toward the fixing unit 70. The transfer belt 53 is an endless belt.

The transfer roller 54 is in contact with the inner surface of the transfer belt 53. The transfer roller 54 is a roller configured to sandwich the transfer belt 53 between the transfer roller 54 and each photosensitive drum 43. The belt electrode 57 is located at an end portion of the transfer roller 54 at another end-side in the first direction. The belt electrode 57 is an electrode electrically connected to the transfer belt 53 via the transfer roller 54. The belt electrode 57 is configured to apply a transfer bias to the transfer roller 54 so as to transfer the toner image on the photosensitive drum 43 to the sheet S in the state where the sheet S is conveyed between the photosensitive drum 43 and the transfer belt 53.

The belt cleaner 60 is located below the transfer belt unit 50. The belt cleaner 60 includes a cleaning roller 61 and a collection box 62. The cleaning roller 61 is in contact with a lower surface 53B of the transfer belt 53. The cleaning roller 61 is configured to collect toner on the transfer belt 53 and to accommodate the same in the collection box 62. The cleaning roller 61 is configured to sandwich the transfer belt 53 between the cleaning roller 61 and the backup roller 56.

The fixing unit 70 is located downstream of the image forming unit 40 and the transfer belt unit 50 with respect to a conveying direction. The fixing unit 70 includes a heating roller 71 and a pressing roller 72 arranged to face the heating roller 71. The pressing roller 72 is configured to press the heating roller 71.

In the image forming part 3, surfaces of the photosensitive drums 43 are uniformly charged by the chargers 44. Thereafter, laser light (dashed-dotted line) from the exposure unit 30 is irradiated to the surfaces of the photosensitive drums 43. As a result, electrostatic latent images are formed on the photosensitive drums 43. Also, the toner in the toner accommodation part is supplied to the developing rollers 46 through the supply rollers. Then, the toner is carried on the developing rollers 46.

The toner carried on the developing rollers 46 is supplied from the developing rollers 46 to the electrostatic latent images on the photosensitive drums 43. As a result, toner images are formed on the photosensitive drums 43. Thereafter, the sheet S fed onto the transfer belt 53 is conveyed between the photosensitive drums 43 and the transfer rollers 54. As a result, the toner images formed on the respective photosensitive drums 43 are transferred to the sheet S. Then, the sheet S is conveyed between the heating roller 71 and the pressing roller 72. As a result, the transferred toner images are heat-fixed on the sheet S.

The discharge unit 4 has a discharge path 81 formed to extend upward from an exit of the fixing unit 70 and to change a direction thereof toward the front, and a plurality of conveyor rollers 82 configured to convey the sheet S. The sheet S having the toner images heat-fixed thereon is enabled to pass the discharge path 81 by the conveyor rollers 82. Thereafter, the sheet S is discharged onto a discharge tray 12 located at an upper part of the apparatus main body 10,

The apparatus main body 10 has an openable and closable front cover 11. The front cover 11 is a front sidewall of the apparatus main body 10. A user can open the front cover 11 and pull out the drum cartridges 41 to an outside of the apparatus main body 10. That is, the drum cartridge 40A is detachably mounted to the apparatus main body 10. Also, the user can pull out the transfer belt unit 50 to the outside of the apparatus main body 10 by demounting the drum cartridge 40A from the apparatus main body 10.

Subsequently, a detailed structure around the transfer belt unit 50 is described.

As shown in FIG. 2, the transfer belt unit 50 has a belt frame 55. The belt frame 55 rotatably supports the drive roller 51 and the driven roller 52.

The drive roller 51 is rotatable about a first axis X1 extending in the first direction. The driven roller 52 is rotatable about a second axis X2 extending in the first direction. The driven roller 52 is located with being spaced from the drive roller 51 in the second direction intersecting with the first direction. In the exemplary embodiment, the second direction is a direction in which the first axis X1 and the second axis X2 are aligned, and intersects with the first direction.

The belt frame 55 has a first frame 55A, a second frame 55B, a third frame 55C, and a handle C1. The first frame 55A is located at an end portion of the transfer belt 53 at one end-side in the first direction. The second frame 55B is located at an end portion of the transfer belt 53 at the other end-side in the first direction. The third frame 55C is located at an end portion of the transfer belt 53 at one end-side in the second direction. The third frame 55C couples an end portion of the first frame 55A at the one end-side in the second direction and an end portion of the second frame 55B at the one end-side in the second direction.

The handle C1 is located on the third frame 55C. The handle C1 is located at an end portion of the belt frame 55 at the one end-side in the second direction. The user can mount and demount the transfer belt unit 50 by gripping the handle C1.

The first frame 55A has a main body part A1, a bearing part A2, an engaging part A3, and a supported part A4. The main body part A1 extends in the second direction. The bearing part A2, the engaging part A3 and the supported part A4 protrude from a side surface of the main body part A1 toward the one end-side in the first direction. The bearing part A2, the engaging part A3 and the supported part A4 protrude from the main body part A1 so as to be distant from the second frame 55B in the first direction.

The second frame 55B has a main body part B1, a bearing part B2, an engaging part B3, and a supported part B4. The main body part B1 extends in the second direction. The bearing part B2, the engaging part B3 and the supported part B4 protrude from a side surface of the main body part B1 toward the other end-side in the first direction. The bearing part B2, the engaging part B3 and the supported part B4

protrude from the main body part B1 so as to be distant from the first frame 55A in the first direction.

The bearing part A2 rotatably supports an end portion of a shaft 51S of the drive roller 51 at the one end-side in the first direction. The bearing part B2 rotatably supports an end portion of the shaft 51S of the drive roller 51 at the other end-side in the first direction. The bearing parts A2, B2 are cylindrical members. The bearing part A2 is located at an end portion of the first frame 55A at the other end-side in the second direction. The bearing part B2 is located at an end portion of the second frame 55B at the other end-side in the second direction. The drive roller 51 has a drive gear 58. The drive gear 58 is configured to transmit the drive force from the motor M of the image forming apparatus 1 to the drive roller 51. The drive gear 58 is located on the first frame 55A.

As shown in FIG. 3A, the bearing parts A2; B2 are supported by a restraint part 14 of the apparatus main body 10 in the state where the belt unit 50 is mounted to the apparatus main body 10. The restraint part 14 is a member configured to restrain a position of the drive roller 51 in the third direction intersecting with the first direction and the second direction via the bearing parts A2, B2. In the exemplary embodiment, the third direction is perpendicular to the first direction and the second direction.

As shown in FIG. 3B, the restraint part 14 has a bottom part 14A extending in the third direction, an upper part 14B extending from one end of the bottom part 14A in the third direction toward the one end-side in the second direction, and a lower part 14C extending from another end of the bottom part 14A in the third direction toward the one end-side in the second direction. The restraint part 14 has an opening at an end portion of the restraint part 14 at the one end-side in the second direction. The restraint part 14 has a U-shape. A length of the lower part 14C in the second direction is greater than a length of the upper part 14B in the second direction.

An interval between the upper part 14B and the lower part 14C is greater than an outer diameter of the bearing parts A2, B2. For this reason, in the state where the belt unit 50 is mounted to the apparatus main body 10, the bearing parts A2, B2 are inserted in the restraint part 14. Thereby, movement of the bearing parts A2, B2 in the third direction is restrained by the upper part 14B and the lower part 14C.

The bottom part 14A is configured to restrain a position of the drive roller 51 in the second direction. The bottom part 14A is in contact with the bearing parts A2, B2 in the state where the belt unit 50 is mounted to the apparatus main body 10. On the other hand, the bottom part 14A may be located while being spaced from the bearing part sA2, B2 in the second direction in the state where the belt unit 50 is mounted to the apparatus main body 10.

Also, the transfer belt unit 50 is rotatable about an axis of the drive roller 51 upon mounting to and demounting from the apparatus main body 10. Specifically, the transfer belt unit 50 is rotatable about the axis of the drive roller 51 between a contact position shown in FIG. 3A and a spaced position shown in FIG. 4.

As shown in FIG. 3A, the engaging parts A3, B3 are members engaged to a pressing member 110 of the apparatus main body 10. The engaging parts A3, B3 have a tapered shape. A distance between the engaging parts A3, B3 and the drive roller 51 in the second direction is a first distance L1. A distance between the engaging parts A3, B3 and the handle C1 in the second direction is a second distance L2 greater than the first distance L1. More specifically, a distance from the axis of the drive roller 51 to a contact points of the engaging parts A3, B3 and the pressing member 110 is the first distance L1. Also, a distance from the contact points of the engaging parts A3, B3 and the pressing member 110 to the other end of the handle C1 in the second direction is the second distance L2.

The pressing member 110 is a member configured to press the engaging part A3; B3 toward a positioning part 15 of the apparatus main body 10 in the second direction. The pressing member 110 is rotatable between an initial position shown in FIG. 4 and a pressing position shown in FIG. 3A. In the meantime, the positioning parts 15 are located at both sides of the transfer belt unit 50 in the first direction.

The pressing member 110 has a rotating shaft 111 rotatably supported by the apparatus main body 10, a first arm part 112 extending from the rotating shaft 111 toward one end-side in the third direction and configured to sandwich the engaging parts A3, B3 between the first arm part 112 and the positioning part 15, a guide part 113 protruding from an end portion of the first arm part 112 at one end-side in the third direction toward the other end-side in the second direction, and a second arm part 114 extending from the rotating shaft 111 toward the one end-side in the second direction. An end portion of the first arm part 112 at the one end-side in the third direction has a tapered shape.

The apparatus main body 10 has a tensile coil spring 120, a spring engaging part 16, and a support part 17.

One end portion of the tensile coil spring 120 is engaged to a tip end portion of the second arm part 114 of the pressing member 110. The other end portion of the tensile coil spring 120 is engaged to the spring engaging part 16. Thereby, the pressing member 110 is always pressed from the pressing position toward the initial position by the tensile coil spring 120. Also, the pressing member 110 pressed by the tensile coil spring 120 presses the engaging parts A3, B3 toward the positioning part 15 in the second direction. As a result, the transfer belt unit 50 is positioned in the second direction with respect to the apparatus main body 10. Here, when the engaging parts A3, B3 deviate from between the pressing member 110 and the positioning part 15, the pressing member 110 comes in contact with the positioning part 15. As a result, the pressing member 110 is kept at the initial position.

Also, the first frame 55A has the supported part A4, a bearing part 52A, a guide hole 52B, and a compression coil spring 52C. The second frame 55B has the supported part B4.

The supported parts A4, B4 are supported by the support part 17 in the state where the belt unit 50 is mounted to the apparatus main body 10. The supported part A4 is located between the engaging part A3 and the handle C1. The supported part B4 is located between the engaging part B3 and the handle C1. The bearing 52A rotatably supports the driven roller 52. The bearing 52A is located at an end portion of the first frame 55A at the one end-side in the second direction. The guide hole 52B is formed to movably support the bearing 52A in the second direction. The compression coil spring 52C is configured to urge the bearing 52A toward the one end-side in the second direction.

The transfer belt unit 50 includes a belt memory 200. The belt memory 200 is located on the belt frame 55. The belt memory 200 includes a memory element 201, and a first electrical contact surface 202. The first electrical contact surface 202 is electrically connected to the memory element 201. In the exemplary embodiment, the memory element 201 and the first electrical contact surface 202 are adjacent to each other. However, the memory element 201 and the first electrical contact surface 202 may be spaced apart.

In the belt memory **200**, information about the transfer belt unit **50** is stored. Specifically, in the belt memory **200**, a conveying speed of the transfer belt **53** measured in advance is stored. Also, in the belt memory **200**, a thickness of the transfer belt **53**, an outer diameter of the drive roller **51**, and an outer diameter of the driven roller **52**, which have been measured in advance, may be stored as examples of component information influencing the conveying speed of the belt.

As shown in FIG. **5**, the first electrical contact surface **202** is located on an outer surface of the belt frame **55**. The first electrical contact surface **202** is located at the end portion of the belt frame **55** at the one end-side in the first direction. Also, the first electrical contact surface **202** is aligned with the handle C**1** in the first direction, when viewed by a user from the third direction. The first electrical contact surface **202** is located at an end portion of the belt frame **55** at the one end-side in the second direction. The first electrical contact surface **202** is located at an opposite side to the drive roller **51** with respect to the driven roller **52** in the second direction. That is, the driven roller **52** is located between the first electrical contact surface **202** and the drive roller **51** in the second direction. The first electrical contact surface **202** is perpendicular to the third direction.

The belt frame **55** has a protrusion **55**T, a holder **210**, positioning parts **212**, a spring holding part **213**, and a spring **214**.

As shown in FIG. **3**A, the belt frame **55** has the protrusion **55**T extending away from the transfer belt **53**. The protrusion **55**T extends in the third direction. The first electrical contact surface **202** is closer to the transfer belt **53** than to a tip end **55**S of the protrusion **55**T in the third direction.

As shown in FIG. **6**, the holder **210** is supported by the spring holding part **213** so as to be slidable in the third direction. Specifically, the third frame **55**C of the belt frame **55** has the holder **210** configured to hold the first electrical contact surface **202**. The first electrical contact surface **202** of the belt memory **200** is held by the holder **210**.

The holder **210** has a concave part **211**A configured to hold the belt memory **200** and a protrusion **211**B extending toward the one end-side in the third direction.

The spring holding part **213** has a hole **213**A extending in the third direction. The spring **214** is located in the hole **213**A. The spring **214** is a compression spring. One end of the spring **214** is in contact with a bottom of the hole **213**A, and the other end of the spring **214** is engaged with the protrusion **211**B of the holder **210**. Thereby, the spring **214** always presses the first electrical contact surface **202** in the third direction.

The positioning parts **212** are located at both sides of the spring holding part **213** in the first direction.

The positioning part **212** is supported by the spring holding part **213** so as to be slidable in the third direction. The positioning part **212** has a positioning protrusion **212**A protruding toward the other end-side in the third direction and an inclined surface **212**B. The positioning protrusion **212**A is located at an end portion of the spring holding part **213** in the first direction. The inclined surface **212**B is located at a position more distant from the spring holding part **211** than the positioning protrusion **212**A in the first direction. The inclined surface **212**B is inclined so as to be more distant from the positioning protrusion **212**A in the third direction as it is more spaced from the first electrical contact surface **202** in the first direction.

The positioning parts **212** are located at both sides of the spring holding part **213** when the transfer belt unit **50** is located at the contact position shown in FIG. **7**. On the other hand, when the transfer belt unit **50** is located at the spaced position shown in FIG. **9**, the positioning parts **212** are slid by an urging member (not shown) or an own weight thereof, and is moved toward the other end-side in the third direction with respect to the spring holding part **213**.

The image forming apparatus **1** includes a first electric contact **300**, a contact holder **310**, and a separation preventing member **320**. As shown in FIG. **7**, the first electric contact **300** is located at an end portion of the apparatus main body **10** at the one end-side in the first direction (refer to FIG. **9**, too). The first electric contact **300** comes into electrical contact with the first electrical contact surface **202** in the state where the transfer belt unit **50** is mounted to the apparatus main body **10**. The first electric contact **300** is held by the contact holder **310**.

As shown in FIG. **8**, the contact holder **310** is held by the apparatus main body **10** and the separation preventing member **320**. The apparatus main body **10** and the separation preventing member **320** hold the contact holder **310** so as to be slidable in the first direction and in the second direction. Specifically, the separation preventing member **320** holds the contact holder **310** so as to be slidable within a range of a region R**1**. The apparatus main body **10** and the separation preventing member **320** hold the contact holder **310** so as to be slidable within a range of a region R**2**. The separation preventing member **320** restrains the contact holder **310** from moving in the third direction. The contact holder **310** is capable of sliding in the first direction and the second direction.

The contact holder **310** has a holding member **311**, holes **312**, guides **313**, a concave part **314**, and an extension part **315**. The holding member **311** is a member holding the first electric contact **300**. The hole **312** is a hole that the positioning protrusion **212**A of the holder **210** is to enter. The guide **313** has an inclined part **313**A. The inclined part **313**A is configured to come into contact with the inclined surface **212**B of the holder **210**, thereby guiding the holder **210**. The concave part **314** supports the holding member **311**. The extension part **315** extends toward the one end-side in the second direction. The extension part **315** is configured to enter between the apparatus main body **10** and the separation preventing member **320**. Thereby, the contact holder **310** is restrained from moving in the third direction.

As shown in FIG. **7**, the apparatus main body **10** has a lever **350**. The lever **350** is rotatable about a rotary axis X**3** extending in the second direction between a first position shown in FIG. **7** and a second position shown in FIG. **9**. When the lever **350** is located at the first position, the first electrical contact surface **202** is in contact with the first electric contact **300**. On the other hand, when the lever **350** is located at the second position, the first electrical contact surface **202** is spaced from the first electric contact **300**.

The lever **350** has a rotating shaft **351**, a first arm **352**, a second arm **353**, and a third arm **354**.

The rotating shaft **351** is rotatable about the rotary axis X**3**. The first arm **352** extends from an outer peripheral surface of the rotating shaft **351**. A tip end portion of the first arm **352** is aligned with the handle C**1** in the first direction. The user can touch the tip end portion of the first arm **352**.

The second arm **353** extends from the outer peripheral surface of the rotating shaft **351** in a direction different from the first arm **352**. The second arm **353** is located while being spaced from the first arm **352** in a rotating direction of the lever **350**. When the lever **350** is located at the first position, a tip end of the second arm **353** comes into contact with the handle C**1**.

The third arm **354** extends from the outer peripheral surface of the rotating shaft **351** in a direction different from the first arm **352** and the second arm **353**. The third arm **354** can be elastically deformed. When the lever is located at the second position, a tip end of the third arm **354** is engaged with the apparatus main body **10**. For this reason, when the lever is located at the second position, the third arm **354** always urges the lever **350** to return from the second position toward the first position.

In a state where the lever **350** is located at the first position, when the user presses the first arm **352** so that the lever **350** rotates from the first position to the second position, the second arm **353** pushes up the transfer belt unit **50** to the spaced position. Thereby, the first electrical contact surface **202** is spaced from the first electric contact **300**. In other words, when the lever **350** is located at the first position, the first electrical contact surface **202** comes into contact with the first electric contact **300**. When the lever **350** is located at the second position, the first electrical contact surface **202** is spaced from the first electric contact **300**.

The apparatus main body **10** has a main body substrate **360** electrically connected to the first electric contact **300**. The main body substrate **360** is located at the end portion of the apparatus main body **10** at the one end-side in the first direction. That is, both the first electric contact **300** and the main body substrate **360** are located at the end portion of the apparatus main body **10** at the one end-side in the first direction. The main body substrate **360** is a substrate including a CPU, a RAM, a ROM and an input/output circuit, for example.

As shown in FIG. **7**, the drum cartridge **41** includes a drum memory **41**M having a second electrical contact surface **41**T (refer to FIG. **1**, too). The apparatus main body **10** has a second electric contact **300**T that is in contact with the second electrical contact surface **41**T in the state where the drum cartridge **41** is mounted to the apparatus main body **10**. The second electric contact **300**T is located at the end portion of the apparatus main body **10** at the one end-side in the first direction. That is, both the second electric contact and the main body substrate **360** are located at the end portion of the apparatus main body **10** at the one end-side in the first direction.

Subsequently, operations that are performed when mounting and demounting the transfer belt unit **50** are described.

As shown in FIG. **4**, when mounting the transfer belt unit **50** to the apparatus main body **10**, the user first inserts the transfer belt unit **50** into the apparatus main body **10** while gripping the handle C**1**. At this time, the user inserts the bearing parts A**2**, B**2** into the restraint parts **14**.

Then, the user rotates the transfer belt unit **50** about the axis of the drive roller **51**. Thereby, the engaging parts A**3**, B**3** come into contact with the guide parts **113** of the pressing members **110**. When the user further rotates the transfer belt unit **50**, the engaging parts A**3**, B**3** press the guide parts **113** of the pressing members **110** against the urging forces of the tensile coil springs **120**. Thereby, the pressing members **110** are rotated from the initial position shown in FIG. **4** to the pressing position shown in FIG. **3**A. At this time, the engaging parts A**3**, B**3** enter between the pressing members **110** and the positioning parts **15**. As a result, the transfer belt unit **50** is positioned in the second direction with respect to the apparatus main body **10**. At this time, the first electrical contact surface **202** comes into contact with the first electric contact **300**. When the first electrical contact surface **202** comes into contact with the first electric contact **300**, the spring **214** presses the first electrical contact surface **202** in the third direction.

When the first electrical contact surface **202** comes into contact with the first electric contact **300**, the positioning protrusions **212**A of the holder **210** enter the holes **312** of the contact holder **310**. As a result, the first electric contact **300** is positioned in the first direction and the second direction. In a case where the positioning protrusions **212**A deviate from the holes **312** of the contact holder **310**, the inclined parts **313**A of the contact holder **310** are guided to the inclined surfaces **212**B of the holder **210**. For this reason, the positioning protrusions **212**A are guided into the holes **312** of the contact holder **310**.

When demounting the transfer belt unit **50** from the apparatus main body **10**, the user first pushes the tip end portion of the first arm **352** of the lever **350** toward the other end-side in the third direction (an arrow direction in FIG. **7**). Thereby, the tip end portion of the second arm **353** pushes up the handle C**1** toward the one end-side in the third direction. Then, the transfer belt unit **50** is moved from the contact position to the spaced position (refer to FIG. **9**). At this time, the user can grip the handle C**1** by pushing fingers from a gap between the handle C**1** and the apparatus main body **10**. The user rotates the transfer belt unit **50** about the axis of the drive roller **51** by raising an end portion of the transfer belt unit **50** by gripping the handle C**1**. Thereby, the engaging parts A**3**, B**3** depart from between the pressing members **110** and the positioning parts **15**. For this reason, as shown in FIG. **4**, the pressing members **110** are rotated in a clockwise direction by the urging forces of the tensile coil springs **120** and are thus returned from the pressing position to the initial position. Thereafter, the user separates the bearing parts A**2**, B**2** from the restraint parts **14** and takes out the transfer belt unit **50** to the outside of the apparatus main body **10**.

According to the transfer belt unit **50** as described above, it is possible to store the information about the transfer belt unit **50**. Also, according to the image forming apparatus **1** including the transfer belt unit **50**, it is possible to store the information about the transfer belt unit **50**.

Also, since the first electrical contact surface **202** of the belt memory **200** is located at the outer surface of the belt frame **55**, the information stored in the belt memory **200** can be easily read out from the first electrical contact surface **202**.

Also, since the drive gear **58** and the first electrical contact surface **202** are arranged at the same side in the first direction, the positioning in the first direction can be performed easily.

Also, since the first electrical contact surface **202** is arranged at an opposite side to the drive roller **51** with respect to the driven roller **52** in the second direction, the first electrical contact surface **202** is unlikely to be an obstacle.

Also, since the first electrical contact surface **202** is aligned with the handle C**1** in the first direction, it is possible to suppress enlargement of the transfer belt unit **50**.

Also, since the holder **210** configured to hold the first electrical contact surface **202** can be slid in the third direction, the first electrical contact surface **202** can stably come into contact with a member configured to read out the information.

Also, since the first electrical contact surface **202** is urged in the third direction by the spring **214**, it is possible to suppress contact defects which are caused due to vibrations and the like.

Also, the first electrical contact surface **202** is closer to the transfer belt **53** than to the tip end **55**S of the protrusion **55**T of the belt frame **55**. Therefore, even when the transfer belt unit **50** is placed on a table or the like, the tip end **55**S of the protrusion **55**T comes into contact with the table, so that the first electrical contact surface **202** does not contact the table. For this reason, it is possible to suppress the first electrical contact surface **202** from being damaged.

Also, since the contact holder **310** can be slid in the first direction and the second direction, the first electrical contact surface **202** can stably contact the first electric contact **300**.

The first electric contact **300**, the second electric contact and the main body substrate **360** are located at the end portion at the one end-side in the first direction. For this reason, it is possible to shorten a wiring that connects the first electric contact **300** and the second electric contact to the main body substrate **360**.

Also, the first electrical contact surface **202** is in contact with the first electric contact **300** when the lever **350** is located at the first position, and the first electrical contact surface **202** is spaced from the first electric contact **300** when the lever **350** is located at the second position. Therefore, it is possible to easily demount the transfer belt unit **50** by locating the lever **350** at the second position.

In the above configuration, the lever **350** can rotate about the rotary axis X**3** extending in the second direction intersecting with the first direction. For this reason, it is possible to compactly arrange the lever **350** in the second direction. As a result, the lever **350** is unlikely to be an obstacle.

Also, the user can push up the transfer belt unit **50** by pushing the first arm **352** of the lever **350**. For this reason, the user can easily demount the transfer belt unit **50**.

Although the exemplary embodiment of the present disclosure has been described, the present disclosure is not limited to the exemplary embodiment.

In the exemplary embodiment, the transfer belt unit has the drive roller and one driven roller. However, the present disclosure is not limited thereto. For example, the transfer belt unit may have the drive roller and two or more driven rollers.

In the exemplary embodiment, the image forming apparatus **1** is the color laser printer. However, the present disclosure is not limited thereto. For example, the present disclosure can be applied to other image forming apparatuses such as a copier, a complex machine, and the like.

What is claimed is:

1. A transfer belt unit comprising:

a transfer roller rotatable about a first axis extending in a first direction;

a transfer belt being in contact with a photosensitive drum in a state where the transfer belt unit is mounted to the apparatus main body, the transfer belt having a first end and a second end spaced apart from the first end in the first direction; and

a belt memory including:

a memory element in which information about the transfer belt unit is stored; and

a first electrical contact surface electrically connected to the memory element, the first electrical contact surface being positioned between the first end of the transfer belt and the second end of the transfer belt in the first direction, wherein

the transfer belt is an endless belt,

the transfer roller is positioned inside of the transfer belt, and

the first electrical contact surface is positioned outside of the transfer belt.

2. The transfer belt unit according to claim **1**, further comprising:

a holder holding the first electrical contact surface, the holder including a protrusion extending from an outer surface of the holder in a second direction intersecting with the first direction.

3. The transfer belt unit according to claim **1**, further comprising:

a backup roller rotatable about a second axis extending in the first direction, the backup roller being in contact with an inner surface of the transfer belt.

4. The transfer belt unit according to claim **1**, further comprising:

a drive roller configured to drive the transfer belt, the drive roller being rotatable about a drive axis extending in the first direction, and the drive roller being in contact with an inner surface of the transfer belt; and

a driven roller being rotatable in association with driving of the transfer belt, the driven roller being rotatable about a driven axis extending in the first direction, the driven roller being in contact with the inner surface of the transfer belt, and the driven roller being spaced from the drive roller in a third direction intersecting with the first direction.

5. The transfer belt unit according to claim **4**,

wherein the first electrical contact surface is positioned closer to the driven roller than to the drive roller in the third direction.

6. The transfer belt unit according to claim **4**,

wherein the driven roller is positioned between the first electrical contact surface and the drive roller in the third direction.

7. The transfer belt unit according to claim **4**,

wherein the drive roller includes a drive gear configured to transmit a drive force to the drive roller, and

wherein the drive gear and the first electrical contact surface are positioned at one end of the transfer belt unit in the first direction.

8. The transfer belt unit according to claim **4**,

wherein the belt memory stores information about a thickness of the transfer belt, an outer diameter of the drive roller, and an outer diameter of the driven roller.

9. The transfer belt unit according to claim **1**,

wherein the belt memory stores information about a conveying speed of the transfer belt.

10. The transfer belt unit according to claim **1**, further comprising:

a belt electrode electrically connected to the transfer belt via the transfer roller.

11. The transfer belt unit according to claim **10**,

wherein the first electrical contact surface is positioned at one end of the transfer belt unit in the first direction, and

wherein the belt electrode is positioned at the other end of the transfer belt unit in the first direction.

12. The transfer belt unit according to claim **1**, further comprising:

a belt frame including a frame protrusion protruding in a second direction intersecting with the first direction,

wherein the first electrical contact surface is positioned between a tip end of the frame protrusion and the memory element in the second direction.

13. The transfer belt unit according to claim **12**,

wherein the belt frame includes a handle located at an end portion of the belt frame at one end side in the second direction, and

wherein the first electrical contact surface is aligned with the handle in the first direction when viewed from a third direction intersecting the first direction and the second direction.

14. The transfer belt unit according to claim **12**,

wherein the belt frame includes a holder holding the first electrical contact surface, and

wherein the holder is slidable in a third direction intersecting with the first direction and the second direction.

15. The transfer belt unit according to claim **14**,

wherein the belt frame further includes a spring configured to press the first electrical contact surface in the third direction.

16. The transfer belt unit according to claim **14**,

wherein the third direction is a direction perpendicular to the first electrical contact surface.

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