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(54) **SHEET CONVEYANCE APPARATUS, IMAGE READING APPARATUS, AND IMAGE FORMING APPARATUS**

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(57) **ABSTRACT**

A sheet conveyance apparatus includes a discharge tray that includes first, second, and third support portions. The first support portion includes first and second portions separately disposed in a width direction orthogonal to a discharge direction, and supports a first sheet that is wider than an interval between the first and second portions in the width direction. The second support portion is disposed between the first and second portions in the width direction at a position lower than the first support portion in a vertical direction, and supports a second sheet that is narrower than the interval between the first and second portions in the width direction. The protruding portion protrudes upward from the second support portion, and contacts a lower surface of a sheet supported by the second support portion to separate upward a leading end of the sheet in the discharge direction from the second support portion.

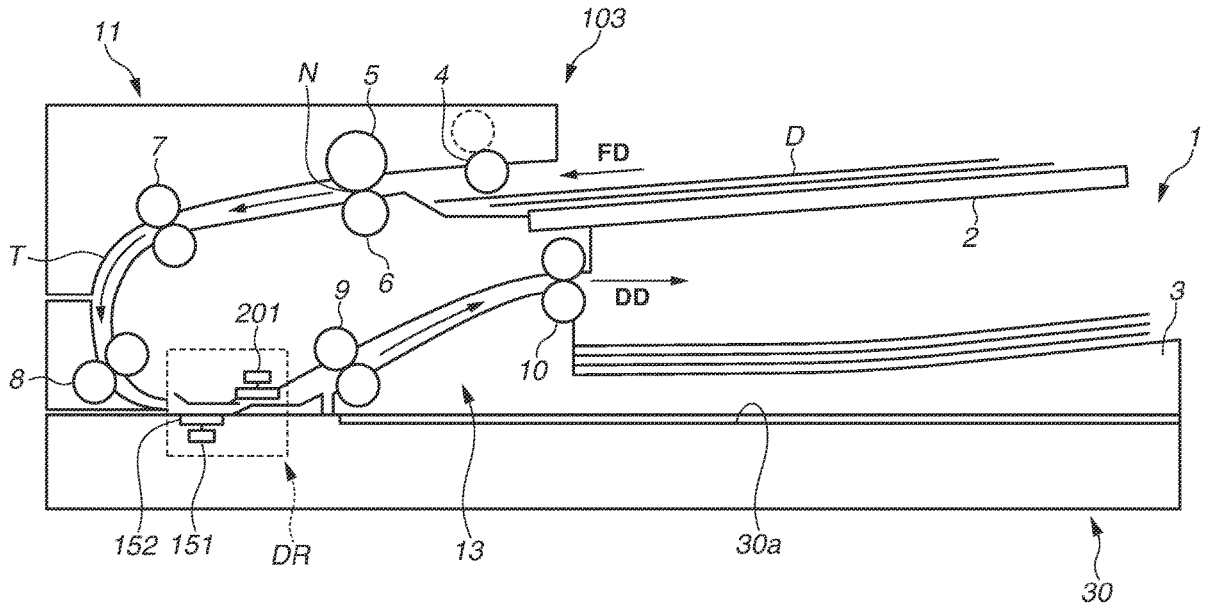


FIG.1

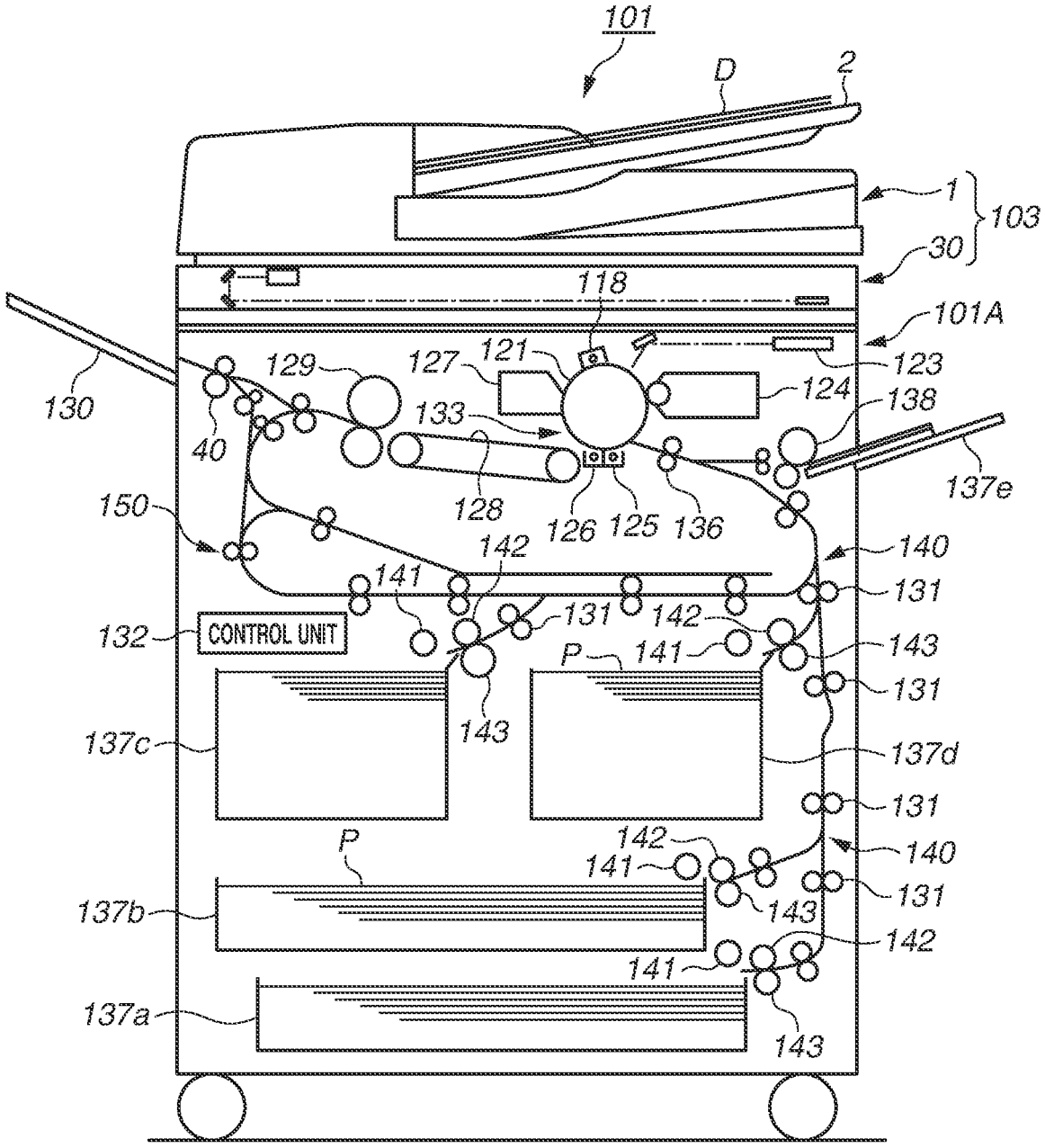

101
D
2
1
103
30
118
101A
123
124
138
137e
129
127
121
133
130
40
128
126
125
136
150
142
140
141
131
132
CONTROL UNIT
P
143
137c
137d
137b
137a

FIG.2

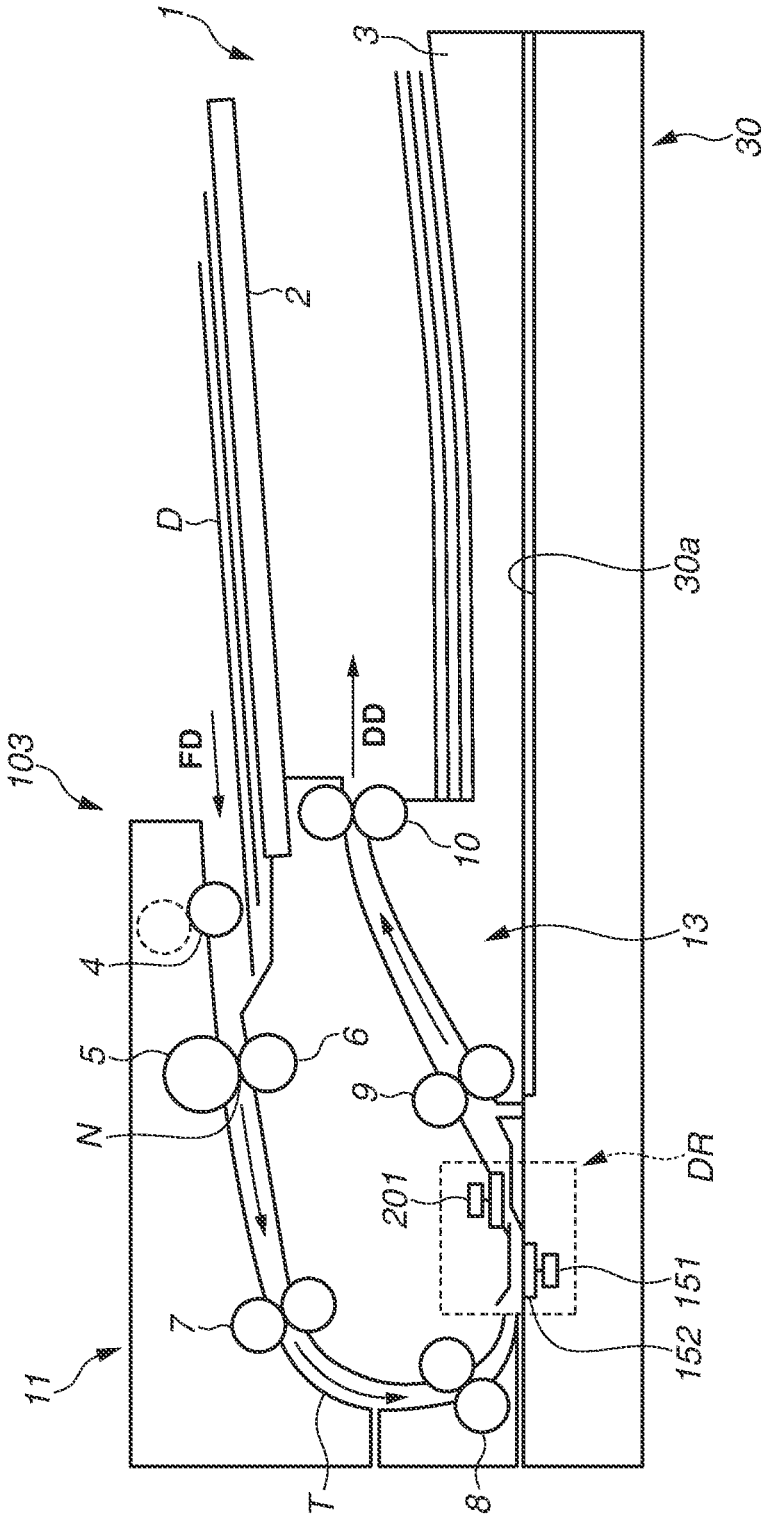


FIG.3

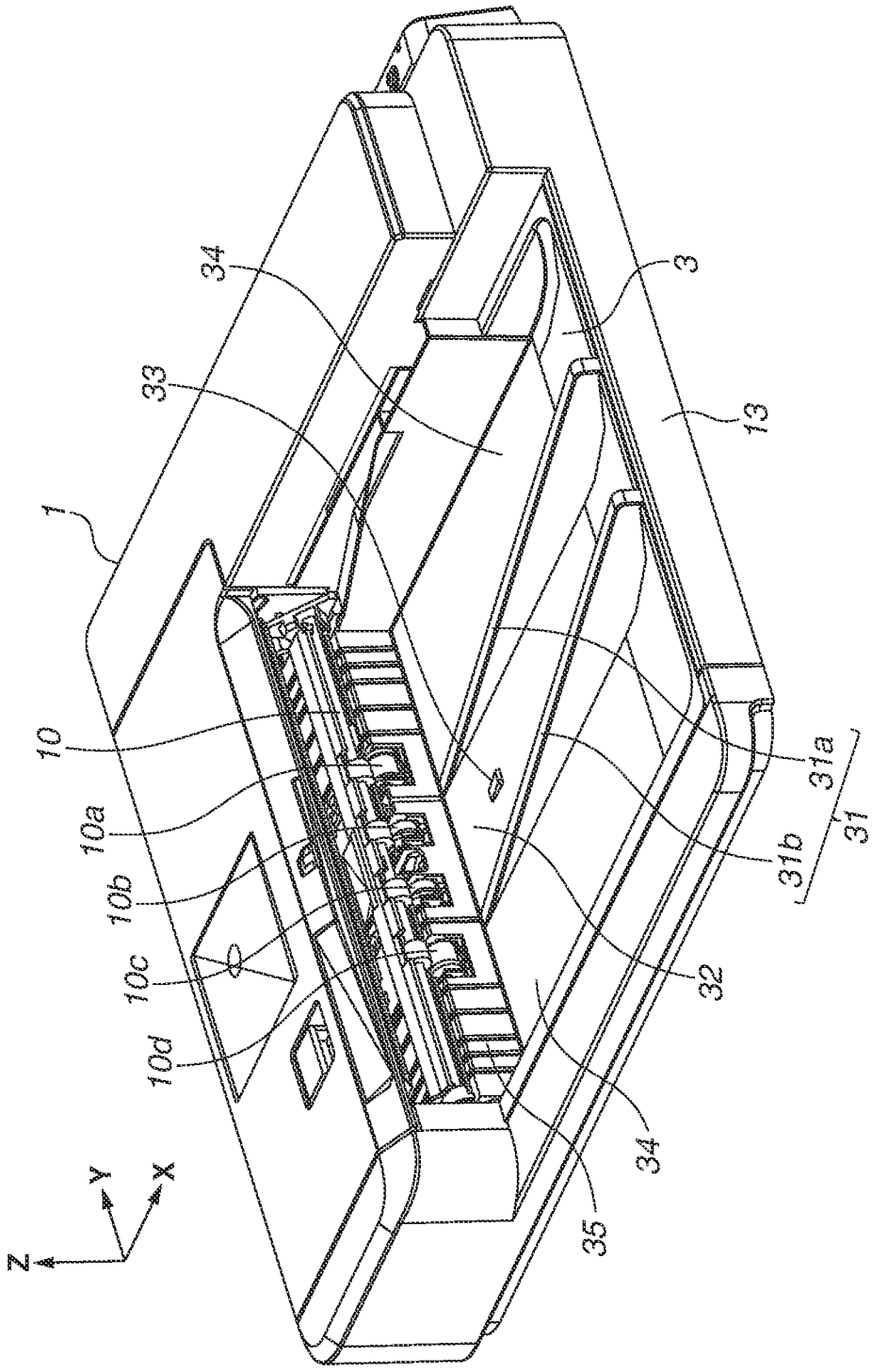


FIG.4

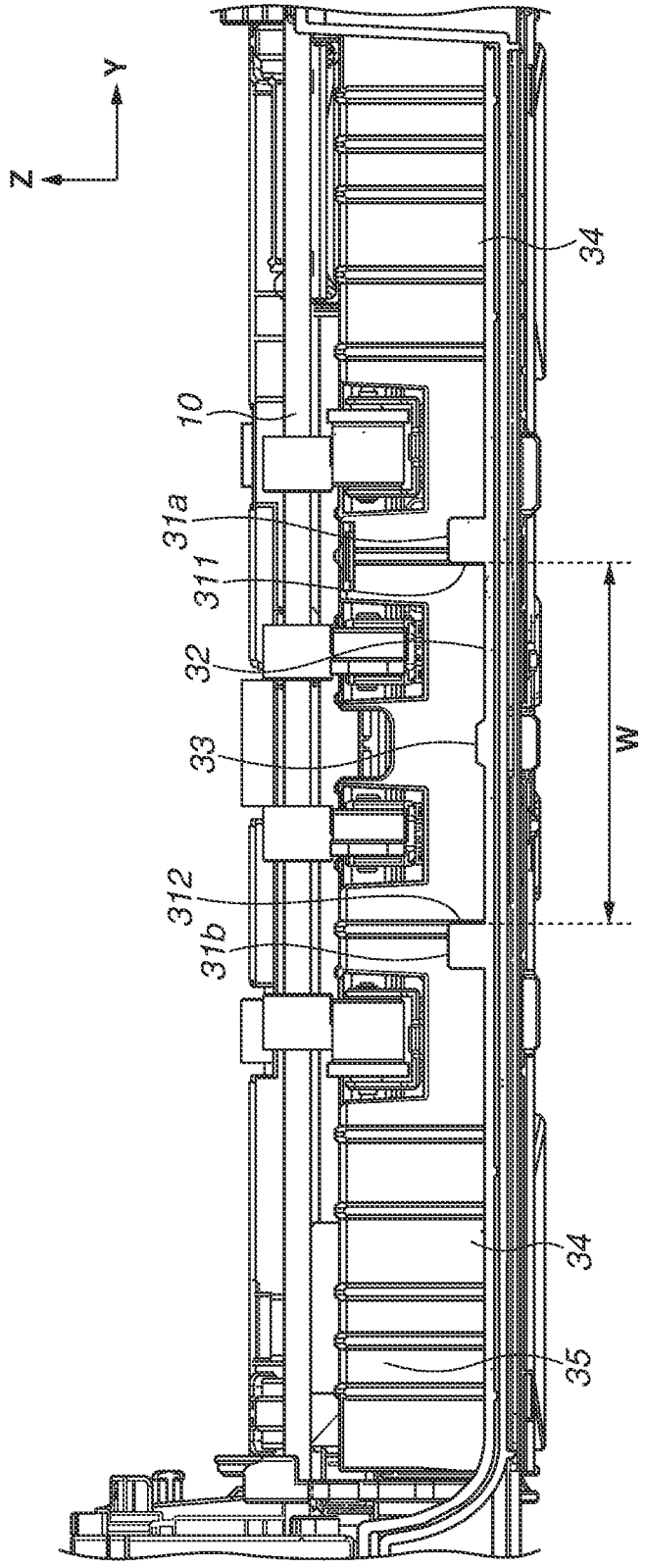


FIG.5

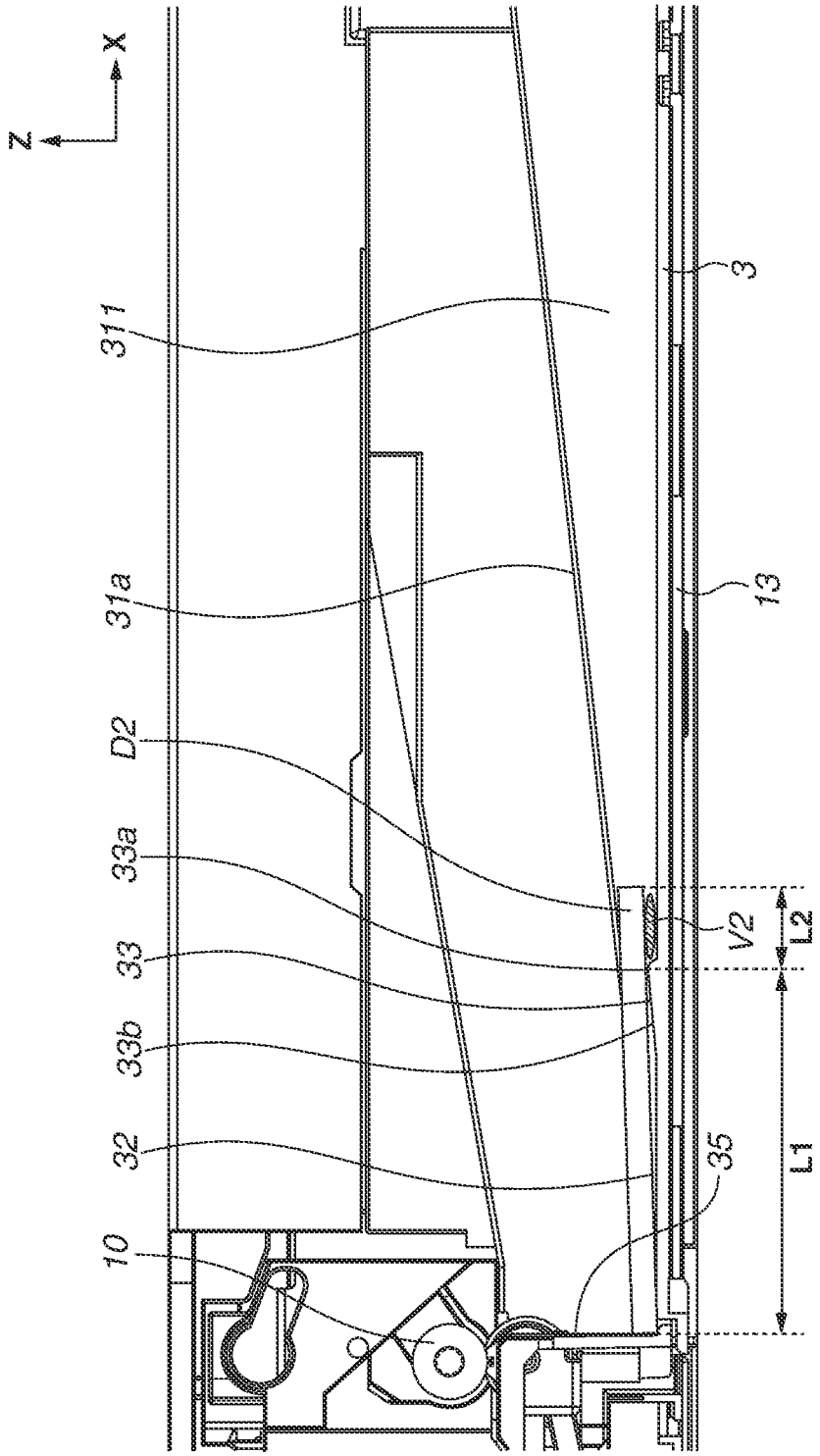


FIG.6

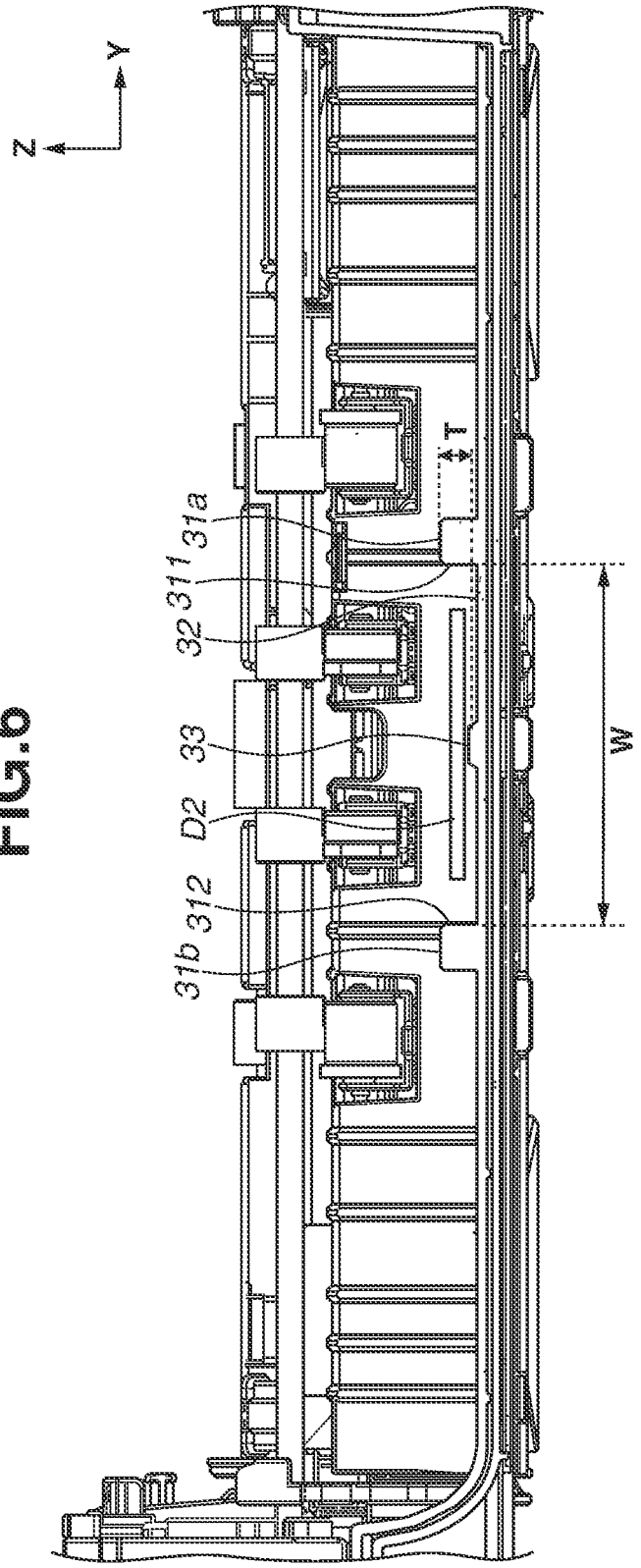


FIG.7

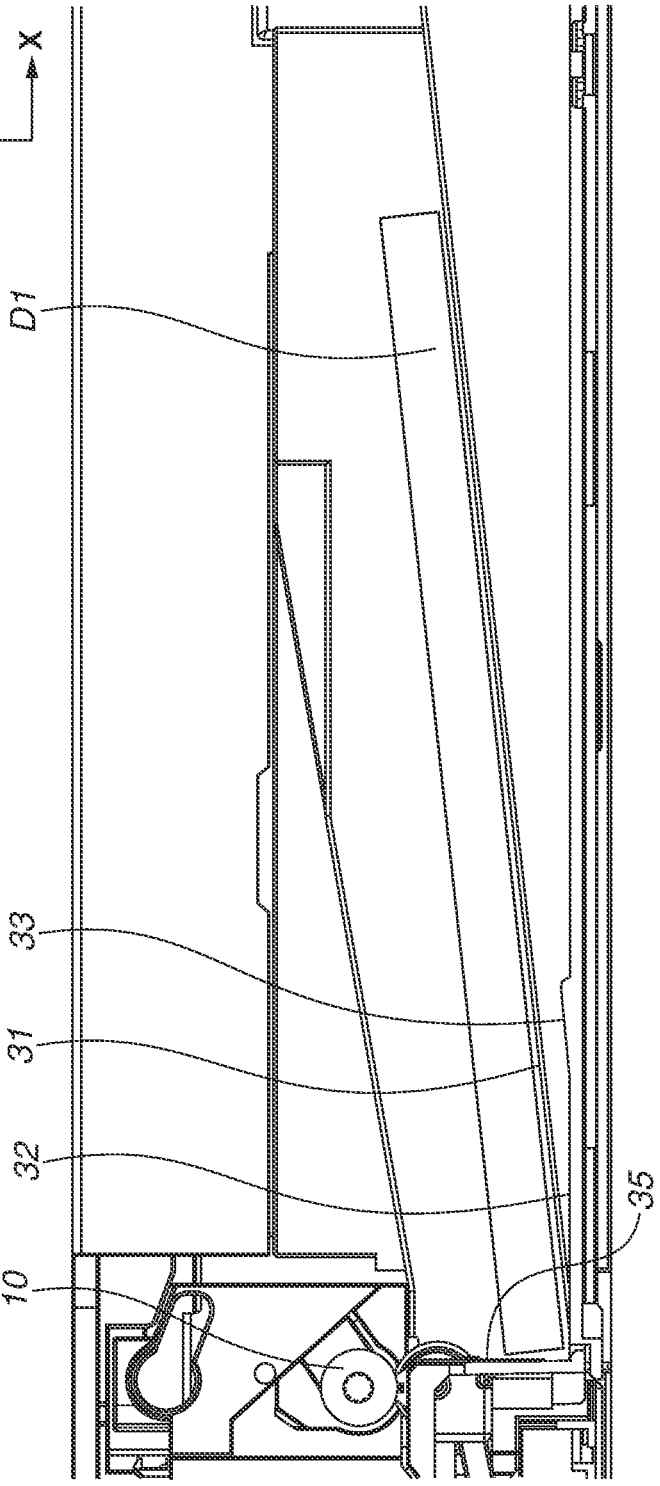


FIG.8

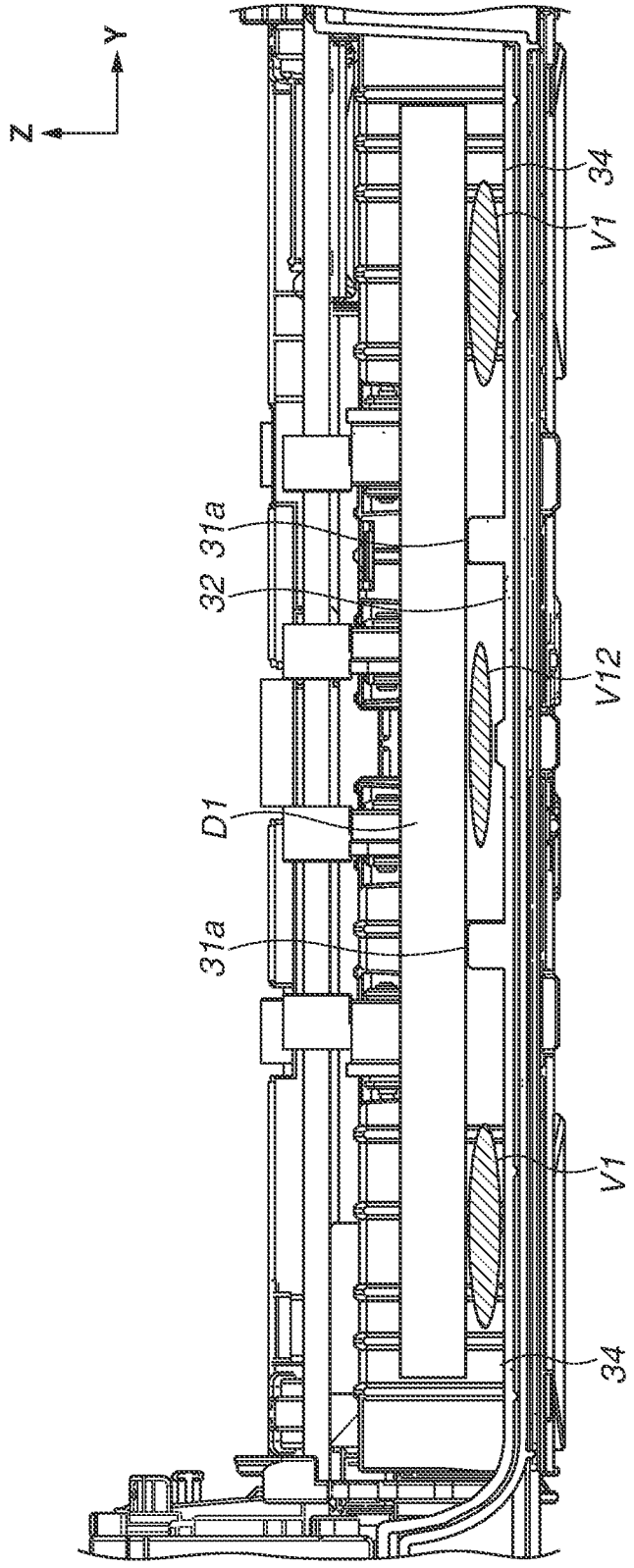


FIG.9

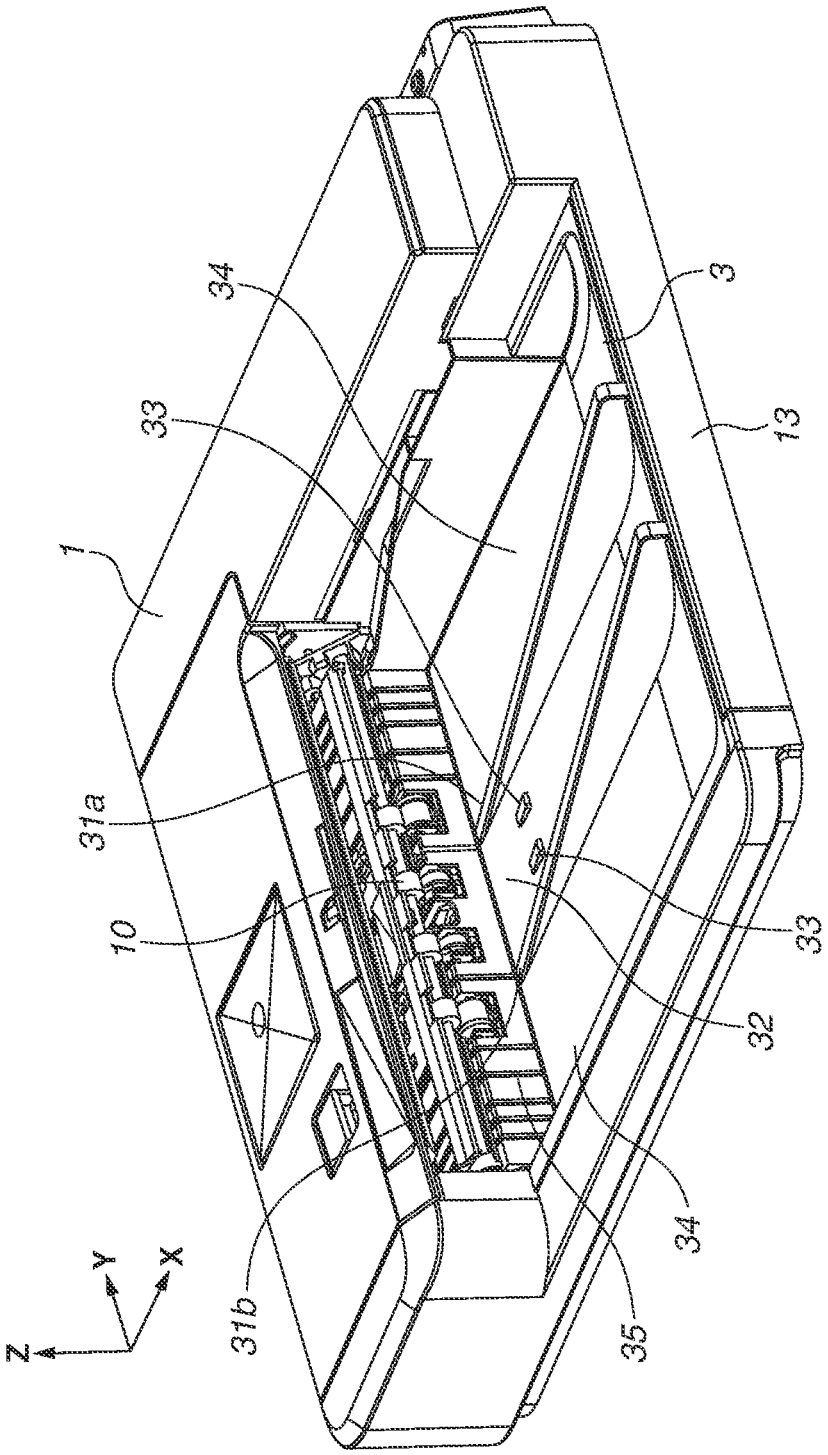


FIG.10

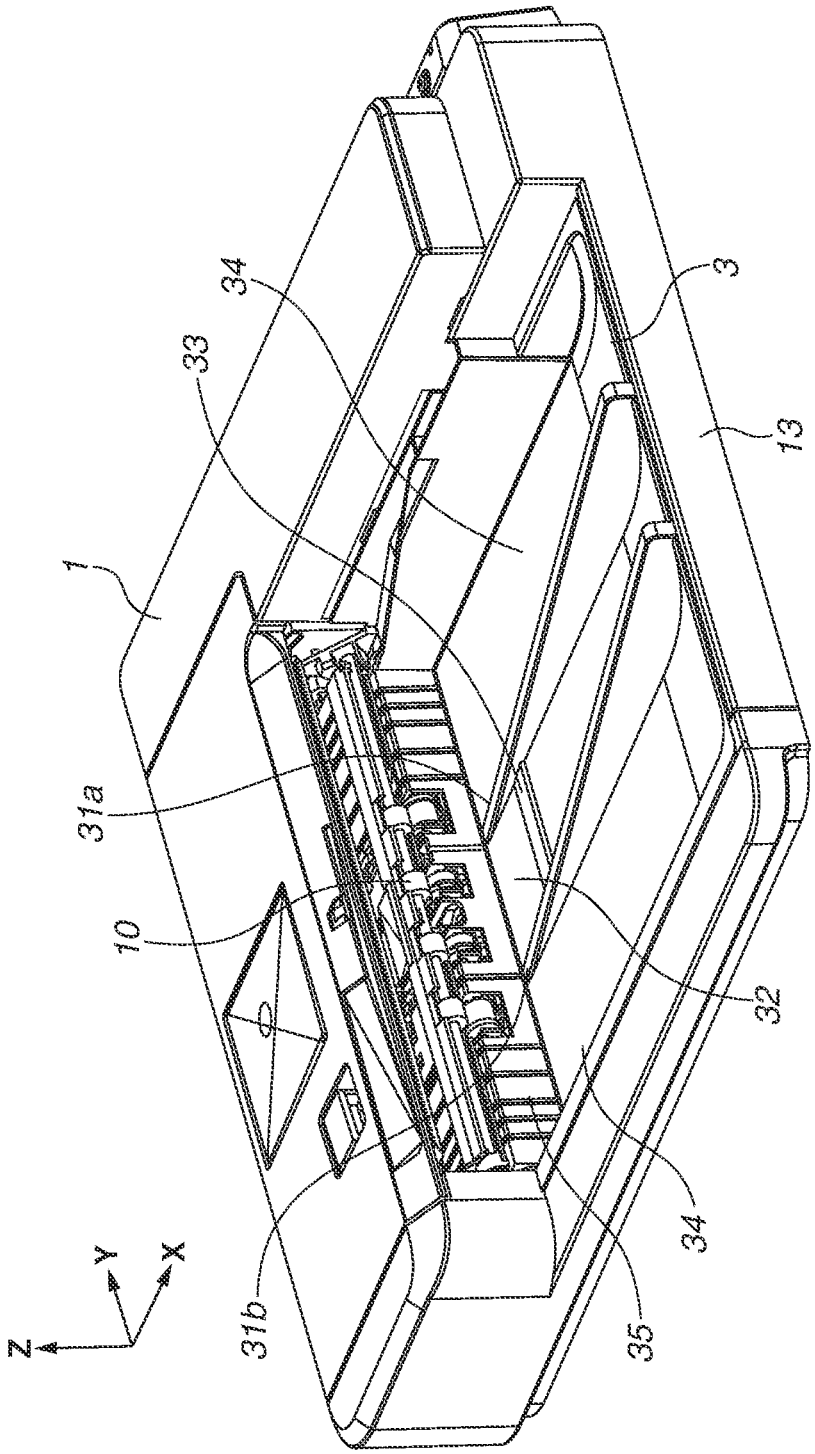


FIG.11

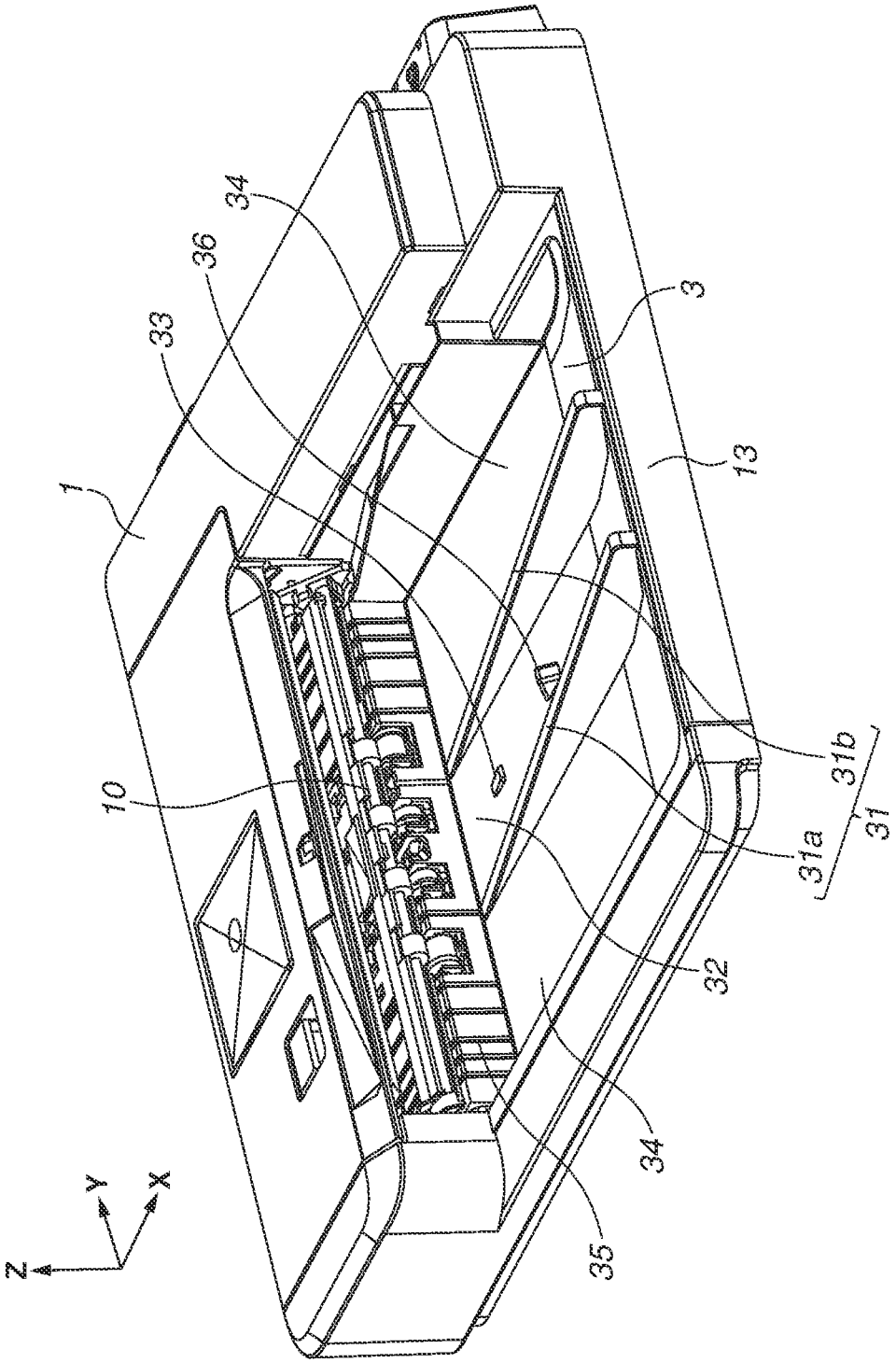


FIG. 12

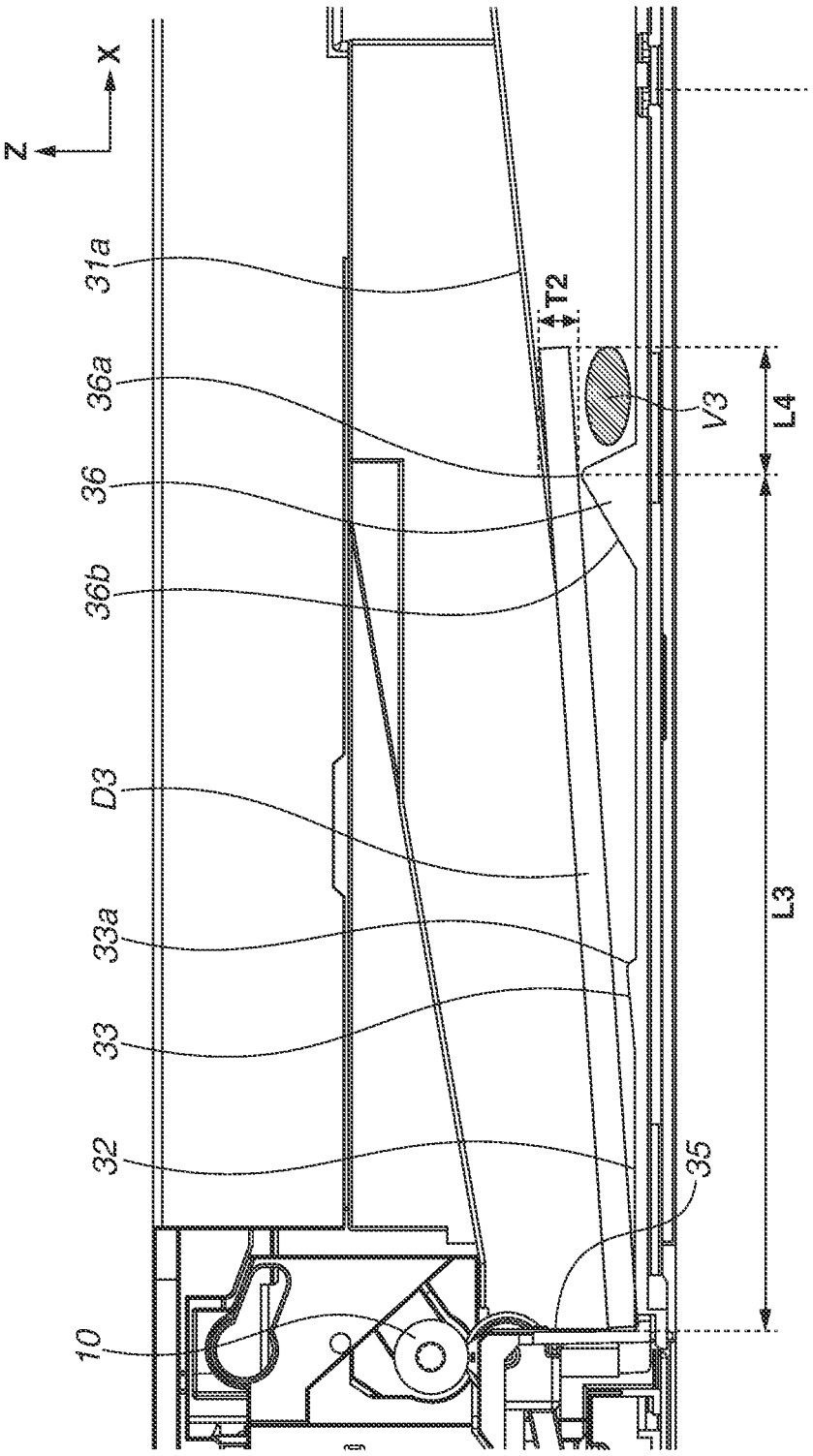
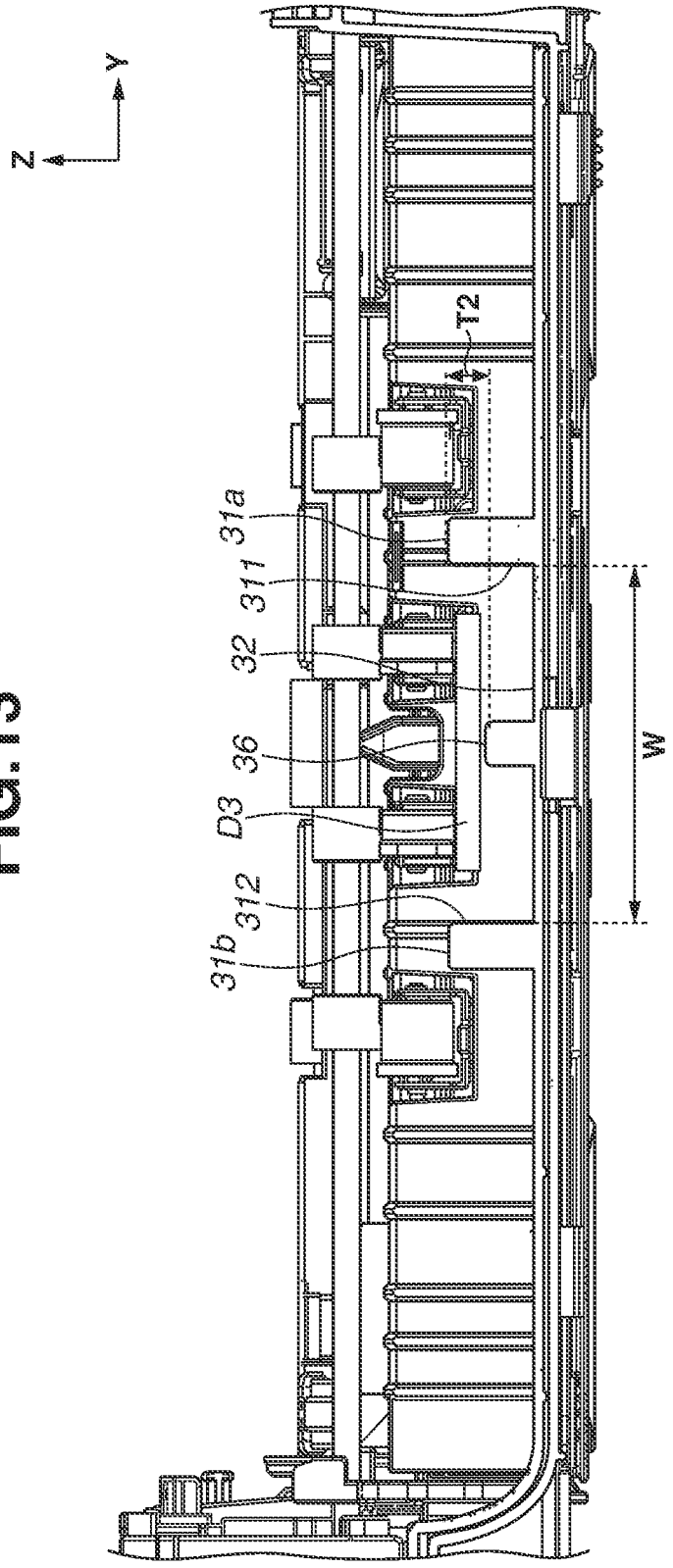


FIG.13



SHEET CONVEYANCE APPARATUS, IMAGE READING APPARATUS, AND IMAGE FORMING APPARATUS

BACKGROUND

Field

[0001] The present disclosure relates to a sheet conveyance apparatus for conveying sheets, and an image reading apparatus and an image forming apparatus including the sheet conveyance apparatus.

Description of the Related Art

[0002] Typically known image reading apparatuses mounted on an image forming apparatus, such as a copying machine, include an automatic document feeder (hereinbelow, referred to as an ADF) that conveys documents stacked on a document tray one by one. In such an image reading apparatus, the document conveyed by the ADF is discharged to a discharge tray after an image (images) on the document is read by a reading unit.

[0003] United States Patent Application Publication No. 2020/0382668 discusses a discharge tray including a first support portion that supports a wide document, and a second support portion that is provided at a position lower than the first support portion to support a narrow document, in order to improve sheet stackability for a small size document. The second support portion is provided with a recessed portion in which a user can insert the user's finger(s) to lift up a document when the user takes out a narrow document. In this way, the user can easily take out the document supported by the second support portion.

[0004] In the above typically known image reading apparatuses having a wide support portion and a conventional recessed portion formed in a narrow support portion of the discharge tray, a shape further recessed lower than the narrow support portion is to be provided in some cases at a position lower than the wide support portion. For this reason, a space for forming the conventional recessed portion is necessary at a position lower than the narrow support portion, and thus, the discharge tray becomes large in a height direction, so that a size of such typically known image reading apparatuses increases.

SUMMARY

[0005] The present disclosure is directed to a sheet conveyance apparatus, an image reading apparatus, and an image forming apparatus from which a user can easily take out a sheet from a sheet discharge tray, while preventing the increase of the height of the discharge tray.

[0006] According to an aspect of the present disclosure, a sheet conveyance apparatus includes a discharge roller configured to discharge a sheet in a discharge direction, and a discharge tray on which the sheet discharged by the discharge roller is to be stacked includes a first support portion, a second support portion, and a protruding portion, wherein the first support portion includes a first portion and a second portion separately disposed in a width direction orthogonal to the discharge direction, and is configured to support a first sheet that is wider than an interval between the first portion and the second portion in the width direction, wherein the second support portion is disposed between the first portion and the second portion in the width direction and at a position lower than the first support portion in a vertical direction, and is configured to support a second sheet that is narrower than the interval between the first portion and the second portion in the width direction, and wherein the protruding portion protrudes upward from the second support portion, and is configured to contact a lower surface of the sheet supported by the second support portion to separate upward a leading end of the sheet in the discharge direction from the second support portion.

[0007] Further features of the present disclosure will become apparent from the following description of exemplary embodiments with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. **1** is a schematic diagram of an entire image forming apparatus.

[0009] FIG. **2** is a section diagram of an image reading apparatus.

[0010] FIG. **3** is a perspective view illustrating a discharge tray according to a first exemplary embodiment.

[0011] FIG. **4** is a section diagram of the discharge tray according to the first exemplary embodiment.

[0012] FIG. **5** is a section diagram illustrating the discharge tray in a state of supporting a small size document.

[0013] FIG. **6** is a section diagram illustrating the discharge tray in the state of supporting the small size document.

[0014] FIG. **7** is a section diagram illustrating the discharge tray in a state of supporting a large size document.

[0015] FIG. **8** is a section diagram illustrating the discharge tray supporting the large size document.

[0016] FIG. **9** is a perspective view illustrating a modification example of the discharge tray.

[0017] FIG. **10** is a perspective view illustrating a modification example of the discharge tray.

[0018] FIG. **11** is a perspective view of a discharge tray according to a second exemplary embodiment.

[0019] FIG. **12** is a section diagram illustrating the discharge tray in a state of supporting a document according to the second exemplary embodiment.

[0020] FIG. **13** is a section diagram illustrating the discharge tray in the state of supporting the document according to the second exemplary embodiment.

DESCRIPTION OF THE EMBODIMENTS

[0021] A first exemplary embodiment of the present disclosure will be described below. Hereinbelow, a sheet conveyance apparatus, an image reading apparatus, and an image forming apparatus according to the present disclosure will be described with reference to the accompanying drawings. Dimensions, materials, shapes, and their relative arrangements of components described in the following exemplary embodiments are not intended to limit the range of the present technique to the exemplary embodiments unless otherwise specifically described.

<Image Forming Apparatus>

[0022] Initially, a schematic configuration of an image forming apparatus **101** will be described with reference to FIG. **1**. Hereinbelow, a position at which a user stands facing an operation unit to perform various inputs and settings to the image forming apparatus **101** is referred to as a "front side" of the image forming apparatus **101**, and the opposite

side thereof is referred to as a "back side". FIG. **1** illustrates an internal configuration of the image forming apparatus **101** viewed from the front side. As illustrated in FIG. **1**, the image forming apparatus **101** includes a printer main body **101**A and an image reading apparatus **103**. The image reading apparatus **103** disposed above the printer main body **101**A includes a reader **30** and an automatic document feeder (ADF) **1** described in detail below, and reads image information by optically scanning a document. The document indicates sheets including paper, such as a paper sheet and an envelope, a plastic film, such as an overhead projector (OHP) sheet, and a cloth sheet. The image information converted into an electrical signal by the image reading apparatus **103** is transferred to a control unit **132** provided in the printer main body **101**A.

[0023] The printer main body **101**A includes an image forming unit **133** for forming an image on a sheet P serving as a recording medium, and a sheet feeding unit **140** for feeding the sheet P to the image forming unit **133**. The sheet feeding unit **140** includes sheet storage units **137***a*, **137***b*, **137***c*, and **137***d* that are capable of storing different sizes of sheets. The sheets P stored in each of the sheet storage units **137***a*, **137***b*, **137***c*, and **137***d* are fed out by a pickup roller **141**, separated by a feed roller **142** and a retard roller **143** one by one, and transferred to a corresponding conveyance roller pair **131**. The sheet P is conveyed to a registration roller pair **136** by being sequentially transferred by a plurality of the conveyance roller pairs **131** arranged along a sheet conveyance path.

[0024] The sheet P placed by a user on a manual feeding tray **137***e* is fed by a feed roller **138** into the printer main body **101**A, and then conveyed to the registration roller pair **136**. The registration roller pair **136** halts the leading end of the sheet P to correct a skew feeding, and then, restarts conveying the sheet P in synchronization with an advancement of an image forming operation, which is a toner image forming process by the image forming unit **133**.

[0025] The image forming unit **133** for forming an image on the sheet P employs an electrophotographic method, and includes a photosensitive drum **121**, which is a photosensitive member. The photosensitive drum **121** is rotatable along a conveyance direction of the sheet P, and around the photosensitive drum **121**, a charging unit **118**, an exposure unit **123**, a developing unit **124**, a transfer charging unit **125**, a separation charging unit **126**, and a cleaner **127** are arranged. The charging unit **118** uniformly charges the surface of the photosensitive drum **121**, and the exposure unit **123** exposes the photosensitive drum **121** to light based on the image information input from the image reading apparatus **103** or the like to form an electrostatic latent image on the photosensitive drum **121**.

[0026] The developing unit **124** stores two-component developer including toner and carrier to develop the electrostatic latent image into a toner image by supplying charged toner to the photosensitive drum **121**. The toner image born on the photosensitive drum **121** is transferred onto the sheet P conveyed from the registration roller pair **136**, using a bias electric field formed by the transfer charging unit **125**. The sheet P serving as a recording medium with the toner image transferred thereon is separated from the photosensitive drum **121** with a bias electric field formed by the separation charging unit **126**, and conveyed toward a fixing unit **129** by a pre-fixing conveyance unit **128**. Adhering substance, such as transfer residual toner which has not been transferred to the sheet P to remain on the photosensitive drum **121**, is removed by the cleaner **127**, and the photosensitive drum **121** prepares for the next image forming operation.

[0027] The sheet P conveyed to the fixing unit **129** is heated while nipped and pressed by a roller pair, so that the toner image is fixed on the sheet P by the toner being melted and fixed. In a case where the image output is completed, the sheet P with the image fixed thereon is discharged via a discharge roller pair **40** to a discharge tray **130** protruding outside the printer main body **101**A. In a case where an image is to be formed on the back side of the sheet P in a double-side printing, the front and back of the sheet P that has passed through the fixing unit **129** is reversed by a reversing unit, and then the sheet P is conveyed to the registration roller pair **136** by a double-side conveyance unit **150**. The sheet P with the image formed thereon again by the image forming unit **133** is discharged to the discharge tray **130**. In this way, the image forming unit **133** is able to form images on the sheet P based on the images read by a first reading unit **151** and a second reading unit **201** described below. The image forming unit **133** serving as an image forming unit may use a different method, such as an ink-jet method, not limited to the electrophotographic method described above.

<Image Reading Apparatus>

[0028] Next, with reference to FIG. **2**, a configuration of the image reading apparatus **103** will be described. FIG. **2** is a schematic section diagram of the image reading apparatus **103**. As illustrated in FIG. **2**, the image reading apparatus **103** includes the reader **30** serving a reading unit for reading a document, and the ADF **1** serving as a sheet conveyance apparatus. The ADF **1** includes a base portion **13**, an open-close cover **11** supported by the base portion **13** to be openable and closable, the document tray **2** to stack documents thereon, and a discharge tray **3** arranged below the document tray **2**. The image reading apparatus **103** includes the first reading unit **151** arranged in the reader **30**, and the second reading unit **201** arranged in the ADF **1**.

[0029] The first reading unit **151** reads an image on a first surface of the document D. The second reading unit **201** reads an image on a second surface of the document D, which is the opposite surface of the first surface. The first surface in the present exemplary embodiment is the lower side surface of the document D in a double-side reading unit DR, and the second surface is the upper side surface of the document D in the double-side reading unit DR. The first reading unit **151** and the second reading unit **201** configure the double-side reading unit DR that is capable of simultaneously reading both sides of the document D conveyed by the ADF **1**. However, the double-side reading unit DR does not necessarily execute double-side simultaneous reading, and reading only one side is also applicable.

[0030] Each of the first reading unit **151** and the second reading unit **201** is configured of a contact image sensor (hereinbelow, referred to as a CIS), which is a scanning device of an equal-magnification optical system. Each of the first reading unit **151** and the second reading unit **201** includes a light source including a light-emitting diode (LED) array arranged in a main scanning direction orthogonal to a conveyance direction of the document D, and a plurality of light receiving elements arranged in the main scanning direction as in the LED array. Light emitted from

the LED array and reflected by the document D is focused on each of the light receiving elements via a lens, and photoelectrically converted by the light receiving elements.

[0031] The reader **30** is fixed on the upper surface of the printer main body **101**A (refer to FIG. **1**). On the upper surface of the reader **30**, a transparent platen glass **30***a* and a moving document reading glass **152** are arranged. The first reading unit **151** is supported by a carriage (not illustrated) movable horizontally in FIG. **2**, and is movable from a predetermined position (illustrated in FIG. **2**) of the double-side reading unit DR along the platen glass **30***a* across the entire length of the platen glass **30***a*.

[0032] The ADF **1** is supported by a hinge mechanism (not illustrated) arranged on the back side in FIG. **2** to be vertically openable and closable with respect to the reader **30**. The document tray **2** serving as a feeding tray supports the document D placed by a user. A document conveyance path T curving almost in a U-shape is formed in the ADF **1**, and conveys the document D placed on the document tray **2** to the double-side reading unit DR via the document conveyance path T. The user can open a part of the document conveyance path T by opening the open-close cover **11** with respect to the base portion **13**.

[0033] Next, a configuration of the ADF **1** for conveying the document D will be described in detail. The ADF **1** includes a pickup roller **4**, a conveyance roller **5**, a separation roller **6**, a registration roller pair **7**, conveyance roller pairs **8** and **9**, and a discharge roller pair **10** in the document conveyance direction (indicated by arrows) in this order. The pickup roller **4** serving as a feed roller is moveable vertically with respect to the upper surface of the document tray **2**, and contacts the document D placed on the document tray **2** to feed the document D in a feeding direction FD. The conveyance roller **5** conveys the document D received from the pickup roller **4** toward downstream in the feeding direction FD. The separation roller **6** is pressed to the conveyance roller **5** to form a separation nip N of the separation roller **6** and the conveyance roller **5**, which serves as a separation portion, and separates the documents D conveyed by the conveyance roller **5** one by one. In the present exemplary embodiment, the conveyance roller **5** and the separation roller **6** form the separation nip N, but it is not limited thereto. For example, instead of the separation roller **6**, a retard roller to which a reversal driving force is input via a torque limiter, or a separation pad may be applied.

[0034] A feed shaft serving as a rotation shaft of the conveyance roller **5** is rotatably supported by the open-close cover **11**, and the pickup roller **4** is swingably supported with respect to the feed shaft via a pickup arm (not illustrated). One of the rollers of the registration roller pair **7** is rotatably supported by the open-close cover **11**.

[0035] The registration roller pair **7** catches the downstream end (hereinbelow, referred to as a leading end) in the conveyance direction of the document D conveyed by the conveyance roller **5** in a rotation stopped state, and warps the document D to correct the skew feeding. The registration roller pair **7** conveys the document D with its skew feeding corrected via a bending portion of the document conveyance path T to transfer it to the conveyance roller pair **8**. The conveyance roller pair **8** feeds the document D into the double-side reading unit DR and transfers the document D to the conveyance roller pair **9** located on the downstream side of the conveyance roller pair **8**. At this time, the images of the document D are read by the first reading unit **151** and the second reading unit **201**.

[0036] The conveyance roller pair **9** transfers the document D that has passed through the double-side reading unit DR to the discharge roller pair **10**. The discharge roller pair **10** discharges the document D in a discharge direction DD. The document D discharged by the discharge roller pair **10** is stacked on the discharge tray **3**.

[0037] The image reading apparatus **103** configured in this manner reads the image information from the document D in a moving-document reading mode and a fixed-document reading mode. In the moving-document reading mode, the ADF **1** scans a document image while feeding the document D. In the fixed-document reading mode, the ADF **1** scans a document placed on the platen glass **30***a*. The moving-document reading mode is selected in a case where the image reading apparatus **103** detects the document D placed on the document tray **2**, or a user explicitly issues an instruction via an operation panel of the printer main body **101**A or the like. In such a case, in a state where the first reading unit **151** is located at a predetermined position of the double-side reading unit DR, the ADF **1** feeds the documents D toward the double-side reading unit DR one by one. In the double-side simultaneous reading mode, both of the first reading unit **151** and the second reading unit **201** irradiate the document D with scan light to scan the document D. In the single-side reading mode, one of the first reading unit **151** and the second reading unit **201** irradiates the document D with light and scans the document D. The image information converted into the electrical signal by the light receiving elements is transferred to the control unit **132** of the printer main body **101**A. In the moving-document reading mode, the first reading unit **151** reads the image on the document through the moving document reading glass **152**.

[0038] In contrast, the fixed-document reading mode is selected in a case where the image reading apparatus **103** detects the document D placed on the platen glass **30***a*, or the user explicitly issues an instruction via the operation panel of the printer main body **101**A or the like. In such a case, the first reading unit **151** irradiates the document D placed on the platen glass **30***a* with light to scan the document D while moving along the platen glass **30***a*. The image information converted into the electrical signal by the light receiving elements of the first reading unit **151** is transferred to the control unit **132** of the printer main body **101**A.

<Discharge Tray>

[0039] Next, a configuration of the discharge tray **3** will be described with reference to FIGS. **3** to **8**. FIG. **3** is a perspective view illustrating the discharge tray **3** of the ADF **1**. In FIG. **3**, the document tray **2** is not illustrated for the convenience of the description. In the following descriptions, the horizontal direction of the image reading apparatus **103** viewed from the front side (front of the image forming apparatus **101**) is defined as an X direction. The front to back direction of the image reading apparatus **103** orthogonal to the X direction is defined as a Y direction (main scanning direction, or width direction of the document D). The vertical direction of the image reading apparatus **103** orthogonal to both of the X direction and the Y direction is defined as a Z direction (vertical direction in a normal use state). The ADF **1** feeds the document D placed on the document tray **2** toward one side (feeding direction FD) in

the X direction, and conveys the document D toward one side (discharge direction DD) in the X direction to discharge the document D to the discharge tray **3**.

[0040] The ADF **1** includes the base portion **13** configuring the external surface of the ADF **1**, and the discharge tray **3** is supported by the base portion **13**. The discharge tray **3** may be integrally formed with the base portion **13**. The discharge tray **3** includes a first support portion **31** for supporting a large size document D**1** (first sheet) with a large width, and a second support portion **32** for supporting a small size document D**2** (second sheet) with a small width.

[0041] In the present exemplary embodiment, the large size document D**1** is wider in the Y direction than the interval between a first portion **31***a* and a second portion **31***b* described below, and the small size document D**2** is narrower than the interval between the first portion **31***a* and the second portion **31***b* in the Y direction. In the present exemplary embodiment, examples of the large size document D**1** include "A" size sheets (A6, A5, A4, or A3), B size sheets (B6, B5, B4, or B3), a letter size sheet (LTR), a legal size sheet (LGL), a statement size sheet (STMT), and a 16K size sheet, which are standard size sheets. Examples of the small size document D**2** include typical business card size sheets (No. 3 [49 millimeters (mm)×85 mm], No. 4 [55 mm×91 mm], western size [89 mm×51 mm]). A minimum size sheet in the small size documents D**2** conveyable by the ADF **1** is the business card No. 3 size (49 mm×85 mm) sheet. In the present exemplary embodiment, "conveyable minimum size document" indicates a sheet of a size predetermined based on the specification or the like of an apparatus. However, the sizes of the large size documents D**1** and the small size documents D**2** are merely examples, and can be freely set for each apparatus.

[0042] The first support portion **31** includes the first portion **31***a* and the second portion **31***b*, which are ribs extending in the X direction. The first portion **31***a* and the second portion **31***b* are arranged with an interval in the Y direction, and the first portion **31***a* is arranged on the back side of the second portion **31***b*. The first portion **31***a* and the second portion **31***b* incline to be higher in the Z direction toward the downstream side of the discharge direction DD. The second support portion **32** is arranged between the first portion **31***a* and the second portion **31***b* in the Y direction, and at a position lower than the surface of the first support portion **31** that contacts the document D in the Z direction. A protruding portion **33** is formed at a central portion of the second support portion **32** in the Y direction. The protruding portion **33** protrudes upward in the Z direction from the second support portion **32**.

[0043] The discharge tray **3** is provided with bottom surfaces **34** in an area on the back side of the first portion **31***a* in the Y direction, and in an area on the front side of the second portion **31***b*. Each of the bottom surfaces **34** is located at a position lower in the Z direction than the surface of the first support portion **31** that contacts a document, and almost equal to the height of the second support portion **32**. The discharge tray **3** may be formed so that the first portion **31***a* and the second portion **31***b* extend toward the back side and the front side in the Y direction, with the bottom surfaces **34** not being provided. A wall portion **35** extending in the Y direction and the Z direction (upward) is formed at upstream side ends of the first support portion **31** and the second support portion **32** of the discharge tray **3** in the discharge direction DD. The upstream end of the large size document D**1** in the conveyance direction (hereinbelow, referred to as a trailing end) supported by the first support portion **31** is brought into contact with the wall portion **35** due to the inclinations of the first portion **31***a* and the second portion **31***b*.

[0044] The discharge roller pair **10** includes four roller members **10***a*, **10***b*, **10***c*, and **10***d* arranged from the back side toward the front side in the Y direction as members to nip the document. Four cutout portions are formed in the wall portion **35** arranged in the Y direction, and the roller members **10***a*, **10***b*, **10***c*, and **10***d* are arranged in the respective cutout portions. The second support portion **32** is located between the roller member **10***a* disposed on the most back side and the roller member **10***d* disposed on the most front side in the Y direction. The first portion **31***a* of the first support portion **31** is located between the roller members **10***a* and **10***b* in the Y direction, and the second portion **31***b* is located between the roller members **10***c* and **10***d*.

[0045] FIG. **4** is a section diagram of the discharge tray **3** viewed from the X direction. The first portion **31***a* of the first support portion **31** includes a wall surface **311** extending in the X direction and the Z direction at a boundary with the second support portion **32** in the Y direction. The second portion **31***b* of the first support portion **31** includes a wall surface **312** extending in the X direction and the Z direction at a boundary with the second support portion **32** in the Y direction. Here, if the ADF **1** feeds the document D longitudinally, the document smallest in width size among the large size documents D**1** is an A6 size (105 mm×148 mm) document, and the document largest in width size among the small size documents D**2** is a business card No. 4 size (55 mm×91 mm) document. In such a case, a distance W between the wall surface **311** and the wall surface **312** in the Y direction is set to satisfy 55 mm<W<105 mm.

[0046] In the present exemplary embodiment, the distance W is 80 mm. In this case, the A6 size document can be stacked on the first support portion **31** without falling into the second support portion **32**, and the business card No. 4 size document can be stacked on the second support portion **32** without running on the first support portion **31**. The distance W is a distance between the first portion **31***a* and the second portion **31***b* of the first support portion **31**, and is a length (width) of the second support portion **32** in the Y direction.

[0047] FIG. **5** is a section diagram of the discharge tray **3** viewed from the Y direction in a case where the small size document D**2** is stacked on the second support portion **32**. FIG. **6** is a section diagram of the discharge tray **3** viewed from the X direction in the case where the small size document D**2** is stacked on the second support portion **32**. As illustrated in FIG. **5**, the protruding portion **33** includes a top position **33***a*, which is a portion (upper end) protruding most from the second support portion **32**, and an inclined portion **33***b* inclining to be higher in the Z direction toward the downstream side in the discharge direction DD. In other words, the inclined portion **33***b* inclines so that a protruding amount of the inclined portion **33***b* from the second support portion **32** increases toward the downstream side in the discharge direction DD. When the small size document D**2** is discharged by the discharge roller pair **10**, the small size document D**2** is stacked on the second support portion **32** of the discharge tray **3**. At this time, the lower surface of the small size document D**2** is brought into contact with the protruding portion **33** formed on the second support portion

32, and caused to collide against the wall portion 35 due to the inclined portion 33*b* to be aligned. When the small size document D2 stacked on the second support portion 32 is brought into contact with the protruding portion 33, a space V2 is formed between the leading end of the small size document D2 and the second support portion 32. More specifically, the protruding portion 33 separates the small size document D2 from the second support portion 32 by levitating the leading end of the small size document D2. On the second support portion 32, the small size documents D2 are stackable up to the height corresponding to a distance T from the top position 33*a* of the protruding portion 33 to the first support portion 31 in the Z direction, and the small size documents D2 stacked on the second support portion 32 are aligned by the wall surface 311 and the wall surface 312 in the Y direction.

[0048] It is desirable that a distance L1 from the wall portion 35 to the top position 33*a* of the protruding portion 33 in the X direction is shorter than the minimum size document conveyable by the ADF 1, and longer than half the minimum size document conveyable by the ADF 1. It is further desirable that a distance L2 from the top position 33*a* to the leading end of the document in the X direction is 10 mm or more. For example, in a case where the minimum size document conveyable by the ADF 1 is a business card No. 3 size document (49 mm×85 mm), the distance L1 from the wall portion 35 to the top position 33*a* of the protruding portion 33 in the X direction is desirably set to satisfy 42.5 millimeters (mm) (85/2 mm)<L1<75 mm. In this way, the distance L2 from the top position 33*a* to the leading end of the document in the X direction becomes 10 mm or more, and a user can pick up the document by inserting the user's finger(s) in the space V2 when the user takes out the document from the second support portion 32. In the present exemplary embodiment, the distance L1 is 60 mm.

[0049] FIG. 7 is a section diagram of the discharge tray 3 viewed from the Y direction in a case where the large size document D1 is stacked on the first support portion 31. FIG. 8 is a section diagram of the discharge tray 3 viewed from the X direction in the case where the large size document D1 is stacked on the first support portion 31. As described above, the first portion 31*a* and the second portion 31*b* incline to be higher in the Z direction toward the downstream side in the discharge direction DD. Accordingly, the large size document D1 stacked on the first support portion 31 collides against the wall portion 35 to be aligned in the X direction. At this time, the protruding portion 33 is located below the first support portion 31 in the Z direction, so that the protruding portion 33 does not contact the large size document D1. Spaces V1 are formed between the large size document D1 stacked on the first support portion 31 and the bottom surfaces 34, and thus, a user can insert the user's finger(s) or a hand in the spaces V1, to easily pick out the large size document D1 from the discharge tray 3. The bottom surfaces 34 may be the same surface (same height) as the first support portion 31, and in such a case, the user can easily take out the large size document D1 from the discharge tray 3 by inserting the user's finger(S) or hand in a space V12 formed between the second support portion 32 and the large size document D1.

[0050] In the present exemplary embodiment described above, the second support portion 32, which supports the discharged small size document D2, includes the protruding portion 33. This configuration enables a user to easily take out the small size document D2 from the discharge tray 3. Since the protruding portion 33 protrudes upward from the second support portion 32, it is possible to reduce the height of the discharge tray 3 in the Z direction, as compared with a configuration with a recessed portion recessed down in the second support portion 32.

<Modification Example of Protruding Portion>

[0051] FIGS. 9 and 10 are perspective views illustrating modification examples of the protruding portion 33. As illustrated in FIG. 9, a plurality of the protruding portions 33 may be formed on the second support portion 32 in the Y direction. In FIG. 9, two protruding portions 33 are aligned on the second support portion 32 in the Y direction. As illustrated in FIG. 10, the protruding portion 33 may be formed on the second support portions 32 in a continuous manner extending from the first portion 31*a* to the second portion 31*b* in the Y direction. In such a case, the alignment capability of the small size document D2 stacked on the second support portion 32 is improved.

[0052] Next, a second exemplary embodiment will be described with reference to FIGS. 11 to 13. The ADF 1 according to the second exemplary embodiment is different from the ADF 1 according to the first exemplary embodiment in that the ADF 1 includes a protruding portion 36 (second protruding portion), in addition to the protruding portion 33 (first protruding portion) described in the first exemplary embodiment. Thus, descriptions of configurations in the second exemplary embodiment similar to the configurations in the first configurations are omitted.

[0053] FIG. 11 is a perspective view illustrating the discharge tray 3 according to the second exemplary embodiment. As in the first exemplary embodiment, the discharge tray 3 of the ADF 1 in the present exemplary embodiment includes the first support portion 31 which supports the large size document D1, and the second support portion 32 which supports the small size document D2. The second support portion 32 according to the present exemplary embodiment includes the protruding portion 33, and the protruding portion 36 formed downstream of the protruding portion 33 in the discharge direction DD. In other words, two protruding portions (protruding portion 33 and protruding portion 36) aligned in the X direction are formed on the second support portion 32.

[0054] In the following descriptions, a document stackable on the first support portion 31 is referred to as a large size document D1, a document stackable on the second support portion 32 and the protruding portion 33 is referred to as a small size document D2, and a document stackable on the second support portion 32 and the protruding portion 36 is referred to as a document D3. In the present exemplary embodiment, the large size document D1 and the small size document D2 respectively have the same sizes as those in the first exemplary embodiment, and the document D3 is a check paper sheet (76 mm×169 mm). More specifically, the document D3 is shorter in width than the large size document D1, and longer than the small size document D2 in the conveyance direction. Since the width of the document D3 is smaller than the distance W between the wall surface 311 and the wall surface 312, the document D3 is stacked on the second support portion 32 of the discharge tray 3 in a case where the document D3 is discharged by the discharge roller pair 10. The sizes of the large size document D1, the small

size document D2, and the document D3 are merely examples, and may be freely set for each apparatus.

[0055] FIG. **12** is a section diagram of the discharge tray **3** viewed from the Y direction in a case where the document D3 is stacked on the second support portion **32**. FIG. **13** is a section diagram of the discharge tray **3** viewed from the X direction in a case where the document D3 is stacked on the second support portion **32**. As illustrated in FIG. **12**, the protruding portion **36** includes a top position **36***a*, which is a portion (upper end) protruding most from the second support portion **32**, and an inclined portion **36***b* inclining to be higher in the Z direction toward the downstream side in the discharge direction DD. The top position **36***a* of the protruding portion **36** is located at a position higher than the top position **33***a* of the protruding portion **33** in the Z direction, and lower than the corresponding position of the first support portion **31** in the Y direction.

[0056] When the document D3 is discharged by the discharge roller pair **10**, the document D3 is stacked on the second support portion **32** of the discharge tray **3**. At this time, the lower surface of the document D3 is brought into contact with the protruding portion **36** formed on the second support portion **32**, and the trailing end of the document D3 is caused to collide against the wall portion **35** by the inclined portion **36***b* to be aligned. When the document D3 stacked on the second support portion **32** is brought into contact with the protruding portion **36**, a space V3 is formed between the leading end of the document D3 and the second support portion **32**. More specifically, the protruding portion **36** separates the document D3 from the second support portion **32** by levitating the leading end of the document D3. On the second support portion **32**, the documents D3 are stackable up to the height corresponding to a distance T2 in the Z direction from the top position **36***a* of the protruding portion **36** to the first support portion **31**, and the documents D3 stacked on the second support portion **32** are aligned in the Y direction by the wall surface **311** and the wall surface **312**.

[0057] A distance L3 from the wall portion **35** to the top position **36***a* of the protruding portion **36** in the X direction is longer than a minimum size document conveyable by the ADF **1**. Thus, the distance L3 is longer than the distance L1. It is desirable that a distance L4 from the top position **36***a* to the leading end of the document D3 in the X direction is 10 mm or more. For example, in a case where the document D3 is a check paper sheet (76 mm×169 mm), it is desirable that the distance L3 from the wall portion **35** to the top position **36***a* of the protruding portion **36** in the X direction is set to satisfy 84.5 mm (169/2 mm)<L3<159 mm. In this way, the distance L4 from the top position **36***a* to the leading end of the document D3 in the X direction becomes 10 mm or more, which enables a user to pick up the document D3 by inserting the user's finger(s) in the space V3 when the document D3 is taken out from the second support portion **32**. In the present exemplary embodiment, the distance L3 is 130 mm.

[0058] In the second exemplary embodiment described above, since the second support portion **32** for supporting the discharged small size document D2 includes the protruding portion **33** as in the first exemplary embodiment, the user can easily take out the small size document D2 from the discharge tray **3**. Further, in the second exemplary embodiment, the second support portion **32** includes the protruding portion **36** in addition to the protruding portion **33**. This configuration enables the user to easily take out the document D3 from the discharge tray **3**. Since the protruding portion **33** and the protruding portion **36** each protrude upward from the second support portion **32**, it is possible to reduce the height of the discharge tray **3** in the Z direction, as compared with a configuration with a recessed portion recessed down in the second support portion **32**.

[0059] According to the present disclosure, it is possible to provide a sheet conveyance apparatus, an image reading apparatus, and an image forming apparatus which enable the user to easily take out a sheet from a discharge tray, while reducing the height of the discharge tray.

[0060] While the present disclosure has been described with reference to exemplary embodiments, it is to be understood that the disclosure is not limited to the disclosed exemplary embodiments. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures and functions.

[0061] This application claims the benefit of Japanese Patent Application No. 2022-156130, filed Sep. 29, 2022, which is hereby incorporated by reference herein in its entirety.

What is claimed is:

1. A sheet conveyance apparatus comprising:

a discharge roller configured to discharge a sheet in a discharge direction; and

a discharge tray on which the sheet discharged by the discharge roller is to be stacked includes a first support portion, a second support portion, and a protruding portion,

wherein the first support portion includes a first portion and a second portion separately disposed in a width direction orthogonal to the discharge direction, and is configured to support a first sheet that is wider than an interval between the first portion and the second portion in the width direction,

wherein the second support portion is disposed between the first portion and the second portion in the width direction and at a position lower than the first support portion in a vertical direction, and is configured to support a second sheet that is narrower than the interval between the first portion and the second portion in the width direction, and

wherein the protruding portion protrudes upward from the second support portion, and is configured to contact a lower surface of the sheet supported by the second support portion to separate upward a leading end of the sheet in the discharge direction from the second support portion.

2. The sheet conveyance apparatus according to claim **1**, wherein an upper end of the protruding portion in the vertical direction is located at a position lower than the first support portion.

3. The sheet conveyance apparatus according to claim **1**,

wherein the discharge tray further includes a wall portion extending upward from an upstream side end portion of each of the first support portion and the second support portion in the discharge direction, and

wherein a distance from the wall portion to an upper end of the protruding portion in the discharge direction is shorter than a length of a minimum size sheet conveyable by the sheet conveyance apparatus in the discharge direction.

4. The sheet conveyance apparatus according to claim **3**, wherein the distance from the wall portion to the upper end of the protruding portion in the discharge direction is longer than half the length of the minimum size sheet in the discharge direction.

5. The sheet conveyance apparatus according to claim **3**, wherein the distance from the wall portion to the upper end of the protruding portion in the discharge direction is longer than 42.5 millimeters (mm) and shorter than 75 mm.

6. The sheet conveyance apparatus according to claim **1**, wherein the discharge tray includes a plurality of the protruding portions disposed in the width direction on the second support portion.

7. The sheet conveyance apparatus according to claim **1**, wherein the protruding portion is formed to extend from the first portion to the second portion in the width direction.

8. The sheet conveyance apparatus according to claim **1**, wherein the protruding portion includes an inclined portion inclining so that a protruding amount of the inclined portion from the second support portion increases toward a downstream side in the discharge direction.

9. The sheet conveyance apparatus according to claim **1**,

wherein the protruding portion is a first protruding portion, and

wherein the discharge tray further includes a second protruding portion that is disposed downstream of the first protruding portion on the second support portion and protrudes upward from the second support portion.

10. The sheet conveyance apparatus according to claim **9**, wherein an upper end of the second protruding portion is located at a position higher than an upper end of the first protruding portion.

11. The sheet conveyance apparatus according to claim **1**, wherein a length of the second support portion in the width direction is longer than 55 millimeters (mm) and shorter than 105 mm.

12. The sheet conveyance apparatus according to claim **1**, further comprising:

a feeding tray on which the sheet is to be stacked; and

a feed roller configured to feed the sheet stacked on the feeding tray,

wherein the discharge tray is disposed below the feeding tray in the vertical direction.

13. An image reading apparatus comprising:

the sheet conveyance apparatus according to claim **1**;

a feeding tray on which the sheet is to be stacked;

a feed roller configured to feed the sheet stacked on the feeding tray; and

a reader configured to read an image on the sheet fed by the feed roller,

wherein the discharge tray is disposed below the feeding tray in the vertical direction.

14. An image forming apparatus comprising:

the sheet conveyance apparatus according to claim **1**;

a feeding tray on which the sheet is to be stacked;

a feed roller configured to feed the sheet stacked on the feeding tray;

a reader configured to read an image on the sheet fed by the feed roller; and

an image forming unit configured to form an image on a recording medium based on image information for the sheet read by the reader,

wherein the discharge tray is disposed below the feeding tray in the vertical direction.

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