



US00RE46620E

(19) **United States**  
(12) **Reissued Patent**  
**Ishida**

(10) **Patent Number:** **US RE46,620 E**  
(45) **Date of Reissued Patent:** **Dec. 5, 2017**

(54) **IMAGE FORMING APPARATUS INCLUDING  
A RECESSED HANDLE PORTION FOR  
EXTENSION PORTION**

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(21) Appl. No.: **14/318,110**

(22) Filed: **Jul. 18, 2014**

**Related U.S. Patent Documents**

Reissue of:

(64) Patent No.: **8,672,429**  
Issued: **Mar. 18, 2014**  
Appl. No.: **13/036,213**  
Filed: **Feb. 28, 2011**

(30) **Foreign Application Priority Data**

Sep. 24, 2010 (JP) ..... 2010-213241

(51) **Int. Cl.**  
**G03G 15/00** (2006.01)  
**A47B 81/00** (2006.01)

(Continued)

(52) **U.S. Cl.**  
CPC ..... **B41J 13/106** (2013.01); **B65H 29/70**  
(2013.01); **B65H 31/02** (2013.01);  
(Continued)

(58) **Field of Classification Search**  
CPC ..... **B41J 13/106**; **B65H 29/70**; **B65H 31/02**;  
**B65H 2301/4212**; **B65H 2402/441**;  
(Continued)

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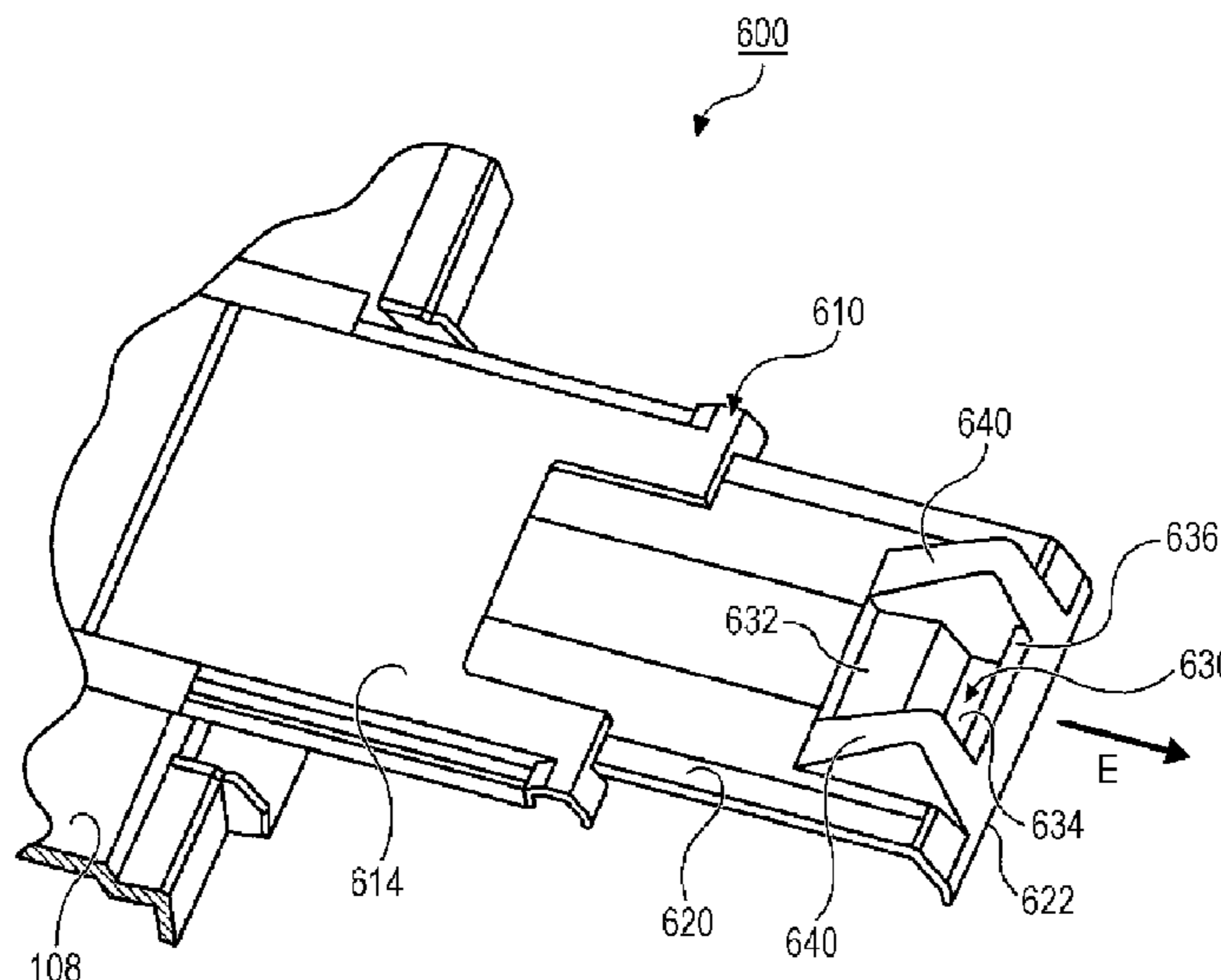
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(57) **ABSTRACT**

An image forming apparatus includes an output unit to  
which a recording medium on which an image has been  
formed is output, the output unit including an output unit  
body, and an extension portion that is disposed on the output  
unit body so as to be extendable from the output unit body  
in an output direction of the recording medium, the exten-  
sion portion including a handle portion that is recessed in a  
direction away from a back surface of the recording sheet so  
as allow a finger to be hooked in a direction in which the  
extension portion is extended in the output direction of the  
recording medium, the back surface being a surface that is  
in contact with the output unit body, and a protrusion that  
protrudes toward the back surface of the recording medium  
from the extension portion.

**11 Claims, 9 Drawing Sheets**



# US RE46,620 E

- (51) **Int. Cl.**  
*B41J 13/10* (2006.01)  
*B65H 29/70* (2006.01)  
*B65H 31/02* (2006.01)  
*G03G 21/16* (2006.01)

- (52) **U.S. Cl.**  
 CPC ..... *G03G 15/6552* (2013.01); *G03G 21/1695*  
 (2013.01); *B65H 2301/4212* (2013.01); *B65H*  
*2402/441* (2013.01); *B65H 2403/60* (2013.01);  
*B65H 2405/11164* (2013.01); *B65H 2405/141*  
 (2013.01); *B65H 2405/324* (2013.01); *B65H*  
*2801/06* (2013.01); *H04N 2201/0091*  
 (2013.01)

- (58) **Field of Classification Search**  
 CPC ..... *B65H 2403/60*; *B65H 2405/141*; *B65H*  
*2405/324*; *B65H 2801/06*; *G03G 15/6552*;  
*G03G 21/1695*; *H04N 2201/0091*  
 USPC ..... 312/223.1; 399/107, 405  
 See application file for complete search history.

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FIG. 1

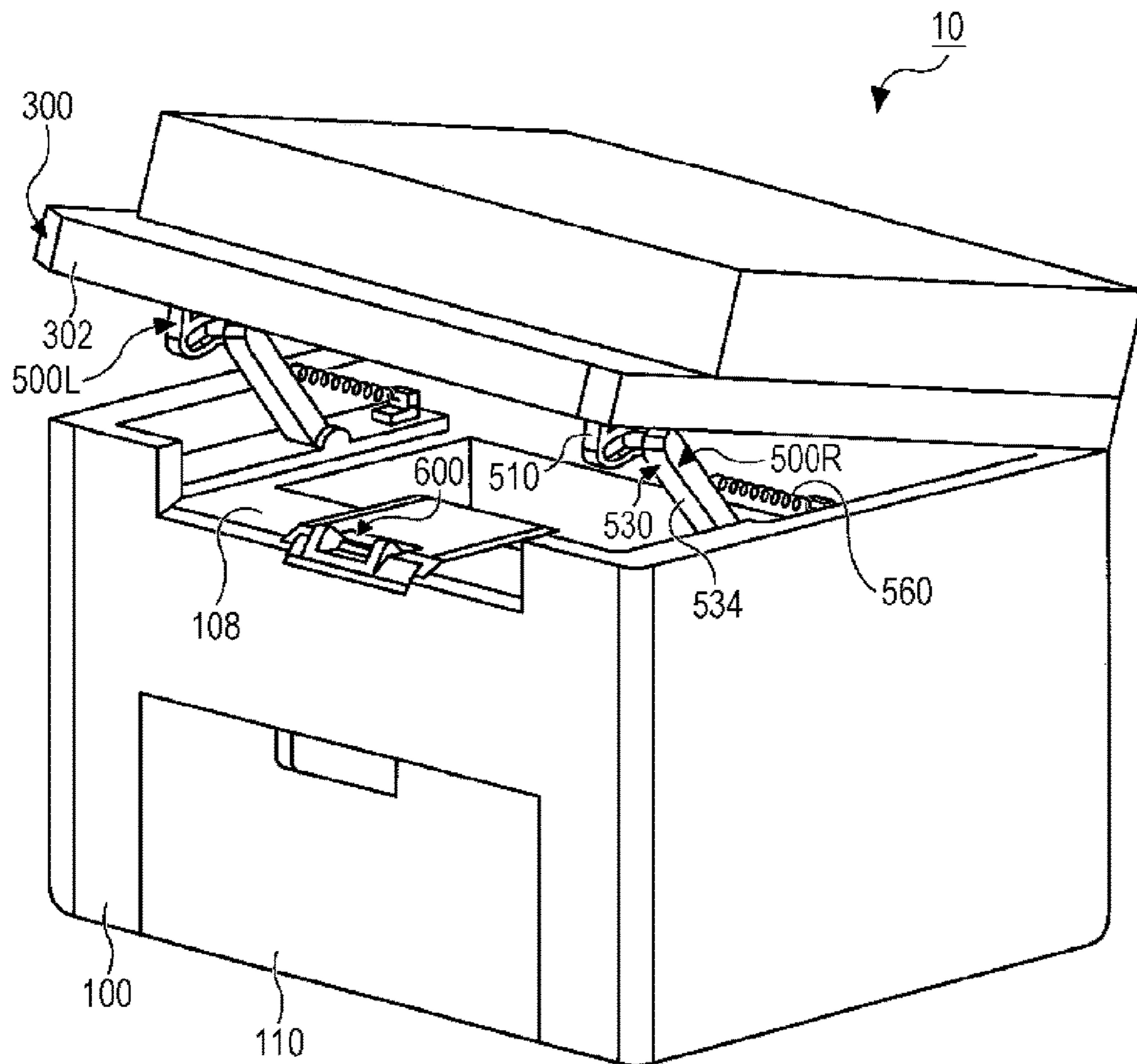


FIG. 2

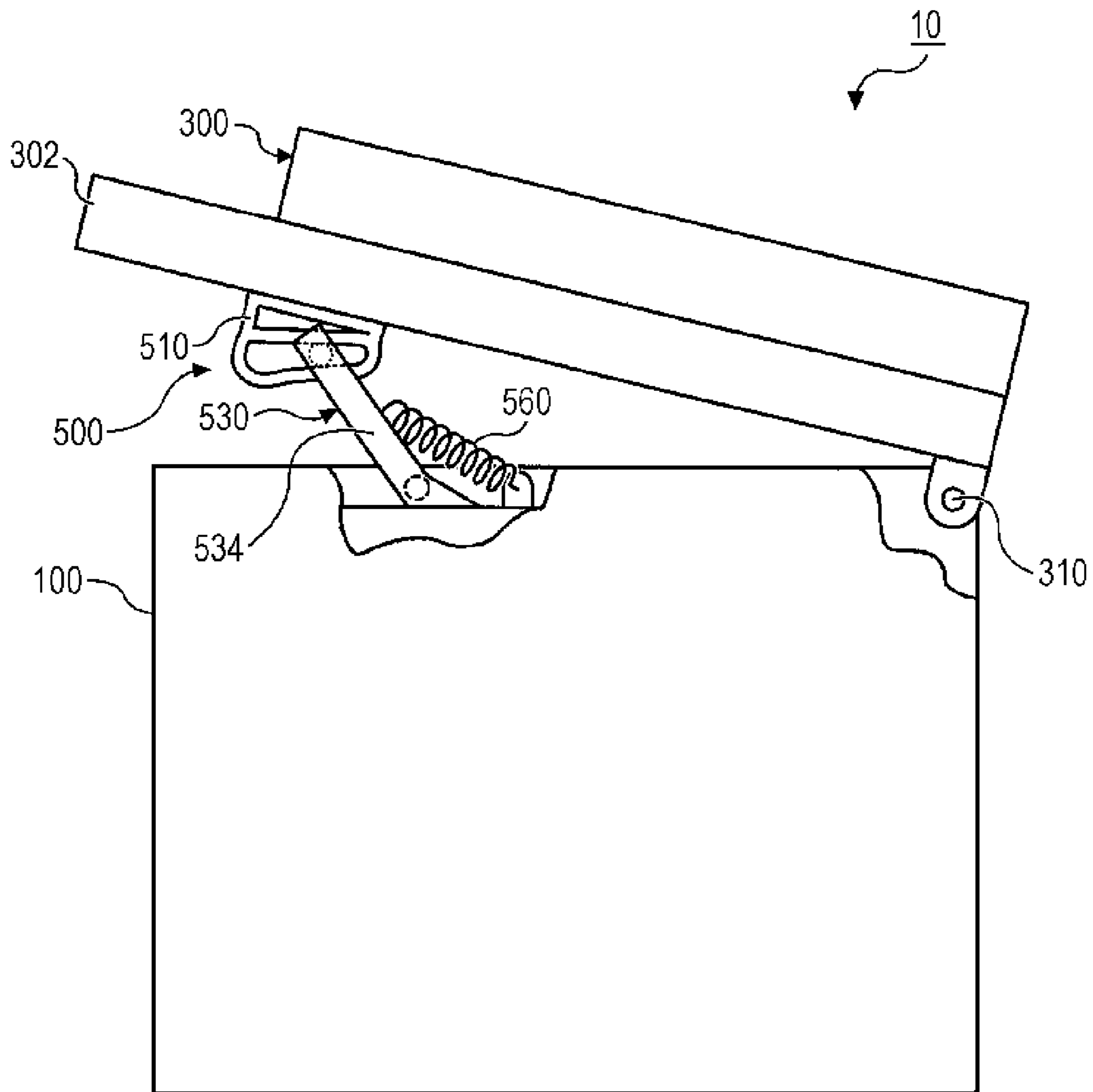


FIG. 3

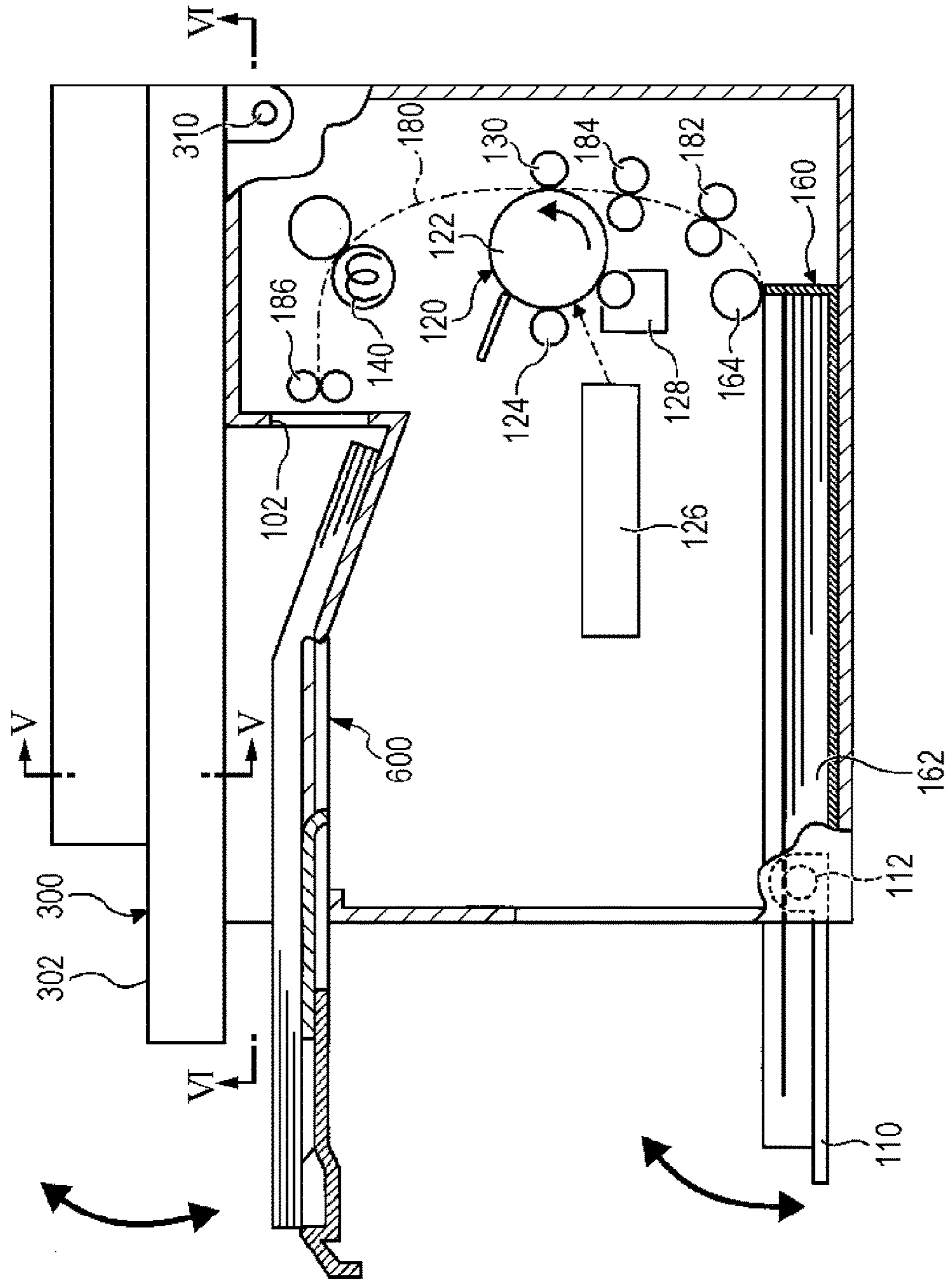


FIG. 4

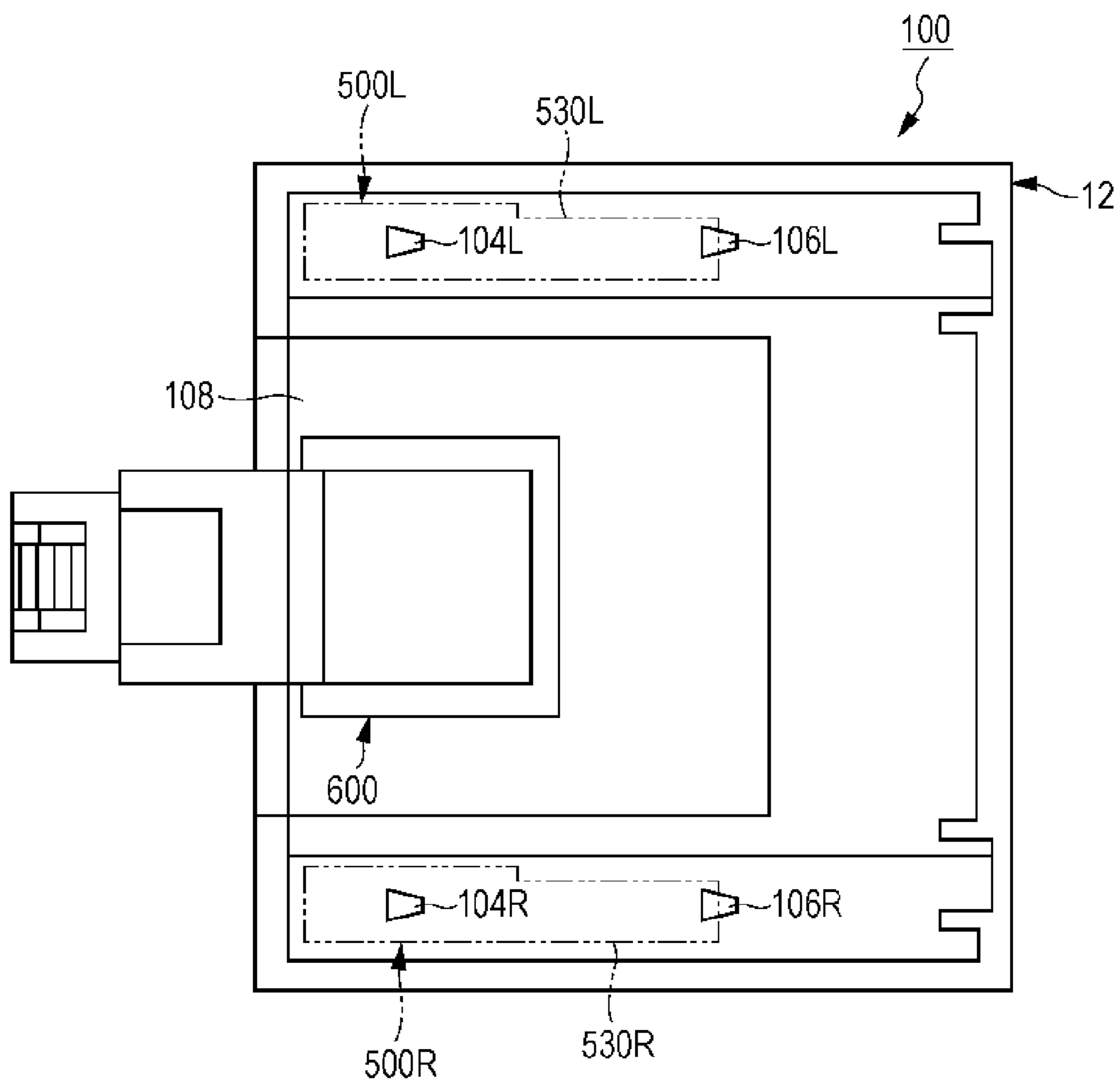


FIG. 5

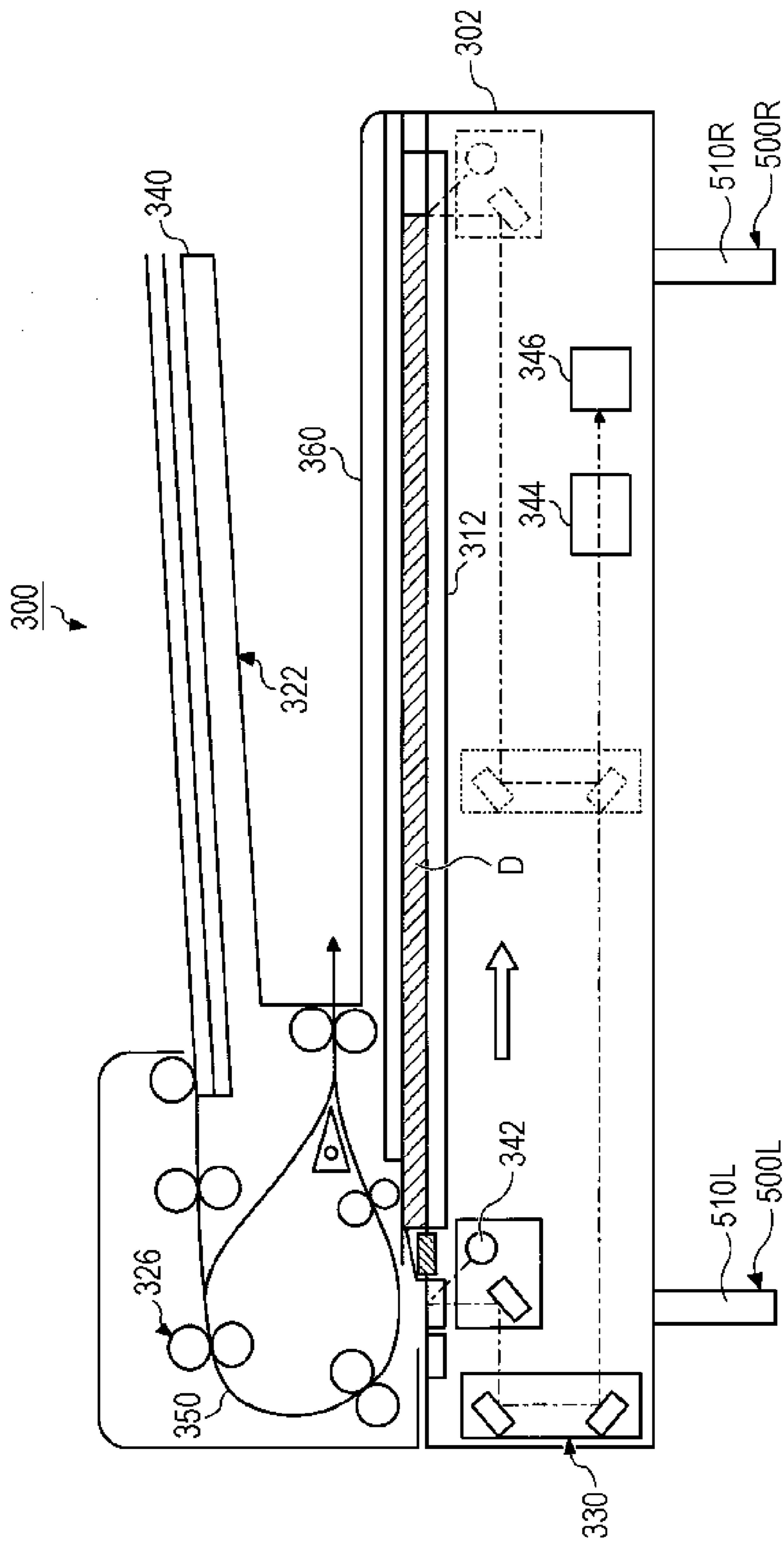


FIG. 6

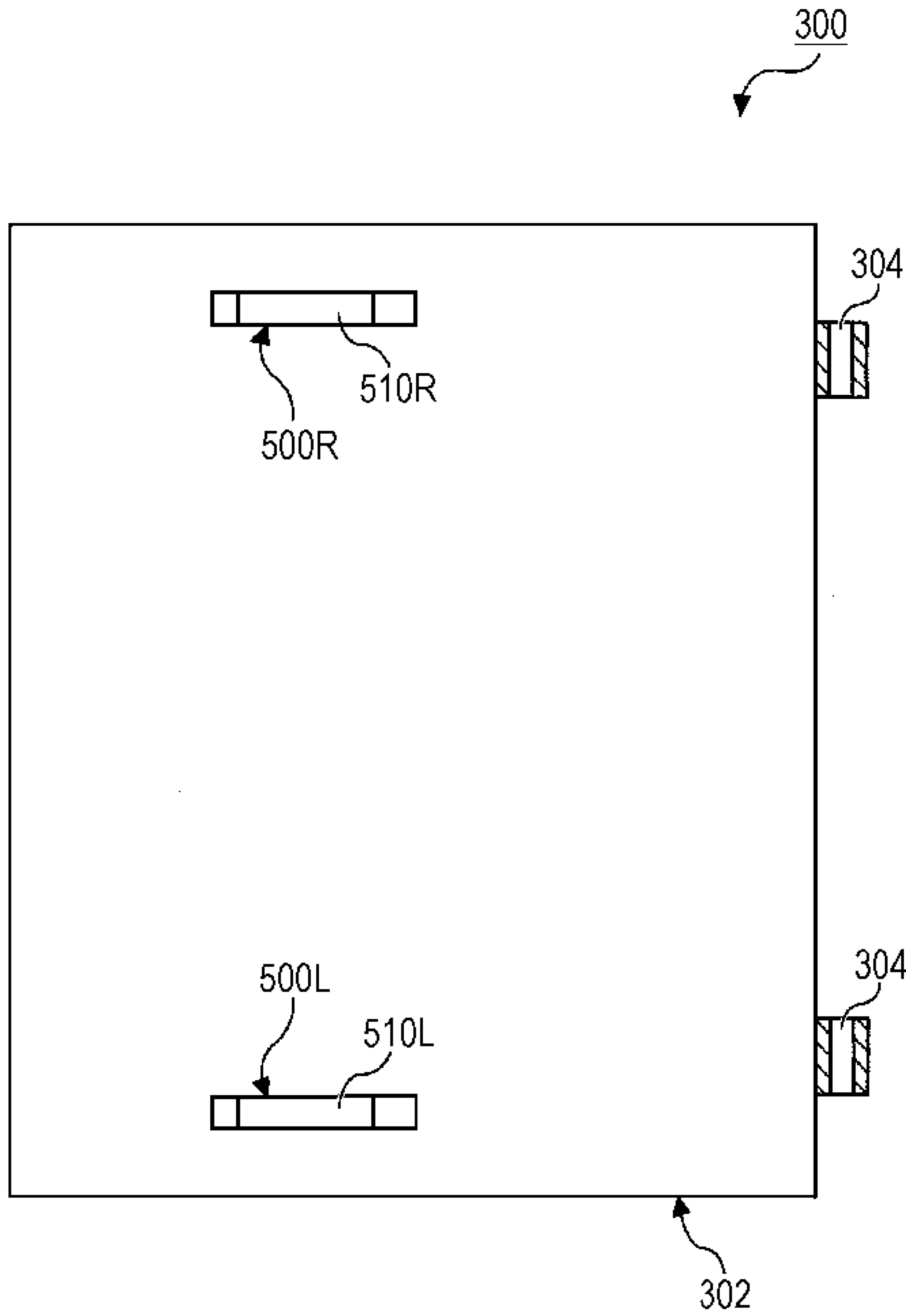




FIG. 7

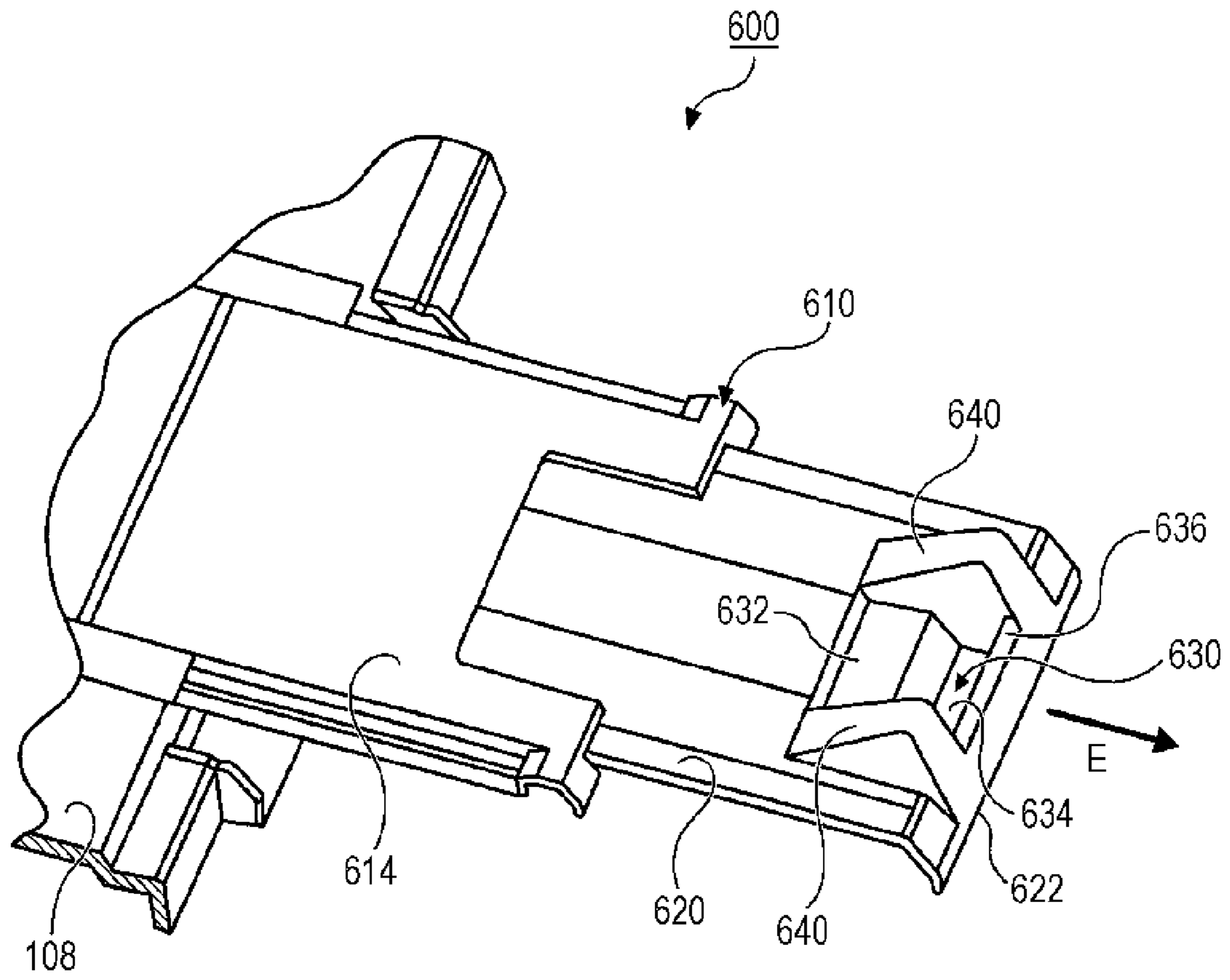


FIG. 8A

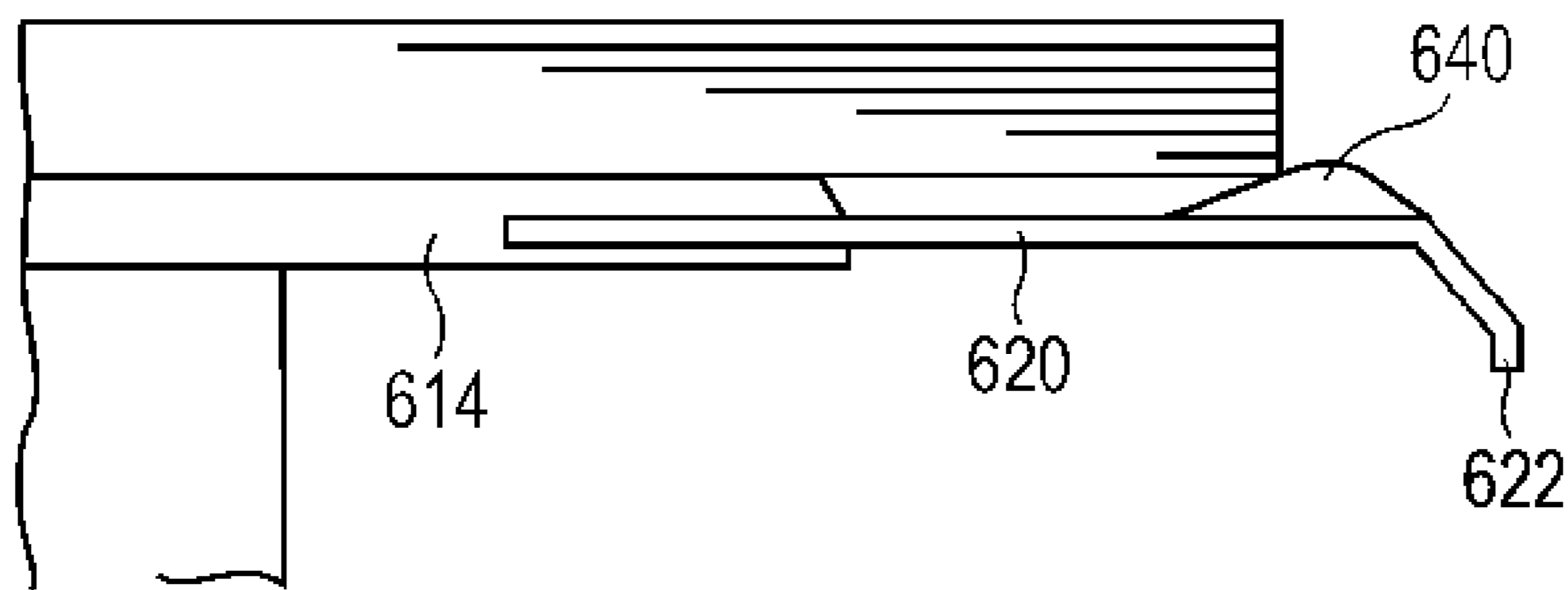


FIG. 8B

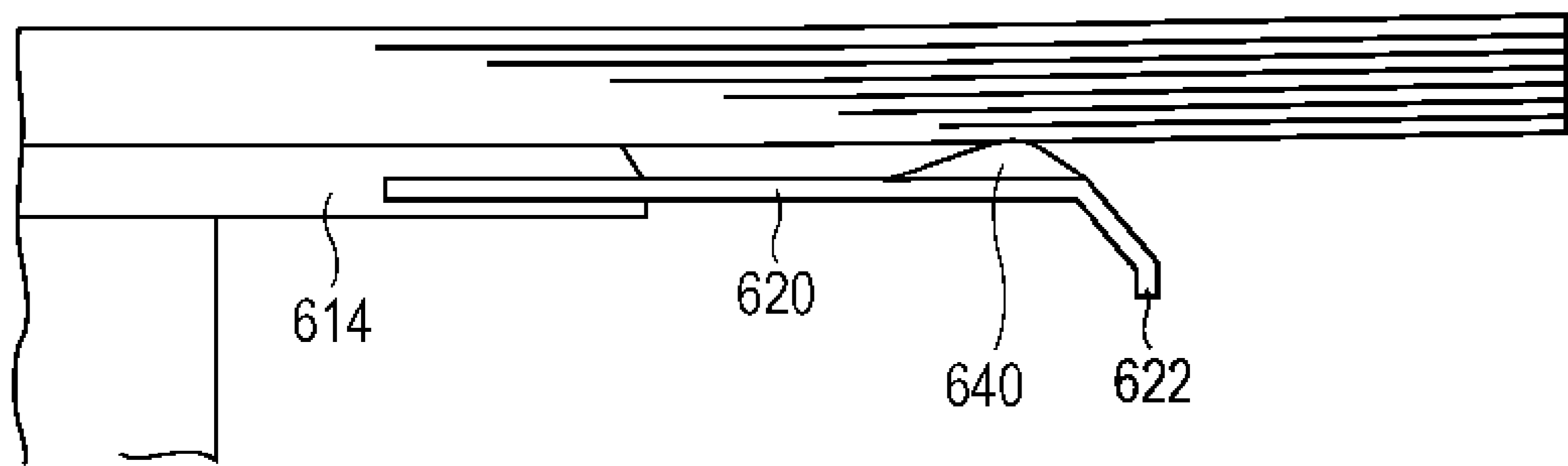
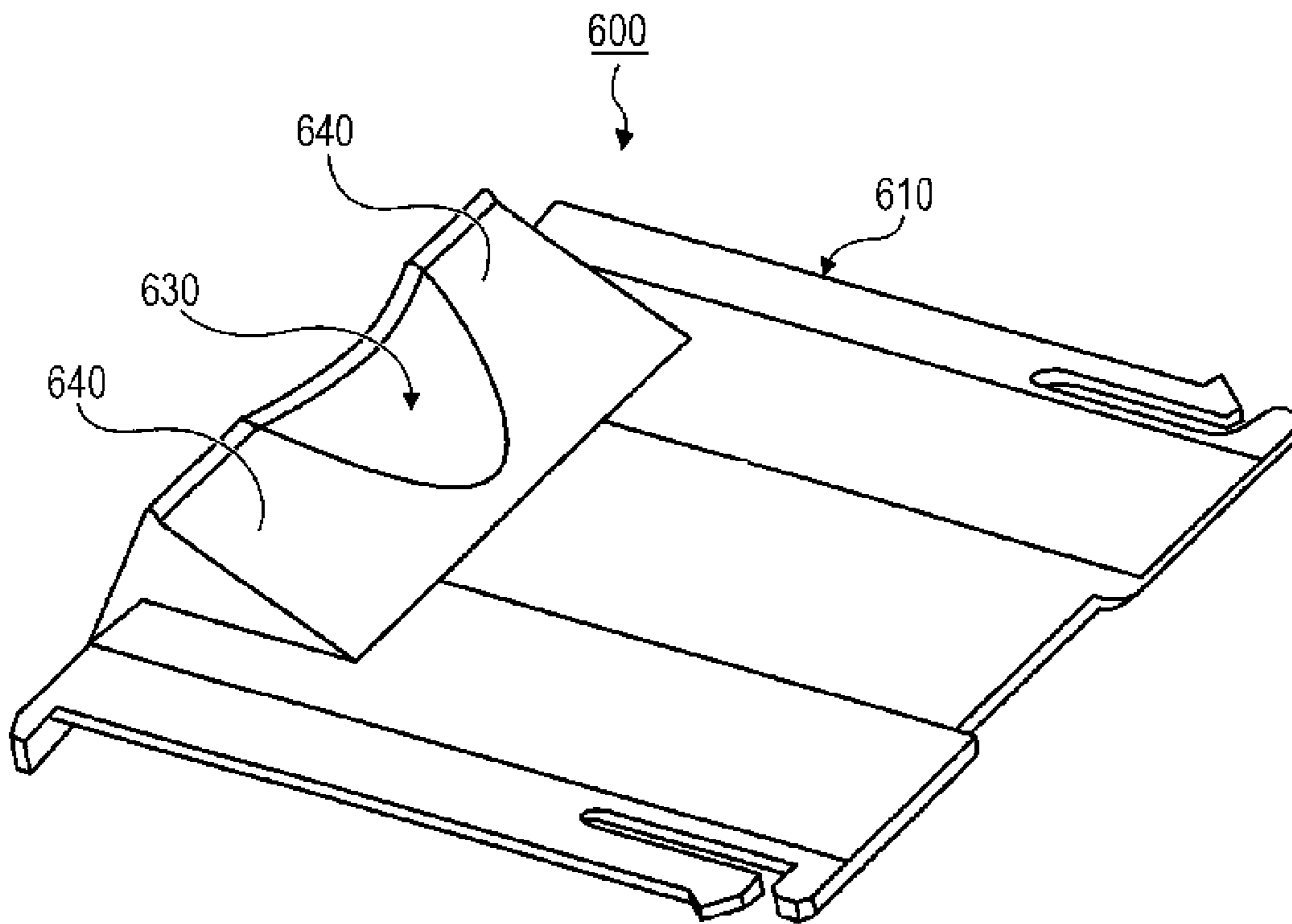


FIG. 9



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**IMAGE FORMING APPARATUS INCLUDING  
A RECESSED HANDLE PORTION FOR  
EXTENSION PORTION**

**Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue; a claim printed with strikethrough indicates that the claim was canceled, disclaimed, or held invalid by a prior post-patent action or proceeding.**

CROSS-REFERENCE TO RELATED  
APPLICATIONS

This application is based on and claims priority under 35 USC 119 from Japanese Patent Application No. 2010-213241 filed Sep. 24, 2010.

BACKGROUND

Technical Field

The present invention relates to an image forming apparatus.

SUMMARY

According to an aspect of the invention, an image forming apparatus includes an output unit to which a recording medium on which an image has been formed is output, the output unit including an output unit body, and an extension portion that is disposed on the output unit body so as to be extendable from the output unit body in an output direction of the recording medium, the extension portion including a handle portion that is recessed in a direction away from a back surface of the recording sheet so as to allow a finger to be hooked in a direction in which the extension portion is extended in the output direction of the recording medium, the back surface being a surface that is in contact with the output unit body, and a protrusion that protrudes toward the back surface of the recording medium from the extension portion.

BRIEF DESCRIPTION OF THE DRAWINGS

An exemplary embodiment of the present invention will be described in detail based on the following figures, wherein:

FIG. 1 is a perspective view of an image forming apparatus according to the exemplary embodiment of the present invention;

FIG. 2 is a cutaway view of the image forming apparatus of FIG. 1, which is viewed from the right side;

FIG. 3 is a sectional view of the image forming apparatus of FIG. 1, which is viewed from the right side;

FIG. 4 is a plan view of an image forming apparatus body of the image forming apparatus illustrated in FIG. 1;

FIG. 5 is a sectional view of a document reading device of the image forming apparatus illustrated in FIG. 1 taken along line V-V of FIG. 3;

FIG. 6 is a sectional view of a document reading device illustrated in FIG. 5 taken along line VI-VI of FIG. 3;

FIG. 7 is a perspective view of an output unit of the image forming apparatus illustrated in FIG. 1;

FIGS. 8A and 8B illustrate how output unit illustrated in FIG. 7 supports sheets, in which FIG. 8A is a left side view

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illustrating how the output unit supports the sheets when the downstream ends of the sheets in the sheet output direction are on the upstream side of an end of an extension portion with respect to the sheet output direction, and FIG. 8B is a left side view illustrating how the output unit supports the sheets when the downstream ends of the sheets in the sheet output direction are on the downstream side of the end of the extension portion with respect to the sheet output direction; and

FIG. 9 is a perspective view of a modification of an output unit of the image forming apparatus illustrated in FIG. 1.

DETAILED DESCRIPTION

Hereinafter, an exemplary embodiment of the present invention will be described with reference to the drawings.

FIGS. 1 to 3 illustrate an image forming apparatus 10 according to the exemplary embodiment of the present invention. As illustrated in FIGS. 1 to 3, the image forming apparatus 10 includes an image forming apparatus body 100, a document reading device 300, and dampers 500R and 500L. The image forming apparatus body 100 is used as a first structure. The document reading device 300 is used as a second structure and as a supported member.

A surface 108 on the upper side of the image forming apparatus body 100 is used as a part of an output unit 600. Sheets that are used as recording media and on which images have been formed are output to the output unit 600. A sheet feeder cover 110 is disposed on the front side of the image forming apparatus body 100. The sheet feeder cover 110 is attached to the image forming apparatus body 100 so as to be openable by using a hinge 112. FIG. 1 illustrates a state in which the sheet feeder cover 110 is closed relative to the image forming apparatus body 100. FIG. 3 illustrates a state in which the sheet feeder cover 110 is open relative to the image forming apparatus body 100. An output slot 102 is formed in the image forming apparatus body 100, and a sheet on which an image has been formed is output through the output slot 102.

An image forming unit 120 and a sheet feeder 160 are disposed in the image forming apparatus body 100. A transport path 180 is formed in the image forming apparatus body 100. The image forming unit 120 includes a photoconductor drum 122, a charging device 124, a latent image forming device 126, a developing device 128, a transfer device 130, and a fixing unit 140. The photoconductor drum 122 is used as an image carrier. The charging device 124 charges a surface of the photoconductor drum 122. The latent image forming device 126 forms a latent image on the surface of the photoconductor drum 122 charged by the charging device 124. The developing device 128 develops the latent image, which has been formed on the surface of the photoconductor drum 122 by the latent image forming device 126, by using developer. The transfer device 130 transfers a developer image, which has been formed on the surface of the photoconductor drum 122 by the developing device 128, to a sheet. The fixing unit 140 fixes the developer image, which has been transferred to the sheet by the transfer device 130, onto the sheet.

The sheet feeder 160 includes one or more sheet containers 162 and a feed roller 164. Sheets are stacked in the sheet container 162. The feed roller 164 feeds the sheets, which are stacked on the sheet container 162. In order to load sheets that are larger than a certain size into the sheet container 162, the sheet feeder cover 110 is opened. When such sheets are loaded, rear ends of the sheets stick out of the

image forming apparatus body **100**, and the sticking-out portions of the sheets are supported by the sheet feeder cover **110** from below with respect to the direction of gravity.

The transport path **180** transports the sheets from the sheet feeder **160** to the transfer device **130** and further transports the sheets toward to the output unit **600**. Along the transport path **180**, the feed roller **164**, transport rollers **182**, registration rollers **184**, the transfer device **130**, the fixing unit **140**, and output rollers **186** are disposed from the upstream side in the sheet transport direction.

The transport rollers **182** transport the sheet toward the registration rollers **184**. The registration rollers **184** temporarily stop movement of the leading edge of the sheet that is being transported toward the transfer device **130**. Then, the registration rollers **184** restart the movement of the leading edge of the sheet toward the transfer device **130** so as to be in time with arrival of a developer image, which has been formed on the photoconductor drum **122**, to the transfer device **130**. The output rollers **186** transport the sheet, on which the developer image has been fixed by the fixing unit **140**, toward the output unit **600**.

The document reading device **300** includes a document reading device body **302**, and is rotatably supported by the image forming apparatus body **100** by using a hinge **310**. The document reading device **300** is openable/closable between an open position (illustrated in FIGS. **1** and **2**) and a closed position (illustrated in FIG. **3**) relative to the image forming apparatus body **100**.

The dampers **500R** and **500L** each absorb shock that is generated due to rotation of the document reading device **300**. The damper **500R** is disposed in a right part of the image forming apparatus **10**, and the damper **500L** is disposed in a left part of the image forming apparatus body **100**. Because the dampers **500R** and **500L** have the same structure, only the damper **500R** will be described, and description of the damper **500L** will be omitted. Hereinafter, the damper **500R** may be referred to as the damper **500**, unless it is necessary to distinguish the damper **500R** from the damper **500L**.

The damper **500** includes a guide member **510** and a damper body **530**. The guide member **510** is used as a guide portion disposed on the document reading device **300**. The damper body **530** includes an arm **534** and a coil spring **560**. The arm **534** is disposed on the image forming apparatus body **100** and used as a member that is guided by the guide member **510**. The coil spring **560** is used as an urging member that urges the arm **534**.

FIG. **4** illustrates the image forming apparatus body **100**. As illustrated in FIG. **4**, attachment holes **104R** and **106R** are formed in the surface **108** on the upper side of the image forming apparatus body **100**. The attachment holes **104R** and **106R** are used for attaching a damper body **530R** of the damper **500R** to the image forming apparatus body **100**. Attachment holes **104L** and **106L** are formed in the upper surface of the image forming apparatus body **100**. The attachment holes **104L** and **106L** are used for attaching a damper body **530L** of the damper **500L** to the image forming apparatus body **100**. The attachment holes **104R** and **104L** are respectively disposed in a front part of the image forming apparatus body **100** as compared with the attachment holes **106R** and **106L**.

FIGS. **5** and **6** illustrate the document reading device **300**. The document reading device **300** includes the document reading device body **302** as described above. A guide member **510R** of the damper **500R** and a guide member **510L** of the damper **500L** are attached to the lower surface of the document reading device body **302**. The document

reading device body **302** includes attachment portions **304**. The attachment portions **304** are attached to the image forming apparatus body **100** by using the hinge **310** (see FIGS. **2** and **3**).

As illustrated in FIG. **5**, the document reading device **300** includes a platen member **312** that is made of an optically transparent material. The platen member **312** is used as a document reading plate on which a document is placed. A platen cover **322** is attached to the document reading device body **302** so as to be openable/closable relative to the document reading device body **302**.

A reading unit **330** is disposed in the document reading device body **302**. The reading unit **330** irradiates the document with light, and reads the document on the basis of reflected light that is reflected from the document. A document transport device **326** is disposed in the platen cover **322**. The document transport device **326** automatically transports a document **D**. The document reading device **300** has a function of reading the document **D** that is being transported by the document transport device **326** and a function of reading the document **D** that is placed on the platen member **312**.

The document transport device **326** includes a document tray **340**, a document transport path **350**, and an output tray **360**. The document **D** to be read is set on the document tray **340**. The document transport path **350** transports the document **D**. After an image on the document **D** has been read, the document **D** is output to the output tray **360**.

The reading unit **330** includes a light source **342**, a lens **344**, and a photoelectric conversion element **346**. The light source **342** irradiates a document with light, and reflected light reflected by the document is collected by the lens **344**, and the collected light is received by the photoelectric conversion element **346**, which converts the light to a signal.

FIG. **7** illustrates the output unit **600**. The output unit **600** includes the surface **108** and the extension portion **610**. The surface **108** is the upper surface of the image forming apparatus body **100** that is used as the output unit body. The extension portion **610** is disposed on the surface **108** so as to be extendable from the surface **108** in the sheet output direction indicated by an arrow **E** in FIG. **7**. The extension portion **610** includes a first extension member **614** and a second extension member **620**. The first extension member **614** is extendable from the surface **108** in the sheet output direction. The second extension member **620** is extendable from the first extension member **614** in the sheet output direction. After an image is formed on a sheet, the extension portion **610** supports a portion of the sheet, which protrudes from an edge of the surface **108**, from below with respect to the direction of gravity.

A handle portion **630** is formed in the second extension member **620** of the extension portion **610**. The handle portion **630** is recessed in a direction away from the back surface (the lower surface) of a sheet so as to allow a finger to be inserted into the handle portion **630** in a direction in which the extension portion **610** is extended in the sheet output direction. Moreover, the extension portion **610** includes two protrusions **640** that protrude toward the back surface of a sheet. As illustrated in FIG. **7**, the handle portion **630** is disposed between the two protrusions **640**.

The handle portion **630** includes a first recess **632**, a second recess **634**, and a wall **636**. The first recess **632** is recessed in a direction away from the back surface of the sheet. The second recess **634** is disposed downstream of the first recess **632** in the sheet output direction and in a direction in which the extension portion **610** is extended with respect to the first recess **632**. The second recess **634**

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has a depth larger than that of the first recess 632. The wall 636 is disposed downstream of the second recess 634 in the sheet output direction and that is in a direction in which the extension portion 610 is extended with respect to the second recess 634. The wall 636 extends in a direction that intersects the sheet output direction.

FIG. 8A illustrates how the output unit 600 supports sheets when the downstream ends of the sheets in the sheet output direction are on the upstream side of an end 622 of the extension portion 610 with respect to the sheet output direction. FIG. 8B is a left side view illustrating how the output unit 600 supports sheets when the downstream ends of the sheets in the sheet output direction are on the downstream side of the end 622 of the extension portion 610 in the sheet output direction. In this way, the extension portion 610 may support sheets when the downstream ends of the sheets in the sheet output direction are on the upstream side of the end 622 of the extension portion 610 with respect to the sheet output direction, or the output unit 600 may support sheets when the downstream ends of the sheets in the sheet output direction are on the downstream side of the end 622 of the extension portion 610 in the sheet output direction.

FIG. 8B illustrates the case where the extension portion 610 supports sheets when the downstream ends of the sheets in the sheet output direction are on the upstream side of the end 622 of the extension portion 610 with respect to the sheet output direction. In this case, a part of the sheets between a part that is supported from below by one of the protrusions 640 and a part that is supported from below by the other of the protrusions falls into the handle portion 630, so that the sheets become curved and thereby rigidity is generated in the sheets. Therefore, it is unlikely that the leading ends of the sheets in the output direction droop.

The extension portion 610 is extended when it is used and contracted when it is not used. In order to extend the extension portion 610, a user inserts his/her finger in the handle portion 630 and pulls out the extension portion 610 forward, so that the first extension member 614 is extended from the surface 108 and the second extension member 620 is extended from the first extension member 614. Thus, in the present exemplary embodiment, although the extension portion 610 has plural extendable portions, the plural portions are extended with one operation and thereby the extension portion 610 is pulled out forward. As compared with a case where the extension portion is extendable so as to be rotated above the surface 108, the extension portion is allowed to be pulled out and extended even if the output space (a gap between the surface 108 and the lower surface of the document reading device body 302) is small, whereby the height of the apparatus may be small.

In the present exemplary embodiment, when sheets have been output onto the output unit, the two protrusions 640 support the sheets, so that a space is formed between the handle portion 630 and the sheets. Therefore, a user extends the extension portion 610 without removing the sheets from the output unit by inserting his/her finger into the space and pulling out the handle portion 630.

In the exemplary embodiment, when a finger is inserted into the handle portion 630, the tip of the finger is guided from the first recess 632, to the second recess 634, and to the wall 636. The second recess 634 is disposed in the direction in which the extension portion 610 is extended with respect to the first recess 632 and has a depth larger than that of the first recess 632. The wall 636 is disposed in the direction in which the extension portion 610 is extended with respect to

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the second recess 634. Therefore, a user need not feel for the position of the wall 636 because the fingertip is naturally guided to the wall 636.

FIG. 9 illustrates a modification of the output unit 600. In the output unit 600 of the image forming apparatus 10 according to the exemplary embodiment of the present invention, the handle portion 630 is formed by a combination of flat surfaces. In contrast, the handle portion 630 of the modification is formed by curved surfaces. In other respects, the output unit 600 of the modification is the same as that of the image forming apparatus 10 according to the exemplary embodiment of the present invention, so that description of such respects is omitted.

As heretofore described, the present invention is applicable to an image forming apparatus, such as a copier, a facsimile machine, or a printer.

The foregoing description of the exemplary embodiments of the present invention has been provided for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Obviously, many modifications and variations will be apparent to practitioners skilled in the art. The embodiments were chosen and described in order to best explain the principles of the invention and its practical applications, thereby enabling others skilled in the art to understand the invention for various embodiments and with the various modifications as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the following claims and their equivalents.

What is claimed is:

1. An image forming apparatus comprising:

an output unit to which a recording medium on which an image has been formed is output, the output unit including

an output unit body which receives the output recording medium on which the image has been formed, and

an extension portion that is disposed on the output unit body so as to be extendable from the output unit body in an output direction of the recording medium, the extension portion including

a handle portion that is recessed in a direction away from a back surface of the recording medium so as to allow a finger to be hooked in a direction in which the extension portion is extended in the output direction of the recording medium, the back surface being a surface that is in contact with the output unit body, and

at least one protrusion that protrudes toward the back surface of the recording medium from the extension portion,

wherein the handle portion includes:

a first recess that is recessed in a direction away from the back surface of the recording medium along the output direction of the recording medium,

a second recess that is disposed downstream of the first recess in the output direction of the recording medium, the second recess having a depth larger than a depth of the first recess, and

a wall that is disposed downstream of the second recess in the output direction of the recording medium, the wall extending in a direction that intersects the output direction of the recording medium.

2. The image forming apparatus according to claim 1, wherein the at least one protrusion comprises two protrusions, and wherein the handle portion is disposed between the two protrusions.

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3. The image forming apparatus according to claim 1, wherein the extension portion comprises a first extension member extendable from the output unit body in the output direction of the recording medium, and a second extension portion extendable from the first extension member in the output direction of the recording medium. 5

4. The image forming apparatus according to claim 1, wherein the depth of the first recess is greater than a depth of a top surface of the extension portion, the top surface of the extension portion being a surface that faces the back surface of the recording medium. 10

5. The image forming apparatus according to claim 1, wherein the extension portion further includes an end that is downstream of the wall in the output direction of the recording medium, the end having a depth larger than the depth of the second recess. 15

6. The image forming apparatus according to claim 1, wherein the at least one protrusion is located at an inside of the extension portion away from lateral edges of the extension portion. 20

7. An output unit to which a recording medium on which an image has been formed is output, the output unit comprising:

an output unit body which receives the output recording medium on which the image has been formed; and 25

an extension portion that is disposed on the output unit body so as to be extendable from the output unit body in an output direction of the recording medium, the extension portion including

a handle portion that is recessed in a direction away from a back surface of the recording medium so as to allow a finger to be hooked in a direction in which the extension portion is extended in the output direction of the recording medium, the back surface being a surface that faces the output unit body, and 30

at least one protrusion that protrudes toward the back surface of the recording medium from the extension portion, 35

wherein the handle portion includes:

a first recess that is recessed in a direction away from the back surface the recording medium along the output direction of the recording medium, 40

a second recess that is disposed downstream of the first recess in the output direction of the recording medium, the second recess having a depth larger than a depth of the first recess, and 45

a wall that is disposed downstream of the second recess in the output direction of the recording medium, the

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wall extending in a direction that intersects the output direction of the recording medium.

8. The output unit according to claim 7, wherein the at least one protrusion comprises two protrusions, and wherein the handle portion is disposed between the two protrusions.

9. An image forming apparatus comprising: [a tray unit on which a recording medium is deposited, the tray unit including]

a tray unit body, and

an extension portion that is [disposed in the tray unit body from which the extension portion is] drawn out [in a drawing out direction away from a main body of the image forming apparatus] from the tray unit body in an output direction of a recording medium, the extension portion including

a protrusion that protrudes from [the] an upper surface of the extension portion,

a handle portion that is recessed [from an upper surface of the extension portion without penetrating through the extension portion] in a direction away from a back surface of the recording medium to allow a finger to be hooked in a direction in which the extension portion is extended in the output direction of the recording medium, the handle portion having a side wall extending in the [drawing out] output direction of the recording medium, 30

wherein at least a portion of the side wall is formed by at least a portion of the protrusion, and wherein when the recording medium is output to the output unit, the protrusion supports the recording medium such that a space is formed between the handle portion and the recording medium. 35

10. The image forming apparatus according to claim 9, wherein the extension portion includes a first extension portion that is disposed on the output unit body so as to be extendable from the output unit body in an output direction of the recording medium and a second extension portion that is disposed on the first extension portion so as to be extendable from the first extension portion in the output direction of the recording medium. 40

11. The image forming apparatus according to claim 10, wherein the protrusion and the handle portion are disposed in the second extension portion. 45

\* \* \* \* \*

UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

PATENT NO. : RE46,620 E  
APPLICATION NO. : 14/318110  
DATED : December 5, 2017  
INVENTOR(S) : Ishida

Page 1 of 1

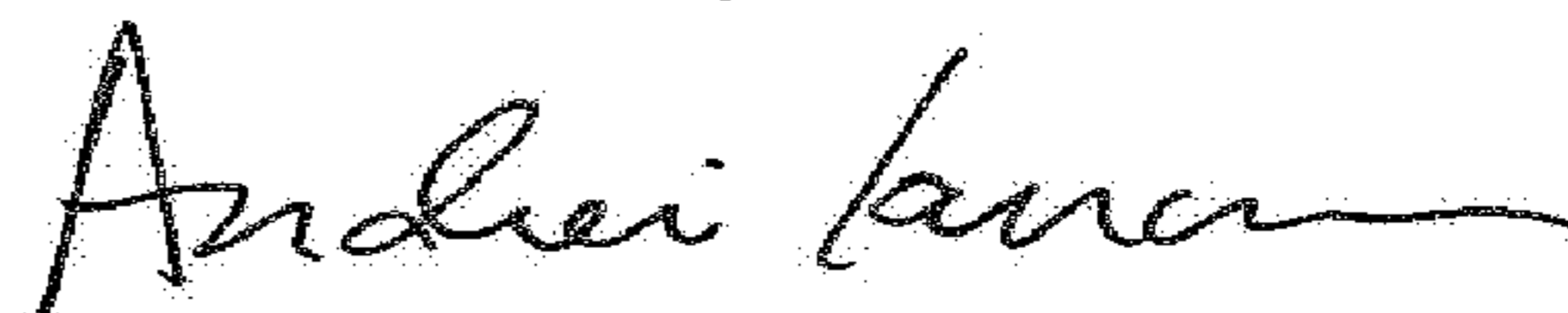
It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Specification

Please insert Line 12 (approx.) of Column 1 as follows:

*--Notice: More than one reissue application has been filed for the reissue of U.S. Patent No. 8,672,429. The reissue applications are U.S. Reissue Patent Application Serial No. 15/795,583, filed on October 27, 2017, and U.S. Reissue Patent Application Serial No. 15/134,635, filed on April 21, 2016, now U.S. Reissue Patent No. RE46,524 E, issued August 29, 2017, each of which is a continuation reissue application of U.S. Reissue Patent Application Serial No. 14/318,110 (the present application), filed on July 18, 2014, now U.S. Reissue Patent No. RE46,620 E, issued December 5, 2017.--*

Signed and Sealed this  
Twelfth Day of June, 2018



Andrei Iancu  
Director of the United States Patent and Trademark Office