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

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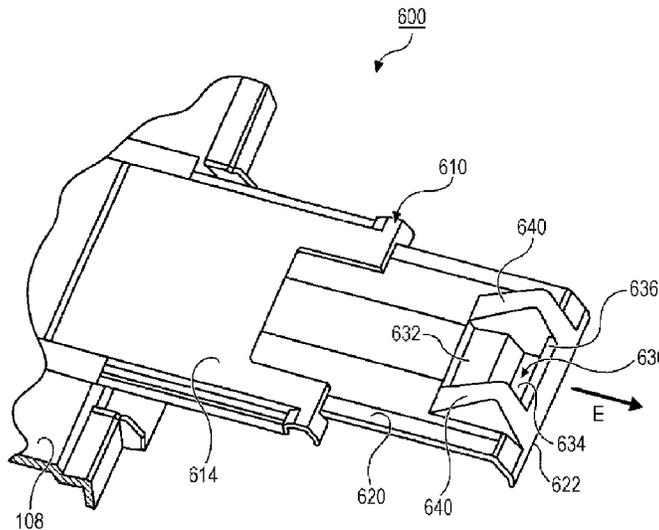
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(57) **ABSTRACT**

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 extension 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**



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 See application file for complete search history.

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FIG. 1

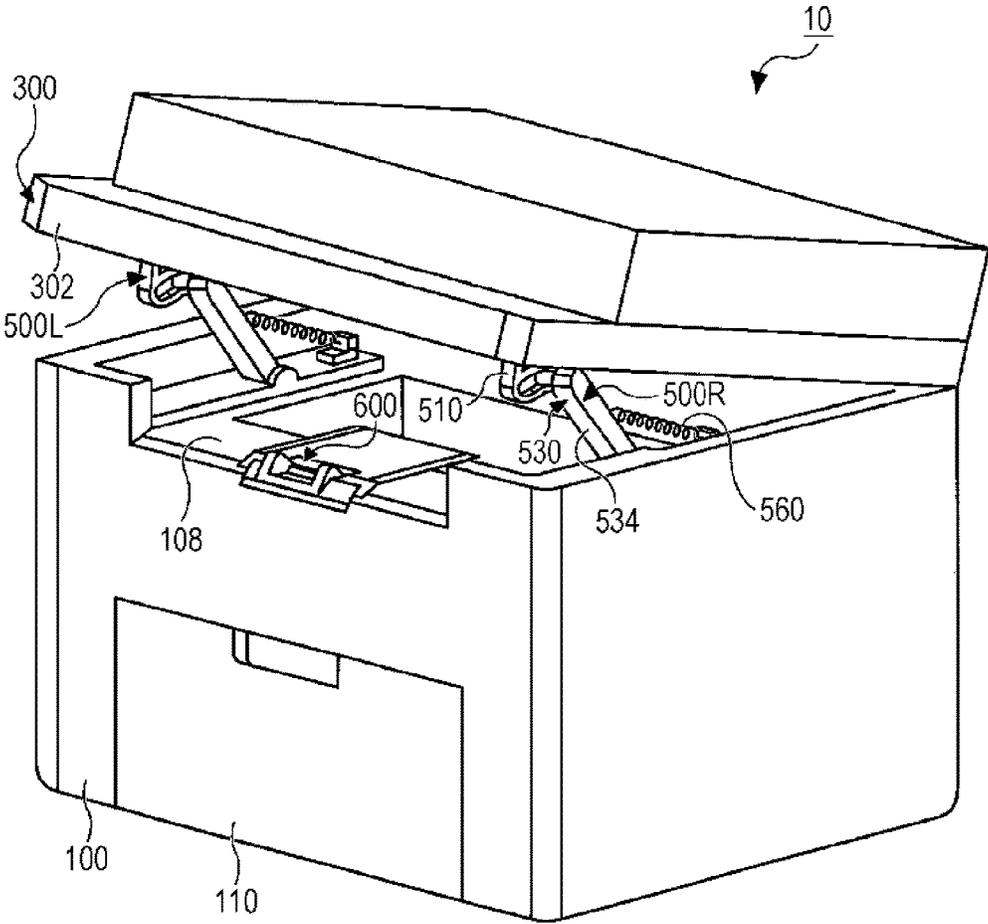


FIG. 2

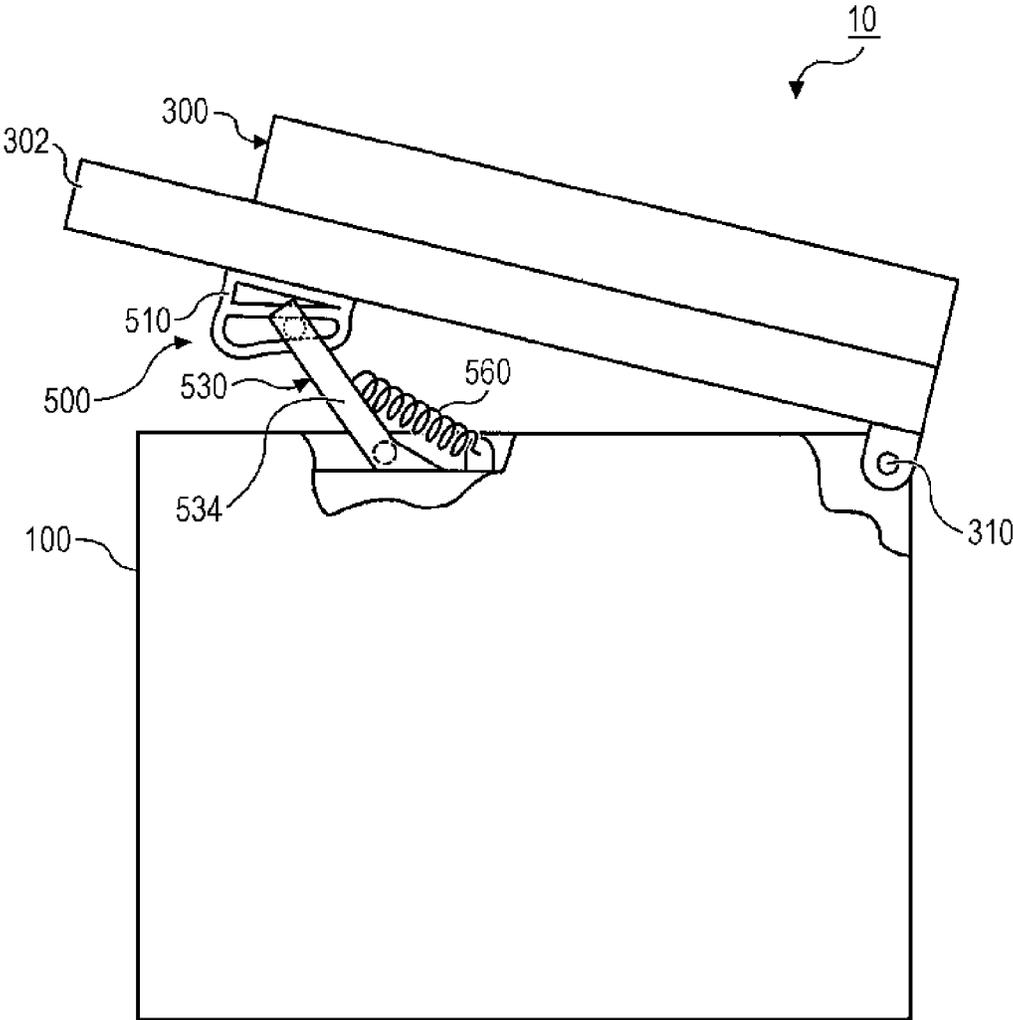




FIG. 4

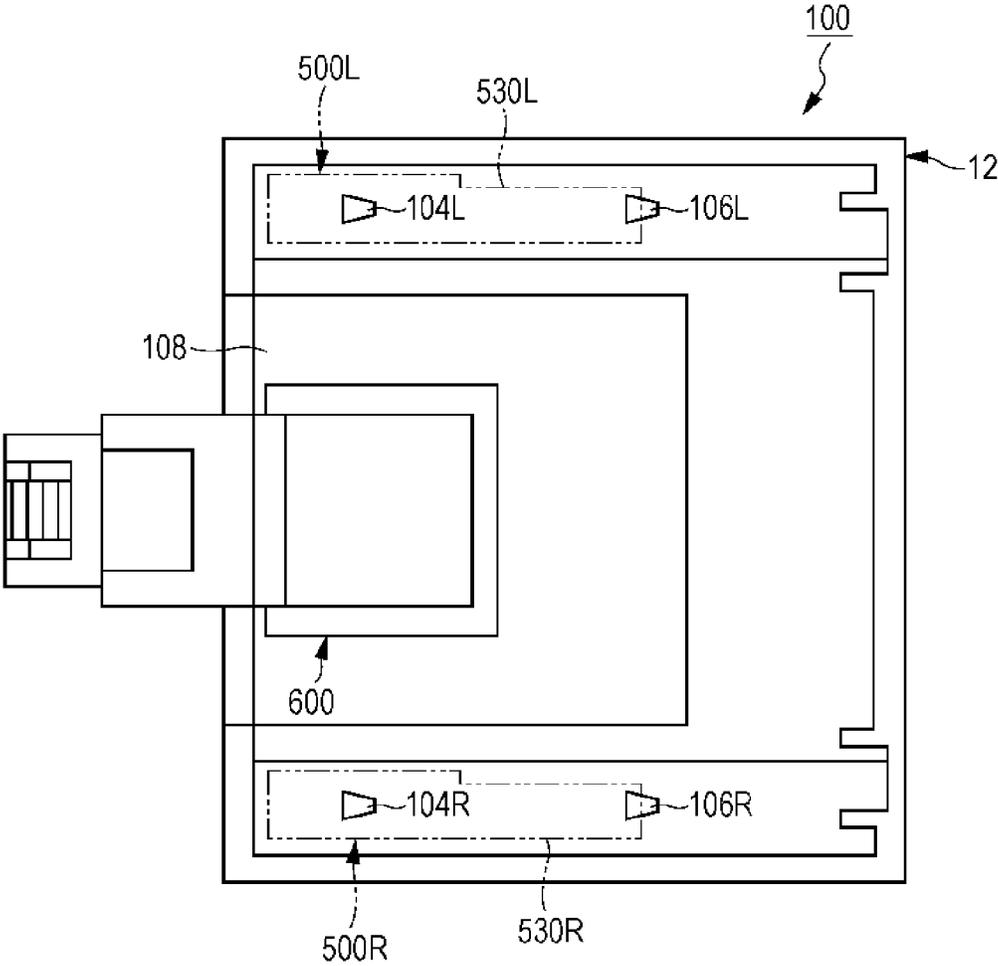


FIG. 5

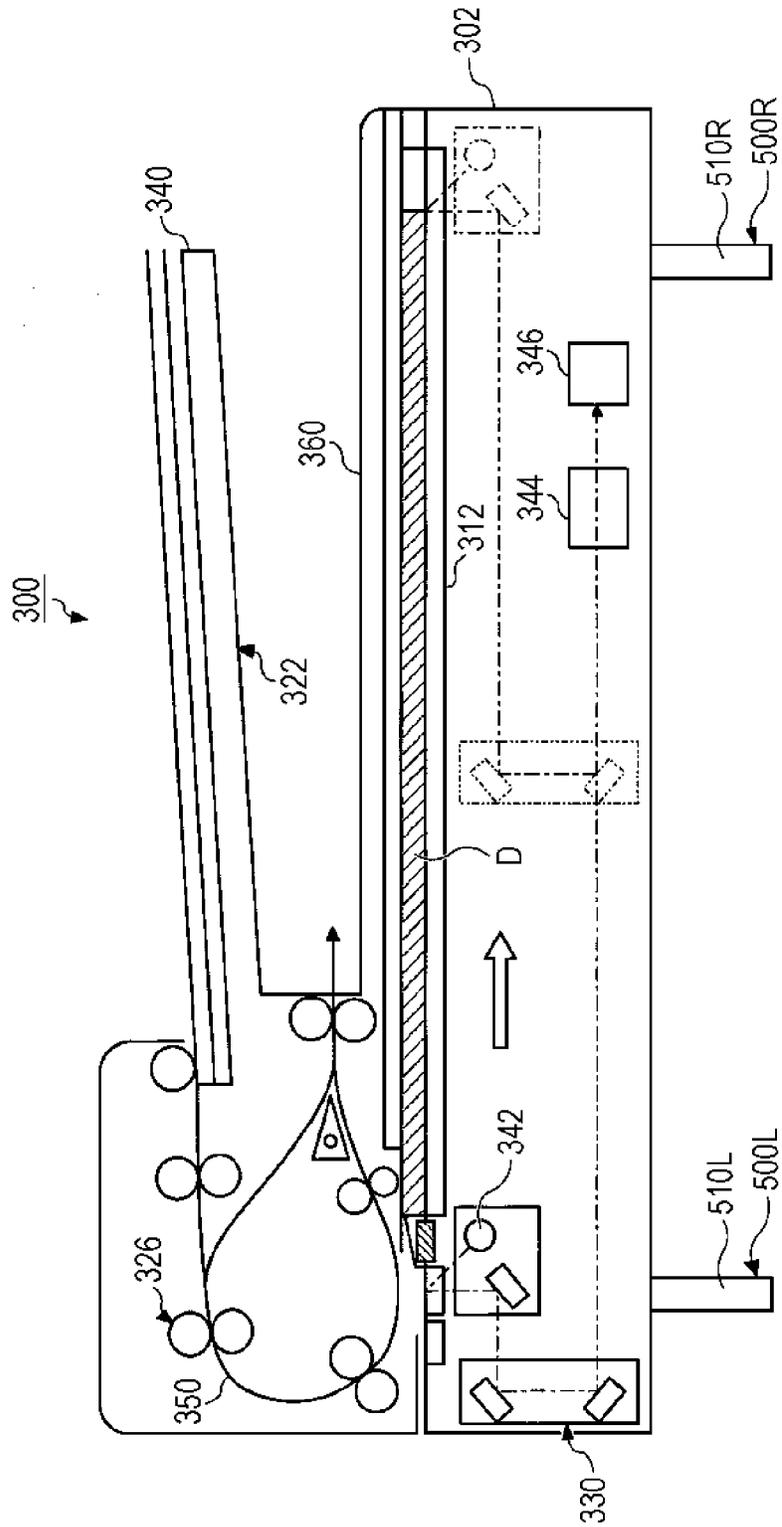


FIG. 6

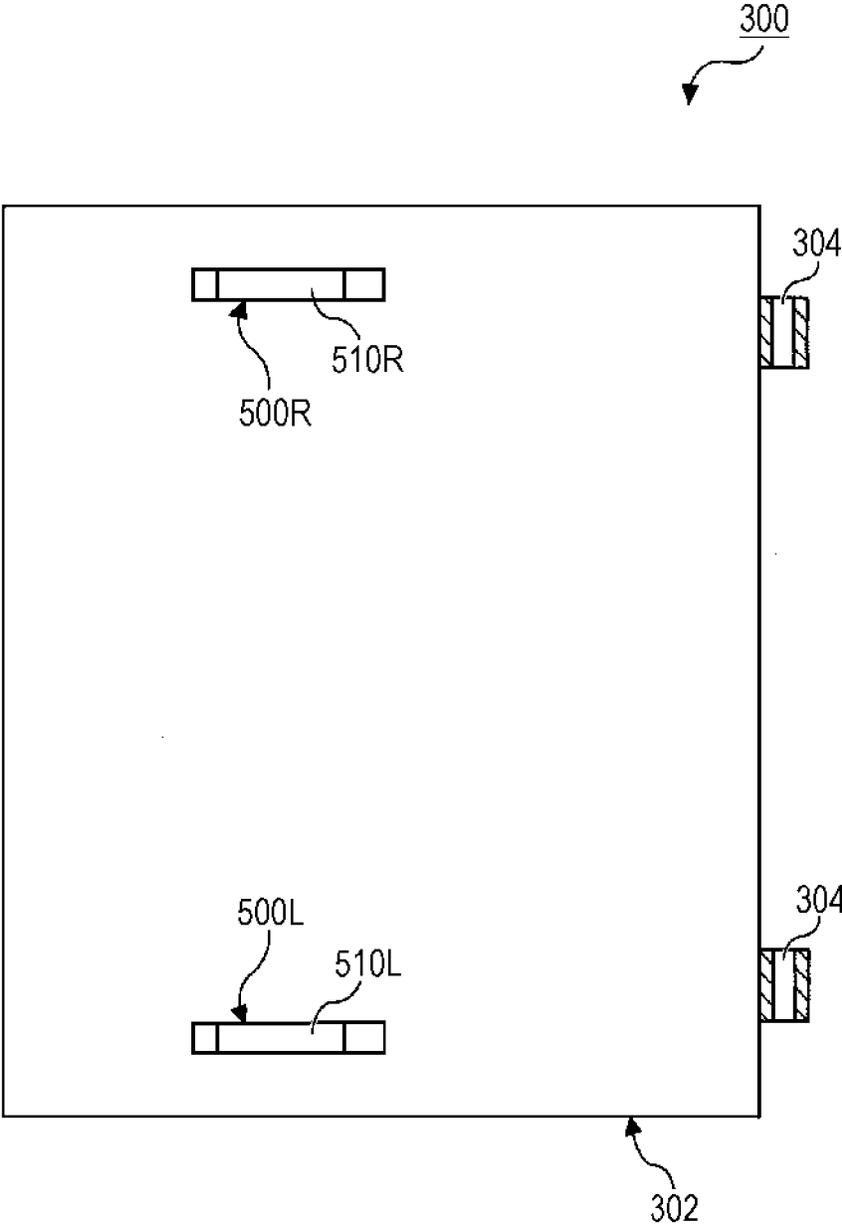


FIG. 7

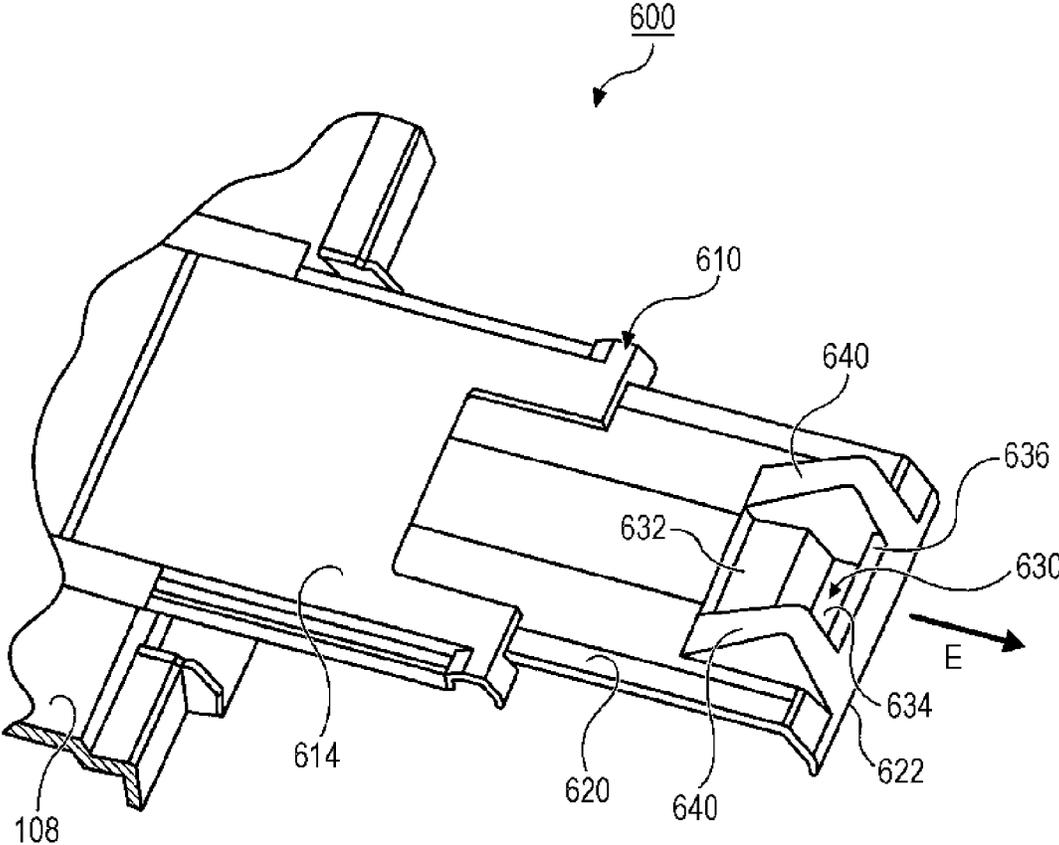


FIG. 8A

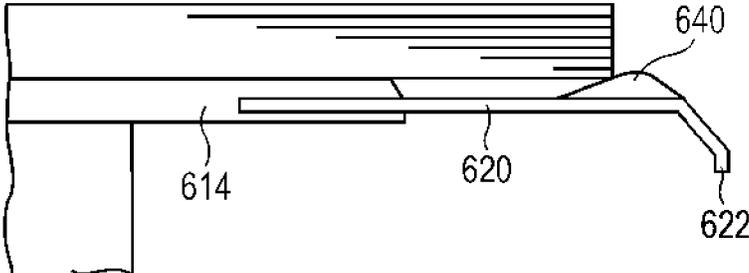


FIG. 8B

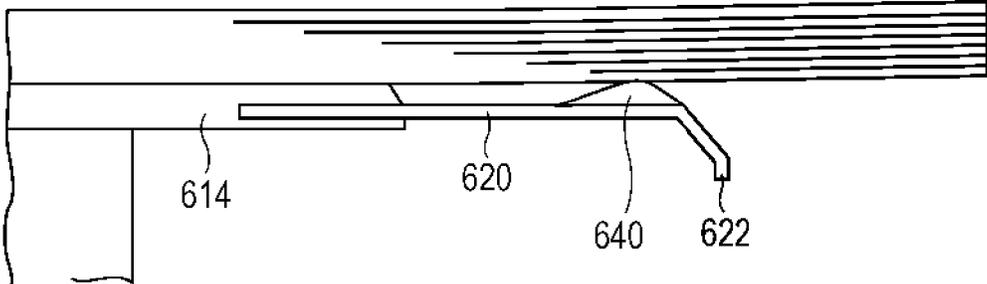
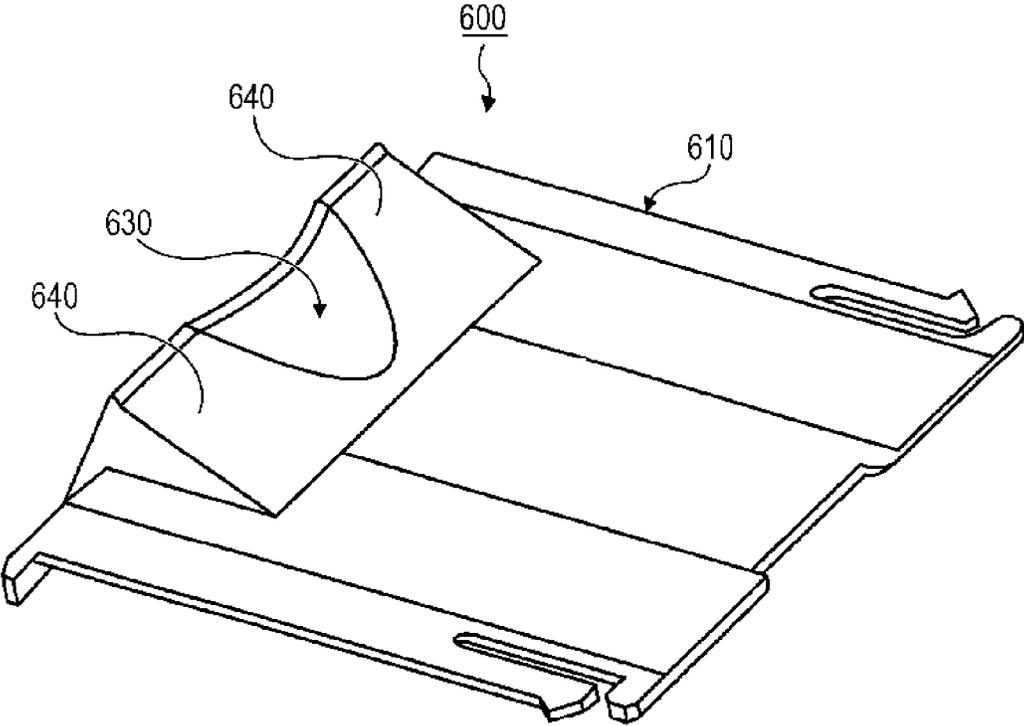


FIG. 9



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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 by irradiating 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

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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 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 100, 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

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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.

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 20

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 35  
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 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

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*,

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.*

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.*

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

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