(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 835 874 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
16.06.2021 Bulletin 2021/24

(21) Application number: **19848448.7**

(22) Date of filing: **09.08.2019**

(51) Int Cl.:
G03G 21/16 *(2006.01)* ***B41J 29/00*** *(2006.01)*
G03G 21/00 *(2006.01)*

(86) International application number:
PCT/JP2019/031621

(87) International publication number:
WO 2020/032251 (13.02.2020 Gazette 2020/07)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
KH MA MD TN

(30) Priority: **09.08.2018 JP 2018150292**

(71) Applicant: **CANON KABUSHIKI KAISHA**
OHTA-KU
Tokyo 146-8501 (JP)

(72) Inventors:
- **TAKEI Yuhei**
  Tokyo 146-8501 (JP)
- **KOSEKI Hiromichi**
  Tokyo 146-8501 (JP)

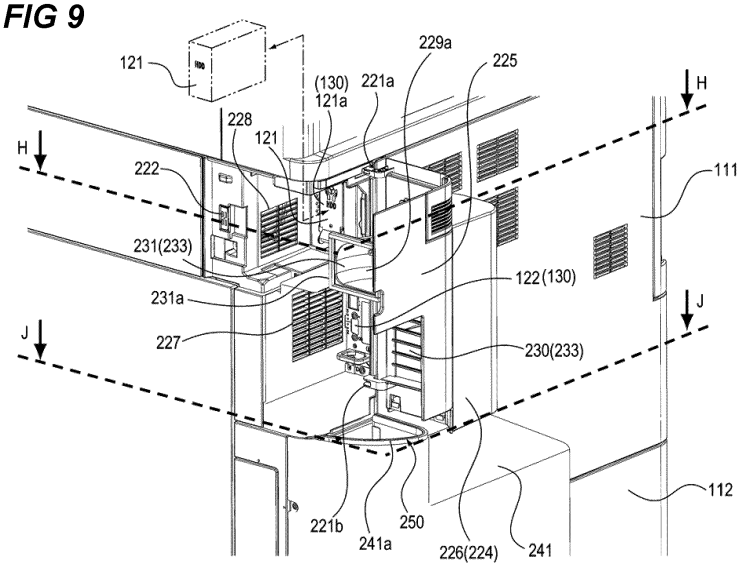
(74) Representative: **TBK**
Bavariaring 4-6
80336 München (DE)

(54) **IMAGE-FORMING DEVICE**

(57) The present invention provides an image forming apparatus in which access to an interface portion is easy even when a duct is provided outside the apparatus.

A duct unit 200 projects to the rear surface side of an image forming apparatus H with respect to a plane to which fans 91 and 92 are fixed in an upper cover 111 and a lower cover 112, and in a state in which an upper duct 224 is attached to the upper cover 111 and the lower cover 112, an exhaust path is formed and, in a state in which the upper duct 224 is not attached to the upper cover 111 and the lower cover 112, an interface portion 130 is exposed and is accessible.

FIG 9



EP 3 835 874 A1

Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to an image forming apparatus such as a copying machine or a printer.

Description of the Related Art

[0002] It has been known that, in an image forming apparatus of an electrophotographic system, heat is applied to components included in a fixing member and wax of toner, whereby fine particles are emitted. The fine particles are called ultrafine particles (UFP) different from ozone and toner powder dust. A reduction in an emission amount of the ultrafine particles is requested.

[0003] In Japanese Patent Laid-Open No. 2017-32833, an image forming apparatus includes a box body portion disposed along the exterior surface of an apparatus main body and a duct portion covering an exhaust port of the apparatus main body provided near a fixing device. In the box body portion, a filter chamber that houses a filter to be opposed to the apparatus main body, a first ventilation portion that causes exhaust to flow into the filter chamber from the duct portion, and a second ventilation portion that emits the exhaust from the filter chamber to the outside are provided. The first ventilation portion and the second ventilation portion are located on the opposite sides across an area center of gravity position of the filter when viewed from the rear side of the apparatus main body.

[0004] As described in Japanese Patent Laid-Open No. 2017-32833, a case in which a duct unit (a box body portion) including a filter, a fan, and a duct is disposed on a main body rear surface is considered. In that case, the duct unit needs to be disposed near an exhaust port near a fixing device in an apparatus main body in order to cause the air exhausted from the exhaust port provided near the fixing device to flow into the duct unit.

[0005] The image forming apparatus sometimes includes, for example, an interface portion including a connecting portion electrically connected to electric contacts of detachably attachable connection units such as a taking out portion of a hard disk drive (HDD) and a local area network (LAN) cable inserting and removing portion. In the image forming apparatus described in Japanese Patent Laid-Open No. 2017-32833, an external finisher is sometimes set on the opposite side of the fixing device in the left-right direction of the apparatus main body in the case in which the apparatus main body is viewed from the rear surface side. In that case, when considering easiness of access by a user, the interface portion needs to be disposed on the opposite side of the external finisher, that is, the fixing device side in the left-right direction of the apparatus main body in the case in which the apparatus main body is viewed from the rear surface side. In that case, the interface portion and the duct unit overlap when disposed. Consequently, in a configuration including the duct unit, it is likely that access to the interface portion is difficult.

[0006] The present invention solves the problems described above, and an object of the present invention is to provide an image forming apparatus in which access to an interface portion is easy even when a duct is provided outside the apparatus.

SUMMARY OF THE INVENTION

[0007] A representative configuration of an image forming apparatus according to the present invention for achieving the object is an image forming apparatus that heats, in a fixing portion, a toner image transferred onto a recording material, fixes the toner image on the recording material, and forms an image, the image forming apparatus including: a cover portion that covers an electric substrate on a rear surface of the image forming apparatus, at least a part of the cover portion forming an exterior of the image forming apparatus; a main body exhaust port for exhausting air on an inside of the cover portion to an outside of the cover portion; a duct unit forming an exhaust path for exhausting the air exhausted from the main body exhaust port, the duct unit including a first duct including an air supply port for supplying the air exhausted from the main body exhaust port and provided detachably attachable to the cover portion and a second duct provided further on a downstream side of the exhaust path than the first duct and fixed to the cover portion; an interface portion provided in a position covered by the first duct and including a connecting portion electrically connected to an electric contact of a detachably attachable connection unit; a filter provided on an inside of the second duct; and a fan that is fixed to the cover portion on the inside of the second duct and exhausts the air in the duct unit, wherein the duct unit projects to the rear surface side of the image forming apparatus with respect to a plane to which the fan is fixed in the cover portion, and, in a state in which the first duct is attached to the cover portion, the exhaust path is formed and, in a state in which the first duct is not attached to the cover portion, the interface portion is exposed and is accessible.

[0008] According to the present invention, it is possible to easily access the interface portion even when a duct is provided outside the apparatus.

[0009] Further features of the present invention will become apparent from the following description of exemplary embodiments with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

FIG. 1 is a sectional schematic view of an image

forming apparatus.
FIG. 2 is a sectional schematic view of a fixing device.
FIG. 3 is a schematic diagram of a fixing device, a fan, and a duct for cooling.
FIG. 4 is an internal explanatory diagram of the image forming apparatus.
FIG. 5 is a graph for explaining driving timing of the fan.
FIG. 6 is a perspective view of the image forming apparatus viewed from the rear surface side.
FIGS. 7A and 7B are schematic diagrams of a duct unit.
FIG. 8 is a perspective view of the duct unit.
FIG. 9 is a perspective view of the duct unit.
FIG. 10 is a sectional view of the duct unit.
FIG. 11 is a sectional view of the duct unit.
FIG. 12 is a sectional view of the duct unit.
FIG. 13 is a perspective view of a lower unit.
FIG. 14 is a perspective view of the lower unit.
FIG. 15 is a sectional view of the lower unit.
FIG. 16 is a graph showing a temperature distribution in a duct of the duct unit.
FIG. 17 is a graph showing a relation between a flow rate of the air supplied from an air supply port of the duct in the duct unit and a flow rate of the air exhausted from a duct exhaust port and an intra-apparatus temperature of the image forming apparatus.
FIG. 18 is a disposition diagram of the duct unit and electric units at the time when the image forming apparatus is viewed from the rear surface side.

DESCRIPTION OF THE OPTIMAL EMBODIMENTS

(First Embodiment)

<Image forming apparatus>

[0011] First, an overall configuration of an image forming apparatus according to a first embodiment of the present invention is explained below together with operation during image formation with reference to the drawings together. Note that dimensions, materials, shapes, relative dispositions, and the like of described constituent components are not meant to limit the scope of the present invention only thereto unless specifically described otherwise.

[0012] FIG. 1 is a sectional schematic view of an image forming apparatus H according to this embodiment. As shown in FIG. 1, the image forming apparatus H is an image forming apparatus of an electrophotographic system that forms an image on a sheet using toners of four colors of yellow, magenta, cyan, and black. The image forming apparatus H includes an image forming portion that transfers a toner image onto a sheet and forms an image, a sheet feeding portion that supplies the sheet toward the image forming portion, and a fixing portion that fixes the toner image on the sheet.

[0013] The image forming portion includes process units 103 (103Y, 103M, 103C, and 103K) that forms toner images of the colors using the toners of the colors described above. The image forming portion includes exposing devices 104 (104Y, 104M, 104C, and 104K), an intermediate transfer belt 6, a secondary transfer roller 8, and a secondary transfer counter roller 9.

[0014] The respective process units 103 include photosensitive drums 3, electrifying rollers 4, developing devices including developing sleeves 5, and primary transfer rollers 7. Note that the process units 103Y, 103M, 103C, and 103K respectively use toners of yellow, magenta, cyan, and black. Components other than the colors of the toners in use are the same in the respective process units.

[0015] Subsequently, an image forming operation is explained. First, when a controller substrate 120 shown in FIG. 18 receives an image forming job signal, a sheet S (a recording material) stacked and stored in a sheet cassette 101 is sent into a registration roller 12 by a pick-up roller 2, a feeding roller 10, and a conveying roller 11. After skew correction and timing correction for the sheet S are performed by the registration roller 12, the sheet S is sent into a secondary transfer portion formed by the secondary transfer roller 8 and the secondary transfer counter roller 9.

[0016] On the other hand, in the image forming portions first, the surfaces of the photosensitive drums 3 are electrified by the electrifying rollers 4. Thereafter, image data transmitted from a not-shown external apparatus or the like is processed by the controller substrate 120. The exposing devices 104 irradiate laser light onto the surfaces of the photosensitive drums 3. Consequently, electrostatic latent images corresponding to the image data are formed on the surfaces of the photosensitive drums 3.

[0017] Thereafter, the toners of the respective colors are caused to adhere to the electrostatic latent images formed on the surfaces of the photosensitive drums 3 by the developing sleeves 5. Toner images are formed on the surfaces of the photosensitive drums 3. A primary transfer bias is applied to the primary transfer rollers 7, whereby the toner images formed on the surfaces of the photosensitive drums 3 are respectively primarily transferred to the intermediate transfer belt 6. Consequently, a full-color toner image is formed on the surface of the intermediate transfer belt 6.

[0018] Thereafter, the secondary transfer counter roller 9 receiving a driving force from a not-shown driving source rotates, whereby the intermediate transfer belt 6 is driven to rotate and the toner image is transferred to the secondary transfer portion. A secondary transfer bias is applied to the secondary transfer roller 8 in the secondary transfer portion, whereby the toner image on the intermediate transfer belt 6 is transferred onto the sheet S.

[0019] Subsequently, the sheet S, on which the toner image is transferred, is conveyed to a fixing device 50. The fixing device 50 includes, as a fixing portion, a fixing belt 20 including a heater 16 (FIG. 2) and a pressure

roller 22 that pressurizes the fixing belt 20 and rotates with the driving force of the not-shown driving source to drive to rotate the fixing belt 20.

[0020] The sheet S conveyed to the fixing device 50 is subjected to heating and pressurizing processes while being nipped and conveyed in a fixing nip portion N formed by the fixing belt 20 and the pressure roller 22. Consequently, the toner image on the sheet S is fixed on the sheet S. Thereafter, the sheet S, on which the toner image is fixed, is discharged to a discharge tray 106 by a discharge roller 70.

[0021] Note that, in this embodiment, paraffin wax is included in the toner. The wax melted by the heat of the fixing process is interposed on an interface between the fixing belt 20 and the toner image to prevent the toner from adhering to the fixing belt 20. A melting point of this wax is approximately 75°C. A target temperature of the fixing nip portion is 170°C.

[0022] Wax is not limited to the wax described above. A compound including a molecular structure of the wax such as a compound obtained by causing a wax molecular structure such as a hydrocarbon chain to react with a resin molecule of the toner can also be used. Another substance having releasing action such as silicon oil can also be used rather than the wax.

[0023] When images are formed on both surfaces of the sheet S, the sheet S is guided to a reversing path 13 after a toner image is fixed on the front surface of the sheet S by the fixing device 50. Thereafter, a reversing roller 14 reversely rotates in a state in which the reversing roller 14 nips the sheet S. After the front and rear surfaces of the sheet S are reversed through a re-feeding path 15, the sheet S is sent to the secondary transfer portion again. Subsequently, an image is formed on the rear surface of the sheet S as on the front surface of the sheet S. Thereafter, the sheet S is discharged to the discharge tray 106.

[0024] A not-shown sheet processing apparatus that performs a binding process, a folding process, and the like on the sheet S, on which the image is formed by the image forming portion, can be attached to the image forming apparatus H. In the image forming apparatus H in this embodiment, the sheet processing apparatus is connected to the left side in FIG. 1 via a not-shown relay unit or the like. That is, the sheet processing apparatus is attached to the opposite side of the fixing device 50 in the left-right direction (the width direction) of the image forming apparatus H with respect to the image forming apparatus H.

<Fixing device>

[0025] Subsequently, the configuration of the fixing device 50 is explained.

[0026] FIG. 2 is a sectional schematic view of the fixing device 50. As shown in FIG. 2, the fixing device 50 includes the fixing belt 20, the pressure roller 22, the heater 16 that generates heat with energization, and a heater holder 17 that holds the heater 16. The fixing device 50 includes a guide member 23, a fixing paper discharge roller 26, a main thermistor 19, and a sub-thermistor 18.

[0027] The pressure roller 22 is formed by forming, with injection molding, a silicone rubber layer having thickness of approximately 3 mm on a core bar made of stainless steel and coating, on the silicone rubber layer, a PFA resin tube having thickness of approximately 40 μm. Both end portions of the core bar of the pressure roller 22 are rotatably held by a not-shown bearing attached to a frame 24. The pressure roller 22 rotates with the driving force of the not-shown driving source.

[0028] The fixing belt 20 is an endless cylindrical member and is loosely externally fit in the heater holder 17. Both end portions of the heater holder 17 in a rotational axis direction of the pressure roller 22 are urged toward the pressure roller 22 by a not-shown urging mechanism with force of 98 N on one side and 196 N in total. Consequently, the heater 16 is pressed against the pressure roller 22 via the fixing belt 20 and the fixing nip portion N is formed. Note that the urging mechanism is configured to be able to release the urging in order to remove the sheet S during jam recovery.

[0029] When the pressure roller 22 rotates, the fixing belt 20 in contact with the pressure roller 22 is driven to rotate around the outside of the heater holder 17 while bringing the inner circumferential surface of the fixing belt 20 into contact with and sliding the inner circumferential surface on the heater 16 with a frictional force. In order to secure a sliding property between the heater holder 17 and the inner circumferential surface of the fixing belt 20, grease is applied to the inner circumferential surface of the fixing belt 20.

[0030] The main thermistor 19 is provided in contact with the rear surface of the heater 16 and detects the temperature of the heater 16. The sub-thermistor 18 is provided elastically in contact with the inner circumferential surface of the fixing belt 20 and detects the temperature of the fixing belt 20. The main thermistor 19 and the sub-thermistor 18 are connected to a CPU 21 via a not-shown A/D converter. The CPU 21 controls energization to the heater 16 by a heater driving circuit 28 based on outputs of the main thermistor 19 and the sub-thermistor 18 and performs temperature adjustment control for the heater 16. Note that the main thermistor 19 is disposed near the center in the longitudinal direction of the heater 16. The sub-thermistor 18 is provided near an end portion in the longitudinal direction of the fixing belt 20.

[0031] The guide member 23 comes into contact with the sheet S to guide the sheet S to the fixing nip portion N. The guide member 23 is formed of polyphenylene sulfide (PPS) resin in this embodiment.

[0032] When the fixing process is performed, first, the sheet S bearing an unfixed toner image is guided into the fixing nip portion N. Subsequently, in the fixing nip portion N, the sheet S is nipped and conveyed with a toner image bearing surface side in contact with the outer

circumferential surface of the fixing belt 20. In this conveyance process, the heat of the heater 16 is applied to the toner image on the sheet S via the fixing belt 20. The unfixed toner image is melted and fixed on the sheet S. Thereafter, the sheet S passed through the fixing nip portion N is curvature-separated from the fixing belt 20 and conveyed to the discharge roller 70 side by the fixing paper discharge roller 26.

<Cooling portion>

[0033] Subsequently, a cooling portion that cools the fixing nip portion N is explained.

[0034] When the sheet S conveyed to the fixing device 50 is large, in the fixing nip portion N, the sheet S passes substantially the entire region in a sheet width direction orthogonal to a conveying direction of the sheet S. Consequently, the heat of substantially the entire region of the fixing nip portion N is taken by the sheet S. The temperature of the fixing nip portion N changes to substantially fixed temperature in the sheet width direction.

[0035] In contrast, when the sheet S conveyed to the fixing device 50 is small, in the fixing nip portion N, the sheet S passes only near the center in the sheet width direction. Accordingly, in fixing nip portion N, the heat near the center in the sheet width direction is taken by the sheet S but the heat at both the end portions is not taken by the sheet S. The temperature at both end portions is high compared with the temperature near the center.

[0036] In this case, when the temperature of the heater 16 is raised in order to keep a fixing property in the center, the temperature in the center reaches a desired temperature but the temperature at both the end portions continues to rise and is likely to adversely affect the fixing device 50, for example, deform a member. Therefore, in order to suppress the temperature raise at both the end portions in the sheet width direction of the fixing nip portion N, the image forming apparatus H includes fans 95 and 96 and a duct for cooling 30 as the cooling portion that cools the fixing nip portion N.

[0037] FIG. 3 is a schematic diagram of the fixing device 50, the fans 95 and 96, and the duct for cooling 30. FIG. 4 is an internal explanatory diagram of the image forming apparatus H and is a perspective view of a state in which a part of the exterior of the apparatus main body is made transparent. FIG. 5 is a graph for explaining driving timing of the fans 95 and 96.

[0038] As shown in FIGS. 3 to 5, the two fans 95 and 96 and the duct for cooling 30 for cooling the fixing belt 20 are provided at both the end portions in a rotational axis direction of the fixing belt 20. The duct for cooling 30 guides the air to both the end portions of the fixing belt 20, that is, non-passage regions where the sheet S having a small size does not pass in the fixing belt 20 when the fixing device 50 performs the fixing process on the sheet S having the small size. Driving of the fans 95 and 96 is turned on when a detected temperature of the sub-thermistor 18 is equal to or higher than a predetermined temperature and is turned off when the detected temperature is equal to or lower than the predetermined temperature.

[0039] With such a configuration, it is possible to suppress the temperature of the non-passage regions from rising when the fixing process is continuously performed in the sheet S having the small size. Note that, in this embodiment, a centrifugal fan such as a sirocco fan is used as the fans 95 and 96. However, fans of other types can also be used.

<Overview of a duct unit>

[0040] Subsequently, an overview of a duct unit 200 that performs dedusting of the air exhausted from the image forming apparatus H is explained. In the image forming apparatus H, the duct unit 200 is attached to an apparatus main body 1. On the rear surface side of the apparatus main body 1, an upper cover 111 and a lower cover 112 are provided as an exterior cover (a cover portion). The duct unit 200 is attached to the apparatus main body 1 via the upper cover 111 and the lower cover 112. The duct unit 200 forms a channel for exhausting the air warmed by the fixing device 50 to the outside of the apparatus main body 1.

[0041] As explained above, when the heat is applied to the toner image on the sheet S for the fixing process in the fixing device 50, a part of the wax included in the toner vaporizes. The vaporized wax is cooled and condensed in the air to be air including dust. It has been found by researches of the present inventor that most of this dust adheres to the vicinity of a sheet introducing port 400 of the fixing device 50 and, in particular, under a high-temperature environment, the dust increases in diameter and easily adheres to the vicinity of the sheet introducing port 400.

[0042] In the BLUE ANGEL standard in Europe, a discharge amount standard for ultrafine particles is specified. It is also desired to reduce a discharge amount of ultrafine particles in the image forming apparatus H. Therefore, the duct unit 200 is mounted on the image forming apparatus H in order to perform dedusting of the air warmed by the fixing device 50.

[0043] FIG. 6 is a perspective view of the image forming apparatus H viewed from the rear surface side. As shown in FIG. 6, the duct unit 200 is provided in the exterior of the image forming apparatus H to project to the rear (the rear surface side). That is, the duct unit 200 projects to the rear (the rear surface side) with respect to the planes of the upper cover 111 and the lower cover 112 functioning as the exterior cover. The duct unit 200 is configured from an upper unit 220 including an upper duct 224 and a lower unit 240 including a lower duct 241 functioning as a second duct coupled to the upper duct 224.

[0044] FIGS. 7A and 7B are schematic diagrams of the duct unit 200. As shown in FIG. 7A, a fan 91 and a fan 92 for performing heat exhaust are provided near the

fixing device 50. The fans 91 and 92 are respectively held by fan holders 280. The fan holders 280 are fastened to a rear side plate 80 (FIG. 4).

[0045] The fan 91 exhausts the air around the fixing device 50. The fan 92 is disposed near a conveyance path for the sheet S further upward (on a sheet conveying direction downstream side) than the fan 91 and exhausts the air around a discharging portion 75 to the outside of the apparatus. The discharging portion 75 is a space above the fixing device 50 and is a space around the discharge roller 70. The fan 91 and the fan 92 are provided further on the rear surface side of the image forming apparatus H than the rear side plate 80 (FIG. 4).

[0046] The air including the dust generated in the fixing device 50 is exhausted from an exhaust port 227 of the apparatus main body 1 by an air current generated by the fan 91 and carried into the upper duct 224 from an air supply port 230 of the upper duct 224. The air including the dust carried upward by the natural convection is exhausted from an exhaust port 228 (a main body exhaust port) of the apparatus main body 1 by an air current generated by the fan 92 and is carried into the upper duct 224 from an air supply port 231 of the upper duct 224.

[0047] The upper duct 224 includes the two air supply ports 230 and 231. The upper duct 224 includes an inner duct 233 provided on the inner surface of a cover member 225 in order to guide the air exhausted from the inside of the apparatus main body 1 via the respective air supply ports 230 and 231. Further, the upper duct 224 includes an outer duct 226 that is coupled to the inner duct 233 and the lower duct 241 of the lower unit 240 and guides the air exhausted from the inside of the apparatus main body 1 via the inner duct 233 to the lower unit 240.

[0048] The airs exhausted from the exhaust ports 227 and 228 are respectively partitioned by a partition wall portion 229a, which is a part of the inner duct 233, and, thereafter, merge in a merging portion 229b and carried to the lower duct 241 via the outer duct 226. That is, the partition wall portion 229a partitioning the air supplied from the air supply port 230 and the air supplied from the air supply port 231 is provided further on an upstream side in a flowing direction of the air than the merging portion 229b.

[0049] The air carried to the lower duct 241 is carried to a duct exhaust port 244 side by an air current generated by a fan 102. After the dust is collected by a filter 260 provided on an exhaust path between the exhaust ports 227 and 228 and the duct exhaust port 244, the air is exhausted to the outside of the image forming apparatus H from the duct exhaust port 244.

[0050] In this way, the filter 260 is disposed further on a downstream side in the flowing direction of the air than the merging portion 229b in which the air supplied from the air supply port 230 and the air supplied from the air supply port 231 merge. Consequently, compared with a configuration in which the airs merge in the filter 260, it is possible to reduce an area of a surface included in the filter 260 and reduce the filter 260 in size.

[0051] As shown in FIG. 7B, a center line L1 of the fan 102 and a center line L2 of the upper duct 224 are arranged not to overlap. Consequently, it is possible to cause the air in the lower duct 241 to flow in the radial direction, cause the air to pass in a wide range of the filter 260, and efficiently collect the dust.

<Detailed configuration of the duct unit>

[0052] Subsequently, a detailed configuration of the duct unit 200 is explained.

[0053] FIG. 8 and FIG. 9 are perspective views of the duct unit 200. FIG. 10 and FIG. 11 are sectional views of the duct unit 200 respectively taken along an L-L cross section shown in FIG. 8 and an H-H cross section shown in FIG. 9. FIG. 12 is a sectional view of the duct unit 200 taken along a J-J cross section shown in FIG. 9. FIG. 8 and FIG. 10 are views showing a case in which the upper unit 220 is in a closed state. FIG. 9, FIG. 11, and FIG. 12 are views showing a case in which the upper unit 220 is in an open state.

[0054] As shown in FIG. 8 to FIG. 12, the upper unit 220 includes shaft portions 221a and 221b. The shaft portions 221a and 221b are coaxially disposed and inserted into not-shown hole portions formed in the upper cover 111, which is the exterior of the apparatus main body 1 of the image forming apparatus H. Therefore, the upper unit 220 is supported by the upper cover 111 to be rotatable around the shaft portions 221a and 221b. The upper unit 220 turns to open and close with respect to the apparatus main body 1 of the image forming apparatus H. It is detected by an open and close sensor 25 functioning as detecting means that the upper unit 220 is in an open state with respect to the apparatus main body 1.

[0055] The upper unit 220 is configured by the cover member 225 forming the exterior cover and the upper duct 224 provided on the inside of the cover member 225. The cover member 225 is formed as an open and close cover for exposing an interface portion 130 including a connecting portion electrically connected to electric contacts of detachably attachable connection units such as a LAN cable connecting portion 122 and an HDD inserting portion 121a provided on the apparatus main body 1 side opposed to the cover member 225.

[0056] In the image forming apparatus H in this embodiment, the interface portion 130 is disposed on the rear surface side of the apparatus main body 1, that is, the opposite side of a side surface to which the sheet processing apparatus is attached in the left-right direction. That is, the interface portion 130 is disposed on a side where the fixing device 50 is disposed in the left-right direction.

[0057] A hard disk drive 121 (hereinafter, HDD 121) can be inserted into and removed from the HDD inserting portion 121a. That is, in a state in which the upper unit 220 is closed, the interface portion 130 provided in the apparatus main body 1 is provided in a position covered

by the inner duct 233 of the duct unit 200. Accordingly, the interface portion 130 is accessible when the upper unit 220 is opened. The HDD 121 can be inserted and removed and a not-shown LAN cable can be connected. When the HDD 121 is attached to the HDD inserting portion 121a, an electric contact of a not-shown connecting portion of the interface portion 130 and an electric contact of the HDD 121 are electrically connected.

[0058] A sheet metal 223 for magnet catch is provided in the cover member 225. A magnet catch 222 is provided in a portion of the upper cover 111 opposed to the sheet metal 223. The cover member 225 is configured to be attractable to the apparatus main body 1 side (the apparatus main body side) by the magnet catch 222.

[0059] The magnet catch 222 urges the cover member 225 in a closing direction with a magnetic force via the sheet metal 223, attracts the sheet metal 223, and holds the cover member 225 in a closed state. That is, the upper unit 220 is held in a closed state by the magnetic force of the magnet catch 222. Note that, in this embodiment, the upper unit 220 uses the magnet catch 222 in order to maintain the closed state. However, a configuration may be adopted in which the upper unit 220 is urged in a closing direction by other urging means.

[0060] In the closed state of the upper unit 220, the air supply port 230 is coupled to the exhaust port 227 from which the air in the apparatus main body 1 is discharged by the fan 91. The air supply port 231 is coupled to the exhaust port 228 from which the air in the apparatus main body 1 is discharged by the fan 92. The outer duct 226 of the upper duct 224 is coupled to the lower duct 241 included in the lower unit 240.

[0061] That is, the inner duct 233 functioning as a first duct is provided to be capable of opening and closing with respect to the apparatus main body 1. When the upper unit 220 is closed with respect to the apparatus main body 1, an exhaust path from the exhaust ports 227 and 228 to the duct exhaust port 244 is formed via the inner duct 233. When the upper unit 220 is opened with respect to the apparatus main body 1, the interface portion 130 is exposed to be accessible. Note that the lower duct 241 is configured as a second duct fixed to the apparatus main body 1.

[0062] The air warmed by the fixing device 50 is exhausted from the exhaust ports 227 and 228 by the fans 91 and 92 and supplied to the inner duct 233 of the upper duct 224 from the air supply ports 230 and 231. Thereafter, the air is carried from the inner duct 233 to the outer duct 226 and from the outer duct 226 to the lower duct 241. Note that, in a state in which the upper unit 220 of the duct unit 200 is closed with respect to the apparatus main body 1, the HDD 121 is prevented by the inner duct 233 from being exposed to an air current. Consequently, the high-temperature air discharged from the exhaust port 228 is prevented from directly touching the HDD 121.

[0063] A sealing member 231a is fixed to the air supply port 231 by a double sided tape in order to seal a gap of a coupling portion to the exhaust port 228. The size of the gap fluctuates according to molding fluctuation of a single component, attachment backlash, or the like. Therefore, the sealing member 231a is preferably configured by compressing an elastic member thicker than the gap. In this embodiment, OPSEALER JKX-1105 (manufactured by SANWA KAKO CO., LTD.) is used as the sealing member 231a.

[0064] A sealing member 226a is fixed to the outer duct 226 by a double sided tape in order to seal a gap of a fixing portion to the cover member 225. The sealing member 226a is preferably configured to compress an elastic member like the sealing member 231a. In this embodiment, CALMFLEX F-2 (manufactured by INOAC CORPORATION) is used as the sealing member 226a.

[0065] A sealing member 241a is fixed to the lower duct 241 by a double sided tape in order to seal a gap of a coupling portion to the outer duct 226. In this embodiment, OPSEALER JKX-1105 (manufactured by SANWAKAKO CO., LTD.) is used as the sealing member 241a. PF-050H (manufactured by DIC Corporation) is used for the surface of the sealing member 241a in order to suppress wear of the sealing member 241a due to opening and closing of the upper unit 220.

[0066] When the upper unit 220 is opened and closed, in order to suppress wear of the sealing member 241a, it is desirable to compress the sealing member 241a in a direction (in this embodiment, the horizontal direction) orthogonal to the rotational axis direction of the upper unit 220. However, when a coupling portion 250 to the lower duct 241 is formed to conform to the external shape of the outer duct 226, the outer duct 226 and the lower duct 241 interfere when the upper unit 220 is opened and closed.

[0067] Therefore, as shown in FIG. 12, the coupling portion 250 of the lower duct 241 and the outer duct 226 is configured by a region F conforming to the external shape of the outer duct 226 and a region G conforming to a moving track on which an end portion 225a of the cover member 225 passes when the upper unit 220 rotates. Consequently, the outer duct 226 and the lower duct 241 do not interfere when the upper unit 220 is opened and closed. When the upper unit 220 is closed, the sealing member 241a can be compressed in a direction orthogonal to the axial direction of the shaft portions 221a and 221b.

[0068] In this way, in this embodiment, a configuration is adopted in which the upper unit 220 is enabled to open and close with respect to the apparatus main body 1 and the sealing member 241a is included between the apparatus main body 1 and the upper unit 220. Consequently, a configuration including the interface portion 130 near a position where the fixing device 50, which is the opposite side of a side surface to which the sheet processing apparatus is attached with respect to the left-right direction of the apparatus main body 1, is considered. Even in this configuration, it is possible to suppress exhaust efficiency of the duct unit 200 from being deteriorated without deteriorating operability of the user.

[0069] Note that, a configuration may be adopted in which the upper unit 220 is detachably attachable to the exterior cover of the apparatus main body 1 if the upper unit 220 is capable of being located, with respect to the apparatus main body 1, in a position where the interface portion 130 is exposed and a position where the interface portion 130 is covered. In this way, the detachably attachable configuration includes an open-closable configuration. A state in which the upper unit 220 is attached to the exterior cover is equal to a closed state of the upper unit 220 with respect to the exterior cover and is a state in which the upper unit 220 covers the interface portion 130. A state in which the upper unit 220 is not attached to the exterior cover is equal to an open state of the upper unit 220 with respect to the exterior cover and is a state in which the upper unit 220 exposes the interface portion 130.

[0070] A configuration in which the upper unit 220 is detachably attachable to the apparatus main body 1 explained above includes a configuration in which the upper unit 220 can be easily detached from the apparatus main body 1 without detaching a fastening tool such as a screw More specifically, the state is a state in which the upper unit 220 is attached to the upper cover 111 functioning as the exterior cover by snap-fit or the like and means a configuration in which the upper unit 220 can be detached from the upper cover 111 without using a tool. In this way, by configuring the upper unit 220 to be easily detachably attachable to the exterior cover, it is possible to suppress exhaust efficiency of the duct unit 200 from being deteriorated while making it easy to access the interface portion 130.

[0071] FIG. 13 is a perspective view of the lower unit 240 in a state in which the fan holders 280 included in the lower unit 240 are detached. FIG. 14 is a perspective view of the lower unit 240 in a state in which the lower duct 241 and the filter 260 included in the lower unit 240 are detached. Note that FIG. 14 is a diagram of a state in which the upper duct 224 is also detached.

[0072] As shown in FIG. 13 and FIG. 14, the upper duct 224 side of the lower duct 241 is opened. This opened portion and the outer duct 226 are coupled. The lower duct 241 is screw-fixed to fixed portions 280a, 111a, and 112a provided in the upper cover 111, the lower cover 112, and the fan holders 280. The upper cover 111 (a first plate-like member) and the lower cover 112 (a second plate-like member), which are plate-like members, are the exterior of the apparatus main body 1. In the lower unit 240, an air channel is formed by the lower duct 241, the upper cover 111, and the lower cover 112.

[0073] Note that, in the upper cover 111, a sealing member 111b is provided in order to seal a gap of a coupling portion to the lower duct 241. In this embodiment, OPSEALER JKX-1105 (manufactured by SANWAKAKO CO., LTD.) is used as the sealing member 111b. The sealing member 111b is stuck to a rib 111d provided in the upper cover 111.

[0074] In the lower unit 240, the fan 102 and the filter 260 are provided on the inside of the lower duct 241. The duct exhaust port 244 is provided in a lower part of the lower duct 241. The duct exhaust port 244 is an exhaust port provided at a downstream end portion in a direction in which the air flows in the lower duct 241.

[0075] The filter 260 has a configuration in which a filter material 262 is fixed to a frame body 261 made of resin. The filter material 262 is provided in a pleat shape in the frame body 261. Consequently, a surface area of the filter material 262 is increased to improve dust collection efficiency. The filter material 262 is divided into two to hold the frame body 261 to secure strength. Note that, in this embodiment, FM-9406WP (manufactured by Japan Vilene Company, Ltd.) is used as the filter material 262.

[0076] A position in the up-down direction of the filter 260 is restricted by four positioning portions 243. The filter 260 is held in a form sandwiched by the inner side of the lower duct 241 and the upper cover 111. A sealing member 260a for sealing gaps between the frame body 261 of the filter 260 and the lower duct 241, the upper cover 111, and the lower cover 112 is provided in the entire circumference of the frame body 261. In this embodiment, CALMFLEX F-2 (manufactured by INOAC CORPORATION) is used as the sealing member 260a.

[0077] The fan 102 is held by the fan holders 280 (holding members). The fan holders 280 are screw-fixed to the lower cover 112. The fan 102 is provided further on a downstream side of an air current exhausted from the duct exhaust port 244 than the filter 260. The fan 102 generates an air current for exhaust from the duct exhaust port 244 of the lower duct 241. As shown in FIGS. 13 and 14, the duct unit 200 is configured to project to the rear surface side of the apparatus main body 1 with respect to a plane to which the fan holder 280 is fixed in the lower cover 112 functioning as the exterior cover. The duct unit 200 is configured to project further to the rear surface side of the image forming apparatus than the rib 111d provided in the upper cover 111 functioning as the exterior cover.

[0078] When an interval between the filter 260 and the fan 102 is too small, an air current generated by the fan 102 passes only a portion of the filter 260. It is likely that the dust collection efficiency is deteriorated. Therefore, in this embodiment, the interval between the filter 260 and the fan 102 is secured approximately 40 mm to maintain the dust collection efficiency. That is, it is preferable that a distance on the exhaust path between the filter 260 and the fan 102 is 40 mm or more.

[0079] A sealing member 280c is provided in the fan holder 280 in order to seal a gap between the fan holders 280 and the lower cover 112. Further, a sealing member 280d is provided in order to seal a gap between the fan holder 280 and the lower duct 241. In this embodiment, OPSEALER JKX-1105 (manufactured by SANWA KAKO CO., LTD.) is used as the sealing members 280c and 280d.

[0080] A bundle wire 283 (an electric wire) for electrically connecting the fan 102 and a not-shown substrate

provided on the inside of the image forming apparatus H is held by the fan holder 280. The bundle wire 283 electrically connects the fan 102 and a not-shown substrate provided in the apparatus main body 1 (on the inner side of the upper cover 111 and the lower cover 112) via a relay connector 284.

[0081] FIG. 15 is a sectional view of the lower unit 240 taken along a K-K cross section shown in FIG. 14. Note that FIG. 15 is a sectional view of a state in which the lower duct 241 and the filter 260 are attached. As shown in FIG. 15, an opening portion 285 for inserting through the bundle wire 283 from the inside of the apparatus main body 1 of the image forming apparatus H is formed in a position between the upper cover 111 and the lower cover 112 functioning as the exterior of the apparatus main body 1 opposed to the lower duct 241.

[0082] In the fan holder 280, a cover portion 280b disposed to be opposed to the opening portion 285 at an interval and covering the opening portion 285 when viewed from a direction (the front-rear direction of the image forming apparatus H) orthogonal to the rotational axis direction of the fan 102 (a direction of a line D shown in FIG. 15) is provided. The cover portion 280b extends to incline in a direction opposite to a flow of the air flowing in the lower duct 241. That is, concerning the direction orthogonal to the rotational axis direction of the fan 102, the distal end portion of the cover portion 280b is present in a position further away from the opening portion 285 than the proximal end portion of the cover portion 280b. The distal end portion of the cover portion 280b is inclined to be further away from the upper cover 111 than the proximal end portion.

[0083] By providing the cover portion 280b in this way, when the air flows in the duct unit 200, it is possible to generate a swirling air current E near the opening portion 285. The air in the apparatus main body 1 (further on the inner side of the apparatus main body 1 than the upper cover 111 and the lower cover 112) can be suppressed from flowing into the lower duct 241 from the opening portion 285 by this air current E. Accordingly, it is possible to suppress occurrence of an adverse effect in which, for example, an unintended flow of the air occurs in the apparatus main body and the toner scatters. It is possible to improve exhaust efficiency of the lower duct 241.

[0084] In this embodiment, an angle (an inclination angle of the cover portion 280b) θ formed by the rotational axis direction of the fan 102 and a direction in which the cover portion 280b extends along a channel of the air is 10°. By setting this angle θ to 10° or more and 45° or less, the swirling air current E is easily generated. The effect explained above can be improved.

[0085] In the upper cover 111 configuring a part of the lower duct 241, a lower end portion 111c on a side close to the lower cover 112 (the opening portion 285) is bent to the inner side of the lower duct. That is, the lower end portion 111c of the upper cover 111 is inclined toward a direction away from the lower cover 112 (the outer side of the apparatus main body 1). With such a configuration, an opening width of the opening portion 285 can be maintained. Therefore, it is easy to secure a space for allowing a bundle wire of the fan 102 and the other wires to pass. Even in a configuration in which the opening portion 285 for wiring the bundle wire 283 is provided, it is possible to suppress the air in the apparatus main body 1 from flowing into the duct unit 200 from the opening portion 285.

<About a temperature distribution and an air flow rate of the duct unit>

[0086] Subsequently, a temperature distribution and an air flow rate of the duct unit 200 are explained.

[0087] First, the temperature distribution of the duct unit 200 is explained. FIG. 16 is a graph showing a temperature distribution in the duct of the duct unit 200. As shown in FIG. 16, the duct unit 200 is configured to be provided on the outer side of the image forming apparatus H and exposed to the outside air. Accordingly, whereas an internal temperature near an inlet of the upper duct 224 is as high as 76°C, an internal temperature near an inlet 241x of the lower duct 241 and further on an upstream side than the filter 260 in a flowing direction of the air drops to 47°C. That is, the filter 260 is provided in a position where a temperature difference between a first temperature of the air in a duct inlet and a second temperature of the air passing in the filter 260 is at least 20°C or more (a predetermined temperature difference) because the duct unit 200 is exposed to the outside air.

[0088] The inlet of the upper duct 224 is the air supply port 230 and the air supply port 231 and means an upstream end portion side of the upper duct 224 in the direction in which the air flows in the duct unit 200. The inlet 241x of the lower duct 241 means an upstream end portion side of the lower duct 241 in the direction in which the air flows in the duct unit 200 and means an end portion side on the opposite side of the duct exhaust port 244 across the filter 260.

[0089] In this way, the duct unit 200 is configured to be exposed to the outside air to lower the temperature of the air in the duct before the air reaches the filter 260. Consequently, condensation of dust sufficiently advances near the filter 260. Since the dust condenses, the dust is easily collected by the filter 260. Therefore, it is possible to improve dust collection efficiency by the filter 260.

[0090] The temperature of the air drops to 41°C near the duct exhaust port 244. Accordingly, it is possible to suppress the temperature of the air exhausted from the duct exhaust port 244 from rising. It is possible to suppress unpleasant feeling from being given to the user.

[0091] Subsequently, a flow rate of the air supplied to and exhausted from the upper duct 224 and the lower duct 241 is explained. FIG. 17 is a graph showing a relation between a flow rate A of the air supplied from the air supply port 230 of the upper duct 224, a flow rate B of the air supplied from the air supply port 231, and a flow rate C of the air exhausted from the duct exhaust port

244 and an intra-apparatus temperature of the image forming apparatus H.

[0092] The flow rate A of the air supplied from the air supply port 230 of the upper duct 224 is substantially equal to a flow rate of the air discharged from the exhaust port 227 of the apparatus main body 1 by the fan 91. The flow rate B of the air supplied from the air supply port 231 is substantially equal to a flow rate of the air discharged from the exhaust port 228 of the apparatus main body 1 by the fan 92. The flow rate C of the air exhausted from the duct exhaust port 244 is substantially equal to a flow rate of the air discharged to the outside of the duct unit 200 by the fan 102.

[0093] As shown in FIG. 17, when a relation among the flow rates is $C < A + B$, the air warmed by the fixing device 50 cannot be sufficiently exhausted. Heat fills the upper duct 224 and the lower duct 241 and the temperature of the image forming apparatus H rises. In this case, it is likely that a deficiency such as adhesion of the toner occurs.

[0094] Therefore, a flow rate of the air per unit time supplied from the air supply ports 230 and 231 is set to be equal to or lower than a flow rate of the air per unit time exhausted from the duct exhaust port 244. That is, the relation among the flow rates A, B, and C is set to $C \geq A + B$. Consequently, it is possible to sufficiently exhaust the air warmed by the fixing device 50 and suppress a temperature rise of the image forming apparatus H. In this embodiment, a configuration is adopted in which the relations among the flow rates explained above is satisfied by increasing the number of rotations of the fan 102 with respect to the fans 91 and 92 or increasing the size of the fan 102 itself.

<Disposition of the duct unit>

[0095] Subsequently, disposition of the duct unit 200 is explained.

[0096] FIG. 18 is a disposition diagram of the duct unit 200 and electric units at the time when the image forming apparatus H is viewed from the rear surface side. As shown in FIG. 18, the controller substrate 120 including an electronic circuit that performs arithmetic processing for outputting received image data as an image is disposed on the rear surface side of the apparatus main body 1 of the image forming apparatus H. A power supply substrate 123 that supplies electric power to the apparatus main body, an engine control substrate 124, the HDD 121, and the like are disposed.

[0097] Note that, in FIG. 18, although not shown in the figure, the upper cover 111 and the lower cover 112 are provided on the outer side as the exterior cover of the image forming apparatus H to cover the controller substrate 120, the power supply substrate 123, the engine control substrate 124, and the like, which are electric substrates. That is, the controller substrate 120, the power supply substrate 123, the engine control substrate 124 are provided on the inner side of the upper cover 111 and the lower cover 112.

[0098] Electronic components such as a CPU mounted on these electric units, in particular, the power supply substrate 123 and the controller substrate 120 are susceptible to heat and need to be cooled. Therefore, fans 97 and 98 for cooling the electronic components mounted on these substrates are provided near the controller substrate 120 and the power supply substrate 123. The fans 97 and 98 and louvers 113 and 114 provided in the upper cover 111, which is the exterior covering the fans 97 and 98, are provided in positions respectively overlapping the controller substrate 120 and the power supply substrate 123 when viewed from the rear surface side of the apparatus main body 1 of the image forming apparatus H. Further, a louver 115 provided in the lower cover 112 functioning as the exterior of the image forming apparatus H is provided in a position overlapping the engine control substrate 124 when viewed from the rear surface side of the apparatus main body 1 of the image forming apparatus H. The duct unit 200 is provided in a position not overlapping the louvers 113, 114, and 115 of the image forming apparatus H with respect to the upper cover 111 and the lower cover 112. The duct unit 200 is provided to project further to the rear surface side of the image forming apparatus H than surfaces on which the louvers 113, 114, and 115 are provided in the upper cover 111 and the lower cover 112 functioning as the exterior.

[0099] As explained above, the air passing in the duct unit 200 is the air having relatively high temperature warmed by the fixing device 50. Accordingly, when the duct unit 200 is located in a position overlapping the electric units when the image forming apparatus H is viewed from the rear surface side, the temperature of the electric units easily rises with the air having high temperature passing in the duct unit 200.

[0100] Therefore, the duct unit 200, the controller substrate 120, the HDD 121, the power supply substrate 123, and the engine control substrate 124 are disposed not to overlap when viewed from the rear surface side of the apparatus main body 1 of the image forming apparatus H. That is, when the image forming apparatus H is viewed from the rear surface, the upper duct 224 is disposed beside the controller substrate 120 and the lower duct 241 is disposed such that a part of the lower duct 241 is located below the controller substrate 120 in the vertical direction. When the image forming apparatus H is viewed from the rear surface, the duct unit is disposed in a position not overlapping a CPU mounted on the controller substrate 120 and a CPU mounted on the power supply substrate 123. Consequently, it is possible to exhaust the air in the image forming apparatus H to the outside of the apparatus via the duct unit 200 without hindering cooling efficiency of the electric units.

[0101] With such a configuration, it is possible to suppress a temperature rise of the electric units that need to be cooled. Since the duct unit 200 does not close the louvers 113, 114, and 115, it is possible to prevent the cooling of the electric units from being hindered.

[0102] Note that, in this embodiment, the configuration is adopted in which the duct unit 200 is disposed avoiding the controller substrate 120, the HDD 121, the power supply substrate 123, and the engine control substrate 124. However, the duct unit 200 is not limited to this configuration. Other configurations may be adopted if the duct unit 200 is at least disposed in a position avoiding the electric units susceptible to heat. A configuration may be adopted in which the duct unit 200 is provided, in the front-rear direction of the apparatus main body 1, in a position overlapping a substrate of a driving system such as a motor driver on which an electronic component susceptible to heat is not mounted.

[0103] According to the present invention, even when the duct unit 200 is provided outside the apparatus, it is possible to easily access the interface portion 130.

[0104] While the present invention has been described with reference to exemplary embodiments, it is to be understood that the invention 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 modifications, equivalent structures and functions.

[0105] This application claims the benefit of Japanese Patent Application No. 2018-150292 filed on August 9, 2018, which is hereby incorporated by reference herein in its entirety.

Claims

1. An image forming apparatus that heats, in a fixing portion, a toner image transferred onto a recording material, fixes the toner image on the recording material, and forms an image, the image forming apparatus comprising:

a cover portion that covers an electric substrate on a rear surface of the image forming apparatus, at least a part of the cover portion forming an exterior of the image forming apparatus;
a main body exhaust port for exhausting air on an inside of the cover portion to an outside of the cover portion;
a duct unit forming an exhaust path for exhausting the air exhausted from the main body exhaust port, the duct unit including a first duct including an air supply port for supplying the air exhausted from the main body exhaust port and provided detachably attachable to the cover portion and a second duct provided further on a downstream side of the exhaust path than the first duct and fixed to the cover portion;
an interface portion provided in a position covered by the first duct and including a connecting portion electrically connected to an electric contact of a detachably attachable connection unit;
a filter provided on an inside of the second duct; and
a fan that is fixed to the cover portion on the inside of the second duct and exhausts the air in the duct unit, wherein
the duct unit projects to the rear surface side of the image forming apparatus with respect to a plane to which the fan is fixed in the cover portion,
in a state in which the first duct is attached to the cover portion, the exhaust path is formed, and
in a state in which the first duct is not attached to the cover portion, the interface portion is exposed and is accessible.

2. The image forming apparatus according to claim 1, wherein
the first duct is open-closable with respect to the cover portion,
the exhaust path is formed when the first duct is in a closed state with respect to the cover portion, and the interface portion is accessible when the first duct is in an open state with respect to the cover portion.

3. The image forming apparatus according to claim 2, wherein
the second duct includes a coupling portion that is coupled to the first duct when the first duct is in the closed state with respect to the cover portion, and
the coupling portion has a shape conforming to a moving track of the first duct by an opening and closing operation of the first duct.

4. The image forming apparatus according to claim 3, wherein the coupling portion includes a sealing member that is compressed when the first duct is in the closed state.

5. The image forming apparatus according to any one of claims 2 to 4, further comprising detecting means that detects that the first duct is in the closed state with respect to the cover portion.

6. The image forming apparatus according to claim 2 or 5, wherein the first duct is maintained in the closed state with respect to the cover portion by a magnet.

7. The image forming apparatus according to any one of claims 1 to 6, wherein
the interface portion includes an insertion portion into which a hard disk drive insertable into and removable from the image forming apparatus is inserted, and
the connecting portion is connected to an electric contact of the hard disk drive inserted into the insertion portion.

8. The image forming apparatus according to claim 7, wherein the duct unit includes an internal duct that,

when a part of the duct unit is in the closed state with respect to the cover portion, separates the hard disk drive inserted into the insertion portion and the main body exhaust port.

9. The image forming apparatus according to any one of claims 1 to 8, wherein a LAN cable is connected to the connecting portion.

FIG 1

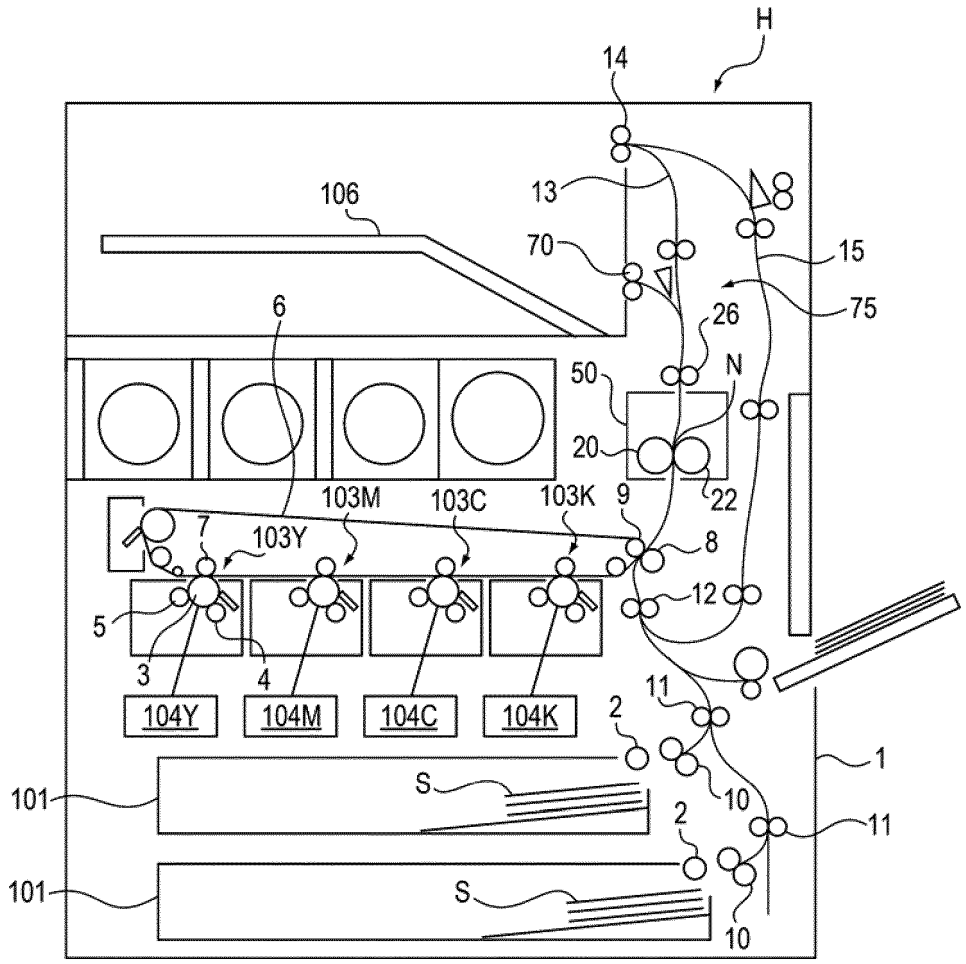

H
14
13
106
70
15
75
6
26
50
N
20
22
103M
103C
103K
9
7
103Y
8
12
5
3
4
104Y
104M
104C
104K
2
11
1
101
S
10
2
11
101
S
10

FIG 2

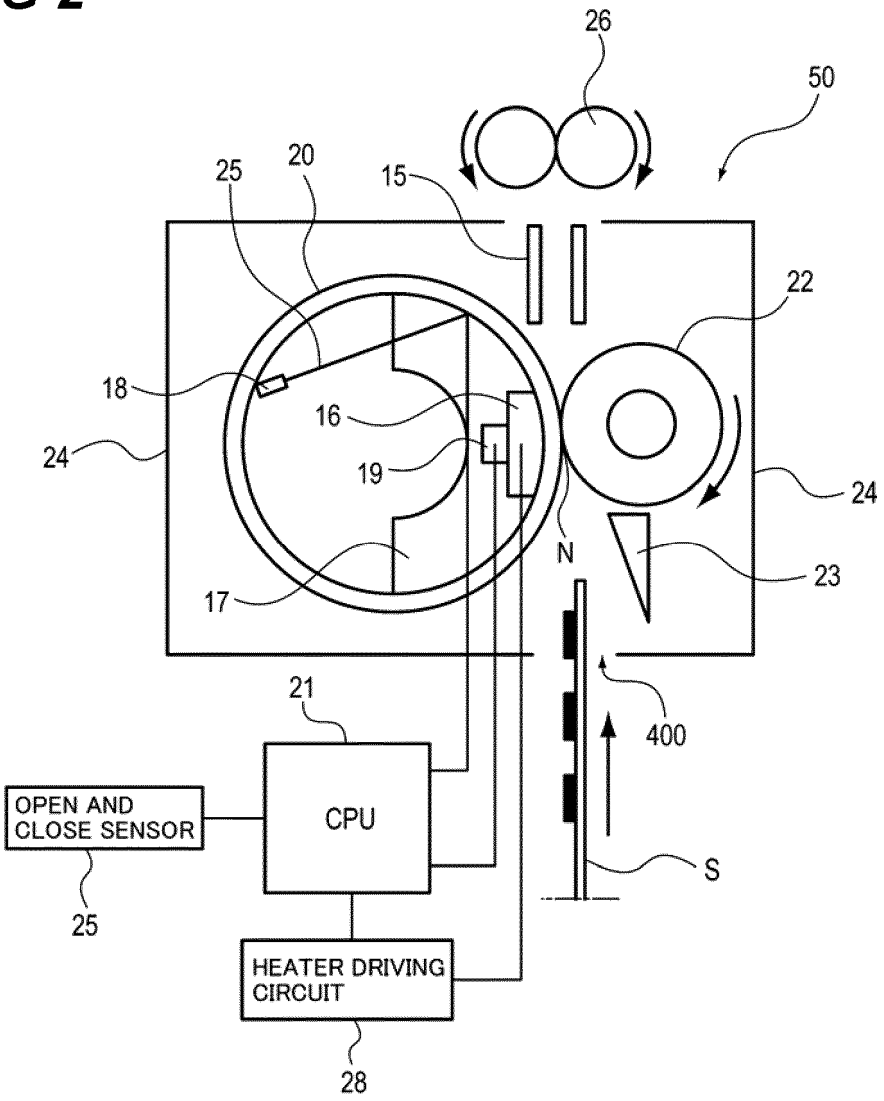

26
50
25
20
15
22
18
16
24
19
24
N
23
17
21
400
OPEN AND CLOSE SENSOR
CPU
S
25
HEATER DRIVING CIRCUIT
28

FIG 3

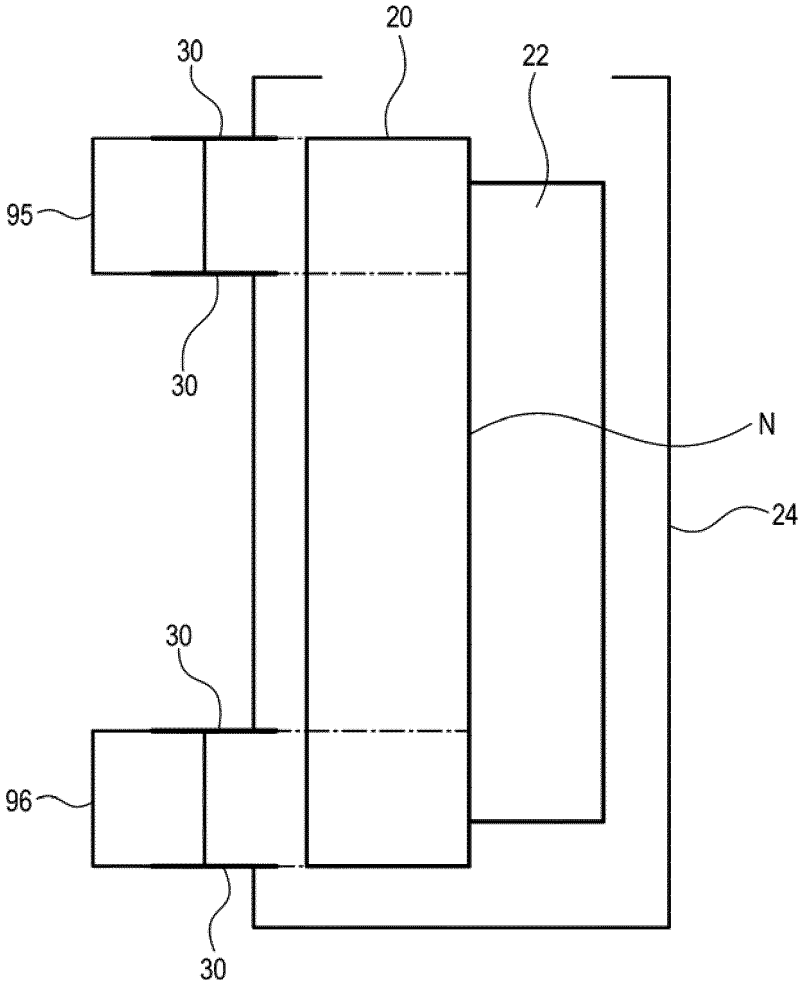


FIG 4

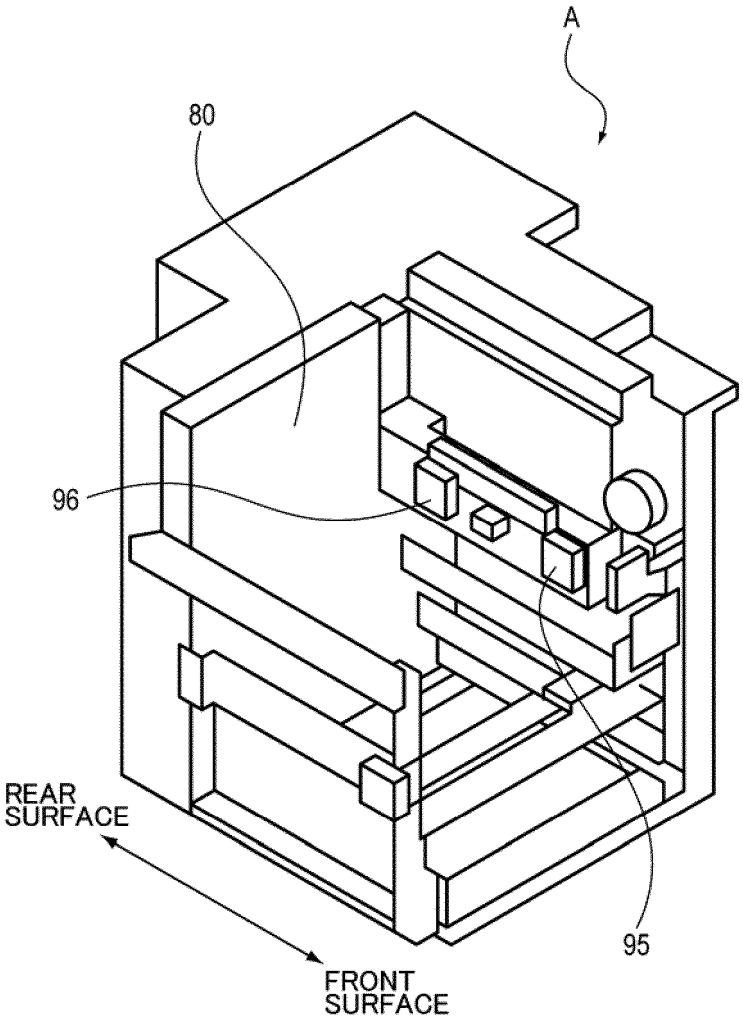


FIG 5

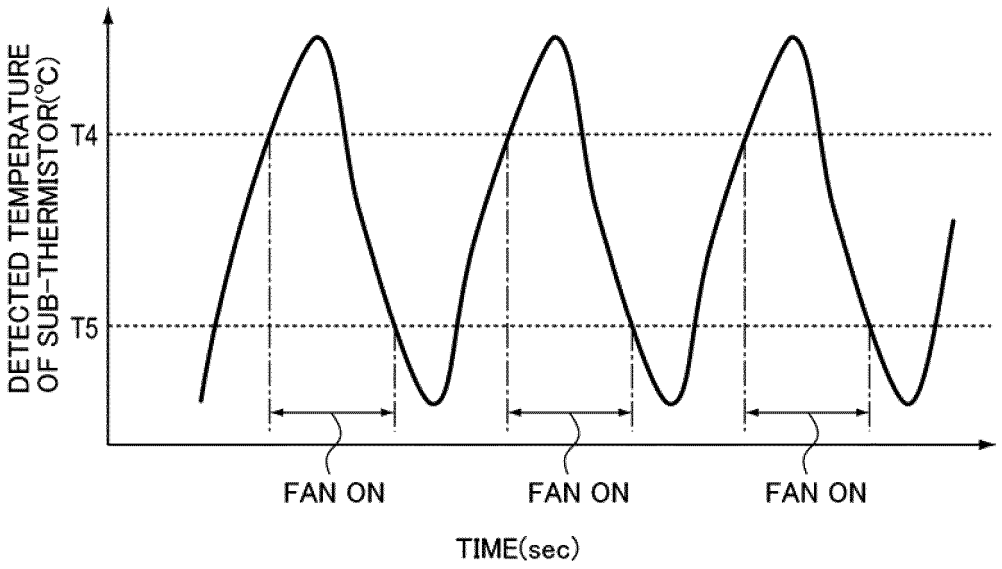

DETECTED TEMPERATURE OF SUB-THERMISTOR(°C)
T4
T5
FAN ON
FAN ON
FAN ON
TIME(sec)

FIG 6

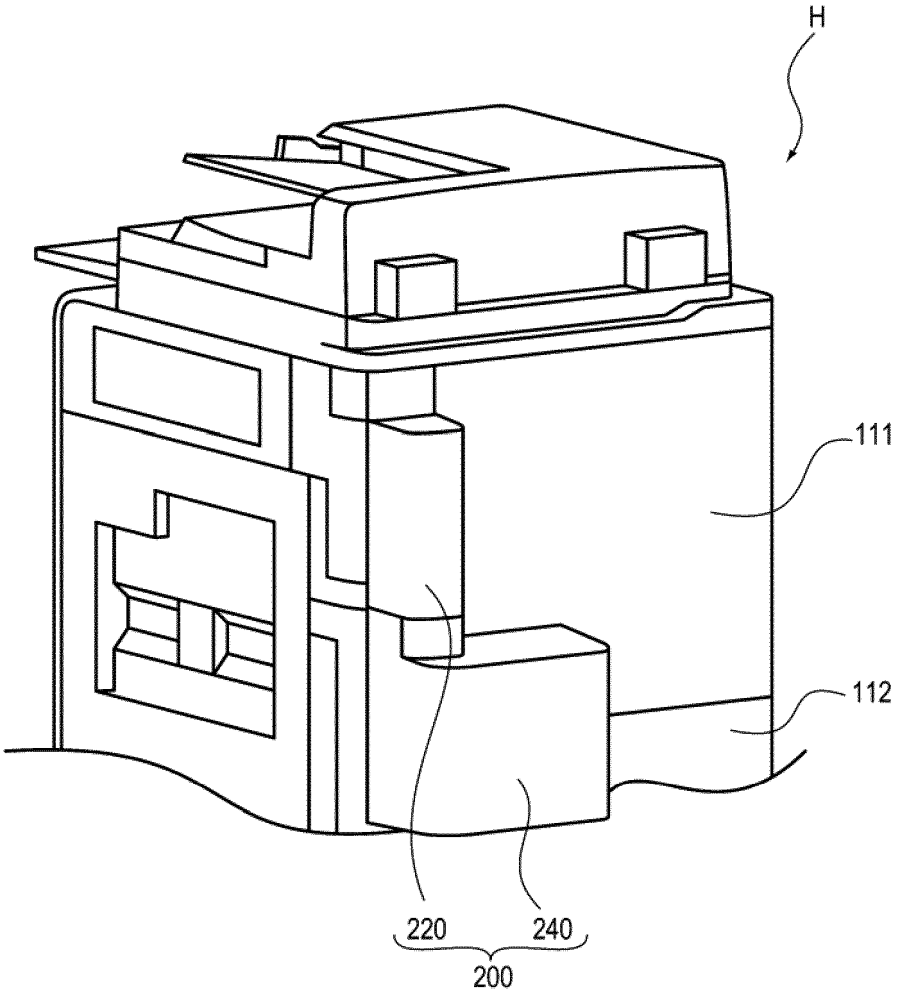


FIG 7A

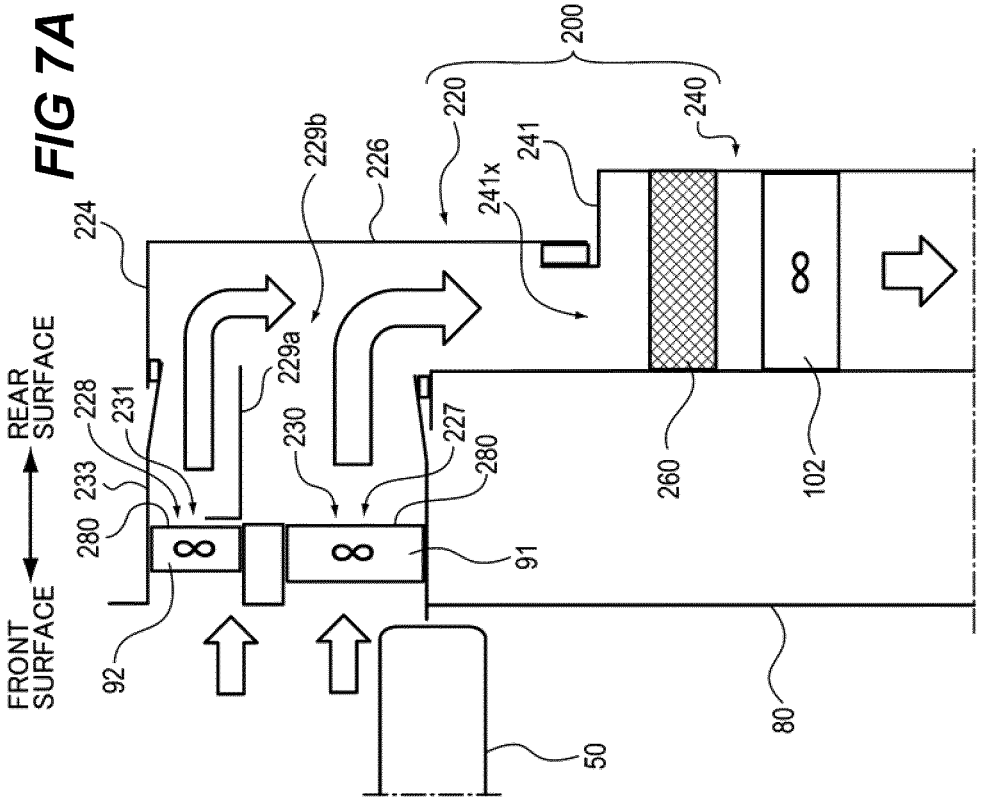

200
220
240
241
241x
229b
226
224
REAR SURFACE
FRONT SURFACE
228
231
233
280
229a
230
227
280
260
102
91
92
80
50

FIG 7B

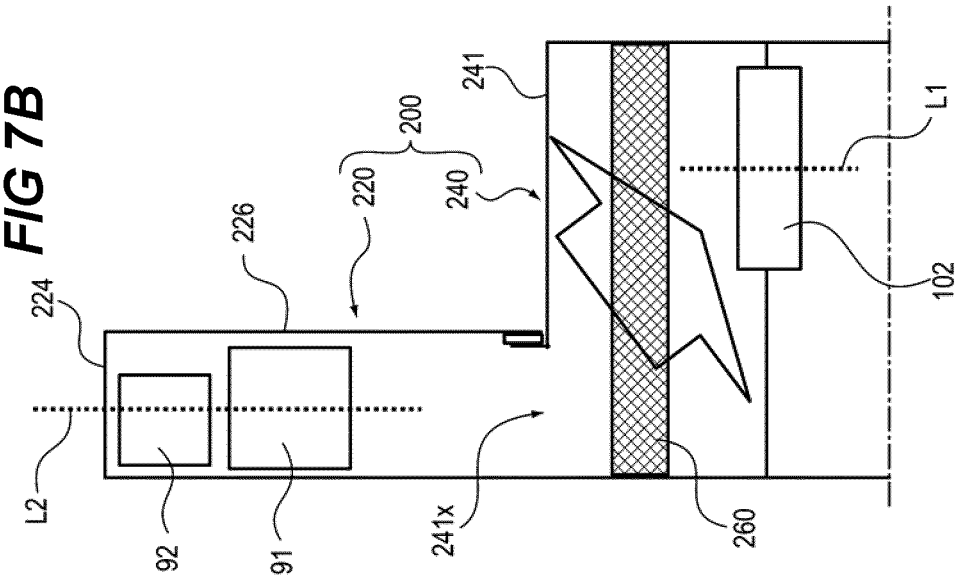

241
200
220
240
L1
226
224
102
L2
92
91
241x
260

FIG 8

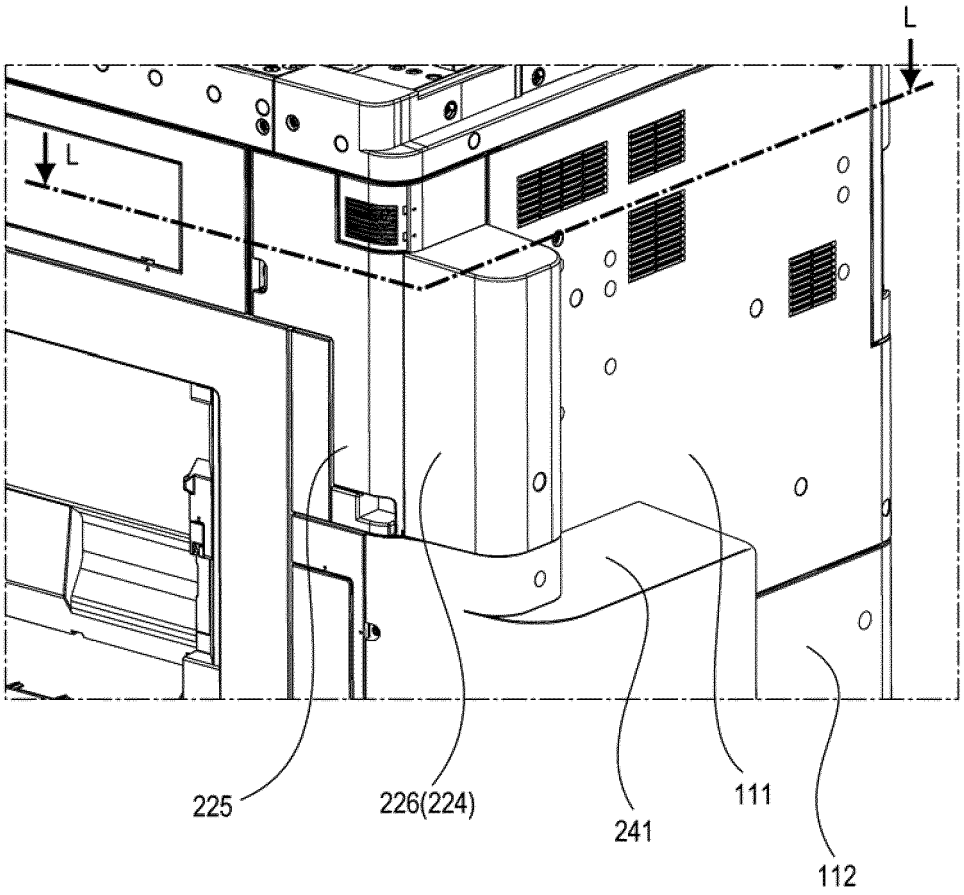


FIG 9

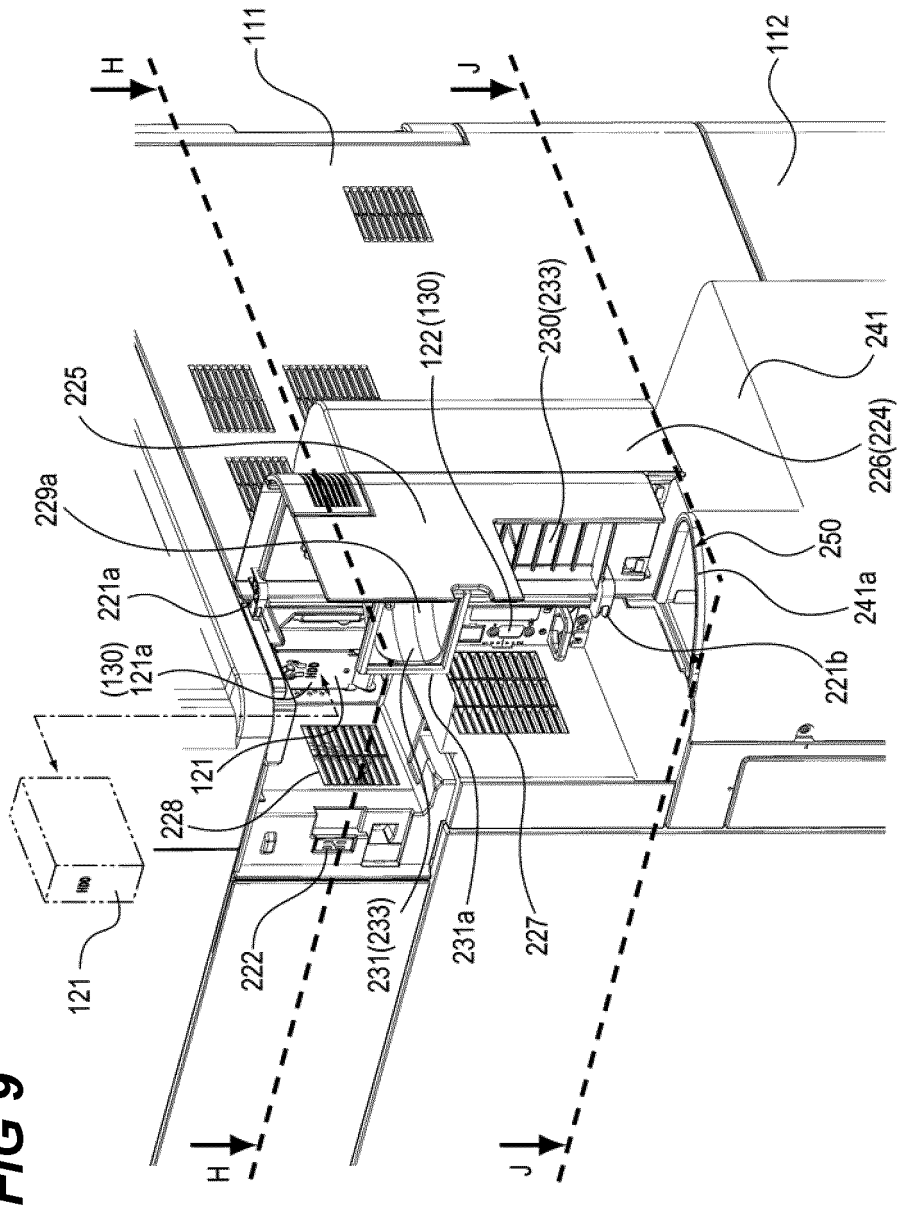

H
111
J
112
122(130)
230(233)
241
225
226(224)
229a
250
221a
241a
(130)
121a
221b
121
228
222
231(233)
231a
227
121
H
J

FIG 10

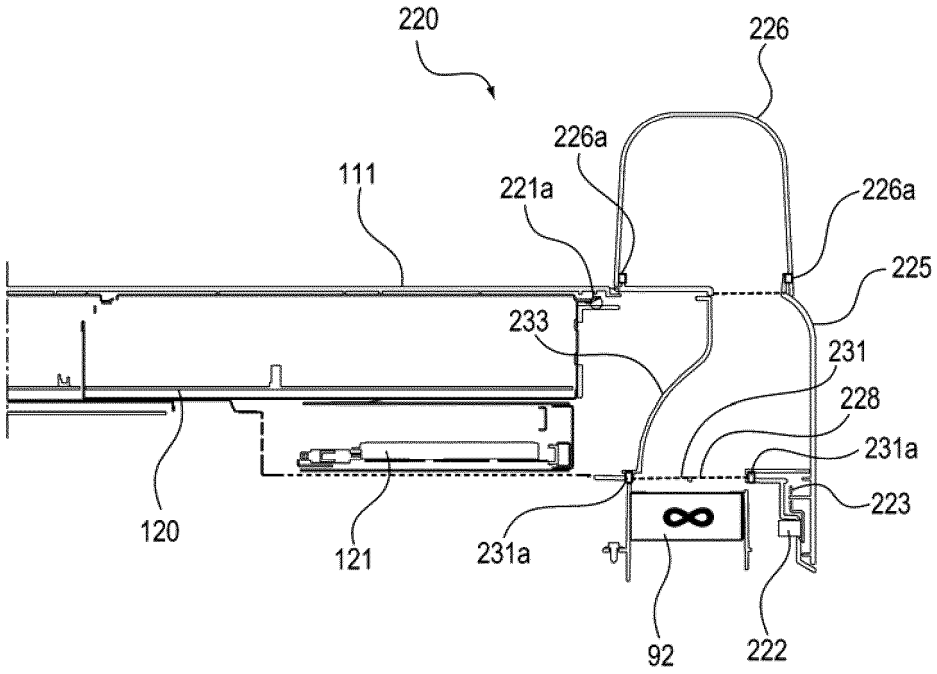

220
226
226a
111
221a
226a
225
233
231
228
231a
223
120
121
231a
92
222

FIG 11

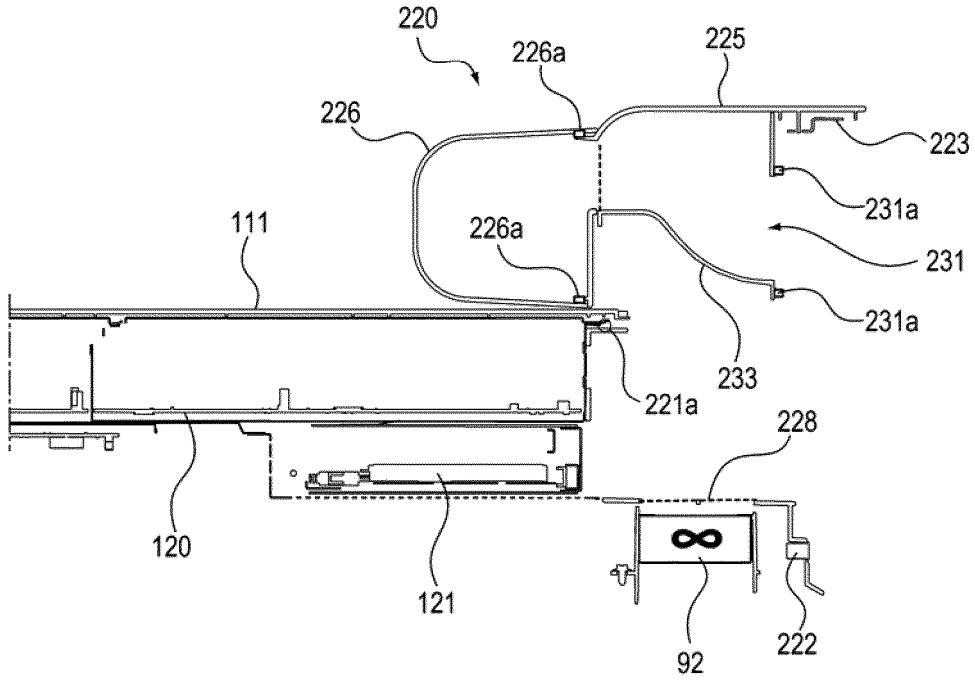

220
226a
225
226
223
231a
111
226a
231
231a
233
221a
228
120
121
92
222

FIG 12

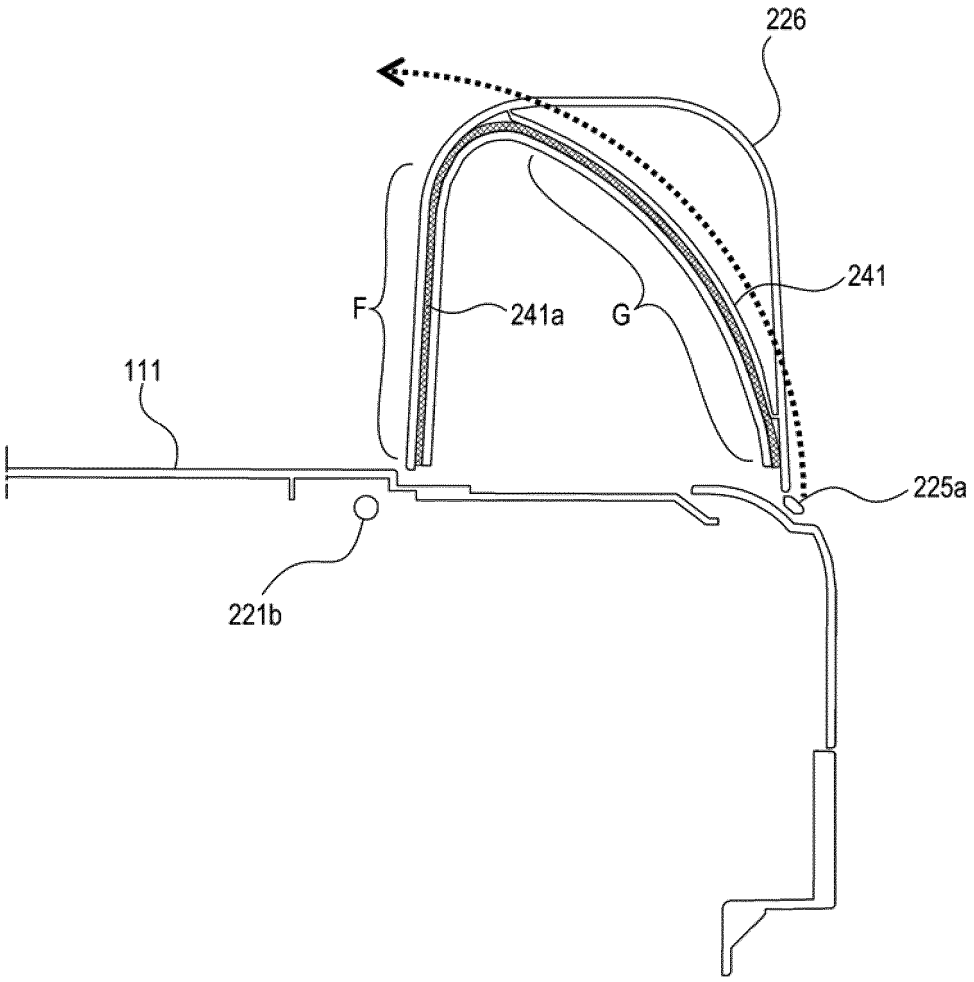
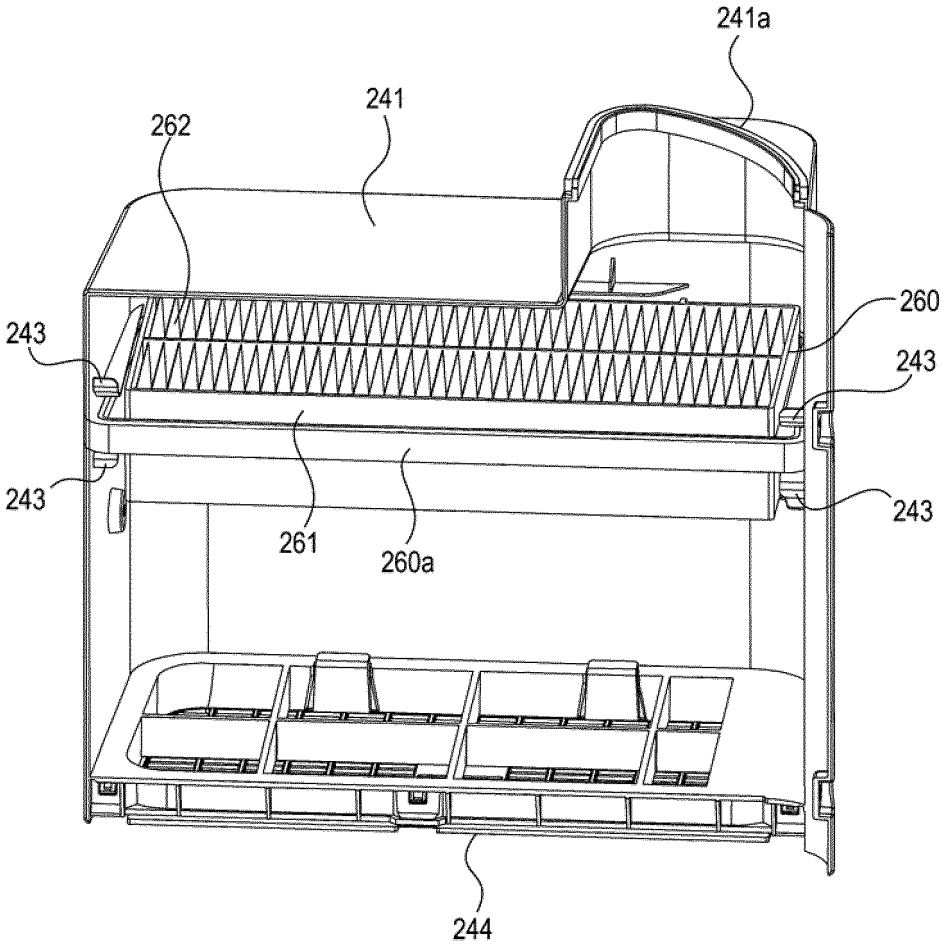


FIG 13



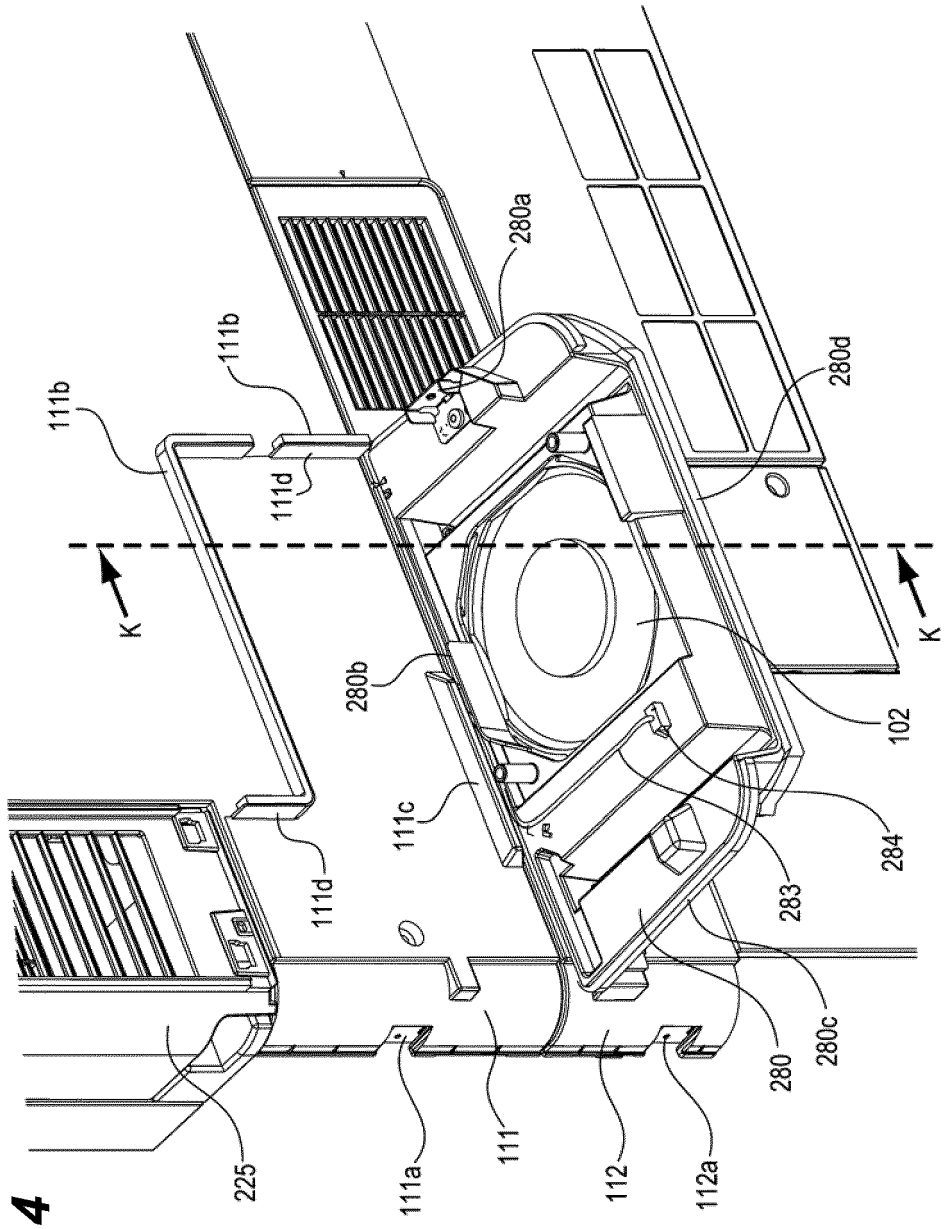

280a
111b
111b
111d
280d
K
K
280b
102
111c
284
111d
283
280c
280
225
111a
111
112
112a

FIG 14

FIG 15

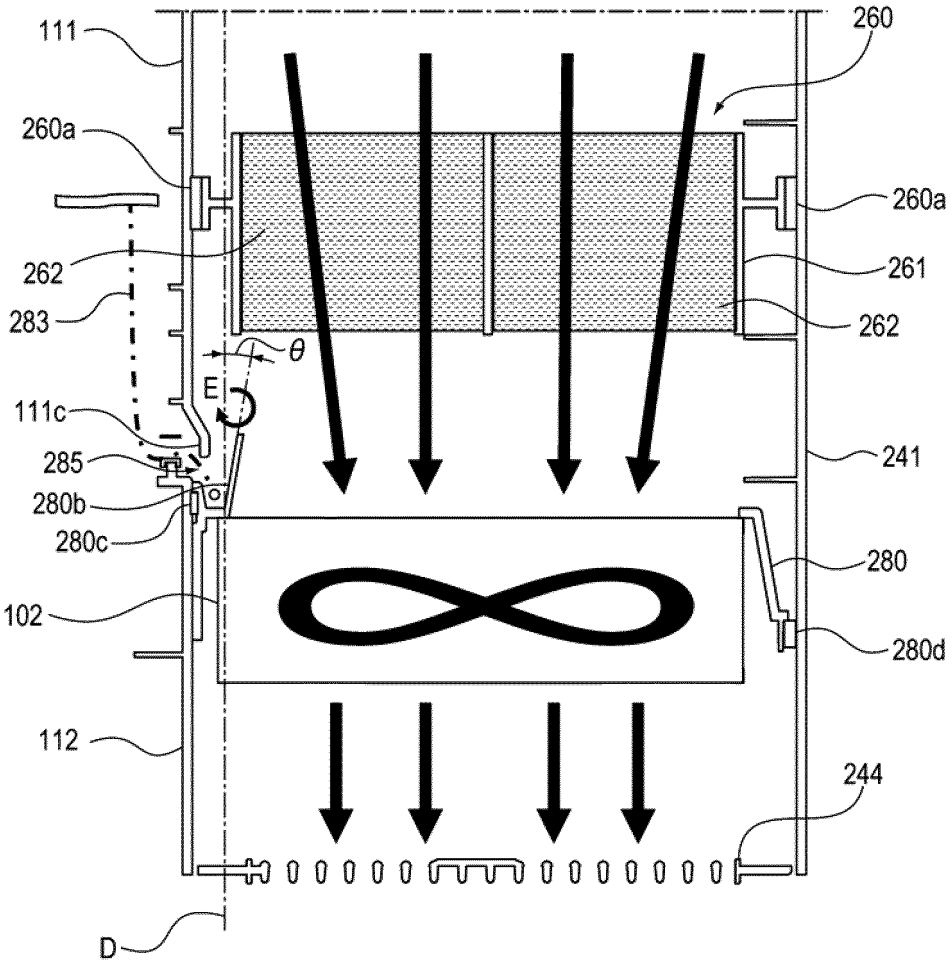

111
260
260a
260a
262
261
283
262
θ
E
111c
241
285
280b
280c
280
102
280d
112
244
D

FIG 16

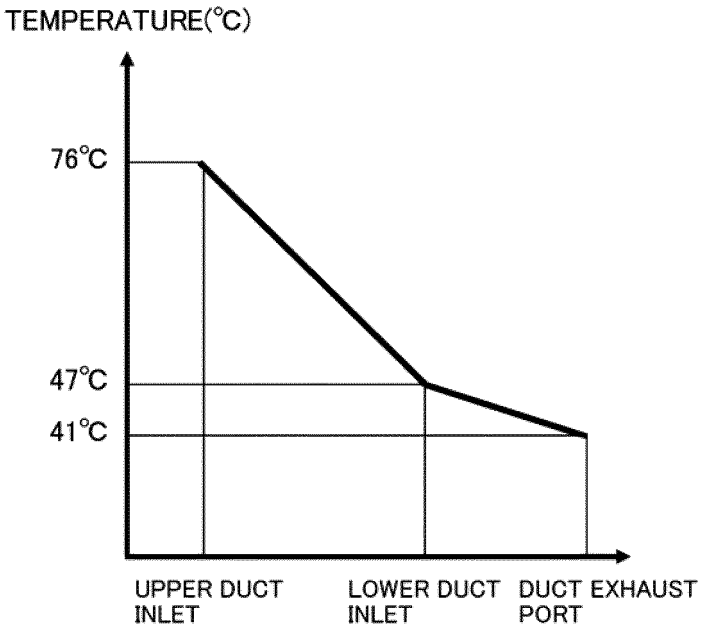

TEMPERATURE(℃)
76℃
47℃
41℃
UPPER DUCT INLET
LOWER DUCT INLET
DUCT EXHAUST PORT

FIG 17

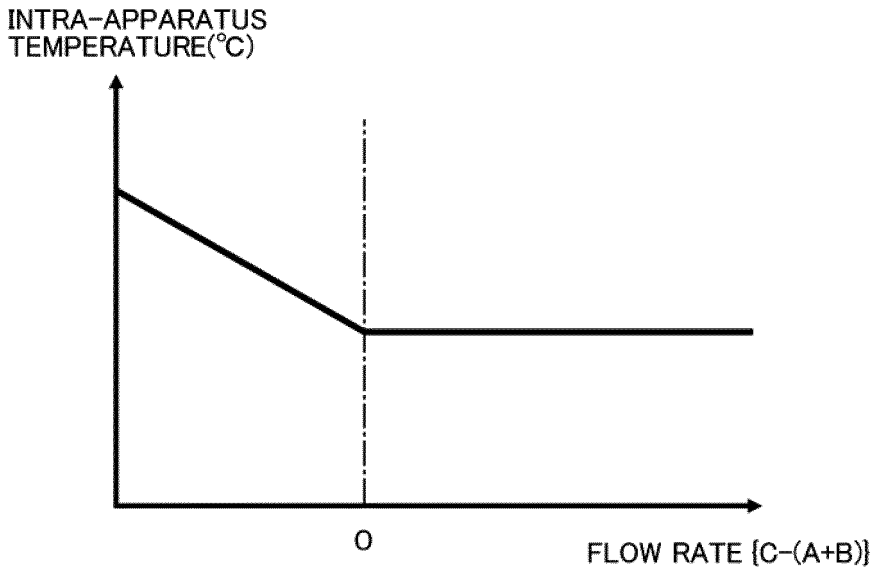
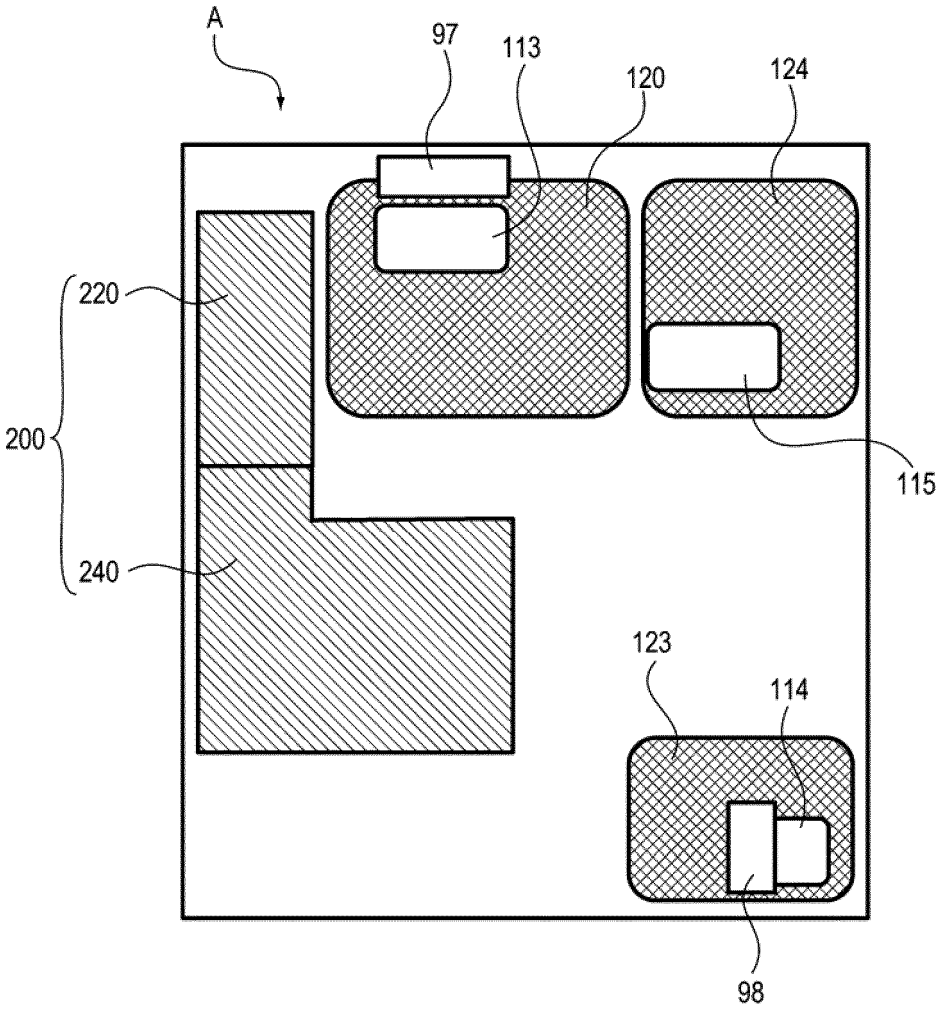


FIG 18



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2019/031621

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. G03G21/16(2006.01)i, B41J29/00(2006.01)i, G03G21/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl. G03G21/16, B41J29/00, G03G21/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan	1922–1996
Published unexamined utility model applications of Japan	1971–2019
Registered utility model specifications of Japan	1996–2019
Published registered utility model applications of Japan	1994–2019

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2009-244672 A (KYOCERA MITA CORP.) 22 October 2009, entire text (Family: none)	1-9
A	JP 2018-91880 A (RICOH CO., LTD.) 14 June 2018, entire text (Family: none)	1-9

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search 17 September 2019 (17.09.2019)	Date of mailing of the international search report 01 October 2019 (01.10.2019)
Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2019/031621

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2007-322809 A (FUJI XEROX CO., LTD.) 13 December 2007, entire text (Family: none)	1-9
A	JP 2015-158580 A (RICOH CO., LTD.) 03 September 2015, entire text (Family: none)	1-9
A	JP 2002-14597 A (CANON INC.) 18 January 2002, entire text (Family: none)	1-9
A	JP 2016-184029 A (KONICA MINOLTA, INC.) 20 October 2016, entire text & US 2016/0286669 A1 & EP 3073331 A1 & CN 106019910 A	1-9
A	JP 2015-36783 A (FUJI XEROX CO., LTD.) 23 February 2015, entire text (Family: none)	1-9
A	JP 2005-335077 A (RICOH CO., LTD.) 08 December 2005, entire text (Family: none)	1-9
A	JP 11-119495 A (FUJI XEROX CO., LTD.) 30 April 1999, entire text (Family: none)	1-9
A	JP 2017-129817 A (CANON FINETECH INC.) 27 July 2017, entire text (Family: none)	1-9
A	US 2012/0070182 A1 (SAMSUNG ELECTRONICS CO., LTD.) 22 March 2012, entire text & KR 10-2012-0029863 A	1-9

Form PCT/ISA/210 (continuation of second sheet) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2017032833 A **[0003] [0004] [0005]**
- JP 2018150292 A **[0105]**