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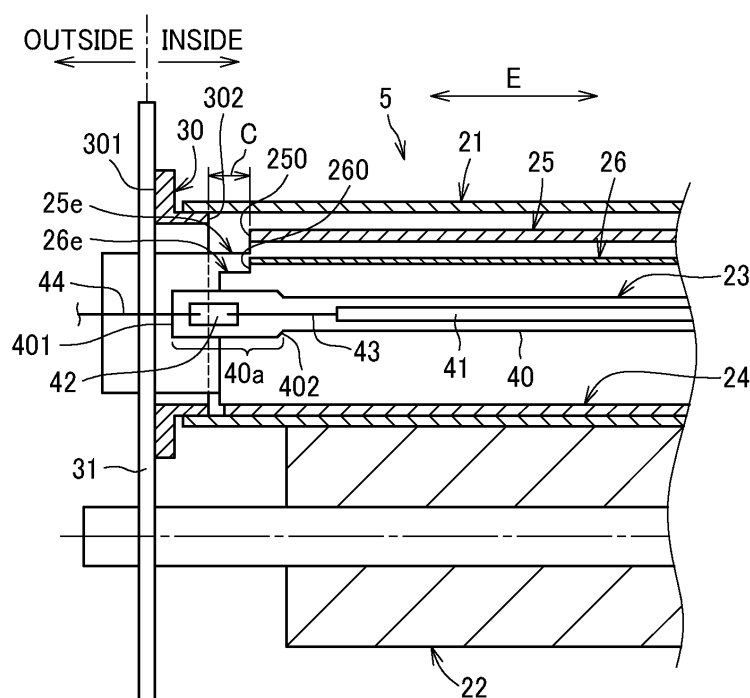
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(54) **FIXING DEVICE AND IMAGE FORMING APPARATUS INCORPORATING SAME**

(57) A fixing device (5) includes a fixing member (21) in a cylindrical shape, an opposite member (22) disposed opposite an outer surface of the fixing member (21), a nip formation member (24) disposed inside a loop of the fixing member (21), a support member (25) disposed inside the loop of the fixing member (21) and configured to support the nip formation member (24), and a heater (23) disposed inside the loop of the fixing member (21).

The nip formation member (24) sandwiches the fixing member (21) between the nip formation member (24) and the opposite member (22) and forms a nip between the nip formation member (24) and the opposite member (22). The heater (23) includes a tube (40) having a sealing portion (40a) at least partially exposed out of the support member (25) and a heat generator (41) accommodated in the tube (40).

FIG. 9



Description**BACKGROUND****Technical Field**

[0001] Embodiments of the present disclosure generally relate to a fixing device and an image forming apparatus incorporating the fixing device.

Description of the Related Art

[0002] An electrophotographic image forming apparatus such as a copier or a printer includes a fixing device to convey a recording medium such as a sheet on which an unfixed image is formed to a nip formed between members such as a roller and a belt facing each other, heat the recording medium, and fix the unfixed image on the recording medium.

[0003] As such a fixing device, for example, JP-6164014-B (JP-2015-69094-A) discloses the fixing device including an endless fixing belt, a heat generator disposed inside a loop of the fixing belt, a nip member contacting an inner surface of the fixing belt, a backup member such as a pressure roller that forms a nip between the fixing belt and the backup member by sandwiching the fixing belt between the backup member and the nip member, and a stay that supports the nip member.

[0004] In the fixing device including a support member such as the stay arranged around a heater that is the heat generator, the support member blocks heat radiation from the heater. Therefore, when the heater continues to generate heat, ambient temperature around the heater increases, and the high ambient temperature may cause an excessive rise in temperature of the heater.

SUMMARY

[0005] It is a general object of the present disclosure to provide an improved and useful fixing device in which the above-mentioned disadvantages are eliminated. In order to achieve the above-mentioned object, there is provided a fixing device according to claim 1. Advantageous embodiments are defined by the dependent claims.

[0006] Advantageously, the fixing device includes a fixing member in a cylindrical shape, an opposite member disposed opposite an outer surface of the fixing member, a nip formation member disposed inside a loop of the fixing member, a support member disposed inside the loop of the fixing member and configured to support the nip formation member, and a heater disposed inside the loop of the fixing member. The nip formation member sandwiches the fixing member between the nip formation member and the opposite member and forms a nip between the nip formation member and the opposite member. The heater includes a tube having a sealing portion at least partially exposed out of the support member and

a heat generator accommodated in the tube.

[0007] According to the present disclosure, an excessive rise in temperature of the heater can be avoided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The aforementioned and other aspects, features, and advantages of the present disclosure would be better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

FIG. 1 is a schematic cross-sectional view of an image forming apparatus according to an embodiment of the present disclosure;

FIG. 2 is a vertical cross-sectional view of a fixing device viewed from a lateral side of the fixing device; FIG. 3 is a perspective view of the fixing device with the vertical cross-sectional view of the fixing device;

FIG. 4 is a vertical cross-sectional view of the fixing device viewed from a front side of the fixing device; FIG. 5 is a perspective view of a belt holder;

FIG. 6 is a perspective view of the belt holder according to a variation;

FIG. 7 is a schematic configuration diagram of a halogen heater;

FIG. 8 is a perspective view of a stay and a reflector;

FIG. 9 is a cross-sectional front view illustrating a main configuration in an end portion of the fixing device according to a first embodiment;

FIG. 10 is a cross-sectional front view illustrating a main configuration in an end portion of the fixing device according to a second embodiment of the present disclosure;

FIG. 11 is a cross-sectional front view illustrating a main configuration in an end portion of the fixing device according to a third embodiment of the present disclosure;

FIG. 12 is a graph illustrating a heat generation distribution of a filament that generates heat larger in a center portion than in end portions in the longitudinal direction;

FIG. 13 is a graph illustrating a heat generation distribution of a filament that generates heat larger in the end portions than in the center portion in the longitudinal direction;

FIG. 14 is a cross-sectional front view illustrating a main configuration in an end portion of the fixing device according to a fourth embodiment of the present disclosure;

FIG. 15 is a cross-sectional front view illustrating a main configuration in an end portion of the fixing device according to a fifth embodiment of the present disclosure;

FIG. 16 is a graph illustrating a comparison between the embodiment of the present disclosure and a comparative example about a temperature rise of the fixing belt outside a sheet conveyance span;

FIG. 17 is a graph illustrating changes in temperatures of the fixing belt detected by temperature sensors at a position corresponding to an opening and a position not corresponding to the opening;

FIG. 18 is a diagram illustrating positions at which the temperature sensors detect the temperatures of the fixing belt;

FIG. 19 is a diagram illustrating how to arrange wires;

FIG. 20 is a diagram illustrating a specific example of how to arrange wires;

FIG. 21 is a diagram illustrating another specific example of how to arrange wires;

FIG. 22 is a perspective view illustrating a variation of the stay and the reflector;

FIG. 23 is a perspective view illustrating another variation of the stay and the reflector;

FIG. 24 is a schematic diagram illustrating an example of a configuration of the image forming apparatus including a fixing device which conveys a sheet in a vertical direction;

FIG. 25 is a perspective view of a stay and a reflector according to a comparative example; and

FIG. 26 is a cross-sectional front view illustrating a main configuration in an end portion of the fixing device according to the comparative example.

[0009] The accompanying drawings are intended to depict embodiments of the present disclosure and should not be interpreted to limit the scope thereof. The accompanying drawings are not to be considered as drawn to scale unless explicitly noted.

DETAILED DESCRIPTION OF EMBODIMENTS

[0010] In describing embodiments illustrated in the drawings, specific terminology is employed for the sake of clarity. However, the disclosure of this specification is not intended to be limited to the specific terminology so selected and it is to be understood that each specific element includes all technical equivalents that have a similar function, operate in a similar manner, and achieve a similar result.

[0011] Although the embodiments are described with technical limitations with reference to the attached drawings, such description is not intended to limit the scope of the disclosure and all of the components or elements described in the embodiments of this disclosure are not necessarily indispensable.

[0012] With reference to drawings, a description is given below of the present disclosure. In the drawings to describe following embodiments of the present disclosure, identical reference numerals are assigned to elements such as members and parts that have an identical function or an identical shape as long as differentiation is possible and a description of those elements is omitted once the description is provided.

[0013] FIG. 1 is a schematic diagram illustrating a configuration of an image forming apparatus according to an

embodiment of the present disclosure. Referring to FIG. 1, a configuration and operation of the image forming apparatus according to the present embodiment are described below.

[0014] An image forming apparatus 1 illustrated in FIG. 1 is a monochrome electrophotographic laser printer. The image forming apparatus 1 according to the embodiments of the present disclosure may be a printer, a copier, a facsimile machine, a multifunction peripheral (MFP) having at least two of copying, printing, scanning, facsimile, and plotter functions. The image forming apparatus 1 is not limited to a monochrome image forming apparatus and may be a color image forming apparatus.

[0015] As illustrated in FIG. 1, the image forming apparatus 1 includes an image forming device 2 to form an image, a recording medium feeding device 3 to feed a sheet P as a recording medium, a transfer device 4 to transfer the image onto the fed sheet P, a fixing device 5 to fix the image transferred onto the sheet P, and a sheet ejection device 6 to eject the sheet P with the fixed image to an outside of the image forming apparatus 1.

[0016] The image forming device 2 includes a drum-shaped photoconductor 7, a charging roller 8 as a charging device to charge a surface of the photoconductor 7, an exposure device 9 as a latent image forming device that exposes the surface of the photoconductor 7 to form an electrostatic latent image on the photoconductor 7, a developing roller 10 as a developing device that supplies toner as a developer to the surface of the photoconductor 7 to visualize the electrostatic latent image, and a cleaning blade 11 as a cleaner to clean the surface of the photoconductor 7.

[0017] As an image forming operation start is instructed, in the image forming device 2, the photoconductor 7 starts to rotate, and the charging roller 8 uniformly charges the surface of the photoconductor 7 to a high potential. Next, based on image data of an original document read by a scanner or print data instructed by a terminal device, the exposure device 9 exposes the surface of the photoconductor 7. Potential of an exposed surface drops, and the electrostatic latent image is formed on the photoconductor 7. The developing roller 10 supplies toner to the electrostatic latent image, thereby developing the latent image into the toner image on the photoconductor 7.

[0018] The toner image formed on the photoconductor 7 is transferred onto the sheet P in a transfer nip between the photoconductor 7 and a transfer roller 15 disposed in the transfer device 4. The sheet P is fed from the recording medium feeding device 3. In the recording medium feeding device 3, a sheet feeding roller 13 feeds the sheet P from a sheet tray 12 to a feeding path one by one. A timing roller pair 14 sends out the sheet P fed from the sheet tray 12 to a transfer nip, timed to coincide with the toner image on the photoconductor 7. The toner image on the photoconductor 7 is transferred onto the sheet P at the transfer nip. After the toner image is transferred from the photoconductors 7 onto the sheet P, the cleaning blade 11 removes residual toner on the photo-

conductor 7.

[0019] The sheet P bearing the toner image is conveyed to the fixing device 5. In the fixing device 5, heat and pressure when the sheet P passes through between a fixing belt 21 and a pressure roller 22 fixes the toner image onto the sheet P. Subsequently, the sheet P is conveyed to the sheet ejection device 6, and an ejection roller pair 16 ejects the sheet P outside the image forming apparatus 1, and a series of print operations are completed.

[0020] With reference to FIGS. 2 to 6, a detailed description is provided of a construction of the fixing device 5 according to embodiments of the present disclosure.

[0021] FIG. 2 is a vertical cross-sectional view of the fixing device 5 viewed from a lateral side of the fixing device 5, FIG. 3 is a perspective view of the fixing device 5 with the vertical cross-sectional view of the fixing device 5, and FIG. 4 is a vertical cross-sectional view of the fixing device 5 viewed from a front side of the fixing device 5. In addition, FIG. 5 is a perspective view of a belt holder 30 to support the fixing belt 21, and FIG. 6 is a perspective view of a variation of the belt holder 30.

[0022] As illustrated in FIG. 2, the fixing device 5 includes the fixing belt 21, the pressure roller 22, a halogen heater 23, a nip formation member 24, a stay 25, a reflector 26, guides 27, and temperature sensors 28.

[0023] The fixing belt 21 is a cylindrical fixing member to fix an unfixed image T to the sheet P and is disposed on the side of the sheet P on which the unfixed image is held. The fixing belt 21 in the present embodiment is an endless belt or film, including a base layer formed on an inner side of the fixing belt 21 and made of a metal such as nickel and stainless steel (SUS) or a resin such as polyimide, and a release layer formed on the outer side of the fixing belt 21 and made of tetrafluoroethylene-perfluoroalkylvinylether copolymer (PFA), polytetrafluoroethylene (PTFE), or the like. Optionally, an elastic layer made of rubber such as silicone rubber, silicone rubber foam, and fluoro rubber may be interposed between the base layer and the release layer. While the fixing belt 21 and the pressure roller 22 press the unfixed toner image against the sheet P to fix the toner image onto the sheet P, the elastic layer having a thickness of about 100 micrometers elastically deforms to absorb slight surface asperities of the fixing belt 21, preventing variation in gloss of the toner image on the sheet P. Additionally, in the present embodiment, the fixing belt 21 is thin and has a small loop diameter to decrease the thermal capacity of the fixing belt 21. For example, the base layer of the fixing belt 21 has a thickness of from 20 μm to 50 μm and the release layer has a thickness of from 10 μm to 50 μm . Thus, the fixing belt 21 has a total thickness not greater than 1 mm. In addition, when the fixing belt 21 includes the elastic layer, the thickness of the elastic layer may be set to 100 to 300 μm . In order to further decrease the thermal capacity of the fixing belt 21, the fixing belt 21 may have the total thickness not greater than 0.20 mm and preferably not greater than 0.16 mm. In the present

embodiment, the fixing belt 21 may have a loop diameter from 20 to 40 mm. Preferably, the loop diameter of the fixing belt 21 may not be greater than 30 mm.

[0024] The pressure roller 22 is an opposite member disposed opposite an outer surface of the fixing belt 21. The pressure roller 22 includes a cored bar; an elastic layer coating the cored bar and being made of silicone rubber foam, fluoro rubber, or the like; and a release layer coating the elastic layer and being made of PFA, PTFE, or the like. According to the present embodiment, the pressure roller 22 is a solid roller. Alternatively, the pressure roller 22 may be a hollow roller. When the pressure roller 22 is the hollow roller, a heater such as a halogen heater may be disposed inside the pressure roller 22. The elastic layer of the pressure roller 22 may be made of solid rubber. Alternatively, if no heater is disposed inside the pressure roller 22, the elastic layer of the pressure roller 22 is preferably made of sponge rubber to enhance thermal insulation of the pressure roller 22. Such a configuration reduces heat conduction from the fixing belt 21 to the pressure roller 22 and improves heating efficiency of the fixing belt 21.

[0025] A driver inside the image forming apparatus 1 drives and rotates the pressure roller 22 in a direction indicated by an arrow A in FIG. 2. The rotation of the pressure roller 22 drives the fixing belt 21 to rotate in a direction B in FIG. 2 due to frictional force therebetween. After the toner image is transferred onto the sheet P, the sheet P bearing the unfixed toner image is conveyed to a nip N between the fixing belt 21 and the pressure roller 22. The rotating fixing belt 21 and the rotating pressure roller 22 convey the sheet P, and the sheet P passes through the nip N. When the sheet P passes through the nip N, heat and pressure applied to the sheet P fixes the unfixed image T to the sheet P.

[0026] The pressure roller 22 and the fixing belt 21 are able to contact and separate each other. If the sheet is jammed in the nip N, separating the pressure roller 22 and the fixing belt 21 from each other and opening the nip N enables the jammed sheet to be removed. One of the pressure roller 22 and the fixing belt 21 may be fixed and the other may be movable so that the pressure roller 22 and the fixing belt 21 contact and separate each other. Alternatively, both the pressure roller 22 and the fixing belt 21 may be moved so that the pressure roller 22 and the fixing belt 21 contact and separate each other.

[0027] The halogen heater 23 is a heating member disposed inside a loop of the fixing belt 21 and emitting infrared light, and radiant heat from the halogen heater 23 heats the fixing belt 21 via the nip formation member 24. Alternatively, instead of the halogen heater 23, a carbon heater, a ceramic heater or the like may be employed as the heater.

[0028] The nip formation member 24 and the pressure roller 22 sandwich the fixing belt 21 to form the nip N. Specifically, the nip formation member 24 extends inside the loop of the fixing belt 21 in a longitudinal direction that is also a direction of a rotation axis of the fixing belt

21 (hereinafter called a belt longitudinal direction) and has a planar nip formation portion 24a that is in contact with an inner circumferential surface of the fixing belt 21, and a pair of bent portions 24b that are bent from both end portions of the nip formation portion 24a in a belt rotation direction B to the opposite side to the pressure roller 22. A pressing member such as a spring presses the pressure roller 22 against the nip formation member 24, which causes the pressure roller 22 to contact the fixing belt 21 and forms the nip N therebetween.

[0029] A nip formation surface 24c of the nip formation portion 24a on the fixing belt 21 side may be coated with an alumite treatment or a fluororesin material in order to improve abrasion resistance and slidability when the fixing belt 21 rotates. Furthermore, a lubricant such as a fluorine-based grease may be applied to the nip formation surface 24c in order to ensure the slidability over time. In the present embodiment, the nip formation member 24 has a planar surface. Alternatively, the nip formation member 24 may have another shape. For example, the nip formation member 24 having a concave shape recessed to the side opposite to the pressure roller 22 leads the outlet of the sheet in the fixing nip N to be closer to the pressure roller 22, which improves separation of the sheet from the fixing belt 21.

[0030] The nip formation member 24 is made of a material having a thermal conductivity larger than that of the stay 25. For example, the material of the nip formation member 24 is preferably copper (thermal conductivity: 398 W / mK) or aluminum (thermal conductivity: 236 W / mK). The nip formation member 24 made of the material having such a large thermal conductivity absorbs the radiant heat from the halogen heater 23 and effectively transmits heat to the fixing belt 21. For example, setting the thickness of the nip formation member 24 to 1 mm or less can shorten a heat transfer time in which the heat transfers from the nip formation member 24 to the fixing belt 21, which is advantageous in shortening a warm-up time of the fixing device 5. In contrast, setting the thickness of the nip formation member 24 to be larger than 1 mm and 5 mm or less can improve a heat storage capacity of the nip formation member 24.

[0031] The stay 25 is a support member to support the nip formation member 24 against the pressing force from the pressure roller 22. In the present embodiment, the stay 25 includes a pair of side wall portions 25a extending in a pressing direction of the pressure roller 22 (the vertical direction in FIG. 2) and arranged in parallel with each other and a bottom wall portion 25b intersecting the side wall portions 25a and connecting ends of the side wall portions 25a on the opposite sides with respect to the pressure roller 22. The side wall portions 25a of stay 25 are in contact with both ends of the nip formation member 24 in the belt rotation direction B via the reflector 26, and, as a result, the stay 25 supports the nip formation member 24. The side wall portions 25a extending in the pressing direction of the pressure roller 22 strengthen the rigidity of the nip formation member 24 in the pressing

direction and reduces the bend of the nip formation member 24 caused by the pressing force of the pressure roller 22. Such a configuration can form the nip N having a uniform width in the longitudinal direction and applying a uniform pressure to the sheet P in the longitudinal direction. The stay 25 is preferably made of an iron-based metal such as stainless steel (SUS) or steel electrolytic cold commercial (SECC) that is electrogalvanized sheet steel to ensure rigidity.

[0032] The reflector 26 are disposed opposite the halogen heater 23 inside the loop of the fixing belt 21 to reflect radiant heat that is infrared light emitted from the halogen heater 23 to the nip formation member 24. In the present embodiment, the reflector 26 includes a reflector portion 26a formed as an ellipse cross-section and a pair of bent portions 26b bent from both ends of the reflector portion 26a in a direction in which the bent portions separate from each other in the belt rotation direction B. Each bent portion 26b is sandwiched between each side wall portion 25a of the stay 25 and the nip formation portion 24a of the nip formation member 24 to hold the reflector 26.

[0033] The infrared light reflected by the reflector 26 is emitted to the nip formation member 24 and heats the nip formation member 24. As described above, the halogen heater 23 directly irradiates the nip formation member 24 with the infrared light, and, additionally, the nip formation member 24 is also irradiated with the infrared light reflected by the reflector 26. Therefore, the nip formation member 24 is effectively heated. Since the reflector 26 is interposed between the halogen heater 23 and the stay 25, the reflector 26 has a function of blocking the infrared light from the halogen heater 23 to the stay 25. This function reduces wasteful energy use to heat the stay 25. Additionally, in the present embodiment, thermal insulation of the layer of air in a gap between the stay 25 and the reflector 26 blocks heat transfer to the stay 25.

[0034] The surface of the reflector 26 facing the halogen heater 23 is treated with mirror finish or the like to increase reflectance. In the present embodiment, reflectance is measured using the spectrophotometer that is the ultraviolet visible infrared spectrophotometer UH4150 manufactured by Hitachi High-Technologies Corporation in which the incident angle is set 5°. In general, the color temperature of the halogen heater varies depending on the application. The color temperature of the heater for the fixing device is about 2500 K. The reflectance of the reflector 26 is preferably 70% or more with wavelengths of high emission intensity in the halogen heater 23, that is, specifically the wavelengths of 900 to 1600 nm and more preferably 70% or more with the wavelengths of 1000 to 1300 nm.

[0035] Alternatively, the stay 25 may have the function of reflection and thermal insulation of the reflector 26. For example, performing the thermal insulation treatment or the mirror finishing on the inner surface of the stay 25 in the halogen heater 23 side enables the stay 25 to func-

tion as the reflector 26. Such a configuration can obviate the reflector 26 that is a separate component from the stay 25. The reflectance of the stay 25 subjected to the mirror finishing is preferably similar to the reflectance of the reflector 26.

[0036] The guides 27 contacts the inner peripheral surface of the fixing belt 21 to guide the rotating fixing belt 21. In the present embodiment, the guides 27 are disposed on both the upstream side and the downstream side of the nip N in the belt rotational direction B. The guide 27 includes an attachment portion 27a fixed to the stay 25 and a curved guide portion 27b in contact with the inner peripheral surface of the fixing belt 21. As illustrated in FIG. 3, the guide portion 27b includes a plurality of ribs 27c that are projections provided at equal distances in the belt longitudinal direction on a guide surface of the guide portion 27b that is the surface of the guide portion 27b in the fixing belt 21 side. Guiding the fixing belt 21 along the guide surface having the plurality of ribs 27c enables smooth rotation of the fixing belt 21 without large deformation of the fixing belt 21.

[0037] The temperature sensors 28 face the outer surface of the fixing belt 21 to detect temperatures of the fixing belt 21. In the present embodiment, the temperature sensors 28 are disposed at two positions, the central position of the fixing belt 21 in the belt longitudinal direction, and one end position of the fixing belt 21 in the belt longitudinal direction. The temperature sensor 28 detects the temperature of the outer circumferential surface of the fixing belt 21, and output of the halogen heater 23 is controlled based on the detected temperatures so that the temperature of the fixing belt 21 becomes a desired temperature that is a fixing temperature. The temperature sensor 28 may be either contact type or non-contact type. The temperature sensor 28 may be a known temperature sensor type such as a thermopile, a thermostat, a thermistor, or a non-contact (NC) sensor.

[0038] As illustrated in FIG. 4, each cylindrical belt holder 30 as a fixing member support to support a lateral end of the fixing belt 21 is inserted in each of both lateral ends of the fixing belt 21. As described above, the belt holders 30 inserted into the both lateral ends of the fixing belt 21 support the fixing belt 21 in a state in which the fixing belt 21 is not basically applied with tension in a circumferential direction thereof while the fixing belt 21 does not rotate, that is, by a free belt system.

[0039] As illustrated in FIGS. 3 to 5, the belt holder 30 includes a C-shaped supporter 30a inserted into the inner periphery of the fixing belt 21 to support the fixing belt 21 and a flange 30b that contacts an end surface of the fixing belt 21 to stop a movement of the fixing belt 21 in the longitudinal direction of the fixing belt 21, that is, walking of the fixing belt 21 in the longitudinal direction. As illustrated in FIG. 6, the supporter 30a may have a cylindrical shape which is continuous over its entire circumference. As illustrated in FIG. 4, the belt holders 30 are fixed on a pair of side plates 31 that are frames of the fixing device 5. The belt holder 30 has an opening 30c as illustrated

in FIG. 5, and both ends of the halogen heater 23 and the stays 25 are supported by the side plates 31 through the openings 30c. The halogen heater 23 and the stays 25 may be supported by the belt holders 30.

[0040] Subsequently, with reference to FIG. 7, a description is provided of a configuration of the halogen heater according to the embodiment of the present disclosure.

[0041] As illustrated in FIG. 7, the halogen heater 23 includes a bulb 40 which is a cylindrical tube made of quartz glass or the like, a filament 41 as a heating generator accommodated in the bulb 40, a thin metal foils 42 made of molybdenum or the like, inner leads 43 and outer leads 44.

[0042] The filament 41 includes coils made of a metal wire such as a tungsten wire and is accommodated in the bulb 40 along the longitudinal direction of the bulb 40. The bulb 40 is filled with an inert gas such as a halogen gas. At both ends in the longitudinal direction of the bulb 40, sealing portions 40a are formed that are flattened to prevent the internal gas from leaking out. Each sealing portion 40a accommodates the metal foil 42. The metal foils 42 are connected to both ends of the filament 41 via the inner leads 43. Additionally, the outer lead 44 is connected to the metal foil 42 at the side opposite to the side where the inner lead 43 is connected. A part of the outer lead 44 is out of the sealing portion 40a, and an end of the part is connected to a power supply via a terminal such as a metal cap or a harness. Since the filament 41 is connected to the power supply via the outer lead 44, the metal foil 42, and the inner lead 43, power supplied from the power supply causes the filament 41 to emit infrared light and generate heat. The metal foils 42, the inner leads 43, and the outer leads 44 hardly generate heat when the power is supplied from the power supply.

[0043] The bulb 40 used for the halogen heater 23 is generally made of a heat-resistant material, but high temperature may cause a crack such as a micro crack in the sealing portion 40a because of its structure. That is, the filament 41 generates heat, and the sealing portion 40a becomes high temperature. The high temperature oxidizes the metal foil 42 and causes a volumetric expansion of the metal foil 42. The volumetric expansion of the metal foil 42 generates a force to expand the sealing portion 40a from the inside. When the sealing portion 40a cannot withstand the force, the force causes the crack in the sealing portion 40a. For example, when the temperature of the sealing portion 40a exceeds 350°C, the crack may occur in the sealing portion 40a. The temperature when the crack occurs is different depending on the configuration and specifications of the halogen heater 23.

[0044] When members such as the stay 25 and the reflector 26 are arranged around the sealing portion 40a, the members prevent heat radiation from the sealing portion 40a and change the space around the sealing portion 40a to a high-temperature environment. In particular, for example, as illustrated in FIG. 26, when the halogen heater 23 is arranged inside the stay 25 and the reflector 26

that are continuously formed in a substantially U-shaped cross section in the longitudinal direction as illustrated in FIG. 25, the sealing portion 40a is surrounded by the stay 25 and the reflector 26 on three sides, the upper side in FIG. 26 and two sides in a direction perpendicular to the paper surface of FIG. 26. Since the stay 25 and the reflector 26 block the hot air around the sealing portion 40a and prevent the hot air from flowing outside, the space around the sealing portion 40a becomes the high-temperature environment.

[0045] To prevent the end of the halogen heater 23 in the longitudinal direction, especially the sealing portion 40a, from overheating, the embodiments of the present disclosure employ the following configurations.

[0046] FIG. 8 is a perspective view illustrating the stay 25 and the reflector 26 according to a first embodiment of the present disclosure.

[0047] As illustrated in FIG. 8, in the embodiment of the present disclosure, the stay 25 has openings 25e that open upward in FIG. 8 and are provided at both end regions of the stay 25 in the longitudinal direction that is the belt longitudinal direction E. Like the stay 25, the reflector 26 also has openings 26e that open upward in FIG. 8 at both end regions in the longitudinal direction that is the belt longitudinal direction E.

[0048] As illustrated in FIG. 9, when the stay 25 and the reflector 26 according to the present embodiment are arranged inside the loop of the fixing belt 21, the opening 25e of the stay 25 and the opening 26e of the reflector 26 are disposed at an end region in a belt width direction and are open on the side opposite to the nip formation member 24 with respect to the halogen heater 23. The above-described arrangement of the openings 25e and 26e opens the region above the sealing portion 40a and the vicinity of the sealing portions 40a, which are opposite to the nip formation member 24. Although FIG. 9 illustrates the configuration of one end of the fixing device, the other end of the fixing device has the same configuration.

[0049] As described above, in the embodiment of the present disclosure, the openings 25e and 26e provided at both end regions of the stay 25 and the reflector 26 in the longitudinal direction open one side of the space around the sealing portions 40a, that is, the side opposite to the nip formation member 24 with respect to the halogen heater 23. Specifically, at least a part of the sealing portion 40a (a part at an outer edge 401 side in the belt longitudinal direction) is disposed outside an edge 250 of the bottom wall portion 25b, which is one of edges of the bottom wall portion 25b and a pair of side wall portions 25a that constitute the stay 25 in the longitudinal direction of each of the bottom wall portion 25b and the side wall portions 25a, in the belt longitudinal direction E (that is, left side in FIG. 9). In the above-described configuration, a portion of the bottom wall portion 25b of the stay 25 facing at least the part of the sealing portion 40a is removed to open a portion of the space around the sealing portion 40a. In the reflector 26, a part of end portion in

the longitudinal direction is cut and removed from the reflector portion 26a having the U-shaped cross section to form an edge 260 in the longitudinal direction of the reflector 26. In the belt longitudinal direction E, at least a part of the sealing portion 40a is disposed outside the edge 260 of the reflector 26. The above-described configuration easily releases the air around the sealing portion 40a to the outside through the openings 25e and 26e. That is, since at least a part of the sealing portion 40a is exposed out of the stay 25 and the reflector 26, the stay 25 and the reflector 26 are unlikely to block heat from the space around the sealing portion 40a of the halogen heater 23. That is, compared with the comparative example illustrated in FIGS. 25 and 26, the heat in the space around the sealing portion 40a is easily released, which can prevent the overheating of the sealing portion 40a.

[0050] Specifically, when the fixing device in the comparative example illustrated in FIGS. 25 and 26 performed the fixing process and continuously passed 500 sheets, the temperature at the sealing portion 40a exceeded 350°C, a temperature that may cause the crack in the sealing portion 40a. When the fixing device in the comparative example performed the fixing process and continuously passed 1000 sheets, the temperature at the sealing portion 40a reached 380°C. On the other hand, when the fixing device according to the embodiment of the present disclosure similarly performed the fixing process and continuously passed 500 sheets or 1000 sheets, the temperature at the sealing portion 40a was maintained at about 320°C and did not reach 350°C as the temperature that may cause the crack in the sealing portion 40a.

[0051] As described above, since the configuration according to the embodiment of the present disclosure can prevent the sealing portion 40a from overheating, the configuration can prevent the occurrence of cracks and disconnections due to an excessive temperature rise at the sealing portion 40a and improve the reliability of the halogen heater 23. In particular, the configuration according to the embodiment of the present disclosure is suitable for the fixing device mounted on a small image forming apparatus used in an office or the like. Generally, since most of the small image forming apparatuses used in the office or the like are designed on the assumption that the number of output sheets per one print job is small, the most of the small image forming apparatuses do not include a blower fan or the like to avoid the temperature rise when the small image forming apparatuses print a large number of sheets. Therefore, applying the configuration according to the embodiment of the present disclosure to such a fixing device can prevent the halogen heater 23 from overheating without providing a blower fan or the like and provide a small and highly reliable fixing device.

[0052] In the comparative example not having the openings 25e and 26e, to prevent the sealing portion 40a from overheating, the sealing portion 40a should be ar-

ranged at a position at which the heat is easily released, that is, the position outside an outer edge 301 (see FIG. 26) of the belt holder 30 in the belt longitudinal direction E. Without such countermeasure, the embodiment of the present disclosure can prevent the sealing portion 40a from overheating. That is, according to the embodiment of the present disclosure, without arranging the sealing portion 40a outside the outer edge 301 (see FIG. 9) of the belt holder 30 in the belt longitudinal direction E, the heat around the sealing portion 40a can be easily dissipated through the openings 25e and 26e. Therefore, in the embodiment of the present disclosure, as illustrated in FIG. 9, the sealing portion 40a can be arranged inside the outer edge 301 of the belt holder 30 in the belt longitudinal direction E, which can reduce the size of the fixing device. To reduce the size of the fixing device as described above, at least the outer edge 401 of the sealing portion 40a in the belt longitudinal direction E is disposed on the inner side of the outer edge 301 of the belt holder 30 in the belt longitudinal direction E. In FIG. 9, a part of the sealing portion 40a is disposed on the inner side of the inner edge 302 of the belt holder 30 in the belt longitudinal direction E. However, depending on the configuration and specifications of the fixing device, the entire sealing portion 40a may be disposed on the inner side of the inner edge 302 of the belt holder 30 to further reduce the size of the fixing device.

[0053] As illustrated in FIG. 9, the openings 25e and 26e are preferably arranged inside the belt holder 30 in the belt longitudinal direction E so that at least a part of the openings 25e and 26e do not overlap the belt holder 30 in the belt longitudinal direction E. That is, the inner edge 250 of the opening 25e and the inner edge 260 of the opening 26e in the belt longitudinal direction E are preferably arranged inside the inner edge 302 of the belt holder 30 in the belt longitudinal direction E. The above arrangement in which at least a part of the openings 25e and 26e do not overlap the belt holder 30 in the belt longitudinal direction E can prevent the belt holder 30 from blocking heat dissipation through the openings 25e and 26e, and the heat is easily dissipated through the openings 25e and 26e.

[0054] In short, in order to facilitate the heat dissipation from the openings 25e and 26e and effectively prevent the sealing portion 40a from overheating, the openings 25e and 26e preferably have a region that corresponds to the sealing portion 40a and does not overlap the belt holder 30, that is, the region indicated by a reference sign C in FIG. 9. Additionally, the reflector 26 preferably has an opening 26e at a position corresponding to the opening 25e of the stay 25 so as not to hinder heat dissipation from the opening 25e of the stay 25. In the embodiment illustrated in FIGS. 8 and 9, since the opening 26e of the reflector 26 is formed so as not to overlap with the entire opening 25e of the stay 25, the configuration in the embodiment can effectively prevent the sealing portion 40a from overheating.

[0055] From the viewpoint of thermal efficiency, the

heat dissipated through the openings 25e and 26e is preferably transferred to the fixing belt 21 as much as possible. Therefore, as illustrated in FIG. 9, the inner edge 250 of the opening 25e and the inner edge 260 of the opening 26e in the belt longitudinal direction E are preferably arranged within the range of the fixing belt 21 in the belt longitudinal direction E. Arranging the openings 25e and 26e as described above causes the heat dissipated through the openings 25e and 26e to easily transfer to the fixing belt 21 and can reduce wasteful energy consumption caused by heat transfer to members other than the fixing belt 21.

[0056] FIG. 10 is a cross-sectional front view illustrating an end portion of the fixing device according to a second embodiment in which the openings 25e and 26e are expanded inward (the right side in FIGS. 9 and 10) in the belt longitudinal direction E as compared with the first embodiment illustrated in FIG. 9.

[0057] In the second embodiment illustrated in FIG. 10, the inner edge 250 of the opening 25e and the inner edge 260 of the opening 26e in the belt longitudinal direction E are arranged corresponding to the inner edge 402 of the sealing portion 40a in the belt longitudinal direction E. The above-described arrangement in which the openings 25e and 26e are arranged corresponding to the entire sealing portion 40a more easily releases hot air around the sealing portion 40a through the openings 25e and 26e and can more effectively prevent the sealing portion 40a from overheating.

[0058] FIG. 11 is a cross-sectional front view illustrating the end portion of the fixing device according to a third embodiment in which the openings 25e and 26e are expanded inward in the belt longitudinal direction E as compared with the second embodiment illustrated in FIG. 10.

[0059] In the third embodiment illustrated in FIG. 11, the inner edge 250 of the opening 25e and the inner edge 260 of the opening 26e in the belt longitudinal direction E are arranged corresponding to an edge 410, which is an outer edge if the filament 41 has the outer edge and an inner edge, of the filament 41 in the belt longitudinal direction E. Since the infrared light radiated from the filament 41 also spreads outward in the belt longitudinal direction E, the infrared light radiated from the edge 410 of the filament 41 passes through the openings 25e and 26e and is directly emitted to the inner peripheral surface of the fixing belt 21. Directly irradiating the inner peripheral surface of the fixing belt 21 with the infrared light through the openings 25e and 26e as described above can increase a temperature rising speed on an end portion of the fixing belt 21 in the longitudinal direction E. The above-described configuration can reduce the heating time (first print time) from a heating standby state to a state where fixing operation is executable and solve the shortage of heat during high-speed rotation.

[0060] By the way, there is the halogen heater including a filament that ununiformly generates heat in the longitudinal direction. For example, such a halogen heater

generates heat set to be different between a center portion and end portions in the longitudinal direction. FIG. 12 is a graph illustrating an example of a heat generation distribution in a type of the filament that generates heat larger in the end portions than in the center portion in the longitudinal direction. FIG. 13 is a graph illustrating an example of a heat generation distribution in a type of the filament that generates heat larger in the center portion than in the end portions in the longitudinal direction. In FIGS. 12 and 13, a range indicated by a reference sign D means a large heat generation region in which the filament generates larger heat than another region in the filament, and a range indicated by a reference sign W means a maximum sheet conveyance span when a sheet having a maximum width among sheets used in the image forming apparatus passes through the fixing nip.

[0061] A continuous fixing process when the image forming apparatus 1 continuously prints many images may accumulate heat in a region of the fixing belt 21 outside a sheet conveyance span in which heat is not easily taken away by the sheet, which may excessively raise the temperature in the region of the fixing belt 21 outside the sheet conveyance span. In such a case, using the halogen heater including the filament that generates a small amount of heat in the end portions as illustrated in FIG. 12 can reduce heat accumulation in the region of the fixing belt 21 outside the sheet conveyance span and prevent the temperature at the region from excessively rising. On the other hand, using the halogen heater including the filament having the heat generation distribution as illustrated in FIG. 13 can prevent a temperature drop in the region of the fixing belt 21 outside the sheet conveyance span when an amount of heat in the region of the fixing belt 21 outside the sheet conveyance span tends to be insufficient.

[0062] When the fixing device uses the halogen heater having the ununiform heat generation distribution in the longitudinal direction as described above, ranges of the openings 25e and 26e may be determined based on the heat generation distribution. For example, in a fourth embodiment in which the fixing device uses the halogen heater including the filament that generates larger heat in the end portions than in the center portion as illustrated in FIG. 13, the ranges of the openings 25e and 26e may be expanded as illustrated in FIG. 14 to a position corresponding to the large heat generation region D in the end portions of the filament 41. That is, the inner edge 250 of the opening 25e and the inner edge 260 of the openings 26e in the belt longitudinal direction E are arranged inside the outer edge d1 of the large heat generation region D in the belt longitudinal direction E. The above-described arrangement can broaden a range on the fixing belt 21 which is directly irradiated with the infrared light in the end portions of the fixing belt 21 in the belt longitudinal direction E and effectively prevent the temperature drop at the end portion of the fixing belt 21 in the belt longitudinal direction E. The openings 25e and 26e expanded to the position corresponding to the large

heat generation region D of the filament 41 can reduce the influence of heat on the sealing portion 40a because the hot air around the sealing portion 40a is easily released through the openings 25e and 26e even when the amount of heat generated on the end portion of the filament 41 is large. In FIG. 14, the openings 25e and 26e are arranged in the belt longitudinal direction corresponding to the entire large heat generation region D of the filament 41, that is, the inner edge 250 of the opening 25e and the inner edge 260 of the opening 26e in the belt longitudinal direction E are arranged at the same position of the inner edge d2 of the large heat generation region D or inside the inner edge d2 in the belt longitudinal direction E. However, the openings 25e and 26e may be arranged corresponding to a part of the large heat generation region D of the filament 41.

[0063] As in a fifth embodiment illustrated in FIG. 15, the ranges of the openings 25e and 26e may be determined based on the maximum sheet conveyance span W. In the fifth embodiment illustrated in FIG. 15, the inner edge 250 of the opening 25e and the inner edge 260 of the opening 26e in the belt longitudinal direction E correspond to the edge of the maximum sheet conveyance span W through which the maximum sheet passes in the nip N. The openings 25e and 26e expanded to the edge of the maximum sheet conveyance span W as described above efficiently dissipate heat outside the sheet conveyance span and can effectively prevent a part of the halogen heater 23 and a part of the fixing belt 21 which are outside the sheet conveyance span from excessively rising temperature.

[0064] FIG. 16 is a graph illustrating a comparison between the fifth embodiment of the present disclosure and the comparative example about the temperature rise of the fixing belt outside the sheet conveyance span. The temperature of the fixing belt outside the sheet conveyance span in the fifth embodiment of the present disclosure illustrated in FIG. 15 is indicated by a reference sign H in FIG. 16. As illustrated in FIG. 16, the configuration according to the fifth embodiment of the present disclosure can prevent the temperature of the fixing belt outside the sheet conveyance span from excessively rising and maintain the temperature of the fixing belt outside the sheet conveyance span near the target temperature. The temperature of the fixing belt outside the sheet conveyance span in the comparative example not having the openings 25e and 26e is indicated by a reference sign G in FIG. 16. As illustrated in FIG. 16, the temperature of the fixing belt outside the sheet conveyance span exceeds the target temperature after the start of continuous printing and tends to gradually rise. The ranges of the openings 25e and 26e determined based on the maximum sheet conveyance span W as described above can prevent the temperature of the fixing belt outside the sheet conveyance span from excessively rising, similarly prevent the temperature of the halogen heater outside the sheet conveyance span from excessively rising, therefore, prevent the temperature of the sealing portion

40a from excessively rising, and prevent the sealing portion 40a from occurring cracks and breaks.

[0065] Preferably, the position of the temperature sensor 28 is determined based on positions of the openings 25e and 26e. In FIG. 17, curves indicated by reference signs Tx and Ty illustrate temperatures of the fixing belt 21 detected by the temperature sensor 28 at different positions. Specifically, the temperature Tx was detected at a position X in an end portion not corresponding to the openings 25e and 26e illustrated in FIG. 18, and the temperature Ty was detected at a position Y corresponding to the openings 25e and 26e. As illustrated in FIG. 17, the temperature Tx detected at the position X not corresponding to the openings 25e and 26e stably remained near the target control temperature. In contrast, the temperature Ty detected at the position Y corresponding to the openings 25e and 26e fluctuated greatly from the target control temperature. The reason is considered as follows. Originally, the thin fixing belt 21 having a small thermal capacity easily changes its temperature. In addition, a portion of the fixing belt 21 corresponding to the openings 25e and 26e is directly irradiated with infrared light through the openings 25e and 26e. Therefore, it is considered that the temperature change increased with the ON / OFF timing of the halogen heater 23. According to this result, to avoid misdetection, the temperature sensor 28 used for controlling the temperature of the fixing belt 21 is preferably arranged to detect the temperature at the position that gives a relatively stable temperature and does not correspond to the openings 25e and 26e rather than the position corresponding to the openings 25e and 26e at which the temperature greatly fluctuates. Furthermore, it is preferable that the temperature sensor 28 detects the temperature at a portion of the fixing belt 21 which is not directly irradiated with infrared light. Therefore, preferably, the temperature sensor 28 detects the temperature at the portion of the fixing belt 21 inside the inner edges 250 of the openings 25e and the inner edges 260 of the openings 26e in the belt longitudinal direction E. The temperature sensor 28 may be disposed on the nip entrance side or the nip exit side. However, at the nip exit side, the temperature sensor 28 detects the temperature after the sheet absorbs the heat of the fixing belt 21. Therefore, preferably, the temperature sensor 28 is disposed at the nip entrance side in which the temperature sensor 28 can detect the temperature before the sheet absorbs the heat.

[0066] When the halogen heater 23 directly irradiates the fixing belt 21 with the infrared light through the openings 25e and 26e, preferably, the halogen heater 23 generates the heat while the fixing belt 21 rotates. Heat generation of the halogen heater 23 while the fixing belt 21 stops its rotation may cause a large temperature difference between a portion which is directly irradiated with the infrared light and a portion other than the portion and distortion in the fixing belt 21 due to thermal expansion. Therefore, the halogen heater 23 generates the heat during the rotation of the fixing belt 21, which can disperse

areas heated by the direct irradiation of the infrared light in the belt rotation direction. As a result, the distortion due to the thermal expansion of the fixing belt 21 is reduced, and deformation and buckling breakage (kinking) of the fixing belt 21 are less likely to occur.

[0067] Further, as in an example illustrated in FIG. 19, wires 45 such as wire harnesses connected to both ends of the halogen heater 23 is preferably arranged so that the wires 45 pass through the openings 25f and 26f that open toward the belt longitudinal direction E and do not pass through the openings 25e and 26e that open upward in the stay 25 and the reflector 26 as illustrated in FIG. 19 in order to avoid deterioration and damage due to heat of the halogen heater 23. One end of each wire 45 is coupled to the halogen heater 23, and the other end of each wire 45 is coupled to an AC power supply. To reduce the influence of the heat of the stay 25 which becomes high in temperature, preferably, the wire 45 passing outside the side wall portion 25a of the stay 25 is disposed away from the stay 25, that is, at a non-contact position, specifically, for example, at a position indicated by reference sign 45A or 45B in FIG. 20. Since the position inside the reflector 26 is affected by the heat from the halogen heater 23 and the reflector 26, preferably, the wire 45 is not arranged in such a position, that is, the position indicated by the reference sign 45C in FIG. 20. When a resin cover 50 (or a guide) is disposed outside the stay 25 as in the example illustrated in FIG. 21, arranging the wire 45 outside the cover 50 can reduce the influence of heat from the stay 25 to the wire 45. When the cover 50 has a step 50a like this example, the wire 45 may be arranged on the step 50a. More preferably, to reduce the influence of the heat of the cover 50, the wire 45 may contact a plurality of ribs 50c disposed on the cover 50 to decrease a contact area between the wire 45 and the cover 50 rather than arranging the wire 45 in contact with the flat portion 50b near the step 50a.

[0068] The present disclosure is not limited to the details of the embodiments described above and various modifications and improvements are possible.

[0069] In the above-described embodiment, to dissipate the heat around the sealing portion 40a, the bottom wall portion 25b of the stay 25 and a part of the reflector 26 corresponding to the bottom wall portion 25b have the openings 25e and 26e (see FIG. 8), but as illustrated in FIG. 22, the side wall portion 25a of the stay 25 and a part of the reflector 26 corresponding to the side wall portion 25a may have the openings 25e and 26e having the same effect as described above.

[0070] As in the example illustrated in FIG. 23, the side wall portion 25a and the bottom wall portion 25b of the stay 25 may be shortened in the belt longitudinal direction to expose at least a part of the sealing portion 40a outside the entire edge 251 of the stay 25 and the entire edge 261 of the reflector 26 in the belt longitudinal direction E. The above-described configuration further facilitates the heat dissipation from the sealing portion 40a and can effectively prevent the sealing portion 40a from overheating.

ing.

[0071] In the above-described embodiment, one halogen heater 23 is disposed inside the loop of the fixing belt 21, but a plurality of heaters may be used. In a configuration using a plurality of heaters, it is preferable to arrange the openings 25e and 26e as described above, particularly for a heater having the innermost sealing portion 40a in the belt longitudinal direction E. The shapes of the stay 25 and the reflector 26 are not limited to the above-described embodiment and may be appropriately changed.

[0072] The present disclosure may be applied to a fixing device not including the reflector 26. The fixing device according to the present disclosure is not limited to the fixing device 5 that conveys the sheet in the horizontal direction as illustrated in FIG. 1. An installation direction of the fixing device 5 may be changed as appropriate, and the present disclosure is also applicable to the fixing device 5 that conveys the sheet in the vertical direction as illustrated in FIG. 24.

[0073] The present disclosure is not limited to the application of the fixing device including the halogen heater having the sealing portion. For example, the present disclosure may be applied to a carbon heater having a sealing portion.

[0074] Numerous additional modifications and variations are possible in light of the above teachings. It is therefore to be understood that, within the scope of the above teachings, the present disclosure may be practiced otherwise than as specifically described herein. With some embodiments having thus been described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the scope of the present disclosure and appended claims, and all such modifications are intended to be included within the scope of the present disclosure and appended claims.

Claims

1. A fixing device (5) comprising:

a fixing member (21) in a cylindrical shape;
 an opposite member (22) disposed opposite an outer surface of the fixing member (21);
 a nip formation member (24) disposed inside a loop of the fixing member (21) to sandwich the fixing member (21) between the nip formation member (24) and the opposite member (22) and form a nip between the nip formation member (24) and the opposite member (22);
 a support member (25) disposed inside the loop of the fixing member (21) and configured to support the nip formation member (24); and
 a heater (23) disposed inside the loop of the fixing member (21),
 the heater (23) including:

a tube (40) having a sealing portion (40a) at least partially exposed out of the support member (25); and
 a heat generator (41) accommodated in the tube (40).

2. The fixing device (5) according to claim 1, further comprising a fixing member support (30) configured to support the fixing member (21), wherein, in a longitudinal direction of the fixing member (21), an edge (250) of the support member (25) that is disposed on an inner side of an outer edge (401) of the sealing portion (40a) is disposed on an inner side of an inner edge (302) of the fixing member support (30).
3. The fixing device (5) according to claim 1 or 2, further comprising a fixing member support (30) configured to support the fixing member (21), wherein at least a part of the sealing portion (40a) is disposed on an inner side of an outer edge (301) of the fixing member support (30) in a longitudinal direction of the fixing member (21).
4. The fixing device (5) according to any one of claims 1 to 3, wherein, in a longitudinal direction of the fixing member (21), an edge (250) of the support member (25) that is disposed on an inner side of an outer edge (401) of the sealing portion (40a) is disposed at a position corresponding to an outer edge (410) of the heat generator (41).
5. The fixing device (5) according to any one of claims 1 to 4, wherein the heat generator (41) has a large heat generation region (D) in an end portion of the heat generator (41) in a longitudinal direction of the fixing member (21) and is configured to generate larger heat in the large heat generation region (D) than another region in the heat generator (41), and wherein, in the longitudinal direction of the fixing member (21), an edge (250) of the support member (25) that is disposed on an inner side of an outer edge (401) of the sealing portion (40a) is disposed on an inner side of an outer edge (d1) of the large heat generation region (D).
6. The fixing device (5) according to any one of claims 1 to 5, wherein, in a longitudinal direction of the fixing member (21), an edge (250) of the support member (25) that is disposed on an inner side of an outer edge (401) of the sealing portion (40a) corresponds to an edge of a maximum sheet conveyance span (W) through which a maximum recording medium passes in the nip (N).

7. The fixing device (5) according to any one of claims 1 to 6, further comprising a reflector (26) disposed between the support member (25) and the heater (23), wherein at least a part of the sealing portion (40a) is exposed out of the reflector (26). 5
8. The fixing device (5) according to any one of claims 1 to 7, further comprising a temperature sensor (28) configured to detect a temperature of a portion of the fixing member (21) which the heater (23) does not directly irradiate with light. 10
9. An image forming apparatus (1) comprising: 15
- an image forming device (2) configured to form an image on a recording medium; and the fixing device (5) according to any one of claims 1 to 8, configured to fix the image formed by the image forming device (2) onto the recording medium. 20

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FIG. 1

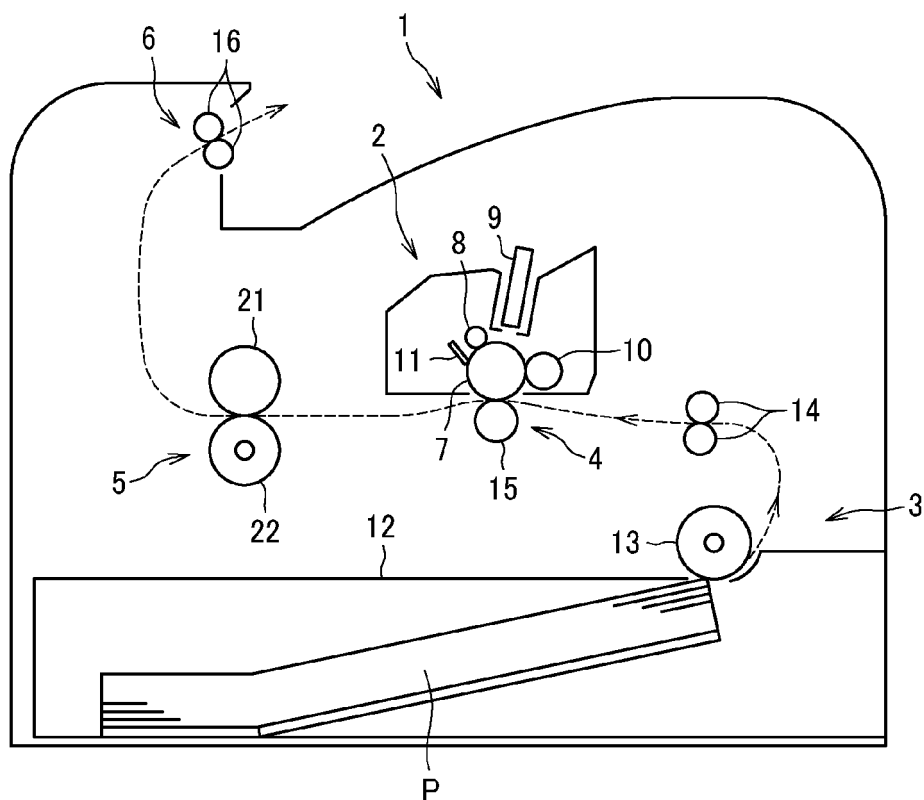


FIG. 2

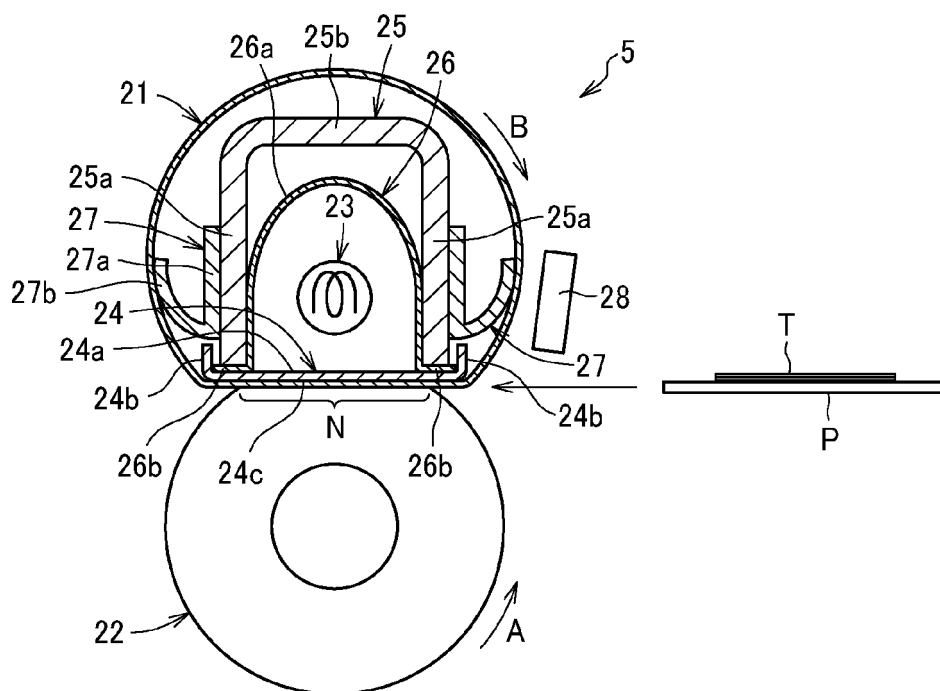


FIG. 3

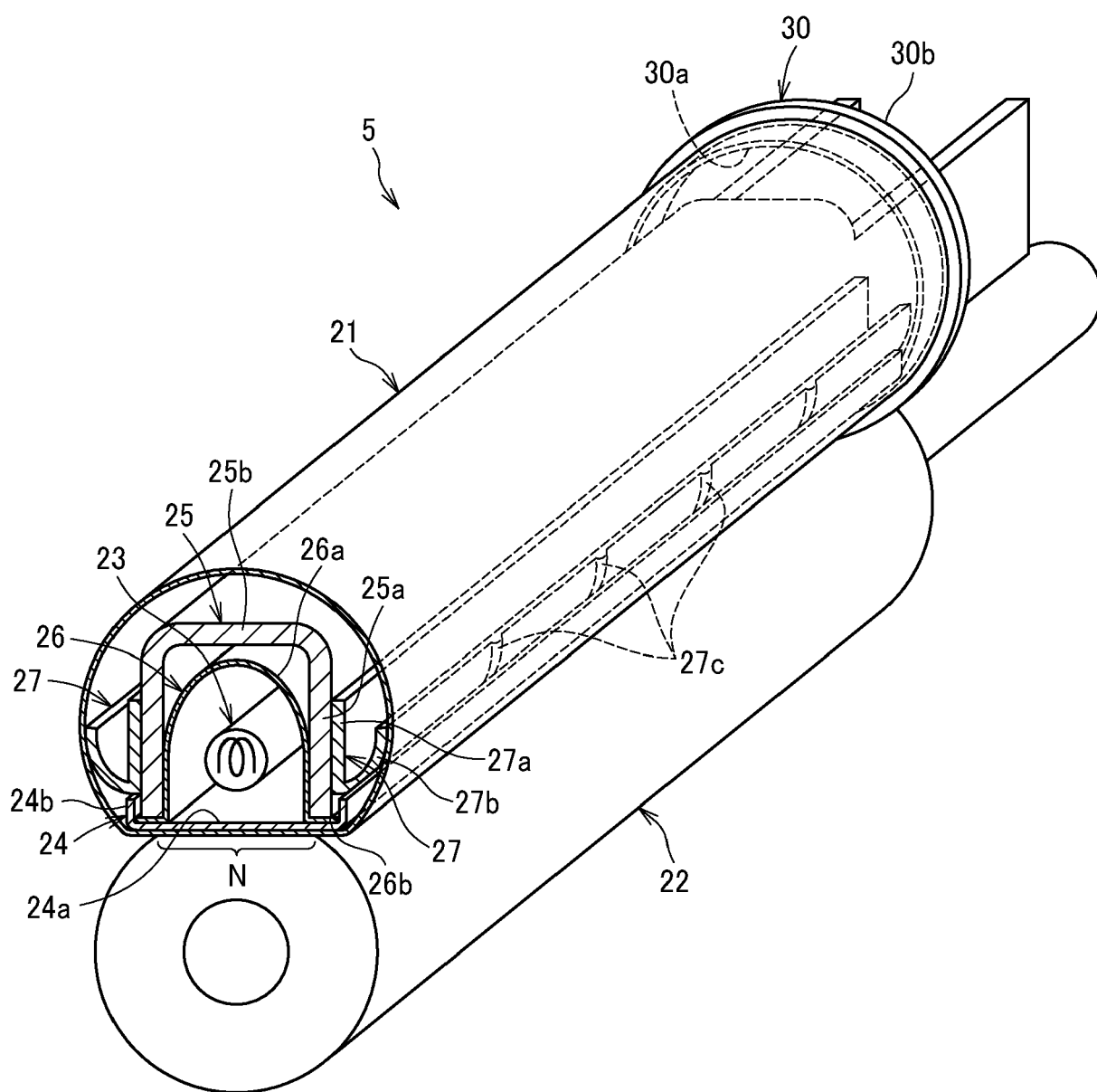


FIG. 4

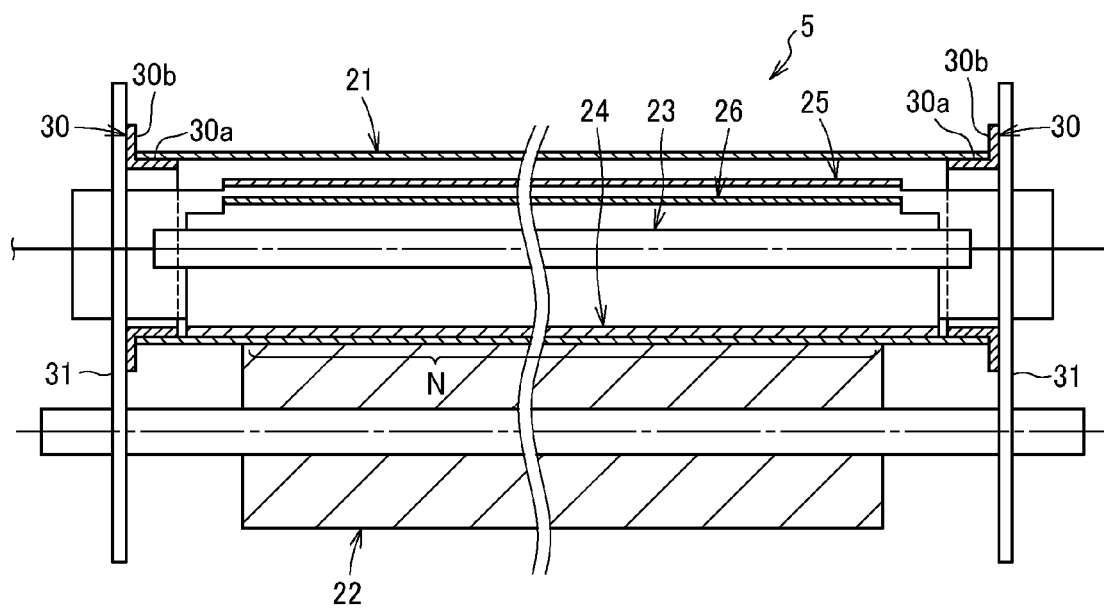


FIG. 5

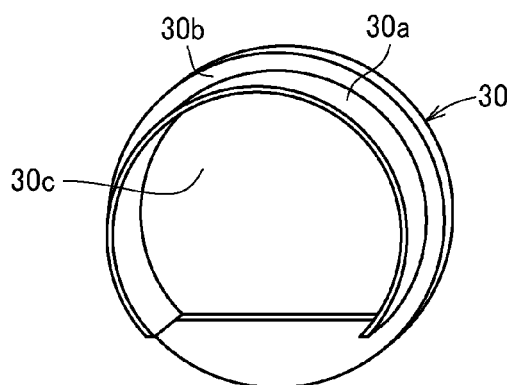


FIG. 6

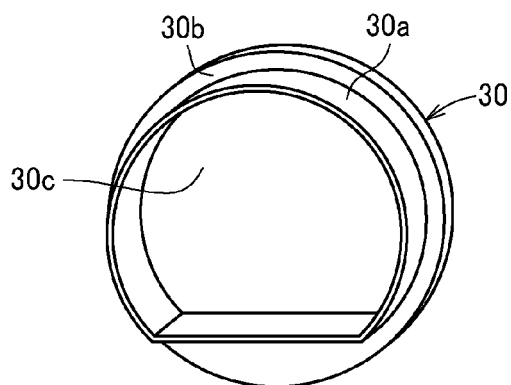


FIG. 7

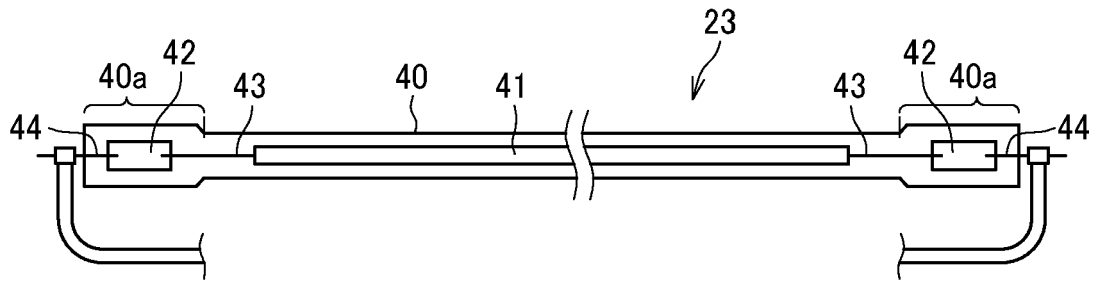


FIG. 8

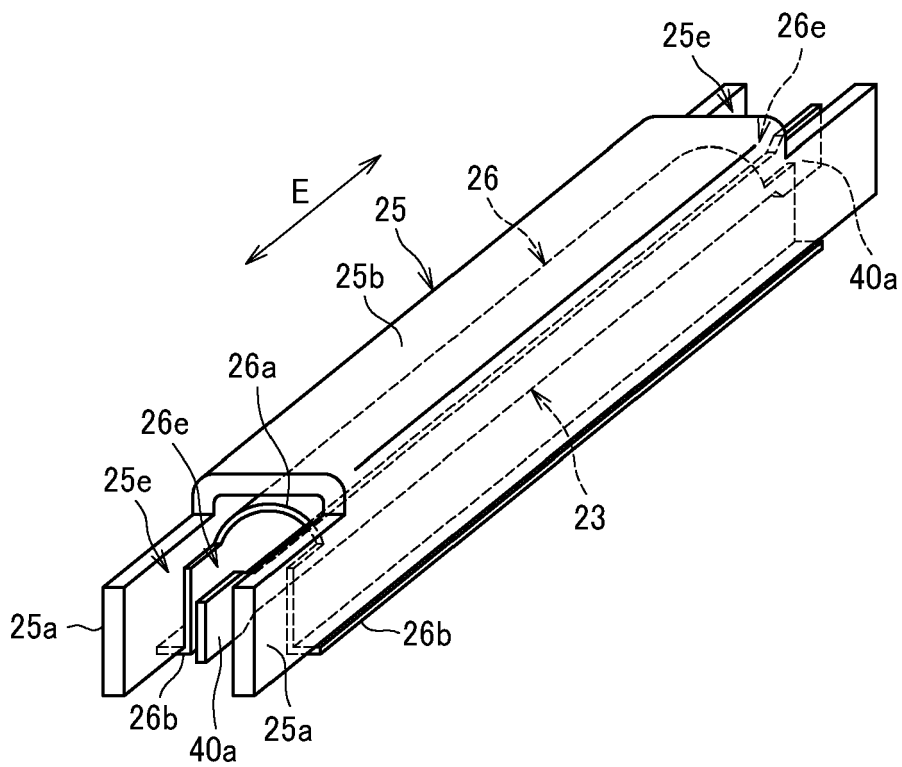


FIG. 9

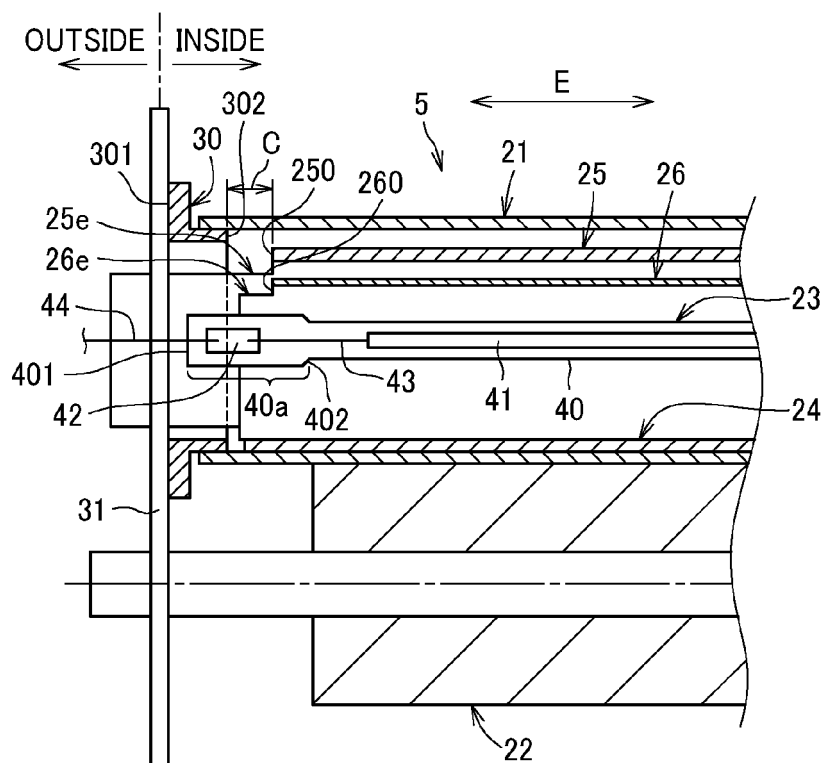


FIG. 10

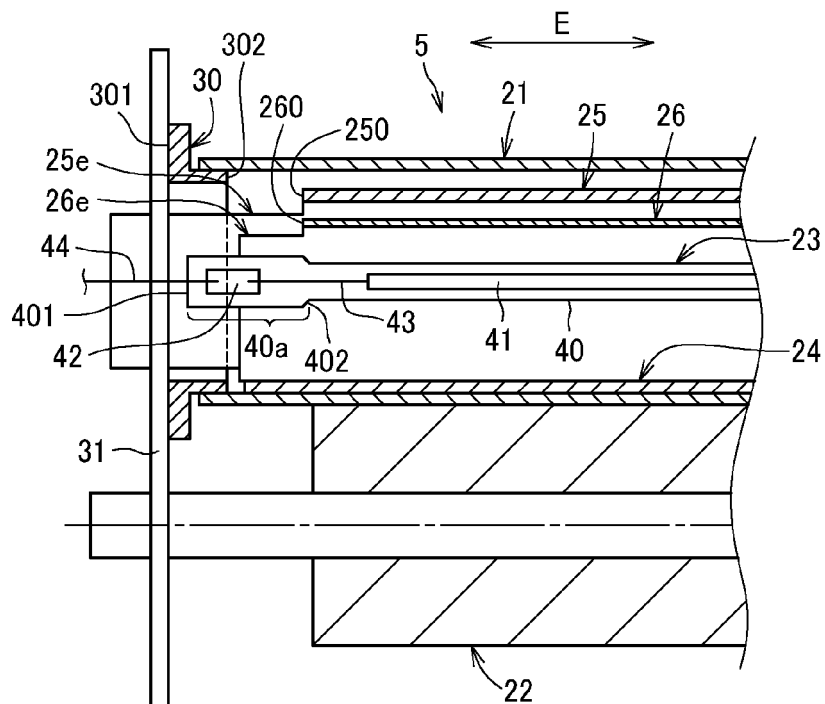


FIG. 11

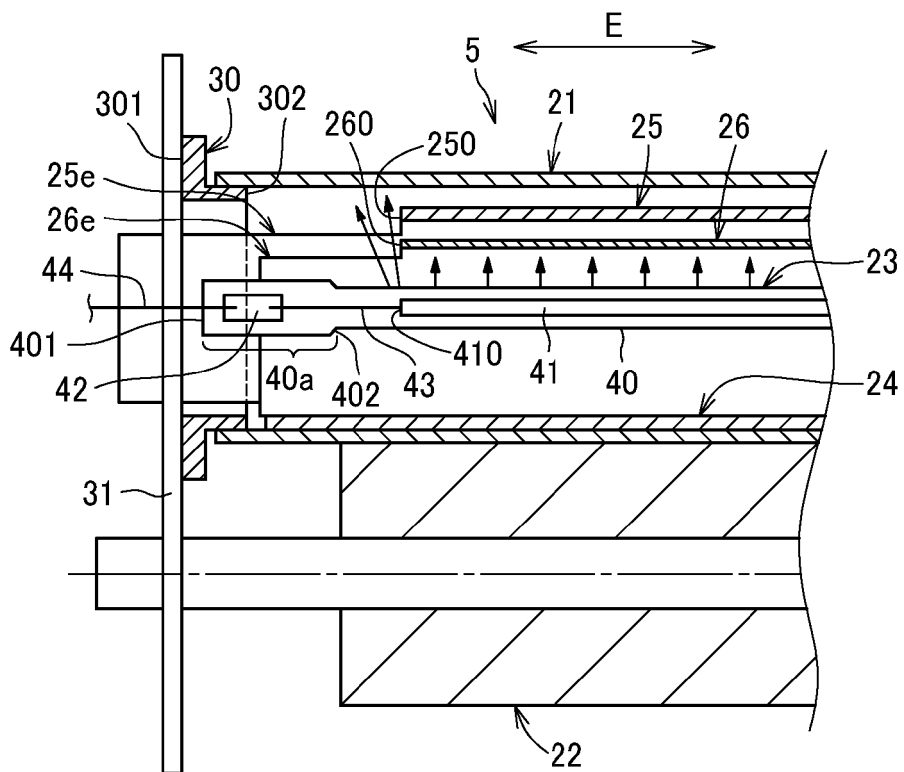


FIG. 12

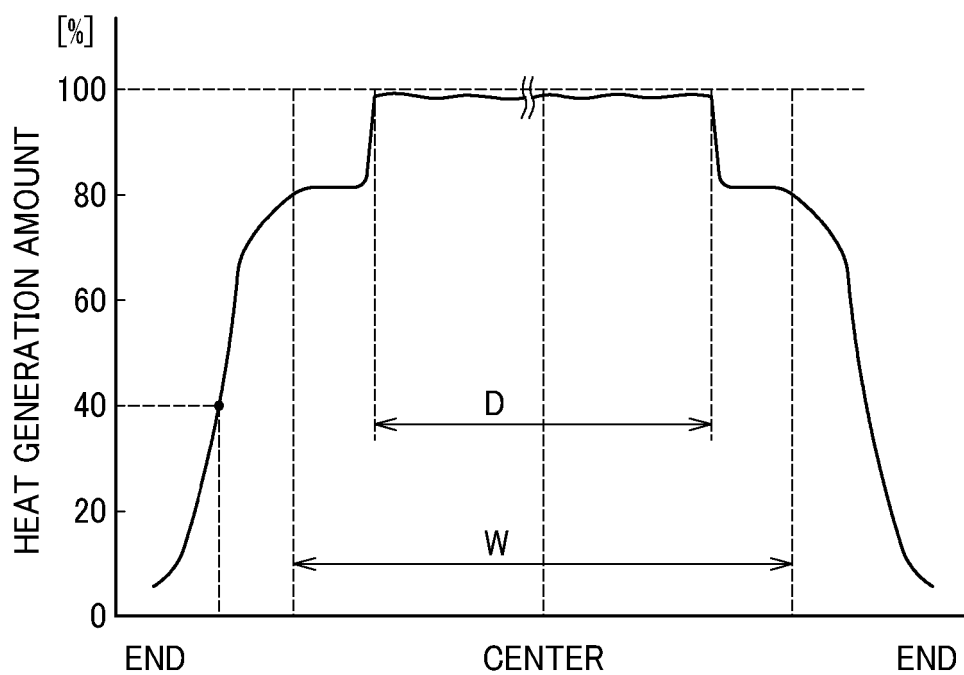


FIG. 13

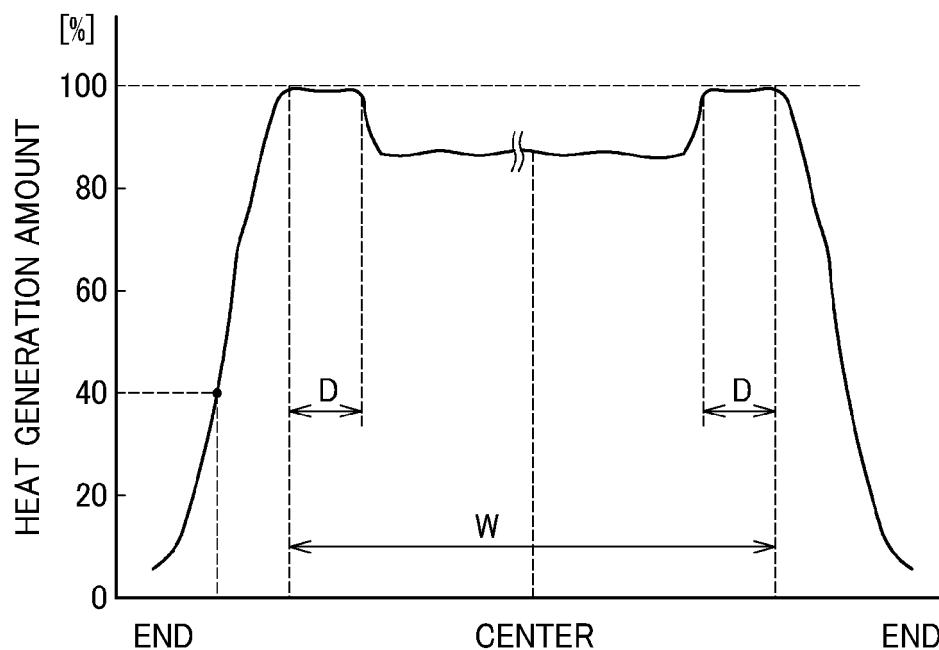


FIG. 14

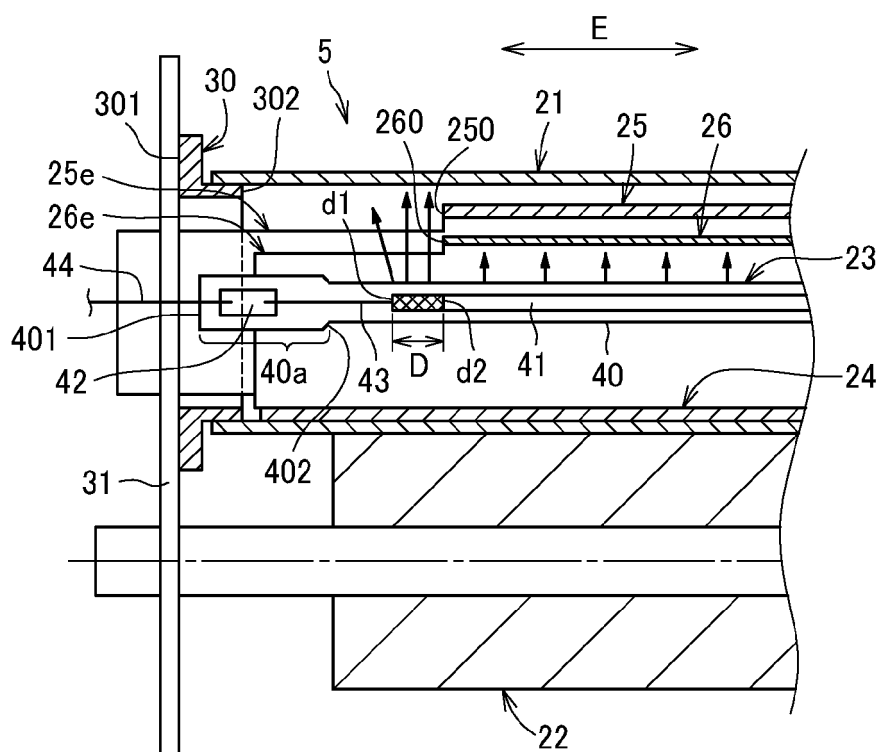


FIG. 15

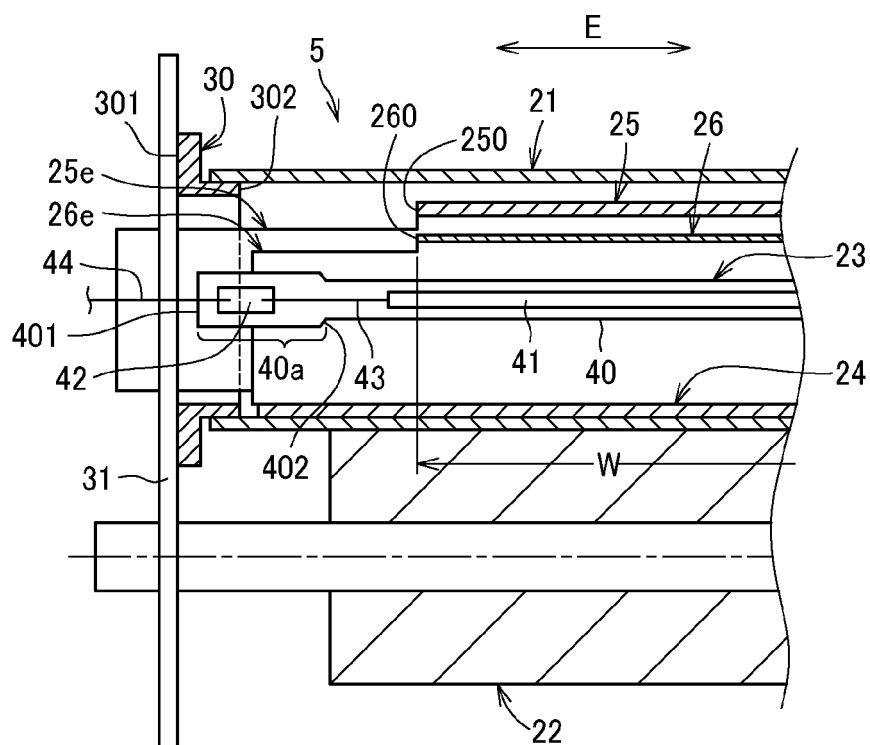


FIG. 16

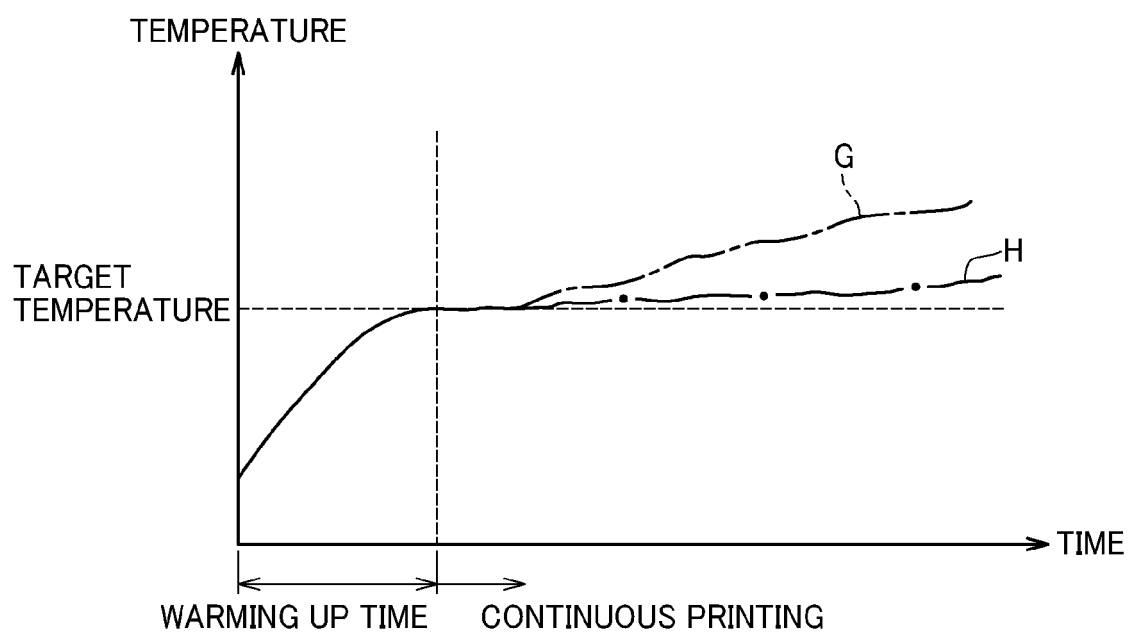


FIG. 17

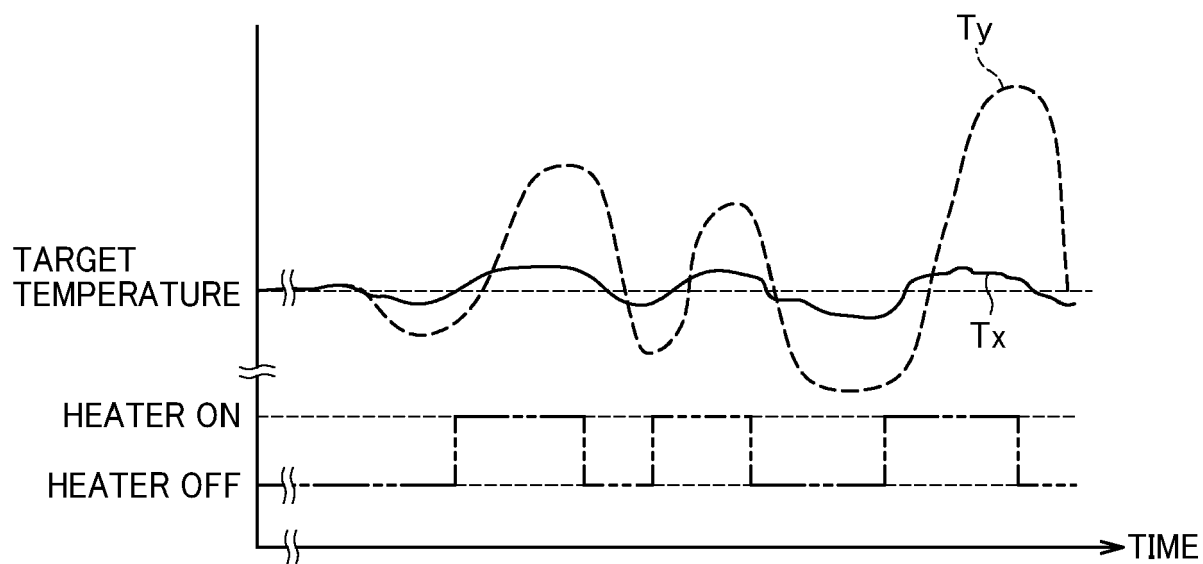


FIG. 18

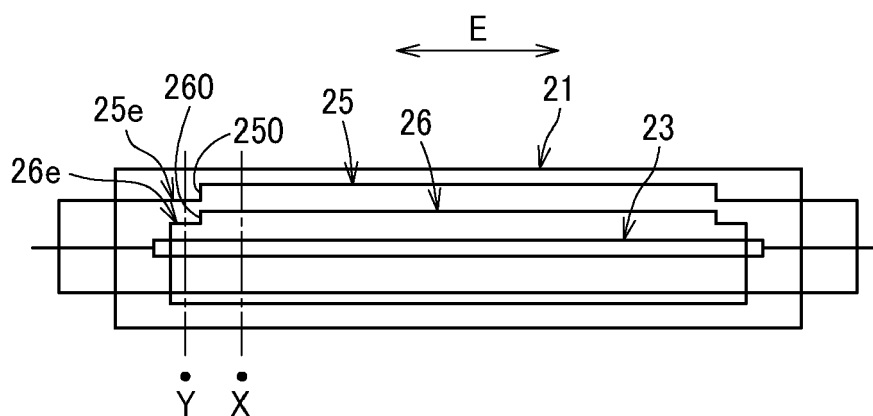


FIG. 19

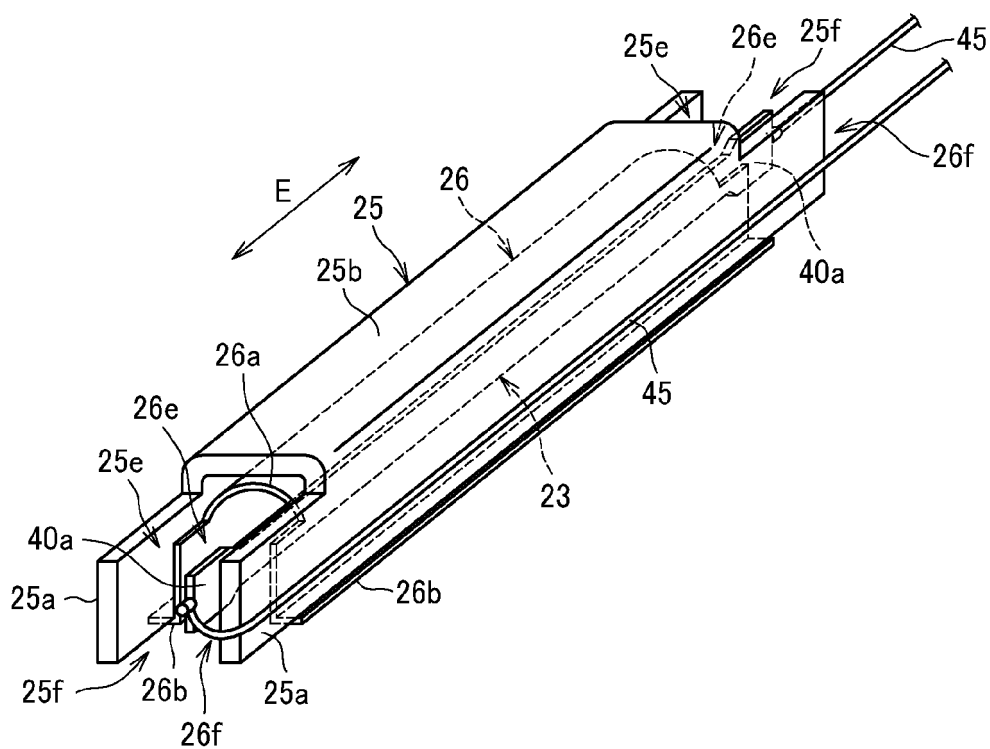


FIG. 20

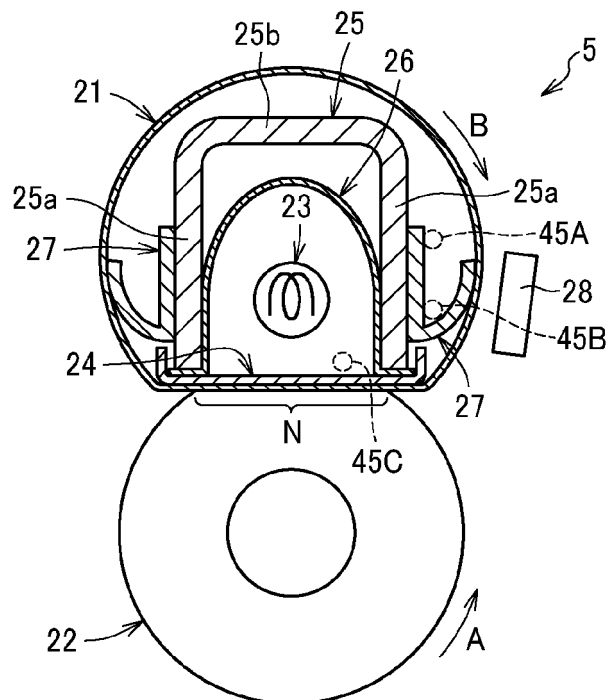


FIG. 21

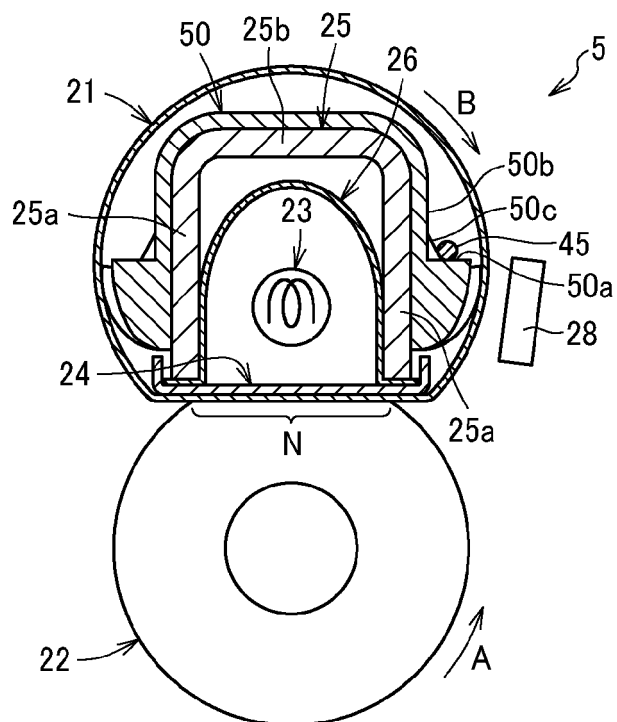


FIG. 22

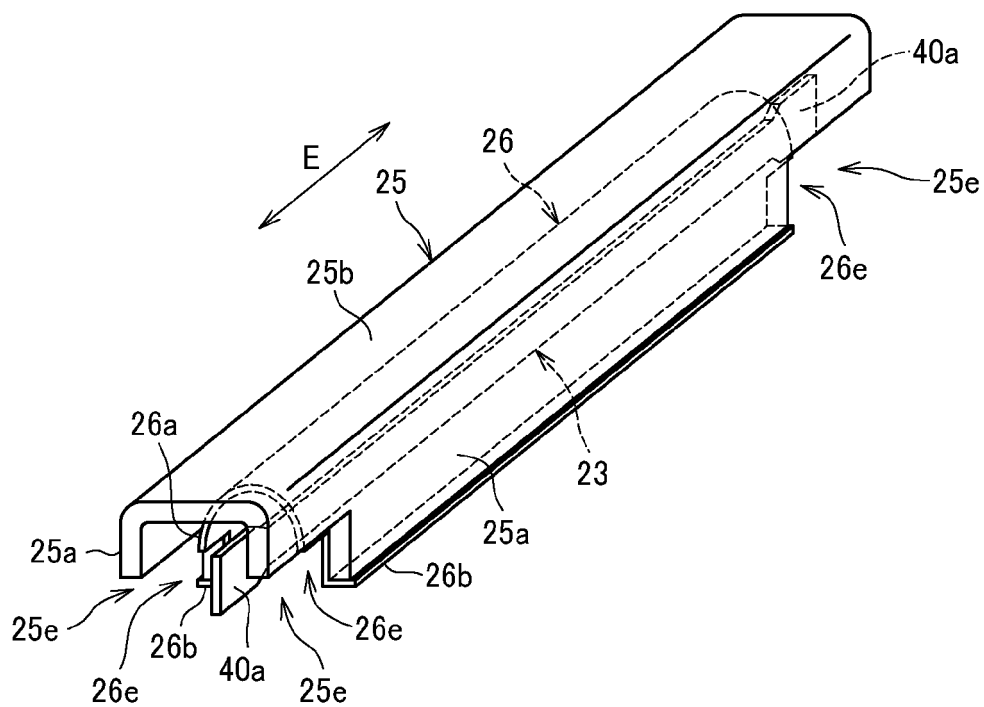


FIG. 23

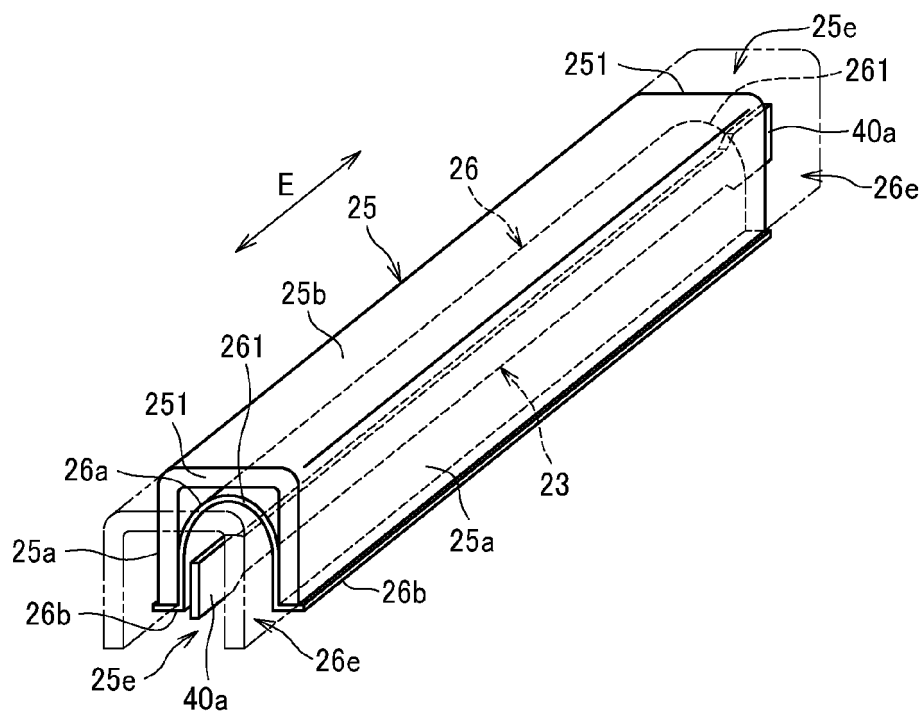


FIG. 24

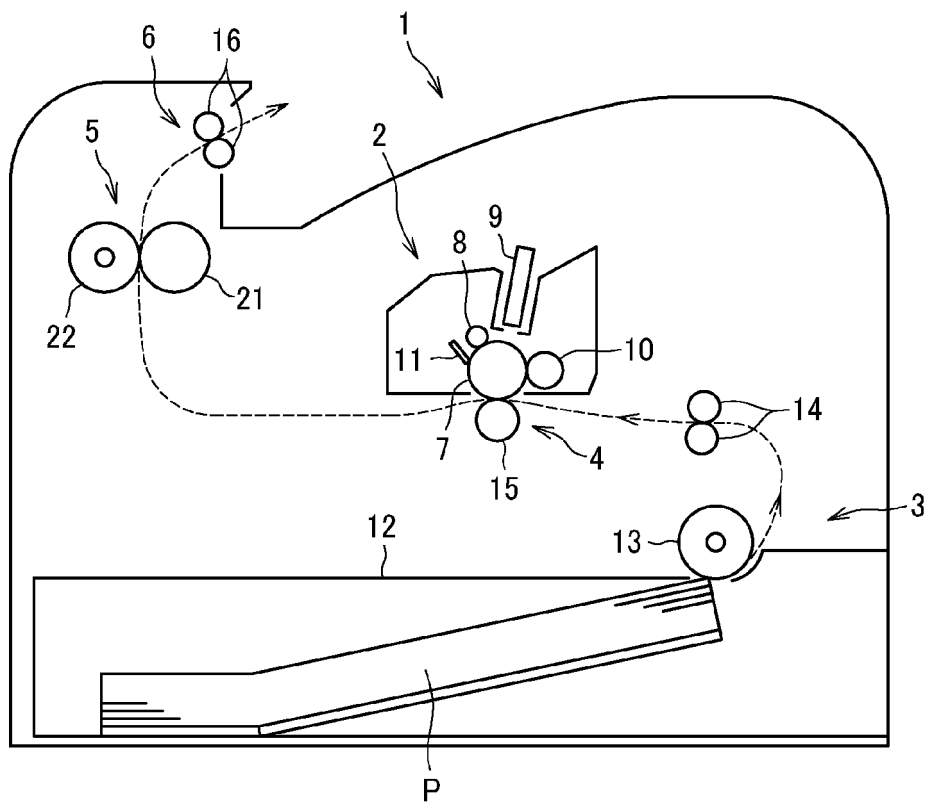


FIG. 25

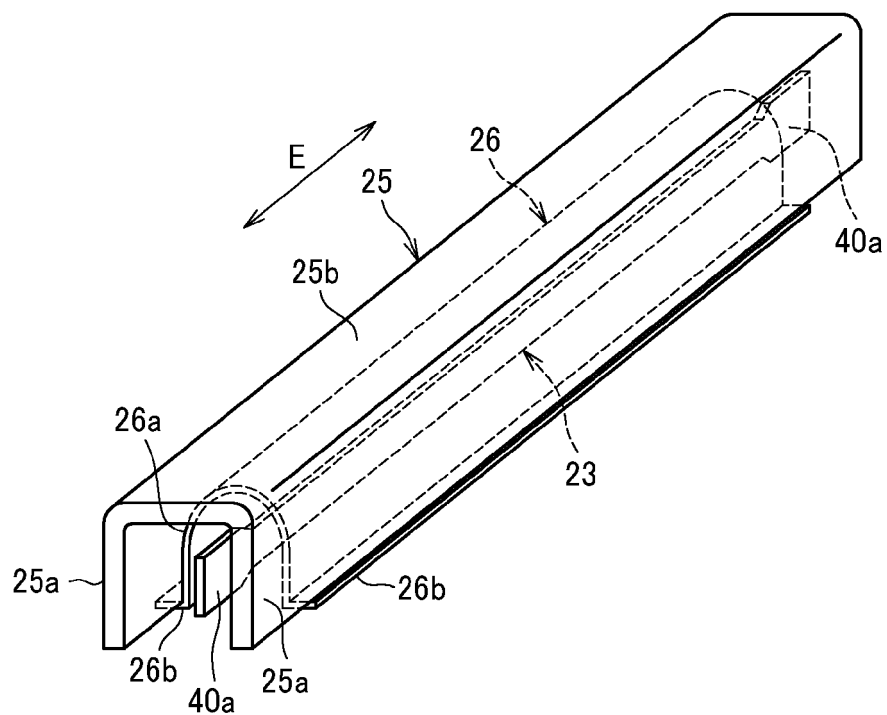
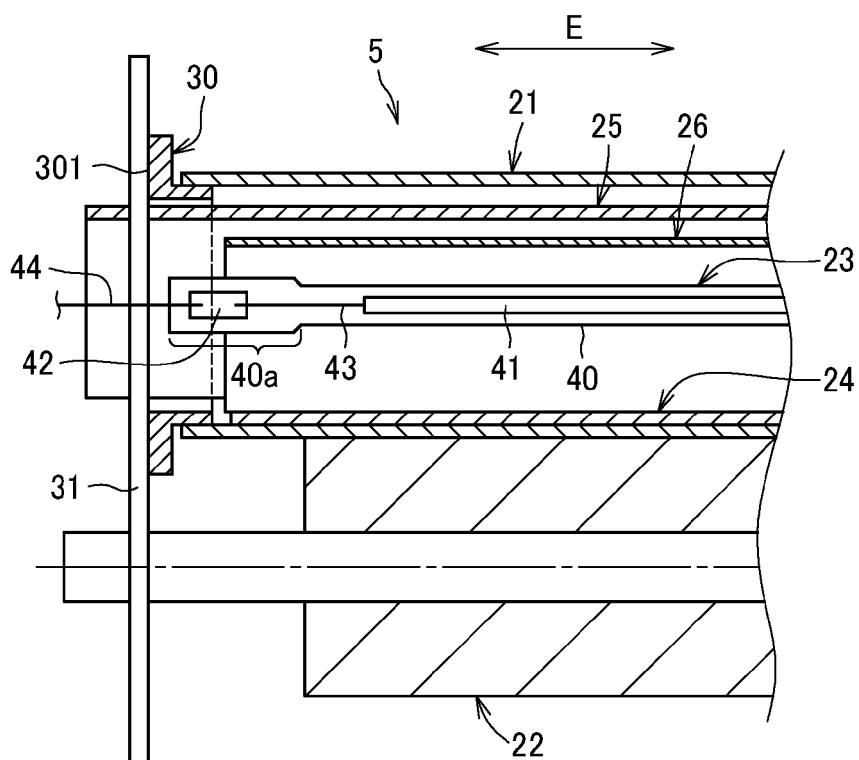


FIG. 26





EUROPEAN SEARCH REPORT

 Application Number
 EP 20 16 1266

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2018/004133 A1 (KOBARU YASUNARI [JP]) 4 January 2018 (2018-01-04)	1,4,9	INV. G03G15/20
A	* paragraph [0016] - paragraph [0036]; figures 1-5 *	2,3,5-8	
X	US 2016/334741 A1 (TAKAHASHI HIRONORI [JP]) 17 November 2016 (2016-11-17) * paragraph [0017] - paragraph [0054]; figures 1-9 *	1-4,7-9	
X	US 2017/248879 A1 (ISHIGAYA YASUNORI [JP] ET AL) 31 August 2017 (2017-08-31) * paragraph [0022] - paragraph [0123]; figures 1-11 *	1,7,9	
X	US 2013/136515 A1 (SAHARA HIROSHI [JP]) 30 May 2013 (2013-05-30) * paragraph [0027] - paragraph [0064]; figures 1-6 *	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			G03G
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 15 July 2020	Examiner Billmann, Frank
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