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(71) Applicant: **Ricoh Company, Ltd.**
Tokyo 143-8555 (JP)

(72) Inventor: **TAKAGI, Hiromasa**
Tokyo, 143-8555 (JP)

(74) Representative: **J A Kemp LLP**
14 South Square
Gray's Inn
London WC1R 5JJ (GB)

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

(57) A fixing device (5) includes a rotatable endless fixing belt (21), a pressing member (22) configured to press the fixing belt (21), a heater (23) disposed inside a loop of the fixing belt (21) and configured to heat the fixing belt (21), and a nip formation member (24) disposed inside the loop of the fixing belt (21) and configured to come into contact with the pressing member (22) via the fixing belt (21) to form a fixing nip. In a longitudinal direction of the heater (23), the heater (23) has a low heat

generation area (23a) that generates a smaller amount of heat than another area of the heater (23). The nip formation member (24) has an elongated portion (242) that extends upstream from the fixing nip in a rotation direction of the fixing belt (21). The elongated portion (242) has the longest part (242a) positioned corresponding to the low heat generation area in the longitudinal direction.

EP 3 690 550 A1

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 image forming apparatus such as a copier, a printer, a facsimile machine, and a multi-functional apparatus including at least two functions of the copier, printer, facsimile machine includes a fixing device to convey a recording medium such as a sheet on which an unfixed image is formed to a fixing nip formed between a fixing belt and a pressing member in the fixing device, heat the recording medium, and fix the unfixed image onto the recording medium.

[0003] The fixing device includes a heater disposed inside a loop of the fixing belt to heat the fixing belt and a nip formation member that contacts the pressing member via the fixing belt to form the fixing nip. The nip formation member supports an inner circumferential surface of the fixing belt to form the fixing nip between the pressing member and the fixing belt, and, in addition, the heater heats the fixing belt via the nip formation member to suitably heat and press a surface of a recording medium conveyed to the fixing nip.

[0004] However, the heating distribution of the heater may be ununiform in a width direction of the fixing belt that is a longitudinal direction of the heater. For example, the heater exists that generates less heat at end portions than the heat generated at a central portion of the heater. Such a heater causes problems such as an extra time for a part of the fixing belt corresponding to a low heat generation area in which the heater generates less heat to reach a temperature for fixing or a fixing failure caused by the part of the fixing belt corresponding to the low heat generation area that does not reach the temperature for fixing. In particular, when the image forming apparatus is switched on first in the morning, the above-described problem is remarkable because the entire image forming apparatus is cooled.

[0005] JP-2017-32633-A discloses the fixing device with a measure to increase the temperature at the end portion of the fixing belt. As illustrated in FIG. 7, the fixing device includes a first heater 202, second heaters 203, a nip member 204, or the like inside a loop of the film 201. The second heaters 203 are disposed upstream from the fixing nip N in a rotation direction of the film 201 and face both end portions of the film 201 in the width direction of the film 201, respectively. The nip member 204 has an extended portion 204a extended upstream from the fixing nip N in the rotation direction of the film 201 and protruding portions 204b disposed on both end

portions of the extended portion 204a. The protruding portions 204b are further extended upstream from a center portion of the extended portion 204a. The second heater 203 increases a heat amount to heat the end portion of the film 201 in the width direction, and the film 201 heated by the second heater 203 can enter the nip between the film 201 and the nip member 204 immediately after the second heater 203 heats the film 201. Therefore, the second heater 203 can raise the temperature at the end portion of the film 201 in the width direction in the fixing nip N to a high temperature.

[0006] As described in JP-2017-32633-A, adding another heater in addition to a main heater and extending the nip formation member to a portion corresponding to the another heater (see the extended portion 204a and the protruding portion 204b in FIG. 7) can compensate for the lack of heat amount to heat a portion that the main heater heats with a relatively small heat amount, that is, in the above-described example, the end portion of the fixing belt in the width direction, to sufficiently heat the fixing belt but causes problems such as increase of manufacturing cost of the fixing device due to adding another part and increase of energy consumption of the fixing device.

SUMMARY

[0007] Under such circumstances, an object of the present disclosure is to sufficiently heat a fixing belt facing a low heat generation area of a heater, using a simple structure. 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.

[0008] Advantageously, the fixing device includes a rotatable endless fixing belt, a pressing member configured to press the fixing belt, the heater disposed inside a loop of the fixing belt and configured to heat the fixing belt, and a nip formation member disposed inside the loop of the fixing belt and configured to come into contact with the pressing member via the fixing belt to form a fixing nip. In a longitudinal direction of the heater, the heater has a low heat generation area that generates a smaller amount of heat than another area of the heater. The nip formation member has an elongated portion that extends upstream from the fixing nip in a rotation direction of the fixing belt. The elongated portion has a longest part positioned corresponding to the low heat generation area in the longitudinal direction.

[0009] According to the present disclosure, the length of the elongated portion of the nip formation member is set longest at a position corresponding to the low heat generation area of the heater. That is, a simple structure in which the elongated portion of the nip formation member has a shape corresponding to the heating distribution of the heater enables the fixing belt to be sufficiently heated at the position corresponding to the low heat generation area, which avoids the occurrence of the fixing fail-

ure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] 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 diagram illustrating a configuration 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 according to the embodiment of the present disclosure 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 includes part A that is a graph illustrating a heating distribution in the longitudinal direction of a halogen heater and part B that is an explanatory diagram illustrating a nip formation member;

FIGS. 6A to 6C are explanatory diagrams illustrating nip formation members having different shapes; and
FIG. 7 is a vertical cross-sectional view of a known fixing device viewed from a lateral side of the fixing device.

[0011] 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

[0012] 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.

[0013] 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.

[0014] Referring to the attached drawings, the following describes embodiments 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.

[0015] 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.

[0016] The 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 copier, a facsimile machine, a multifunction peripheral (MFP) having at least two of copying, printing, scanning, facsimile, and plotter functions in addition to the printer. The image forming apparatus 1 is not limited to a monochrome image forming apparatus and may be a color image forming apparatus.

[0017] 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 to the image forming device 2, 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.

[0018] 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.

[0019] 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.

[0020] 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 photoconductor 7.

[0021] 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 the fixing belt 21 and the 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.

[0022] With reference to FIGS. 2 to 4, a detailed description is provided of a construction of the fixing device 5. 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.

[0023] As illustrated in FIG. 2, the fixing device 5 includes the fixing belt 21, the pressure roller 22, a halogen heater 23 as a heater, a nip formation member 24, a stay 25 as a contact part, a reflector 26, and temperature sensors 28.

[0024] 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 and preferably 30 mm or less.

[0025] The pressure roller 22 is a pressing member disposed opposite an outer circumferential 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.

[0026] A driver disposed inside the image forming apparatus 1 drives and rotates the pressure roller 22 in a direction indicated by 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 T is conveyed to a fixing 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 fixing nip N. When the sheet P passes through the fixing nip N, heat and pressure applied to the sheet P fix the unfixed toner image T onto the sheet P.

[0027] The pressure roller 22 and the fixing belt 21 are configured to be 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 configured to be fixed and the other may be configured to 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 configured to move so that the pressure roller 22 and the fixing belt 21 contact and separate each other.

[0028] The halogen heater 23 is a heater disposed inside a loop of the fixing belt 21 and emitting infrared light including far infrared light or near infrared light, and radiant heat from the halogen heater 23 heats the fixing belt 21 from the inside. Alternatively, instead of the halogen heater 23, a carbon heater, a ceramic heater or the

like may be employed as the heater. In the present embodiment, only one halogen heater 23 is disposed in the loop of the fixing belt 21, but a plurality of halogen heaters 23 having different heat-generating areas may be used according to the width of the sheet.

[0029] The nip formation member 24 sandwiches the fixing belt 21 together with the pressure roller 22, to form the fixing nip N. Specifically, the nip formation member 24 is disposed inside the loop of the fixing belt 21 and has a planar nip formation portion 241 that is in contact with an inner circumferential surface of the fixing belt 21 and an elongated portion 242, which is described in detail below, extending upstream from the nip formation portion 241 (the fixing nip) in the direction B of rotation of the fixing belt 21. 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 form the fixing nip N between the pressure roller 22 and the fixing belt 21.

[0030] The nip formation member 24 has a bent portion 243 bent from a downstream end of the nip formation portion 241 in the direction B of rotation of the fixing belt 21 to the side opposite to the pressure roller 22. The upstream side of the elongated portion 242 in the direction B of rotation of the fixing belt 21 is configured to have a rounded surface. The rounded upstream portion of the elongated portion 242 prevents damage to the inner circumferential surface of the fixing belt 21 caused by sliding between the upstream portion of the elongated portion 242 and the inner circumferential surface of the fixing belt 21. In addition, the nip formation member 24 has a bent portion 244 continuously bent from an upstream end of the rounded upstream portion of the elongated portion 242 to the opposite side to the pressure roller 22.

[0031] A nip formation surface 241a on the nip formation portion 241 facing the fixing belt 21 directly contacts the inner circumferential surface of the fixing belt 21. Therefore, when the fixing belt 21 rotates, the fixing belt 21 slides along the nip formation surface 241a. In order to improve the abrasion resistance and the slidability of the nip formation surface 241a, the nip formation surface 241a may be treated with alumite or coated with fluororesin material. Additionally, a lubricant such as a fluorine-based grease may be applied to the nip formation surface 241a to ensure slidability over time. In the present embodiment, the nip formation surface 241a is planar. Alternatively, the nip formation surface 241a may define a recess or other shape. For example, the nip formation surface 241a 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.

[0032] The nip formation member 24 is made of a material having a large thermal conductivity such as 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 con-

ductivity 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.

[0033] The stay 25 is attached to a rear side surface of the nip formation member 24 via the reflector 26 and supports the nip formation member 24 against the pressure of the pressure roller 22. Similar to the nip formation member 24, the stay 25 extends in the width direction of the fixing belt 21 inside the loop of the fixing belt 21. In the present embodiment, the stay 25 has a U-shaped cross-section including a pair of vertical wall portions 25a and a bottom wall portion 25b that connects the pair of vertical wall portions 25a.

[0034] The pair of vertical wall portions 25a of the stay 25 supports both ends of the nip formation member 24 in the direction B of rotation of the fixing belt 21. The vertical wall portions 25a extending in a direction in which the pressure roller 22 presses against the nip formation member 24 that is a vertical direction in FIG. 2 strengthens the rigidity of the stay 25 in the direction in which the pressure roller 22 presses against the nip formation member 24 and reduces the bend of the nip formation member 24 caused by the pressing force of the pressure roller 22. Such a configuration results in a uniform width of the nip 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.

[0035] The reflector 26 is disposed opposite the halogen heater 23 inside the loop of the fixing belt 21 to reflect the 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. Each bent portion 26b of the reflector 26 is sandwiched between each vertical wall portion 25a of the stay 25 and the nip formation portion 241 of the nip formation member 24 to hold the reflector 26.

[0036] An opening of an ellipse concave surface of the reflector portion 26a is arranged to face the nip formation member 24 to reflect the radiant heat from the halogen heater 23 toward the nip formation member 24. That is, 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 portion 26a. Therefore, the nip formation member 24 is effectively heated.

[0037] Since the reflector portion 26a is interposed between the halogen heater 23 and the stay 25, the reflector portion 26a functions to block the radiant heat from the halogen heater 23 to the stay 25. This function reduces wasteful energy use to heat the stay 25. In other words, the radiant heat from the halogen heater 23 is applied to the space surrounded by the reflector 26 and the nip formation portion 241 and is blocked from parts disposed outside the space, such as 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 portion 26a blocks heat transfer to the stay 25.

[0038] The surface of the reflector portion 26a 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 used in the present embodiment 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.

[0039] 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 function 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.

[0040] The temperature sensor 28 is disposed outside the loop of the fixing belt 21 and detects a temperature of the fixing belt 21. In the present embodiment, the temperature sensors 28 are disposed at two positions, the central position in the width direction of the fixing belt 21, and one end position in the belt width direction of the fixing belt 21. Output of the halogen heater 23 is controlled based on the temperature of the outer circumferential surface of the fixing belt 21 detected by the temperature sensor 28. Thus, the temperature of the fixing belt 21 is adjusted to a desired 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.

[0041] As illustrated in FIGS. 3 and 4, the halogen heater 23, the nip formation member 24, the stay 25, and the reflector 26 are disposed across the fixing belt 21 in a width direction of the fixing belt 21 that is a lateral direction in FIG. 4, and this direction is hereinafter referred to as

a lateral direction of each part, for example, the lateral direction of the halogen heater 23.

[0042] A pair of belt holders 30 is inserted into both lateral ends of the fixing belt 21 in the axial direction of the fixing belt 21 to rotatably support the fixing belt 21. As described above, the belt holders 30 inserted into the inner periphery 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.

[0043] 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 face of the fixing belt 21 to stop a movement of the fixing belt 21 in the width direction, that is, walking of the fixing belt 21 in the width direction. The supporter 30a may have a cylindrical shape which is continuous over its entire circumference. As illustrated in FIG. 4, each of the belt holders 30 is fixed on a pair of side plates 31 that are frames of the fixing device 5. The belt holder 30 has an opening, and both ends of the halogen heater 23 and the reflector 26 are fixed to the side plates 31 through the openings. The halogen heater 23 and the reflector 26 may be fixed to the belt holder 30.

[0044] Next, descriptions are given of a heating distribution (a light emission amount distribution) of the halogen heater 23 in the longitudinal direction and a shape of the elongated portion of the nip formation member 24 corresponding to the heating distribution below in detail.

[0045] Part A of FIG. 5 is a graph illustrating the heating distribution in the longitudinal direction of the halogen heater 23, the horizontal axis represents positions in the longitudinal direction of the halogen heater 23, and the vertical axis represents heat generation amounts (light emission amounts) of the halogen heater 23. As illustrated in part A of FIG. 5, the halogen heater 23 generates a large amount of heat at a central portion in the longitudinal direction and a relatively small amount of heat at end portions and has a low heat generation areas 23a having a low watt density at the end portions. Specifically, at the end portion in the longitudinal direction of the halogen heater 23, the heat generation amount gradually decreases toward the end of the halogen heater 23. The low heat generation area 23a partially overlaps a sheet conveyance span of the sheet P having the maximum width H and passed through the fixing device, and the temperature of the fixing belt 21 is unlikely to increase at an end portion corresponding to an end portion of the sheet P having the maximum width H.

[0046] As illustrated in part B of FIG. 5, in the present embodiment, the elongated portion 242 of the nip formation member 24 has longest parts 242a having the maximum length and disposed at both end portions in the longitudinal direction. Specifically, the elongated portion 242 has a flat surface area having a substantially uniform length L1 at a central portion in the longitudinal direction and the longest part 242a having a length L2 at each end

portion in the longitudinal direction ($L2 > L1$). A tapered surface area connects between the longest part 242a and the flat surface area at the central portion in the longitudinal direction. In the longitudinal direction, the longest part 242a partially overlaps the sheet conveyance span of the sheet P having the maximum width H.

[0047] As illustrated in FIG. 2, in the present embodiment, since the nip formation member 24 has the elongated portion 242, the nip formation member 24 can contact the fixing belt 21 at an upstream position from the fixing nip N in the direction B of rotation of the fixing belt. Accordingly, the nip formation member 24 can preheat the fixing belt 21 at the upstream position from the fixing nip N.

[0048] In particular, in the present embodiment, setting the length of the elongated portion 242 based on the heating distribution of the halogen heater 23 enables the halogen heater 23 to efficiently heat the fixing belt 21. That is, since the amount of heat generated at the end portion in the longitudinal direction by the halogen heater 23 is smaller than the amount of heat generated at the central portion, based on the smaller amount of heat, the length of the elongated portion 242 at the end portion in the longitudinal direction is made longer than the length of the elongated portion 242 at the central portion. Specifically, the elongated portion 242 has the longest part 242a at a position corresponding to the low heat generation area 23a in which the heat generation amount of the halogen heater 23 is small. The above-described structure can give a long preheating time at the end portion in the width direction of the fixing belt 21 in which raising the temperature of the fixing belt 21 is difficult and sufficiently heat the entire width of the fixing belt 21 to raise the temperature of the fixing belt 21 to a target fixing temperature. As a result, the above-described structure can reduce temperature unevenness in the fixing nip N of the fixing belt 21 and prevent an occurrence of a fixing failure. Additionally, the above-described structure can shorten the warm-up time when the fixing device 5 starts operation and save energy of the fixing device 5.

[0049] In addition, the tapered surface connecting between the central portion of the elongated portion 242 and the end portion of the elongated portion 242 in the longitudinal direction enables the length of the elongated portion 242 to increase based on decrease of the heat generation amount of the halogen heater 23 in the longitudinal direction, which can efficiently reduce the temperature unevenness of the fixing belt 21.

[0050] The longest part 242a arranged outside the sheet conveyance span of the sheet P having the maximum width H and along the longitudinal direction can sufficiently preheat an area of the fixing belt 21 in which the temperature of the fixing belt 21 easily drops.

[0051] With reference to FIGS. 6A to 6C, variations of the shape of the elongated portion 242 are described.

[0052] As illustrated in FIG. 6A, the elongated portion 242 may have a curved upstream edge having lengths that increase from a central position indicated by an al-

ternate long and short dash line C in FIGS. 6A to 6C to the longest part 242a at the end portion in the longitudinal direction. Alternatively, as illustrated in FIG. 6B, the upstream edge of the elongated portion 242 may be a tapered shape connecting between the central position in the longitudinal direction of the elongated portion 242 and the longest part 242a at the end portion of the elongated portion 242. For example, in a configuration that is different from the above-described embodiment and has a heating distribution of the heater gradually decreasing from the central position to the end portion in the longitudinal direction, the elongated portion 242 as illustrated in FIGS. 6A and 6B described above can reduce heating unevenness in the width direction of the fixing belt 21 and efficiently reduce the temperature unevenness of the fixing belt 21. As described above, the shape of the elongated portion 242 may be appropriately selected in accordance with the heating distribution of the heater in the longitudinal direction.

[0053] Moreover, as illustrated in FIG. 6C, the length of the elongated portion 242 may be increased step by step from the central position to the end portion in the longitudinal direction, that is, $L2 > L3 > L1$. The above-described configuration of the elongated portion 242 allows setting the lengths of the elongated portion, for example, corresponding to various widths of the sheets passed through the fixing device 5, in particular, widths of the sheets frequently used in the fixing device 5.

[0054] The longest part 242a may be partially overlapped with the sheet conveyance span of the sheet P having the maximum width H as illustrated in part B of FIG. 5, or, as illustrated in FIG. 6B, disposed outside the sheet conveyance span of the sheet P having the maximum width H. As described above, the length and shape of the elongated portion 242 and the range of the longest part 242a may be appropriately selected in consideration of the heating distribution of the halogen heater 23, the temperature drop of the fixing belt 21, and the like.

[0055] The present disclosure is not limited to the details of the embodiments described above and various modifications and improvements are possible.

[0056] The image forming apparatus according to the present embodiment of the present disclosure is applicable not only to a monochrome image forming apparatus illustrated in FIG. 1 but also to a color image forming apparatus, a copier, a printer, a facsimile machine, or a multifunction peripheral including at least two functions of the copier, printer, and facsimile machine.

[0057] The sheets P serving as recording media may be thick paper, postcards, envelopes, plain paper, thin paper, coated paper, art paper, tracing paper, overhead projector (OHP) transparencies, plastic film, prepreg, copper foil, and the like.

[0058] In the embodiment described above, the length of the elongated portion at the end portion in the longitudinal direction is set to be longer than the length of the elongated portion at the central portion in the longitudinal direction, but, for example, when increasing the amount

of heat added to the central portion of the fixing belt is desired, the length of the elongated portion at the central portion in the longitudinal direction may be set to be longer than the length of the elongated portion at the end portion in the longitudinal direction.

[0059] The present disclosure is not limited to the above-described embodiments, and the configuration of the present embodiment can be appropriately modified other than suggested in each of the above embodiments within the scope of the technological concept of the present disclosure. In addition, the positions, the shapes, and the number of components are not limited to the disclosed embodiments, and they may be modified suitably in implementing the present disclosure.

Claims

1. A fixing device (5) comprising:

a rotatable endless fixing belt (21);
 a pressing member (22) configured to press the fixing belt (21);
 a heater (23) disposed inside a loop of the fixing belt (21) and configured to heat the fixing belt (21), the heater (23) having, in a longitudinal direction of the heater (23), a low heat generation area (23a) that generates a smaller amount of heat than another area of the heater (23); and
 a nip formation member (24) disposed inside the loop of the fixing belt (21) and configured to come into contact with the pressing member (22) via the fixing belt (21) to form a fixing nip, the nip formation member (24) having an elongated portion (242) that extends upstream from the fixing nip in a rotation direction of the fixing belt (21),
 the elongated portion (242) having a longest part (242a) positioned corresponding to the low heat generation area in the longitudinal direction.

2. The fixing device (5) according to claim 1, wherein, in a longitudinal direction of the nip formation member (24), a length at an end portion of the elongated portion (242) in the rotation direction is greater than a length at a central portion of the elongated portion (242) in the rotation direction.
3. The fixing device (5) according to claim 1 or 2, wherein, in a longitudinal direction of the nip formation member (24), the longest part (242a) is disposed outside a sheet conveyance span of a recording medium having a maximum width among recording media used in the fixing device (5).
4. The fixing device (5) according to any one of claims 1 to 3, wherein the elongated portion (242) has a rounded

surface at an upstream end in the rotation direction.

5. An image forming apparatus (1) comprising the fixing device (5) according to any one of claims 1 to 4.

FIG. 1

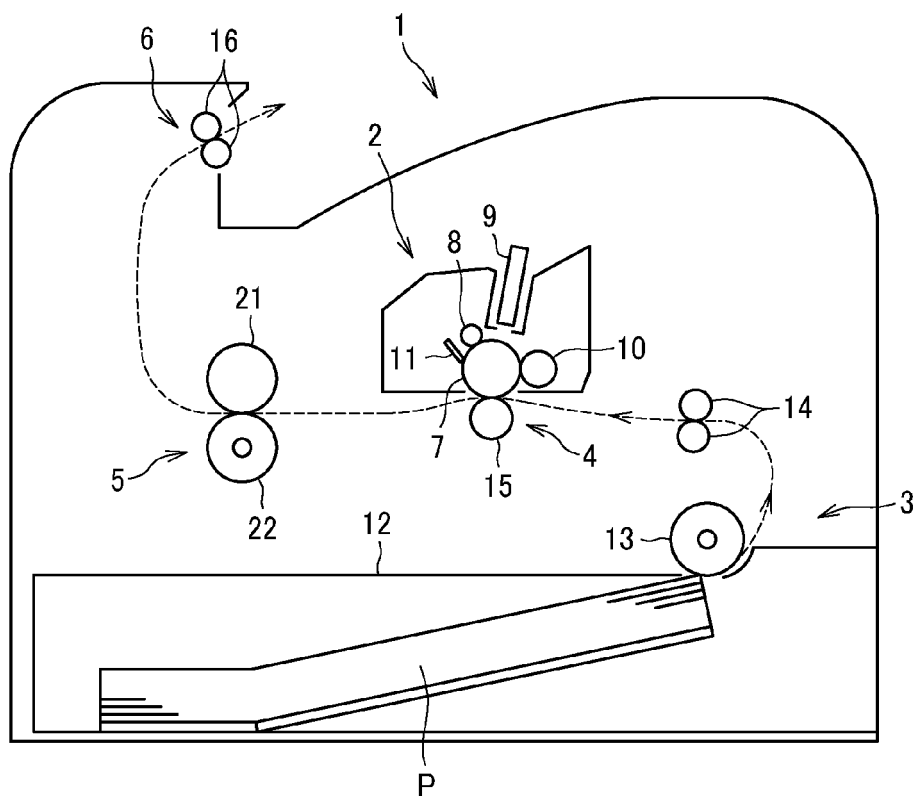


FIG. 2

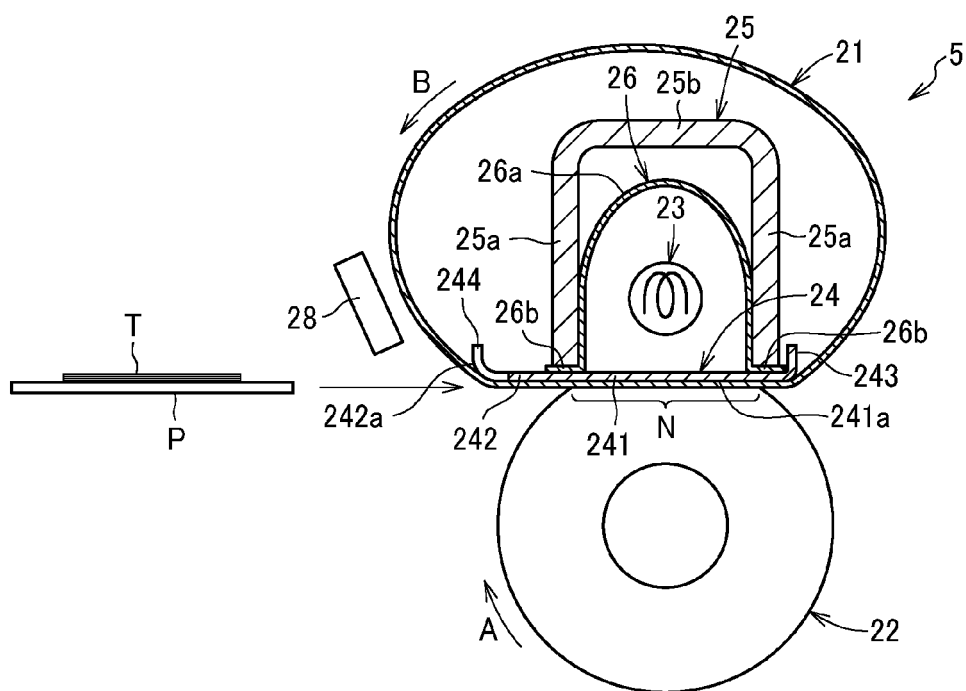


FIG. 3

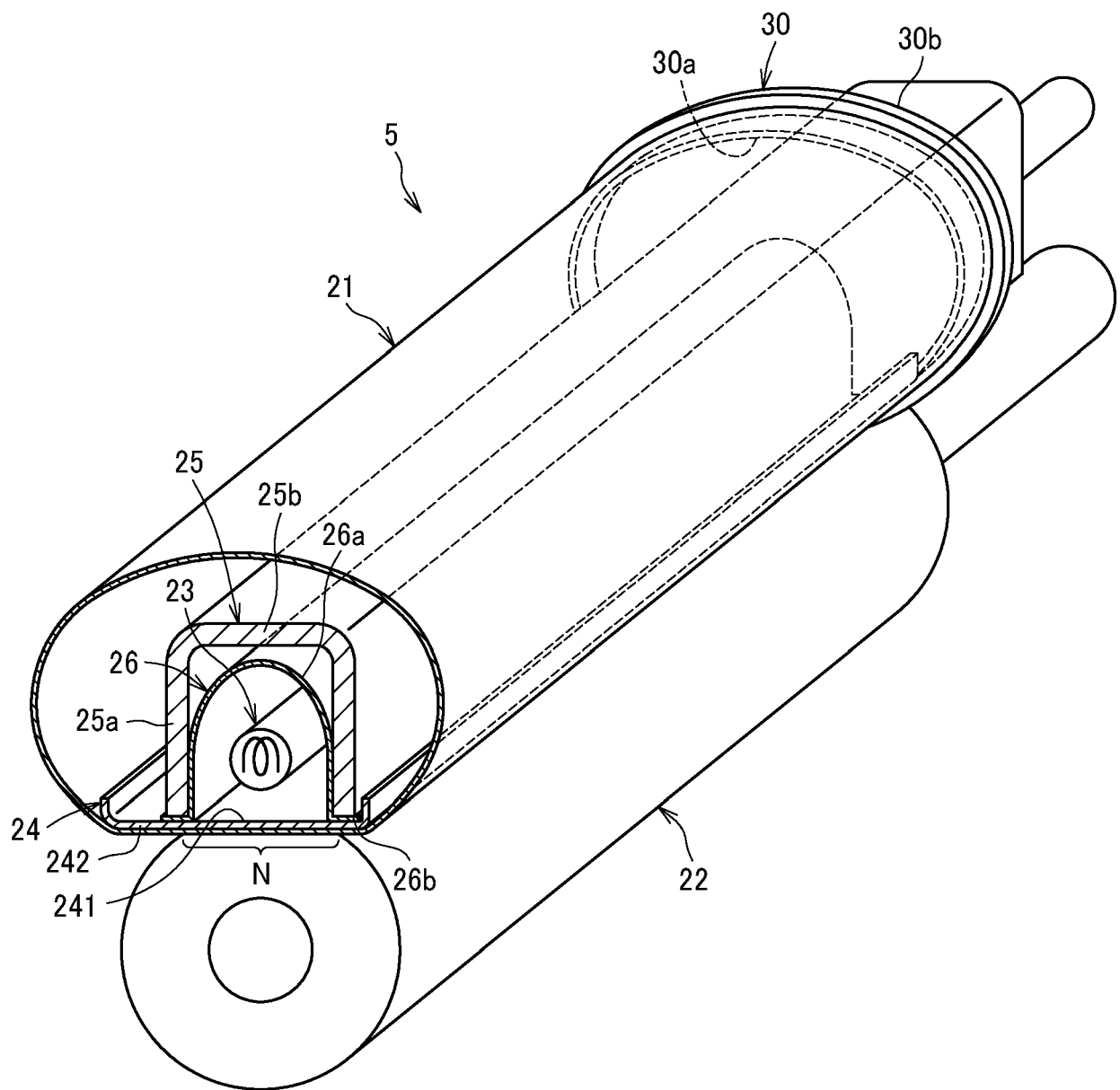


FIG. 4

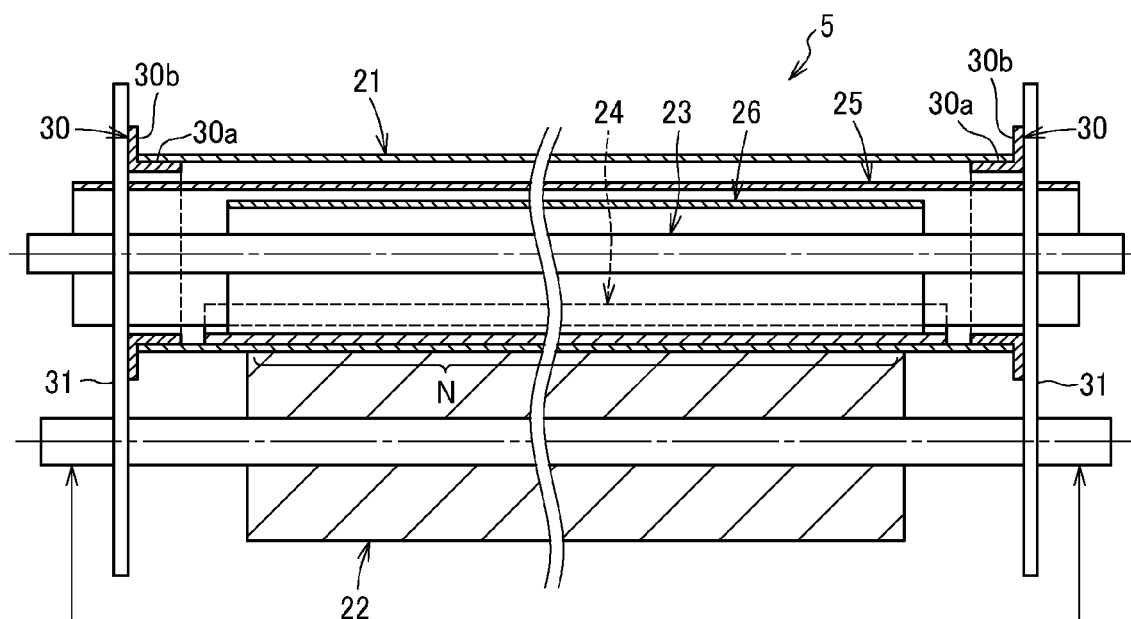


FIG. 5

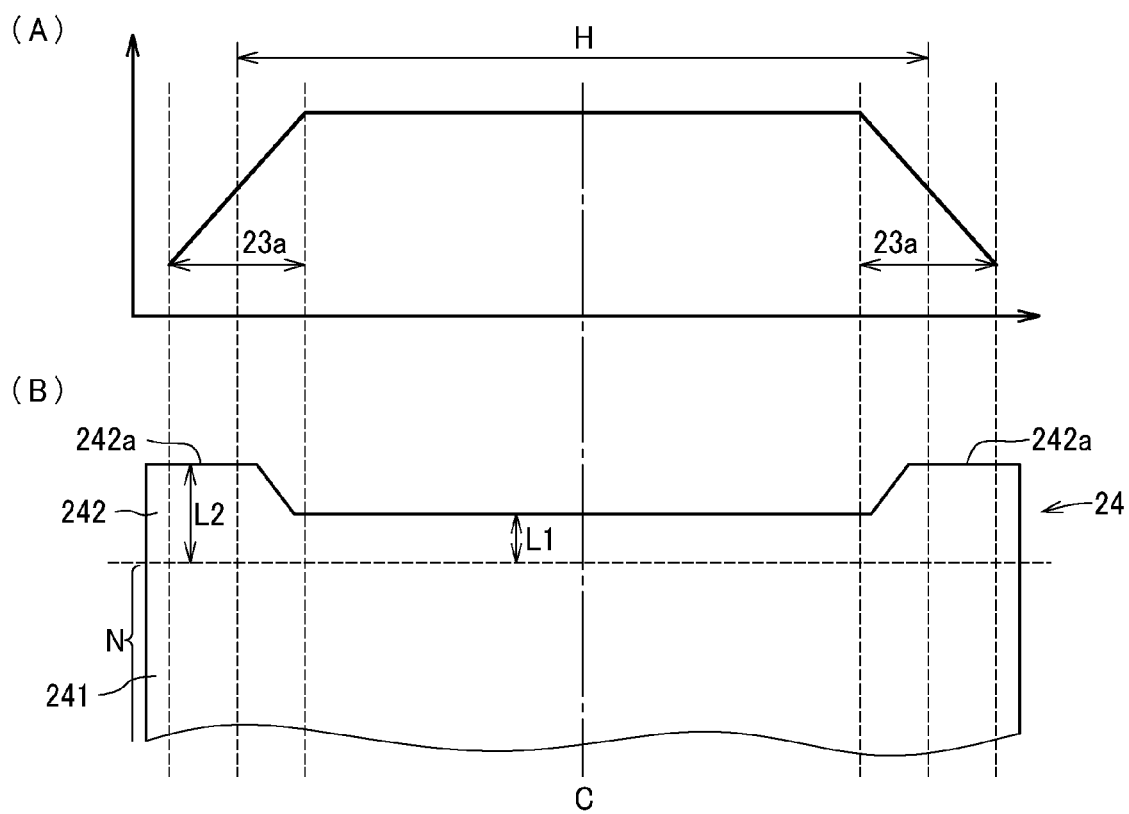


FIG. 6A

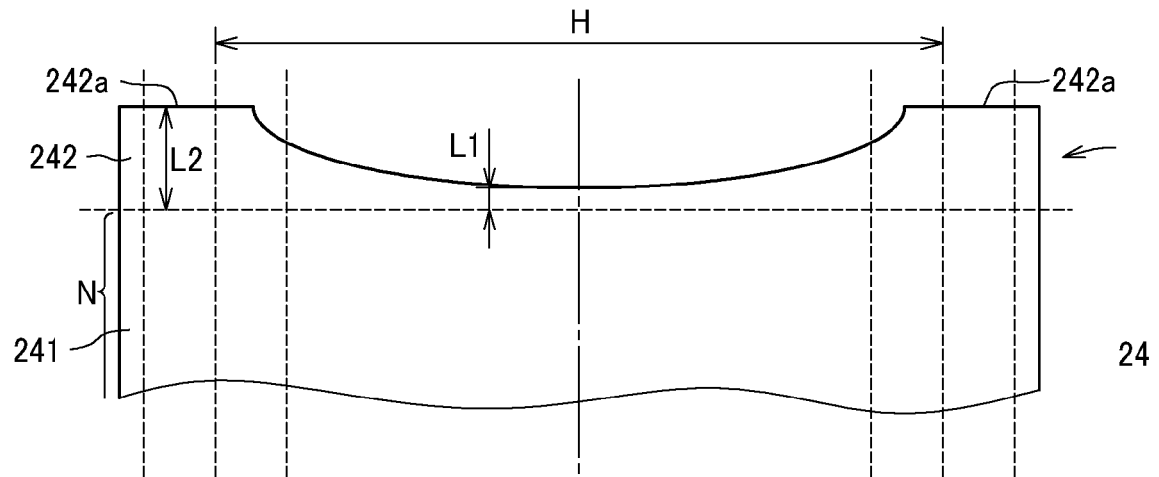


FIG. 6B

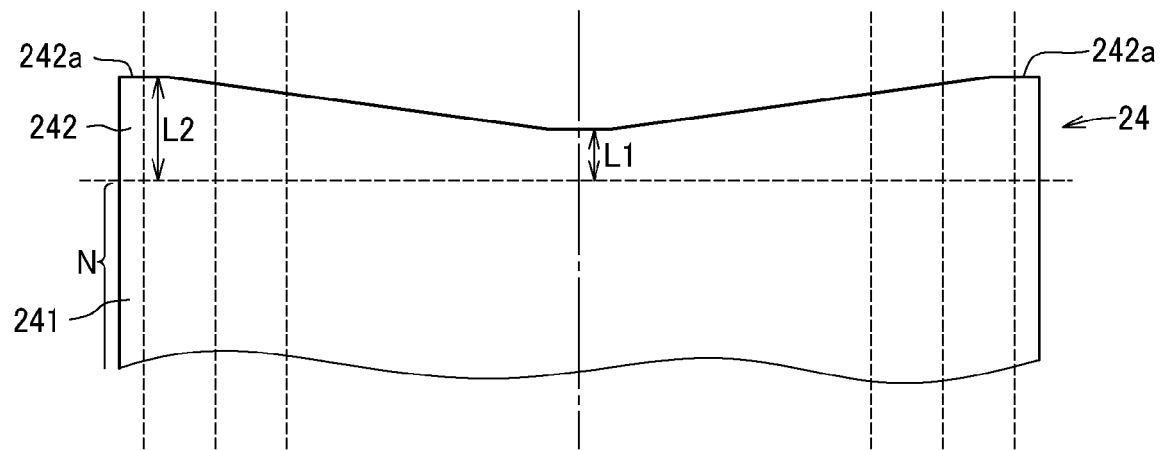


FIG. 6C

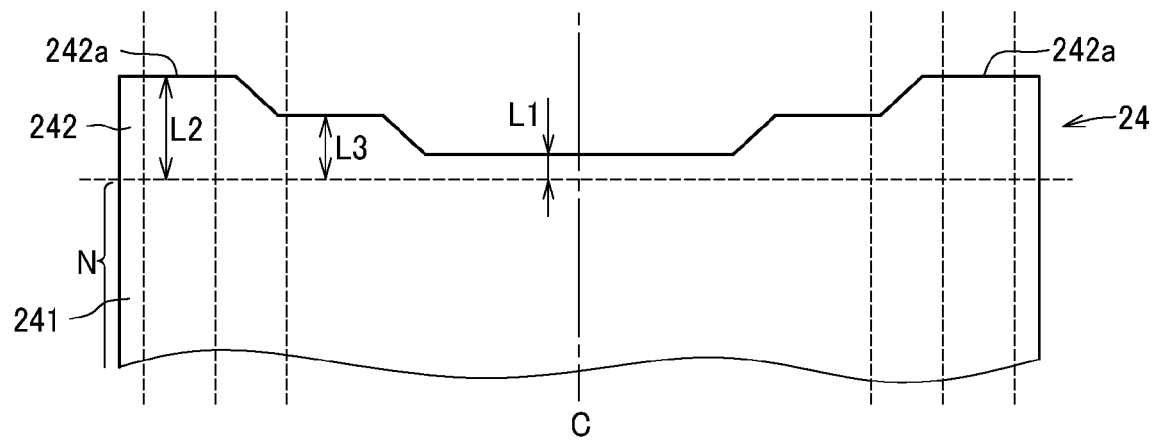
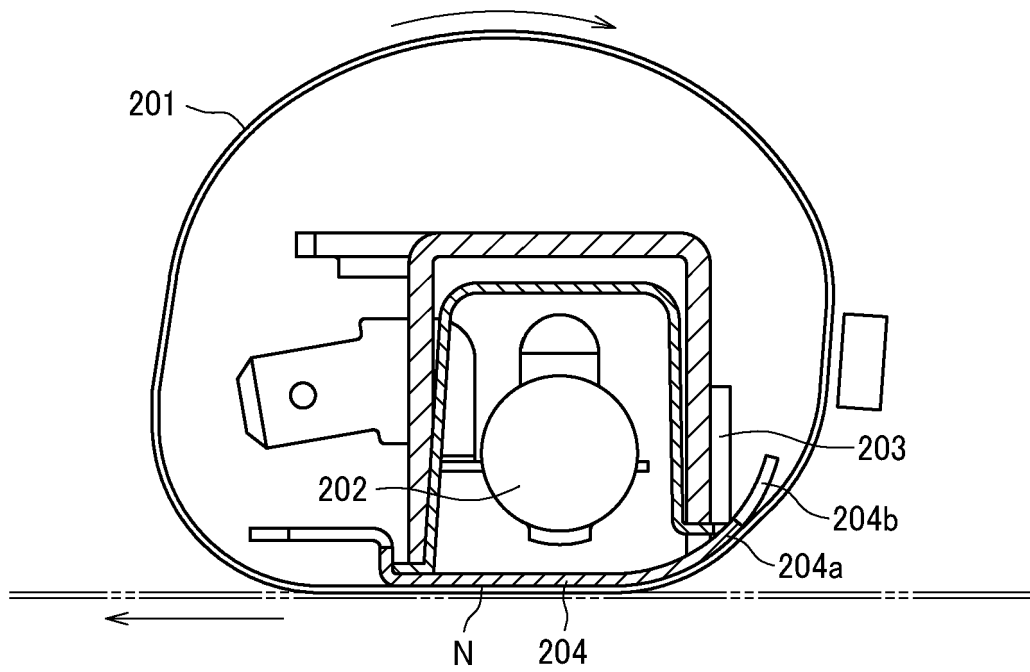


FIG. 7





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Munich		18 June 2020	Billmann, Frank
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