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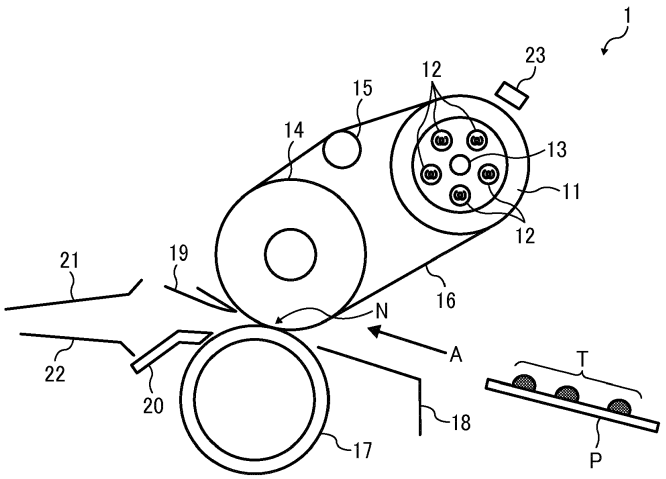
(54) FIXING DEVICE AND IMAGE FORMING APPARATUS

(57) A fixing device (1, 1A) includes a cylindrical heat roller (11); a plurality of heaters (12) disposed inside the heat roller (11), extending along a longitudinal axis of the heat roller (11); and a heat adjuster (13, 13a, 13b), disposed among the plurality of heaters (12), to adjust heat from one to another of the plurality of heaters (12). An image forming apparatus (200) includes an image forming section (200A) to form an image on a recording medium (P); and the fixing device (1) as described above, to fix the image onto the recording medium (P).

FIG. 1



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Description

BACKGROUND

Technical Field

[0001] The present invention relates to a fixing device and an image forming apparatus including the same.

Background Art

[0002] In a fixing device employed in an image forming apparatus, a heat roller fixing system or belt fixing system is one way to fix a toner image to a recording medium such as a sheet of paper or the like.

[0003] In the heat roller fixing system, a fixing roller incorporating a heating device, such as an infrared heater, and a pressure roller that presses against the fixing roller form a nip portion, the recording medium carrying an unfixed toner image thereon is sandwiched by and conveyed through the nip portion, is heated and pressed, and the unfixed toner image is fixed onto the recording medium.

[0004] In the belt fixing system, an endless fixing belt is stretched around the heat roller that incorporates the infrared heater, and the fixing roller; a nip portion is formed by a pressure roller and the fixing belt; and the recording medium carrying an unfixed toner image is sandwiched and conveyed in the nip portion and is heated and pressed, to thereby fix the unfixed toner image thereon.

[0005] In such a fixing device, slow speed of the conveyed recording medium and/or thickness of the recording medium may increase the amount of heat absorbed from the fixing belt or the fixing roller, which is undesirable. To cope with such a phenomenon, a plurality of heating devices is disposed inside the heat roller to stabilize a temperature of the fixing belt or the fixing roller (see, for example, JP-H08-234605-A and JP-2005-202202-A). With such an arrangement, the plurality of heating devices affect each other as well, so that the temperature of the heating device exceeds its rated temperature, thereby degrading the heating device. For example, as illustrated in FIG. 2 of JP-H08-234605A, a portion of a heater 2 opposed to other heaters 3, 4, and 5 is heated by its own heat as well as the other three heaters, so that the temperature of the heater 2 may exceed the rated temperature. As the number of heating devices increases, the risk of such excess heating also increases, and the temperature of the device may exceed the rated temperature more often.

[0006] In view of the above problem, the present invention aims to provide a fixing device capable of preventing degradation of the heating device due to an excess of heat, even though a plurality of heating devices is employed.

SUMMARY

[0007] In one embodiment of the disclosure, provided is an optimal fixing device including a cylindrical heat roller; a plurality of heaters disposed inside the heat roller, extending along a longitudinal axis of the heat roller; and a heat adjuster, disposed among the plurality of heaters, to adjust heat from one to another of the plurality of heaters.

[0008] In another embodiment of the disclosure, provided is an image forming apparatus including an image forming section to form an image on a recording medium; and the fixing device as described above, to fix the image onto the recording medium.

[0009] According to the present invention, the heat adjuster is disposed to adjust heat from one to another of the plurality of heat rollers, thus preventing degradation of the heat roller due to an excess of heat even though the plurality of heat rollers is employed.

[0010] These and other objects, features, and advantages of the present invention will become apparent upon consideration of the following description of the preferred embodiments of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

FIG. 1 schematically illustrates a fixing device according to a first embodiment of the present invention;

FIG. 2 is an enlarged view of a heat roller including a heat adjuster as illustrated in FIG. 1;

FIG. 3 is another example of the heat adjuster as illustrated in FIG. 2;

FIG. 4 is further another example of the heat adjuster as illustrated in FIG. 2;

FIG. 5 schematically illustrates a fixing device according to a second embodiment of the present invention;

FIG. 6 schematically illustrates a heat adjuster of a fixing device according to a third embodiment of the present invention; and

FIG. 7 schematically illustrates an image forming apparatus according to a fourth embodiment of the present invention.

DETAILED DESCRIPTION

[0012] In describing exemplary 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 operate in a similar manner and achieve a similar result.

[0013] Referring now to the drawings, wherein like ref-

erence numerals designate identical or corresponding parts throughout the several views, in particular to FIG. 1, an image forming apparatus 1 according to an exemplary embodiment of the present disclosure is explained.

[0014] It is to be noted that, in the drawings for explaining exemplary embodiments of this disclosure, identical reference numerals are assigned, as long as discrimination is possible, to components such as members and component parts having an identical function or shape, thus omitting description thereof once it is provided.

(First Embodiment)

[0015] A fixing device 1 according to a first embodiment of the present invention will be described with reference to FIGS. 1 to 4.

[0016] FIG. 1 is a general configuration of the fixing device 1. As illustrated in FIG. 1, the fixing device 1 includes a heat roller 11, a plurality of infrared heaters 12 (which may be collectively referred to as the infrared heater 12), a heat adjuster 13, a fixing roller 14, a tension roller 15, a fixing belt 16, a pressure roller 17, an inlet guide 18, a separation plate 19, a stripper finger 20, an upper outlet guide 21, a lower outlet guide 22, and a temperature sensor 23.

[0017] The heat roller 11 serves to heat the fixing roller 14. The heat roller 11 is a cylindrical, hollow roller formed of aluminum or iron. The heat roller 11 and the fixing roller 14 are disposed opposite with a space therebetween, such that each axis thereof is parallel to the other. A plurality of infrared heaters 12 and the heat adjuster 13 are disposed inside the heat roller 11. Thus, the heat roller 11 serves as a rotatable cylindrical heating device, and accommodates heating means (here, the infrared heaters 12) and the heat adjuster 13 therein.

[0018] FIG. 2 is an enlarged view of the heat roller 11. As illustrated in FIG. 2, a total of five infrared heaters 12a, 12b, 12c, 12d, and 12e, referred to collectively as the infrared heater 12, are disposed inside the heat roller 11. The heat adjuster 13 is disposed inside the heat roller 11.

[0019] The infrared heater 12 is a known heating device, has a cylindrical shape, and is formed to extend along the longitudinal axis of the heat roller 11. The five infrared heaters 12a, 12b, 12c, 12d, and 12e are disposed around an internal circumference of the heat roller 11, that is, in a predetermined circle, such that adjacent heaters are disposed with an equal interval between adjacent heaters when viewed in cross-section. The number of infrared heaters 12 is five in the present embodiment; however, the number of heaters is not limited to five although number cannot be less than 2, so long as all infrared heaters can be disposed inside the heat roller 11.

[0020] More specifically, each heater 12 is rated at 1,000 watts. When all of five heaters are lit during printing, the maximum total watt number becomes 5,000 watts. Because the heater fuses at around or more of the above maximum watt number, the heat adjuster 13 disposed in the center of the plural heaters is necessary.

[0021] In the present embodiment, the interval between adjacent heaters is 3.75 mm. The heat adjuster 13 in the form of a dummy heater glass tube includes a bossy surface due to molding process, so that the heat adjuster 13 positions slightly offset from a rigid center relative to each of the heaters 12.In addition, the infrared heater 12 is used as a heating device in the present embodiment; however, alternatively, a halogen heater or any other heating device may be used. Further, the heating device is not limited to the cylindrical shape, but may be a rectangular shape in cross-section. In short, so long as the heating device is disposed to extend along the longitudinal axis of the heat roller 11, the shape is not limited in particular.

[0022] The heat adjuster 13 is made of glass, has a cylindrical shape, and extends in the longitudinal axis of the heat roller 11. Specifically, the heat adjuster 13 is a hollow tube. Air or a gas such as nitrogen is sealed inside the tube. The heat adjuster 13 is disposed at an internal central portion of the heat roller 11. More specifically, the heat adjuster 13 is disposed equidistant from each of the infrared heaters 12a, 12b, 12c, 12d, and 12e.

[0023] Lateral ends of each of the infrared heaters 12 and the heat adjuster 13 are secured to, for example, a metal plate. The both lateral ends or one end of the infrared heater 12 are connected to a power line and the electricity is supplied to the infrared heater 12.

[0024] The heat adjuster 13, being a non-heat generating member, does not itself generate heat, but instead absorbs the heat the infrared heater 12 disposed therearound generates. Then, the heat absorbed by the heat adjuster 13 is cooled/discharged by thermal conduction from both lateral ends. As a result, for example, the infrared heater 12a may be directly heated by adjacent infrared heaters 12b and 12e; however, direct heat to the infrared heater 12a from the infrared heaters 12c and 12d disposed opposite with the heat adjuster 13 sandwiched in between, can be reduced. As a result, possibility to exceed the rated temperature or the heat-resistant temperature can be reduced. Specifically, the heat adjuster 13 disposed among the plurality of infrared heaters 12, absorbs heat from the infrared heaters 12, to thereby prevent excessive heating of the infrared heater 12 by the other infrared heaters 12. The plurality of infrared heaters 12 and the heat adjuster 13 need not always be disposed in alignment, but may be disposed such that the heat from one of the infrared heaters 12 can be blocked by at least part of the heat adjuster 13 as illustrated in FIG. 2.

[0025] In addition, although the temperature inside the heat roller 11 is different based on the output or number of infrared heaters 12, it may increase up to approximately 900 degrees C. As a result, the heat adjuster 13 may preferably be formed of quartz glass that does not blacken at 900 degrees C and does not expand due to heat. However, the heat adjuster 13 may be formed of other

glass materials or heat-resistant materials that do not blacken at such a temperature and do not expand due to heat, considering the temperature inside the heat roller 11. Other examples of glass materials include, for example, Neoseram (registered trademark), Pyrex (registered trademark), and the like. So long as the heat conductivity is low and the excessive temperature rise of the heat adjuster 13 can be suppressed, the material is not limited to glass, and other heat-resistant materials such as ceramic can be employed.

[0026] As illustrated in FIG. 2, the diameter of the heat adjuster 13 is smaller than that of the infrared heater 12; however, alternatively the diameter may be the same or larger than that of the infrared heater 12. Further, the cross-sectional shape of the heat adjuster 13 may be polygonal, and is not limited to a circular shape. For example, because five infrared heaters 12 are disposed in the present embodiment, the cross section of the heat adjuster may be hexagonal and the infrared heaters 12 may be disposed opposite each line or each point of the hexagonal shape of the heat adjuster 13. The heat adjuster 13 having a diameter of 6 mm (φ6) according to the present embodiment is spaced away from the glass tube surface of each of the five infrared heaters 12 by approximately four to five millimeters (4 mm $\leq$ 5 mm).

[0027] The fixing roller 14 is a cylindrical roller including a metal core that is formed of, for example, aluminum or iron; and an elastic layer formed of silicone rubber and disposed around the circumference of the metal core. The elastic layer may employ foamed silicone rubber so that the heat from the fixing belt 16 is not absorbed by the elastic layer and the warm-up time period can be reduced. In addition, the fixing roller 14 is driven to rotate by a drive unit or a cylindrical rotary member formed of a motor, gears, and the like.

[0028] The tension roller 15 is a cylindrical roller, designed to apply an appropriate tension to the fixing belt 16. Due to this appropriate tension serving as a frictional force, an internal circumference of the fixing belt 16, the heat roller 11, and an outer circumference of the fixing roller 14 are so fitted not to cause slipping.

[0029] The fixing belt 16 is an endless belt member stretched between the heat roller 11 and the fixing roller 14. The fixing belt 16 has a three-layer structure in cross-section, and includes a base formed such as nickel, stainless steel, polyimide, and the like; an elastic layer formed of silicone rubber; and a PFA (tetrafluoroethylene-perfluoroalkoxyethylene copolymer) layer disposed on the circumference of the silicone rubber layer. The fixing belt 16 is stretched around the heat roller 11 and the fixing roller 14 with a constant tension. As described above, the tension roller 15 applies such a tension to the fixing belt 16 that does not cause a slip among the inner circumferential surface of the fixing belt 16, the heat roller 11, and the outer circumferential surface of the fixing roller 14. When the fixing roller 14 is driven to rotate, the fixing belt 16 rotates and causes the heat roller 11, a driven roller, to rotate.

[0030] The pressure roller 17 is a roller to press the fixing roller 14. The pressure roller 17 is a cylindrical roller including a metal core that is formed of, for example, aluminum or iron; and an elastic layer formed of silicone rubber and disposed around the circumference of the metal core. The pressure roller 17 is rotatably disposed, and the outer circumferential surface of the pressure roller 17 is pressed against the fixing roller 14 via the fixing belt 16, to thereby pressurize the fixing roller 14. A portion pressed by the fixing roller 14 and the pressure roller 17 via the fixing belt 16 is a so-called nip portion N. Specifically, the pressure roller 17 serves as a pressing member, and the fixing roller 14 serves as a fixing member.

[0031] The inlet guide 18 is a platelet member to guide the sheet P serving as a recording medium on which an unfixed toner image T is formed, to the nip portion N, in a direction indicated by an arrow A.

[0032] The separation plate 19 serves to prevent the sheet P from winding around the fixing belt 16 or to separate the sheet P from the fixing belt 16. The stripper finger 20 serves to prevent the sheet P from winding around the pressure roller 17 or to separate the sheet P from the pressure roller 17.

[0033] The upper outlet guide 21 is a platelet member to guide the sheet P on which the toner image T has been fixed in the nip portion N, to a sheet ejection tray, and the like. The lower outlet guide 22 is a platelet member to guide the sheet P on which the toner image T has been fixed in the nip portion N, to a sheet ejection tray, and the like. The upper outlet guide 21 and the lower outlet guide 22 pass the sheet P in between to guide it to the sheet ejection tray, and the like.

[0034] The temperature sensor 23 is disposed near an outer surface of the fixing belt 16. The temperature sensor 23 senses a surface temperature of the fixing belt 16. The sensed temperature is used for controlling the infrared heater 12.

[0035] In the thus-configured fixing device 1, the surface temperature of the fixing belt 16 is sensed by the temperature sensor 23, and the infrared heater 12 is controlled such that the surface temperature of the fixing belt 16 is set to a predetermined set temperature based on the sensed temperature of the fixing belt 16. The above control is performed by controlling ON/OFF of the infrared heater 12, such that all the infrared heaters 12 are simultaneously turned on or off.

[0036] The fixing belt 16 is heated by the heat roller 11 heated by the infrared heater 12. The heated fixing belt 16 is driven to rotate by a rotary driving of the fixing roller 14.

[0037] The sheet P on which the unfixed toner image T is formed is conveyed to the fixing device 1, and passes through the nip portion N from the inlet guide 18, in which the unfixed toner image T is fused and fixed onto the sheet P. The sheet P is then sent to the sheet ejection tray, and the like, via the upper outlet guide 21 and the lower outlet guide 22.

[0038] The heat adjuster 13 formed of glass is dis-

posed at an internal central portion of the infrared heaters 12, which are disposed around an internal circumference of the heat roller 11 of the fixing device 1. With such a configuration, the heat adjuster 13 can absorb the heat emitted from the infrared heaters 12, reduces direct influence from other infrared heaters 12 disposed opposite each infrared heater 12, and lowers a possibility that the temperature rises exceeding the rated temperature. As a result, degradation of the infrared heaters 12 due to heat can be prevented. Further, shortening of the lifetime of the infrared heaters 12 can be avoided.

[0039] The heat adjuster 13 is disposed equidistant from each of the plurality of infrared heaters 12a, 12b, 12c, 12d, and 12e, so that the temperature inside the heat roller 11 due to the heat emitted from each of the infrared heaters 12, can be even.

[0040] Furthermore, because the heat adjuster 13 is formed of glass with a low thermal conductivity, an excessive temperature rise of the heat adjuster 13 can be suppressed.

[0041] When the heat adjuster 13 is formed of the quartz glass with a very low thermal conductivity, the thermal expansion of the heat adjuster 13 can be suppressed, and even when the diameter of the heat roller 11 is small, the heat adjuster 13 can be disposed in a small space.

[0042] The present fixing device 1 includes a pressure roller 17, a rotary member to press the fixing roller 14 and the fixing belt 16, and the fixing roller 14 and the pressure roller 17 are pressed together via the fixing belt 16, to thereby form a nip portion N at the pressed portion. With such a structure, the fixing device employing the belt fixing system can be formed, thereby enabling to fuse and fix the unfixed toner image T even with a short warm-up time.

[0043] Heretofore, the heat adjuster 13 having a hollow tube has been described; alternatively, however, it may be formed of a solid bar. A heat adjuster 13a as illustrated in FIG. 3 includes a solid bar shape. Even with this configuration, the same effect as that of FIG. 2 can be obtained.

[0044] In the example of FIG. 2, only one heat adjuster 13 is used, but a plurality of heat adjusters 13 may be used. For example, as illustrated in FIG. 4, a plurality of heat adjusters 13 is disposed at a center of the heat roller 11. The number of heat adjusters 13 is not limited to the number as exemplified in FIG. 4. In FIG. 4, three heat adjusters 13 are disposed in contact with each other in a condensed manner; however, the heat adjusters can be adjacently disposed with an equal interval relative to the cross-sectional center of the heat roller 11 and relative to each of the heat adjusters 13.

(Second Embodiment)

[0045] A fixing device 1 according to a second embodiment of the present invention will be described with reference to FIG. 5. The same reference numerals will be applied to a part which is the same as the already explained part in the first embodiment and redundant explanation thereof will be omitted.

[0046] As illustrated in FIG. 5, a heat adjuster 13b is substituted for the heat adjustor 13. The heat adjuster 13b includes a core 13b1 formed of a glass tube as employed in the first embodiment, and a reflection layer 13b2 formed around the circumference of the core 13b1. Specifically, in the present embodiment, the heat adjuster 13 reflects heat from the infrared heaters 12, to thereby prevent excessive heating of one infrared heater 12 by the other infrared heater 12.

[0047] Exemplary materials of the reflection layer 13b2 include gold or silver capable of resist such a high temperature of approximately 900 degrees C and reflecting heat. Depending on the degree of heat-resistant temperature, SUS (Steel Special Use Stainless) or aluminum may be used. The reflection layer 13b2 is formed by coating gold and the like on the glass tube.

[0048] Alternatively, the reflection layer 13b2 may include a concave and convex surface so as to reflect heat to the inner circumferential surface of the heat roller 11. The surface of the reflection layer 13b2 may be configured to diffuse light irregularly. That is, the infrared heater 12 is preferably formed not to be heated by the reflected heat.

[0049] In addition, not limited to forming the reflection layer 13b2, the surface of the glass tube can be subjected to a direct process such as a frosted glass treatment, so that the heat can be diffused. Alternatively, the reflection layer 13b2 may be a hollow tube or a solid tube formed of gold or SUS.

[0050] With such a configuration, the heat adjuster 13b includes the reflection layer 13b2 that reflects heat to the external surface, can reduce direct influence from other infrared heaters 12 disposed at opposed positions, and lowers a possibility that the temperature rises to exceed the rated temperature. As a result, degradation of the infrared heater 12 due to heat can be prevented. Further, shortening of the lifetime of the infrared heaters 12 can be avoided.

[0051] In addition, because the heat is reflected to the inner circumference of the heat roller 11, the heat absorbed by the heat adjuster 13 as illustrated in FIG. 2 can be used to heat the heat roller 11, thereby improving the heating efficiency.

[0052] In the second embodiment, the heat adjuster 13b may be a hollow tube or a solid bar. The cross-sectional shape of the heat adjuster 13b may be polygonal, not limited to a circular shape. The heat adjuster 13b may be formed of a plurality of tubes or bars.

(Third Embodiment)

[0053] A fixing device 1 according to a third embodiment of the present invention will be described with reference to FIG. 6. The same reference numerals will be applied to a part which is the same as the already explained part in the first and second embodiments and

redundant explanation thereof will be omitted.

[0054] As illustrated in FIG. 6, a fixing device 1A according to the third embodiment includes a heat roller 11a, an infrared heater 12, a heat adjuster 13, a pressure roller 17, an inlet guide 18, a separation plate 19, a stripper finger 20, an upper outlet guide 21, a lower outlet guide 22, and a temperature sensor 23. Specifically, the fixing device 1A employs heat roller fixing system.

[0055] In the third embodiment, the infrared heater 12, the heat adjuster 13, the pressure roller 17, the inlet guide 18, the separation plate 19, the stripper finger 20, the upper outlet guide 21, the lower outlet guide 22, and the temperature sensor 23 are similarly configured as those in the first embodiment.

[0056] The heat roller 11a according to the third embodiment is formed of a cylindrical, hollow roller formed of, for example, aluminum or iron, and includes a total of five infrared heaters 12a, 12b, 12c, 12d, and 12e each serving as an infrared heater 12, disposed inside the heat roller 11. The heat adjuster 13 is disposed inside the heat roller 11a. A portion pressed by the pressure roller 17 and press-contacted by the pressure roller 17 is a so-called nip portion N. Notably, the heat roller 11a also serves as the fixing roller 14.

[0057] As illustrated in FIG. 6, the heat adjuster 13 employed in the first embodiment is used; however, the heat adjuster 13 may be substituted by the heat adjuster 13a of FIG. 3 or may be substituted by the heat adjuster 13b as depicted in the second embodiment.

[0058] According to the third embodiment, the pressure roller 17 to press the heat roller 11a is included, and a nip portion is formed by the pressure roller 17 and the heat roller 11a. As configured as above, the heat roller fixing system can be embodied, the fixing device can be miniaturized, and the unfixed toner image T can be fused and fixed.

(Fourth Embodiment)

[0059] A fourth embodiment of the present invention will be described with reference to FIG. 7. The same reference numerals will be applied to a part, which is the same as the already explained part in the first to third embodiments, and redundant explanation thereof will be omitted.

[0060] The present embodiment is an example of image forming apparatus including the fixing device 1 or the fixing device 1A explained in the first to third embodiments.

[0061] Specifically, the image forming apparatus 200 according to the present embodiment is a tandem-type color copier. The image forming apparatus 200 is a high-speed copier including following structural parts. The image forming apparatus 200 includes an image forming section 200A, a sheet feed section 200B, and a fixing device 1.

[0062] The image forming section 200A includes a transfer belt 210 that includes a transfer surface extending in the horizontal direction and has a structure to form an image of a color having a complementary color relation with a color-separated color on an upper surface thereof. Photoconductors 205Y, 205M, 205C, and 205K capable of carrying an image by a color of toner (yellow, magenta, cyan, or black) having a relation of complementary color are disposed along the transfer surface of the transfer belt 210.

[0063] Each photoconductor 205Y, 205M, 205C, or 205K includes a drum that rotates in a counterclockwise direction similarly. (Hereinafter, Y-color is used as representative for simplification of the description.) Each photoconductor 205Y includes an optical writing device 201 (disposed at two positions in the present embodiment), a charger 202Y, and a developing device 203Y Each photoconductor 205Y further includes a primary transfer device 204Y and is disposed as illustrated in FIG. 7. Each developing device 203 accommodates toner of respective colors.

[0064] The transfer belt 210 is stretched around a drive roller and a driven roller, and is configured to rotate in the same direction at a position opposed to each photoconductor 205Y, 205M, 205C, or 205K. A transfer roller 212 is disposed at a position opposed to an opposite roller 211, one of the driven rollers. A conveyance path of the sheet P from the transfer roller 212 to the fixing device 1 is along a horizontal direction.

[0065] The sheet feed section 200B includes a paper tray 220 to contain multiple sheets P each as a recording medium stacked thereon; and a conveyance structure to separate each sheet one by one from the top of the sheets stacked inside the paper tray 220, to convey it to the transfer roller 212.

[0066] Concerning image formation performed in the image forming apparatus 200, a surface of the photoconductor 205Y is evenly charged by the charger 202Y and an electrostatic latent image is formed on the photoconductor 205Y based on image information sent from an image reader. The electrostatic latent image is rendered visible as one-color toner image by the developing device 203Y accommodating yellow toner, and the thus-formed toner image is primarily transferred on the transfer belt 210 by a primary transfer device 204Y that applies a predetermined amount of bias voltage. Other photoconductors 205M, 205C, and 205K perform image formation similarly to the photoconductor 205Y employing different color of toner, and the toner images of respective colors are sequentially overlaid on the transfer belt 210 electrostatically.

[0067] Subsequently, the toner image that has been primarily transferred from each photoconductor 205 to the transfer belt 210, is transferred to the sheet P that has been conveyed thereto by the opposite roller 211 and the transfer roller 212. The sheet P onto which the toner image has been transferred, is further conveyed to the fixing device 1, and the toner image on the sheet P passed through a fixing nip N formed between the fixing belt 16 and the pressure roller 17, so that the toner image

on the sheet P is fixed onto the sheet P. The sheet P ejected from the fixing device 1 is discharged to a sheet ejection tray 215 along a sheet discharge path.

[0068] According to the present embodiment, degradation, due to heat, of the heating means such as the infrared heaters for use in the fixing device 1 included in the image forming apparatus 200, can be prevented. As a result, shortening of the lifetime of the infrared heaters 12 can be avoided, and the maintenance cost rise due to replacement of the parts can be suppressed.

[0069] Although the fixing device 1 as illustrated in FIG. 7 is used as an exemplary embodiment, the fixing device 1a as illustrated in FIG. 6 is equally used.

[0070] As the image forming apparatus, a color copier has been described heretofore, but the present embodiment can be applied to printers, facsimile machines, and other types of image forming apparatuses, so long as the image forming apparatus employs a fixing device to fix an image to the recording medium such as a sheet using effects of heat.

Claims

1. A fixing device (1, 1A) comprising:

a cylindrical heat roller (11);
a plurality of heaters (12) disposed inside the heat roller (11), extending along a longitudinal axis of the heat roller (11);
and
a heat adjuster (13, 13a, 13b), disposed among the plurality of heaters (12), to adjust heat from one to another of the plurality of heaters (12).

2. The fixing device (1, 1A) as claimed in claim 1, wherein the heat adjuster (13, 13a, 13b) is disposed equidistant from each of the plurality of heaters (12).

3. The fixing device (1, 1A) as claimed in claim 1 or 2, wherein the plurality of heaters (12) is disposed equidistantly around an inner circumference of the heat roller (11), and the heat adjuster (13, 13a, 13b) is disposed at an internal central portion of the heat roller (11).

4. The fixing device (1, 1A) as claimed in any one of claims 1 to 3, wherein the heat adjuster (13, 13a, 13b) absorbs heat generated by the plurality of heaters (12).

5. The fixing device (1, 1A) as claimed in any one of claims 1 to 4, wherein the heat adjuster (13, 13a, 13b) is formed of glass.

6. The fixing device (1, 1A) as claimed in claim 5, wherein the heat adjuster (13, 13a, 13b) is formed of quartz glass.

7. The fixing device (1, 1A) as claimed in any one of claims 1 to 3, wherein the heat adjuster (13, 13a, 13b) reflects heat from the plurality of heaters (12).

8. The fixing device (1, 1A) as claimed in claim 7, wherein the heat adjuster (13a, 13b) comprises:

a core (13b1) formed of glass tube; and
a reflection layer (13b2) formed around a circumference of the core (13b1).

9. The fixing device (1) as claimed in any one of claims 1 to 8, comprising:

a fixing roller (14);
a belt (16), stretched around a heat roller (11) and the fixing roller (14), to be driven rotatably; and
a pressure roller (17) to press against the fixing roller (14) via the belt (16), wherein the pressure roller (17), and the belt (16) pressed by the pressure roller (17) form a nip portion (N).

10. The fixing device (1A) as claimed in any one of claims 1 to 8, further comprising a pressure roller (17) to press against the heat roller (11),
wherein the pressure roller (17) and the heat roller (11) form a nip portion (N).

11. The fixing device (1, 1A) as claimed in any one of claims 1 to 10, wherein a total rated power of the plurality of heaters (12) sums up to 5,000 watts or greater.

12. An image forming apparatus (200) comprising the fixing device (1) as claimed in any one of claims 1 to 11.

13. An image forming apparatus (200) comprising:

an image forming section (200A) to form an image on a recording medium (P); and
the fixing device (1) as claimed in any one of claims 1 to 11, to fix the image onto the recording medium (P).

FIG. 1

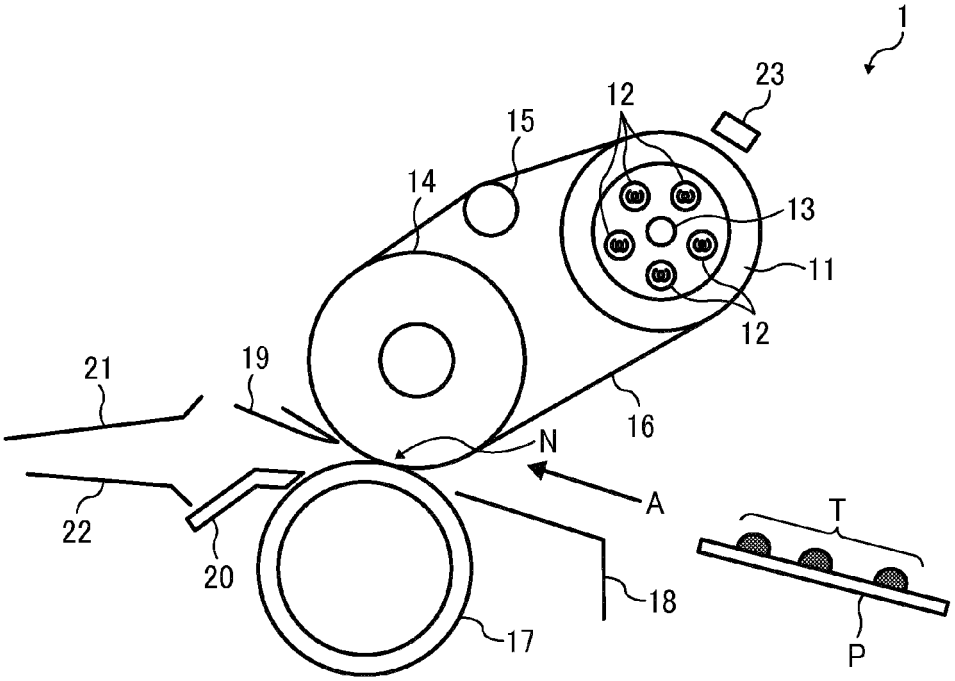

1
23
12
15
14
13
11
12
21
19
16
N
A
22
20
18
T
17
P

FIG. 2

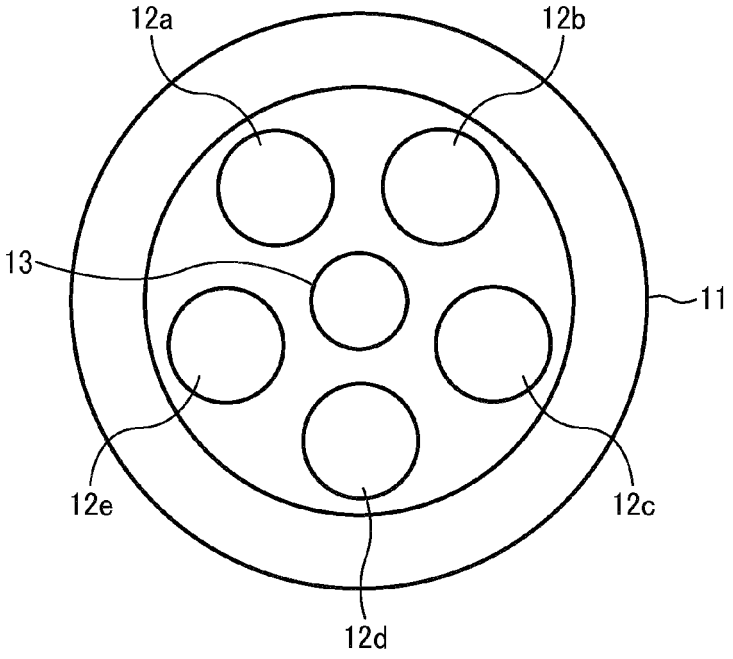

12a
12b
13
11
12e
12c
12d

FIG. 3

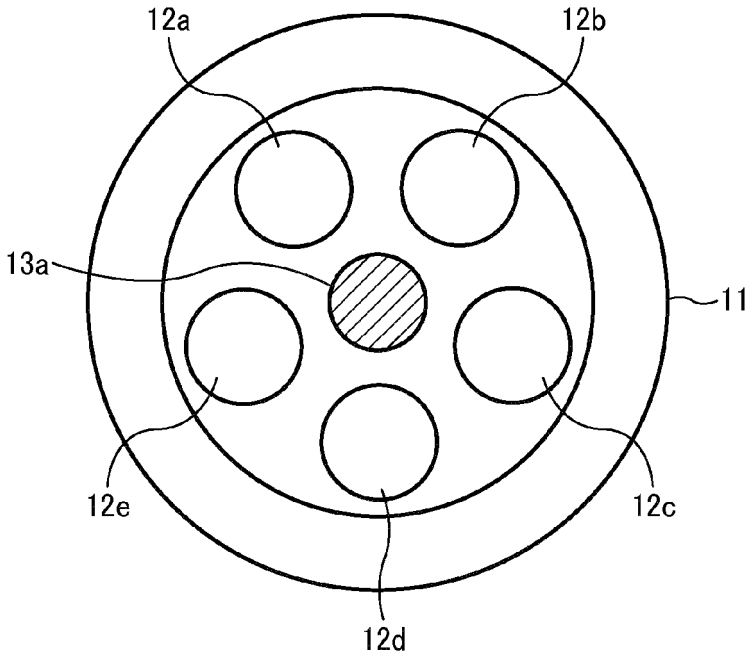


FIG. 4

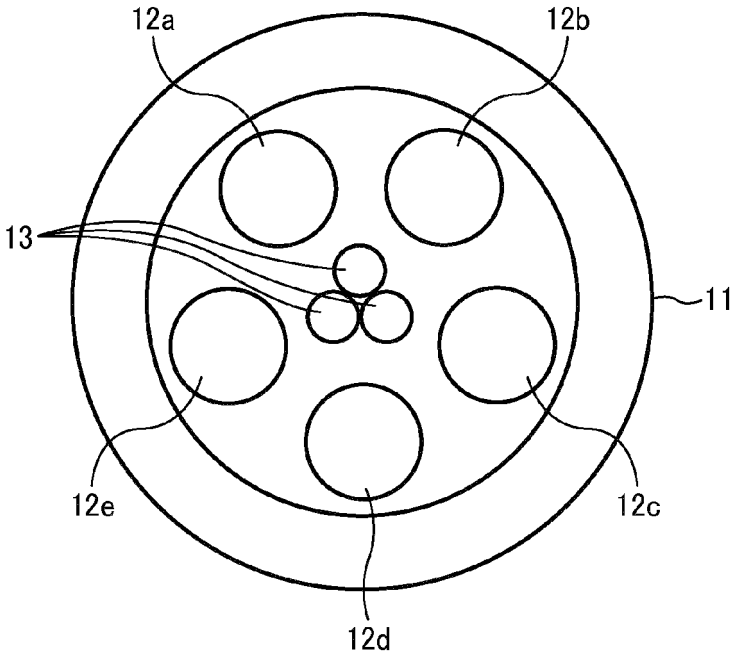


FIG. 5

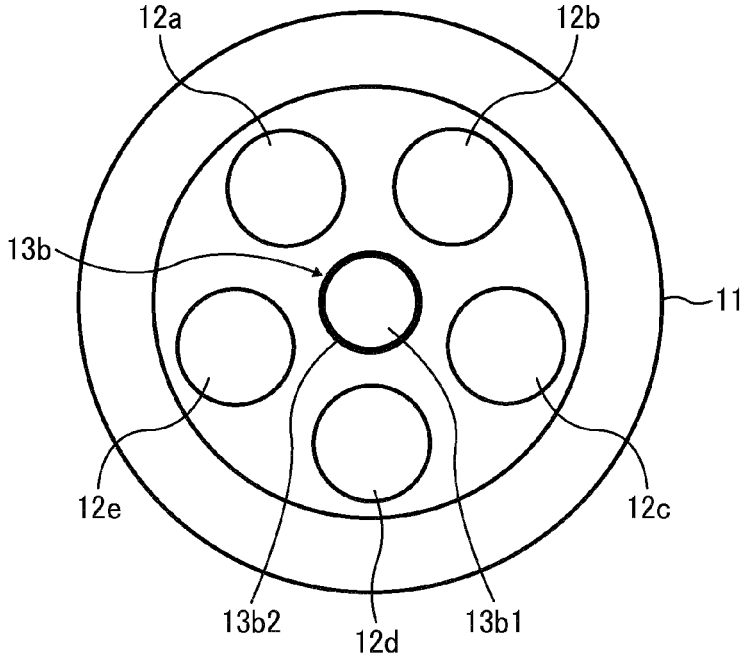

12a
12b
13b
11
12e
12c
13b2
12d
13b1

FIG. 6

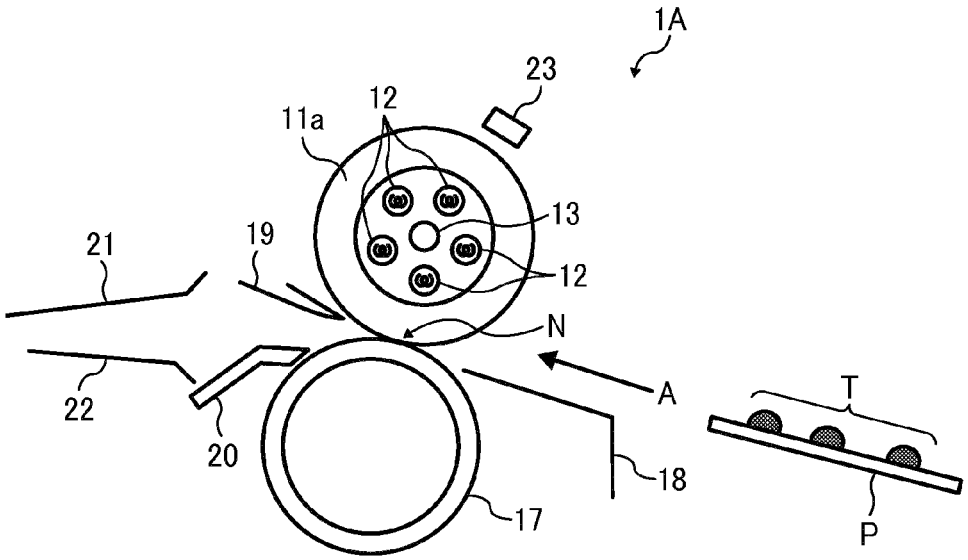
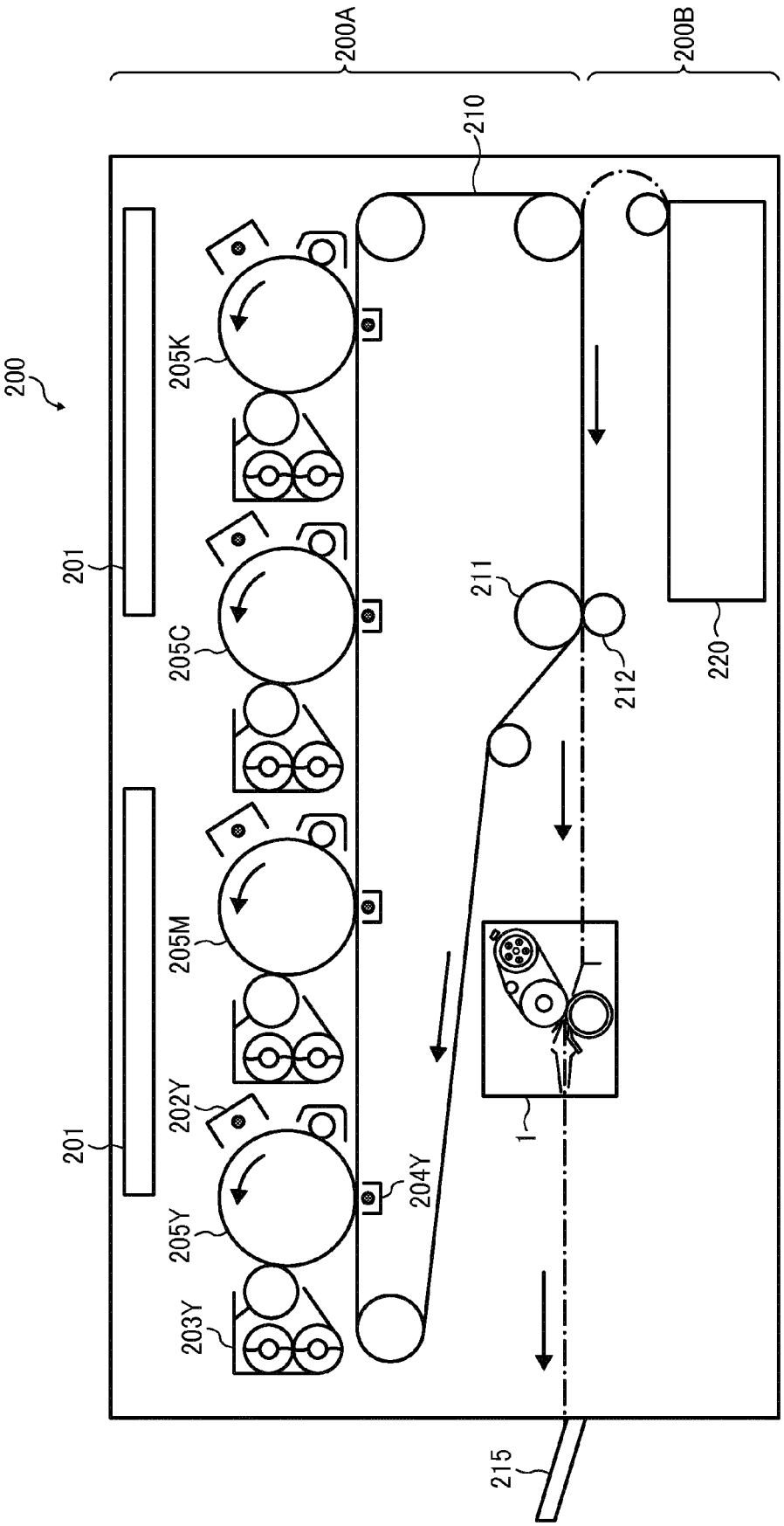

1A
23
12
11a
13
21
19
12
N
A
T
22
20
18
17
P

FIG. 7


200A
200B
210
200
205K
201
205C
211
212
220
205M
202Y
201
1
204Y
205Y
203Y
215

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EUROPEAN SEARCH REPORT

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	7 April 2016	Guidet, Johanna

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