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(54) **FIXING DEVICE**

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(57) **ABSTRACT**

In a fixing device, a connection portion of a first power supply terminal is at a position closer to one end portion of a heater in a longitudinal direction of the heater than a contact portion of the first power supply terminal, and a connection portion of a second power supply terminal is at a position closer to the other end portion of the heater in the longitudinal direction than a contact portion of the second power supply terminal. A power supply cable connected to the connection portion of the first power supply terminal extends toward the one end portion of the heater, and a power supply cable connected to the connection portion of the second power supply terminal is bent from extending toward the other end portion of the heater to extend toward the one end portion of the heater.

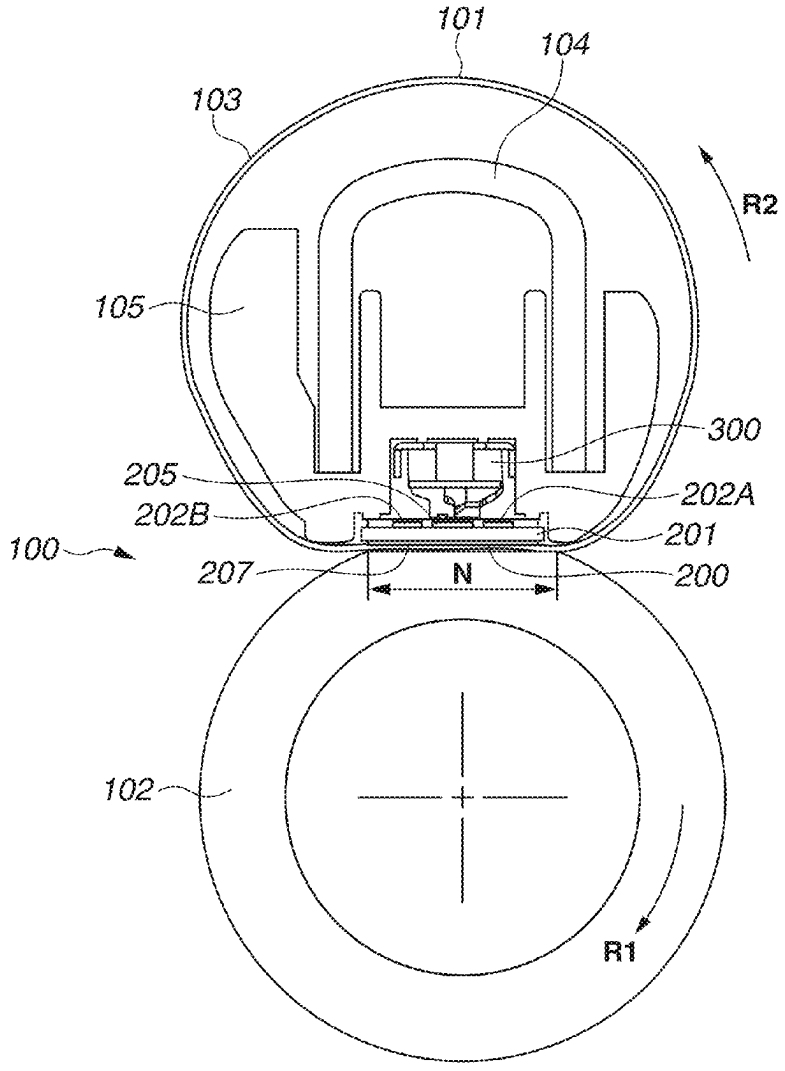


FIG.1

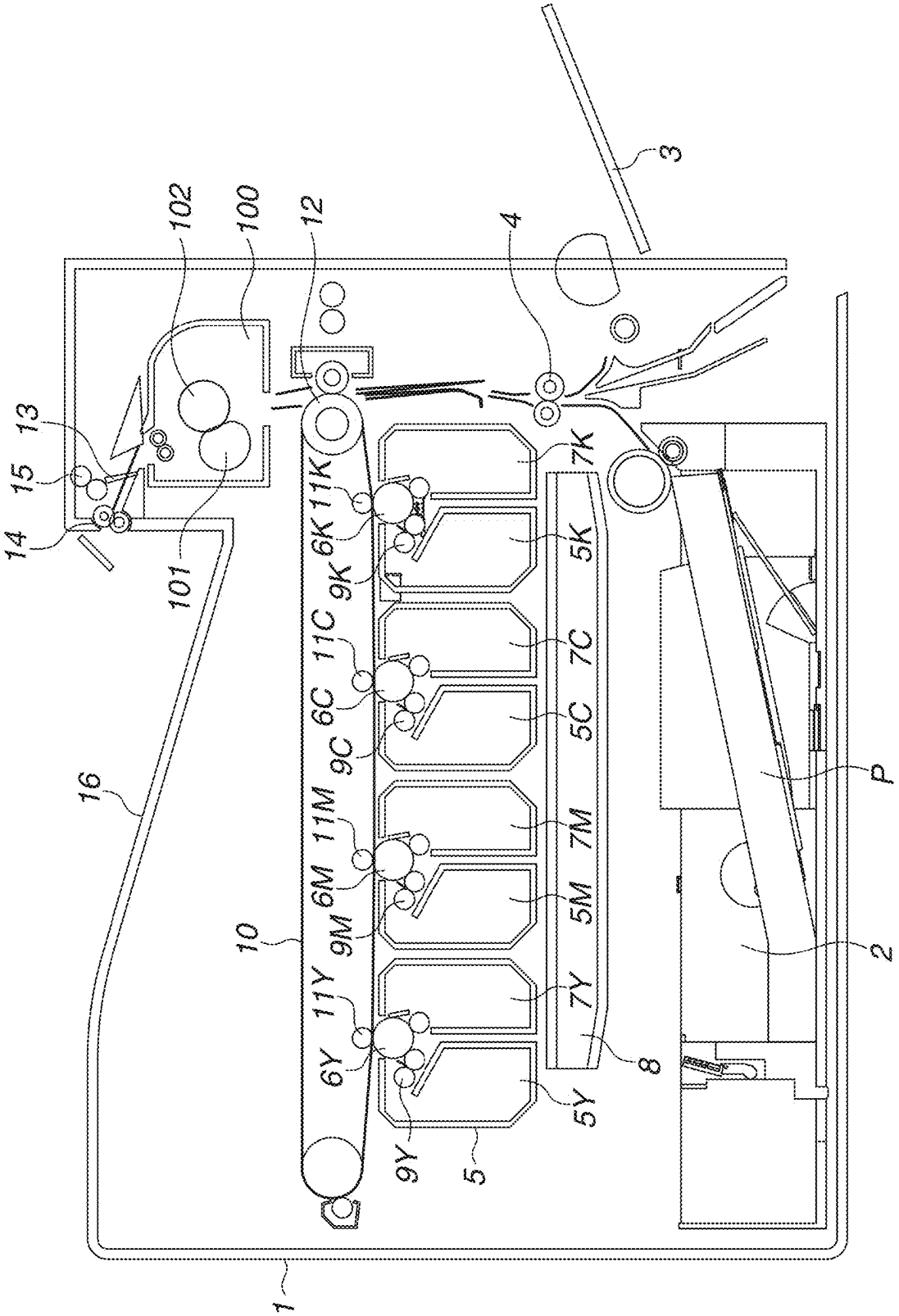

3
102
100
12
4
13
15
14
101
7K
11K
6K
9K
5K
11C
6C
9C
7C
5C
16
11M
6M
9M
7M
5M
10
11Y
6Y
9Y
7Y
5Y
8
5
P
2
1

FIG.2

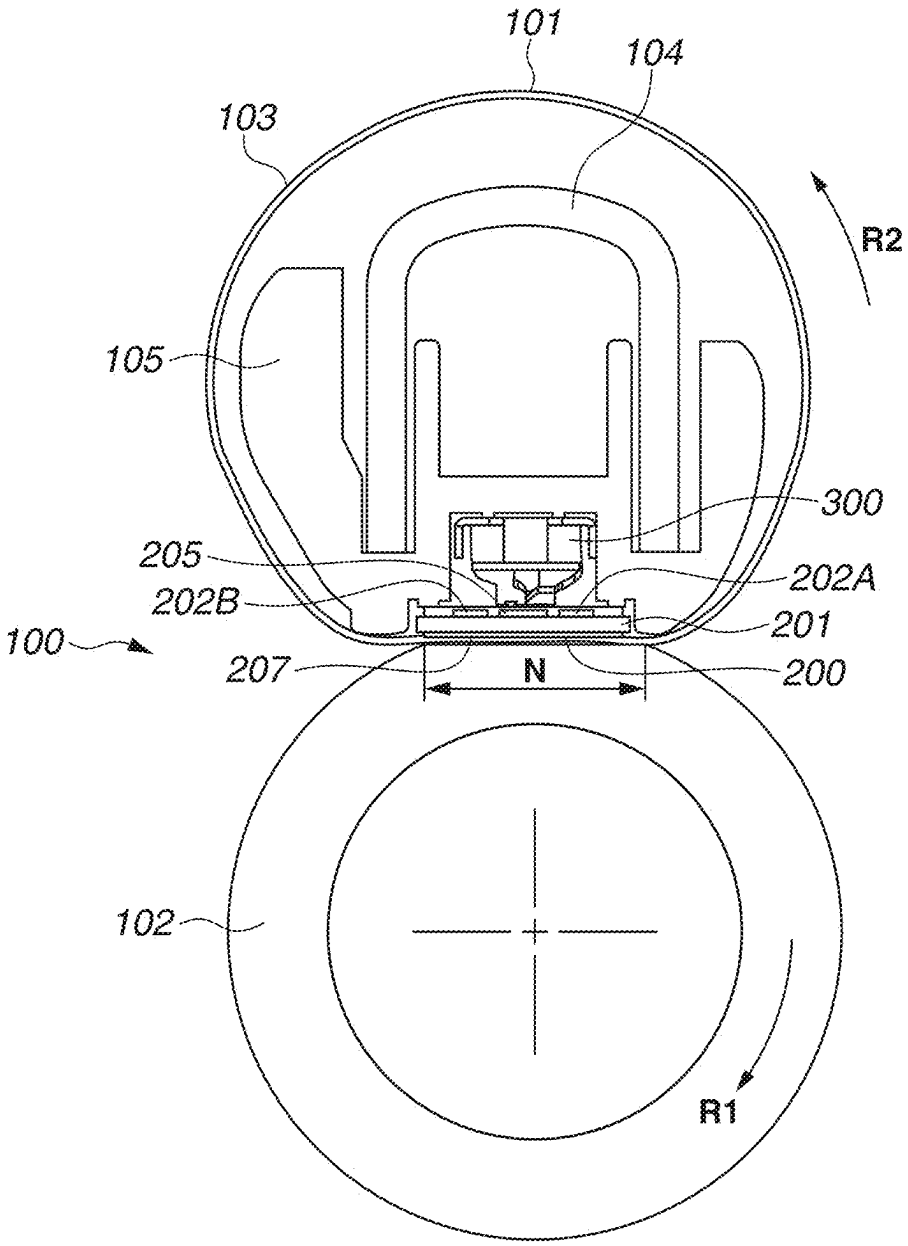


FIG.3

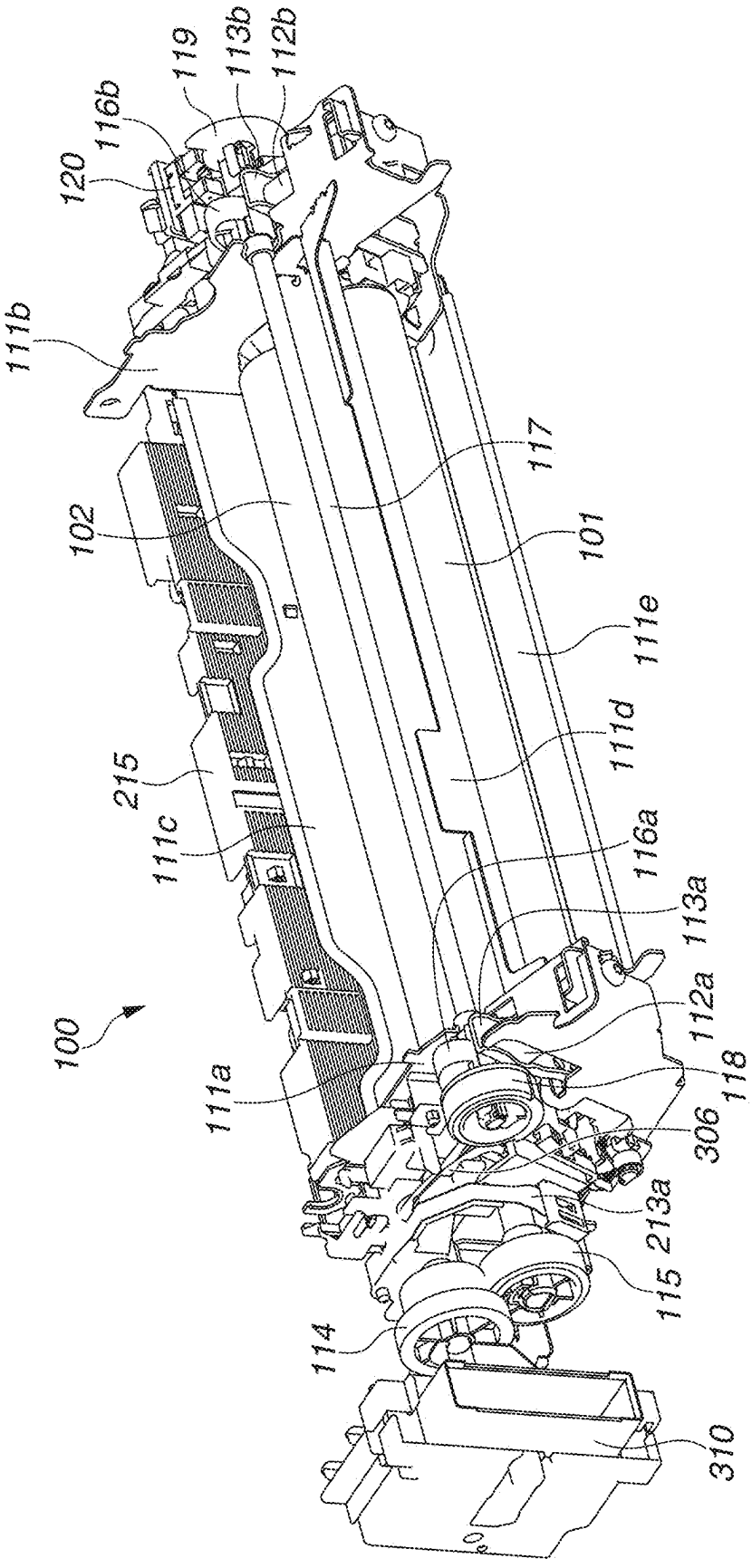

100
111a
111b
111c
111d
111e
112a
112b
113a
113b
114
115
116a
116b
117
118
119
120
101
102
213a
215
306
310

FIG.4

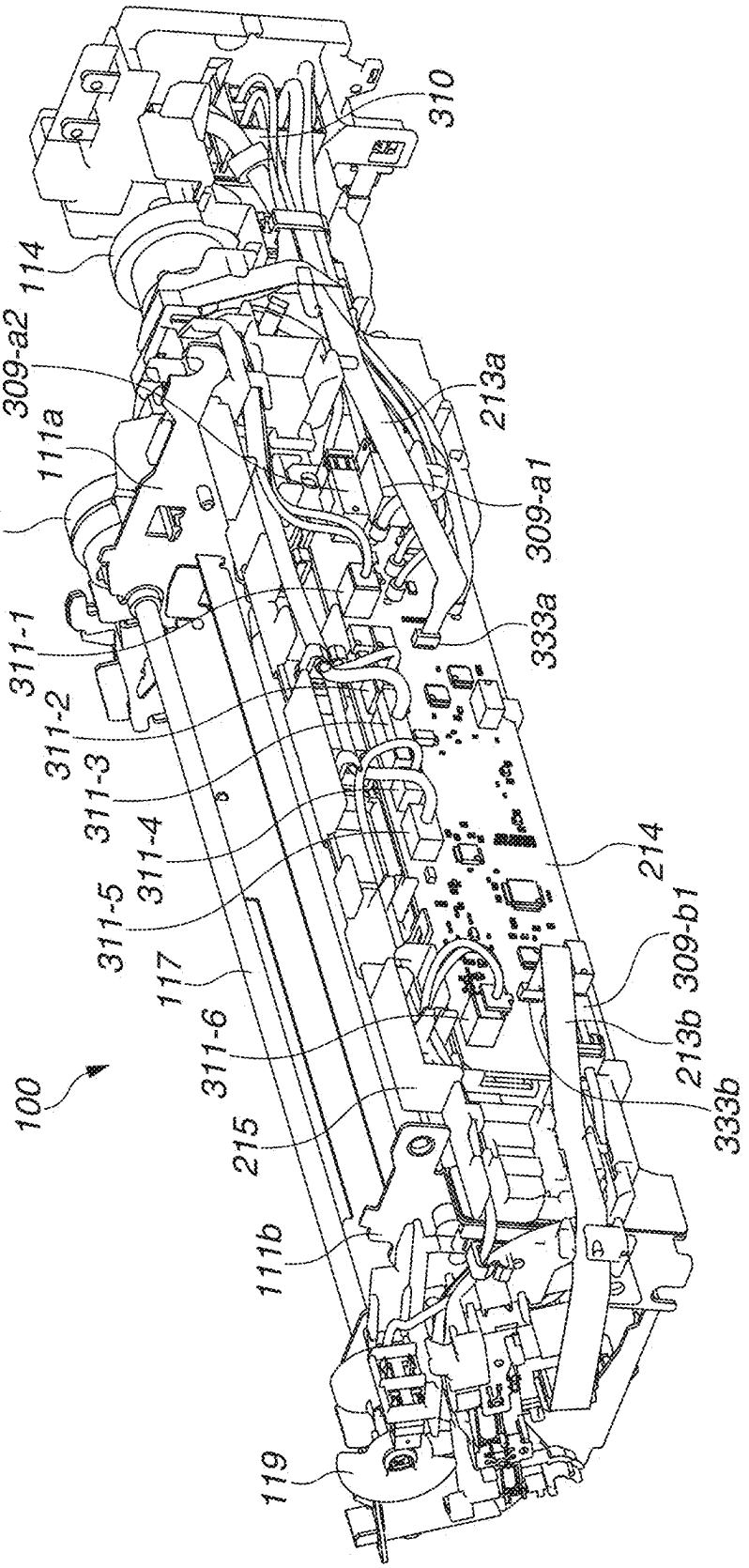
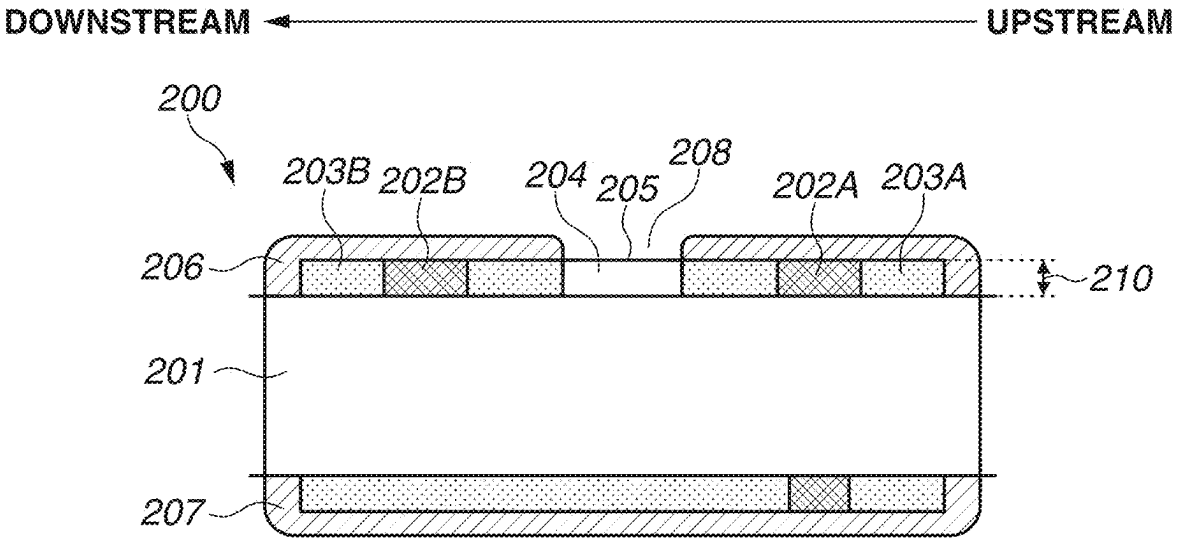

310
114
309-a2
111a
118
213a
309-a1
311-1
333a
311-2
311-3
311-4
311-5
214
309-b1
117
311-6
213b
100
215
333b
111b
119

FIG.5


DOWNSTREAM
UPSTREAM
200
203B
202B
204
205
208
202A
203A
206
210
201
207

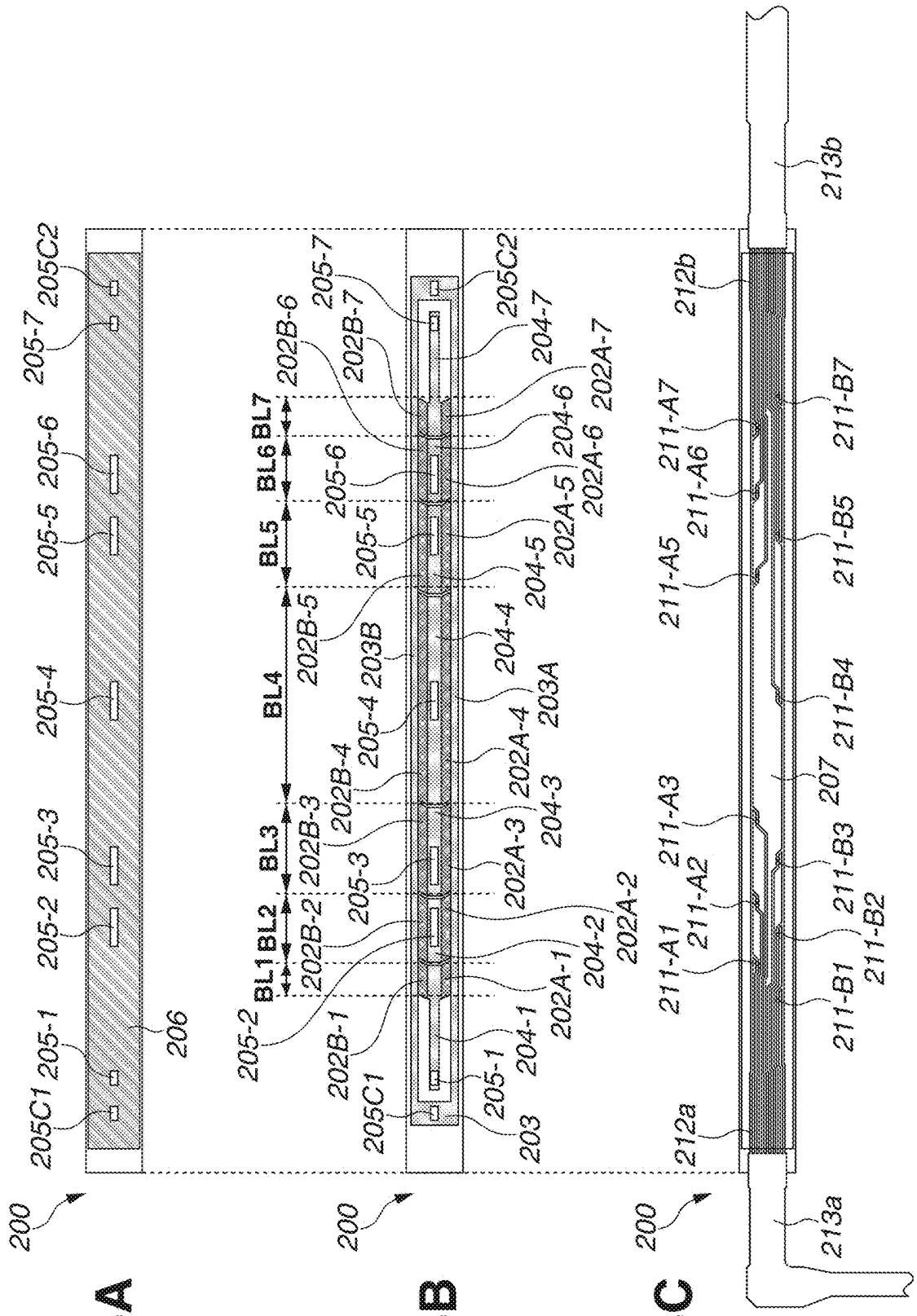


FIG.6A

FIG.6B

FIG.6C

FIG.7

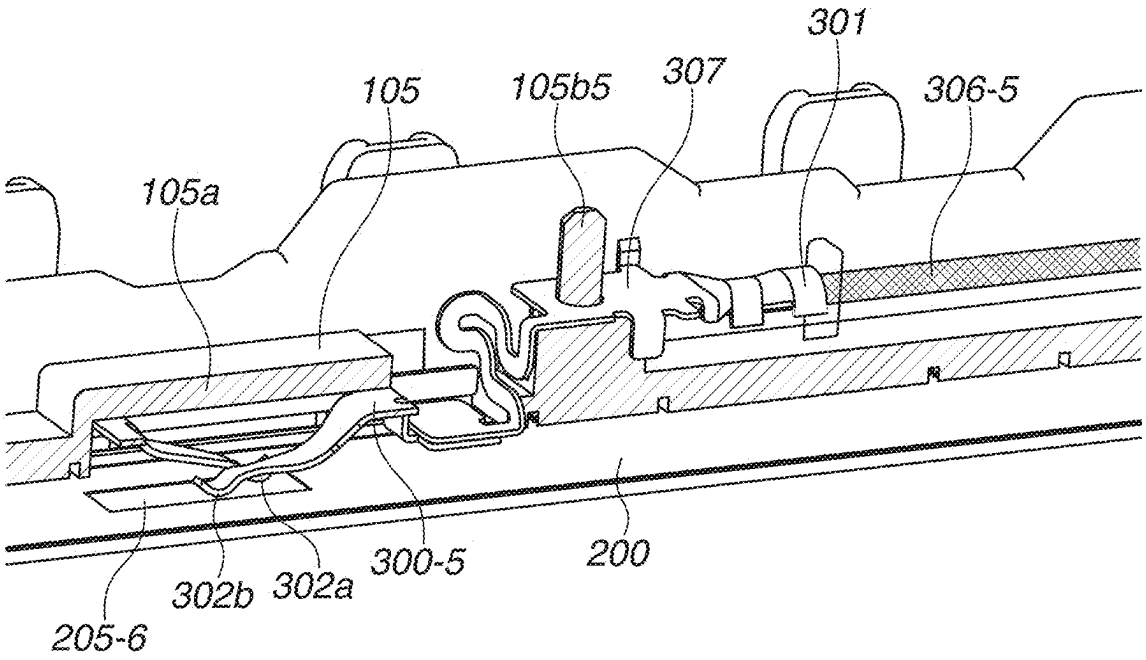


FIG.8

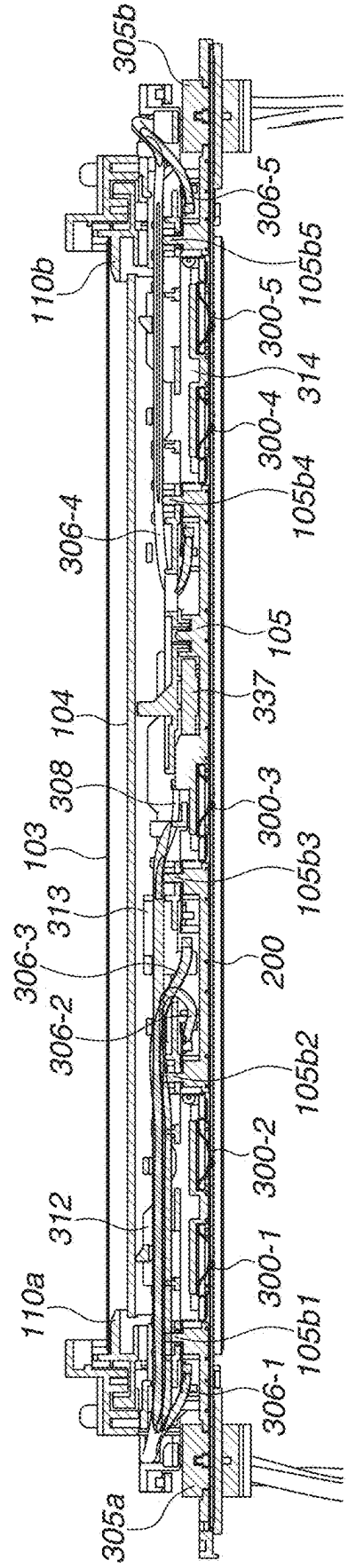

305b
306-5
105b5
110b
300-5
314
300-4
105b4
306-4
105
337
104
308
300-3
103
105b3
313
306-3
200
306-2
105b2
300-2
312
300-1
110a
105b1
306-1
305a

FIG.9

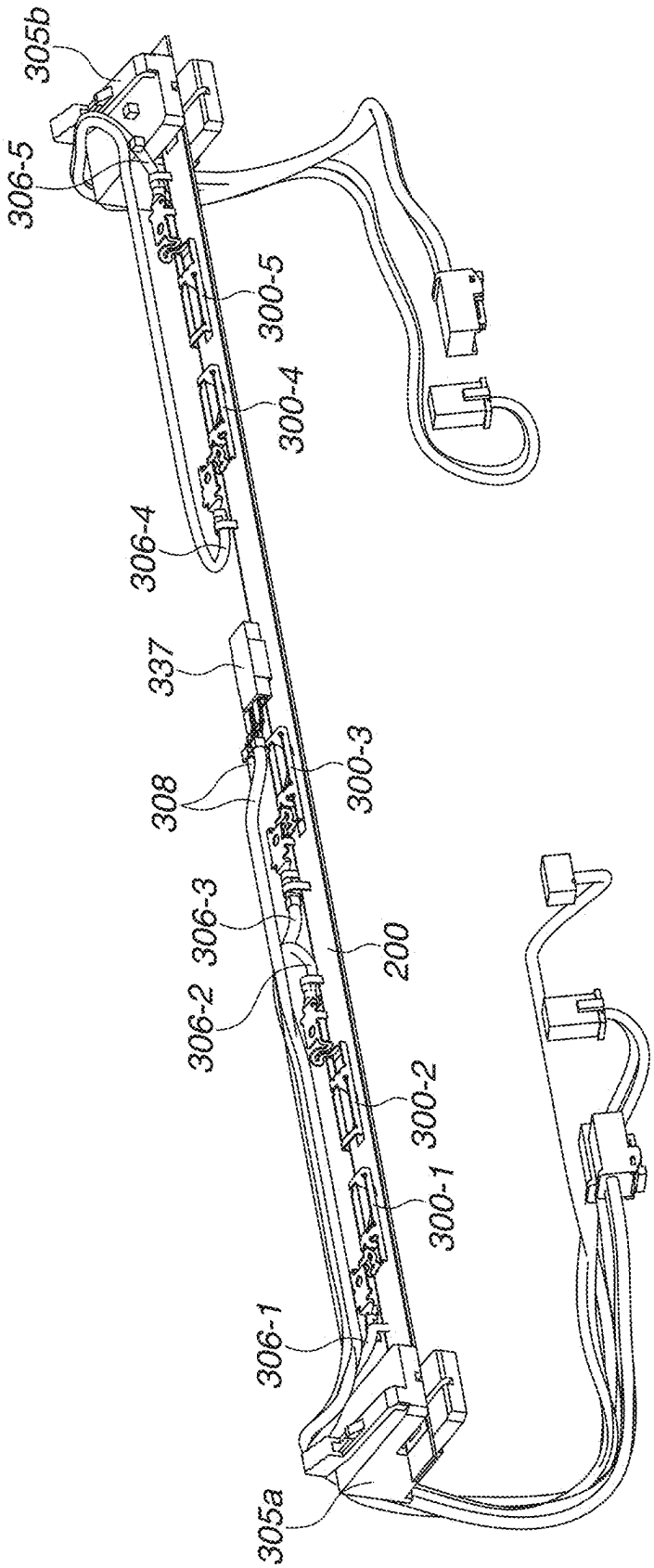
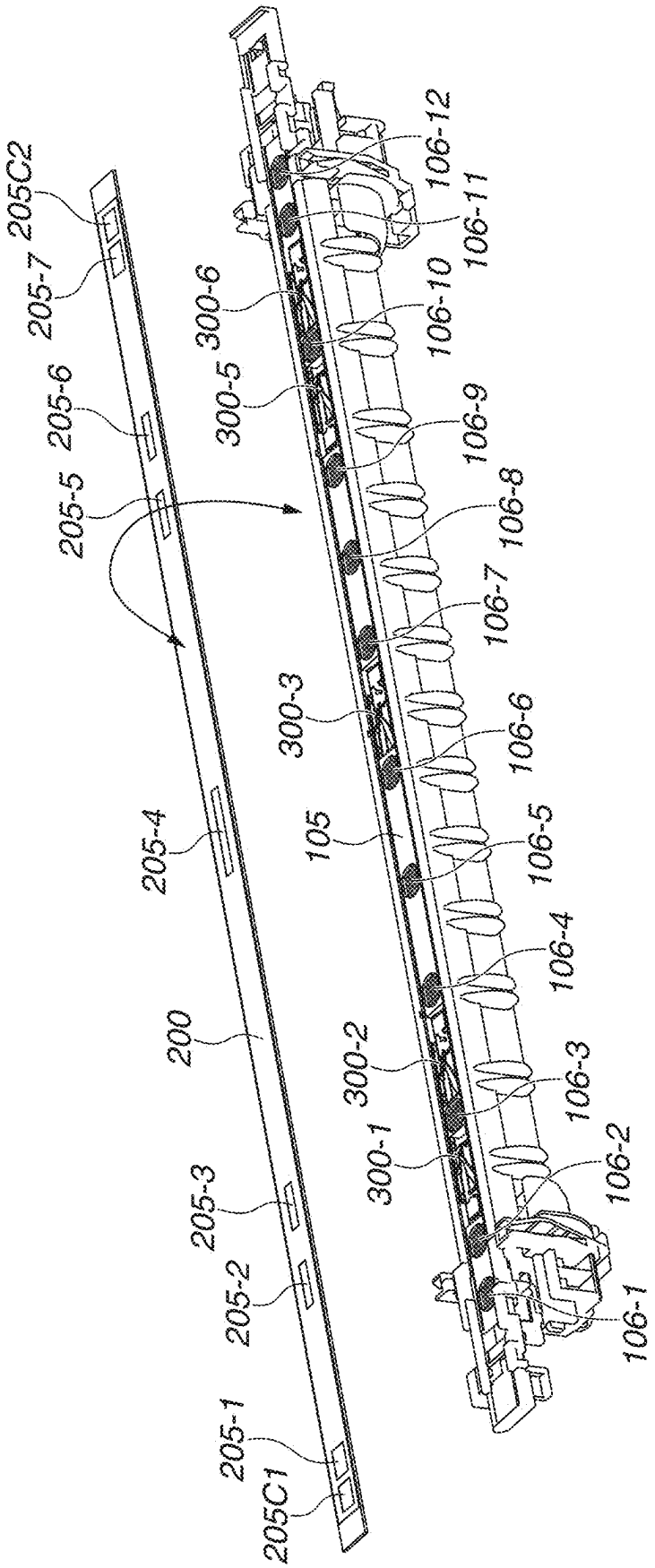

305b
306-5
300-5
300-4
306-4
337
308
300-3
306-3
200
306-2
300-2
300-1
306-1
305a

FIG.10


205C2
205-7
205-6
205-5
205-4
205-3
205-2
205-1
205C1
200
105
300-6
300-5
300-3
300-2
300-1
106-12
106-11
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106-8
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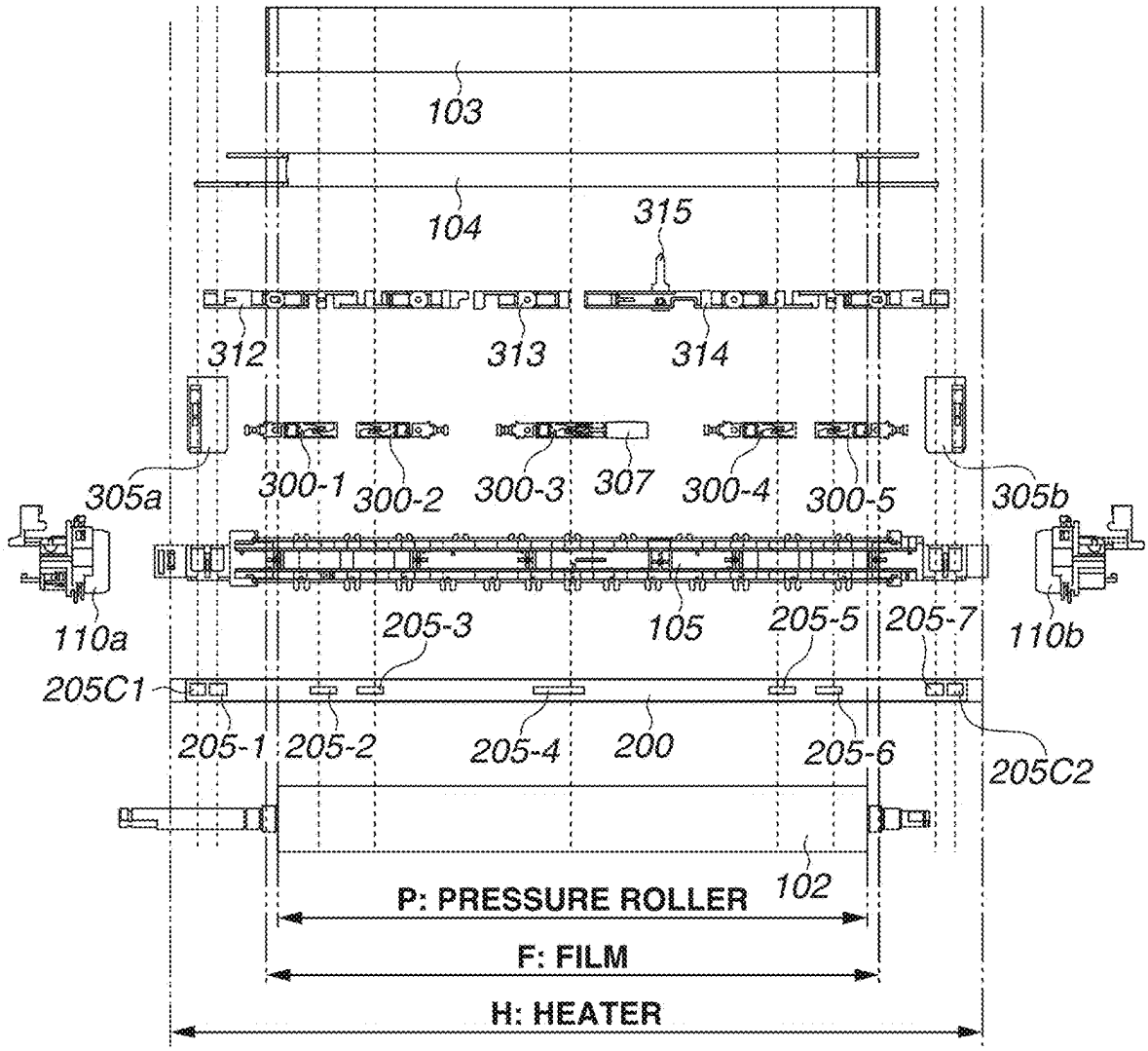
106-5
106-4
106-3
106-2
106-1

FIG.11


103
104
315
312
313
314
305a
300-1
300-2
300-3
307
300-4
300-5
305b
110a
205-3
105
205-5
205-7
110b
205C1
205-1
205-2
205-4
200
205-6
205C2
102
P: PRESSURE ROLLER
F: FILM
H: HEATER

FIXING DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. patent application Ser. No. 18/329,238, filed on Jun. 5, 2023, which claims priority from Japanese Patent Application No. 2022-091291, filed Jun. 6, 2022, which are hereby incorporated by reference herein in their entireties.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present invention relates to a fixing device mounted on an image forming apparatus such as a printer or copier that uses an electrophotographic recording method or an electrostatic recording method.

Description of the Related Art

[0003] In general, when small-size sheets are consecutively printed, a non-sheet-passing portion of a fixing device may overheat due to a reduction in heat transferred to the recording material. A fixing device using a cylindrical film (belt) has a small heat capacity and thus is less likely to conduct heat in the longitudinal direction of the fixing device, and thus the degree of temperature rise of a non-sheet-passing portion tends to increase. The overheating damages components of the fixing device.

[0004] Therefore, there has been conceived a fixing device in which a heat generating element on a heater substrate is divided into a plurality of heat generating blocks in the longitudinal direction of a heater, so that a heat generation distribution corresponding to the size of a recording material can be formed (Japanese Patent Application Laid-Open No. 2020-095157). In the heater discussed in Japanese Patent Application Laid-Open No. 2020-095157, an electrode (a terminal of the heater) on the heater substrate is in contact with a power supply terminal for supplying power to the heat generating element, and is disposed within an area where the heat generating element is disposed in the longitudinal direction of the heater, in order to suppress an increase in the size of the heater substrate.

[0005] In the case of the heater in which the heat generation distribution corresponding to the size of the recording material can be formed, the size of a heat generating block disposed at a position close to an end portion of the heater in the longitudinal direction of the heater is smaller in the longitudinal direction of the heater than the size of a heat generating block disposed as the middle. It is necessary to dispose the electrode in this small area of the heat generating block, and the power supply terminal in contact with the electrode also needs to be disposed in a small area, so as not to short-circuit electrically with an adjacent power supply terminal. However, because a power supply cable is connected to the power supply terminal, the smaller the size of one heat generating block is, the more difficult it is to arrange the power supply terminal and the power supply cable.

SUMMARY OF THE INVENTION

[0006] The present invention is directed to providing a fixing device in which a power supply terminal in contact with an electrode of a heater and a power supply cable are efficiently arranged in an internal space of a film.

[0007] According to an aspect of the present invention, a fixing device that fixes a toner image formed on a recording material to the recording material by heat includes a film having a cylindrical shape, a heater in an internal space of the film, the heater including a substrate, and a plurality of heat generating blocks located on the substrate and arranged in a longitudinal direction of the heater, a plurality of power supply terminals in contact with electrodes of the respective plurality of heat generating blocks, and a plurality of power supply cables connected to the respective plurality of power supply terminals, wherein each of the plurality of power supply terminals includes a contact portion in contact with the electrode and a connection portion connected to the power supply cable, wherein the plurality of heat generating blocks includes a first heat generating block and a second heat generating block next to each other in the longitudinal direction, wherein the plurality of power supply terminals includes a first power supply terminal in contact with the first heat generating block and a second power supply terminal in contact with the second heat generating block, the first power supply terminal and the second power supply terminal being located in the internal space of the film, wherein the connection portion of the first power supply terminal is at a position closer to one end portion of the heater in the longitudinal direction than the contact portion of the first power supply terminal, and the connection portion of the second power supply terminal is at a position closer to the other end portion of the heater in the longitudinal direction than the contact portion of the second power supply terminal, wherein the power supply cable connected to the connection portion of the first power supply terminal extends toward the one end portion of the heater, and wherein the power supply cable connected to the connection portion of the second power supply terminal is bent from extending toward the other end portion of the heater to extend toward the one end portion of the heater.

[0008] According to another aspect of the present invention, a fixing device that fixes a toner image formed on a recording material to the recording material by heat includes a film having a cylindrical shape, a heater in an internal space of the film, the heater including a substrate, and a plurality of heat generating blocks located on the substrate and arranged in a longitudinal direction of the heater, a plurality of power supply terminals in contact with electrodes of the respective plurality of heat generating blocks, and a plurality of power supply cables connected to the respective plurality of power supply terminals, wherein a part of the plurality of power supply cables extends from one end portion of the film in the longitudinal direction to an outside of the film, and a rest of the plurality of power supply cables extends from the other end portion of the film in the longitudinal direction to the outside of the film, and wherein a number of the power supply cables extending from the one end portion of the film to the outside of the film is an even number, and a number of the power supply cables extending from the other end portion of the film to the outside of the film is an odd number.

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

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. **1** is a sectional view of an image forming apparatus.

[0011] FIG. **2** is a sectional view of a heating unit and a pressure roller.

[0012] FIG. **3** is a perspective view of a fixing device as viewed from the front.

[0013] FIG. **4** is a perspective view of the fixing device as viewed from the rear.

[0014] FIG. **5** is a sectional view of a heater in a widthwise direction.

[0015] FIGS. **6**A to **6**C are plan views of the heater.

[0016] FIG. **7** is a partial perspective view of a power supply unit for the heater.

[0017] FIG. **8** is an overall view of the power supply unit for the heater.

[0018] FIG. **9** is an overall perspective view of the power supply unit for the heater.

[0019] FIG. **10** is a perspective view illustrating the relationship between the heater and a holding member.

[0020] FIG. **11** is an exploded plan view illustrating the positional relationship between components forming the heating unit and the pressure roller in the longitudinal direction of the fixing device.

DESCRIPTION OF THE EMBODIMENTS

Exemplary Embodiment

(Summary of Image Forming Apparatus)

[0021] First, an image forming apparatus to which the present invention is applicable will be described. FIG. **1** is a sectional view of an overall configuration of a printer **1** (the image forming apparatus) according to an exemplary embodiment. A sheet feeding cassette **2** is housed in a lower part of the printer **1**, in a drawable manner. On the right side of the printer **1**, a manual feed unit **3** is disposed. Recording materials P are stacked in each of the sheet feeding cassette **2** and the manual feed unit **3**, and the recording materials P are to be separated and fed one by one to a registration roller **4**. The printer **1** includes an image forming unit **5** in which image forming stations **5**Y, **5**M, **5**C, and **5**K corresponding to colors of yellow, magenta, cyan, and black, respectively, are arranged side by side. The image forming unit **5** forms a toner image to be transferred onto the recording material P. In the image forming unit **5**, photosensitive drums **6**Y, **6**M, **6**C, and **6**K each serving as an image bearing member are arranged, and further, charging devices **7**Y, **7**M, **7**C, and **7**K that each uniformly charge the surface of the corresponding photosensitive drum **6** are arranged. In the following, the photosensitive drums **6**Y, **6**M, **6**C, and **6**K may be collectively referred to as the photosensitive drum **6**. Further, a scanner unit **8** that forms an electrostatic latent image on the photosensitive drum **6** by emitting a laser beam based on image information is disposed, and development devices **9**Y, **9**M, **9**C, and **9**K that each develop the electrostatic latent as a toner image by attaching toner to the electrostatic latent are arranged, in the image forming unit **5**. Furthermore, primary transfer units **11**Y, **11**M, **11**C, and **11**K that each transfer the toner image on the photosensitive drum **6** to a transfer belt **10** are arranged in the image forming unit **5**. The primary transfer units **11**Y, **11**M, **11**C, and **11**K may be collectively referred to as the primary transfer unit **11**.

[0022] The toner image on the transfer belt **10**, to which the toner image has been transferred by the primary transfer unit **11**, is transferred to the recording material P by a secondary transfer unit **12**. When passing through a fixing device **100**, the toner image is fixed to the recording material P by a heating unit **101** and a pressure roller (a roller) **102** in pressure contact with the heating unit **101**, by heat and pressure. Afterward, the conveyance direction of the recording material P is changed by a both-sided flapper **13**, and the recording material P is subsequently conveyed to a discharge roller pair **14** or a switchback roller pair **15**. The recording material P in the case of single-sided printing is conveyed to the discharge roller pair **14**, upon passing through the fixing device **100**. The recording material P in the case of double-sided printing is conveyed to the switchback roller pair **15**, and reversed in the conveyance direction by the switchback roller pair **15**. The reversed recording material P is conveyed to the discharge roller pair **14**, upon passing through the registration roller **4**, the secondary transfer unit **12**, and the fixing device **100** again. Finally, upon passing through the discharge roller pair **14**, the recording material P is discharged to a stacking unit **16**. While the full-color laser beam printer including the plurality of photosensitive drums **6** is described as the image forming apparatus, the present invention is also applicable to a fixing device mounted on a monochromatic copier or printer that includes one photosensitive drum **6**.

(Fixing Device)

[0023] Next, the fixing device **100** according to the present exemplary embodiment will be described with reference to FIGS. **2**, **3**, and **4**. The fixing device **100** is a fixing unit that fixes the toner image on the recording material P to the recording material P by heat and pressure. The fixing device **100** includes support frames **111** (**111***a* to **111***e*), the heating unit **101**, and the pressure roller **102**. FIG. **2** is a sectional view of the heating unit **101** and the pressure roller **102** disposed inside the fixing device **100**. FIG. **3** is a perspective view of the fixing device **100** as viewed from the front, and FIG. **4** is a perspective view of the fixing device **100** as viewed from the rear.

[0024] The heating unit **101** includes a film **103** having a cylindrical shape, and including a base layer made of metal such as stainless steel (SUS) or heat-resistant resin such as polyimide. In addition, a heater **200** and a holding member **105** holding the heater **200** are disposed in an internal space of the film **103**. The holding member **105** is made of a material having heat resistance and slidability, such as heat-resistant resin, e.g., a liquid crystal polymer. Further, a stay member **104** made of metal and reinforcing the holding member **105** is also disposed in the internal space of the film **103**. At each of both end portions of the film **103** in the film longitudinal direction, a film flange **110** (**110***a*, **110***b*) supported by the stay member **104** and supporting the inner surface of the end portion of the film **103** to regulate the position of the film **103** in the film longitudinal direction is disposed.

[0025] The heater **200** includes a heater substrate **201**, a sliding layer (a glass layer) **207** in contact with the film **103**, and heat generating elements **202**A and **202**B. The heat generating elements **202**A and **202**B are disposed on the back surface (the surface opposite to the surface where the sliding layer **207** is disposed) of the heater substrate **201**. The heat of the heat generating elements **202**A and **202**B is

transmitted to the film **103** via the heater substrate **201** and the sliding layer **207**. The longitudinal direction of the heater **200** (i.e., the longitudinal direction of the film **103**) is the same as the width direction (the direction orthogonal to the conveyance direction) of the recording material P.

[0026] The pressure roller (the roller) **102** includes a metal core portion made of metal and an elastic layer made of silicone rubber or the like, and is rotatably supported by the support frames **111***a* and **111***b* via a bearing (not illustrated). The pressure roller **102** is in contact with an outer peripheral surface of the film **103**. The heating unit **101** is supported by the support frames **111***a* and **111***b* in a manner movable in a direction for pressure contact via the film flange **110**. Further, the heating unit **101** is urged by a pressure spring **112** (**112***a*, **112***b*) to be described below toward the pressure roller **102**, via the film flange **110** and the stay member **104**. In other words, the heating unit **101** is urged toward the pressure roller **102**, and a fixing nip portion N is formed by the heating unit **101** and the pressure roller **102**. To be more specific, the film **103** is interposed between the heater **200** and the pressure roller **102**, and the fixing nip portion N for pinching and conveying the recording material P is formed between the film **103** and the pressure roller **102**. A metal plate superior in heat conduction may be interposed between the film **103** and the heater **200**.

[0027] A driving force from a motor (not illustrated) disposed in the printer **1** is transmitted to an idler gear **114**. A drive gear **115** is attached to the metal core portion of the pressure roller **102**, and the drive gear **115** meshes with the idler gear **114**. The driving force is transmitted to the drive gear **115**, so that the pressure roller **102** is rotated in a rotation direction R**1**. Further, the film **103** is driven to rotate in a rotation direction R**2** by a contact frictional force between the pressure roller **102** and the film **103**.

[0028] The pressure spring **112** is a spring (in this example, a compression spring) that applies an urging force to bring the heating unit **101** into pressure contact with the pressure roller **102**. The pressure spring **112** urges each of both end portions of the heating unit **101** toward the pressure roller **102** via a lever member **113** (**113***a*, **113***b*), the film flange **110**, and the stay member **104**.

[0029] A cam **116** (**116***a*, **116***b*) presses the lever member **113** in the direction opposite to the urging direction of the pressure spring **112** at the time of a predetermined rotation phase, thereby reducing (or eliminating) the nip pressure of the fixing nip portion N. The reduced-pressure (or eliminated-pressure) state is set at the time when the recording material P jams, the time when the printer **1** is powered off, or the like. The two cams **116***a* and **116***b* are connected by a camshaft **117** having end portions to which a cam gear **118** and a flag **119** are attached, and the cams **116***a* and **116***b* are rotated by transmission of a driven force to the cam gear **118** by a drive unit (not illustrated) disposed in the printer **1**. The rotation phase of the cam **116** is detected by the flag **119** and a sensor **120**, and the rotation of the cam **116** is controlled based on a detection signal.

(Heater)

[0030] The heater **200** according to the present exemplary embodiment will be described in detail with reference to FIGS. **4**, **5**, and **6**A to **6**C. FIG. **5** is a sectional view of the heater **200** in the widthwise direction (the conveyance direction of the recording material P). The heater **200** generates heat by supply of power to the heat generating elements **202**A and **202**B disposed in a conductive layer **210** on the heater substrate **201** made of ceramic. In the conductive layer **210**, a first conductive element **203** and a second conductive element **204** are disposed along the longitudinal direction of the heater **200**. The first conductive element **203** includes first conductive elements **203**A and **203**B diverging from the first conductive element **203**. The first conductive elements **203**A and **203**B are disposed on the upstream side and the downstream side, respectively, of the conveyance direction of the recording material P. The second conductive element **204** is disposed between the heat generating elements **202**A and **202**B. In the widthwise direction of the heater **200**, the first conductive elements **203**A and **203**B are disposed so that the heat generating elements **202**A and **202**B and the second conductive element **204** are interposed therebetween. In the arrangement example in FIG. **5**, the first conductive element **203**A, the heat generating element **202**A, the second conductive element **204**, the heat generating element **202**B, and the first conductive element **203**B are arranged in this order from the upstream side to the downstream side of the conveyance direction of the recording material P. Further, an insulating protective layer (a glass layer) **206** covering the heat generating elements **202**A and **202**B, the first conductive elements **203**A and **203**B, and the second conductive element **204** is disposed on the back surface of the heater **200**. The sliding layer **207** formed by coating using glass or polyimide having superior slidability is disposed on the side where the sliding surface of the heater **200** slides on the film **103**. The heater **200** includes a heat generating block including the heat generating elements **202**A and **202**B.

[0031] FIGS. **6**A to **6**C are plan views of the heater **200**. FIG. **6**A illustrates the back surface of the heater **200**, and FIG. **6**B illustrates a state where the protective layer **206** is removed from the back surface of the heater **200**. FIG. **6**C illustrates the surface of the heater **200** in a state where the sliding layer **207** is removed.

[0032] The heater **200** includes a plurality of heat generating blocks BL**1** to BL**7** arranged in the longitudinal direction of the heater **200**. The heat generating block BL**1** includes heat generating elements **202**A-**1** and **202**B-**1**. The heat generating block BL**2** includes heat generating elements **202**A-**2** and **202**B-**2**. The heat generating block BL**3** includes heat generating elements **202**A-**3** and **202**B-**3**. The heat generating block BL**4** includes heat generating elements **202**A-**4** and **202**B-**4**. The heat generating block BL**5** includes heat generating elements **202**A-**5** and **202**B-**5**. The heat generating block BL**6** includes heat generating elements **202**A-**6** and **202**B-**6**. The heat generating block BL**7** includes heat generating elements **202**A-**7** and **202**B-**7**. The heater **200** of the present exemplary embodiment includes the seven heat generating blocks BL**1** to BL**7**.

[0033] The first conductive element **203** is disposed along the longitudinal direction of the heater **200**. The first conductive element **203** includes the first conductive element **203**A connected to the heat generating elements **202**A-**1** to **202**A-**7**, and the first conductive element **203**B connected to the heat generating elements **202**B-**1** to **202**B-**7**. The second conductive element **204** includes a second conductive element **204**-**1** connected to the heat generating element **202**A-**1** and the heat generating element **202**B-**1**, and a second conductive element **204**-**2** connected to the heat generating element **202**A-**2** and the heat generating element **202**B-**2**. The second conductive element **204** further

includes a second conductive element **204-3** connected to the heat generating element **202**A-**3** and the heat generating element **202**B-**3**, a second conductive element **204-4** connected to the heat generating element **202**A-**4** and the heat generating element **202**B-**4**, and a second conductive element **204-5** connected to the heat generating element **202**A-**5** and the heat generating element **202**B-**5**. The second conductive element **204** further includes a second conductive element **204-6** connected to the heat generating element **202**A-**6** and the heat generating element **202**B-**6**, and a second conductive element **204-7** connected to the heat generating element **202**A-**7** and the heat generating element **202**B-**7**. The second conductive elements **204-1** to **204-7** are arranged apart from each other. Therefore, the second conductive element **204** is divided into seven.

[0034] Common electrodes **205**C**1** and **205**C**2** and electrodes **205-1** to **205-7** are each exposed from the corresponding one of a plurality of opening portions **208** located in the protective layer **206**. The common electrodes **205**C**1** and **205**C**2** are part of the first conductive element **203**. The electrodes **205-1** to **205-7** are part of the second conductive elements **204-1** to **204-7**, respectively. The electrode **205-1** is an electrode for supplying power to the heat generating block BL**1**. The electrode **205-2** is an electrode for supplying power to the heat generating block BL**2**, and the electrode **205-3** is an electrode for supplying power to the heat generating block BL**3**. Similarly, the electrodes **205-4** to **205-7** are electrodes for supplying power to the heat generating blocks BL**4** to BL**7**, respectively. The common electrodes **205**C**1** and **205**C**2** are common electrodes for supplying power to the heat generating blocks BL**1** to BL**7** via the first conductive elements **203**A and **203**B.

[0035] The heater **200** can supply power to each of the heat generating blocks BL**1** to BL**7** independently, via the electrodes **205-1** to **205-7**. It is possible to suppress the temperature rise of a non-sheet-passing area through which the recording material P does not pass, by changing the proportion of the power to be supplied to each of the heat generating blocks BL**1** to BL**7**. For example, when a toner image formed on the recording material P having a width corresponding to the heat generating blocks BL**3** to BL**5** is fixed to the recording material P by heat, the power to be supplied to each of the heat generating blocks BL**1**, BL**2**, BL**6**, and BL**7** is made to be smaller than the power to be supplied to each of the heat generating blocks BL**3** to BL**5**. The temperature rise of the non-sheet-passing area can be thereby reduced. The proportion of the power to be supplied to each of the heat generating blocks BL**1** to BL**7** may be changed depending on the width of an image to be formed on the recording material P.

[0036] Meanwhile, the printer **1** is configured so that the center of the recording material P passes through the center of the heat generating block BL**4** in the longitudinal direction of the heater **200**. The heat generating block BL**4** located as the middle of the plurality of heat generating blocks is a heat generating block through which the recording material P always passes regardless of the size of the recording material P. In the longitudinal direction of the heater **200**, the size of each of the heat generating blocks BL**2** (a first heat generating block), BL**3** (a second heat generating block), BL**5** (a third heat generating block), and BL**6** (a fourth heat generating block) is smaller than the size of the heat generating block BL**4** (a fifth heat generating block). Therefore, the distance between the electrode **205-2** and the electrode **205-3** and the distance between the electrode **205-5** and the electrode **205-6** are short.

[0037] Thermistors **211**-A**1** to **211**-A**3**, **211**-A**5** to **211**-A**7**, **211**-B**1** to **211**-B**5**, and **211**-B**7** each serving as a temperature detection element are printed on a surface, which faces the film **103**, of the heater substrate **201**. These twelve thermistors may be collectively referred to as the thermistor **211**. The thermistors **211**-A**1** and **211**-B**1** detect the temperature of an area corresponding to the heat generating block BL**1**. The thermistors **211**-A**2** and **211**-B**2** detect the temperature of an area corresponding to the heat generating block BL**2**. The thermistors **211**-A**3** and **211**-B**3** detect the temperature of an area corresponding to the heat generating block BL**3**. The thermistor **211**-B**4** detects the temperature of an area corresponding to the heat generating block BL**4**. The thermistors **211**-A**5** and **211**-B**5** detect the temperature of an area corresponding to the heat generating block BL**5**. The thermistor **211**-A**6** detects the temperature of an area corresponding to the heat generating block BL**6**. The thermistors **211**-A**7** and **211**-B**7** detect the temperature of an area corresponding to the heat generating block BL**7**. Each of the plurality of heat generating blocks BL**1** to BL**7** is controlled to be maintained at a predetermined target temperature, during a fixing process. The thermistor **211** is used to control the temperature of each of the plurality of heat generating blocks BL**1** to BL**7** or to prevent an abnormal temperature rise in each of the plurality of heat generating blocks BL**1** to BL**7**.

[0038] Two conductive elements are connected to each of the plurality of thermistors **211**. A conductive element **212***a* illustrated in FIG. **6**C indicates a conductive element connected to a flexible printed circuit (FPC) **213***a*, and a conductive element **212***b* illustrated in FIG. **6**C indicates a conductive element connected to an FPC **213***b*.

[0039] The conductive element **212***a* and the FPC **213***a* are soldered, and the conductive element **212***b* and the FPC **213***b* are also soldered. As illustrated in FIG. **4**, the FPC **213***a* and the FPC **213***b* wrap around to the rear surface of the fixing device **100**. The end portion opposite to the end portion, which is connected to the heater **200**, of the FPC **213***a* and that of the FPC **213***b* are connected to an electric substrate **214** disposed on the rear surface of the fixing device **100**, by connectors **333***a* and **333***b*, respectively. The FPC **213** (**213***a*, **213***b*) is a flat cable formed by laminating a conductive metal to a thin base film made of a material having insulating properties such as polyimide.

(Configuration for Power Supply to Heater)

[0040] A power supply unit for supplying power to the electrode **205** of the heater **200** will be described with reference to FIGS. **7** to **11**. FIG. **7** is a partial perspective view of the power supply unit for the heater **200**, and FIG. **8** is an overall view of the power supply unit for the heater **200**. FIG. **9** is an overall perspective view of the power supply unit for the heater **200**, and FIG. **10** is a perspective view illustrating the relationship between the heater **200** and the holding member **105**. FIG. **11** is an exploded plan view illustrating the positional relationship between components forming the heating unit **101** and the pressure roller **102** in the longitudinal direction of the fixing device **100**. The power supply structures for the heat generating blocks BL**2** to BL**6** are substantially the same except for the orientation of a power supply terminal **300** and the wiring direction of a cable **306**. FIG. **7** illustrates the power supply structure for

the heat generating block BL**6** representing the heat generating blocks BL**2** to BL**6**, and the detailed description of the power supply structures for the other heat generating blocks BL**2** to BL**5** will be omitted.

[0041] A power supply terminal **300-5** is a metal pressed component, and includes contact portions **302***a* and **302***b*, a mount portion **307**, and a connection portion **301**. The contact portions **302***a* and **302***b* are portions in contact with the electrode **205-6**. The contact portions **302***a* and **302***b* have spring characteristics, and vary in elasticity. Therefore, the magnitude of a load when pressing the contact portion **302***a* against the electrode **205-6** and the magnitude of a load when pressing the contact portion **302***b* against the electrode **205-6** are different. This is to prevent the two contact portions **302***a* and **302***b* from vibrating at the same frequency, with respect to vibrations occurring in a motor or the like inside the printer **1**, or vibrations occurring when the recording material P passes through the fixing nip portion N. Such a configuration of the contact portions **302***a* and **302***b* can minimize the possibility that the two contact portions **302***a* and **302***b* simultaneously move away from the electrode **205-6**.

[0042] The power supply terminal **300-5** crimps (connects) a cable (a power supply cable) **306-5**, using the connection portion **301**. As illustrated in FIG. **4**, the cable **306-5** wraps around to the rear surface of the fixing device **100**, and is connected to a connector **311-1** of the electric substrate **214** disposed on the rear surface.

[0043] The power supply terminal **300-5** is attached to the holding member **105** by inserting a boss **105***b***5** of the holding member **105** into the mount portion **307**. FIG. **9** illustrates a power supply terminal **300-1** in contact with the electrode **205-2** for the heat generating block BL**2**, and a power supply terminal **300-2** in contact with the electrode **205-3** for the heat generating block BL**3**. FIG. **9** further illustrates a power supply terminal **300-3** in contact with the electrode **205-4** for the heat generating block BLA, a power supply terminal **300-4** in contact with the electrode **205-5** for the heat generating block BL**5**, and the power supply terminal **300-5** in contact with the electrode **205-6** for the heat generating block BL**6**. FIG. **8** illustrates a boss **105***b***1** inserted into the power supply terminal **300-1**, and a boss **105***b***2** inserted into the power supply terminal **300-2**. FIG. **8** further illustrates a boss **105***b***3** inserted into the power supply terminal **300-3**, a boss **105***b***4** inserted into the power supply terminal **300-4**, and the boss **105***b***5** inserted into the power supply terminal **300-5**.

[0044] As illustrated in FIG. **8**, a contact holder **312** that guides a cable **306-1** crimped to the power supply terminal **300-1**, a cable **306-2** crimped to the power supply terminal **300-2**, and a cable **306-3** crimped to the power supply terminal **300-3** is disposed on the power supply terminals **300-1** and **300-2**. The contact holder **312** is attached to the boss **105***b***1** and the boss **105***b***2**. A contact holder **313** that guides the cable **306-3** crimped to the power supply terminal **300-3** and a cable **308** crimped to a safety element (a thermal switch) **337** is disposed on the power supply terminal **300-3**. The safety element **337** is an element disposed at a power supply circuit for supplying power from a power supply (not illustrated) to the heat generating blocks BL**1** to BL**7**, and operates to break the power supply circuit if the temperature of the heater **200** rises to an abnormal temperature. The contact holder **313** is attached to the boss **105***b***3**. A contact holder **314** that guides a cable **306-4** crimped to the power supply terminal **300-4** and the cable **306-5** crimped to the power supply terminal **300-5** is disposed on the power supply terminals **300-4** and **300-5**. The contact holder **314** is attached to the boss **105***b***4** and the boss **105***b***5**. FIG. **7** illustrates a state where the contact holder **314** is removed.

[0045] After the contact holders **312**, **313**, and **314** are attached to the bosses **105***b***1** to **105***b***5** of the holding member **105** made of resin, the bosses **105***b***1** to **105***b***5** are flattened by heat for crimping, so that the contact holders **312**, **313**, and **314** are prevented from coming off. Therefore, the structure for preventing the power supply terminals **300-1** to **300-5** from coming off serves as a structure for preventing the contact holders **312**, **313**, and **314** from coming off. If the bosses **105***b***1** to **105***b***5** made of resin are used as the structure for preventing the contact holders **312**, **313**, and **314** from coming off in a structure where the distance between the power supply terminals **300-1** to **300-5** and the stay member **104** made of metal is short, an insulation distance therebetween is easily secured. This can prevent an electrical short circuit between the power supply terminals **300-1** to **300-5** and the stay member **104**. In addition, attaching the plurality of power supply terminals **300-1** to **300-5** to the one holding member **105** can improve the positional accuracy between the power supply terminals close to each other, so that an electrical short circuit between the power supply terminals can also be prevented.

[0046] The plurality of power supply terminals **300-1** to **300-5** urge the heater **200** by constant contact pressure. Therefore, as illustrated in FIG. **10**, the heater **200** is fixed to the holding member **105** by adhesion using adhesion portions **106-1** to **106-12**, in order to prevent the relative position between the heater **200** and the holding member **105** from changing. The temperature of the heater **200** is high when generating heat, so that thermal expansion and thermal contraction of the heater substrate **201** occur. Therefore, the heater **200** and the holding member **105** are adhered to each other using a silicon adhesive having heat resistance and elasticity in order to maintain the adhesion strength. Further, the adhesion portions **106-1** to **106-12** of the holding member **105** have a knurled shape, in order to enhance the adhesion strength by increasing the area of a surface to which the adhesive is applied. The contact pressure of the contact portions of the power supply terminals **300-1** to **300-5** is thereby stabilized. Moreover, because the heater **200** is fixed to the holding member **105**, abrasion of the contact portion due to misregistration between the electrode and the contact portion is also prevented, so that the reliability of the electrical contact improves.

[0047] As illustrated in FIGS. **9** and **10**, two power supply terminals (not illustrated), one is in contact with the common electrode **205**C**1** at one end portion of the heater **200** and the other is in contact with the electrode **205-1** for the heat generating block BL**1**, are disposed inside a connector **305***a* inserted into the heater **200** in the widthwise direction of the heater **200**. Further, two power supply terminals (not illustrated), one is in contact with the common electrode **205**C**2** at the other end portion of the heater **200** and the other is in contact with the electrode **205-7** for the heat generating block BL**7**, are disposed inside a connector **305***b* inserted into the heater **200** in the widthwise direction of the heater **200**.

[0048] As illustrated in FIG. **11**, the electrodes **205-2** to **205-6** are disposed within the area of the film **103** in the longitudinal direction of the heater **200**. On the other hand,

the common electrodes **205**C**1** and **205**C**2** and the electrodes **205-1** and **205-7** are disposed outside the area of the film **103** (outside both end portions of the film **103**) in the longitudinal direction of the heater **200**. In this way, the number of components built in the film **103** is decreased by reducing the power supply terminals disposed in the internal space of the film **103**, so that the outer diameter of the film **103** can be reduced, and thus the heating unit **101** can be downsized.

[0049] A member **315** is a discharging member in contact with an inner surface of the film **103**, and prevents toner from offsetting with respect to the film **103** because of charge of the film **103**.

[0050] The distance between the electrode **205-2** (a first electrode) and the electrode **205-3** (a second electrode) next to each other in the longitudinal direction of the heater **200** is short. Therefore, the distance between the power supply terminal **300-1** (a first power supply terminal) and the power supply terminal **300-2** (a second power supply terminal) next to each other in the longitudinal direction of the heater **200** is also short. Similarly, the distance of the electrode **205-5** (a third electrode) and the electrode **205-6** (a fourth electrode) next to each other in the longitudinal direction of the heater **200** is short. Therefore, the distance between the power supply terminal **300-4** (a third power supply terminal) and the power supply terminal **300-5** (a fourth power supply terminal) next to each other in the longitudinal direction of the heater **200** is also short. For this reason, in a case where the power supply terminal **300-1** (the first power supply terminal) and the power supply terminal **300-2** (the second power supply terminal) are disposed to face in the same direction, these power supply terminals can interfere with each other. Similarly, in a case where the power supply terminal **300-4** (the third power supply terminal) and the power supply terminal **300-5** (the fourth power supply terminal) are disposed to face in the same direction, these power supply terminals can interfere with each other. The heater **200** of the present exemplary embodiment includes the heat generating block BL**4** (the fifth heat generating block) whose size in the longitudinal direction of the heater **200** is larger than those of the first to fourth heat generating blocks BL**2**, BL**3**, BL**5**, and BL**6** in contact with the first to fourth power supply terminals, respectively.

[0051] Therefore, as illustrated in FIGS. **8**, **9**, and **11**, the power supply terminal **300-1** and the power supply terminal **300-2** are disposed to be opposite to each other in terms of orientation (in terms of the positional relationship between the contact portion and the connection portion in the longitudinal direction of the heater). Specifically, the connection portion of the power supply terminal **300-1** faces in the direction toward one end portion (the end portion on the common electrode **205**C**1** side) of the heater **200** in the longitudinal direction of the heater **200**. The connection portion of the power supply terminal **300-2** faces in the direction toward the other end portion (the end portion on the common electrode **205**C**2** side) of the heater **200**. The power supply terminals are thereby prevented from interfering with each other.

[0052] Further, the cable **306-1** connected to the connection portion of the power supply terminal **300-1** extends toward the one end portion (the end portion on the common electrode **205**C**1** side) of the heater **200**. Further, the cable **306-2** connected to the connection portion of the power supply terminal **300-2** is bent from extending in the direction toward the other end portion of the heater **200** to extend toward the one end portion of the heater **200**. The two cables **306-1** and **306-2** can be thereby drawn from the same end portion of the film **103** in the longitudinal direction of the heater **200**, so that the heating unit **101** can be downsized.

[0053] Similarly, the power supply terminal **300-4** and the power supply terminal **300-5** are disposed to be opposite to each other in terms of orientation. Specifically, the connection portion of the power supply terminal **300-4** faces in the direction toward the one end portion (the end portion on the common electrode **205**C**1** side) of the heater **200** in the longitudinal direction of the heater **200**. The connection portion of the power supply terminal **300-5** faces in the direction toward the other end portion (the end portion on the common electrode **205**C**2** side) of the heater **200**. The power supply terminals are thereby prevented from interfering with each other. Further, the cable **306-4** connected to the connection portion of the power supply terminal **300-4** is bent from extending in the direction toward the one end portion of the heater **200** to extend toward the other end portion of the heater **200**. The cable **306-5** connected to the connection portion of the power supply terminal **300-5** extends toward the other end portion of the heater **200**. The two cables **306-4** and **306-5** can be thereby drawn from the same end portion of the film **103** in the longitudinal direction of the heater **200**, so that the device can be downsized.

[0054] The cables **306-1** and **306-2** extend toward the one end portion of the heater **200**, and the cables **306-4** and **306-5** extend toward the other end portion of the heater **200**. Therefore, there is no area where all the four cables **306-1**, **306-2**, **306-4**, and **306-5** overlap at an arbitrary point in the longitudinal direction of the heater **200**, and thus the diameter of the film **103** can be reduced. Moreover, the length of the cable to be used can also be reduced.

[0055] Further, the safety element **337** is disposed in an area where none of the four cables **306-1**, **306-2**, **306-4**, and **306-5** is present, in the longitudinal direction of the heater **200**. The heating unit **101** can be thereby further downsized.

[0056] Next, the placement of the cables **306** and **308** and the FPC **213** extending from the heating unit **101** will be described.

[0057] The cables **306** and **308** and the FPC **213** drawn from the heating unit **101** pass on the outer side of the support frames **111***a* and **111***b* from both end portions of the heating unit **101**, and are connected to the electric substrate **214** disposed on the rear surface of the fixing device **100**, using cable connectors **309** and **311**. The cables **306** and **308** are placed in a path close to the support frames **111***a* and **111***b*, from the heating unit **101** to the electric substrate **214**, in order to prevent the FPC **213** from being bent or torn. The FPC **213** is placed farther away from the support frames **111***a* and **111***b* than the cables **306** and **308**. The FPC **213***a* on the side where the idler gear **114** and the drive gear **115** are disposed has an FPC shape extending in a direction perpendicular to the longitudinal direction of the heater **200**, to be prevented from being caught in the gear. The cables **306** and **308** and the FPC **213** may be placed separately, and, for example, the FPC **213** may be placed after the cables **306** and **308** are placed.

[0058] The electric substrate **214** disposed on the rear surface of the fixing device **100** is attached to a substrate holding member **215** attached to the support frame **111**C, and is covered by a cover member (not illustrated) attached to the substrate holding member **215**. This achieves electrical insulation between electric components mounted on the

electric substrate **214** and the support frame **111**C, and prevents attachment of water drops to the electric components due to moisture generated when the recording material P is pinched and conveyed through the fixing nip portion N. Cables for supplying power to the heater **200**, a plurality of sensors, the safety element **337**, and the like and a cable connected to a drawer connector **310** for electrically connecting to the main body of the printer **1** are connected to the electric substrate **214**. As illustrated in FIG. **3**, multiple grooves having a small pitch and extending in a pressure roller axial direction are located on the surface on the supporting frame **111***c* side in the substrate holding member **215**, in order to prevent the water drops due to the condensation of the moisture generated from the fixing nip portion N from falling. The water drops are thereby kept in the grooves, and thus prevented from falling downward in the fixing device **100**. In the present exemplary embodiment, the grooves have a width of 1.0 mm, a depth of 0.5 mm, and a pitch of 2.0 mm, but are not limited thereto, and these values may be freely set.

[0059] In FIG. **4**, a connector **309**-*a***1** is a connector connected to a cable extending from the power supply terminal in contact with the electrode **205-1** of the heat generating block BL and a cable extending from the power supply terminal in contact with the common electrode **205**C**1**. A connector **309**-*b***1** is a connector connected to a cable extending from the power supply terminal in contact with the electrode **205-7** of the heat generating block BL**7** and a cable extending from the power supply terminal in contact with the common electrode **205**C**2**. A connector **309**-*a***2** is a connector connected to the cable **306-3** extending from the power supply terminal **300-3** in contact with the electrode **205-4** of the heat generating block BL**4**. The connector **311-1** is a connector connected to the cable **306-4** extending from the power supply terminal **300-4** in contact with the electrode **205-5** of the heat generating block BL**5** and the cable **306-5** extending from the power supply terminal **300-5** in contact with the electrode **205-6** of the heat generating block BL**6**. A connector **311-2** is a connector connected to the cable **308** extending from the safety element (thermal switch) **337**. A connector **311-3** is a connector connected to a cable of a secondary power supply for driving a central processing unit (CPU) or the like. A connector **311-4** is a connector connected to a cable of the sensor **120** for detecting the rotation phase of the cam **116**. A connector **311-5** is a connector connected to a cable of a power supply for driving the thermistors **211**-A**1** to **211**-A**3**, **211**-A**5** to **211**-A**7**, **211**-B**1** to **211**-B**5**, and **211**-B**7**. A connector **311-6** is a connector connected to the cable **306-1** extending from the power supply terminal **300-1** in contact with the electrode **205-2** of the heat generating block BL**2** and the cable **306-2** extending from the power supply terminal **300-2** in contact with the electrode **205-3** of the heat generating block BL**3**. As illustrated in FIGS. **8** and **9**, a part of the plurality of power supply cables extends from one end portion of the film **103** in the longitudinal direction of the heater **200** to the outside of the film **103**, and the rest of the plurality of power supply cables extends from the other end portion of the film **103** to the outside of the film **103**. Further, the number of the power supply cables extending from the one end portion of the film **103** to the outside of the film **103** is an even number, and the number of the power supply cables extending from the other end portion of the film **103** to the outside of the film **103** is an odd number.

[0060] While the present invention has been described with reference to exemplary embodiments, it is to be understood that the invention is not limited to the disclosed exemplary embodiments. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all equivalent structures and functions.

What is claimed is:

1. A fixing device that fixes a toner image formed on a recording material to the recording material by heat, the fixing device comprising:

a film having a cylindrical shape;

a heater in an internal space of the film, the heater including a substrate, and a plurality of heat generating blocks located on the substrate and arranged in a longitudinal direction of the heater;

a plurality of power supply terminals in contact with electrodes of the respective plurality of heat generating blocks; and

a plurality of power supply cables connected to the respective plurality of power supply terminals,

wherein each of the plurality of power supply terminals includes a contact portion in contact with the electrode and a connection portion connected to the power supply cable,

wherein the plurality of heat generating blocks includes a first heat generating block and a second heat generating block next to each other in the longitudinal direction,

wherein the plurality of power supply terminals includes a first power supply terminal in contact with the first heat generating block and a second power supply terminal in contact with the second heat generating block, the first power supply terminal and the second power supply terminal being located in the internal space of the film,

wherein the connection portion of the first power supply terminal is at a position closer to one end portion of the heater in the longitudinal direction than the contact portion of the first power supply terminal, and the connection portion of the second power supply terminal is at a position closer to the other end portion of the heater in the longitudinal direction than the contact portion of the second power supply terminal,

wherein the power supply cable connected to the connection portion of the first power supply terminal extends toward the one end portion of the heater, and

wherein the power supply cable connected to the connection portion of the second power supply terminal is bent from extending toward the other end portion of the heater to extend toward the one end portion of the heater.

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