

12

EUROPEAN PATENT APPLICATION

21 Application number: **90105850.3**

51 Int. Cl.⁵: **G03G 15/20**

22 Date of filing: **27.03.90**

30 Priority: **28.03.89 JP 76253/89**

43 Date of publication of application:
03.10.90 Bulletin 90/40

64 Designated Contracting States:
DE ES FR GB IT

71 Applicant: **CANON KABUSHIKI KAISHA**
30-2, 3-chome, Shimomaruko, Ohta-ku
Tokyo(JP)

72 Inventor: **Yanagida, Ikuko**
c/o Canon Kabushiki Kaisha
3-30-2 Shimomaruko, Ohta-ku, Tokyo(JP)

74 Representative: **Pellmann, Hans-Bernd,**
Dipl.-Ing. et al
Patentanwaltsbüro
Tiedtke-Bühling-Kinne-Grupe-Pellmann-Gra-
ms-Struif Bavariaring 4
D-8000 München 2(DE)

54 **An image fixing apparatus.**

57 An image fixing apparatus includes a heater having a heat generating resistor for generating heat upon power supply thereto and a base member for supporting the heat generating resistor; a film slidable on the heater, wherein a recording material sup-

porting a visualized image is heated by the heat by the heater through the film; and a projection toward the recording material for guiding the film, so that the film is moved without contact to an edge of the base member.

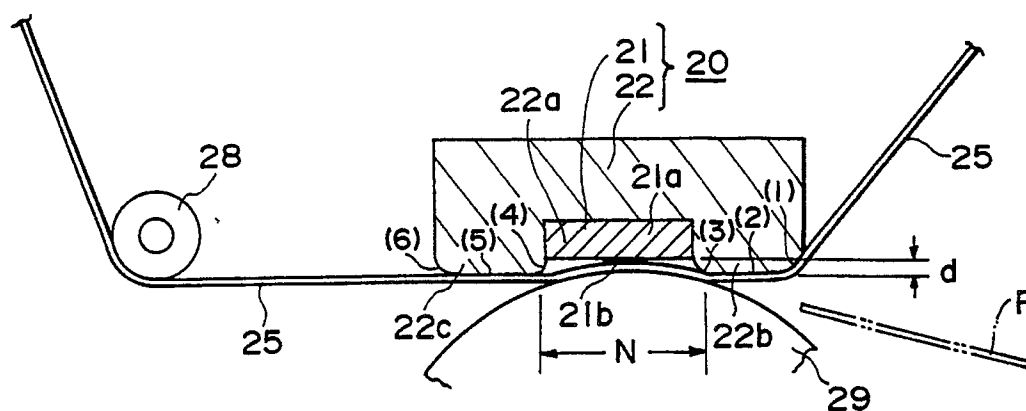


FIG. 1

FIELD OF THE INVENTION AND RELATED ART

The present invention relates to an image fixing apparatus usable with an image forming apparatus such as a copying machine, a laser beam printer, a microfilm reader/printer, a facsimile machine, a recorder or an image display apparatus, for heat-fixing into a permanent fixed image a heat-fixable unfixed toner image which corresponds to object image information and which has been directly or indirectly (image transfer type) on a recording material such as electro-fax sheet, a transfer material sheet, an electrostatic recording sheet, a printing sheet or the like.

In a widely used conventional image fixing apparatus wherein the toner image is fixed on the recording medium supporting an unfixed toner image, the recording material is passed through a nip formed between a heating roller maintained at a predetermined temperature and a pressing or back-up roller having an elastic layer and press-contacted to the heating roller.

However, the heating-roller type fixing system involves a problem that the warming up period until the surface of the heating roller reaches a predetermined temperature is long.

In order to solve this problem, U.S. Serial No. 206,767 proposes a novel image fixing apparatus wherein the toner image is fused using a small thermal capacity heater and an image fixing film slidable relative to the heater. This fixing apparatus comprises a heat generating resistor on a low thermal capacity substrate.

Figure 4 shows an example of such an image fixing apparatus using the low thermal capacity stationary heater and the thin film. The apparatus comprises a fixing film 25 in the form of an endless belt functioning as the above-described film. The film 25 is stretched around a driving roller 26, a follower roller 27, a heater assembly 20 below between the rollers and a guiding roller 28 below the driving roller 26. The follower roller 27 functions as a tension roller for the fixing film 25. The apparatus further comprises a pressing roller functioning as a pressing roller, and is effective to urge the fixing film 25 at its bottom surface to the heater assembly 20.

The heater assembly 20 includes as major components a linear heater 21 having a low thermal capacity and a supporting member 22 for fixedly supporting the heater in thermal insulative relation. A heat generating resistor material 21b is mounted on a substrate 21a and generates heat upon electric power supply thereto. The heat generating resistor material 21b is instantaneously increased in its temperature by the electric power supply, and since the fixing film 25 has a small thickness, and therefore, has a low thermal capac-

ity, the fixing operation is possible as soon as the power supply is started.

The fixing film 25 is not limited to the endless belt, but may be in the form of a rolled film, as shown in Figure 5, wherein the film is rolled on a supply shaft 30 and the free end thereof is fixed to the take-up shaft 31 by way of the nip between the heater assembly and the pressing roller 29, so that the fixing film 25 is traveled from the supply shaft 30 side to the take-up shaft 31 side at the same speed as the recording material P conveying speed.

In the examples of Figures 4 and 5, the fixing film sliding surface is such that the heater surface 21 is flush with the surface of the supporting member 22, so that the entire sliding surface is smooth, whereby the fixing film 25 can slide on the sliding surface. However, it is practically difficult because of the required processing and assembling accuracy that the surface of the heater 21 and the surface of the supporting member 22 are made completely flush. If even a small part of the edge of the heater projects beyond the surface, it can scrape or tear the film, thus decreasing the service life of the fixing film.

When the base plate 21a is made of ceramic material such as alumina, it is difficult to smoothly round the edge portion of the ceramic base plate 21a. The edge of the heater is particularly important. There is a similar problem with respect to the edge of the supporting member 22.

It is possible that when a part of the film is partly creased or partly projected during passage by the edge portion, it can scrape the unfixed toner image on the recording material introduced into the fixing apparatus, with the result of disturbed image. The scraped toner can contaminate the film, the recording material and the pressing roller.

SUMMARY OF THE INVENTION

Accordingly, it is a principal object of the present invention to provide an image fixing apparatus wherein the fixing film can smoothly slide on a heater.

It is another object of the present invention to provide an image fixing apparatus wherein the heater can be used without rounding an edge of the heater.

It is a further object of the present invention to provide an image fixing apparatus wherein the fixing film can move without sliding contact with the edge.

These and other objects, features and advantages of the present invention will become more apparent upon a consideration of the following description of the preferred embodiments of the

present invention taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a partial sectional view of an image fixing apparatus according to an embodiment of the present invention.

Figure 2 is a partial sectional view of an image fixing apparatus according to another embodiment of the present invention.

Figure 3 is a sectional view of an image forming apparatus incorporating an image fixing device according to an embodiment of the present invention.

Figures 4 and 5 are sectional views of an image fixing apparatus according to background art.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The preferred embodiments of the present invention will be described in conjunction with the accompanying drawings wherein like reference numerals are assigned to the elements having the corresponding functions.

Figure 3 is a sectional view of an image forming apparatus incorporating an image fixing device according to an embodiment of the present invention. The exemplary image forming apparatus is an electrophotographic copying apparatus wherein an original supporting platen is reciprocable, a rotatable drum is used, and an image is transferred therefrom.

The apparatus comprises a housing 100, a reciprocable original supporting platen 1 made of transparent member such as glass plate disposed on the top plate 100a of the housing 100, wherein the original supporting platen 1 is reciprocable rightwardly (a) and leftwardly (a') on the top plate 100a at predetermined speeds.

An original G is placed face down on the original supporting platen 1 at a predetermined placing reference, and is covered by an original cover 1a.

A slit opening 100b is formed on the top plate 100a extending in a direction perpendicular to the reciprocable movement direction of the original supporting platen (perpendicular to the sheet of the drawing). The slit constitute a part of the original illuminating system. The face-down image surface of the original G placed on the original supporting platen 1 passes by the slit opening 100b during the movement of the original supporting platen 1 toward the right side (a). During the passage, the light L of the lamp 7 illuminates the original G

through the slit opening 100b and the transparent original supporting platen 1. The light reflected by the original is imaged on the surface of the photosensitive drum 3 through an array 2 of imaging elements having a short focus and a small diameter.

The photosensitive drum 3 is coated with a photosensitive layer such as zinc oxide photosensitive layer or an organic photoconductor photosensitive layer. It is rotatable about a central axis 3a at a predetermined peripheral speed in the clockwise direction (b). During the rotation, the photosensitive drum 3 is uniformly charged to a positive or negative polarity by a charger 4, and the uniformly charged surface is exposed to the image light of the original through the slit opening, so that an electrostatic latent image corresponding to the light image is sequentially formed on the surface of the photosensitive drum 3.

The electrostatic latent image is visualized into a toner image with heat-softening or -fusing resin or the like by the developing device 5, and the visualized toner image is conveyed to the image transfer station having the transfer discharger 8.

The transfer material sheets P are contained in a cassette S. The sheet is singled out from the cassette by rotation of a pick-up roller 6 and is fed to the photosensitive drum 3 in such a timed relationship that when the leading of the toner image formed portion on the drum 3 reaches the transfer discharger 8, the leading edge of the transfer sheet P reaches the position between the transfer discharger 8 and the photosensitive drum 3. By the transfer discharger 8, the toner image is sequentially transferred onto the fed sheet from the photosensitive drum 3.

The sheet having received the toner image is sequentially separated from the surface of the photosensitive drum 3 by an unshown separating means and is introduced by conveying device 10 to an image fixing apparatus 11, where the unfixed toner image is heat-fixed. Thereafter, it is discharged onto the discharge tray outside the apparatus as a final print (copy) by a guide 35 and discharging rollers 36.

On the other hand, the surface of the photosensitive drum 3 having been subjected to the toner image transfer operation is cleaned by the cleaning device 13 so that the residual toner or other contamination are removed to be prepared for the next image forming operation.

Referring to Figure 1, the fixing apparatus 11 according to this embodiment will be described. Except for the heater 20, the fundamental structures thereof are similar to those of Figure 4.

In operation, when an image formation start signal is generated in the image forming apparatus, the image forming operation starts by which un-

fixed visualized image (powdery toner image, in this embodiment) corresponding to the object image information is formed on the recording material. The recording material is conveyed to the image fixing apparatus 11 with the image bearing side facing up, and is introduced into the fixing apparatus along a guide. The leading edge of the recording material P is detected by a recording material detecting sensor (not shown) disposed in the recording material passage adjacent to the fixing apparatus 11, at a point of time slightly before it enters the fixing apparatus 11. In response to the detection signal thereof, the fixing film 25 in the form of an endless belt starts to rotate in the clockwise direction. The rotational driving speed for the fixing film is such that the peripheral speed thereof is substantially equal to the recording material P conveying speed to the fixing apparatus 11. The fixing film 25 rotates without crease or snaking movement. Also, the power supply control to the heat generating member 21b of the heater 21 of the heater assembly 20 is also started.

The recording material P enters the nip formed between the fixing film 25 and the pressing roller 29, so that the bottom surface of the fixing film 25 is contacted to the unfixed toner image with pressure, while it is being conveyed through the nip N together with the fixing film 25.

During the passage of the recording material P through the fixing nip N, the toner image supporting side of the recording material is effectively heated by the thermal energy provided by the heater 21 of the heater assembly 20 through the small thickness of the fixing film 25, by which the toner image Ta is fused into a toner image Tb which is adhered on the surface of the recording material P. The recording material P is separated from the fixing film 25 when it leaves the fixing nip N. At the time of the separation, the temperature of the fused toner Tb is lower than that at the position of the heat generating member 21b, but it is still higher than the glass transition point of the toner, so that the toner Tb has sufficient rubber property, and therefore, the toner image supporting side of the recording material P at the time of the separating point does not follow the surface of the fixing film, and has proper surface roughness. The toner Tb is cooled down into a solidified image Tc with the proper surface roughness maintained. Therefore, the fixed toner image is not glossy, and therefore, the image quality is high.

Since the toner is sufficiently heated and fused by the heater, no low temperature offset occurs. In addition, the recording material is separated from the fixing film after the temperature of the toner sufficiently decreases, and therefore, no high temperature offset occurs.

The recording material P separated from the

fixing film 25 is guided along the guide 35 to the discharging rollers 36, during which the temperature of the toner Tb higher than the glass transition point decreases spontaneously down below the glass transition point, and therefore, is solidified into a solid image Tc. The recording material P now having the recorded image information is discharged onto the discharging tray 12.

The power supply control to the heat generating element 21b of the heater 21 is stopped at the time when a predetermined timer period elapses, the timer period being determined on the basis of the time required from the sensor detecting the trailing edge of the recording material P to the trailing edge thereof passing through the fixing nip N. Then, the rotation of the fixing film 25 is stopped. The fixing apparatus 11 is in the stand-by state until the leading edge of the next recording material is detected by the sensor.

In this embodiment, the glossiness of the image is prevented by separating the recording material from the film while the temperature of the toner is higher than the glass transition point. However, it is possible that the conveyance of the fixing film 25 together with the recording material P closely contacted thereto is continued after the recording material P passes through the fixing nip N, during which the heat of the softened or fused toner Tb is irradiated to cool the toner into a solidified toner Tc, and then it is sequentially separated from the fixing film 25 surface. In this case, the coagulation force of the toner solidified by the cooling step is very large, so that the toner behaves as a mass, and therefore, the adhesive or bonding force thereof to the recording material increases, while the adhesive force or bonding force to the fixing film decreases significantly. Since the toner is pressed by the pressing member when it is heated, softened or fused, at least a part of the toner constituting the image is soaked into the surface layer of the recording material, and the anchoring effect by the cooling and the solidification of the soaked portion is effective to increase the adhesive or bonding force of the toner to the recording material. As a result, the portion of the recording material in which the image has been fixed is easily and sequentially separated from the fixing film without production of the toner offset to the fixing film.

In this case, the image becomes glossy, and therefore, is usable when the glossiness is desired.

As will be understood, the temperature of the heater 21 is instantaneously raised to a fixable temperature (quick start), upon power supply to the heat generating element 21b, and therefore, the preliminary heating to the heater in which the temperature of the heater is raised beforehand is not required. Also, the heat transfer to the pressing

roller 22 during the non-image-fixing operation is small. During the fixing operation, the fixing film, the toner image and the recording material are in the fixing nip N between the heater 21 and the pressing roller 29, and in addition, the heat generating period is short with the result of steep temperature gradient, by which the pressing roller 29 is not easily raised in temperature. The temperature of the pressing roller is maintained at a level lower than the fusing point of the toner even when the image forming operation is continuously performed in a practical manner.

In the apparatus having this structure, the toner image made of heat-fusible toner on the recording material P is first heated and fused by the heat generating member through the fixing film 25, and particularly, the surface portion thereof is completely softened and fused. At this time, the pressing roller 23 establishes close contact between the heater, the fixing film, the toner image and the recording material, so that the heat transfer is efficient. Therefore, the toner image can be efficiently heated and fused with the heating of the recording material P minimized. Particularly by limiting the power supply heat generating period, the energy consumption can be saved.

The size of the heater may be small, and therefore, the thermal capacity thereof may be small. For those reasons, it is not necessary to raise the temperature of the heater beforehand, so that the power consumption during the non-image formation can be minimized, in addition, the temperature rise in the apparatus can be prevented.

The description will be now made as to the fixing film used in this embodiment. The fixing film 25 is made of a thin film having good heat-resistive properties and having good parting properties with respect to the visualizing agent (toner). Where it is in the form of an endless belt repeatedly used, the durability thereof against the repeated use is to be high.

In order to reduce the thermal capacity for the purpose of accomplishing the quickly startable apparatus, the thickness thereof is preferably not more than 100 microns, further preferably not more than 40 microns. It may be a single layer film of a heat resistive resin such as PI (polyimide), PEI (polyetherimide), PES, PFA (copolymer of tetrafluoroethylene-perfluoroalkylvinylether), or it may be a multi-layer film including a 20 microns thickness base film coated with a parting layer of 10 microns at least on the side contactable to the recording material, the coating being made of PTFE resin (tetrafluoroethylene resin), PFA or another fluorinated resin added by electrically conductive material.

The pressing roller 29 has a rubber elastic layer made of silicone rubber having a good part-

ing property. The pressing roller 29 is pressed to the bottom surface of the heater assembly 20 under a total pressure of 4 - 7 kg by an unshown urging means through the fixing film 25 interposed therebetween. The pressing roller 29 rotates following the movement of the fixing film 25, or it is driven at the peripheral speed substantially equal to the movement speed of the film 25.

The fixing nip N is formed by the pressing of the pressing roller 29 toward the bottom surface of the heater assembly 20. The width of the heater 21 is within the width of the fixing nip N.

The heater assembly 20 will be described in detail. The heater assembly 20 comprises a low thermal capacity linear heater 21 and a supporting member 22 for fixedly supporting the heater 21. The heater 21 includes a substrate 21a having a low thermal capacity, a high heat-resistivity and a high thermal conductivity, more particularly, an elongated alumina substrate having a thickness of 1 mm, a width of 10 mm and a length of 240 mm, and a heat generating element 21b on one side of the substrate, more particularly, heat generating resistor material such as silver-palladium or the like applied in a width of 1 mm by screen printing, for example, along the length of the substrate at substantially the center of the width of the substrate.

At a side of the substrate 21a opposite from the side having the heat generating resistor is provided with a temperature detecting element. The power supply to the heat generating resistor material is controlled so that the temperature detecting element detects a constant temperature.

The supporting member 22 for fixedly supporting the heater 21 is a molded heat-resistive resin having a sufficient rigidity, high heat-resistivity and low thermal conductivity. Examples of usable materials are PET (polyethyleneterephthalate), bakelite, PPS (polyphenylenesulfide), PAI (polyimide amide), PI, PEEK (polyether ether ketone) resins.

In the bottom surface of the fixing film contactable side of the supporting member 22, a groove 22a is formed. The heater 21 is extended along the length of the supporting member 22 substantially at the center of the width (measured in the direction of the fixing film movement). The groove 22a has a depth larger than the thickness of the heater 21. The heater 21 is set in the groove 22a with the heat generating element 21b thereon facing outwardly, using double-sided adhesive tape or bonding agent or the like to fix it to the supporting member 22. The entire strength or rigidity of the heater assembly 20 is assured by the supporting member 22.

The heater assembly 20 is mounted on the main assembly of the fixing apparatus by mounting an fixing the supporting member 22 on the mounting portion of the main assembly provided at a

predetermined position thereof, with the bottom surface of the supporting member including the outer surface of the heater 21 facing downwardly.

The fixing film 25 in the form of the endless belt rotates while the inside surface thereof slides on the bottom surface of the supporting member 22 including the outer surface of the heater 21 of the heater assembly 20. The heat generating element 21b of the heater 21 generates heat when it is supplied with electric power through the power supply electrodes connected to the longitudinal opposite ends thereof. The heater 21 sinks in the groove 22a, so that the portions 22b and 22c of the supporting member 22 sandwiching the heater 21 in the direction of the fixing film travel is outside the outer surface of the heater 21, in other words, a stepped portion d is formed in connection with the outer surface of the heater. The height of the step d is preferably 0.1 - 2 mm.

The portions 22b and 22c of the supporting member includes portions (1), (2), (3), (4), (5) and (6), as shown in Figure 1 the corners of the portions are rounded with radii $R = 0.2 - 5$ mm into rounded portions (1), (3), (4) and (6). The surface roughness of the surface portions (2) and (5) and the rounded portions (1), (3), (4) and (6) is not more than 3.2 S, the surfaces are smooth.

In this manner, projections toward the recording material side beyond the outer surface of the heater are provided for guiding the film toward the recording material side at the upstream and downstream of the heater with respect to the movement direction of the film, by which the film does not slide on the edge of the heater.

Therefore, the heater can be used without rounding its edges. This permits to use poor machinability material such as the ceramic material for the heater. The projections are made by the molding on the supporting member made of resin having excellent machinability or productivity. Because of this, the processing and assembling steps are simple without the necessity of adding a process step.

In the manner described above, the damage or wearing of the inside surface of the film is prevented, so that the service life of the film is significantly increased. In addition, the scraping of the unfixed toner image and the image disturbance on the recording material to be subjected to the image fixing operation, due to the presence of the edges of the heater or the supporting member, are prevented, and in addition, the possible contamination of the film, the pressing member and the recording material by the scraped toner is also prevented.

Furthermore, the stability in the travel of the film is increased, and the stability and reliability of the fixing operation is improved.

Referring to Figure 2, another embodiment of

the present invention will be described. In this embodiment smoothly rotatable rollers 22d and 22e for guiding the fixing film are provided on the supporting member upstream and downstream of the heater 21 with respect to the movement of the film. Those rollers are projected outwardly beyond the outer surface of the heater 21 to provide steps d with the outer surface of the heater. The height of the steps is 0.1 - 2 mm.

According to this embodiment, although the number of parts of the apparatus is increased due to the provision of the separate guiding rollers 22d and 22e, the force required for sliding the film is decreased because of the provision of the rotatable rollers, so that the required driving force for the film can be reduced.

In this embodiment, the description has been made with respect to the endless fixing film. It is possible that a non-endless film is used, as shown in Figure 5.

Where the fixing film 25 is not endless, a replaceable rolled film can be employed, wherein almost all of the fixing film 25 is taken up on the take-up reel 31 from the supply reel 30, a new roll of film is mounted (a wind-up and exchange type).

In this type, the thickness of the fixing film can be reduced substantially without regard to the durability of the fixing film, so that the power consumption can be reduced. For example, the fixing film in this type may be made of a less expensive material such as PET (polyester) film which is treated for heat-durability having a thickness of 12.5 microns or lower. As another alternative type, the used fixing film taken up on the take-up shaft can be rewound on the feeding shaft, or the take-up shaft and the feeding shaft are interchanged with each other to use the fixing film repeatedly, if the thermal deformation or thermal deterioration of the fixing film is not significant (a rewinding and repeatedly using type).

In this type, the fixing film is preferably made of a material exhibiting high heat-resistivity and mechanical strength, such as polyimide resin film having a thickness of 25 microns which is coated with a parting layer made of fluorinated resin or the like having a good parting properties to constitute a multi-layer film. A press-contact releasing mechanism is preferably provided to automatically release the press-contact between the heater and the pressing roller during the rewinding operation.

Where the fixing film is used repeatedly as in the rewinding and repeatedly using type and an endless belt type, a felt pad may be provided to clean the film surface and to apply a slider mount of parting agent such as silicone oil by impregnating the pad with the oil, by which the surface of the film is maintained clean and maintained in good parting property. Where the fixing film is treated

with insulating fluorinated resin, electric charge is easily produced on the film, the electric charge disturbing the toner image. In that case, the fixing film may be rubbed with a discharging brush which is electrically grounded to discharge the film. On the contrary, the film may be electrically charged by applying a bias voltage to such a brush without grounding as long as the toner image is not disturbed. It is a possible measure against the image disturbance due to the electric charge to add carbon black or the like in the fixing film. The same means is applicable against the electric charge of the pressing roller. As a further alternative, anti-electrification agent may be applied or added. In any of the above endless belt type, the wind-up and exchange type and the rewinding and repeatedly using type, the fixing film may be in the form of a cartridge detachably mountable at a predetermined position in the fixing apparatus 11 to facilitate the fixing film exchanging operation.

The heater 21 or the heat generating element 21b may be in the form of a ceramic chip array having a PTC characteristic. The power supply is not limited to the form of the pulsewise power supply but may be in the on-off power supply of AC or DC voltage.

While the invention has been described with reference to the structures disclosed herein, it is not confined to the details set forth and this application is intended to cover such modifications or changes as may come within the purposes of the improvements or the scope of the following claims.

An image fixing apparatus includes a heater having a heat generating resistor for generating heat upon power supply thereto and a base member for supporting the heat generating resistor; a film slidable on the heater, wherein a recording material supporting a visualized image is heated by the heat by the heater through the film; and a projection toward the recording material for guiding the film, so that the film is moved without contact to an edge of the base member.

Claims

1. An image fixing apparatus, comprising:
a heater having a heat generating resistor for generating heat upon power supply thereto and a base member for supporting the heat generating resistor;
a film slidable on said heater, wherein a recording material supporting a visualized image is heated by the heat by said heater through said film; and
a projection toward the recording material for guiding said film, so that said film is moved without contact to an edge of said base member.

2. An apparatus according to Claim 1, wherein said base member is of ceramic material.

3. An apparatus according to Claim 1, wherein said base member has a high thermal conductivity and is provided on a side thereof opposite from a side supporting said heat generating resistor with a temperature detecting element for controlling the power supply to said heat generating resistor.

4. An apparatus according to Claim 1, further comprising a holding member for holding said heater, and wherein said holding member is provided with said projection.

5. An apparatus according to Claim 4, wherein said holding member is of thermally insulating material.

6. An apparatus according to Claim 1, wherein said projection includes projected portions sandwiching said heater in a direction of movement of said film.

7. An apparatus according to Claim 1, further comprising an urging member for urging said heater, said film and the recording material.

8. An apparatus according to Claim 1, wherein said visualized image is a toner image, and wherein a temperature of toner constituting the toner image at a point where the recording medium is separated from said film is higher than a glass transition point of the toner.

9. An apparatus according to Claim 1, wherein said film has a thickness not more than 100 microns.

10. An apparatus according to Claim 9, wherein said film has a thickness not more than 40 microns.

11. An apparatus according to Claim 1, wherein said film is in the form of an endless belt.

12. An apparatus according to Claim 1, wherein said projection is convex toward said film without corner.

13. An apparatus according to Claim 12, wherein said projection is rounded.

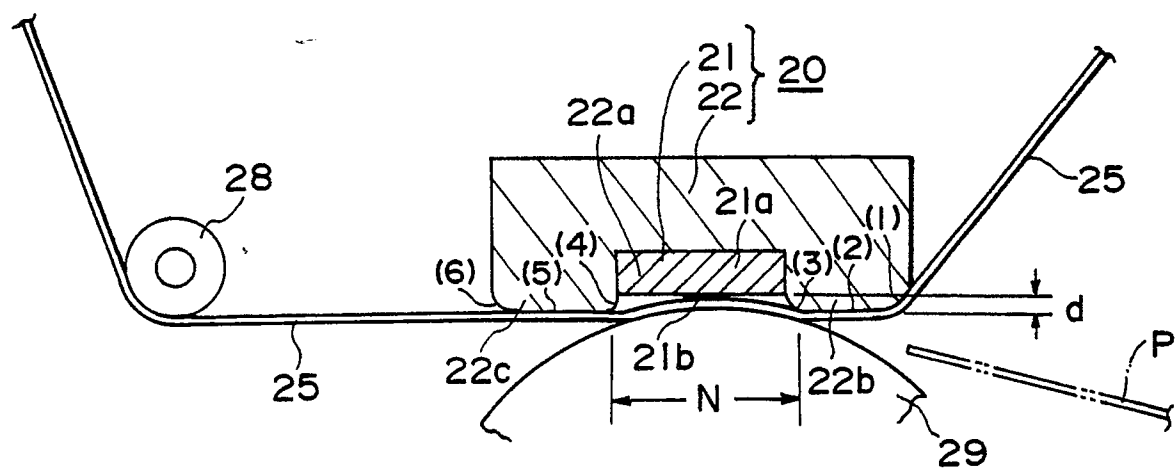


FIG. 1

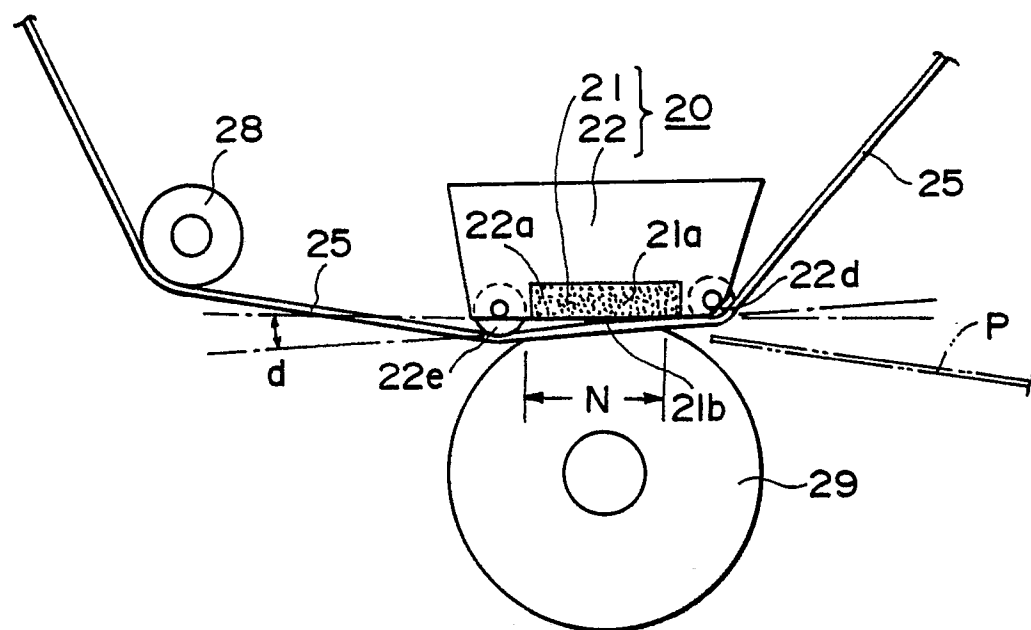
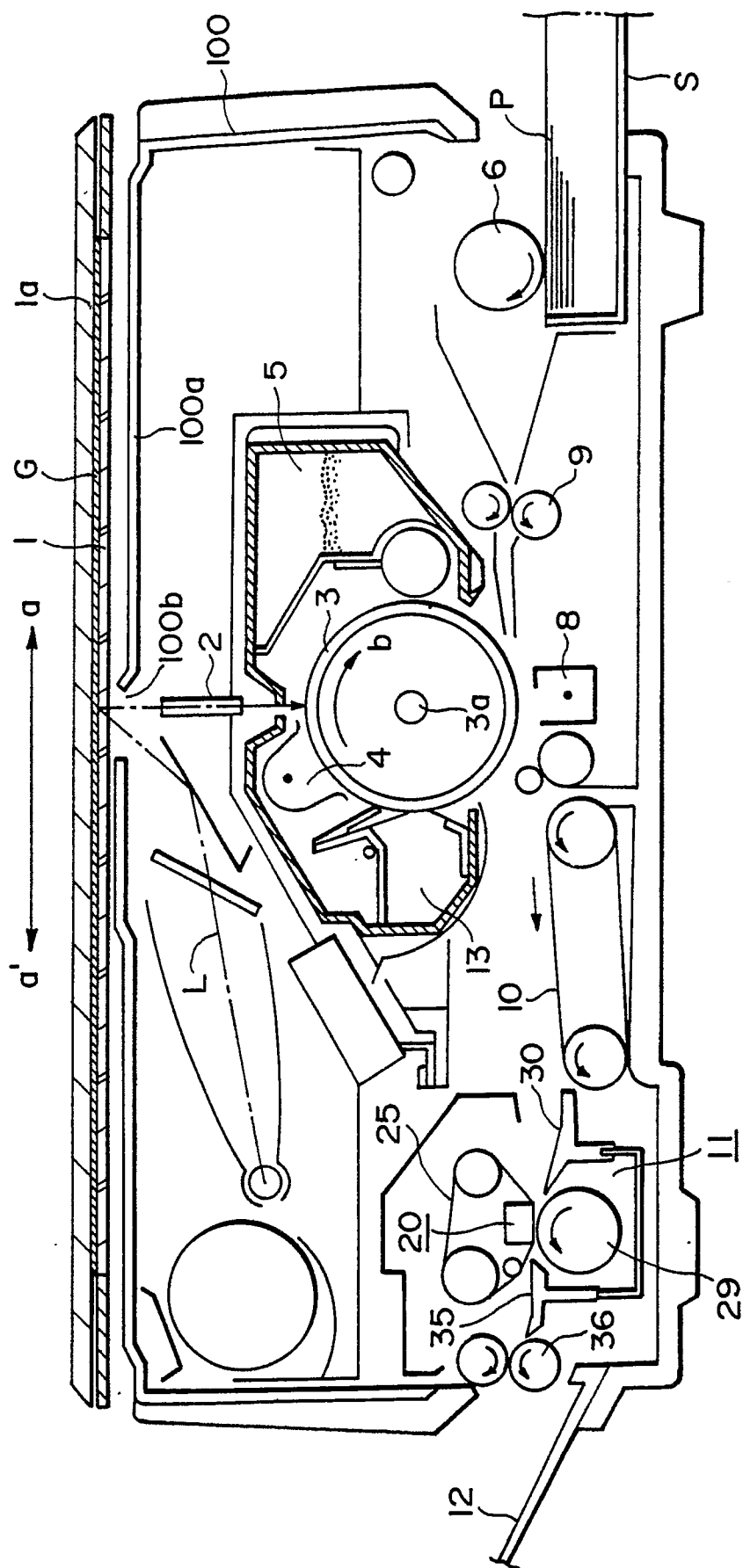


FIG. 2



361

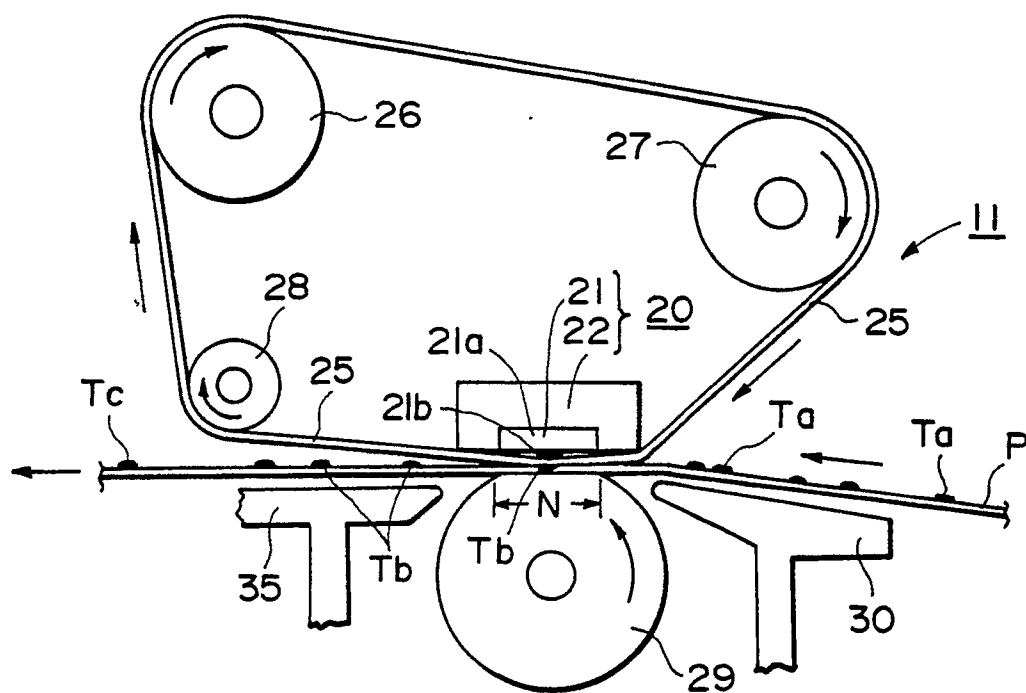


FIG. 4

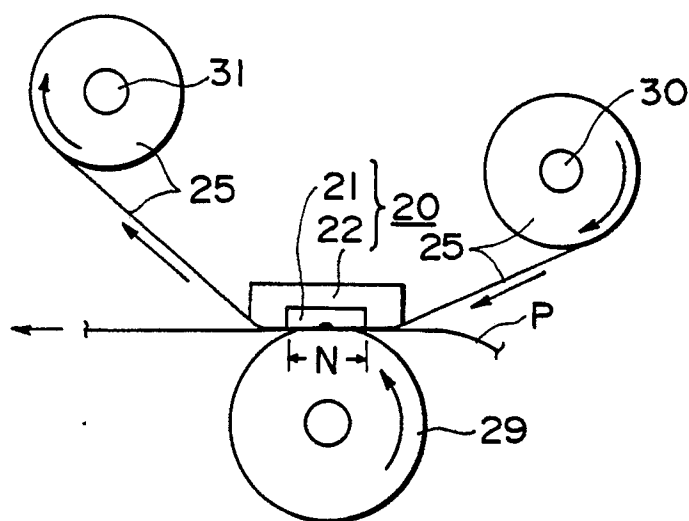


FIG. 5