

Thermal toner fixing device for xerographic apparatus

This invention relates to a thermal toner fixing device for a xerographic apparatus.

In many forms of xerographic apparatus, the surface of an electrostatically charged photosensitive drum is exposed to image-carrying light to form an electrostatic latent image thereon, toner is caused to adhere to the latent image to develop it, and the toner image is transferred to a sheet of paper and fixed thereon.

The toner fixing operation in this process is commonly conducted using a thermal toner fixing device like the one shown in Figure 3 of the accompanying drawings. This device has a heated roller, indicated generally by the reference number 2, rotatably supported on a shaft 1 and heated by an appropriate heat source to a temperature of around 180°C, and a silicon rubber pressure roller, indicated generally by the reference number 5, supported on a shaft 4. The surface 3 of the heated roller 2 and the surface 6 of the pressure roller 5 are forced against each other with a force calculated to produce a predetermined contact pressure along the length of the rollers. When a sheet of paper 7 bearing a toner image is inserted between the rollers 2 and 5 and the rollers are rotated so as to pass the sheet between the rollers, the toner is melted and fixed to the paper by the heat of the heated roller 2.

When a sheet of paper 7 that is narrower than the axial length of the heated roller 2 (which is in the lateral

direction of the apparatus as a whole) is passed between the rollers, the pressure roller 5 absorbs more heat at the portions where the paper is not present than at the portions where it is. The temperature at the surface of the pressure roller 5 therefore rises to around 180°C at portions where it is in direct contact with the heat roller 2, as compared with only around 50°C at portions where it indirectly contacts the heat roller 2 through the paper.

The diameter of the pressure roller 5 at the end portions to either side of the paper 7 therefore increases considerably owing to thermal expansion. As a result, the heated roller 2 is pushed away (upwards in the usual orientation of such apparatus, and as seen in Figure 3), with a tapered step 8 forming in the pressure roller 5 on either side of the portion in contact with the paper 7 and a gap 9 is formed between the surface 3 of the heat roller 2 and the surface 6 of the pressure roller 5 at the portion where the paper is present. That is apt to give rise to slippage between the paper 7 and the rotating heated and pressure rollers so that the paper is liable to be improperly conveyed and may jam.

An object of the invention is to provide a thermal toner fixing device for a xerographic apparatus in which heat accumulating in the pressure roller is dissipated or dispersed so as to achieve uniform thermal deformation throughout the pressure roller and thus enable both wide and narrow sheets of paper to be conveyed accurately and quickly.

The invention provides a thermal toner fixing device for a

xerographic apparatus for fixing a toner image to a sheet of paper by heating the sheet of paper as it is passed between a rotatable heated roller and a rotatable pressure roller in contact therewith, which device comprises a heat dissipation mechanism for dissipating heat accumulating in the pressure roller arranged to warm relatively cool portions of the pressure roller with heat dissipated from relatively warm portions of the pressure roller, which heat dissipation mechanism comprises a hollow thermally conductive drum, in rolling contact with the pressure roller, having heat dissipating fins connecting its internal surface to a central shaft and means for causing air to flow along the hollow interior of the drum and to take up heat being dissipated by the drum.

In the thermal toner fixing device for a xerographic apparatus according to the invention, since heat accumulating in the pressure roller is dissipated by the heat dissipation mechanism, thermal deformation of the pressure roller is prevented and the surface temperature of the pressure roller becomes relatively even throughout.

Since the whole surface of the pressure roller is therefore pressed onto the surface of the heated roller at the predetermined pressure, sheets of paper can be conveyed accurately and quickly by the rotation of the heated and pressure rollers without slipping or jamming.

One form of thermal toner-fixing device constructed in accordance with the invention will now be described by way of example only with reference to Figures 1 and 2 of the accompanying drawings, in which:

Figure 1 is a schematic front view of a thermal toner fixing device according to the invention;

Figure 2 is a schematic side view of the thermal toner fixing device shown in Figure 1; and

Figure 3 is a view similar to Figure 1 of a previously proposed thermal toner fixing device.

Referring to Figures 1 and 2, in one form of toner-fixing device according to the invention, the constituent elements corresponding to those of the previously proposed device

described above with reference to Figure 3 are assigned the same reference numerals as in the earlier description and will not be explained here again.

The toner-fixing device shown in Figures 1 and 2 comprises a hollow aluminium heat dissipation drum, indicated generally by the reference number 10, rotatably supported on a shaft 11 at an appropriate location in a xerographic apparatus (not shown).

The shaft 1 is parallel to the shaft 4 of the pressure roller 5, and part of the surface 12 of the heat dissipation drum 10 (the uppermost part as seen in Figure 1) is pressed onto the surface 6 of the pressure roller 5 with a force selected to produce a predetermined pressure, enabling the drum to absorb heat by conduction from the pressure roller 5. The drum 10 rotates in the direction indicated by an arrow in Figure 2 when the pressure roller 5 rotates in the direction indicated by an arrow. The heat dissipation drum 10 is open at both lateral ends 13 and 14. A plurality of equiangularly spaced heat dissipation fins 16 extend radially between the shaft 11 at the centre of the hollow interior 15 of the heat dissipation drum 10 and the inner surface of the drum.

The heat absorbed by the heat dissipation drum 10 from the pressure roller 5 is thus dissipated both outwards from the portions of the surface 12 of the drum 10 that are not in contact with the roller and through the heat dissipation fins 16 into the hollow interior 15 of the drum.

A duct 17 provided in communication with one end 13 of the

heat dissipation drum 10 is provided internally with a rotating fan 18 powered by a motor (not shown).

An air stream generated by the rotation of the fan 18 passes from the end 13, through the hollow drum interior 15 and out at the other end 14, carrying with it the air within the hollow interior 15 that has been warmed by the heat dissipated by the fins 16.

When a narrow piece of paper 7, of a width smaller than the length of the pressure roller 5, is passed between the pressure roller 5 and the heated roller 2, high temperature heat is directly conducted from the heated roller 2 to the end portions of the pressure roller 5 at either side of the paper 7, while high temperature heat is also conducted from the heated roller 2 to the centre region of the pressure roller 5 through the paper 7.

That heat is thereafter conducted from the pressure roller 5 to the heat dissipation drum 10 rotating in contact with the roller 5 and is dissipated both outwards from the surface 12 of the heat dissipation drum 10 and from the heat dissipation fins 16 into the hollow interior 15.

Air is blown by the fan 18 from the end 13 of the heat dissipation drum 10, through the hollow interior 15, where it is warmed by the heat from the fins 16, and to the outside through the other end 14 of the drum. The hollow interior 15 of the heat dissipation drum 10 is therefore cooled, thereby promoting the dissipation of heat from the fins 16 and, in turn, the absorption of heat by the heat dissipation drum 10

from the roller 5. As a result, the end regions of the pressure roller 5 are prevented from rising to a high temperature and, therefore, from experiencing excessive thermal expansion.

In addition, the movement of the hot air in the hollow interior 15 of the heat dissipation drum 10 by the fan 18 warms the central region of the heat dissipation drum 10, which is at a lower temperature than the region towards the end 13, and that in turn warms the central portion of the pressure roller 5 in contact with the central portion of the heat dissipation drum 10 and causes it to undergo thermal expansion.

As a consequence, the heat distribution becomes more uniform across the full width of the pressure roller 5, the amount of its thermal expansion in the radial direction becomes more nearly constant throughout, the surface 6 of the pressure roller 5 and the surface 3 of the heated roller 2 press onto each other at the predetermined pressure, and the paper 7 is reliably conveyed through the fixing device.

When a wide sheet of paper 7 is conveyed through the rollers, the surface 3 of the heat roller 2 and the surface 6 of the pressure roller 5 contact each other through the paper over their entire lengths. Since the effect of such contact is obvious from the foregoing explanation, it will not be discussed here.

Since the present invention provides a heat dissipation mechanism for dissipating heat accumulating in particular

portions of the roller through contact with the heat roller, the thermal expansion of the pressure roller remains relatively uniform even when a sheet of paper that is narrower than the length of the rollers is passed between the heated and pressure rollers. As a result, the pressure roller and the heated roller do not separate but are pressed against each other over their entire lengths at the predetermined pressure through the paper, so that the paper can be reliably conveyed in the proper manner.



Claims:

1. A thermal toner-fixing device for a xerographic apparatus for fixing a toner image to a sheet of paper by heating the sheet of paper as it is passed between a rotatable heated roller and a rotatable pressure roller in contact therewith, which device comprises a heat dissipation mechanism for dissipating heat accumulating in the pressure roller arranged to warm relatively cool portions of the pressure roller with heat dissipated from relatively warm portions of the pressure roller, which heat dissipation mechanism comprises a hollow thermally conductive drum, in rolling contact with the pressure roller, having heat dissipating fins connecting its internal surface to a central shaft and means for causing air to flow along the hollow interior of the drum and to take up heat being dissipated by the drum.

2. A thermal toner-fixing device substantially as hereinbefore described with reference to, and as shown in, Figures 1 and 2 of the accompanying drawings.

3. Xerographic apparatus incorporating a toner-fixing device as claimed in claim 1 or claim 2.

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