An improved pressure roll construction for a pressure heated fusing apparatus in where the pressure roll is formed with reinforcing elements at the ends thereof.

3 Claims, 4 Drawing Figures
PRESSURE ROLL CONSTRUCTION

This application relates to heated pressure fusing systems and in particular to an improved pressure roll construction which resists bulging at the roll ends thereby minimizing any deviation from uniform loading along the roll.

In the practice of xerography as described in U.S. Pat. No. 2,297,691 to Chester F. Carlson, a xerographic surface comprising a layer of photoconductive insulating material affixed to a conductive backing is used to support electrostatic images. In the usual method of carrying out the process, the xerographic surface is electrostatically charged uniformly over its surface and then exposed to a light pattern of the image being reproduced to thereby discharge the charge in the areas where the light strikes the layer. The undischarged areas of the layer thus form an electrostatic charge pattern in conformity with the configuration of the original light pattern.

The latent electrostatic image can then be developed by contacting it with a finely divided electrostatically attractable material such as a powder. The powder is held in image areas by the electrostatic charges on the layer. Where the charge field is greatest, the greatest amount of powder is deposited. Thus, a powder image is produced in conformity with the light image of the document or object being reproduced. The powder is subsequently transferred to a sheet of paper or other surface and suitably affixed thereto to form a permanent print.

A typical device for fixing the toner particles to the backing sheet is by passing it through pressure rolls at least one of which is heated. Normally, the copy sheet is passed through the nip of a relatively hard metallic heated fuser roll and a relatively soft rubber backup roll as described, for example, in U.S. Pat. Nos. 3,256,002 and 3,268,351. A problem may result particularly in the case of higher processing speeds and increased pressures when the soft pressure roll bulges out at the ends causing non-uniform loading on the ends and thus an unsatisfactory fused image and paper wrinkling.

The present invention is to obviate this bulging of the pressure roll at the ends so as to produce uniform loading along the entire length of the roll.

It is therefore an object of the present invention to improve pressure heated fusing systems.

It is another object of the present invention to improve uniform loading of pressure heated fusing rolls.

It is another object of the present invention to extend the life of soft pressure rolls used as pressure fusing devices.

It is still another object of the present invention to minimize costs and unnecessary maintenance of copier/duplicator systems.

These and other objects of the instant invention are obtained by a new and improved pressure roll construction of silicone rubber with a thin exterior coating which contacts the heated fuser roll uniformly along the entire length thereof.

Further objects of this invention together with additional features and advantages thereof will become apparent from the following detailed description of the embodiment of the invention when read in conjunction with the accompanying drawings wherein:

FIG. 1 is a schematic representation of an automatic xerographic reproducing machine incorporating a pressure heated fusing apparatus utilizing the improved pressure roll construction of the present invention;

FIG. 2 is a side elevational view of the pressure heated fusing apparatus;

FIG. 3 is a side elevational view of a prior art pressure roll construction; and

FIG. 4 is an elevational view of the pressure roll construction according to the present invention.

Referring now to FIG. 1 of the drawings there is shown an embodiment of the invention in a suitable environment such as an automatic xerographic reproducing machine. The automatic reproducing machine includes a xerographic plate or surface 10 formed in the shape of a drum. The plate has a photoconductive layer or light receiving surface on a conductive backing Journal in a frame to rotate in the direction indicated by the arrow. The rotation will cause the plate surface to sequentially pass a series of xerographic processing stations. For purposes of the present disclosure the several xerographic processing stations in the path of movement of the plate surface may be described functionally as follows:

A charging station A which the uniform electrostatic charge is deposited onto the photosensitive plate.

An exposure station B at which light or radiation pattern of copies to be reproduced is projected onto the plate surface to dissipate the charge in the exposed areas thereof to thereby form a latent electrostatic image of the copies to be reproduced.

A developing station C at which xerographic developing material including toner particles having an electrostatic charge opposite to that of the latent electrostatic image is cascaded over the latent electrostatic image to form a powdered image in configuration of the copy being reproduced.

A transfer station D which the powdered image is electrostatically transferred from the plate surface to a transfer material such as paper which is then passed through a heated pressure fusing system having an improved oil applying pad according to the present invention as will be described hereinafter.

A drum cleaning and discharge station E at which the plate surface is brushed to remove residual toner particles remaining thereon after image transfer and at which the plate is exposed to a relatively bright light source to effect substantially complete discharge of any residual electrostatic charge remaining thereon.

For further details of the xerographic processing stations above reference is made to U.S. Pat. No. 3,645,615 filed July 3, 1969 and commonly assigned herewith.

Referring now in particular to FIG. 2 there is shown a pressure heated fusing apparatus which includes a heated fuser roll 16 and an improved backup pressure roll 18 according to the present invention. Fuser roll 16 is a hollow circular cylinder with a metallic core 20 and a Teflon layer 22. A quartz lamp 24 serves as a source of thermal energy and is located at the center of the fuser roll. Power to the lamp is controlled by a thermal sensor generally called a thermistor contacting the periphery of the fuser roll as described, for example, in U.S. Pat. No. 3,357,249. The backup roll 18 is also a circular cylinder and is made up of a metal core 30 surrounded by a thick rubber layer 32 and also a Teflon layer 34 to prevent soaking silicone oil into rubber layer 32 and subsequent swelling.
When the two rollers 16 and 18 are engaged as shown in FIG. 2 the applied load deforms the rubber in the pressure roll to provide the nip with a finite width. The copy sheet 40 electrostatically bearing the toner images 42 on the underside is brought into contact with the nip of the rolls with the toner image contacting the fuser roll 16. For a given temperature of the fuser roll, the fusing rate will depend upon the contact arc length of the support material against the dwell time, i.e. the time the toner images remain between the fuser roll 16 and the backup roll 18. Dwell time can be varied either by changing the surface velocity of the rolls or by varying the contact arc length and holding the speed of the roll the same. Contact arc length depends on the softness of the rubber on backup roll 18 and on the amount of pressure between the rolls 16 and 18. The mechanism for driving the rolls and for lowering and raising the rolls into contact can be accomplished by any suitable means as that described, for example, in U.S. Pat. No. 3,291,466 or by a suitable mechanical camming device.

As a sheet of material is advanced between the rolls 16 and 17 the toner images on the support material will contact the peripheral heated surface of the roll 16 whereby the toner images become tackified and in this tackified condition the toner will tend to offset on this roll except that it is partially prevented from doing so by the Teflon coating on the roll.

An oil dispensing apparatus 45 includes wicking assembly 48, an oil pan 50 for maintaining a supply of silicone oil 51 and an applicator roll 52. The oil pan is loaded against the heated fuser roll 16 by a spring action mounting (not shown) as details of the mounting form no part of the present invention. Applicator roll 52 is used to convey a thin film of oil to the bottom face 55 of the wicking assembly as the applicator roll is rotated in the direction shown by the arrow. Desirably, the applicator roll 52 is driven by an oil dispensing motor 58 which is energized during the fusing operation for a period depending upon the number of copies being produced.

In the past bulging at the ends of the pressure roll 18 resulted in uneven loading and improperly fused images and paper wrinkle. The bulging is best shown by numeral 90 in FIG. 3. In order to eliminate the bulging on the ends one or more thin stiffening members 92 are molded with the rubber of the pressure roll 18. Members 92 are circular or spiral or any other desired shape and arranged around the axis of roll 18. The stiffening members can be made of any suitable material. Preferred materials are stainless steel, aluminum, plastic, fiber glass or combinations thereof. The thickness of the members ranges from about 0.001 to about 0.010 inches. It has been found that bulging is minimized by the above construction with an accompanying improvement in copy quality.

While the instant invention as to its objects and advantages has been described as being carried in a specific embodiment thereof it is not intended to be limited thereby but is intended to be covered broadly within the scope of the appended claims.

What is claimed is:

1. In a heated pressure roll fusing system for fusing toner images of electrostatic copying machines in which a heated fuser roll is urged into pressure contact with a relatively soft pressure backing roll, an improved pressure roll device comprising,
   a core member,
   a cylindrical member made of rubber positioned around said core member, said rubber being relatively thick and soft and having a tendency to bulge at the ends thereof under fusing conditions, said cylindrical member being formed with at least one thin stiffening member inserted at each of the ends thereof said stiffening members being circular in shape and having a thickness ranging from about .001 inches to about .010 inches to minimize end bulge to improve fusing and reduce wear.
   2. A pressure roll device according to claim 1 wherein said stiffening members are made of stainless steel, aluminum, plastic, fiberglass or combinations thereof.
   3. A pressure roll device according to claim 1 wherein said cylindrical member has an exterior layer which is impervious to oil.

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