United States Patent [19]

Thettu et al.

[11] **3,861,860**

[45] **Jan. 21, 1975**

[54] **DRY FUSER ROLL CLEANING APPARATUS**

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[73] Assignee: **Xerox Corporation,** Stamford, Conn.

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[52] **U.S. Cl.** **432/59,** 15/256.52, 355/15

[51] **Int. Cl.** **G03g 15/00**

[58] **Field of Search** ..... 15/256.52, 100, 1.5; 101/425; 355/15, 3 R, 3 DD; 117/21, 17.5; 118/637, 76; 432/60, 59, 75; 219/244, 216, 219/388, 469; 96/1; 100/93 RP; 29/131, 132

[56] **References Cited**

UNITED STATES PATENTS

3,637,976	1/1972	Ohta et al.	219/216
3,649,992	3/1972	Thettu	15/256.52
3,781,105	12/1973	Meagher	355/3

Primary Examiner—Harvey C. Hornsby
Assistant Examiner—C. K. Moore

[57] **ABSTRACT**

Cleaning apparatus for a dry heated pressure fusing system comprising a roll including a rigid core member covered with a sleeve made of a polyester polymer material. The roll is movable into pressure contact with the heated fuser roll during the fusing operation. Upon raising the temperature of the polyester polymer material toner and other contaminants are physically removed from the fuser roll surface and do not re-transfer. An alternative embodiment calls for a soft deformable blanket to be positioned intermediate the core member and sleeve.

3 Claims, 3 Drawing Figures

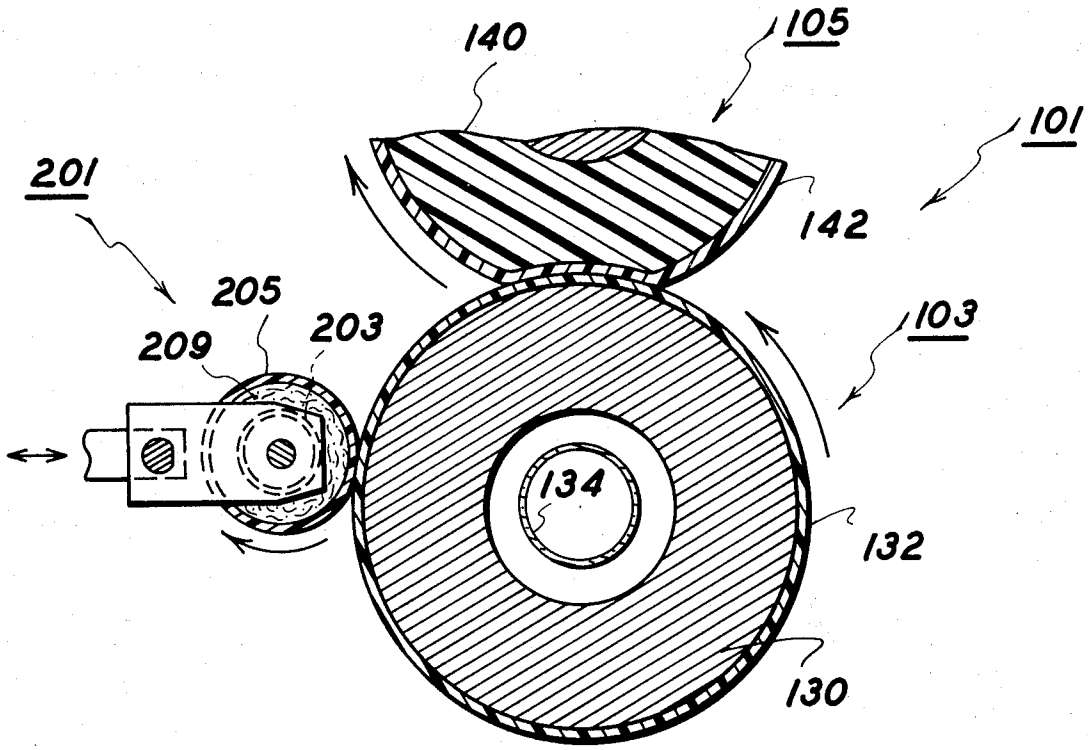


FIG. 1

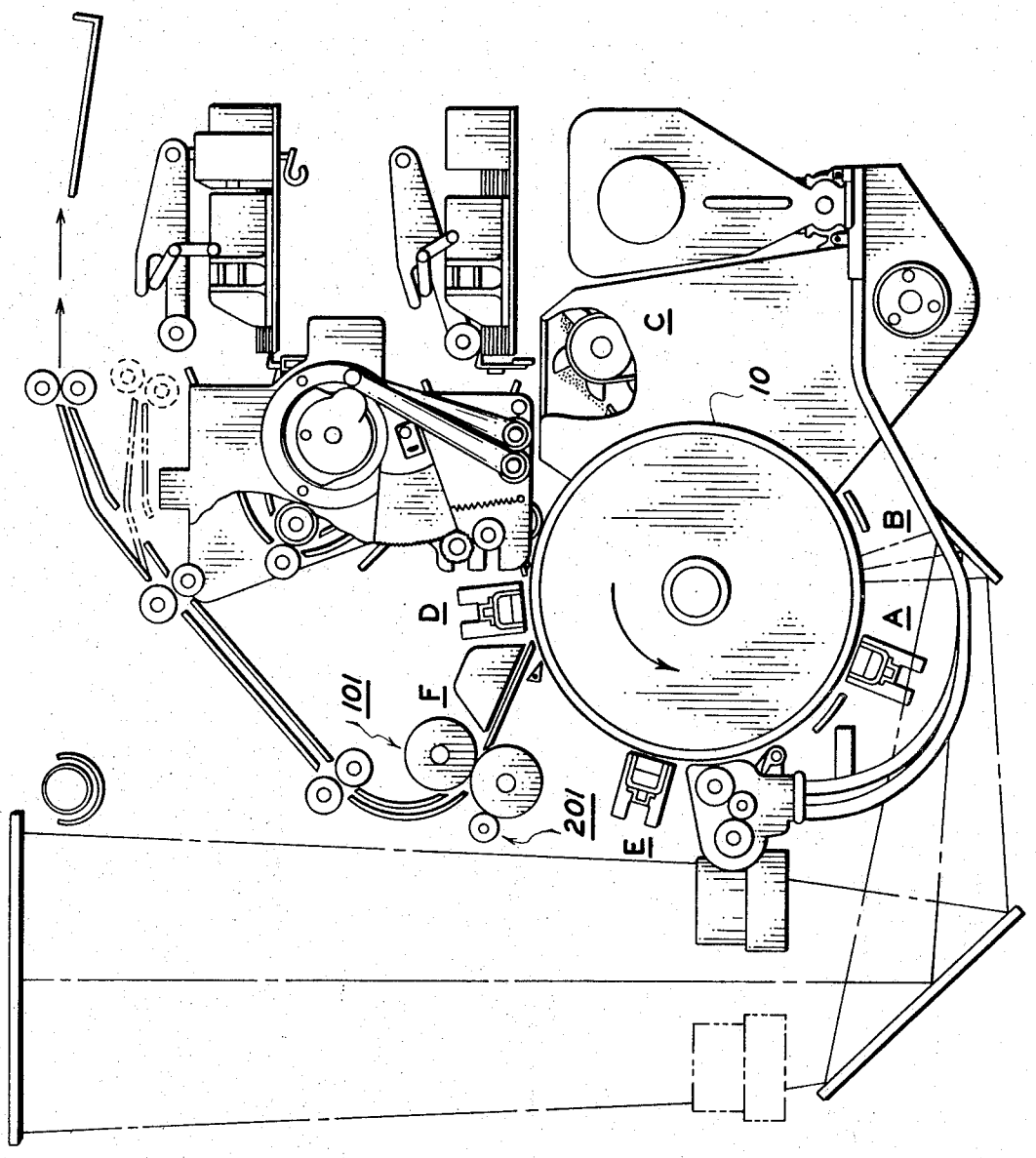


FIG. 3

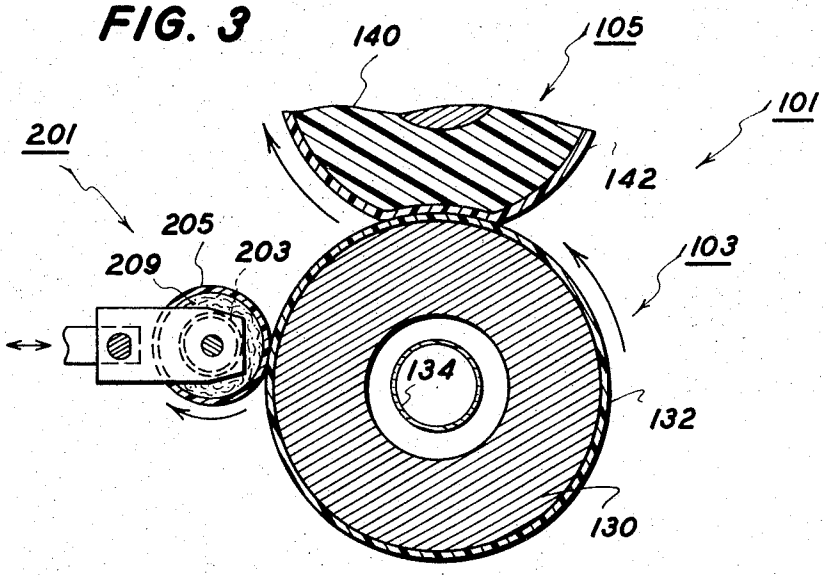
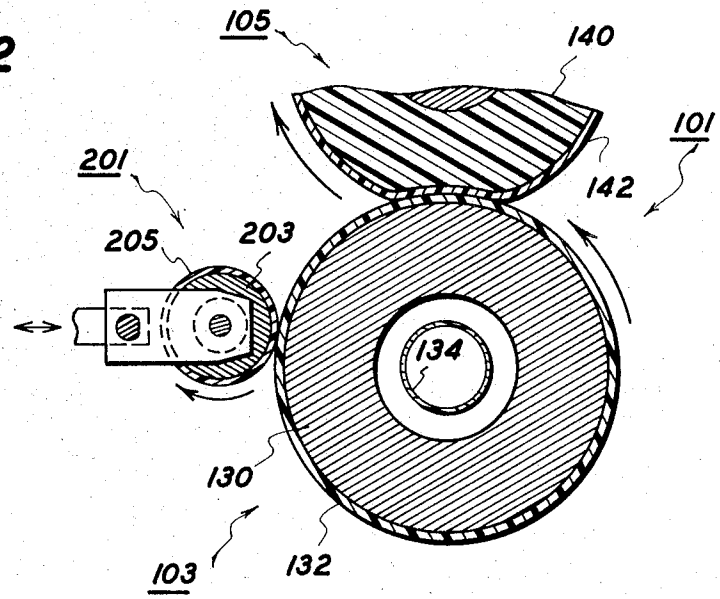

140
105
101
201
142
205
209
203
103
134
132
130

FIG. 2


105
140
101
201
142
205
203
134
130
103
132

DRY FUSER ROLL CLEANING APPARATUS

This invention relates to an improved cleaning apparatus for use with a dry heated pressure fusing system in an electrostatic reproduction system to produce high quality copies free of toner and contaminants.

It has been recognized that one of the preferred ways for fusing a powder image to a substrate is to bring the powder into direct contact with a hot surface, such as a heated roller. The roller surface may be dry, i.e. no application of a liquid release agent to the surface of that roller as described for example, in U.S. Pats. Nos. 3,498,596, 3,539,161, and 3,666,247. Alternatively, the fuser roll surface may be wetted with a release agent such as silicone oil as described in U.S. Pats. Nos. 3,268,351 and 3,256,002.

In the dry fusing system there is a tendancy for the fuser roll to collect paper contamination and toner particles which in turn cause an offset to build up on the fuser roll surface and be deposited on the copy sheets. In the past cleaning roll surfaces have permitted too much wetting of the fuser roll surface causing the toner and contaminants collected onto the cleaning roll to be retransferred back to the fuser roll surface. As a result the toner and contaminants have deposited onto the copy sheets.

The present invention is an improved cleaning roll apparatus for cleaning dry fuser roll to remove undesirable paper contaminants and toner and maintain the fuser roll surface clean of the contaminants and toner.

It is therefore the principle object of the present invention to improve cleaning of dry heated pressure fusing roll devices.

It is a further object of the present invention to enable removal of paper contaminants and toner particles from a dry heated fuser roll without redeposit back to the fuser roll.

It is a further object of the present invention to maintain toner removed from the surface of the fuser roll from retransferring to the fuser roll and ultimately onto copy sheets.

It is a further object of the present invention to improve copy quality of copy sheets fused by dry pressure. heated fuser systems.

These as well as other objects of the invention and further features thereof will be better understood upon reference to the following detailed description of the invention to be read in connection with the drawings wherein:

FIG. 1 illustrates schematically a xerographic reproducing apparatus incorporating a heated pressure fuser roll apparatus constructed in accordance with the present invention;

FIG. 2 is an enlarged portion of FIG. 1 illustrating an alternative embodiment;

FIG. 3 is a view similar to FIG. 2 illustrating an alternative embodiment.

Referring now to the drawings, there is shown in FIG. 1 a preferred embodiment of the subject invention in a suitable environment such as an automatic xerographic reproducing machine. The automatic xerographic 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, journaled 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 the purpose 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, at which a uniform electrostatic charge is deposited on the photoconductive plate;

An exposure station B, at which light or a 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 copy to be reproduced;

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

A transfer station D at which the toner powder image is electrostatically transferred from the plate surface to a transfer material or a support surface; and

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.

The preceding description of the xerographic process is sufficient for an understanding of the instant invention. Further details may be had by reference to U.S. Pat. No. 3,578,859 filed July 3, 1969 and commonly assigned herewith.

At the fusing station F the fusing assembly **101** comprises a fuser roll **103** and pressure roll **105** through which the copy sheet to be fused is advanced through the nip formed by contact of the fuser roll and pressure roll. The copy sheet is stripped from the fuser roll **10** as by stripper fingers. The fuser roll comprises a rotating member **130** having an elastic compressible coating **132** made of silicone rubber or any suitable heat resistant compressible material as described for example in the aforementioned patents. The rotating member may be internally heated by a heat source **134** as described in U.S. Pat. Nos. 3,666,247 or externally heated as described in U.S. Pat. Nos. 3,498,586 and 3,539,161. The pressure roll comprises a rotating member **140** which is covered with an elastic layer **142** or a slightly higher durometer and the fuser roll coating **132** as described in the aforementioned patents.

Referring specifically to FIG. **2** in accordance with the present invention a cleaning roll apparatus **201** is positioned to clean fuser roll **103** of paper contamination and non-visual as well as visual toner offset particles. Cleaning roll apparatus **201** includes a metal core member **203** which is covered by a cylindrical sleeve member **205** made of a polyester polymer material. Any suitable polyester polymer materials having a melting or softening point ranging from about 120°C to about 275°C can be used. Typical materials are aliphatic, aromatic or mixtures of aliphatic, aromatic polyesters. Examples of these classes of materials are polyethylene oxolate, poly-pp[1] xylelene trepthalate, polyethylene/ neopentyl terephthalate. Preferred materials of the mixed class of polyesters are PE–100 or PE–200, trademarks of Goodyear Company, of Akron, Ohio.

Sleeve member **205** has a thickness of about 0.005 to about 0.030 inches. The sleeve member may be applied to the metal core member **203** by any suitable technique such as solvent spraying, extrusion wrapping, hot melt rolling or combinations thereof. Preferably the final application is by heat shrinking and extruded polyester tube over the core member. Desirably, hot rolling is applied during the heat shrinking process.

It has been found that paper contamination on the fuser roll **103** is physically attracted to sleeve **205** due to good adhesion at high temperatures. The viscosity of the polyester polymer material is such that it has high elongation at the operating temperatures coupled with excellent wetting properties.

Any loose paper fiber and/or background toner particles are attracted by the fuser roll surface. The contamination and toner particles collect on the fuser roll surface and are transferred to the sleeve member **205** by virtue of the physical adhesion of the contamination to the polyester polymer material. Also, the elastomeric characteristic of silicone rubber enables microconformability for positive transfer. The contamination and toner particles collect on the surface of the sleeve member and due to the hot rolling occurring during the cleaning operation mix with the polyester polymer materials. Cleaning roll apparatus **201** is retractable away from the fuser roll surface when the machine is not producing copies. The retraction of the cleaning roll apparatus may be accomplished by any suitable device such as the device described in U.S. Pat. application Ser. No. 254, 269, filed June 17, 1972 and commonly assigned herewith.

An alternative embodiment is shown in FIG. **3** in which metal core member **203** is blanketed on a roll made of soft deformable material which is covered by the sleeve of polyester polymer material. Roll **209** can be made of any suitable soft heat resistant material. Typical materials with high surface energy fillers are silicone rubber, Nomex, Dacron, trademarks of duPont Corporation, Wilmington, Delaware or combinations thereof. The embodiment of FIG. **3** renders good conforming characteristics particularly in the case of non-uniform fuser roll surfaces.

By the above described invention the dry heated fuser roll surface is cleaned continuously during the copying mode of operation to remove toner and other contaminants. The polyester polymer cleaning surface enables less wetting to the fuser roll surface at high temperatures than is the case with other cleaning roll surfaces. Moreover, there is an increased elongation and tackiness of the cleaning roll surface thereby ensuring high cohesive forces in the cleaning roll material. At the same time the cleaning roll surface remains sufficiently soft at wide operating temperatures enabling good overall contact with the fuser roll surface being cleaned.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. In a dry heated pressure fusing system for fusing toner images of an electrostatic copying machine in which a heated dry fuser roll and back-up roll define a contact arc to fuse toner images onto copy sheets, an improved cleaning apparatus to release degrading contaminants and toner from the fuser roll surface comprising:

roll means movable into pressure contact with a dry heated fuser roll surface during the copying operation;

said roll means including a rigid core member covered by a sleeve made of a polymer material selected from the group of aliphatic, aromatic, or mixtures of aliphatic, aromatic polyesters,

wherein said polyester material has a melting or softening point ranging from about 120°C to about 275°C,

wherein said sleeve has a thickness ranging from about 0.005 to about 0.030 inches,

wherein said roll means is retractable out of pressure contact with said fuser roll surface during non-fusing periods.

2. Apparatus according to claim **1** including a cylindrical member made of a soft conformable material positioned intermediate said core member and said sleeve.

3. Apparatus according to claim **2** wherein said soft conformable material is selected from the group consisting of Nomex, Dacron, silicone rubber or combinations thereof.

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