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Hamaker

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[54] **SLEEVELESS PRESSURE ROLL CLEANER**

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[52] **U.S. Cl.** **432/60**; 432/75; 432/228; 15/1.5; 15/256.52; 432/2

[51] **Int. Cl.** **F03g 13/20**

[58] **Field of Search** ..... 432/59–62, 432/227–230, 75.2; 219/216, 388, 469; 100/93 RP; 15/1.5, 1.7, 256.52; 118/637; 355/15

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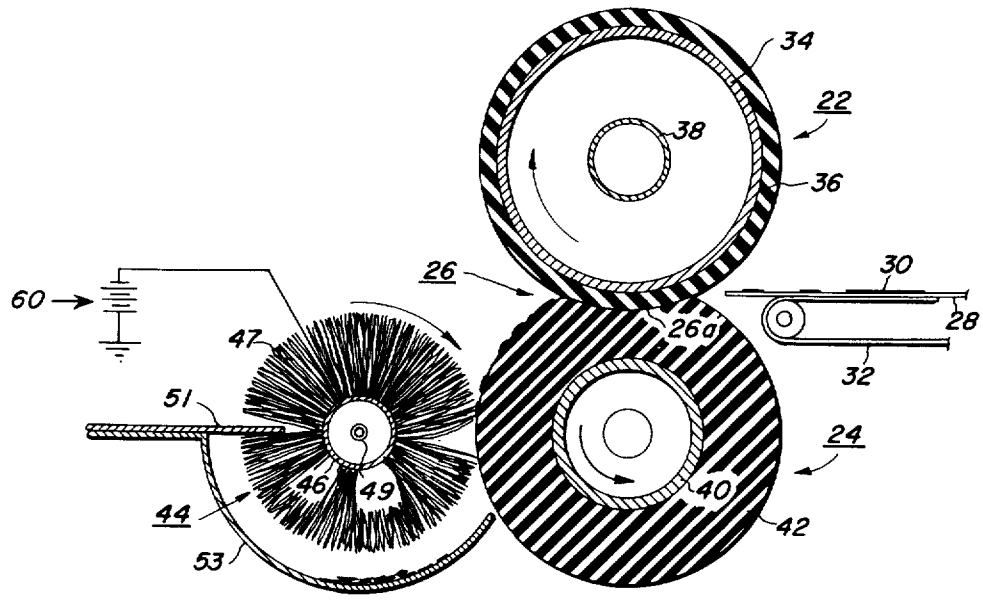
[57] **ABSTRACT**

Roll fusing device for a xerographic reproducing apparatus characterized by the provision of a heated member for cleaning toner material from an elastomeric back-up or pressure roll. The specific heated member comprises a wire brush which is rotated such that a brushing action is performed relative to the surface of the elastomeric back-up roll.

10 Claims, 3 Drawing Figures



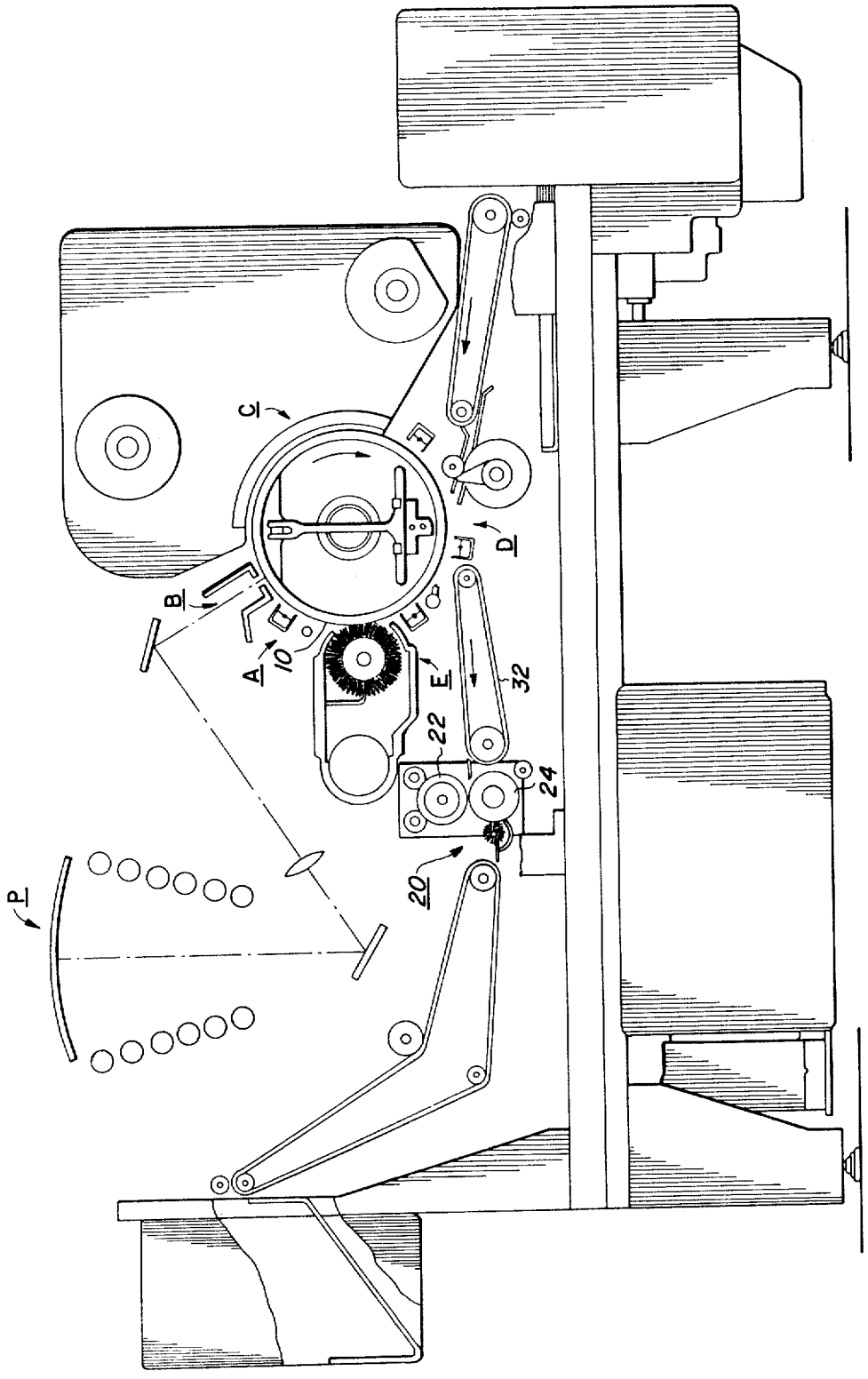
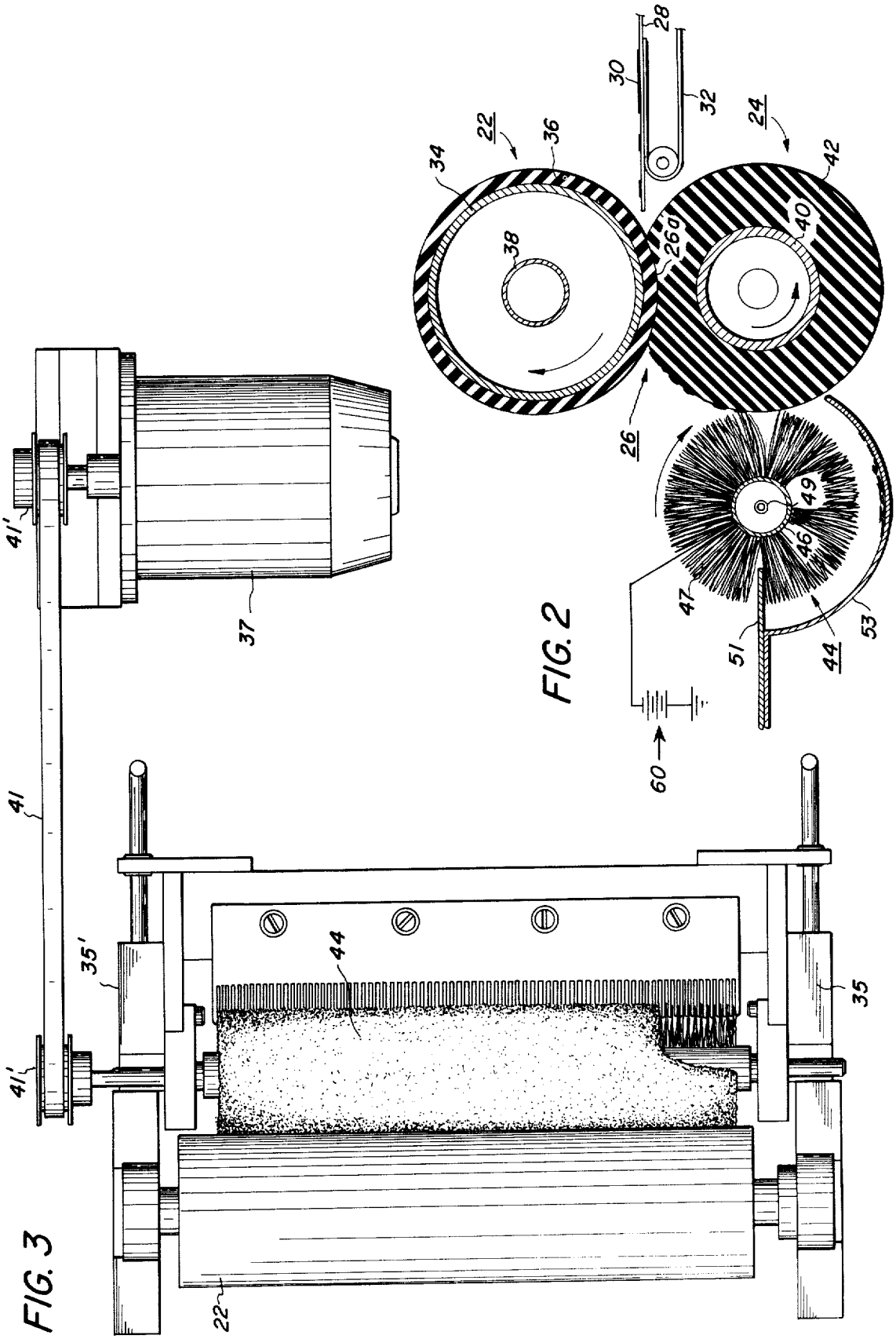


FIG. 1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26a
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41'
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41'
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FIG. 2

FIG. 3

SLEEVELESS PRESSURE ROLL CLEANER

BACKGROUND OF THE INVENTION

This invention relates generally to xerographic copying apparatus and more particularly to a roll fusing system for affixing electroscopic toner material to a support member.

In order to permanently affix or fuse electroscopic toner material to a support member by heat, it is necessary to elevate the temperature of the electroscopic toner material to a point at which at least one of the constituants of the toner material is caused to become tacky. This action causes the toner to be absorbed to some extent into the fibers of the support member which in many instances constitutes paper. Thereafter, as the toner material is cooled, solidification of the toner material occurs causing the toner material to be firmly bonded to the support member.

In both the electrographic as well as the xerographic recording arts, the use of thermal energy for fixing toner images onto a support member is old and well known.

One approach to thermal fusing of electroscopic toner images onto a support has been to pass the support with the toner images thereon between a pair of opposed roller members, at least one of which is either externally or internally heated. In this type of arrangement the toner image contacts the surface of the heated roll member in the nip between rollers to thereby produce heating of the toner image within the nip.

During operation of a fusing system of the above-described type, the support member to which the toner images are electrostatically adhered is moved through the nip formed between the rolls with the toner image contacting the fuser roll. By controlling the heat transferred to the toner and by the provision of proper roll surface material, virtually no offsetting of toner particles from the copy sheet to the fuser roll is experienced under normal conditions. This is because the heat applied to the surface of the roll is insufficient to raise the temperature of the surface of the roller above the hot offset temperature of the toner whereat the toner particles in the image areas of the toner would liquify and cause a shearing action within the molten toner to thereby result in offsetting. Shearing occurs when the inter-particle forces holding the viscous toner mass together is less than the surface energy forces tending to offset it to a contacting surface such as a fuser roll.

Occasionally, however, extraneous toner particles will be offset to the fuser roll by an insufficient application of heat to the surface thereof by imperfections in the properties of the surface of the roll, or by the toner particles insufficiently adhering to the copy sheet by the electrostatic forces which normally hold them there. In such a case, extraneous toner particles may be transferred to the surface of the fuser roll beyond the nip with subsequent transfer to the back-up roll during periods of tome when no copy paper is in the nip and before the back-up roll can be moved out of contact with the fuser roll.

Moreover, toner can be picked up by the back-up roll during fusing of duplex copies or simply from the surrounding atmosphere.

It will be appreciated that in order to prevent such toner particles being transferred to the copy paper it would be necessary to remove the toner particles from the fuser roll and/or the back-up roll. It will be further

appreciated that if enough toner accumulates on the back-up roll improper paper feed will occur.

One arrangement for minimizing the foregoing phenomena commonly referred to as offsetting, has been to provide a fuser roll with an outer covering or sleeve of polytetrafluorethylene, commonly known as Teflon, to which a release agent such as silicone oil is applied.

In certain prior art devices, the back-up roll is provided with a Teflon sleeve which is cleaned by contact with a web or wick cleaning member without the aid of oil or other release agent being applied thereto. It has been observed that continued operation with elevated temperatures such as exhibited in the fusing environment of xerographic reproducing apparatus, the life expectancy of materials such as Teflon is greatly curtailed.

Silicone rubbers employed in back-up rolls have been found to better withstand such operating conditions, however, they do not readily lend themselves to being cleaned by conventional techniques such as webs and wicks. This is due to the relatively high coefficient of friction and asperities in the surface of the silicone rubber.

Another method of cleaning back-up rolls is by the provision of a doctor or wiper rod that is driven by the pressure roll which it contacts. The toner deposits itself onto the wiper rod (possibly by virtue of a surface tension phenomenon) as long as it is in a "soft" viscous condition. Eventually the toner layer on the wiper rod will build up to the point where the cleaning action is inefficient. At this point the wiper rod must be replaced or cleaned thereby creating an undesirable preventative maintenance procedure.

Accordingly, it is the principle object of this invention to provide a new and improved fuser for xerographic copying apparatus.

Another object of this invention is to provide in a xerographic copying apparatus a toner fusing device including new and improved means for minimizing toner offset to the copy paper.

Still another object of this invention is to provide a new and improved roll fusing device for xerographic copying apparatus wherein there is provided a new and improved method of cleaning the back-up roll in order to minimize toner offset to the copy paper.

Yet another object of this invention is to provide a new and improved roll fusing device for xerographic copying apparatus wherein there is provided a wire or metallic brush which is rotated such that it performs a brushing action on the surface of the back-up roll in order to remove toner particles therefrom.

BRIEF SUMMARY OF THE INVENTION

The above-cited objects of the present invention are accomplished by the provision of a roll fusing arrangement comprising a back-up roll having an outer elastomeric surface and a wire or metallic brush supported for rotation such that it performs a brushing action on the surface of the back-up roll.

The brush structure is provided internally thereof with a heater structure for elevating the temperature of the bristles of the brush in order to enhance their function of removing the toner material from the back-up roll.

A stationarily mounted comb is provided such that the extremities of the bristles move through the teeth of the comb whereby the toner material picked up from

the back-up roll is removed from the bristles with subsequent deposition thereof into a catch tray subadjacent the cleaning brush.

DETAILED DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of a xerographic recording apparatus to which the present invention relates;

FIG. 2 is a side elevational view of a roll fusing device incorporated in the apparatus of FIG. 1; and

FIG. 3 is a top plan view of the fusing device of FIG. 2.

DETAILED DESCRIPTION OF THE INVENTION

For a general understanding of the apparatus incorporating the improved fusing device, reference may be had to FIG. 1 in which the various system components for the xerographic copying apparatus are schematically illustrated. In the apparatus illustrated, a light image of a document to be reproduced is projected onto the sensitized surface of the xerographic plate to form an electrostatic image thereon. Thereafter, the latent image is developed with an oppositely charged developing material to form a xerographic powder image corressponding to the latent image on the plate surface. The powder image is then electrostatically transferred to a support surface to which it is fused whereby the powder is caused to be permanently adherred to the support surface which surface usually comprises plain paper.

In the illustrated apparatus, an original to be copied is placed upon a transparent support platen P fixedly arranged in an illumination assembly and image rays are projected by means of an optical system for exposing the photosensitive surface of the xerographic plate in the form of a drum indicated by reference character **10**.

The drum **10** is mounted upon the frame of the machine and is adapted to rotate in the direction of the arrow at a constant rate. During this movement of the drum, it passes a charging station A where a uniform electrostatic charge is applied to the surface thereof.

Next at an exposure station B, exposure of the drum surface to the light image discharges the xerographic plate in the areas struck by light, whereby there remains on the surface a latent electrostatic image in image configuration corresponding to the light image projected from the original on the supporting platen.

As the drum surface continues its movement, the electrostatic image passes through a developing station C in which there is positioned a developer assembly. The developer assembly delivers developing material to the upper part of the drum whereat the material is directed to cascade over the drum surface in order to provide development of the electrostatic image. As the developing material is cascaded over the drum surface toner particles in the development material are deposited on the surface to form powder images.

The developed electrostatic image is moved by the drum to a transfer station D whereat a sheet of copy paper is moved at a speed in synchronism with a moving belt in order to accomplish transfer of the developed image. There is provided at this station a sheet transport mechanism adapted to transport sheets of paper from a paper handling mechanism to the developed image on the drum at station D.

After the sheet is stripped from the drum, it is conveyed to a fuser apparatus generally indicated by the reference numeral **20** whereat the developed and transferred xerographic powder image on the sheet material is permanently affixed thereto as will be described more fully hereinafter. After fusing, the finished copy is discharged from the apparatus by a belt conveyor to a suitable point for collection externally of the apparatus.

Suitable drive means are arranged to drive the drum in conjunction with timed exposure of an original to be copied to effect conveying and cascading of toner material to separate and feed sheets of paper and to transport same across the transfer station D and to convey the sheet of paper through the fuser apparatus in timed sequence to produce copies of the original.

The fuser apparatus as illustrated in Figure, comprises a fuser roll **22** and a back-up or pressure roll **24** having a nip **26** defined therebetween, through which copy paper **28** is moved in order to permanently affix images of toner particles **30** thereto.

The copy paper **28** having the toner images electrostatically adhered thereto is moved to the nip **26** by means of a conveyor belt **32** which receives the copy paper from the photosensitive member **10** herein disclosed by way of example, as a drum structure.

The fuser roll may be fabricated from any conventional material by well-known techniques in the art whereby a roll structure is provided comprising a rigid, heat conductive substrate or support **34** such as aluminum, overcoated with an abhesive material layer **36** such as polytetraflourethylene. The fuser roll is provided internally thereof with a source of thermal energy such as a tungsten filiment, quartz lamp **38** for heating the roll to operational temperatures. Power is supplied to the quartz lamp **38** such that during operation the outermost surface temperature of the polytetraflourethylene is on the order of 200°–400°F.

The back-up or pressure roll **24** comprises a rigid support **40** and a relatively thick resilient layer **42** of silicone rubber. The back-up roll **24** and the fuser roll **22** are supported in a conventional manner by support members **35** and **35'** such that one or the other can be driven by the main drive of the machine.

Pressure is applied to the back-up roll **24** such that it is deformed to provide a contact surface area indicated at **26*a***. The heat transfer to the toner image is a function of speed and surface temperature of the fuser roll and the dwell time attributed to the contact surface area **26*a***. Typical pressures, surface temperatures and speeds are, respectively, 120 psi, 300°F and 20 inches/-second.

In a typical fuser of the type herein described, a release fluid such as silicone oil is applied to the abhesive surface **36** to enhance the toner release characteristics thereof such that if toner does find its way onto the surface, such toner will be given up to a fuser roll cleaning member (not shown) conventionally in the form of a wick or pad which contacts the surface **36.**

As shown in FIGS. **2** and **3**, a cleaning member **44** which lightly contacts the pressure roll **24** is drivingly coupled to a motor **37** by means of a belt and sprockets **41** and **41'**. The cleaning member **44** comprises a brush structure having an electrically conducting support member **46** having, for example, metal bristles **47** carried thereby (FIG. **2**). In the preferred embodiment of the invention, a radiant heater structure preferably a

tungsten filiment, quartz lamp **49**, is supported at the center of the roll **44** and is coextensive with the longitudinal axis thereof. While the heater structure **49** is disclosed as being internal, it will be appreciated that it could also be externally positioned.

In order to enhance the cleaning action of the brush, the bristles preferably are arranged in a spiral configuration on the support member **46**. As the brush is rotated by the motor **37** the extremities of the bristles are moved through a stationarily mounted comb structure **51** for the purpose of removing toner particles or materials from such extremities with subsequent deposition of the toner in a catch tray **53**. While the catch tray is shown as being supported relative to the cleaning member **44** by means of conventional fasterners, it will be appreciated that in order to facilitate emptying of the catch tray it may be installed in a manner facilitating easy removal thereof.

Since all of the toner may not be deposited into the catch tray it is also desirable to provide for easy removal of the comb and replacement thereof due to accumulation of toner material thereon.

In some applications of the present invention it may be desirable to provide a bias voltage on the order of 300 to 400 volts DC positive in order to attract toner to the metallic bristles of the cleaning member **44**. This may be accomplished by a D.C. source of potential indicated by reference character **60**.

Those skilled in the art will recognize that the foregoing illustrative embodiment of the invention represents but a single preferred embodiment and various modifications can be made to the apparatus without departing from the spirit of the inventive concept. For example, the function of brush **44** is not limited to the cleaning of the back-up roll since it could also be employed for cleaning the fuser roll particularly where the fuser roll also has an elastomeric outer surface. It should be appreciated that the cleaning brush **44** will also function to remove other contaminants, such as paper fibers, from the rolls. Accordingly, the scope of protection sought by Letters Patent is to be defined solely by the appended claims.

What is claimed is:

1. Apparatus for fusing electroscopic toner particles to a substrate, said apparatus comprising:

a first roll member;

a second roll member mounted for simultaneous rotation with said first roll member and in contact therewith;

means for heating one of said roll members; and

means for cleaning toner particles from the other of said members, said toner cleaning means comprising a brush rotatable in contact with the surface of said other member and including a plurality of metallic bristles.

2. Apparatus according to claim **1** including means for heating said metallic bristles.

3. Apparatus according to claim **2** wherein said brush has a circular cross section and said bristles are arranged in a spiral configuration along the longitudinal axis of said brush.

4. Apparatus according to claim **3** including means for applying a bias voltage to said bristles such that they attract toner material from said other member.

5. Apparatus according to claim **4** including a stationary comb through which said bristles are moved whereby toner material is picked up by said brush are removed therefrom and deposited in a removable catch tray.

6. Apparatus according to claim **5** including a removable catch tray.

7. The method of fusing electroscopic marking particles to the substrate in image configuration comprising the steps of:

contacting said marking particles with a heated roll member and simultaneously contacting the back side of said substrate with a pressure roll member; and

rotating a metallic brush in contact with the surface of said pressure roll member to remove marking particles therefrom.

8. The method according to claim **7** including the step of supplying heat to said brush.

9. The method of claim **8** including the step of applying a bias voltage to said metallic brush to thereby cause marking particles to be attracted thereto from said pressure roll member.

10. Apparatus for fusing electroscopic toner particles to a substrate, said apparatus comprising:

a first roll member;

a second roll member mounted for simultaneous rotation with said first roll member and in contact therewith;

means for heating one of said roll members; and

means for cleaning contaminants from the other of said members, said toner cleaning means comprising a brush rotatable in contact with the surface of said other member and including a plurality of metallic bristles.

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