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Thettu

[11] **3,796,183**

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[54] **FREE FLOATING PRESSURE BIASING APPARATUS FOR CLEANING ROLL FUSER**

[75] Inventor: **Raghulinga R. Thettu,** Webster, N.Y.

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

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[52] **U.S. Cl.** **118/70,** 101/425, 118/104, 118/637, 263/6

[51] **Int. Cl.** **B05c 11/02**

[58] **Field of Search** 117/17.5; 118/104, 262, 118/637; 263/6

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Primary Examiner—Mervin Stein
Assistant Examiner—Leo Millstein

[57] **ABSTRACT**

A free floating pressure biasing apparatus for applying predetermined pressure on cleaning roll devices cleaning residual toner particles from the heated fuser roll of a heated pressure fusing system in an electrostatic copy machine. Two springs, one heavy and one light or low rate, are employed in a housing urging the cleaning roll devices against the heated fuser roll. During the non-fusing condition the pressure is low to insure proper temperature due to biasing from a low rate spring. During the fusing operation both springs act against the cleaning roll devices to maintain an effective cleaning operation. A modified embodiment of the apparatus including an additional spring normally urging the cleaning rolls away from the fuser roll surface during the non-fusing operation.

5 Claims, 8 Drawing Figures

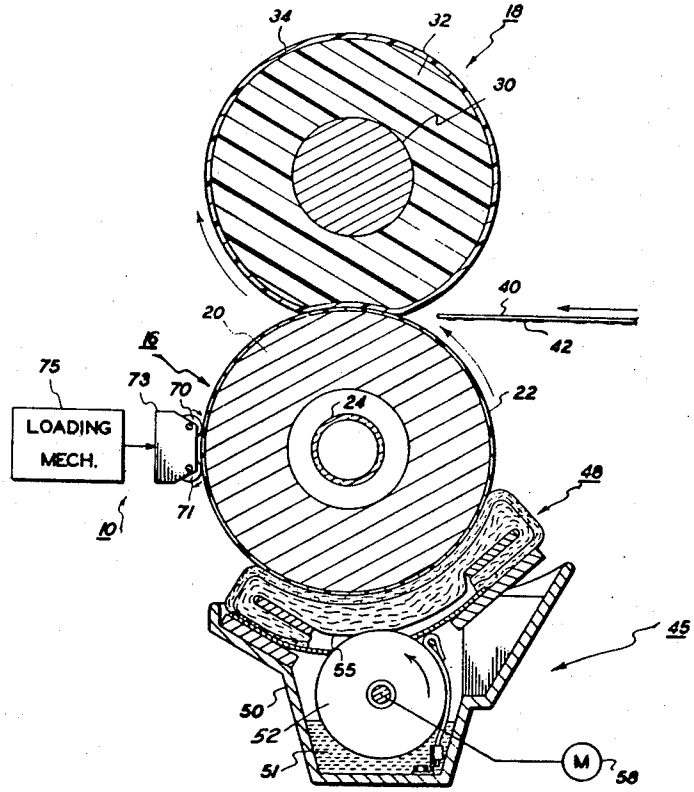
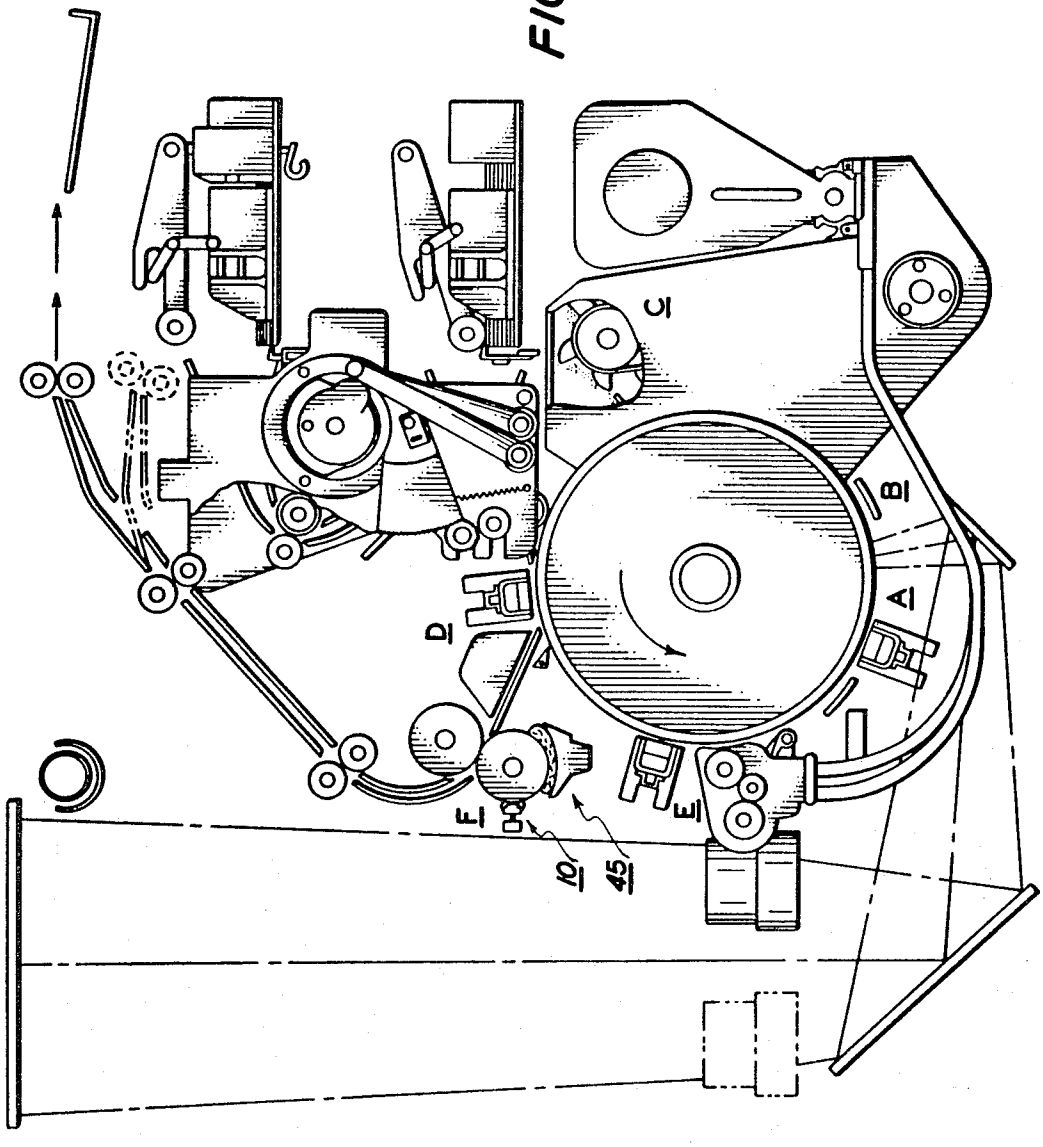


FIG. 1



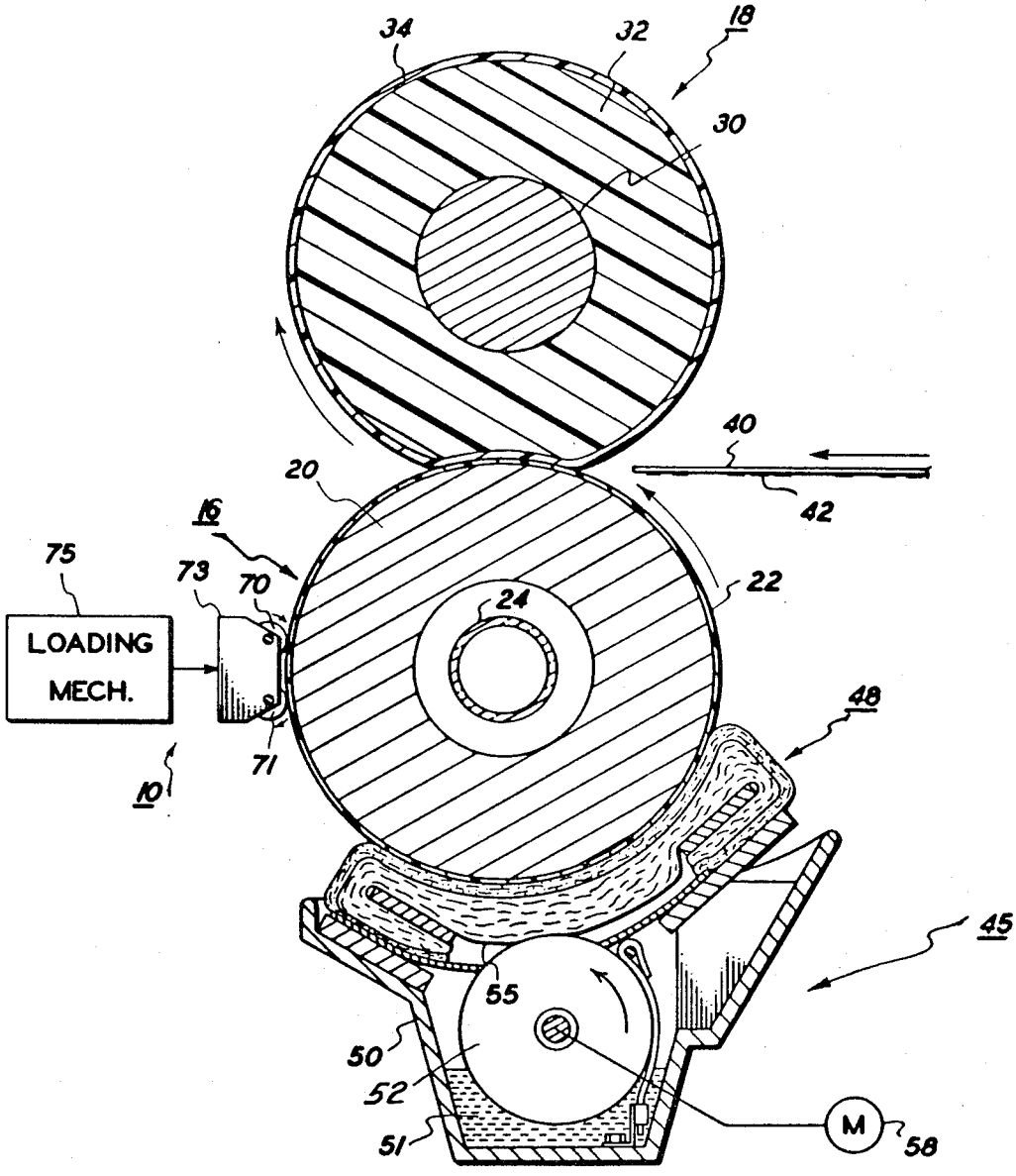

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FIG. 2

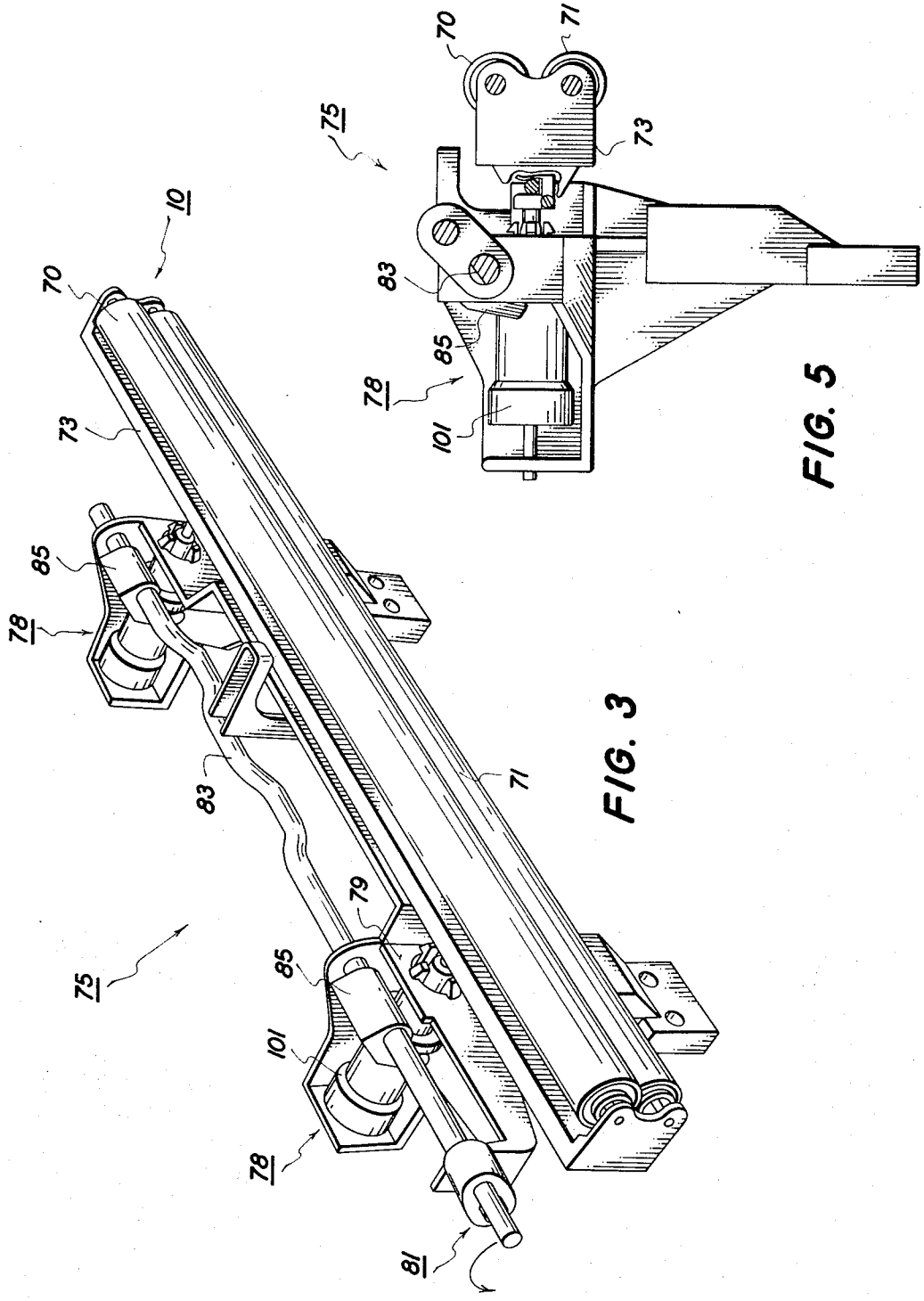

FIG. 3

FIG. 5

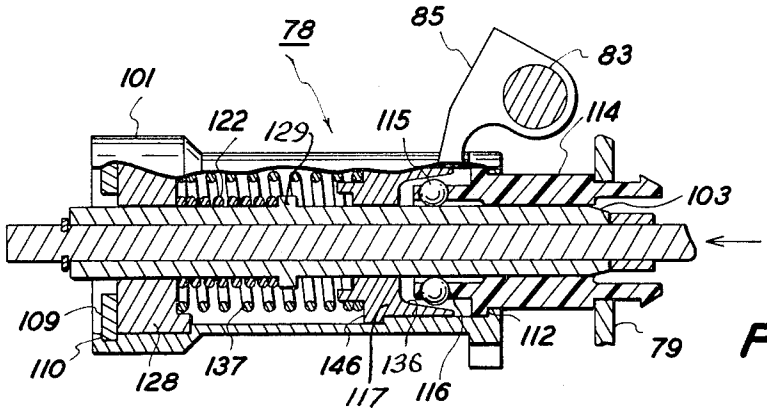

FIG. 4a

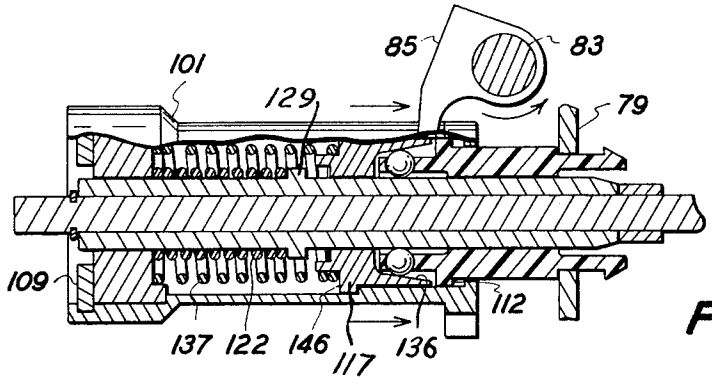

FIG. 4b

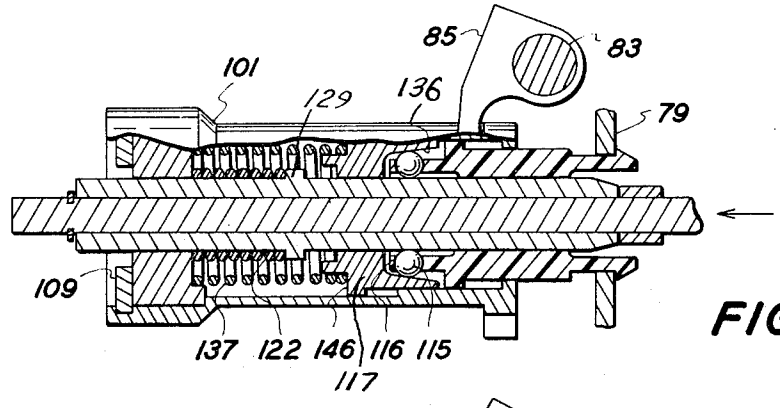

FIG. 4c

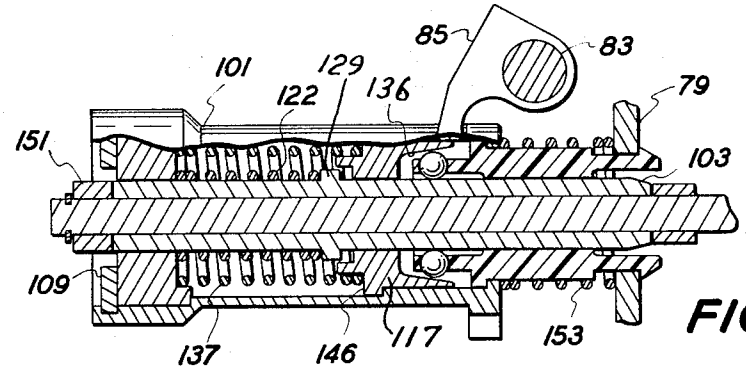

FIG. 6

FREE FLOATING PRESSURE BIASING APPARATUS FOR CLEANING ROLL FUSER

This invention relates to fusing systems and in particular to a free floating pressure biasing apparatus for maintaining predetermined pressure on cleaning devices for cleaning toner particles from the fuser roll of a heated pressure fusing system.

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; where the charge field is least, little or no material 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.

One typical device for fixing the toner particles to the backing sheet is by a heated pressure fuser roll system in which the copy sheet is passed through the nip of a Teflon coated heated fuser roll and a backup roll as described in U.S. Pat. Nos. 3,256,002 and 3,268,351. In such fusing systems, care must be taken to remove unwanted toner particles from the heated fuser roll prior to its contact with the copy being fused. If care is not taken to keep the fuser roll free of toner particles, these toner particles can build up on the face of the fuser roll and degrade the quality of the fix by removing the fusing properties on the surface of the roll contacting the copy sheet and toner images. Furthermore, such unwanted toner particles can be released from the fusing roll upon its subsequent contact with the toner image to fuse toner particles to the copy sheet in non-imaged areas.

It has been found that with high-speed duplicating machines in present use that cleaning rolls having a toner coated conformable surface may be used effectively to clean residual toner from the heated fuser roll as described in copending application Ser. No. 221,569, filed on Jan. 28, 1972 and commonly assigned herewith. The apparatus of the present invention is for the purpose of enabling a free floating constant force loaded biasing on the cleaning roll such that proper temperature on the cleaning roll is maintained even during the non-fusing operation.

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

It is another object of the present invention to enhance cleaning of a heated fuser roll.

It is another object of the invention to provide cleaning rollers which conform with fuser roll surfaces being cleaned and maintain uniform contact therewith.

It is still another object of the present invention to prevent uneven cleaning of fuser rolls.

It is still another object of the present invention to assure cleaning of fuser rolls by cleaning rollers which will not stick to the fuser rolls.

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

These and other objects of the instant invention are obtained by a new and improved cleaning roller assembly which comprises one or more cleaning rollers having a conformable surface which is urged into predetermined pressure contact with a heated fuser roll surface during the fusing operation but is in free floating contact with the roll surface during non-fusing operation to prevent sticking during the cleaning operation.

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 heated pressure fusing system utilizing the improved cleaning roller assembly of the present invention;

FIG. **2** is a side elevational view of the heated pressure fusing system and improved cleaning roller assembly;

FIG. **3** is an isometric view of the cleaning roller assembly with parts broken away to illustrate certain details;

FIGS. **4** (*a*) – **4** (*c*) show side sectional views of the free floating pressure biasing mechanism in sequence of operation according to the present invention;

FIG. **5** is an end view of the cleaning roller assembly; and

FIG. **6** is a side sectional view of a modified embodiment of the pressure biasing mechanism.

Referring now to the drawings as shown in FIG. **1**, an embodiment of the invention is a suitable environment such as an automatic xerographic reproducing machine. The automatic xerographic reproducing machine includes a xerographic plate or surface 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 a 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 photoconductive 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 have 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 heated pressure fusing system having a cleaning roller assembly **10** as will be described hereinafter; 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.

For further details of the xerographic processing stations, above reference is made to copending application Ser. No. 838,902 filed July 3, 1969.

Referring now in particular to FIG. **2** there is shown details of the heated pressure fusing system which includes a heated fuser roll **16** and a backup pressure roll **18.** 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 under side 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, such as a mechanical camming device.

As a sheet of material is advanced between the rolls **16** and **18** 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. However, it is by the wicking apparatus of the present invention which is successful in applying a thin film of offset preventing liquid such as silicone oil to the Teflon surface **22** of the fuser roll **16** such that toner offset is prevented as will be described hereinafter.

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. It should be understood that cleaning roller apparatus **10** can be used to clean dry fuser rollers as well as oil wetted fuser rolls as described above. For example the cleaning roller apparatus could be used to clean any contamination of the surface of the dry fuser roll as described in U.S. Pat. Nos. 3,539,161 and 3,498,596.

Cleaning roller apparatus **10** maintains the working heated surface of fuser roll **16** in a toner-free condition thereby preventing unwanted residual toner particles from being redeposited upon subsequent copies as they are fused. The cleaning roller apparatus of the invention cleans any residual toner particles adhering to the surface of the heated fuser roll continuously and uniformly during the cleaning operation. The cleaning roller apparatus includes a plurality of cleaning rollers **70** and **71** which are constructed so as to have a soft and conformable surface to insure proper contact with the relatively hard exterior of the heated fuser roll **16.** Cleaning rollers **70** and **71** are mounted on a movable holder or carriage **73.** Carriage **73** is biased by a free floating constant force loading mechanism **75** according to the present invention which enables the carriage to be capable of applying a uniform load both when the cleaning rollers are fully contaminated with toner particles or freshly installed and enable free floating of the assembly during non-fusing operation.

Referring now to FIG. **3,** there is shown the free floating constant force mechanism **75** which includes a pair of free floating pressure biasing assemblies **78** movably supported on frame **79** and actuatable by actuating assembly **81** including shaft **83** carrying camming members **85.** For purposes of explanation it is deemed sufficient that only one of the free floating pressure biasing assemblies **78** be described in detail.

Referring now to FIGS. 4(*a*) – 4(*c*), there is shown details of the free floating pressure biasing assembly which includes a housing **101,** enclosing an outer shaft member **103** extending between a retaining ring **109** received in the groove **110** of the housing and a spacer member **114** whose movement is restricted by a shoulder portion **112** formed in the housing **101.** Spacer member **114** carries a plurality of hardened precision balls **115** which are received in pockets **116** formed in spacer member **114.** Balls **115** are free floating within the spacer member **114** and enable the outer shaft member **103** to move freely towards the left and right as long as a wedge shaped friction ring member **117** is not in contact with balls **115.**

A low rate of compression spring **122** is held between a bearing member **128** carried in housing **101** and a step portion **129** on outer shaft **103.** When the outer shaft **103** is moved towards the left, the spring **122** is compressed as best shown in FIG. 4(a). Bearing member **128** is trapped between the housing **101** and the retaining ring **109.** As a result the outer shaft member **103** can move freely to the left and right.

It will be noted that friction ring member **117** is shaped as a conical wedge portion **136** on one side and as a stepped shoulder **146** on the other side. By this arrangement the friction ring member may be free floating between the outer shaft member and the housing unless the housing is moved to the right by actuating cam member **85** as shown in FIG. **4**(*b*), causing the wedge portion **136** to engage balls **115.** If this occurs, a relatively heavy spring **137** bears against friction ring member **117** causing outer shaft member **103** to lock as shown in FIG. **4**(*c*). It will now be appreciated that a heavy biasing pressure is exerted against carriage **73** and thus the cleaning rollers achieve proper conformability during the cleaning operation.

In operation the cleaning rollers during the nonfusing mode of operation are in a floating state against the action low rate spring **122.** This mode of operation enables the cleaning rolls to be in kissing contact with the surface of the fuser roll and insures proper temperature of the toner laden surface of the cleaning rollers such that the toner is soft and, therefore, ideal for cleaning the fuser roll surface. As the residual toner starts to build up on the cleaning rollers their diameter increases and hence the cleaning rollers gradually push against spring **122,** which gradually increases the load on the cleaning rollers. For example, when the rollers have grown in size to about three quarters of an inch diameter from about one half inch diameter, there is an increase of about one quarter pound pressure. It will be appreciated that there is always a gap betwen the balls **115** and the friction ring member **116** due to the spring **122** always acting against the bearing **128** which carries with it housing **101** to maintain the positive separation of the balls and the friction ring member.

During the cleaning mode of operation, housing **101** is moved towards the right or towards the fuser roller, causing spring **122** and heavy spring **137** to compress. Spring **137** pushes the friction ring member **116** against the balls **115** thereby causing the outer shaft **103** to lock. As a result a much higher load is transmitted to the cleaning rollers as required for the cleaning process. When the actuating assembly is released, the balls in the friction ring member are separated and only spring **112** maintains the cleaning rollers in free floating contact with the heated fuser roller to effect proper temperature on the cleaning roller surface during the non-fusing operation.

It has been found that it is desirable to retract the cleaning roll apparatus away from the fuser roll under certain circumstances as, for example, in the case of cleaning dry or non-oil wetted fusing systems. This may be easily achieved by insertion of a spacer member **151** and a spring member **153,** as shown in FIG. **6.** It will be appreciated that during the fusing operation that heavy loading by spring **122** and spring **137** is still maintained, which enables buildup of contamination on the cleaning rollers.

It will now be appreciated that due to the unique free floating pressure biasing apparatus of the present invention, the toner buildup on the cleaning rollers will not adversely affect the loading characteristics against the heated fuser roll. Moreover, the cleaning rollers are at all times maintained into pressure contact with the heated fuser roll to insure proper operating temperatures so that residual toner may adhere to the cleaning rollers.

What is claimed is:

1. In a fusing system for fusing toner images in an electrostatic copying machine in which a heated roll surface is used to fix the toner images to copy sheet material and cleaning rollers contact the heated roll surface for cleaning toner offset onto the heated roll surface, an improved pressure biasing apparatus acting on the cleaning rollers, comprising

carriage means supporting at least one cleaning roller in contact with the heated roll surface to be cleaned,

pressure biasing means for urging said carriage means towards the heated roll surface at a predetermined pressure,

said pressure biasing means including slidable shaft means movable from a first position in which said cleaning roller is in a free floating condition low pressure contact with the heated roll surface to a second position in which the cleaning roller is maintained in relatively high pressure contact against the heated roll surface, and

actuating means for moving said shaft means from the first position to the second position during the fusing operation.

2. Apparatus to claim **1** wherein said slidable shaft means is acted on by a relatively light spring means when in said first position and by relatively heavy spring means when in said second position.

3. Apparatus according to claim **2** wherein said shaft means is carried in a housing displaceable upon actuation by said actuating means for locking said slidable shaft means into relatively high pressure contact against said heated fuser roll.

4. In a fusing system for fusing toner images in an electrostatic copying machine in which a heated roll surface is used to fix the toner images to copy sheet material and cleaning rollers contact the heated roll surface for cleaning toner offset onto the heated roll surface, an improved pressure biasing apparatus acting on the cleaning rollers, comprising

carriage means supporting at least one cleaning roller in contact with the heated roll surface to be cleaned,

pressure biasing means for urging said carriage means towards the heated roll surface at a predetermined pressure,

said pressure biasing means including slidable shaft means movable from a first position in which said shaft means is in a free floating condition to a second position in which the shaft means is maintained in pressure contact against the heated roll surface,

actuating means for moving said shaft means from the first position to the second position during the fusing operation,

wherein said slidable shaft means is acted on by a relatively light spring means when in said first position and by relatively heavy spring means when in said second position,

wherein said shaft means is carried in a housing displaceable upon actuation by said actuating means for locking said slidable shaft means into relatively high pressure contact against said heated fuser roll, and

wherein said housing includes a friction member engaging ball members carried on said slidable shaft means.

5. In a fusing system for fusing toner images in an electrostatic copying machine in which a heated roll

surface is used to fix the toner images to copy sheet material and cleaning rollers contact the heated roll surface for cleaning toner offset onto the heated roll surface, an improved pressure biasing apparatus acting on the cleaning rollers, comprising

carriage means supporting at least one cleaning roller member in contact with the heated roll surface to be cleaned,

pressure biasing means for urging said carriage means towards the heated roll surface at a predetermined pressure,

said pressure biasing means including slidable shaft means movable from a first position in which said shaft means is in a free floating condition to a second position in which the shaft means is maintained in pressure contact against the heated roll surface,

actuating means for moving said shaft means from the first position to the second position during the fusing operation

wherein said slidable shaft means is acted on by a relatively light spring means when in said first position and by relatively heavy spring means when in said second position,

wherein said shaft means is carried in a housing displaceable upon actuation by said actuating means for locking said slidable shaft means into relatively high pressure contact against said heated fuser roll, and

wherein said housing is further acted on by additional spring means normally urging said housing in a direction away from said heated roll surface during the non-fusing operation.

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