United States Patent [19]

Mueller

[11] **3,856,462**

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[54] **REPRODUCTION MACHINE FUSER**

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

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[52] **U.S. Cl.** ..... **432/60,** 432/228, 226/179, 100/93 RP, 219/469

[51] **Int. Cl.** **G03g 5/00,** H05b 3/10

[58] **Field of Search** ..... 432/59-60, 432/227-228, 246; 219/216, 469, 388; 100/93 RP, 168, 174, 176; 38/44, 52; 117/21; 226/179; 271/DIG. 2

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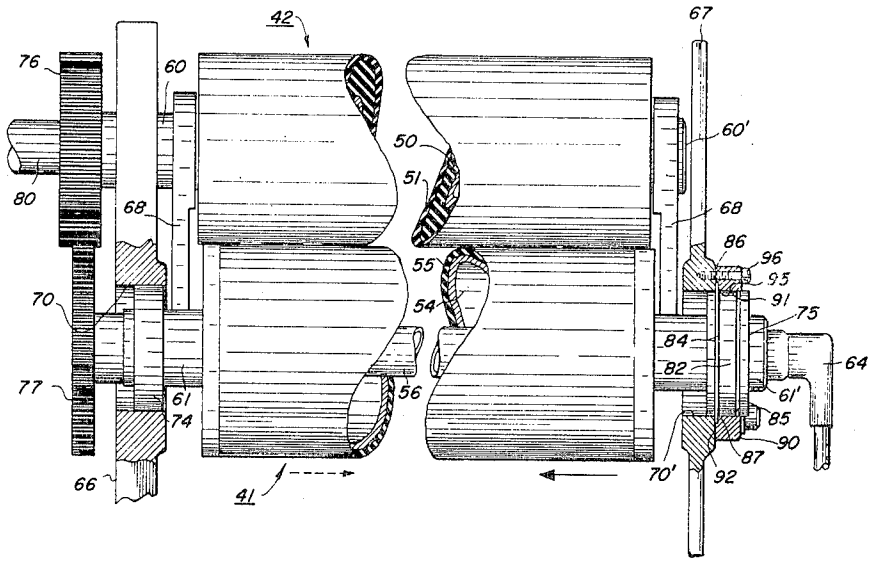
[57] **ABSTRACT**

A fuser apparatus for a reproduction or copying machine, the fuser comprising a heated fixing roll and cooperating pressure roll which together form a nip between which the copy material being fused passes. One or more stripper fingers at the fuser exit cooperate with the fuser rolls to prevent the copy material from sticking thereto. To obviate uneven or spot wear on the fuser roll surface, which may result from contact of some operative element, such as the stripper fingers, or a temperature sensor, or from the copy material itself thereagainst, the fuser roll is supported for limited axial displacement relative to the pressure roll. Such fuser roll support is obtained through a movable roll bearing structure, which includes a bearing lock to retain the bearing structure and the fuser roll itself in a selected axial position.

4 Claims, 3 Drawing Figures



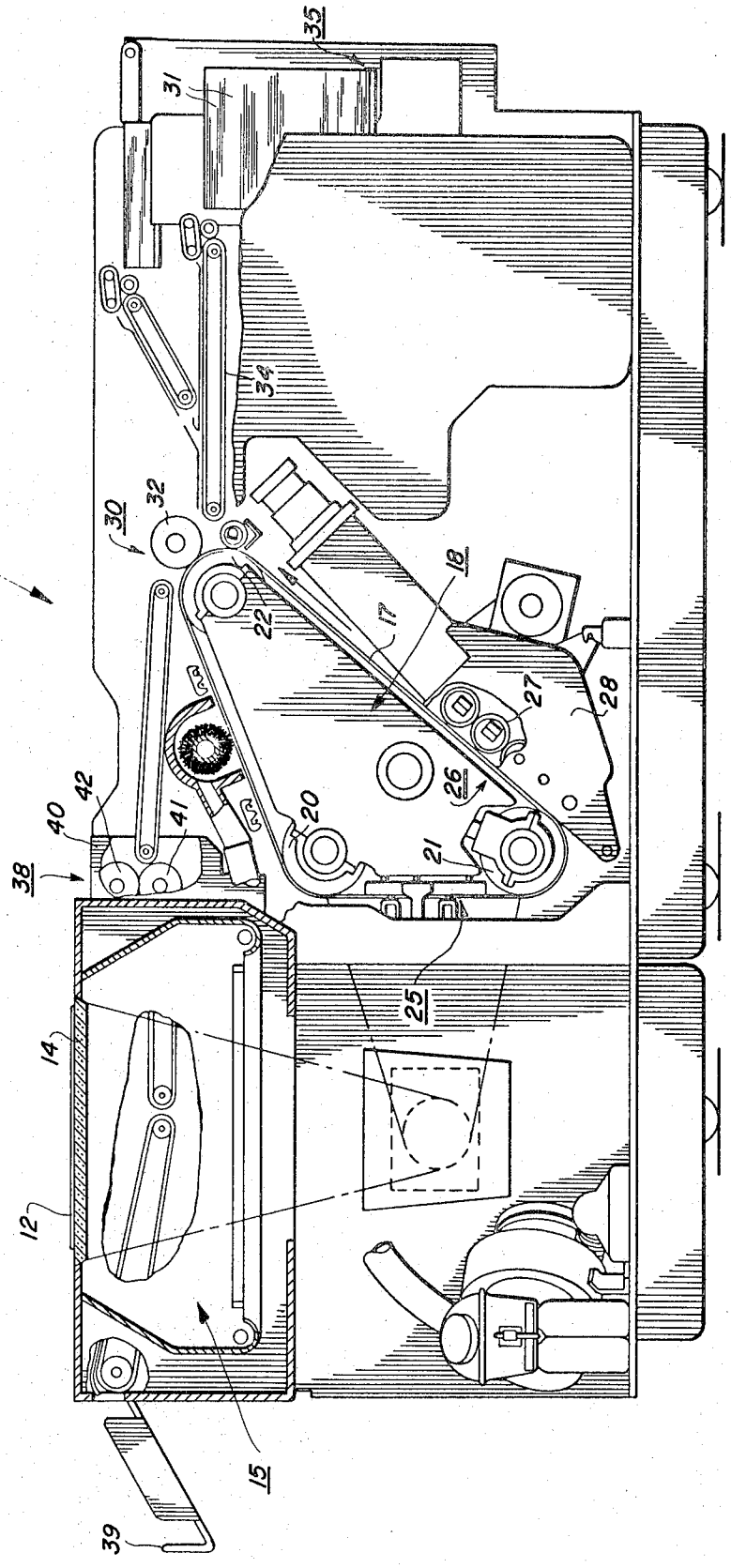


FIG. 1

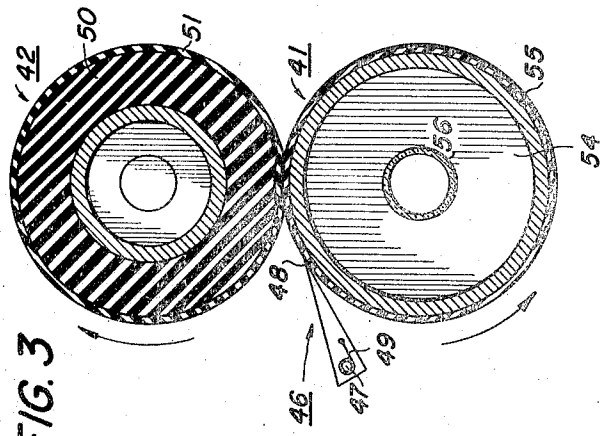

42
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FIG. 3

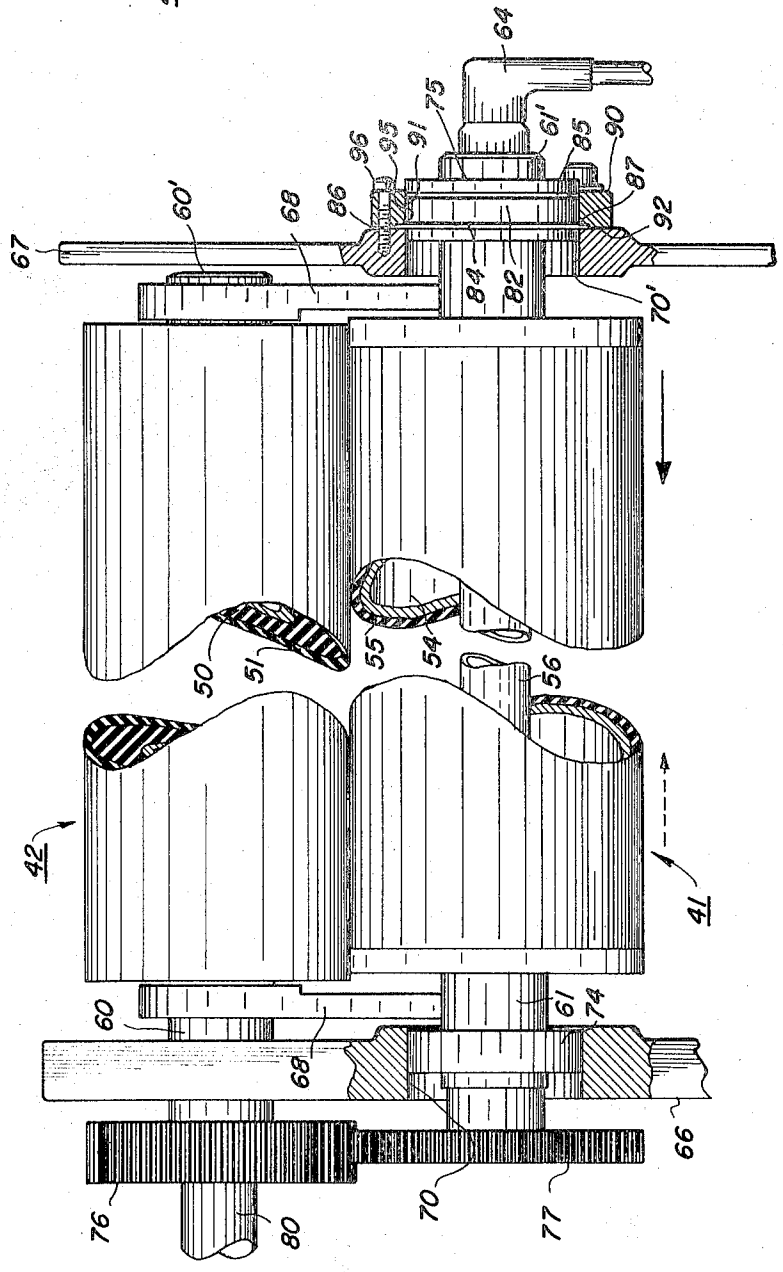
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FIG. 2

REPRODUCTION MACHINE FUSER

This invention relates to a fusing apparatus for reproduction or copying machines, and more particularly, to an improved fusing apparatus incorporating means to offset spot or uneven wear of the fuser roll surface.

In order to fix, i.e. fuse, a toner developed image, reproduction or copying machines incorporate a fixing device, conventionally called a fuser. While the fuser may take many forms, as, for example, a vapor fuser, heat or combination heat-pressure type fusers appear today to be most prevalent. One combination heat-pressure fuser consists of the heated fusing roll in physical contact with a relatively soft pressure roll, these rolls cooperating to form a fusing nip between which the copy material being fused pass. To prevent offsetting of the toner onto the fuser rolls, particularly the hot fusing roll, the roll surfaces are preferably covered with a release material.

To assure removal of the fused material, for example, copy sheets, from the fusing roll and to obviate any tendency for the copy material to stick or adher to the fusing roll surface, stripping fingers are often provided adjacent the fuser exit to strip the fused copy material therefrom. To assure effective and reliable operation of the stripper fingers, the fingers are normally biased or otherwise held in operative engagement with the fusing roll periphery. Over a period of use, the constant rubbing of the stripper fingers against the roll periphery may wear away the release material and result in lines or grooves being worn in the fusing roll surface. In time, this may have a deleterious effect on fuser operation.

In a similar vein, many fusers incorporate a heat detector or sensor for the purpose of controlling heat input to the fuser and to protect against dangerous overheating. The aforesaid sensor may be arranged to rest or ride against the fuser surface and this in turn may wear away a portion of the release material.

In addition, it has been found that over an extended operating period, the copy material itself can cause excessive wear on certain portions of the fusing roll surface, most notatably along the line where the relatively sharp edges of the copy material contact the fusing roll. This problem is perhaps furthered by the tendency in the industry toward common sheet sizes, i.e. 11 inches.

It is therefore a principle object of the present invention to provide a new and improved fusing apparatus for reproduction and copying machines.

It is an object of the present invention to provide an improved roll-type fuser incorporating means to axially shift the fuser pressure and fusing rolls relative to one another to offset spot roll on the roll surfaces.

It is a further object of the present invention to provide a copier fuser structure designed to accommodate any deleterious effect on the fusing roll release coating resulting from contact with the copy material and/or from contact with operative components of the copier such as the stripper fingers.

This invention relates to a reproduction machine for producing copies of documents, comprising in combination, a fuser for mixing the copy images developed, the fuser having cooperating pressure and heated fusing rolls forming therebetween a nip through which copies to be fused pass, and means supporting the fusing roll for shifting movement in an axial direction

whereby to permit the surface of the fusing roll to be displaced to offset uneven wear on the surface of the fusing roll.

Other objects and advantages of the present invention will be apparent from the ensuing description and drawings, in which:

FIG. 1 is a schematic view of an exemplary reproduction or copying machine incorporating the improved fuser of the present invention;

FIG. 2 is an enlarged top plan view showing details of the fuser roll support mechanism of the present invention; and

FIG. 3 is an enlarged side view in section of the fuser shown in FIG. 2.

Referring particularly to FIG. 1 of the drawings, an exemplary copier/reproduction machine, designated generally by the numeral 10 and incorporating the improved fuser 38 of the present invention, is there shown. As in all electrostatic systems such as the xerographic type machine illustrated, a light image of a document to be reproduced is projected onto the sensitized surface of a xerographic plate to form an electrostatic latent image thereon. Thereafter, the latent image is developed with an oppositely charged developing material to form a xerographic powder or toner image, corresponding to the latent image on the plate surface. The toner image is then electrostatically transferred to a support or copy material where it is fused by a fusing device so that the toner image is permanently adhered to the copy material.

In machine 10, an original document 12 to be copied is placed upon a transparent support platen 14 fixedly arranged in an illumination assembly generally indicated by the reference numeral 15 and disposed at the left end of the machine. While upon the platen, the document 12 is illuminated, thereby producing image rays corresponding to the informational areas on the original. The image rays are projected by means of an optical system onto the photosensitive surface of a xerographic plate. In the exemplary copier/reproduction machine 10, the xerographic plate is in the form of a flexible photoconductive belt 17 supported in a belt assembly 18.

The support assembly 18 for photoconductive belt 17 includes three rollers 20, 21, and 22 located with parallel axes at approximately the apices of a triangle. The upper roller 22 is rotatably driven by a suitable motor and drive means (not shown) to drive belt 17 in the direction shown by the arrow in FIG. 1. During this movement of the belt, the reflected light image of the original document 12 on platen 14 is flashed upon the photoreceptor surface of belt 17 at an exposure station 25 to produce an electrostatic latent image thereon.

The continued movement of photoconductive belt 17 carries the electrostatic image through a developing station 26 in which there is positioned a developer assembly generally indicated by the reference numeral 28. There the latent electrostatic image is developed by means of toner through the use of a multiple magnetic brush system 27.

The developed electrostatic image is carried by belt 17 to the transfer station 30 where the develoed image is transferred to a copy material such as a sheet 31 of copy paper brought forward between transfer roll 32 and belt 17. In order to accomplish transfer of the developed image solely by means of the electrical bias on transfer roller 32, the copy sheet 31 is moved at sub-

stantially the same speed as belt **17.** A sheet transport mechanism generally indicated at **34** is provided to advance copy sheets **31** along a preset path from a paper handling mechanism generally indicated by the reference numeral **35** to transfer station **30** whereat the developed image is transferred.

Following transfer, the copy sheet **31** is stripped from belt **17** and conveyed by the sheet transport mechanism **34** through fuser **38** wherein the toner image is permanently fused or affixed thereto. Following fusing, the finished copy is discharged into output tray **39.**

While individual copy sheets **31** have been illustrated it will be appreciated that endless of web-type copy material may be used.

Photoconductive belt **17** comprises a photoconductive layer of selenium, which is the light receiving surface and imaging medium for the apparatus, on a conductive backing. Further details regarding the structure of the belt assembly **18** and its relationship with the machine and support therefor may be found in U.S. Pat. No. 3,730,623, issued May 1, 1973, and assigned to the same assignee.

Fuser **38** includes a suitable housing **40** within which is disposed a lower heated fuser roll **41** and an upper back-up or pressure roll **42,** rolls **41, 42** cooperating to form a nip through which the copy sheets **31** pass. Fuser rolls **41,42** are driven in the direction shown by the solid line arrows in FIG. **3.** To assure removal of sheets **31** therefrom, one or more stripper fingers **46** are rotatably supported as by shaft **47** in fuser housing **40** at the fuser discharge side such that the leading edge **48** of fingers ride or rest against the surface of fuser roll **41.** To assure sustained contact of fingers with the fuser roll surface, suitable spring biasing means **49** are provided.

Pressure roll **42** includes a rigid internal core **50** which may be steel, for example, over which a relatively thick flexible sleeve-like cover **51** formed from a suitable release material is disposed. Fuser roll **41** similarly has a rigid internal core **54** which may, for example, be copper, having a relatively thin coating **55** of a suitable release material thereover. The relatively thin fuser roll coating **55** may, for example, be applied by spray coating techniques. One suitable release material for both pressure roll cover **51** and fuser roll coating **55** may comprise polytetrafluoroethylene.

Sleeve **51** of pressure roll **42** and coating **55** of fuser roll **41** serve to prevent the toner on copy sheets **31** from offsetting onto the surface of either roll **41** or **42** as well as to aid in preventing the sheets **31** themselves from sticking to one or the other of fuser and pressure rolls **41, 42,** respectively. To heat fuser roll **41,** the center of core **54** is hollow and a suitable heating lamp **56** is disposed therewithin. Heating lamp **56** is connected to a suitable source of electrical power (not shown). As will be understood, heat from lamp **56** radiates the core **54** and is conducted to the exterior coating **55** on the periphery thereof. The heat from fuser roll **41** cooperates with whatever pressure is exerted by pressure roll **42** to fuse the toner developed images on copy sheets **31.** Other heating lamp arrangements or heating sources may be used instead of the lamp arrangement illustrated.

The metal cores **50, 54** of rolls **41, 42** are each provided with projecting stub shafts **60, 60'** and **61, 61',** respectively. In this connection, it will be understood that stub shaft **61'** of fuser roll **41** is hollow to accommodate insertion and removal of heat lamp **56** as well as the electrical leads **64** thereto. The stub shafts of fuser and pressure rolls **41, 42,** respectively, are used to support rolls **41, 42** in operative engagement with one another, stub shafts **60, 60'** of pressure roll **42** being suitably journaled in support arms **68** while stub shafts **61, 61'** of fuser roll **41** are rotatably journaled by roller type bearings **74, 75** in fuser housing side walls **66, 67.** The pressure roll support arms **68** are pivotally mounted within fuser housing **40** by suitable means (not shown) enabling pressure roll **42** to be separated from fuser roll **41** when desired, i.e., as for servicing of fuser **38,** as more fully described in U.S. Pat. No. 3,754,819, issued Aug. 28, 1973, and assigned to the same assignee. Suitable bias means (not shown) are provided to place pressure roll **42** in operating contact with fuser roll **41.**

Fuser roll bearings **74, 75** are supported in side walls **66, 67** of fuser housing **40.** For this purpose, fuser housing side walls **66, 67** each have bearing bores **70, 70'** therethrough within which bearings **74, 75** rest, bores **70, 70'** being slightly oversize to permit the supporting bearings **74, 75** for fuser roll **41** to slide axially therewithin.

Stub shafts **60, 61,** which project from one side of pressure and fuser rolls **42** and **41,** respectively, have meshing roll drive gears **76, 77** affixed to the terminal ends thereof. Gears **76, 77** serve to drivedly interconnect the fuser and pressure rolls **41, 42** with each other. A suitable fuser drive shaft **80** is provided to rotate the pressure roll gear **76** in the direction indicated by the solid line arrow in FIG. **3,** shaft **80** being drivingly connected to gear **76** by suitable means (not shown).

As described, bearings **74, 75,** which rotatably support fuser roll **41,** are slideably disposed within bearing bores **70, 70'** of fuser housing walls **66, 67.** To control the degree of fuser roll axial displacement and prevent unwarranted axial displacements of the roll, the periphery of the outer bearing race **82** of bearing **75** has a pair of spaced grooves **84, 85** extending about the circumference thereof. The outer surface or boss **86** of the fuser housing wall **67** adjoining the bearing bore is relatively flat to present a stop or abutment surface. A bearing lock ring **87,** which conveniently may consist of cooperating ring halves, is provided. The cross-sectional width of lock ring **87** is slightly less than the width of grooves **84, 85** to permit ring **87** to be inserted in one or the other as will appear. The inner diameter of ring **87** is substantially equal to the outer diameter of grooves **84, 85** while the outer diameter of ring **87** is somewhat greater than the diameter of bearing bore **70'.** By this construction, lock ring **87,** when inserted into one of the grooves **84, 85,** projects radially outwardly therefrom to prevent, in cooperation with boss **86** on wall **67,** axial movement of fuser roll **41** toward the opposite wall **66** (in the direction shown by the solid line arrow in FIG. **2**).

An outer bearing cap **90** is provided having an internal bore **91** substantially equal to the diameter of bearing bore **70'.** The outer dimension of bearing cap **90** is substantially greater than the outer diameter of locking ring **87** to permit cap **90** to overlay ring **87.** Bearing cap **90,** which is relied upon to prevent axial displacement of fuser roll **41** in the opposite direction, is provided with a relatively flat inside wall **92** adapted to abut boss **86** on wall **67.** To accommodate lock ring **87,** wall **92** of bearing cap **90** is recessed at **95.** Screws **96** serve to

releasably retain bearing cap 90 in place on the fuser housing wall 67.

By the above-described construction, it will be understood that inter-engagement of lock ring 87 with a selected groove 84 or 85 in the outer bearing race 82 of the fuser roll bearing 75 locates fuser roll 41 against axial displacement in one direction, i.e., in the direction indicated by the solid line arrow of FIG. 2. Lock ring 87 is in turn trapped between boss 86 on fuser housing wall 87 and bearing cap 90 to prevent axial displacement of the outer race 82 of bearing 75, and fuser roll 41, in the opposite direction, i.e. the dotted line arrow shown in FIG. 2.

As a result of the continual movement of copy sheets 31 along the same path between fuser and pressure rolls 41, 42, the edges of sheets 31, which are relatively sharp, tend to wear away or erode the relatively thin coating 55 of release material on the metal core 54 of fuser roll 41. This may result in the coating 55 being worn off the surface of roll 91 in these areas with the result that toner may adhere or offset onto the fuser roll surface at these points.

In a similar vein, contact of the stripper fingers 46 with the fuser roll surface may in time wear away the surface coating 55 on fuser roll 41 where fingers 46 contact roll 41. As described, erosion of the release material coating roll 41 may result in the toner offsetting onto the roll surface with attendant degradation in the quality of the copies produced.

In addition, the eroding or wearing away of the release coating on fuser roll 41 may in time result in an uneven or scored roll surface which itself may affect adversely fusing contact between rolls 41, 42 of fuser 38.

To obviate the above, fuser roll 41 is shifted axially to establish a different surface relationship between fuser roll 41 and the copy sheets 31, as well as between the surface of roll 41 and any other components such as stripper fingers 46 in contact therewith. The aforesaid shifting of fuser roll 41 may be undertaken in accordance with a predetermined servicing routine, i.e. after a preset number of copies, or when inspection of the fuser roll 41 indicates the desirability of doing so.

Where it is desired to shift fuser roll 41 axially, bearing cap 90 is removed by removing attaching screws 96. This permits lock ring 87 to be extracted from the groove 84 or 85 previously used. The entire fuser roll 41 including bearings 74, 75 may then be shifted axially until the unused groove 84 or 85 comes into operative position adjacent fuser housing wall 67. Lock ring 87 may then be inserted into the new groove, and bearing cap 90 reinstalled to lock fuser roll 41 in the new position. As can be appreciated from the aforementioned description, the fuser roll 41 need not be removed from the fuser housing 40 nor need fuser 38 itself be otherwise dis-assembled.

To facilitate axial movement of fuser roll 41, pressure between rolls 41, 42 may be released as described in the aforementioned U.S. Pat. No. 3,754,819. And to facilitate proper location of the roll 41, lock ring 87 may be first inserted in the selected groove and thereafter serve as a locating stop.

While fuser roll 41 has been described herein as supported for movement, it will be understood that pressure roll 42 may instead or in addition be supported for axial displacement to accommodate spot wear on the pressure roll surface.

While the invention has been described with reference to the structure disclosed, it is not confined to the details set forth, but is intended to cover such modifications or changes as may come within the scope of the following claims.

What is claimed is:

1. In a reproduction machine for producing copies of documents, said machine having a fuser for fixing the copy images developed, said fuser having cooperating pressure and heated fusing rolls forming therebetween a nip through which copies to be fused pass, the improvement comprising

means supporting said fusing roll for a shift in an axial direction relative to said pressure roll from one relatively permanent operating position to a second relatively permanent operating position whereby to permit the surface of said fusing roll to be displaced to a new position relative to said pressure roll to offset uneven wear on the surface of said fusing roll.

2. The reproduction machine according to claim 1 including at least one relatively thin finger-like element adapted to contact the periphery of said fusing roll at one point thereof to strip copy material therefrom, shifting of said fusing roll to said second relatively permanent operating position serving to present fresh fusing roll surface for contact by said finger-like element.

3. The reproduction machine according to claim 1 in which said support means includes locking means for retaining said fusing roll in a selected operating position.

4. In an electrostatic type copying machine having a photoconductive member, means to charge the member in preparation for imaging, means to expose the member to form a latent electrostatic image of the original being coped thereon, means to develop the image, means to transfer the developed image to copy material, means for permanently fixing the transferred image on the copy material including a fuser roll having an offset inhibiting coating on the surface thereof, and feeding means to feed the copy material along a predetermined path into operative relationship with the transfer means whereat the developed image is transferred to the copy material and thereafter to the fixing means whereat the image is permanently fixed, the improvement comprising:

means supporting said fuser roll for manual shifting movement along the roll axis relative to said copy material predetermined path whereby to enable the wear effects of said copy material against said fuser roll coating to be offset.

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