

[54] REPRODUCTION MACHINE FUSER

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

[56]

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[57]

ABSTRACT

A fuser apparatus for a reproduction or copying machine, the fuser comprising a heated fixing roll and co-operating 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.

5 Claims, 3 Drawing Figures

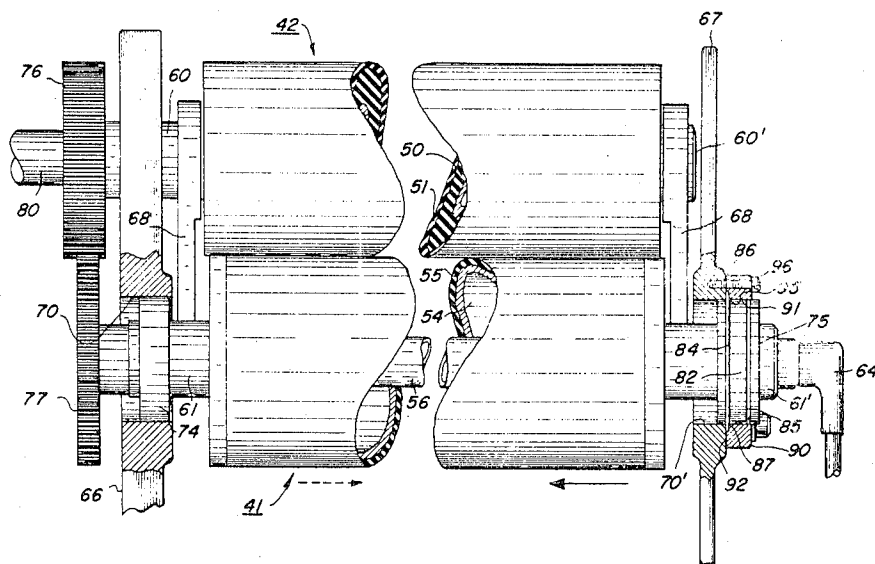


FIG. 1

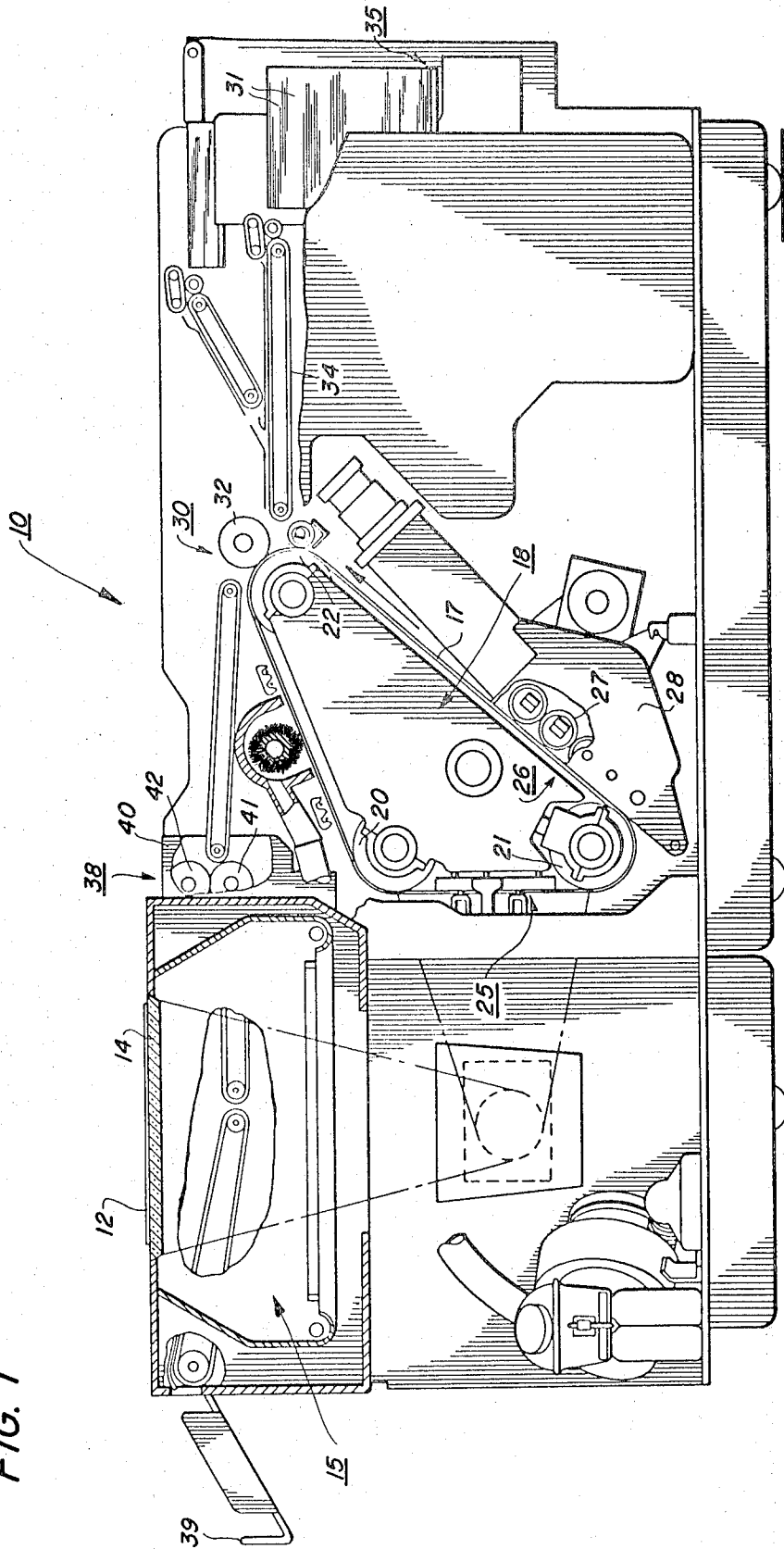


FIG. 3

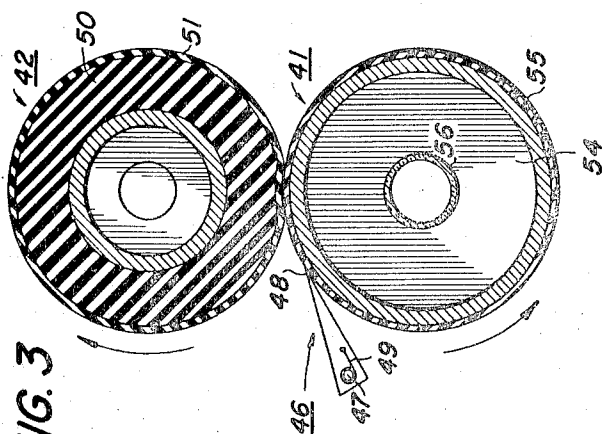
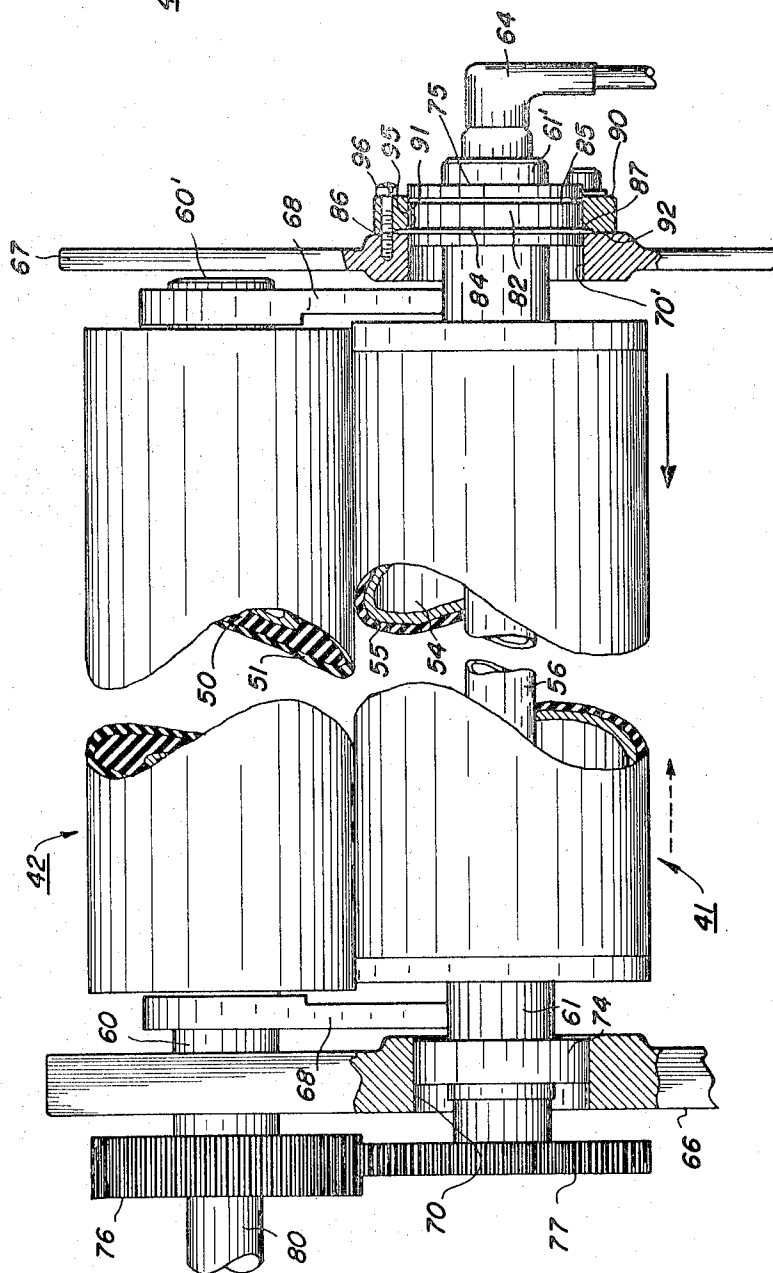


FIG. 2



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 adhere 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 notably 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 displaceable bearings permitting the fuser pressure and fusing rolls to be shifted axially relative to one another to offset spot roll on the roll surfaces.

It is a further object of the present invention to provide an improved fuser roll support designed to facilitate axial shifting of the roll to offset spot wear on the roll surface.

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

shifted axially whereby to offset spot wear on the surface of the fuser roll, and locking means for releasably locking the bearing means and the fuser roll in selected position.

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 plane 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 developed image is transferred to a copy material such as a sheet 31 of copy paper brought forward between transfer roller 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 substantially 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 to 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 there-within.

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 drivenly 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 drivenly 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 thereaf-

ter 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, the machine including a fuser for fixing the copy images developed, the fuser having cooperating pressure and heated fusing rolls forming therebetween a nip through which the copies to be fused pass, the improvement comprising:

bearing means supporting said fuser roll for rotation, said bearing means being movable in an axial direction to permit said fuser roll to be shifted axially relative to said pressure roll whereby to offset spot wear on the surface of said fuser roll; and

locking means for releasably locking said bearing means and said fuser roll in selected position.

2. The reproduction machine according to claim 1 in which said reproduction machine includes a frame defining a bearing stop, said bearing means including an outer bearing ring, said bearing ring having at least two grooves in the outer periphery thereof, each of said grooves representing a preselected roller position, and lock means engageable with a selected one of said grooves and said stop to retain said bearing ring and said roll in selected axial position.

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

a bearing pair adjacent each end of said fusing roll to rotatably journal said roll,

frame means for supporting said bearing pair, said bearing pair being axially displaceable relative to said frame means whereby to permit said fusing roll to be moved relative to said pressure roll to present fresh fusing roll surface and reduce uneven wear on said fusing roll, and

locking means cooperable with at least one of said bearings comprising said bearing pair and said frame means to lock said fuser roll in selected axial position.

4. The reproduction machine according to claim 3 in which said one bearing is provided with plural stops representing predetermined axial positions of said fusing roll, said locking means comprising a lock element engageable with a selected one of said bearing stops to retain said fusing roll in selected axial position.

5. The reproduction machine according to claim 4 in which said locking means is releasable to permit said lock element to be withdrawn and said fusing roll shifted to another position.

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