United States Patent [19]

Bruan

[11] **3,809,861**

[45] **May 7, 1974**

[54] **REPRODUCTION MACHINE FUSER ASSEMBLY**

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

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[52] **U.S. Cl.**..... **219/469,** 100/93 RP, 219/216

[51] **Int. Cl.**..... **B21b 27/06,** G03g 15/20

[58] **Field of Search**..... 219/469–471; 432/59, 228; 100/93 RP; 101/247; 355/9, 12

[56] **References Cited**

UNITED STATES PATENTS

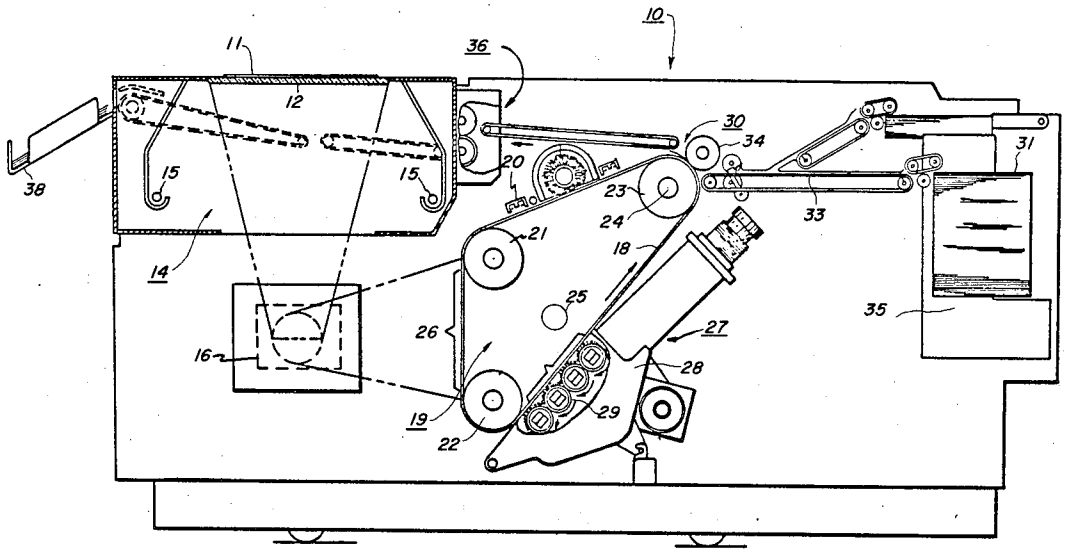
1,296,112	3/1919	Peiler	100/93 RP
3,227,854	1/1966	Ramsey et al.	219/388 X
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Primary Examiner—C. L. Albritton

[57] **ABSTRACT**

An electrostatographic type reproduction machine having a fuser for fixing developed images on the copy material, the fuser having cooperating heated and pressure rollers. The pressure roller is supported for movement away from the other roller to permit the rollers to be separated and the fuser unloaded. For this purpose, the pressure roller is carried in a pivotable frame driveable by cams into physical contact with the heated roller. A spring type return driver, which is loaded on movement of the pressure roller into contact with the heated roller, serves, when unlatched, to rapidly drive the fuser rollers apart. To reduce noise and shock on the fuser and related parts occasioned by release of the latch and unwinding of the spring drive, a viscous dampener is provided to retard separating movement of the fuser rollers.

3 Claims, 4 Drawing Figures



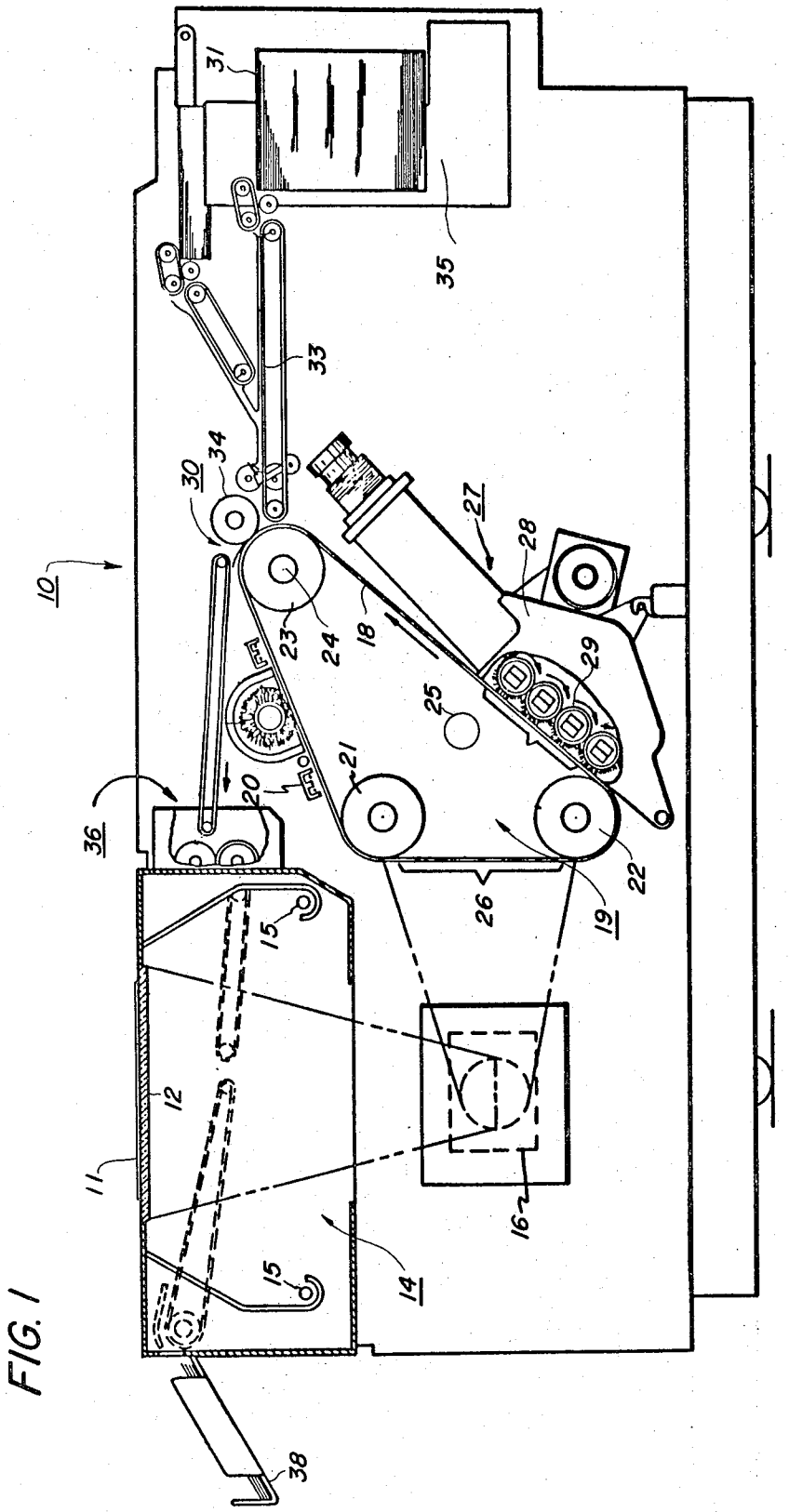

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FIG. 1

FIG. 2

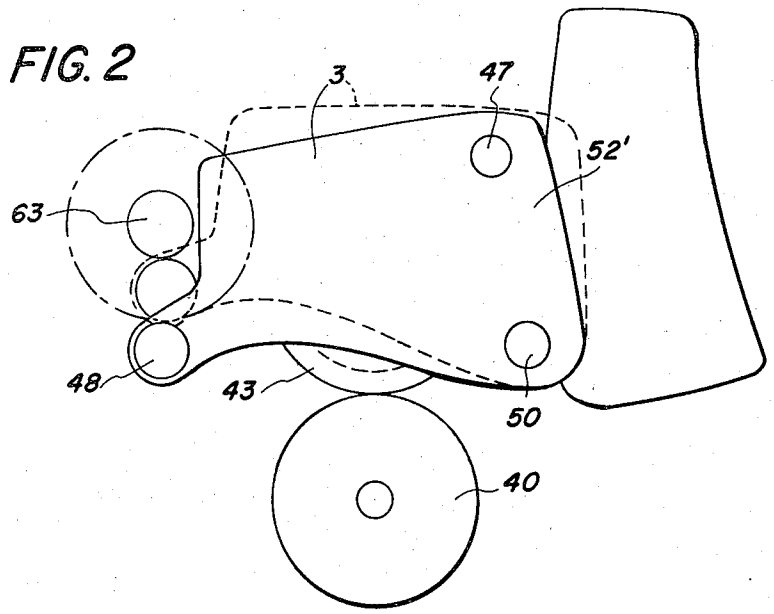

3
47
52'
63
48
43
50
40

FIG. 3

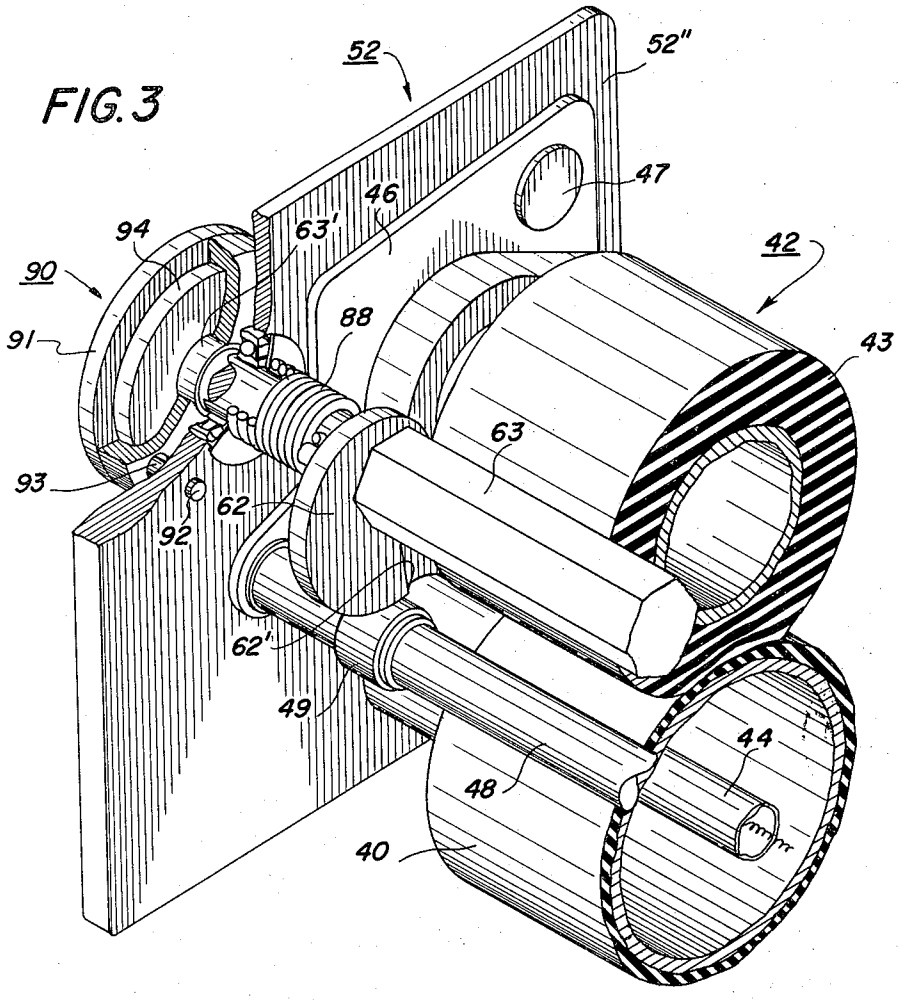
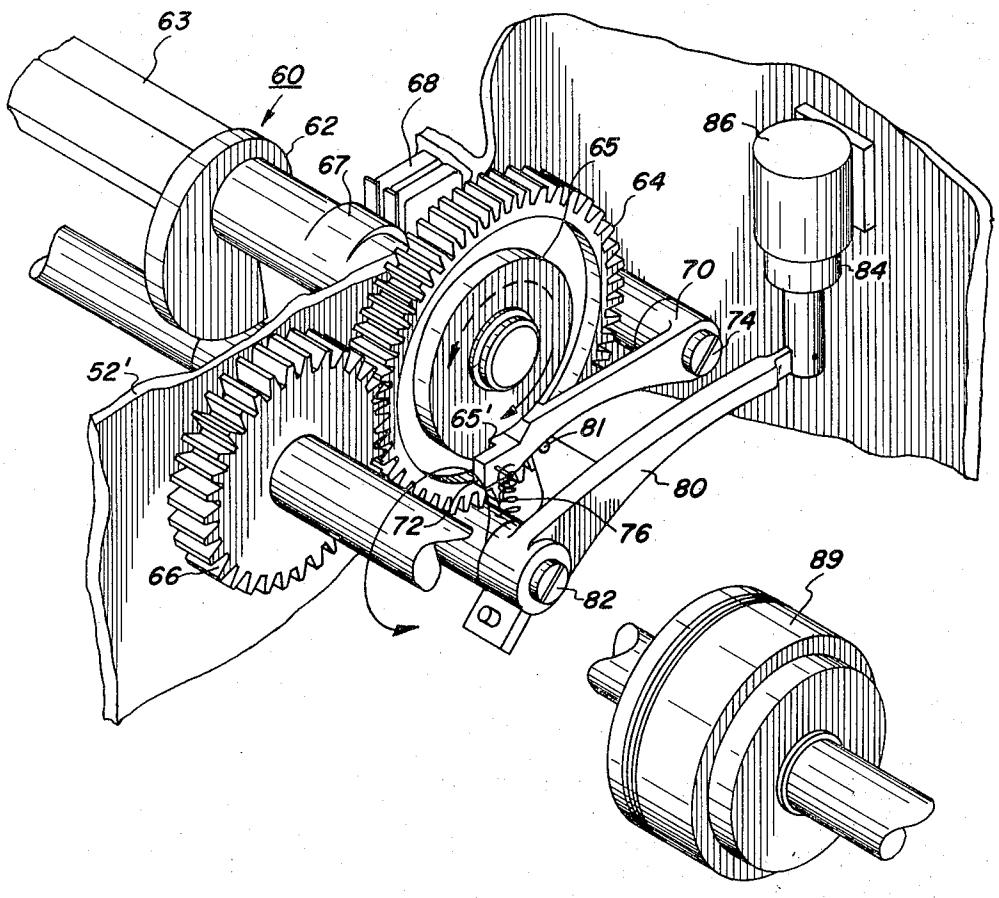

52
52"
47
46
63'
94
90
42
91
88
43
63
93
62
92
62'
49
44
48
40

FIG. 4



REPRODUCTION MACHINE FUSER ASSEMBLY

This invention relates to a fuser for electrostatographic type reproduction machines, and more particularly to an improved fuser release mechanism.

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 plate 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 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 may then be developed by contacting it with a finely divided electrostatically attractable material, such as a resinous powder. The powder is held in the image areas by the electrostatic fields on the layer. Where the field is greatest, the greatest amount of material is deposited, and where the field is least, little or no material is deposited. Thus, a powder image is produced in conformity with the light image of the copy being reproduced. The powder is subsequently transferred to a suitable surface such as a sheet of paper or other surface and suitably affixed, such as by heat, pressure, and the like, to thereby form a permanent print.

The aforedescribed powder may be fixed by exposing the image bearing sheet to heat and/or pressure, normally effected by a fuser. One type of fuser consists of cooperating heated and pressure rollers, the rollers forming a nip through which the image bearing sheet is passed and thereby fixed. The fuser heated roller is generally formed of a metallic substrate for high heat transfer efficiency, whereas the pressure roller is formed with a flexible surface material to provide a sufficiently wide nip when placed in contact with the fuser roller to efficaciously fuse the powder. However, prolonged contact of the heated roller directly with the pressure roller in the absence of paper may be deleterious to the flexible surface material of the pressure roller. This may occur when the machine is in standby mode.

To obviate premature degeneration of one or both of the fuser rollers, a release mechanism may be provided therefor. One type of fuser release mechanism employs one or more relatively strong springs to effectuate such release, the arrangement being such that the springs are compressed into a bias condition upon movement of the fuser rollers into operating contact, such spring disposition being maintained by a suitable latch. When it is desired to release the fuser, as, for example, at the end of a copy cycle, the latch is released and the fuser rollers spring apart.

However, to provide the requisite driving force necessary to move the relatively heavy fuser rollers apart in quick order, one or more very strong springs are required. These tend, when released, to accelerate the fuser parts quickly, and due to the mass of the moving fuser parts, there results a large mass inertia which, on the fuser part reaching the limit stop, generates a strong impact and loud noise.

It is therefore an object of the present invention to provide a new and improved fuser for electrostatographic machines.

Another object of this invention is to provide an improved apparatus for releasing fusing and pressure rollers in the fuser of an electrostatographic machine.

Still another object of the invention is to provide a novel apparatus for retarding the release motion of the fusing elements of a copying machine to reduce shock loads and noises resulting therefrom.

A still further object of the invention is to provide a release assembly for the heated fusing and pressure rollers of a reproduction machine fuser incorporating means to slow releasing motion of the roller parts.

It is an object of the present invention to provide an improved fuser for reproduction machines incorporating shock absorber means to control the high speed releasing movement of the fuser.

It is an object of the present invention to provide, in a fusing apparatus having one part supported for separating movement together with drive means therefor, a viscous dampener for retarding separating movement of the fuser part and reduce shock loads attending subsequent braking thereof.

This invention relates to a fusing apparatus adapted for use with reproduction machines, the combination comprising; cooperating first and second rollers adapted to form a nip through which copies being fused pass, at least one of the rollers being heated; means supporting the fist roller for movement into and out of cooperative pressure relationship with the second roller; drive means adapted when actuated to move the first roller into pressure relationship with the second roller; bias means adapted when loaded and activated to move the first roller away from the second roller, the drive means serving when actuated to load the bias means; means for locking the rollers in pressure relationship with the bias means in a pre-set loaded condition ready to move the first roller away; means to release the locking means and activate the bias means to move the first roller away; and motion control means to retard movement of the first roller under the influence of the bias means whereby to reduce shock loads on the apparatus attending subsequent stopping of the first roller.

Other objects and advantages will be apparent from the ensuing description and drawings in which:

FIG. 1 is a schematic sectional view of an exemplary electrostatic reproduction machine embodying the improved fuser of the present invention;

FIG. 2 is a side view of the fuser pressure roller assembly illustrating the positioning of the pressure roller in an image transfer mode;

FIG. 3 is a partial sectional isometric view of the fuser and the fuser release mechanism showing details of the dampener of the present invention; and

FIG. 4 is an enlarged exploded isometric view showing details of the fuser release mechanism.

For a general understanding of the invention, an exemplary reproduction or copying machine, designated generally by the numeral **10**, is schematically shown in FIG. 1 of the drawings.

Referring thereto, documents **11** to be copied are placed one at a time upon the transparent support platen **12** fixedly arranged in an illumination assembly generally indicated by the reference numeral **14** (at the left end of the machine as seen in FIG. 1). Light rays

from suitable illuminators, for example flash lamps **15**, are flashed upon the document **11** resting on platen **12** to produce image rays corresponding to the document informational areas. The image rays are projected by means of a suitable optical system **16** onto the photosensitive surface of a xerographic plate. In the arrangement shown, the xerographic plate is in the form of a flexible belt **18** supported on a belt assembly, generally indicated by the reference numeral **19**.

Belt **18** comprises a photoconductive layer of selenium which is the light receiving surface and imaging medium for the apparatus, on a flexible conductive backing. The surface of the photoconductive belt is made photosensitive by a previous step of uniformly charging the same by means of a corona generating device or corotron **20**.

Belt **18** is movably supported by rollers **21, 22, 23** of belt assembly **19**, rollers **21, 22,** and **23** being positioned with their axes substantially parallel to one another. Belt assembly **19** is slidably mounted as a unit upon support shafts **24** and **25**, roller **23** being rotatably supported on shaft **24**. Shaft **24** is in turn secured to the machine frame and is rotatably driven by a suitable motor and drive assembly (not shown) in the direction of the arrow at a constant rate during the copying cycle. During exposure of belt **18**, the portion of the moving belt exposed (that portion of the belt running between rollers **21** and **22**) receives the reflected light image of the document **11** on platen **12** so that there is produced an electrostatic latent image on the surface of the belt. For convenience, the exposure area is designated by the numeral **26**.

As the image bearing portion of belt **18** moves away from the exposure area **26**, the electrostatic image thereon passes through a developing station **27** in which there is positioned a developer assembly, generally indicated by the reference numeral **28**. Development assembly **28** serves to develop the electrostatic image with a suitable electroscopic powder, commonly known as toner, by means of multiple brushes **29**.

The developed electrostatic image on belt **18** next moves to a transfer station **30** whereat the image is transferred from belt **18** to a sheet of copy paper **31** by means of a transfer roller **34**. Sheet **31** is fed at a speed in synchronism with the belt **18** to avoid smearing or blurring of the image, transfer of the developed image being effected through the electrical bias on the transfer roller **34** in a manner known to those skilled in the art. A sheet transport mechanism, generally indicated at **33**, is provided to feed sheets **31** from paper supply tray **35** to transfer station **30**.

Following transfer, the sheet is separated from belt **18** and is conveyed to a fuser assembly, generally indicated by the reference numeral **36**, wherein the developed and transferred xerographic powder image on sheet **31** is permanently fused or fixed. After fusing, the finished copy is discharged from the apparatus into tray **38**.

Further details regarding the structure of the belt assembly **14** and its relationship with the machine and support therefor may be found in the copending application Ser. No. 102,312, filed in 1970, assigned to the same assignee and now U.S. Patent No. 3,730,623, issued on May 1, 1973.

Referring now to FIGS. **2** and **3**, the fuser assembly **36** is comprised of a fuser roller **40** and a pressure roller assembly, generally indicated as **42**. Pressure roller assembly **42** includes pressure roller **43**. The fuser roller **40** is formed of a suitable heat conductive material, such as copper, and is provided with a source of heat **44**, such as a quartz lamp, centrally positioned therein to heat the roller **40** to operational temperatures. The pressure roller **43** is mounted for rotation in end plates **46**. A support bar **47** and a cam follower shaft **48** including suitable cam followers **49**, are mounted on end plates **46**. A pivot shaft **50** is affixed to and extends through the end plates **46** and is mounted for rotation in the fuser frame assembly, generally indicated as **52**.

Referring now to FIGS. **3** and **4**, a cam assembly, generally indicated as **60**, has cams **62** mounted on a cam shaft **63**. Shaft **63** is journaled in frame member pair **52'**, **52''**, one end of shaft **63** projecting therebeyond and having gear **64** mounted thereon. Gear **64** includes an internally formed stop **65**. Gear **64** engages a drive gear **66**, as more fully hereinafter described. A switch cam **67** positioned on shaft **63** in juxtaposition with switch assembly **68**, is provided. As will appear, switch assembly **68** controls operation of latching solenoid **86** and the driving clutch **89** for gear **66**. A latch **70** having a latching surface **72** is mounted for rotation on the adjoining frame member **52'** as by screw pin **74** such that, on raising of latch **70**, the latching surface **72** interengages with surface **65'** of stop **65** to prevent rotation of cam shaft **63** in the direction shown by the dotted line arrow in FIG. **4**. Spring **76** biases latch **70** away from stop **65** (downward as seen in FIG. **4**).

Lever **80**, positioned below the latch **70**, is mounted for rotation on frame member **52'** as by screw pin **82**. One end of lever **80** is coupled to armature **84** of solenoid **86**. Lever **80** has a pin-like abutment **81** adapted to engage the surface of latch **70** and thereby move latch **70** upwardly into latching engagement with stop **65** upon activation of solenoid **86**.

A torsion spring **88** (more than one may be employed) is secured between cam shaft **63** and the fuser frame assembly **52**, spring **88** serving to move the fuser rollers **40, 43** apart upon release of latch **70** at the termination of an image transfer mode as will appear.

The opposite end **63'** of cam shaft **63** projects through the other one of frame member pair **52''**. A motion retarding device or shock absorber in the form of a rotary viscous type dampener **90** is supported on end **63'** of shaft **63**. Referring particularly to FIG. **3**, dampener **90** includes a hollow housing or shell **91** secured to frame member **52''** as by interlocking pin and slot **92, 93**, pin **92** being fixed to and projecting from frame member **52''** into slot **93** in the inside wall of housing **91**. A ring-like disc **94** is disposed internally of housing **91**, disc **94** being mounted on and fixably secured to cam shaft **63** as by means of a key (not shown). The relative dimensions of the chamber formed by dampener housing **91** and disc **94** are such that a small clearance is provided therebetween, such clearance being filled with a relatively heavy viscous fluid. Suitable fluid sealing means (not shown) may be provided to prevent leakage of the viscous fluid therefrom.

In operation, upon activation of the copying machine **10** by the operator, the fuser heating element **44** is energized to heat the fuser roller **40** to a desired temperature at which time the reproduction machine **10** shifts to a standby mode ready to be placed in an image transfer mode. Generation of a signal to place the machine in production energizes drive clutch **89**, to turn gear **66**. Gear **66** in turn drives gear **64** to turn cam shaft **63**

and cams 62 thereon in a clockwise direction as shown by the solid line arrow in FIG. 4.

On rotation of cam shaft 63, cams 62 thereon work against followers 49 to swing pressure roll assembly 42 about the axis of pivot shaft 50 (counterclockwise in FIG. 2) to bring pressure roller 43 into contact with fuser roller 40. Following rotation of cam shaft 62 through a predetermined angle, switch cam 67 actuates the switch assembly 68 to disengage clutch 89, interrupting power to gear 66. At the same time switch assembly 68 energizes solenoid 86. Energization of the solenoid 86 draws armature 84 thereof upwardly thereby lifting lever 80 and raising latch 70 to a point where the latching surface 72 thereof engages surface 65' of stop 65. This locks the cam shaft 63 against rotation in the opposite direction under the influence of spring 88 and the natural tendency of fuser rollers 40, 43 to separate, it being understood that the clockwise rotation of cam shaft 63, during which fuser rollers 40, 43 are brought into operative contact, winds torsion spring 88. Accordingly, pressure roller 43 is held in operative contact with fuser roller 40. Fuser 36 of copy machine 10 is now in the operational mode illustrated by the solid lines in FIG. 2.

Upon generation of a signal indicative of the completion of fusing, solenoid 86 is de-energized. This permits spring 76 to move latch surface 72 out of interfering relationship with cam stop 65 thereby releasing torsion spring 88. Spring 88 accordingly unwinds to rotate cam shaft 63 in a counterclockwise direction as shown by the dotted line arrow in FIG. 4 to move pressure and fuser rollers 43, 40, respectively, apart. Fuser 36 therefor returns to a standby condition.

In order to effect immediate separation of fuser and pressure rollers 40, 43, respectively, as may be necessary in the event of a malfunction, against the relatively large mass inertia of the pressure roll assembly 42, torsion spring 88 must be relatively powerful. The use of a relatively powerful spring for this purpose tends however to overdrive the pressure roller assembly 42 such that the stop ramps 62' on cams 62 strike against cam followers 49 with substantial force and impact. This imposes high and quite undesirable shock loads on the fuser parts as well as generating undesirable noise.

Dampener 90 obviates this problem by retarding acceleration of cam shaft 63 under the impetus of spring 88, dampener 90 resisting the tendency of cam shaft 63 to accelerate at too great a rate. Thus excessive and unnecessary buildup in the rotational speed of cam shaft 63 is restrained and impact between cams 62 and followers 49 thereof and noise are held to a minimum. At the same time, dampener 90 permits sufficient initial acceleration of the pressure roller assembly 42 to assure timely separation of the pressure and fuser rollers 43, 40, respectively, in the event of a malfunction.

It is understood that dampener 90 normally provides no effective retarding action during movement of the pressure roll assembly 42 into operative position since such movement, under the action of cams 62, is relatively slow and constant.

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 pressure roll fuser fusing apparatus adapted for use with copy producing machines, said fusing apparatus including cooperating first and second rollers adapted to form a nip through which copies being fused pass with one of said rollers being heated, the combination of:

means supporting said first roller for movement into and out of cooperative pressure relationship with said second roller;

drive means adapted when actuated to move said first roller into pressure relationship with said second roller;

bias means adapted when loaded and activated to move said first roller away from said second roller, said drive means serving when actuated to load said bias means;

means for locking said rollers in pressure relationship with said bias means loaded and ready to move said first roller away;

means to release said locking means whereby to activate said bias means and move said first roller away; and

motion control means to retard movement of said first roller under the influence of said bias means whereby to reduce shock loads on said apparatus attending subsequent stopping of said first roller.

2. In a fuser assembly for an electrostatographic machine including a fuser roller and a pressure roller, the combination of:

means rotatably supporting said pressure roller for movement between an operative position in contact with said fuser roller and in inoperative position out of operative contact with said fuser roller, said supporting means including at least one cam following surface portion;

cam means engageable with said cam following surface;

drive means for operating said cam means to move said pressure roller toward said fuser roller and into said operative position in an image transfer mode of said machine;

spring means for moving said pressure roller away from said fuser roller and into said inoperative position, said drive means being adapted to place said spring means under torsional pressure when moving said pressure roller to said operative position;

locking means cooperable with said supporting means following movement of said pressure roller to said operative position to lock said pressure roller in said operative position against the bias of said spring means; and

motion control means operable on release of said locking means to retard accelerating movement of said pressure roller by said spring means whereby to reduce impact and noise resulting from engagement of said cam means with said cam following surface on movement of said pressure roller to said inoperative position.

3. The fuser assembly according to claim 2 in which said motion control means comprises a viscous dampener.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,809,861 Dated May 7, 1974

Inventor(s) Oskar J. Braun

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Title page, Inventor, change "Bruan" to --Braun--.

Signed and sealed this 29th day of October 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.

UNITED STATES PATENT OFFICE
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FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
★ U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.