United States Patent [19]

Thettu

[11] **3,907,493**

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[54] **VISCO-ELASTIC DAMPENER MECHANISM FOR FUSER ASSEMBLY**

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

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[52] **U.S. Cl.** **432/60;** 432/228; 188/268; 219/469

[51] **Int. Cl.²**... **F27B 9/28;** B21B 27/06; G03G 5/00

[58] **Field of Search** ..... 432/59, 60, 227, 228; 219/469, 216, 388; 100/93 RP; 188/268; 226/176, 186

[56] **References Cited**

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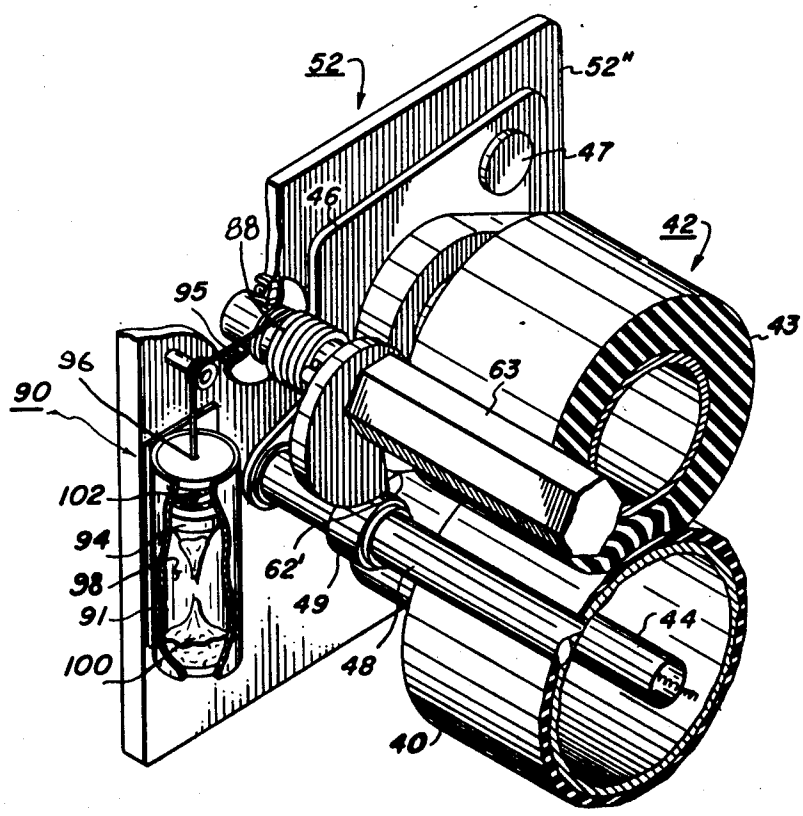
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Primary Examiner—John J. Camby
Assistant Examiner—Henry C. Yuen

[57] **ABSTRACT**

An electrostatographic reproduction machine having a fuser for fixing developed images on the copy material. The fuser has cooperating pressure heated rollers where a 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 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 visco-elastic dampener mechanism is provided to retard separating movement of the fuser rollers. The visco-elastic dampener mechanism uses a sliding disc in a housing which are coated with a silicone rubber which is contacted by a silicone putty material.

3 Claims, 4 Drawing Figures



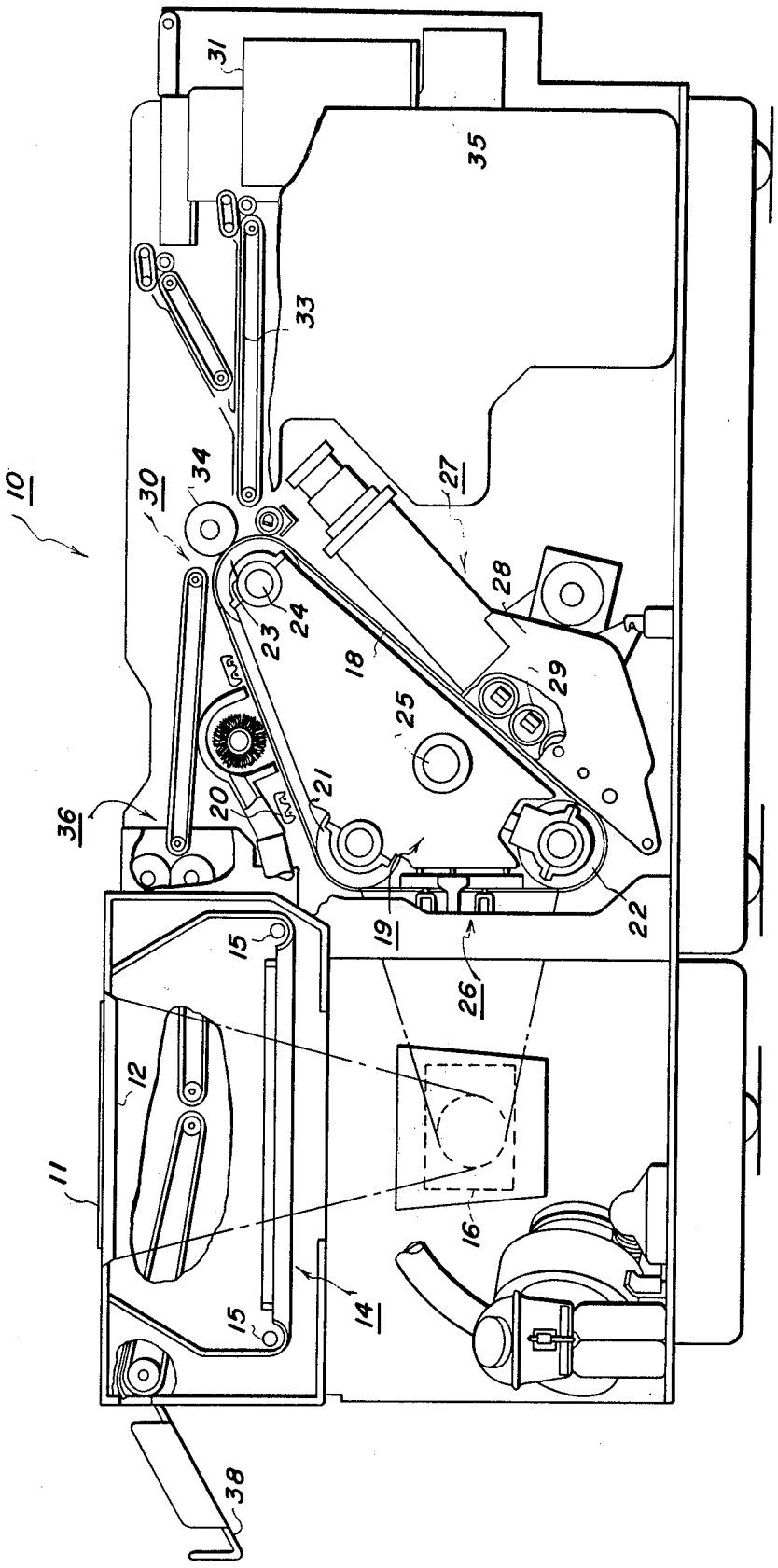

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FIG. 1

FIG. 2

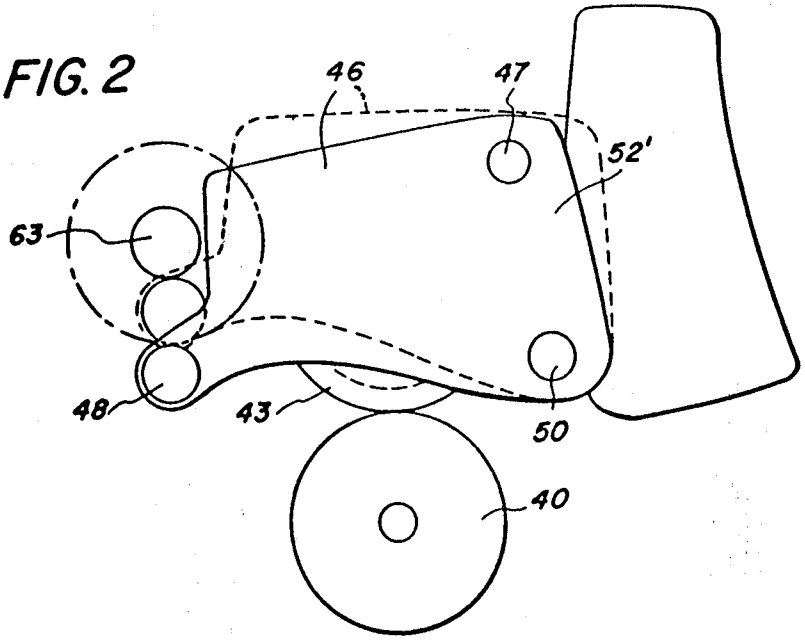

46
47
52'
63
48
43
50
40

FIG. 3

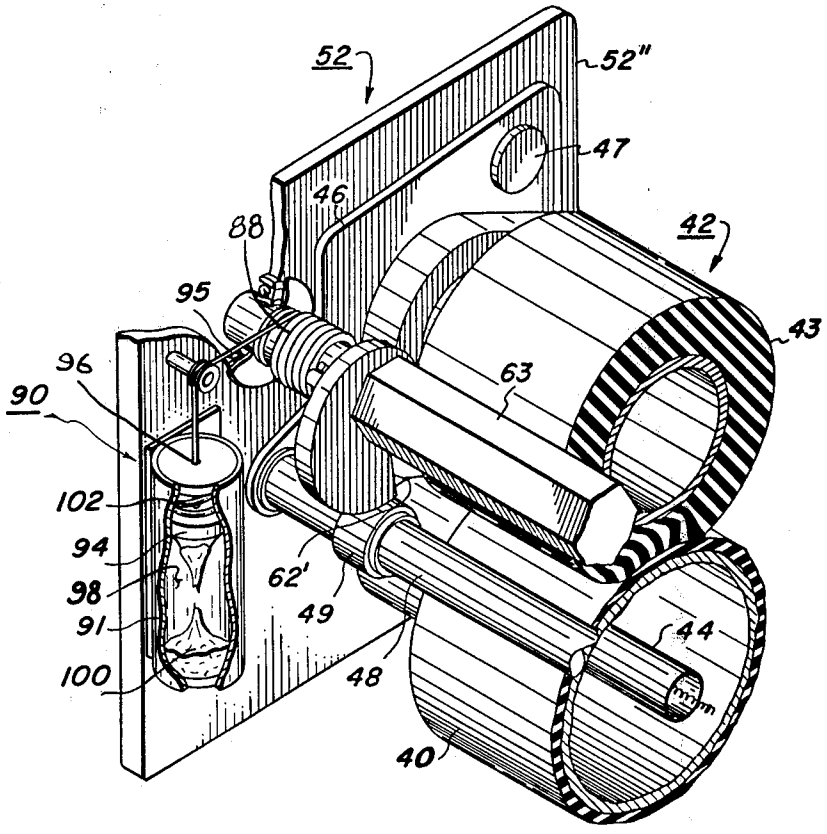
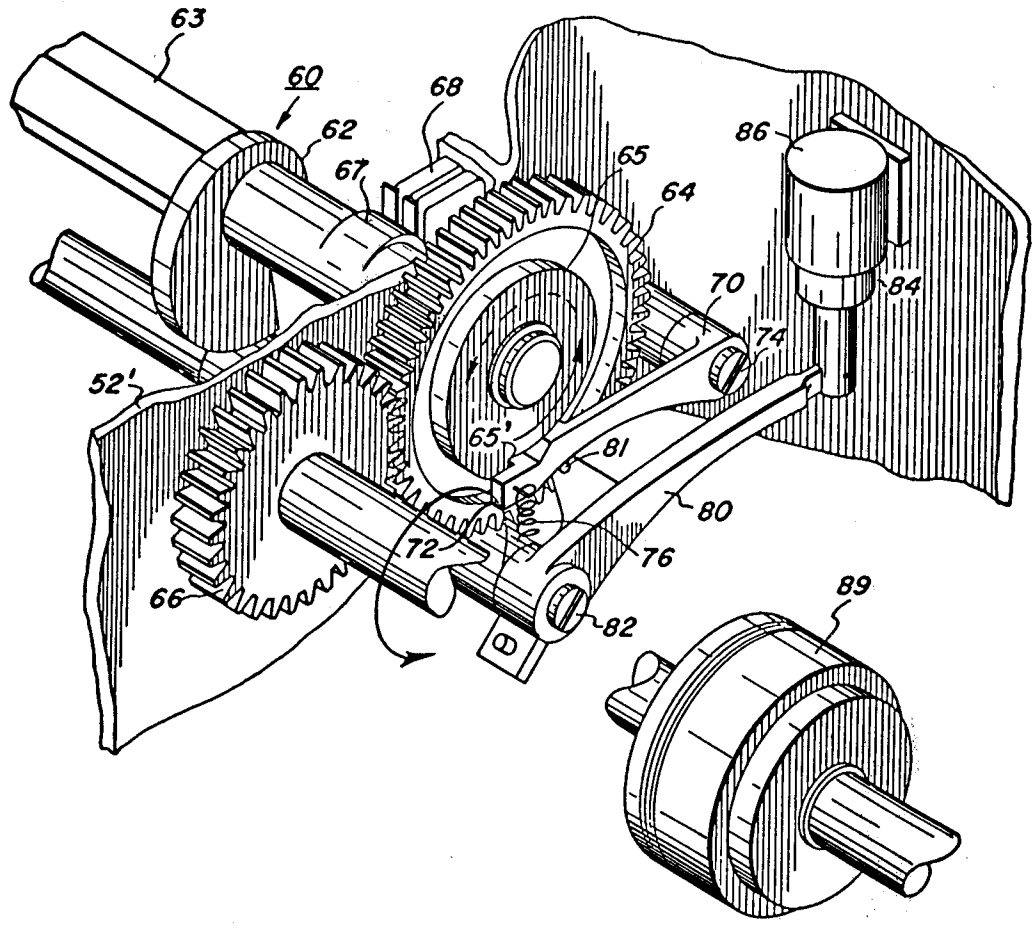

52
52"
47
46
88
42
95
43
96
63
90
102
94
62'
98
49
91
44
100
48
40

FIG. 4



VISCO-ELASTIC DAMPENER MECHANISM FOR FUSER ASSEMBLY

This invention relates to a pressure heated fuser for electrostatographic type reproduction machine, and more particularly to an improved dampener release mechanism to minimize unlatch noise.

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 aforesaid 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 roll dampener mechanism to minimize noise and to increase fuser roll life by ensuring positive roll separation.

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 reliable release assembly for the heated fusing and pressure rollers of a reproduction machine fuser to cushion the shock of the roller parts.

It is another object of the present invention to provide an improved fuser for reproduction machines incorporating a visco-elastic shock absorber to enable high speed releasing movement of the fuser and yet absorb the shock load.

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 first roller for movement into and out of cooperative pressure relationship with the second roller; drive means 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 the 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 position 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 visco-elastic 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** that 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** sup-

ported 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 slideably mounted as a unit upon support shafts **24** and **25,** roller **23** being rotably 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 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 therefore may be found in the copending application Ser. No. 102,312, filed in 1970, now U.S. Pat. No. 3,730,623 issued on May 1, 1973 and assigned to the same assignee.

Referring 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 heated 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 pivot shaft **50** is affixed to and extends through the end plate **46** and is mounted for rotation in the fuser frame assembly, generally indicated as **52.**

Referring now to FIG. **3** 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 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.**

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''.**

In accordance with the invention a motion retarding device or shock absorber in the form of a visco-elastic dampener **90** is supported on end **63'** of shaft **63.** Dampener **90** includes a tubular housing or shell **91** secured to frame member **52''** as by any suitable support member fixed to a projecting frame member **52''.** Received in one end of housing **91** is a disc member **94** which is connected to cam shaft **63** by a flexible belt on cable **95** wrapped therearound. Flexible belt **95** is received through aperture **96** formed in the top of housing **91.** At the opposite end of housing **91** is a quantity of visco-elastic material. Any suitable material such as Dow Corning C-20982 commonly referred to as silicone putty can be used. The surface of disc member **94** and housing **91** have a coating **98** made of material having a high surface affinity for silicone putty such as silicone rubber manufactured under the trademark of General Electric RTV 112, which readily adheres to the silicone putty. A spring **102** is positioned between disc member **94** and the top of housing **91** to dampen the movement of the disc member after separation and breaking of the silicone putty.

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 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 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 interferring 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** therefore returns to a standby condition.

In order to effect 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 of 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 cam **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.

Visco-elastic dampener **90** obviates this problem by retarding acceleration of cam shaft **63** under the impetus of spring **88** thereby resisting the tendency of cam shaft **63** to accelerate at too great a rate. The rotation of the cam shaft unwinds cable **95** during loading of the pressure roll against the fuser roll such that the moving disc member makes good contact with the silicone putty material **100.** When the latch is released the cam shaft rotates in the opposite direction. This in turn pulls the moving disc member away from the silicone putty. The silicone putty offers resistance to the sudden pull and then breaks. In doing so it absorbs the shock of release and allows the cam shaft to return gently under the resistance of spring **102.** Thus, excessive and unnecessary buildup in the rotation speed of cam shaft **63** is restrained and impact between cams **62** and followers **49** thereof and noise is held to a minimum. At the same time, visco-elastic dampener **90** permits timely separation of the pressure and fuser rollers **43, 40** respectively, in the event of a malfunction. In addition the visco-elastic dampener is reliable and does not leak in the sense of a liquid system subject to stresses.

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 roller 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;

visco-elastic dampener means including a supply of silicone putty operable on release of said locking means to cushion the load of said first roller under the influence of said bias means upon subsequent stopping of said first roller and movement away from said second roller,

said visco-elastic dampener means including a housing receiving a sliding disc member which is connected to a flexible cable wrapped around a shaft connected to said drive means, said housing containing said silicone putty which is in surface contact with said sliding disc member.

2. Apparatus according to claim **1** wherein said housing and disc member are coated with a material having a high surface affinity for silicone putty.

3. Apparatus according to claim **2** wherein said high surface energy material is silicone rubber.

* * * * *