

- [54] **PRESSURE HEATED FUSER ASSEMBLY**
[75] Inventor: **Alan F. McCarroll**, Rochester, N.Y.
[73] Assignee: **Xerox Corporation**, Stamford, Conn.
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[51] Int. Cl. **G03g 5/00**
[58] Field of Search **432/227-228, 432/59-60; 271/273, 274; 226/186, 187, 176, 177; 219/216, 388, 469; 92/12**

[56] **References Cited**
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Primary Examiner—John J. Camby
Assistant Examiner—Henry C. Yuen

[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, an adjustable pneumatic dampener is provide to retard separating movement of the fuser rollers.

1 Claim, 5 Drawing Figures

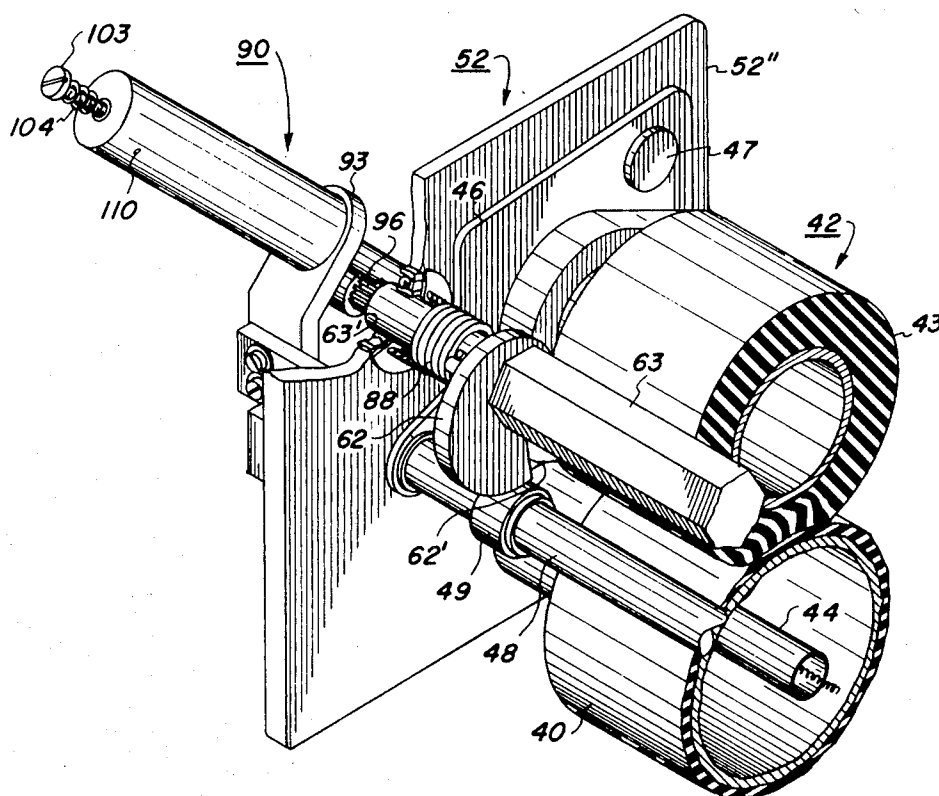


FIG. 1

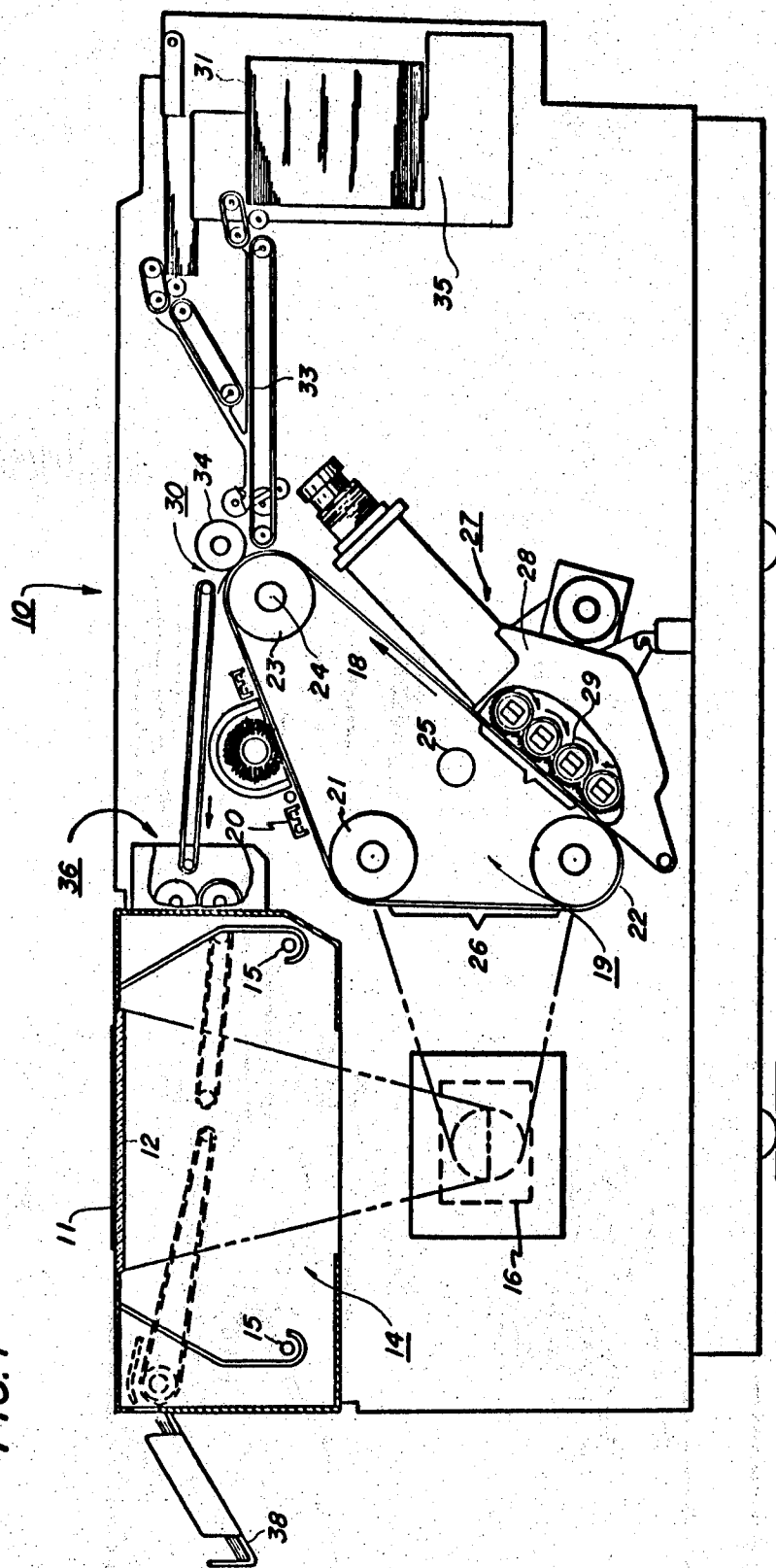


FIG. 2

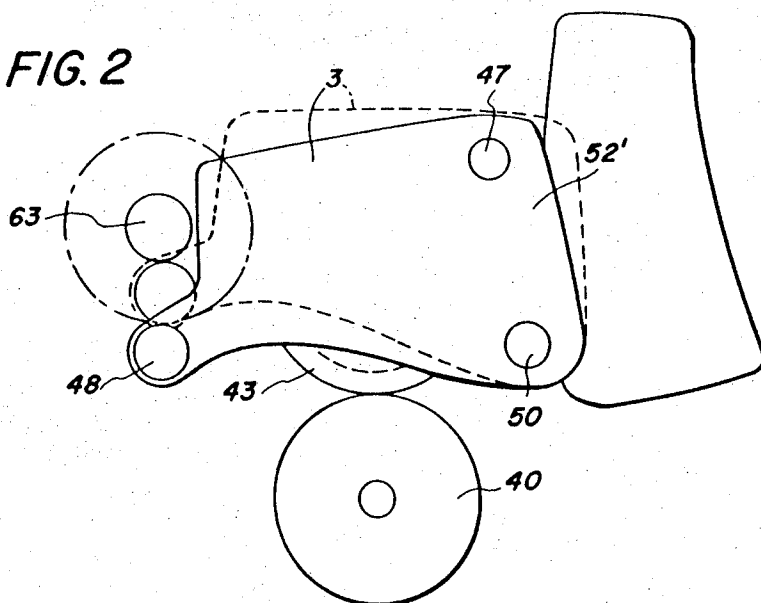


FIG. 3

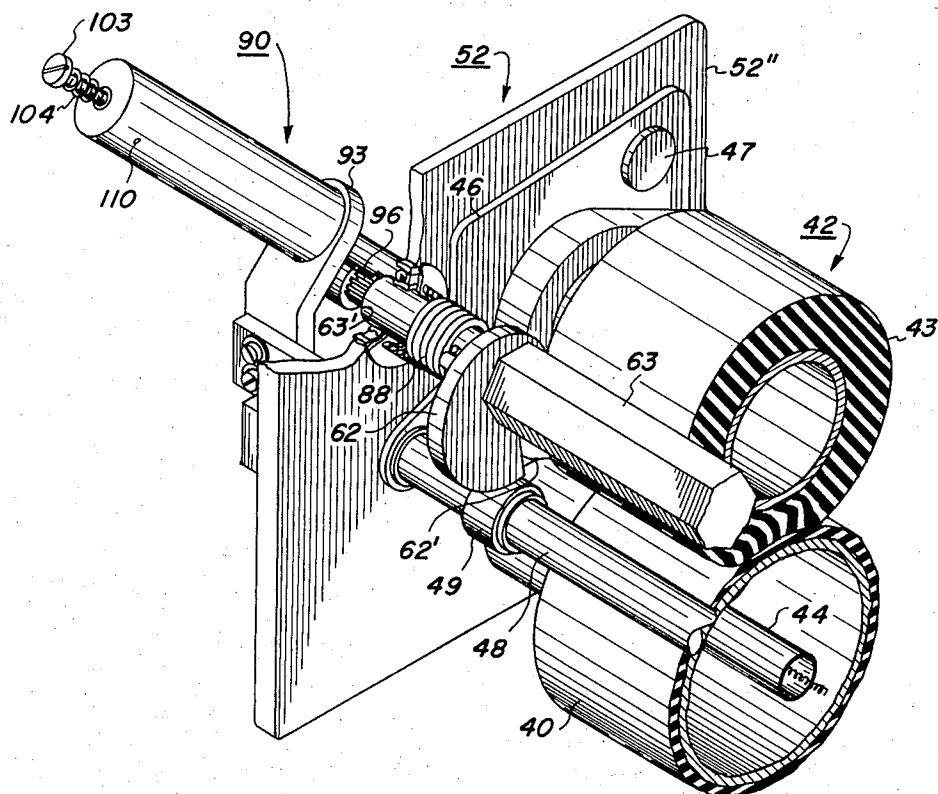


FIG. 5

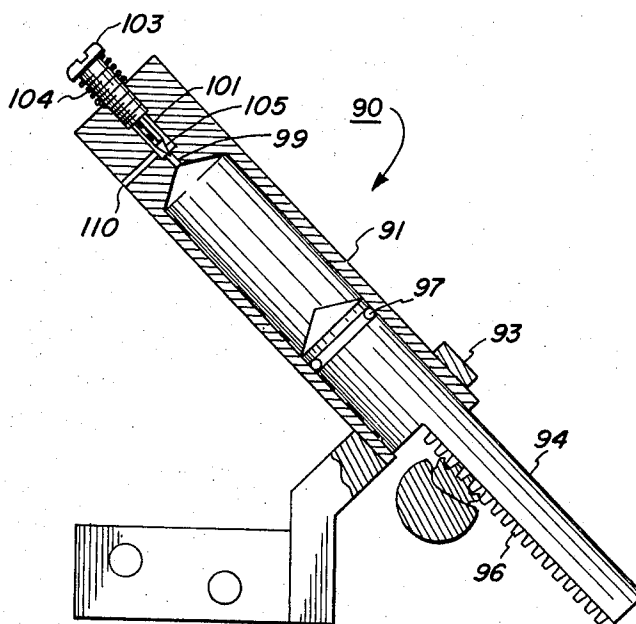
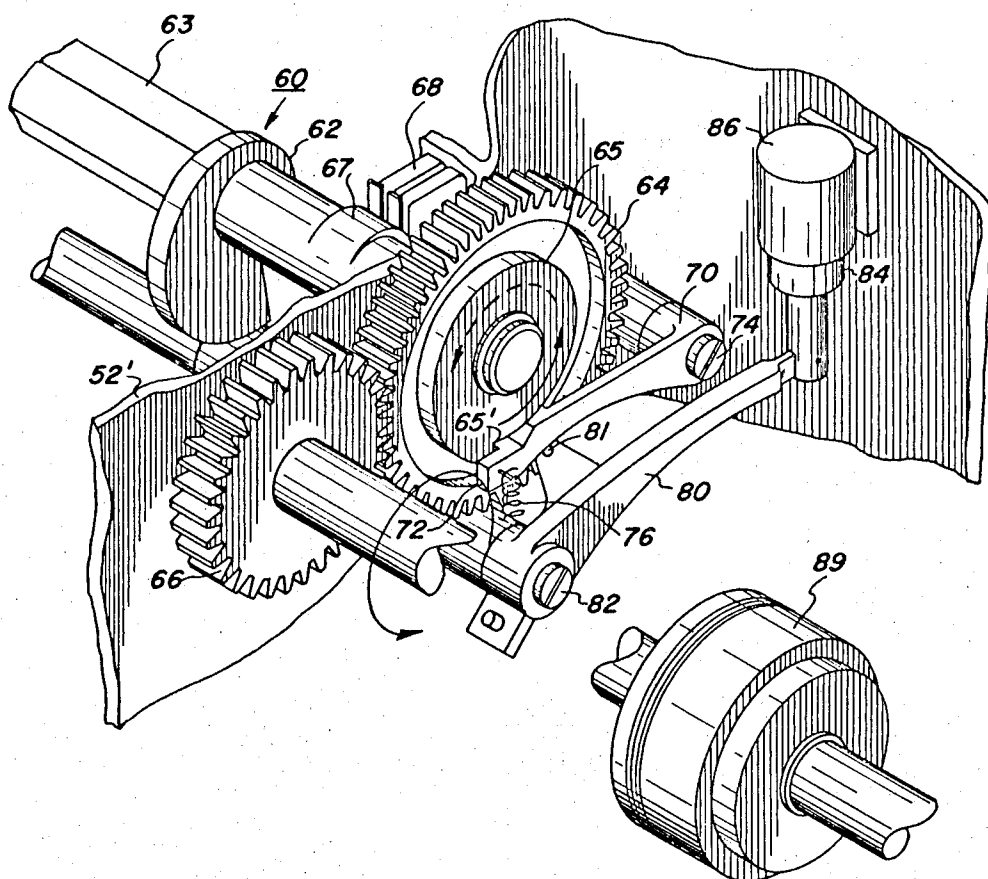


FIG. 4



PRESSURE HEATED FUSER ASSEMBLY

This invention relates to a pressure heated fuser for electrostatographic type reproduction machine, 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 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 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 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 an object of the present invention to provide an improved fuser for reproduction machines incorporating shock absorber means to enable high speed releasing movement of the fuser and yet absorb the shock load.

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, an adjustable 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 first 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 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 dampener of the present invention;

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

FIG. 5 is a side sectional view of the dampener of the present invention.

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 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 slideably 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.

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 heated conductive material, such as copper, and is provided with a source of heat 44, such as 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 plate 46 and is mounted for rotation in the fuser frame assembly, generally indicated as 52.

Referring now to FIGS. 3, 4, and 5, 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 inter-engages 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 lock 70 away from latch 70 (downward as seen in FIG. 4).

Lever 80, positioned below the lock 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 pneumatic dampener 90 is supported on end 63' of shaft 63. Referring particularly to FIGS. 3 and 5, dampener 90 includes a tubular housing or shell 91 secured to frame member 52'' as by support member 93 fixed to and projecting from frame member 52''. Received in one end of housing 91 is a piston rod member 94 which is formed with teeth 96 at one end thereof. At the other end the rod member has a sealing ring 97 to ensure a snug fit in housing 91. At the opposite end of housing 91 the diameter of the opening tapers to a restricted orifice 99 and then increases to a larger diameter opening 101 which engages as by a thread on a screw member 103. Screw member 103 has an extension 105 which is tapered so as to fit within orifice 99. Also formed in that end of the housing is a channel 110 in communication with the atmosphere. The end teeth 96 on rod member 94 upon rotation of the shaft. By this structure the rod member is extended to the position shown in FIG. 5 when the fuser rollers are operating

and when released the rod member is cushioned with increasing force as the air pressure within housing builds up above atmospheric pressure due to compression against the rod member upon release. Screw member 103 is adjustable to control the amount of load "cushioning" desired and has a spring 104 to offset any vibrations.

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 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 therefore 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 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.

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 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. In addition, the 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 apparatus adapted for use with copy producing machine, 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;
 - pneumatic dampener means 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 pneumatic dampener means comprising a housing receiving a sliding piston member which engages said drive means, said housing being formed with an orifice in communication with the atmosphere, and
 - an adjustable needle member operatively movable into and out of said orifice to vary the opening thereof.

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