

[54] **COMPENSATING CAM FOR USE IN A
COPYING MACHINE FOR
SYNCHRONIZING THE OPERATION
BETWEEN A DEVELOPER APPLICATOR
AND AN IMAGING SURFACE**

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[51] Int. Cl. G03g 9/04
[58] Field of Search 355/10, 16, 17, 5,
355/3, 14; 117/17.5; 118/637, 410

[56] **References Cited**

UNITED STATES PATENTS

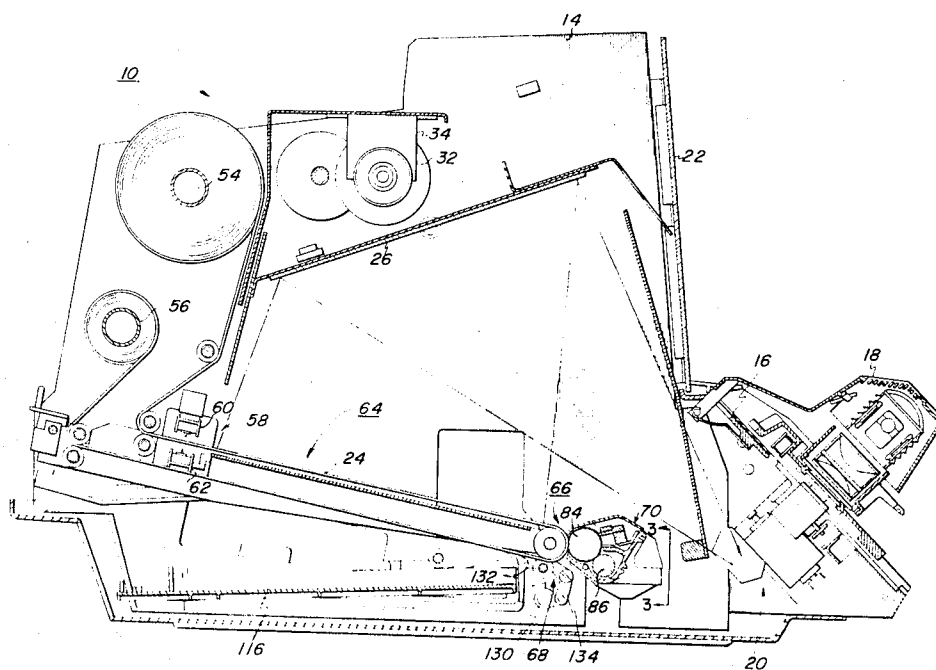
3,616,740	11/1971	Eloranta	118/410 X
2,968,553	1/1961	Grundlach	117/17.5 X
3,572,288	3/1971	Turner	117/17.5 X
3,103,445	9/1963	Bogdonoff et al.	355/17 X

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[57] **ABSTRACT**

A development system comprising a modular developer unit engageable with an image bearing surface for development of the image and disengageable therefrom during other portions of the operation cycle. The modular developer unit contains within the housing structure thereof, developer feed and doctoring structure for presenting appropriate quantities of developer material to an applicator surface also contained in the housing structure but protruding from an opening therein. The developer system further comprises a cam arrangement and synchronizing structure for timely movement of the applicator surface into and out of contact with the image surface in accordance with a predetermined sequence of operation.

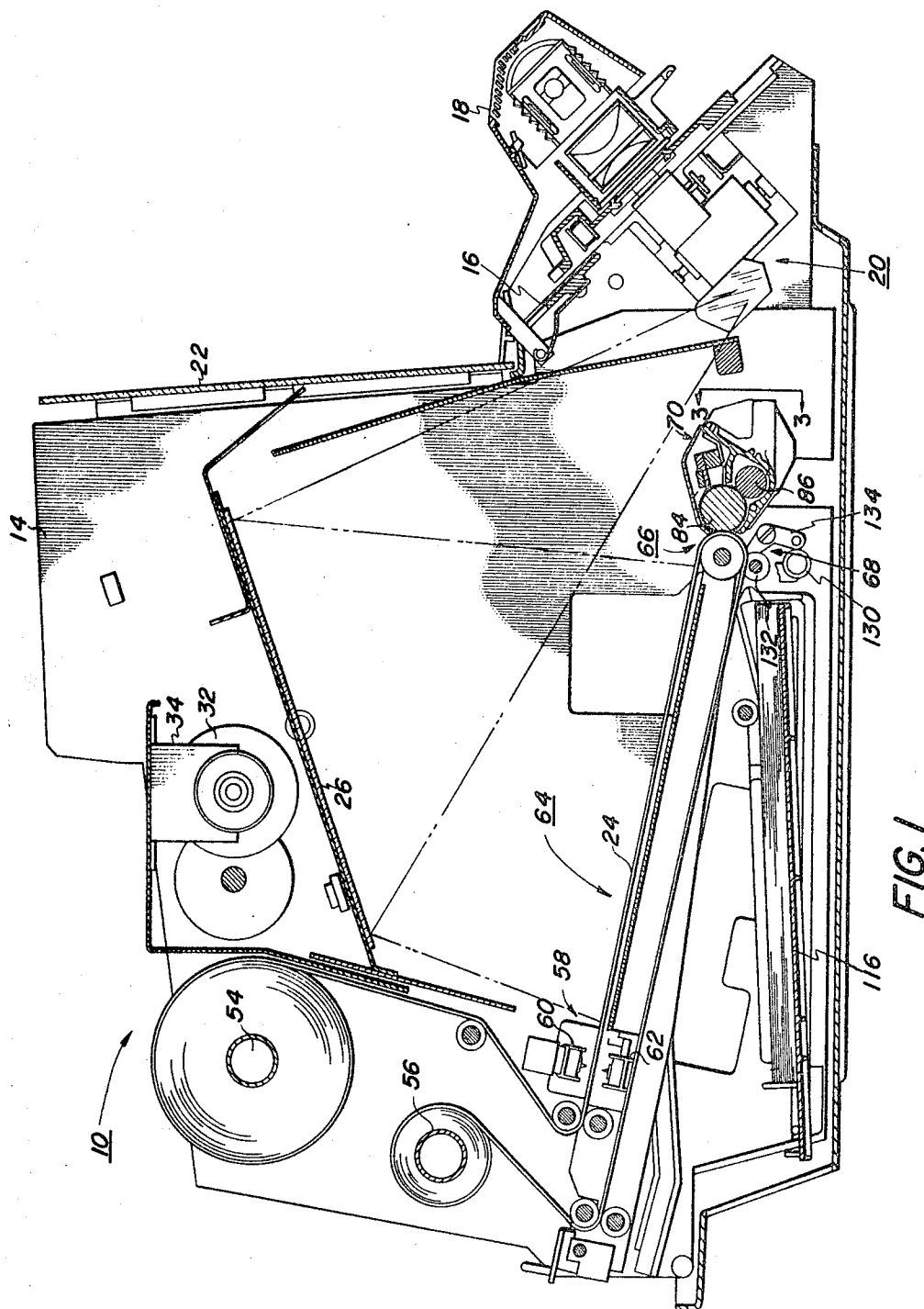
2 Claims, 5 Drawing Figures



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SHEET 1 OF 3



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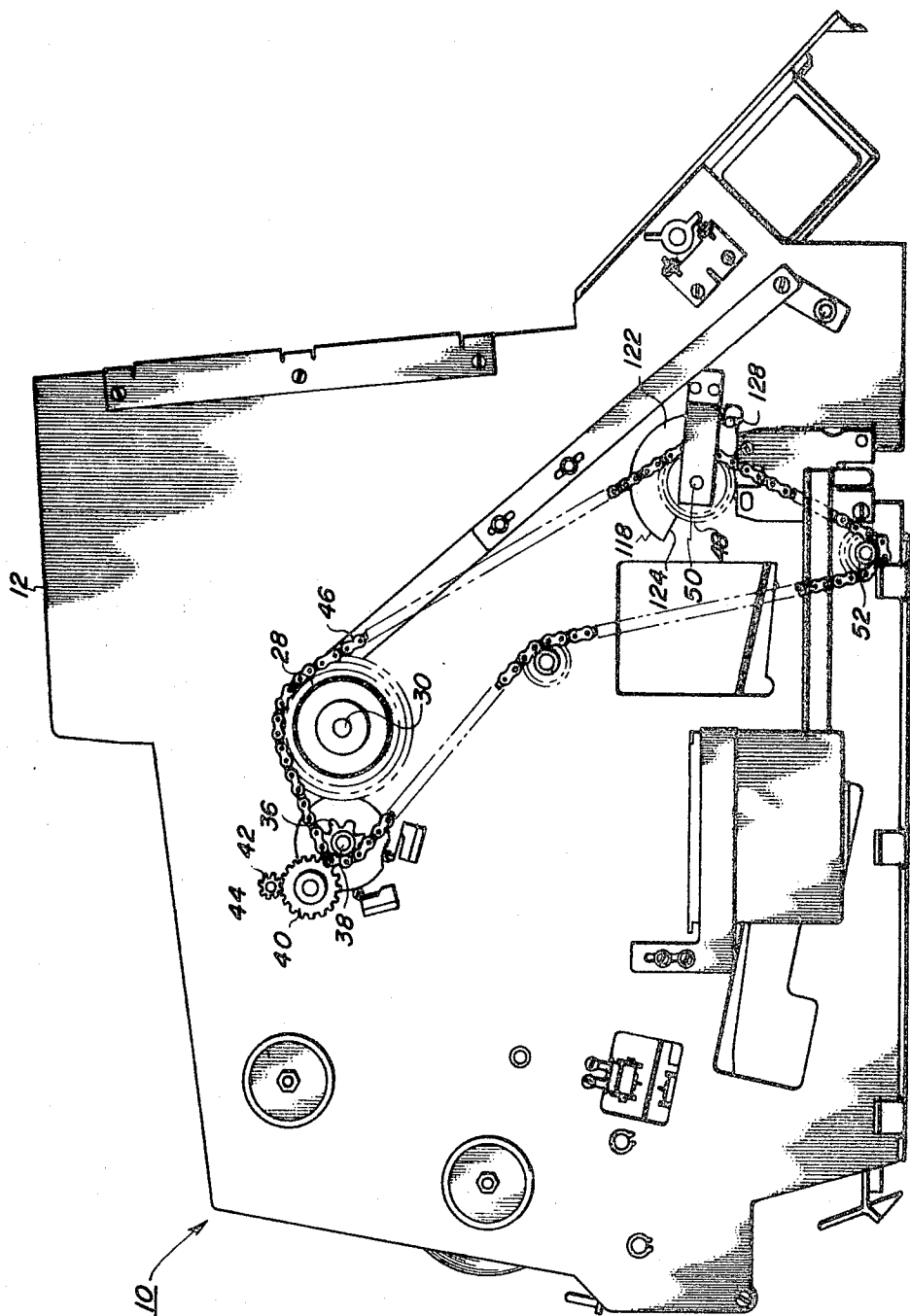


FIG. 2

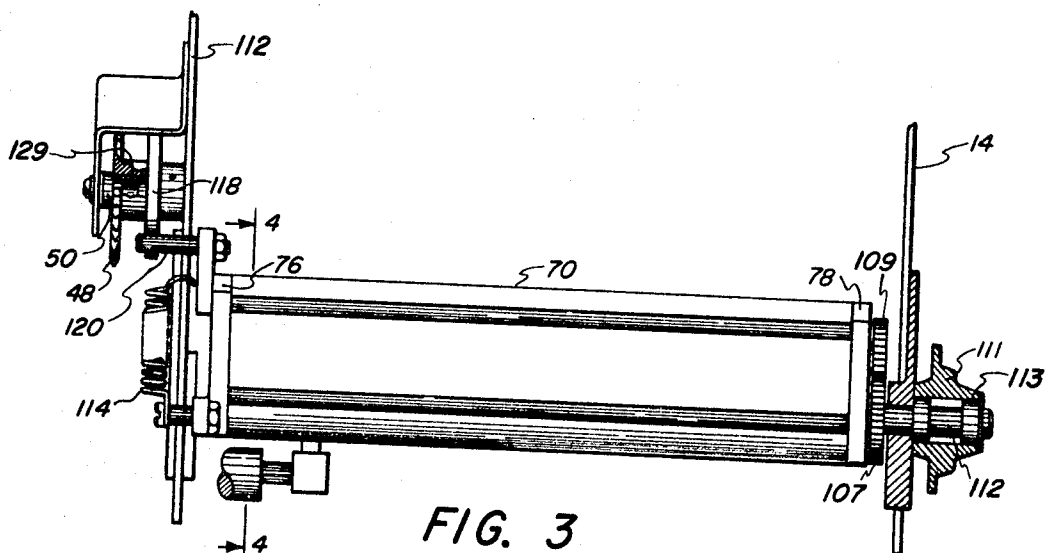


FIG. 3

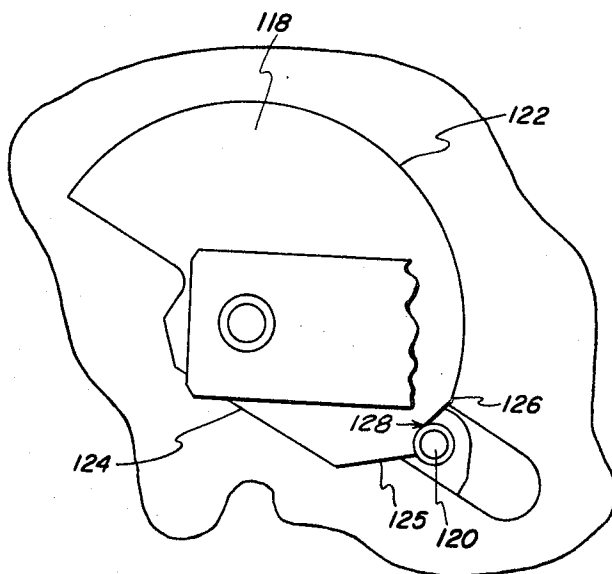


FIG. 5

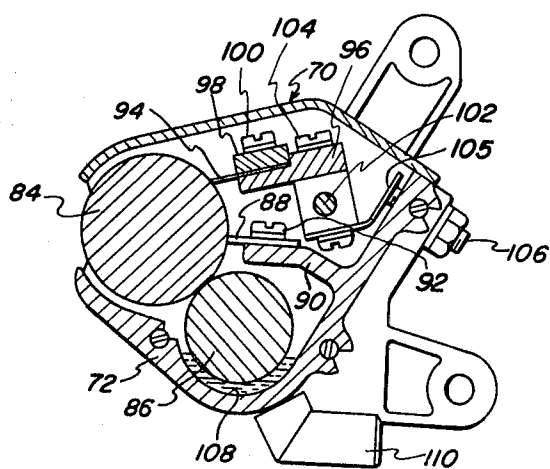


FIG. 4

COMPENSATING CAM FOR USE IN A COPYING MACHINE FOR SYNCHRONIZING THE OPERATION BETWEEN A DEVELOPER APPLICATOR AND AN IMAGING SURFACE

BACKGROUND OF THE INVENTION

This invention relates, in general, to electrostatic recording apparatus and more particularly, to an improved development system therefor.

In electrostatic recording as typified by xerography, it is usual to form an electrostatic image on an insulating or photoconductive insulating surface, generally conforming to information to be recorded or reproduced. This image may then be developed or made visible by the application of an electrostatically attractable material which deposits in conformity with the electrostatic image to produce a visible record. In the usual embodiments of xerographic development, it is conventional to employ finely divided insulating materials, generally powders, which are presented to the image bearing surface in particulate form. Thus, commercially, the electrostatic image is generally developed by cascading across the image surface a mixture of relatively large beads or granules bearing on their surfaces finely divided pigmented insulating dust particles. Alternatively, insulating or conductive dust and liquid inks have been presented to the image, the former being contained in an air suspension. Likewise, developer dust may be carried on the surface of a brush or brush-like fibers such as a fur brush or a simulated brush of magnetically adhering particles.

In a system where the device for presenting or applying the developer to the image bearing surface continuously contacts that surface, synchronization of operation between the applicator and the surface is not a problem. Conversely, where disengagement of the applicator from the image bearing surface is necessitated by the inherent operation of the machine, synchronization is of the utmost importance in order to get development of an entire image.

Accordingly, the general object of this invention is to provide a new and improved electrostatic recording machine.

It is a more particular object of this invention to provide, in an electrostatic recording machine, a new and improved development system.

Another object of this invention is to provide, in an electrostatic recording machine, new and improved structure for effecting engagement and disengagement between a recording surface and structure associated therewith.

BRIEF SUMMARY OF THE INVENTION

The above-cited objects are accomplished, generally speaking, by providing a development system employing a developer module which is retractable from developing engagement with the electrostatic imaging surface and wherein the developer module is a substantially closed, self-contained, compact unit with exposure to outside surfaces only where necessary. More particularly, the applicator module comprises within its confines a system to supply developer material to an applicator surface and a doctoring system to provide metered amounts of developer in doctored configuration on the applicator surface. The applicator in the developer module is a path defining surface along a portion of which a developer module is open to the exte-

rior to permit the developing engagement with an image bearing surface. All elements in the developer module are securely but removably positioned in their necessary configuration and this alignment of elements is continuously maintained. The entire developer module is pivotally mounted on the feed roller shaft which is coextensive with the longitudinal axis thereof and is spring loaded to position the applicator surface in developing engagement with the imaging surface by a rotatable cam, in such a manner that the developer module is in developing configuration only along a predetermined path of the imaging surface. That is, the developer applicator is retractable from developing engagement during that portion of the imaging material path which does not bear an electrostatic latent image to be developed. The developer applicator is in developing engagement substantially only when that portion of the photosensitive path bearing an image to be developed is in the area of the applicator.

Further objects and advantages of the present invention will become more apparent when considered in connection with the detailed descriptions of the drawings and preferred embodiment forming a part hereof.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view as viewed from just within the left side support frame of a combination viewer-printer machine incorporating the invention;

FIG. 2 is a side elevational view of the machine illustrated in FIG. 1, as viewed from the outside of the left side support frame;

FIG. 3 is a rear plan view of a developer system forming a part of the invention,

FIG. 4 is a cross-sectional view taken along the line 4-4 of FIG. 3, and

FIG. 5 is an enlarged plan view of a cam structure forming a part of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT OF THE INVENTION

Referring to the drawings, especially FIGS. 1 and 2 reference character 10 shown on FIG. 2 only designates generally a combination viewer-printer machine having its external housing or cabinet structure removed in order to disclose the interior workings of the machine. The machine 10 comprises a plurality of support structures 12 (FIG. 2), 14 and 16 (FIG. 1) the latter of which constitutes an inclined wall which supports a lamp housing structure 18 and a film projection system generally indicated 20. The lamp housing and projection system serve to project an image from microfilm onto a screen 22 for viewing thereof. The image may be alternately projected to a photosensitive surface herein disclosed as a photoconductive web 24, projection of the image to either the screen or web being accomplished by means of a rotatable mirror 26 which in the position shown reflects an image from the microfilm source to the photosensitive web 24. The mirror structure 26 is adapted for pivotal movement between the position shown and a position displaced counterclockwise therefrom by means of a sprocket 28 fixedly mounted to a mirror support shaft 30. The photoconductive web comprises a photoconductive layer overlying a conductive layer.

Rotational movement of the sprocket 28 is accomplished by means of a motor 32 supported by frame structure 34 which, in turn, is supported intermediate

the supports 12 and 14. The motor 32 is operatively connected to the mirror sprocket 28 by means of a sprocket 36 carried by a shaft 38. The sprocket 36 is driven by an idler gear 40 which meshes with a gear (not shown) also carried by the shaft 38 and also with a gear 42 carried by an output shaft 44 driven by motor 32. A chain 46 drivingly connects the sprocket 36 with the sprocket 28 for effecting tilting of the mirror 26 in one direction during clockwise rotation of the sprocket 36 and in the opposite direction during counterclockwise rotation thereof. The chain 46 also, drivingly connects a sprocket 48 operatively connected to a cam shaft 50 and a sprocket 52 for effecting transfer of an image from the photosensitive material 24 to a sheet of plain paper.

The photosensitive web 24 is supported for serpentine movement through the machine by means of a supply reel structure 54 and a take-up reel structure 56 supported by means of the plates 12 and 14, intermediate thereof. The motor 32 by means of sprockets and a chain connection therefor (not shown) serve to move the photosensitive material past a charging station 58 comprising upper and lower corotron units 60 and 62, an exposure station generally indicated 64, a development station 66 and image transfer station 68.

The foregoing mentioned processing stations and structures, for the purposes of the present disclosure may be described as follows:

The corona charging structure 60 and 62 serve to place a uniform electrostatic charge on a portion of the web 24. Although other charging devices known to those skilled in the art may be utilized it is preferable to utilize corona discharge from a wire filament or wire filament array which is maintained at a high potential as described, for example, in U.S. Pat. No. 2,588,699 to Carlson U.S. Pat. No. 2,836,726 to Vyverberg U.S. Pat. No. 2,777,957 to Walkup, U.S. Pat. No. 2,778,946 to Mayo and others.

An exposure station 64 where light patterns of objects projected from a microfilm dissipate the charge placed on the photosensitive member 24 in accordance with light patterns of the film to thereby leave a latent electrostatic image on the surface of the web.

A developing station 66 whereat a liquid developer is applied to the latent electrostatic image in order to render the image visible.

It will be apparent that while the present invention is disclosed in conjunction with a liquid development system and in conjunction with image transfer in a viewer-printer machine, the invention is not necessarily limited to such applications.

The development station 66 has thereat a developer module structure 70, as shown in FIG. 4, generally comprising a housing structure 72 which may be of one piece construction. The developer housing structure may, for example, by an extruded aluminum tray. A top cover 74 provides means for closing the top of the developer module and is securely fastened to end plates 76 and 78 (see FIG. 3) of the developer module by means of two or more screws (not shown). The end plates are securely fastened to the developer tray by means of screws (not shown). A developer applicator roll 84 is supported within the housing structure for rotation about its longitudinal axis by means of bearing structures carried by each end plate. A feed roller 86 is also supported in the developer tray for rotation about its longitudinal axis and is disposed subadjacent

the developer applicator 84. An edge and corner doctor blade 88 is supported adjacent to each end of the applicator 84 by means of a support arm 90 forming an integral part of the tray structure 72 by any suitable means such as a screw 92. A main doctor blade 94 is carried by a support member 96 and attached thereto by means of a clamp 98 held in place by screws 100. The doctor blade support 96 is securely mounted on a pivot shaft 102 by means of screws 104. The pivot shaft 102 which is cylindrically shaped at its ends to pivot within the end plates 76 and 78 is spring loaded, in position, by a flat spring 105 which provides adjustable tensioning by means of a setscrew 106. Liquid developer material is fed to a reservoir of sump area 108 by means of a conduit 110 connected to an ink supply (not shown). Developer is carried from the sump area 108 through rotation of the feed roll 86 rotation of which is effected through a sprocket 111 (FIG. 3) carried by a one-way clutch 113 supported by a shaft 112 forming an integral part of feed roller 86. A chain drive (not shown) operatively connects the sprocket 111 to the motor 32. A gear 107 carried by a shaft 112 drives a gear 109 carried by shaft of the applicator 84 to thereby cause rotation of the applicator for uniformly presenting developer thereto.

The developer module 70 is pivotally supported by means of the shaft 112 (see FIG. 3) carrying the feed roller 86. The module is urged in a counterclockwise direction, as viewed in FIG. 1, by means of a pair of bias springs 114 at each end (only one shown) whereby the applicator roll 84 is urged into engagement with the photosensitive web 24 during the development process.

During operation, the uppermost portion of the web 24 moves from left to right, as viewed in FIG. 1. At this time the portion of the web passing the charging station 64 receives a uniform electrostatic charge. The uniformly charged web portion is then exposed with subsequent passage thereof through the developer station 66. After development the image is transferred to plain paper at which time the developed portion of the web moves back past the developer station 66 to thereby effect transfer of the developed image to plain copy paper 116 which paper is moved toward the front of the machine during transfer. It will be appreciated that during charging and image transfer it is undesirable to have the developer applicator in engagement with the web, since developer material is not required and would therefore be wasted.

Accordingly, the module structure 70 is adapted to be pivoted clockwise by means of a cam 118 and a cam follower 120 which is an integral part of the developer module to (See FIGS. 2, 3 and 5), the cam being carried by the sprocket shaft 50. As best shown in FIG. 5, the cam structure 118 is provided with a high side 122 and a low side 124 the former of which engages the cam follower 120 and thereby serves to maintain disengagement of the applicator roll 84 from the photosensitive material 24 during charging of the photosensitive material 24 and as mentioned hereinabove during image transfer. The low side 124 of the cam structure 118, as will be apparent, permits engagement between the applicator roll 84 and the web 24, under the influence of the bias spring 114, during development of the latent electrostatic image. The low side 124 is followed by an inclined surface 125 which causes disengagement of the developer module.

Because the developer module structure 70 is spring loaded, the cam follower 120 causes the cam to slip ahead (i.e. in a clockwise direction as viewed in FIG. 2) approximately 6° whenever the cam follower drops off the high side 122 of the cam. The cam also slips ahead 6° when the cam follower moves off the inclined surface 125 thereby resulting in 372° of rotation of the cam for each print cycle. For the purpose of programming the cycle of operation of the machine it is essential that the cam only rotate 360° for each print cycle. Accordingly, the cam 122 is provided with an inclined detent profile 126 (FIG. 5) in the area where the cam follower would come to rest by virtue of the advancement discussed above. In operation, the cam follower 120 stops part way up the incline of the detent profile at the end of the second forward advance of the chain which is the second step in the print cycle. The chain reverses for the final steps of the print cycle whereby the spring loaded developer forces the cam to back up until the cam follower is bottomed in home position 128 from which it started. A one-way clutch 129 which has the same construction as the clutch 113 allows the chain 46 to run in the reverse direction during the transfer step of the copy making cycle. The detent 126 prevents the cam from rotating in the counterclockwise direction.

While the present invention has been described with reference to the particular structure disclosed herein, it is not intended that it be limited to the specific details and this application is intended to cover such modifica-

tions or changes as may come within the purposes off the improvements or scope of the claims forming a part hereof. For example, a cam structure 130 (see FIG. 1) is provided which effects disengagement of a transfer roll 132 from the web 24 through actuation of a cam follower 134 against the bias force of a spring, not shown, which spring acts to urge the roll 132 into engagement with the web.

What is claimed is:

1. In a copying machine:

an imaging surface;

means for producing an image on said surface;

means for applying developer material to said surface;

a cam structure and positive drive therefor for effecting disengagement of said developer applying means from said imaging surface and subsequent engagement therewith in accordance with the predetermined cycle of operation; and

a bias spring and cam follower operable between first and second positions for rendering said cam structure operable, said cam structure comprising an inclined surface intermediate said first and second positions and said bias spring cooperating with said inclined surface for moving said cam structure in a reverse direction to said first position.

2. Structure according to claim 1 including means for opposing the force of said bias spring for maintaining said cam follower in said first position.

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