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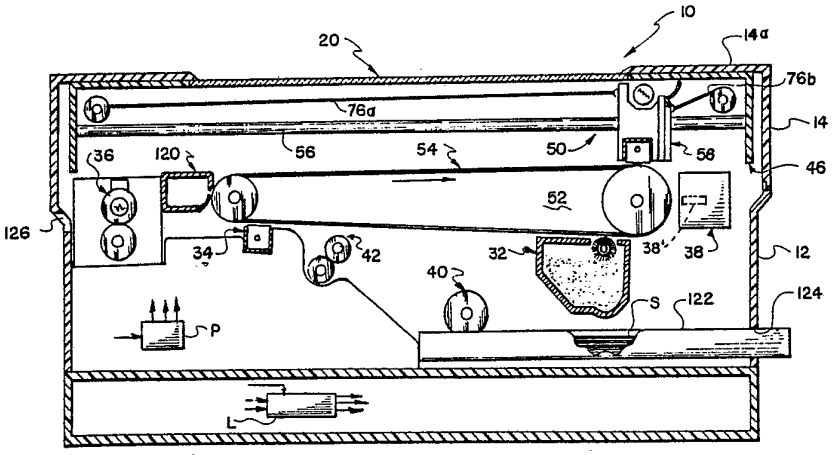

(57) Abstract

A multi-mode apparatus (10) for electrophotographically reproducing electronically generated information or information obtained optically from a document. This apparatus comprises a photoconductive belt (54) mounted for movement about a closed loop path through electrophotographic process stations. A light emitting component (38), located in fixed relation to the photoconductive belt closed loop path, produces light images from electronically generated signals. Further, a mechanism (50), associated with the photoconductive belt, supports a primary charger (78), a lamp (70) and a lens assembly (74) for movement relative to a transparent document-supporting platen (20) of the apparatus. Movement of the photoconductive belt and the supporting mechanism are controlled whereby during optical reproduction, the belt is held stationary while the supporting mechanism is moved with the primary charger activated to charge the belt and expose the belt to a reflected light image of a document on such platen, and on reproduction of electronically generated information, the belt is moved past the stationary supporting mechanism, with the primary charger actuated, and the stationary light emitting component to charge and expose the belt to electronically generated information.

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MULTI-MODE ELECTROPHOTOGRAPHIC REPRODUCTION APPARATUS

TECHNICAL FIELD

This invention is directed in general to electrophotographic reproduction apparatus, and more particularly to a multi-mode electrophotographic apparatus capable of reproducing electronically generated information or information obtained optically from a document.

BACKGROUND ART

Electrophotographic reproduction apparatus typically reproduce information by exposing a uniformly charged photoconductive surface to a light image of information. The light image modifies the uniform charge on the photoconductive surface so as to form a charge pattern, or latent image, on the surface corresponding in an image-wise configuration to the information to be reproduced. Pigmented marking particles, exhibiting a charge of opposite polarity to that of the latent image charge pattern, are brought into contact with the photoconductive surface and adhere to the areas of the surface where the charge pattern exists to develop the latent image and form a transferable image. Thereafter, the transferable image is transferred to a receiver member and permanently fixed to such member by heat and/or pressure to form the desired reproduction.

Exposing of the photoconductive surface has primarily been accomplished by one of two methods. One method of photoconductive surface exposure involves forming a light image of a document (generally referred to as optical copying). In this method, light is directed from a lamp assembly at a document with the light reflected from (or transmitted through) the document being directed through a lens unit into focus on the photoconductive surface. The light from the lamp may illuminate the

entire document at one time (referred to as flash exposure), or may be passed through a slit and moved relative to the document to illuminate successive line segments of the document (referred to as scan exposure).

The second method of photoconductive surface exposure involves the use of an electronically controlled light emitting component (generally referred to as nonimpact printing), such as a laser or a plurality of light emitting diodes (LED's). The light emitting component is turned on and off to expose the photoconductive surface in a line-by-line fashion to form a desired charge pattern thereby creating a latent image on the surface corresponding in an image-wise configuration to the information to be reproduced. The information to be reproduced is electronically generated and is used to control the turning on and off of the light emitting component.

While the above described photoconductive surface exposure methods have, in practice, proven to be difficult to incorporate in a single reproduction apparatus, several attempts at their combination have been shown in the literature. Particularly, U.S. Pats. No. 4,046,471 (issued September 6, 1977, in the name of Branham et al); 4,355,882 (issued October 26, 1982, in the name of Snelling); and 4,471,175 (issued October 16, 1984, in the name of Snelling) show multi-mode electrophotographic reproduction apparatus which provide for optical copying of documents by reflected light exposure and printing of electronically generated information by light emitting component exposure. The apparatus disclosed in the '471 patent utilizes a complex laser scanner assembly as the light emitting component for electronically generated information printing and margin erase in the optical copying mode. The

apparatus disclosed in the '882 patent also utilizes a complex laser scanner assembly. This apparatus also requires an asynchronous photoconductive belt drive to accommodate for differences in speeds necessary to accomplish laser scanning and electrophotographic processing. The apparatus disclosed in the '175 patent utilizes a simplified LED assembly as the light emitting component. However, it requires a complex prism/lens mechanism for focusing both the LED produced image and the optically produced image at the photoconductive member surface.

DISCLOSURE OF INVENTION

In this invention, a multi-mode apparatus for electrophotographically reproducing electronically generated information or information obtained optically from a document comprises a photoconductive belt mounted for movement about a closed loop path through electrophotographic process stations. A light emitting component, associated with the photoconductive belt, produces light images from electronically generated signals. Further, a mechanism, associated with the photoconductive belt, supports a lamp and a lens assembly for movement relative to a transparent document-supporting platen of the apparatus. According to an important feature of the invention, the light emitting component is located in fixed relation to the photoconductive belt closed loop path. Further, the support mechanism includes a primary charger. Movement of the photoconductive belt and the supporting mechanism are controlled whereby during optical reproduction, the belt is held stationary while the supporting mechanism is moved to charge and expose the belt to a light image of a document on such platen, and on reproduction of electronically generated information,

the belt is moved past the stationary support mechanism and light emitting component so that the belt is charged and exposed to electronically generated information. According to one preferred embodiment of this invention the supporting mechanism may also include apparatus for converting a document into electrical signals as the support mechanism is moved relative to the platen.

With the multi-mode electrophotographic reproduction apparatus according to this invention, by employing a moving photoconductive belt and stationary exposure mechanism, a high quality, low cost apparatus is provided for reproducing electronically generated information (i.e., a nonimpact printer). At the same time, by employing a stationary photoconductive belt and moving exposure optics for reproducing documents (i.e., a copier),. reduction in the size, number of parts, and cost for the apparatus is achieved.

The invention, and its objects and advantages, will become more apparent in the detailed description of the preferred embodiments presented below.

BRIEF DESCRIPTION OF THE DRAWINGS

In the detailed description of the preferred embodiments of the invention presented below, reference is made to the accompanying drawings, in which:

Figure 1 is a view, in perspective, of the multi-mode electrophographic reproduction apparatus according to this invention;

Figure 2 is a front elevational view of the multi-mode electrophographic reproduction apparatus of Fig. 1 on an enlarged scale, in cross-section, and with portions broken away or removed to facilitate viewing;

Figure 3 is a view, in perspective, of the multi-mode electrophographic reproduction apparatus with portions in a position to enable ready access to the apparatus interior;

Figure 4 is a front elevational view of the optical exposure assembly on an enlarged scale, in cross-section and with portions broken away or removed to facilitate viewing;

Figure 5 is a front elevational view, similar to Fig. 4 of an alternate embodiment of the optical exposure assembly including an assembly for converting a document to electrical signals;

Figure 6 is an end elevational view of the photoconductive belt support, for the multi-mode electrophographic reproduction apparatus according to this invention, in its operative position, partly in cross-section and with portions broken away or removed to facilitate viewing;

Figure 7 is an end elevational view of the photoconductive belt support, similar to Fig. 6, in its position to permit access to the interior of the reproduction apparatus;

Figure 8 is an end elevational view of the photoconductive belt support, similar to Fig. 6, in its position to enable the photoconductive belt to be readily removed and replaced;

Figure 9 is a front elevational view of the photoconductive belt support including a tensioning mechanism, partly in cross-section and with portions broken away or removed to facilitate viewing;

Figure 10 is a top plan view of the photoconductive belt support tensioning mechanism, partly in cross-section and with portions broken away or removed to facilitate viewing;

Figure 11 is a front elevational view of the cam assembly for the photoconductive belt support tensioning mechanism;

Figure 12 is a front elevational view, partly in cross-section, of the drive mechanism for the multi-mode electrophographic reproduction apparatus according to this invention with portions broken away or removed to facilitate viewing;

Figure 13 is a schematic illustration of the optical reproduction mode of operation for the multi-mode electrophographic reproduction apparatus according to this invention;

Figure 14 is a schematic illustration of the printing reproduction mode of operation for the multi-mode electrophographic reproduction apparatus according to this invention; and

Figure 15 is a schematic illustration of the electronic input to the multi-mode electrophographic reproduction apparatus when in its printing mode of operation.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the accompanying drawings, Figs. 1-3 show a multi-mode electrophotographic reproduction apparatus, designated generally by the numeral 10, according to this invention. The apparatus 10 includes a housing H having a lower portion 12 and an upper portion 14 interconnected by a hinge mechanism 16. The upper and lower housing portions 12, 14 are retained in a closed relation by a latch 18, with release of the latch enabling the portions to be opened (see Fig. 3) to permit access to the interior of the apparatus 10. The upper portion 14 has a stationary transparent platen 20, formed in the top surface 14a thereof, for supporting a document to be optically reproduced. An opaque cover member 22 is connected to the upper portion 14 by an articulating hinge mechanism 24. The member 22 is thus capable of covering a document placed on the platen 20 for optical reproduction, or articulated to

hold a book (or other three dimensional object to be optically reproduced) on the platen. A front panel 12a of the lower portion 12 of the housing H is opened to provide access to the interior of the apparatus 10.

The lower portion 12 of the housing H has a control panel 26, located at the bottom front thereof beneath the panel 12a. The control panel 26 is operatively coupled to a logic and control unit L for the apparatus 10 and enables an operator to select operating parameters for the apparatus and monitor its functions. The logic and control unit L includes, for example, a microprocessor receiving operator input signals and timing signals. Based on such signals and a program from the microprocessor, the unit L produces signals to control the operation of the apparatus 10 for carrying out the reproduction process. The production of the program for a number of commercially available microprocessors such as an INTEL Model 8080 or Model 8085 microprocessor (which along with others are suitable for use with this invention) is a conventional skill well understood in the art. The particular details of any such program would, of course, depend on the architecture of the designated microprocessor.

A pair of oppositely disposed machine plates 28, 30, are located within the lower portion 12 of the housing H. The plates serve to locate, and relatively position, various elements utilized in the electrostatographic process for image reproduction as will be discussed in detail hereinbelow. Such elements include, for example, a magnetic brush developer station 32, a transfer charger 34, and a heat/pressure fuser assembly 36. Additionally, the plates support a mechanism 38 for reproducing electronically generated information, a receiver

member feed mechanism 40, and receiver member registration mechanism 42. Further, a drive assembly 44 (see Fig. 12) is supported by the rear plate 30. The drive assembly 44 includes a motor M, gear train G and a plurality of clutches CL_1-CL_3 interrelated in a well known manner for effecting operation of various components and elements of the apparatus 10. Of course, other drive assemblies, such as belts and pulleys, are suitable for use with this invention.

The upper portion 14 of the housing H contains a supporting member 46 in the form of a rigid frame 48. The frame serves to locate and relatively position an optical exposure assembly 50 and an assembly 52 for supporting a photoconductive belt 54. The photoconductive belt 54 is a composite structure containing a dielectric support covered with a typical photoconductive material such as shown, for example, in U.S. Pat. No. 3,615,414, issued Oct. 26, 1971 in the name of Light. Of course, other organic or inorganic photoconductive materials are suitable for use with this invention. Moreover, the photoconductive belt may be bi-polar; that is it may accept a positive or negative charge. Exposure will therefore alternatively generate a charge pattern for development with pigmented marking particle of the same charge characteristics by discharging either that portion of the image corresponding to the information content to be reproduced or the background. This enables optical exposure to erase the background of a document to be reproduced with subsequent development of the information content of such document. On the other hand, the mechanism for reproducing electronically generated information erases, and subsequently developes, the information content for a reduced duty cycle of such mechanism.

The optical exposure assembly 50 comprises a pair of rails 56 fixed to the frame 48 beneath, and outboard of, the platen 20. A carriage 58 is slidably mounted on the rails 56. The carriage 58 comprises a housing 60 extending, in the direction from front to back of the apparatus 10, substantially the full length of the platen 20. Movement of the carriage 58 along the rails 56 is accomplished by the drive assembly 44 which is coupled to a spool 62 through a clutch CL_3. The spool 62 is, in turn, connected to one side of the carriage housing 60 through a wire 66 (see Fig. 4), wound up on the spool on actuation of the clutch to move the housing along the rails from a parked position (shown in Fig. 2) for a distance substantially equal to the width of the platen 20. A spring 68 connected to the opposite side of the carriage housing 60 urges the housing in a direction whereby the housing is returned to its parked position on deactuation of the clutch CL_3.

As best shown in Fig. 4, the carriage housing 60 of the optical exposure assembly supports an exposure lamp 70. An integral reflector 72 extends from the housing 60 and directs light from the lamp 70, when energized, in a line segment toward the platen 20. Such light reflects off of a document on the platen as the carriage 58 is moved by the drive assembly 44 from its parked position along the rails 56. A lens assembly 74 is supported by the carriage housing 60 at a location which enables the reflected light image to be focused on the photoconductive belt 54. The lens assembly 74 may be, for example, a linear lens array which extends for the full dimension of the platen 20 in the direction transverse to the direction of movement of the carriage 58 along the rails 56. A pair of opaque, spool-wound, shades 76a, 76b are respectively

coupled to opposite sides of the housing 60 and wind/unwind therewith so that only light passing through the lens assembly 74 exposes the photoconductive belt 54. The housing 60 also supports a primary corona charger 78, which is located immediately upstream of the lens assembly 74 and similarly extends for the full dimension of the platen 20 in the direction transverse to the direction of movement of the carriage 58 along the rails 56. The charger 78 is energized by a power supply source P to provide for placement of a uniform electrostatic charge on the photoconductive belt 54 in the manner to be described hereinbelow.

The assembly 52 for supporting the photoconductive belt 54 is best shown in Figs. 6-11. Such assembly comprises a pair of rollers R_1, R_2 supported by a torque frame 80 (See Fig. 3). The torque frame, which maintains the rollers R_1, R_2 in substantial relative alignment, is in turn supported at its rearwardly facing end 80a on a pivot shaft 82 carried by a portion 84 of the rigid frame 48 of the supporting member 46. The forwardly facing end 80b of the torque frame has a pin 86 extending outwardly therefrom. The pin 86 is adapted to be engaged by a latching mechanism 88 carried by the rigid frame 48. Such engagement retains the assembly 52 in the supporting member 46 in accurate positional relation to the platen 20 (see Fig. 6), and thus relative to the optical exposure assembly 50. The rigid frame 48 has a pair of datums 48a which respectively engage a pair of datums 28a extending from the machine plate 28 when the upper portion 14 is in its closed position. The cooperative engagement of the datums assures accurate location of the upper portion with the electrostatographic process stations in the lower portion 12. A rod 89

is connected to the portion 84 of the rigid frame 48 and is engaged by a torsion bar 90 coupled to the machine plate 30. The torsion bar 90 applies a force to the rod 89 which acts to counter balance the weight of the upper portion 14 of the housing H when such upper portion is pivoted about the hinge 16 (see Fig. 7) to an open position to provide access to the interior of the apparatus 10. When the portion 14 is in its open position, the latching mechanism 88 may be released to enable the torque frame 80 to pivot about the shaft 82 to a position (see Fig. 8) where removal and replacement of the photoconductive belt 54 is facilitated.

The run of the photoconductive belt 54 facing the platen 21 must be held in a substantially planer configuration for focused exposure of a reflected light image of a document to be reproduced. At the same time, the photoconductive belt 54 must be capable of being readily removable for replacement. To accomplish these ends, the torque frame 80 includes a mechanism T for inducing tension in the belt 54 entrained about the rollers R_1, R_2. The tensioning mechanism T includes a pair of plates 92 (only one side of the tensioning mechanism is shown in Figs. 9, 10, with the opposite side being of mirrored construction). The plates 92, at one end, capture the shaft R_{2a} of the roller R_2. The captured shaft R_{2a} passes through slots 96 formed in the ends 80a, 80b of the torque frame 80. A rod 94, connected between the plates 92 adjacent to their ends opposite the shaft capturing ends, passes through slots 98 formed in the torque frame ends 80a, 80b. A shaft 100 is captured by, and extends between, the ends 80a, 80b intermediate of the roller R_2 and the rod 94. The shaft 100 carries cam members 102 immediately outboard of the

ends 80a, 80b. The cam members 102 respectively engage a cam surface 104 formed in the plates 92 (see Fig. 11). Rotation of the shaft 100 to control the relative engagement of the cam members and surfaces is controlled by a lever 106 mounted on the shaft outboard of the plate 92 adjacent to the end 80a of the torque frame. As such, the lever 106 is readily accessible to an operator when the portion 14 of the apparatus 10 is in its open position and the torque frame 80 is in its position of Fig. 8. A tension mechanism 108, such as a coiled tension spring, is connected between the shaft 100 and rod 94 to urge the plates 92, and thus the roller R_2, toward the left in Figs. 9 and 10. Accordingly, when the lever 106 is in a position to set the relationship between cam members 102 and respective cam surfaces 104 as shown in phantom lines in Fig. 11, a force is supplied to the roller R_2 so that tension is applied to the belt 54 to maintain a planer configuration for its upper run between the rollers R_1 and R_2. Alternatively, when the lever 106 is in a position to set the relationship between cam members 102 and respective cam surfaces 104 as shown in solid lines in Fig. 11, the roller R_2 is moved to the right to relieve the tension in the belt 54. The belt is thus readily removable from the rollers so as to be easily replaced with a new belt.

Turning now to the operation of the above described multi-mode electrophotographic reproduction apparatus according to this invention, such apparatus is capable of making optical reproductions of documents (functions as a copier) or reproductions of electronically generated information (functions as a nonimpact printer). The operative cycle for optical reproduction is schematically illustrated in Fig. 13. A document to be reproduced is placed on the

platen 20 under the member 22, and the operator programs the apparatus 10 for a desired number of reproductions, for example, by inputting such information to the logic and control unit L through the operator control panel 26. When the operator depresses a start button on the panel 26, the logic and control unit L actuates the drive assembly 44 to move the carriage 58 from its parked position along the rails 56 under the platen 20 to a position at the far left of the rails (when viewing Fig. 2 for example). As this right-to-left carriage movement is begun, the primary charger 78 is activated and the lamp 70 is turned on. The primary charger 78 deposits a uniform electrostatic charge on the photoconductive belt which is subsequently modified, in a line-by-line fashion, to form the latent image charge pattern by scan projection of the focused light reflected image of the document provided through the lens assembly 74 oriented in the carriage 58 immediately behind the primary charger.

At the end of travel of the carriage 58, the primary charger 78 and lamp 70 are turned off, and the housing is returned (to the right) to its parked position. Substantially simultaneously, the drive assembly 44 initiates drive of the photoconductive belt supporting rollers R_1, R_2 to transport the belt 54 clockwise (when viewing Fig. 2) in a closed loop path about the rollers. The area of the belt containing the latent image charge pattern is thus successively transported through the electrostatographic process stations. That is, such area is brought into operative association with the developer station 32 where pigmented marking particles are adhered to the charge pattern to develop a transferable image, to the area beneath the transfer charger 34 where such image is transferred

to a receiver member, and then through a cleaning station 120 where any residual marking particles are removed prior to reuse of that area of the belt.

The receiver member to which the marking particle image is transferred is typically a cut sheet of plain bond paper. The sheet is, for example, stored within a stack of sheets S held in a cassette 122 which is insertable through an opening 124 in the lower portion 12 of the housing H. The cassette 122, when inserted into the lower portion 12, is held therein in a fixed position in relation to the receiver member feed mechanism 40, such as a friction roller for example. At a proper time determined by the logic and control unit L, the feed roller is actuated by the drive assembly 44 and picks the top most sheet from the cassette 122 and transports such sheet to the receiver member registration mechanism 42, such as a pair of registration rollers for example. The registration rollers, also actuated by the the drive assembly 44, adjust the transport timing of the transport of the receiver sheet so that the sheet is delivered into contact with the photoconductive belt 54 at the vicinity of the transfer charger 34 in register with the transferable image on the belt. As the receiver sheet and the photoconductive belt pass beneath the transfer charger 34, such charger is activated to generate an electrical field which causes the marking particles to migrate from the belt to the receiver sheet. After transfer, the receiver sheet passes from the photoconductive belt 54 to the fuser assembly 36 where the transferred image is fixed to the sheet by heat and/or pressure, and delivered through an exit slot 126 in the lower portion 12 of the housing H for operator retrieval of the finished reproduction. Of course, in accordance with this

invention supply of receiver members may be accomplished in other ways such as by being manually fed or fed from a plurality of cassettes stored within the apparatus 10.

The operative cycle for reproduction of electronically generated information is shown schematically in Fig. 14. Prior to describing the operative cycle, a few words are in order regarding the electronic generation of information. Electronically generated information is typically produced by a host computer. The apparatus 10 is capable of interfacing with a plurality of host computers C_1-C_n (see Fig. 15). If more than one computer attempts to send signals to the apparatus 10 at the same time, the logic and control unit L sets priority so that the reproduction of one complete set of information signals from a particular computer are completed before the reproduction of the next set of signals is begun. The information from the computer, in the form of digital electrical signals, is fed to a raster image processor (RIP) 110 under the control of the unit L. The RIP 110 also interfaces with a font cartridge 112 which directs the RIP to form the signals from the computer into a serial train of signals in a particular form corresponding, for example, to a particular style type face for the reproduction. The RIP 110 then feeds the appropriate signal train to a driver 114. The driver 114 is coupled to the mechanism 38 for reproducing electrically generated information so as to activate the mechanism for reproducing the signals in the selected image pattern by appropriate exposure of the photoconductive belt 54. For example, in the illustrated embodiment the mechanism 38 is a series of LED's (extending across the belt in the direction transverse to belt movement) which are turned on for

the desired exposure of the belt. Of course, other mechanisms for reproducing electronically generated information, such as an assembly providing for ion deposition for example, are suitable for use with this invention.

When a host computer communicates with the apparatus 10, the logic and control unit L actuates the drive assembly 44 to initiate drive of the photoconductive belt supporting rollers R_1, R_2 to transport the belt 54 clockwise (when viewing Fig. 2) in a closed loop path about the rollers. Substantially simultaneously the primary charger 78 is activated (with the carriage 58 remaining in its parked position). The primary charger deposits a uniform electrostatic charge on the photoconductive belt which is subsequently modified to form the latent image charge pattern by the activation of the mechanism 38 for scan printing electrically generated information by the driver 114. As with the above described operative cycle for reproducing documents, the area of the belt containing the modified latent image charge pattern is successively transported through the electrostatographic process stations in the same manner. That is, image development, receiver member delivery, transfer, fusing, and photoconductive belt cleaning are carried out as described above.

In an alternative embodiment of the multi-mode electrophotographic reproduction apparatus according to this invention, such apparatus is adapted to perform conversion of documents to electrical signals in addition to its above described modes of operation. In order to accomplish such conversion, the optical exposure assembly 50' takes the form shown in Fig. 5. The carriage 58' of the optical exposure assembly 50' includes a scanning

mechanism 130 in addition to a primary charger 78', lamp 70', and lens assembly 74' similar to corresponding elements described above with reference to Fig. 4. The scanning mechanism 130 is capable of converting a light image to corresponding electrical signals. An exemplary scanning mechanism 130 is, for example, a plurality of light emitting elements 132 and a series of light detecting elements 134 such as charge coupled devices (CCD's) arranged in an array extending across the platen 20 in the direction transverse to travel of the photoconductive belt.

To operate the apparatus 10 in the document conversion mode, an operator places a document on the platen 20 under the member 22 and actuates the control panel 26 to indicate to the logic and control unit L that such mode is to be accomplished. The unit L activates the light detecting elements 134 and turns on light emitting elements 132 (the lamp 70' and the primary charger 78' are maintained in their off condition). Substantially simultaneously, the drive assembly 44 is actuated to move the carriage 58' from its parked position along the rails 56' under the platen to a position at the far left of the rails (when viewing Fig. 2 for example). During this right-to-left movement, light from the emitting elements 132 is reflected as a line-by-line light image of the document on the platen and is focused by lens assembly 136 on the detecting elements 134 for sensing and conversion to corresponding electrical signals. Such signals may be sent to a host computer where they can be displayed, manipulated (for example, to edit the original document), and returned to the apparatus 10 for reproduction according to the above described cycle for reproducing electronically generated information. Of course, the electrical signals from the scanning mechanism 130 may be stored

in memory within the apparatus 10 and directly reproduced according to the above described cycle for reproducing electronically generated information.

With the multi-mode electrophotographic reproduction apparatus according to this invention, by employing a moving photoconductive belt and stationary exposure mechanism, a high quality, low cost apparatus is provided for reproducing electronically generated information (i.e., a nonimpact printer). At the same time, by employing a stationary photoconductive belt and moving exposure optics for reproducing documents (i.e., a copier), reduction in the size, number of parts, and cost for the apparatus is achieved.

The invention has been described in detail with particular reference to preferred embodiments thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention.

Claims:

1. Apparatus (10) utilizing a photoconductive member (54) mounted for movement about a closed loop path through electrophotographic process stations, said apparatus including means (38) for producing images from signals corresponding to electronically generated information, and means (50) for supporting a lamp (70) and a lens assembly (74) for movement relative to a transparent document-supporting platen (20) for electrophotographically reproducing information from a document, said apparatus characterized by said image producing means (38) being located in fixed relation to said photoconductive member closed loop path; said support means (50) including a primary charger (78) located relative to said lamp so as to be immediately upstream thereof in the direction of movement of said photoconductive member about it's closed loop path, and means (L) for controlling movement of said photoconductive member and said supporting means whereby during reproduction of a document, said photoconductive member is held stationary while said supporting means is moved to expose said member to a reflected light image of a document on such platen and said primary charger is activated as said supporting means is moved to uniformly charge said photoconductive member prior to exposure, and during reproduction of electronically generated information, said supporting means being held stationary and said photoconductive member is moved past said image producing means, said primary charger being activated to uniformly charge said photoconductive member as said member moves past said supporting means prior to moving past said image producing means.

2. The invention of Claim 1 characterized by said supporting means (50) further including means (134), responsive to a reflected light image of a document on the platen of the reproduction apparatus, for converting such image into electrical signals corresponding, image-wise, thereto.

3. The invention of Claim 1 characterized by said image producing means (38) including means for receiving electronically generated information and converting such information to appropriate signals and a light emitting component (38') responsive to such signals for exposing said photoconductive member.

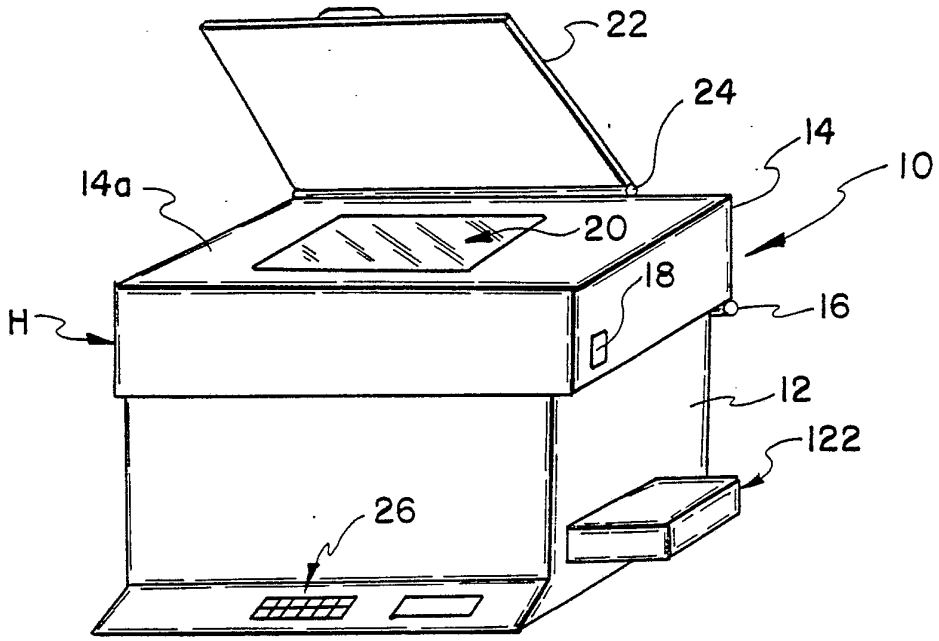
4. The invention of Claim 3 characterized by said light emitting component (38') being a plurality of light emitting diodes.

5. The invention of Claim 1 characterized by said supporting means (50) including a pair of rails (56) mounted in fixed relation to the platen (20), and a carriage (58) slidably engaging said rails, said carriage including a receiver for said lamp, an integral reflector (72) for directing light from said lamp at the platen, a holder for said lens assembly to position said lens assembly for focusing reflected light from a document on the platen onto said belt, and a holder for said primary charger for positioning said charger upstream of said lens assembly.

6. A combination optical copier and nonimpact printer (10) including means (52) for supporting a photoconductive belt for movement along an endless path through operative relation with a series of electrophotographic process stations, a portion of such endless path being relatively flat; a transparent platen (20) adapted to receive a document, said platen being located in substantially

spaced parallel relation with said flat portion of such endless path; said apparatus characterized by movable exposure means (50) mounted between said flat portion and said platen for movement parallel thereto, said movable exposure means including means (70, 72, 74) for scan exposure of a light image of a document received on said platen onto an area of the photoconductive belt located in said flat portion of such endless path while the belt is stationary and said movable exposure means is moved; stationary exposure means (38) positioned at a fixed location adjacent such endless path for exposure of the photoconductive belt in response to electronic image information while the belt is moved past said exposure means; and charging means (78) mounted to be movable with said movable exposure means to uniformly charge the photoconductive belt prior to exposure by said movable exposure means as it moves and to be stationary for charging of the moving photoconductive belt prior to exposure by said stationary exposure means.

7. The invention of claim 6 characterized by sensing means (134) for converting an image of a document to an electrical signal corresponding thereto, and electronic scanning means (132, 136) movable with said movable exposure means for scan projecting an image of a document received on said platen onto said sensing means to create such electronic signal.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24
14
10
14a
20
18
H
16
12
122
26

FIG. 1

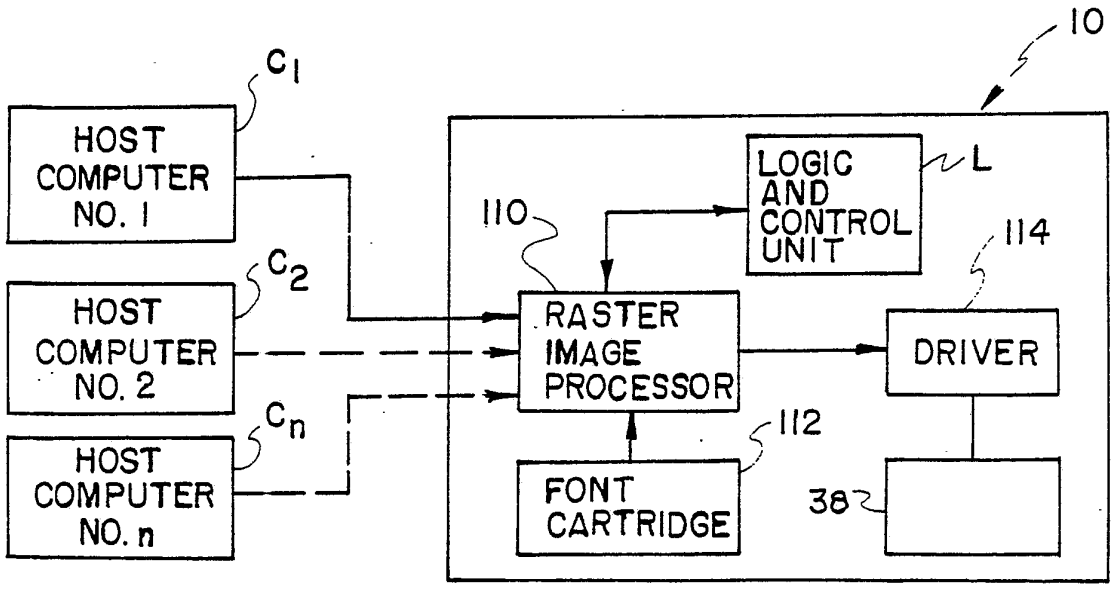

10
C1
HOST COMPUTER NO. 1
C2
HOST COMPUTER NO. 2
Cn
HOST COMPUTER NO. n
LOGIC AND CONTROL UNIT
L
110
114
RASTER IMAGE PROCESSOR
DRIVER
112
FONT CARTRIDGE
38

FIG. 15

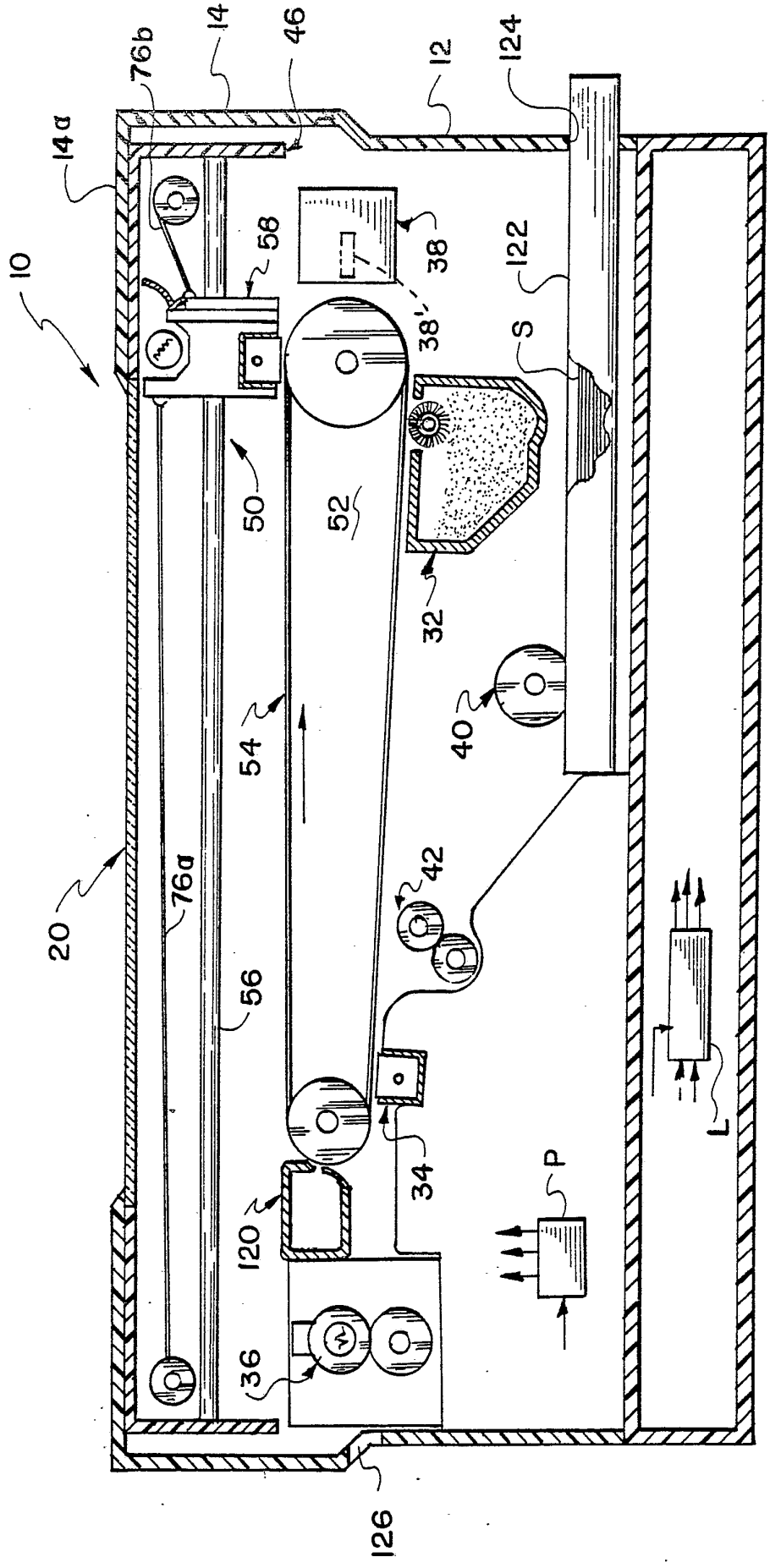
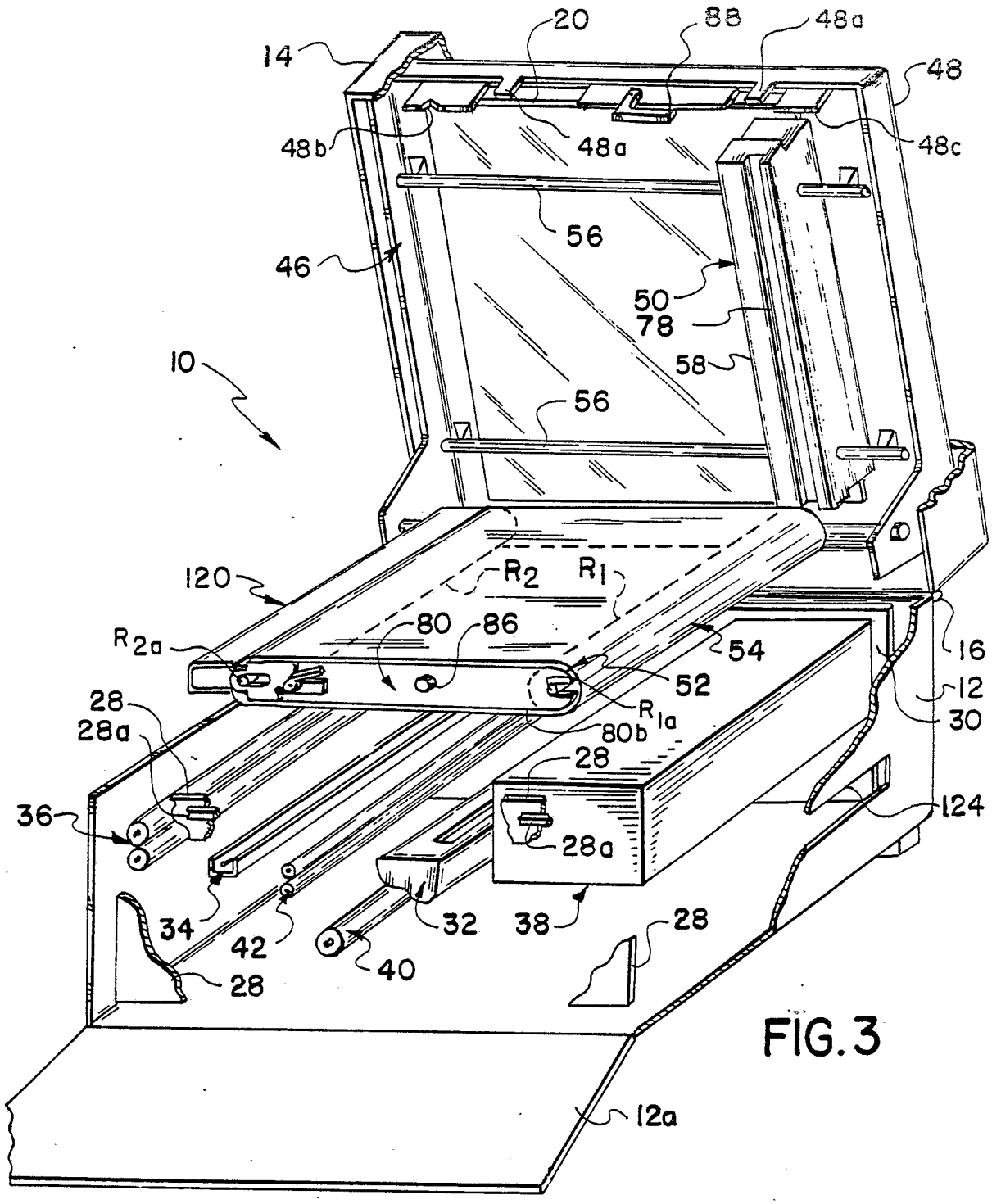

10
12
14
14a
20
32
34
36
38
38'
40
42
46
50
52
54
56
58
76a
76b
120
122
124
126
S
L
P

FIG. 2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88
48a
14
48
48b
48a
48c
56
46
50
78
58
10
56
120
R2
R1
80
86
54
R2a
16
52
12
28
R1a
30
28a
80b
28
36
124
28a
34
42
32
38
28
40
28
12a

FIG. 3

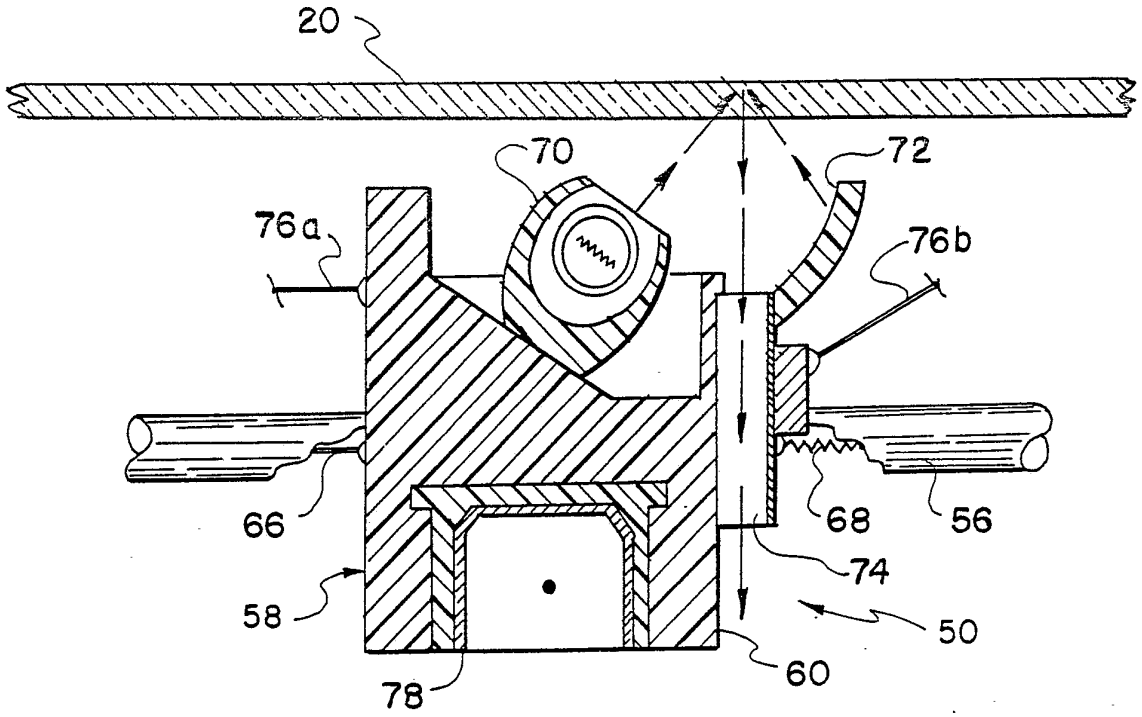

20
70
72
76a
76b
66
68
56
74
58
50
60
78

FIG. 4

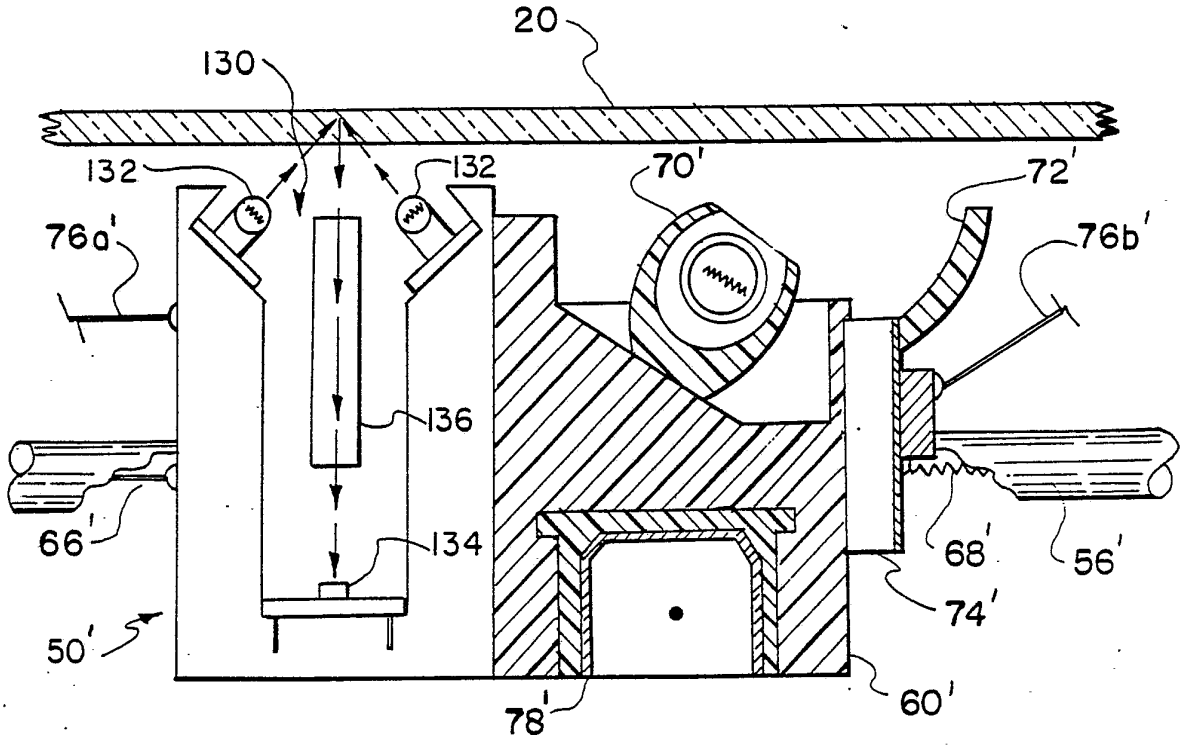

20
130
132
132
70'
72'
76a'
76b'
136
134
66'
68'
56'
74'
50'
60'
78'

FIG. 5

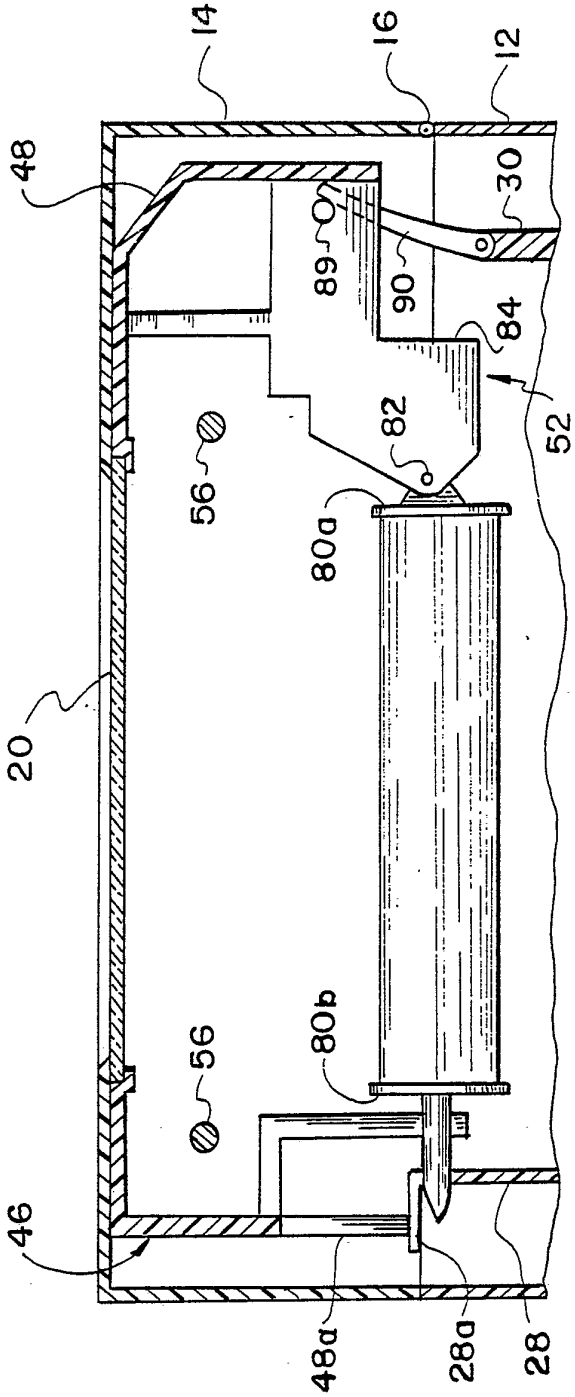


FIG. 6

FIG. 7

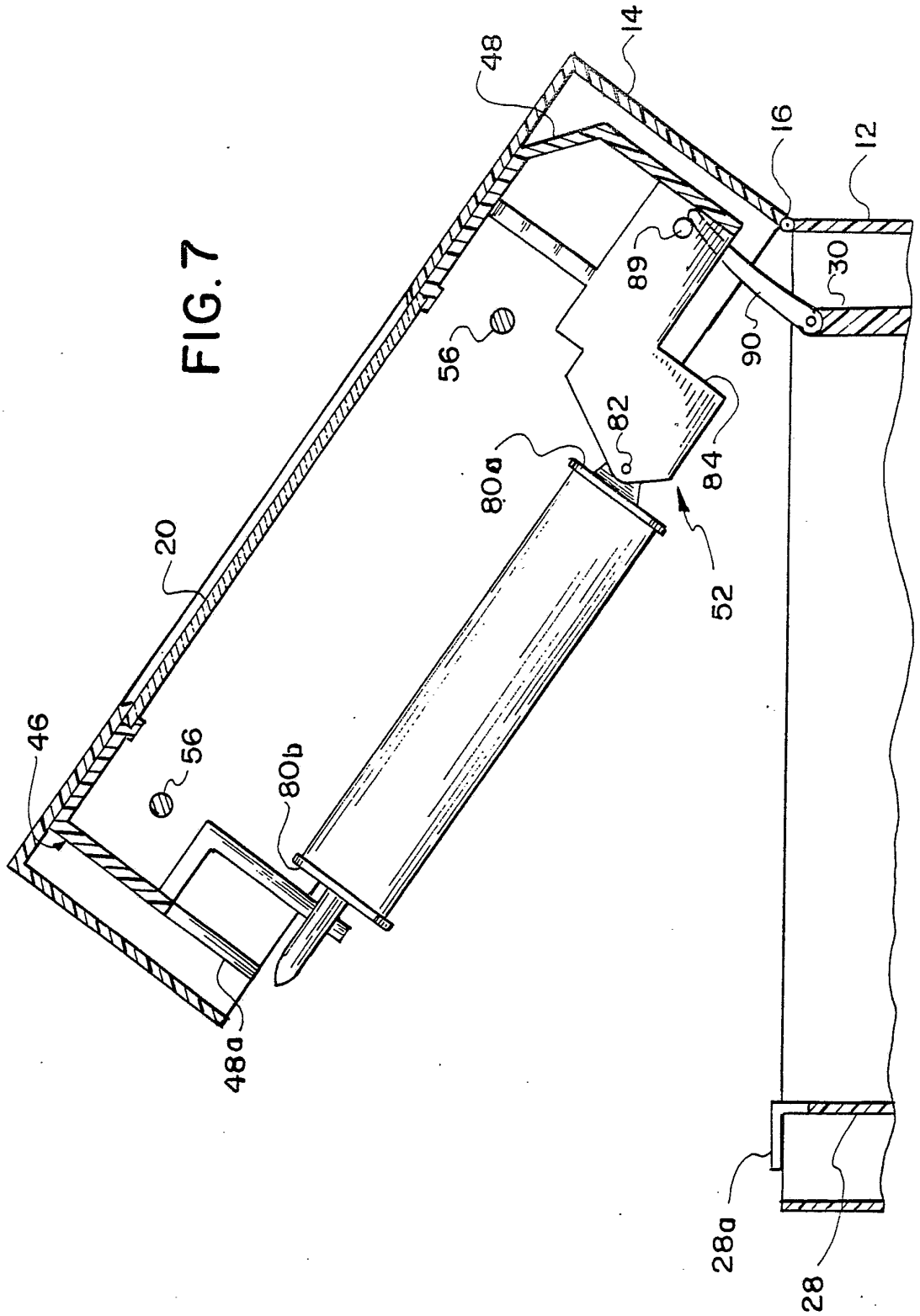
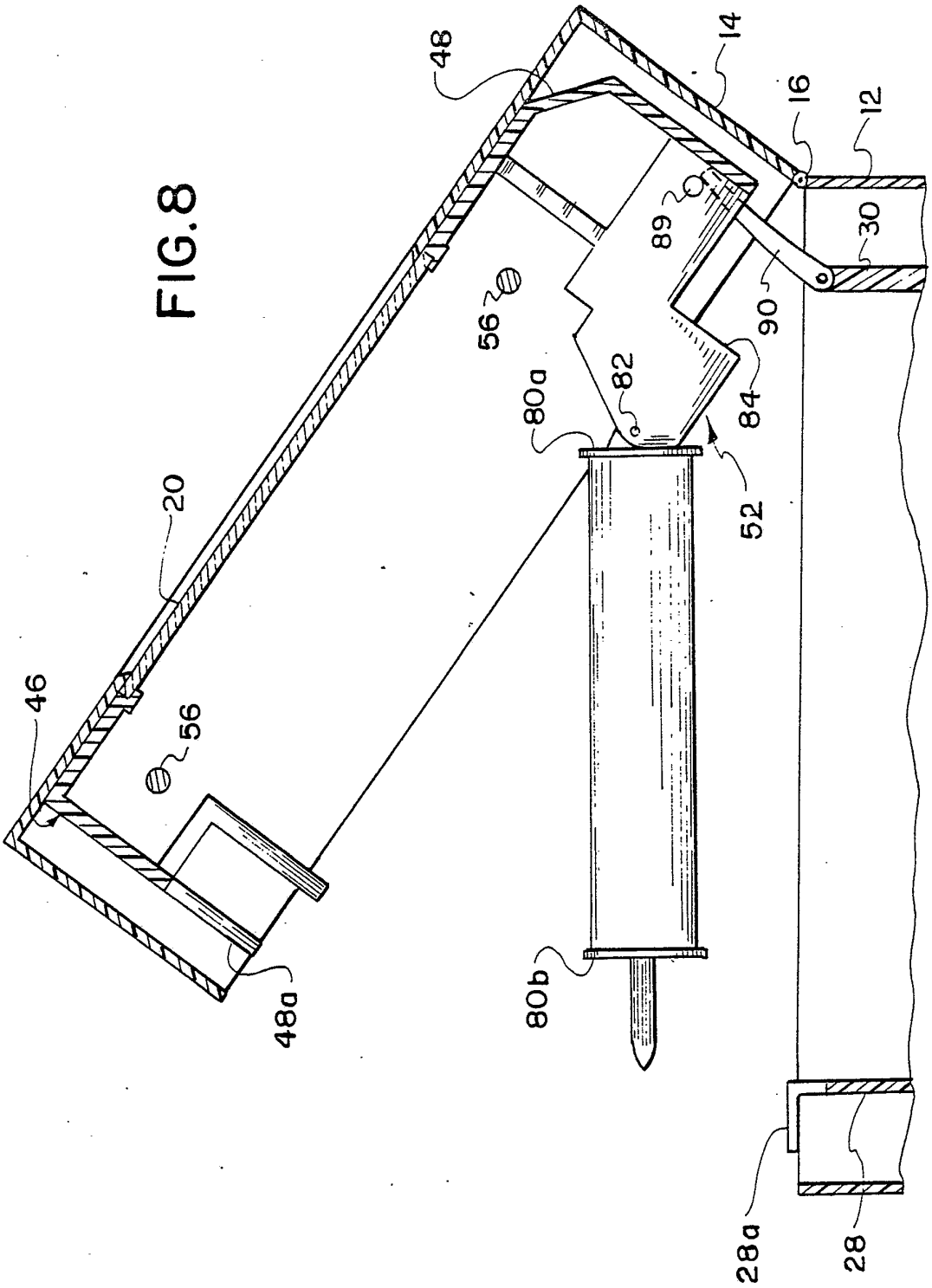


FIG.8



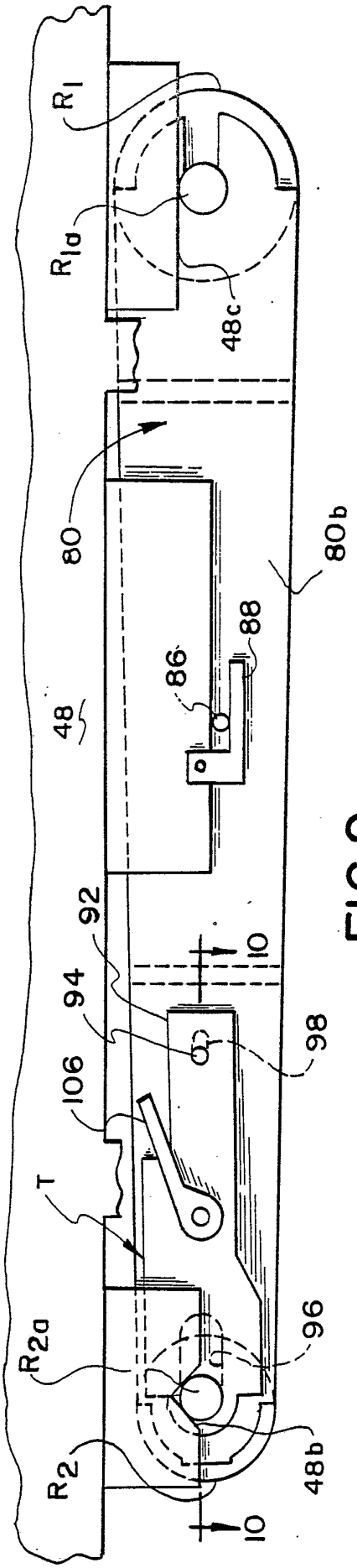


FIG. 9

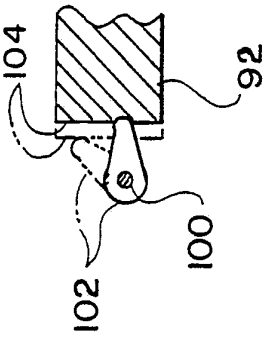


FIG. 11

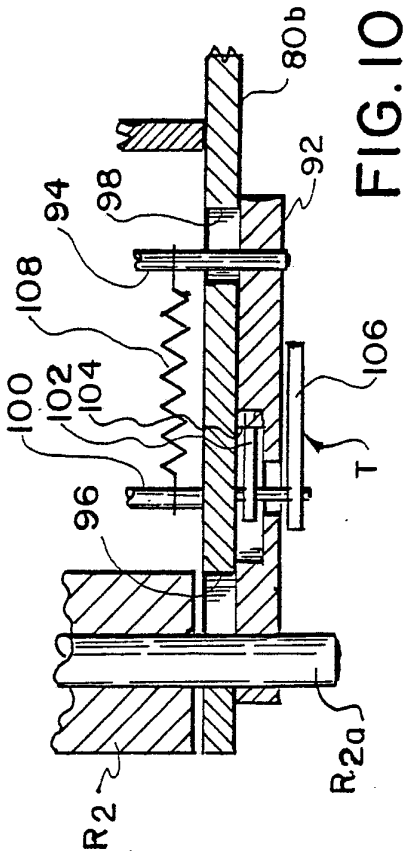


FIG. 10

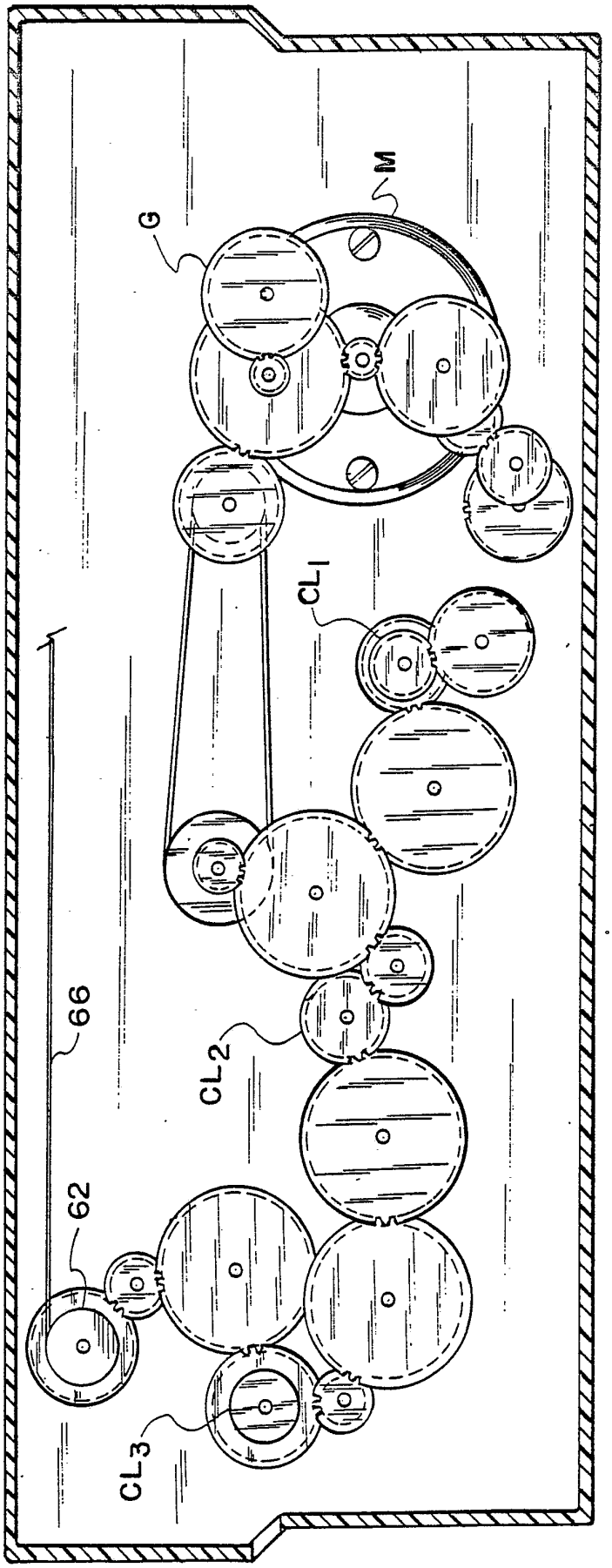


FIG. 12

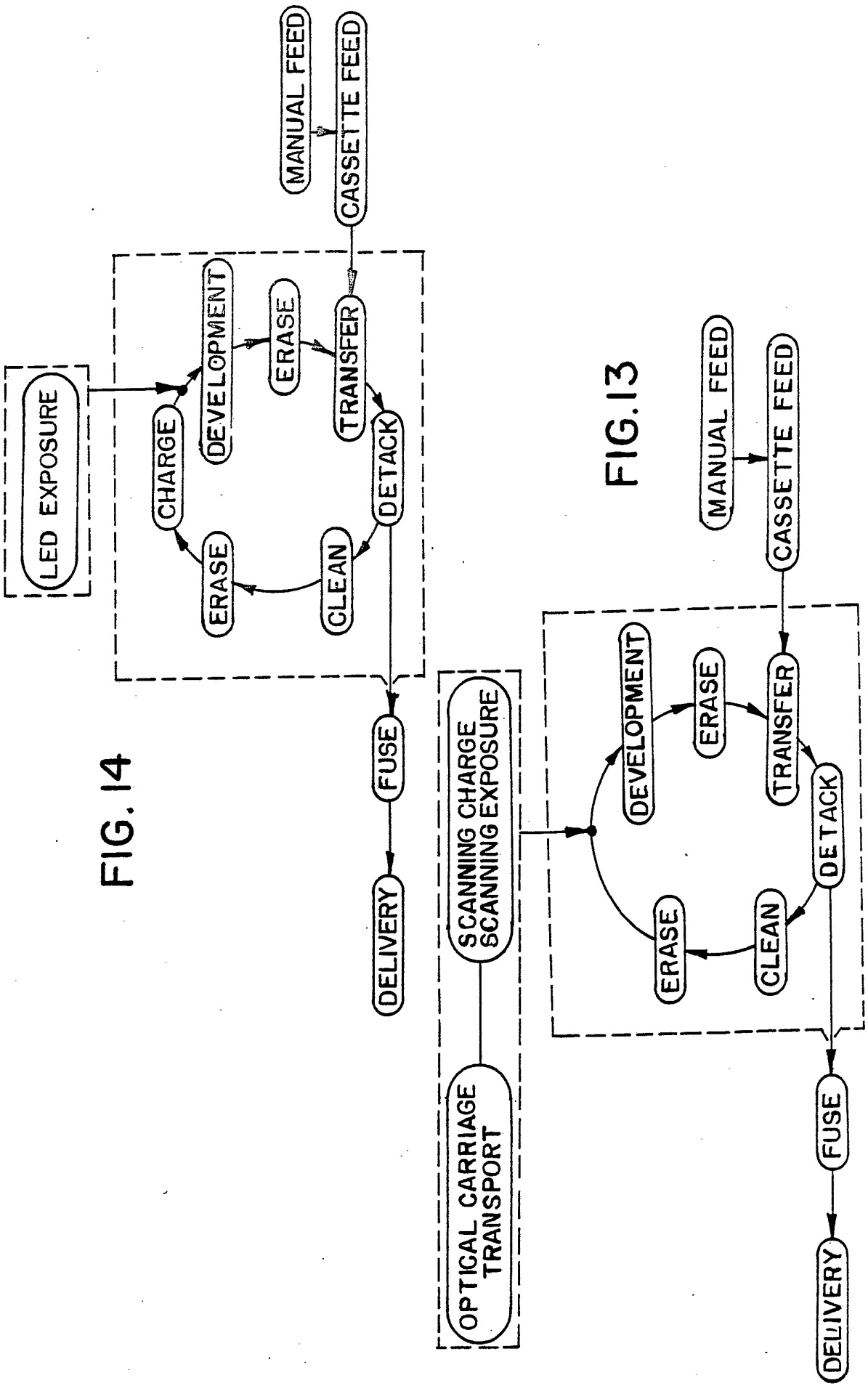

MANUAL FEED
CASSETTE FEED
LED EXPOSURE
CHARGE
DEVELOPMENT
ERASE
TRANSFER
DETACK
ERASE
CLEAN
FUSE
DELIVERY
SCANNING CHARGE SCANNING EXPOSURE
OPTICAL CARRIAGE TRANSPORT
DEVELOPMENT
ERASE
TRANSFER
DETACK
ERASE
CLEAN
MANUAL FEED
CASSETTE FEED
FUSE
DELIVERY

FIG. 14

FIG. 13

INTERNATIONAL SEARCH REPORT

International Application No PCT/US 88/02522

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[4]: G 03 G 15/22; G 03 G 15/28

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC[4]	G 03 G 15/22; G 03 G 15/28; G 03 G 15/052; G 03 G 15/04; G 03 G 15/32; H 04 N 1/10

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
Y	US, A, 4134668 (COBURN) 16 January 1979 see column 2, line 27 - column 4, line 51; figures 1,2 --	1,3,5,6
Y	US, A, 3397628 (B. GRANZOW et al.) 20 August 1968 see column 2, line 54 - column 3, line 50; figure 8 --	1,3,5,6
A	Patent Abstracts of Japan, volume 8, no. 275 (P-321)(1712), 15 December 1984, & JP, A, 59142568 (FUJI XEROX K.K.) 15 August 1984 see abstract --	1,3,5,6
A	US, A, 4477175 (SNELLING) 16 October 1984 see abstract; figures 1-3 cited in the application --	1-4,6,7
A	US, A, 4188113 (HIRAGA) 12 February 1980 see abstract --	1-3,6,7

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* Special categories of cited documents: [10]

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
25th November 1988	20 DEC 1988
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	P.C.G. VAN DER PUTTEN

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	Patent Abstracts of Japan, volume 6, no. 179 (P-142)(1057), 14 September 1982, & JP, A, 5793379 (FUJITSU K.K.) 10 June 1982 see abstract	1,6
A	Patent Abstracts of Japan, volume 10, no. 152 (P-462)(2208), 3 June 1986, & JP, A, 614076 (MATSUSHITA DENKI SANGYO K.K.) 9 January 1986 see abstract	1,3,6
A	US, A, 3765757 (WEIGL) 16 October 1973 see column 5, lines 10-49; figures 4-6	1,5,6
A	Patent Abstracts of Japan, volume 8, no. 137 (P-282)(1574), 26 June 1984, & JP, A, 5937569 (RICOH K.K.) 1 March 1984 see abstract	1,6

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. US 8802522 SA 23939

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 12/12/88
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 4134668	16-01-79	DE-A- 2644953	21-04-77
		JP-A- 52063340	25-05-77
US-A- 3397628		None	
US-A- 4477175	16-10-84	JP-A- 59119375	10-07-84
US-A- 4188113	12-02-80	JP-A- 54056313	07-05-79
US-A- 3765757	16-10-73	NL-A- 7217693	03-07-73
		FR-A- 2166151	10-08-73
		DE-A- 2264414	05-07-73
		DE-A- 2261011	12-07-73
		FR-A,B 2178256	09-11-73
		FR-A,B 2178257	09-11-73
		BE-A- 793551	29-06-73
		US-A- 3867027	18-02-75
		AU-A- 5058672	04-07-74
		GB-A- 1419978	31-12-75
		CA-A- 1004289	25-01-77
		JP-A- 48078944	23-10-73