United States Patent

Becker

[15] **3,687,445**

[45] **Aug. 29, 1972**

[54] **XEROGRAPHIC PLATE TRANSPORTING MECHANISM**

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

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[21] Appl. No.: **68,098**

[52] **U.S. Cl.** **271/54,** 271/84

[51] **Int. Cl.** **B65h 5/10**

[58] **Field of Search** 271/14, 54, 84; 74/50, 25, 74/37; 49/69

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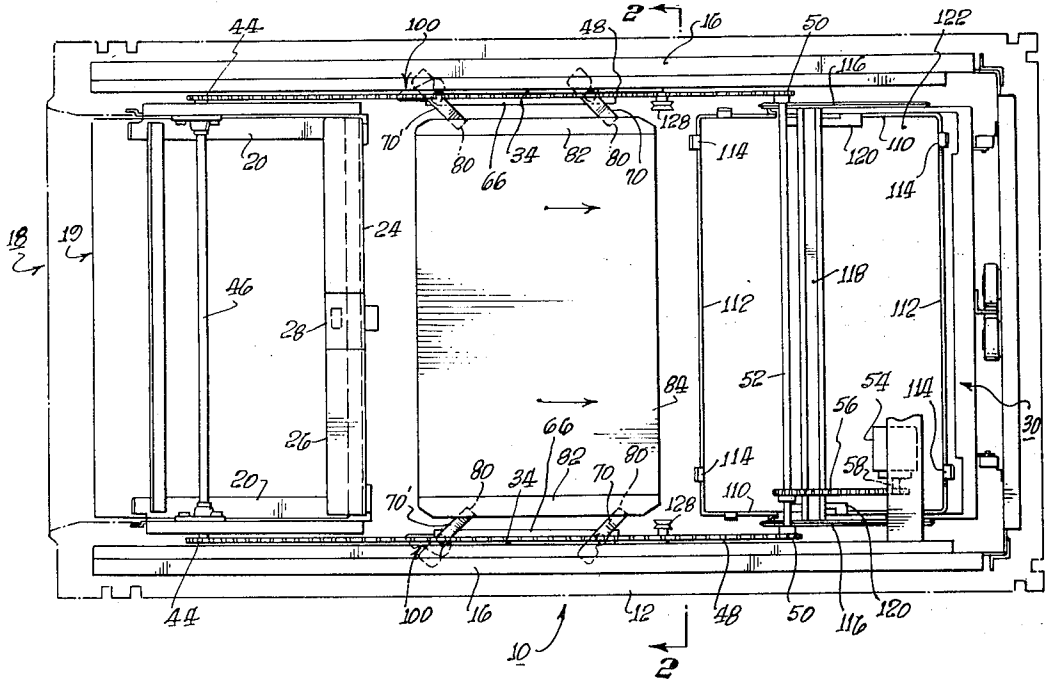
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[57] **ABSTRACT**

A mechanism for transporting a flat xerographic plate through an automated xerographic processing system including a pair of opposed shuttle plates, each of the shuttle plates having a vertical slot therein, endless drive chain means passing over sprocket wheels at each of two terminal positions, means to drive the drive chain means in one direction only, a pin securely mounted on each drive chain associated with the drive chain means and adapted to pass through the vertical slot in each shuttle plate, means supported by each shuttle plate to engage a xerographic plate at a first terminal position and means to cause the plate engaging means to become disengaged from the xerographic plate at the second terminal position. In each terminal position, the pins passing through the vertical slots engage the outer periphery of the sprocket wheels therein and, with continued movement of the drive chains, the pins are caused to move either upwardly or downwardly within each slot whereby the direction of travel of the shuttle plates is reversed. Thus, continuous unidirectional motion of the drive means is smoothly translated into two-directional movement of the plate transport mechanism along a single horizontal plane.

16 Claims, 9 Drawing Figures



Patented Aug. 29, 1972 3,687,445

4 Sheets-Sheet 1

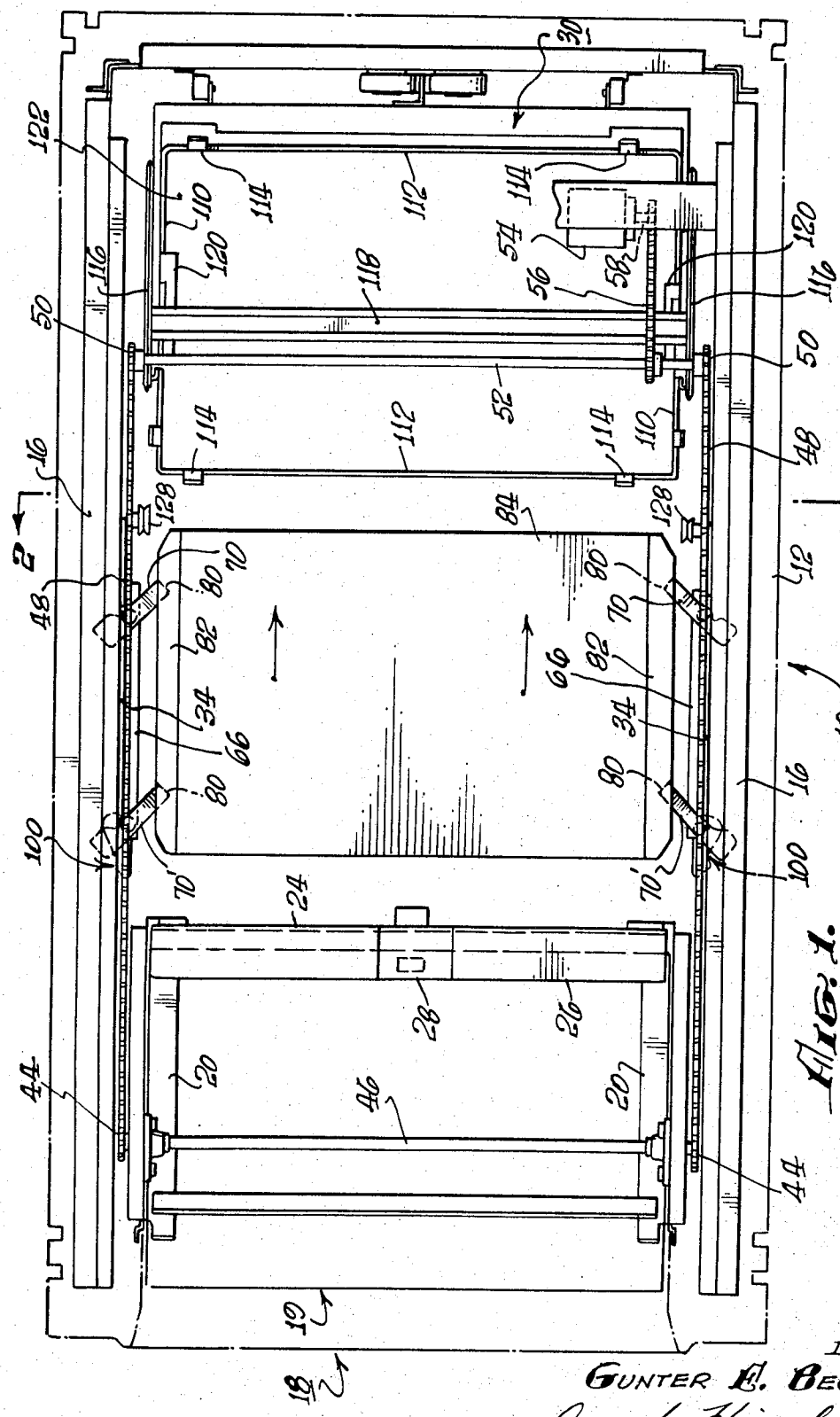


Fig. 1.

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ATTORNEY.

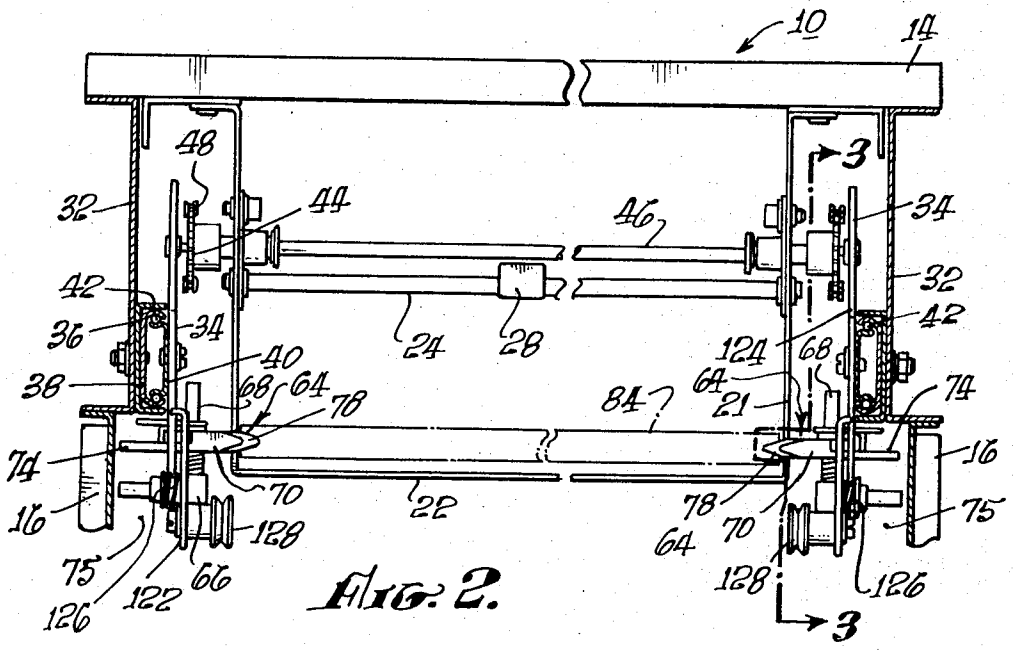

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FIG. 2.

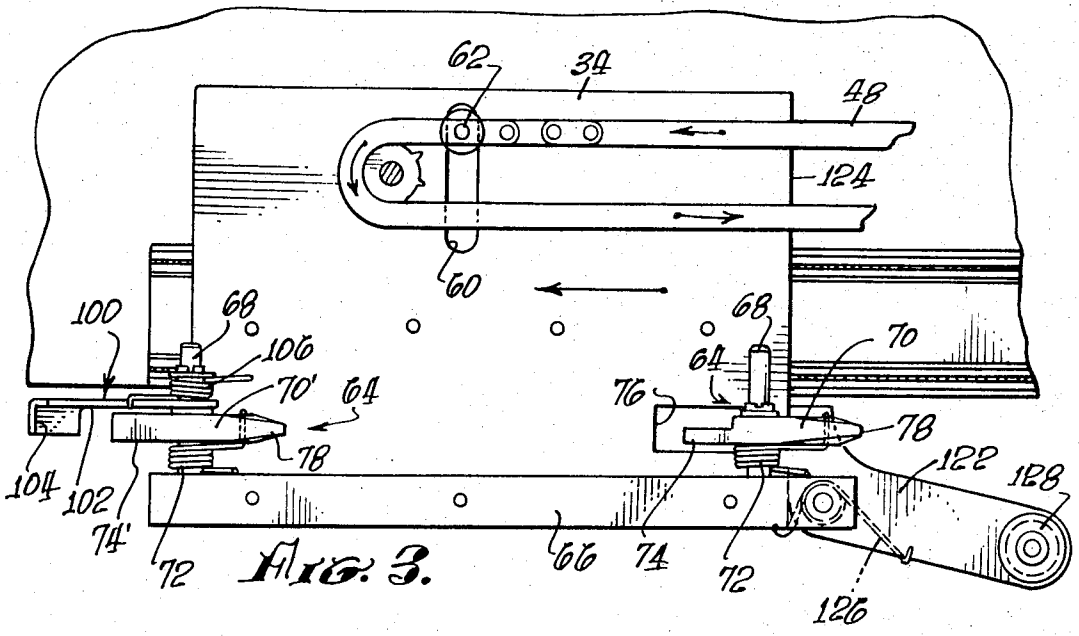

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FIG. 3.

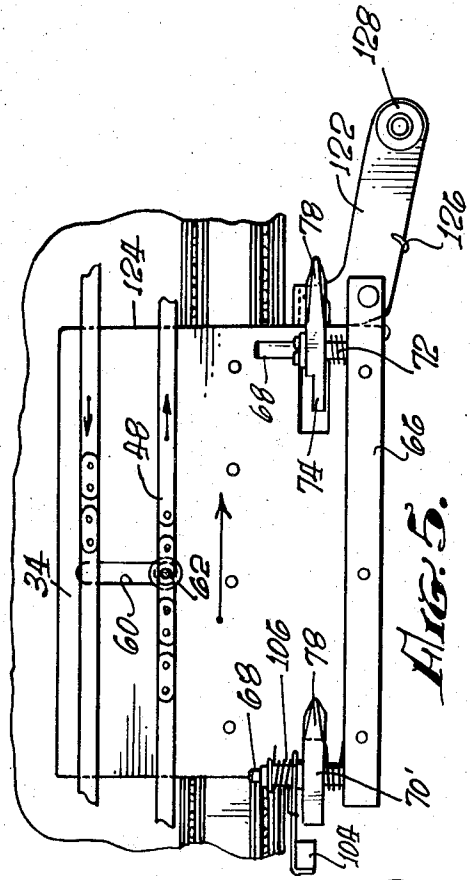


Fig. 5.

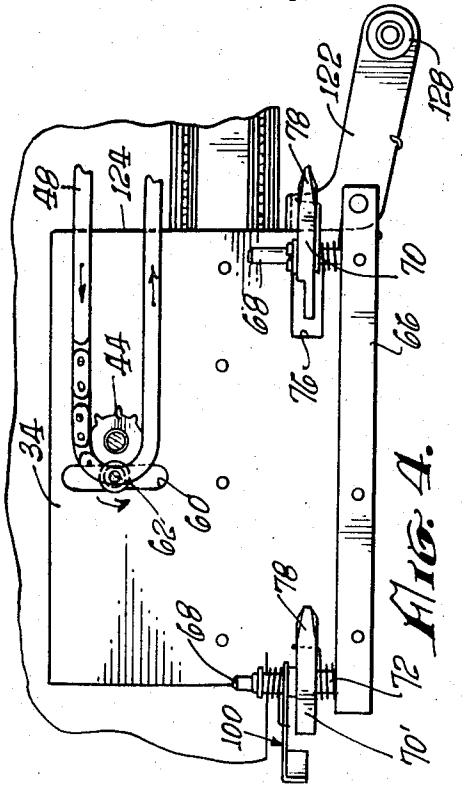


Fig. 4.

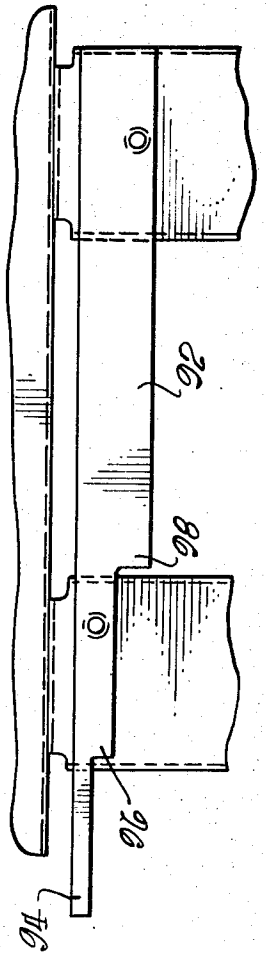


Fig. 6.

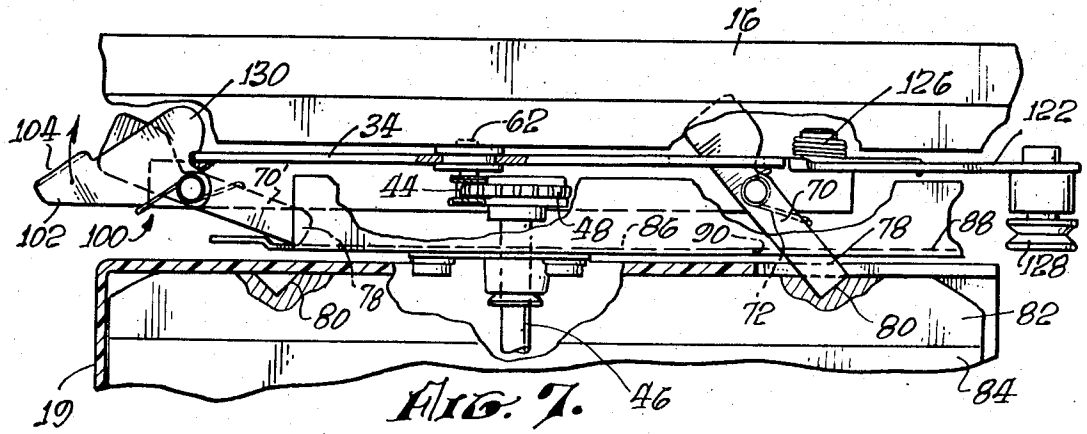


FIG. 7.

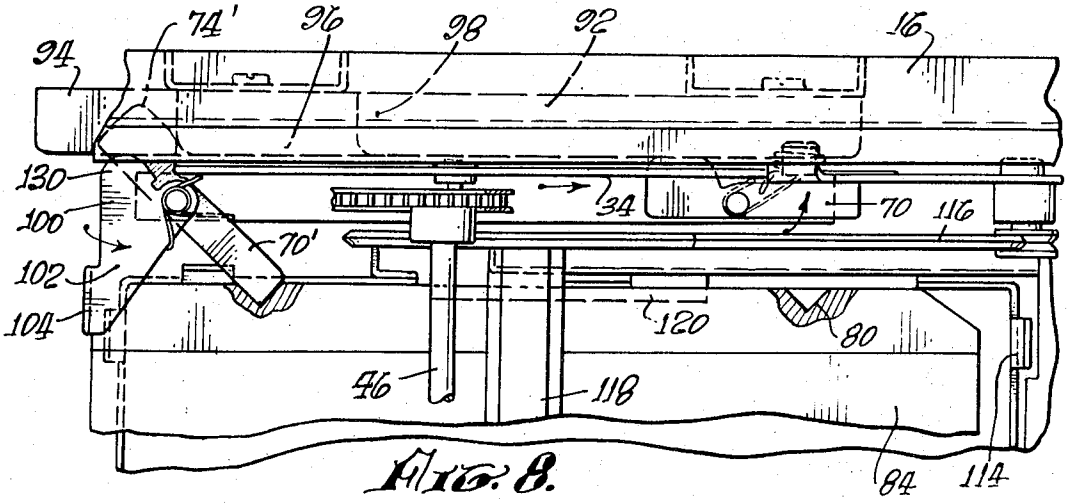


FIG. 8.

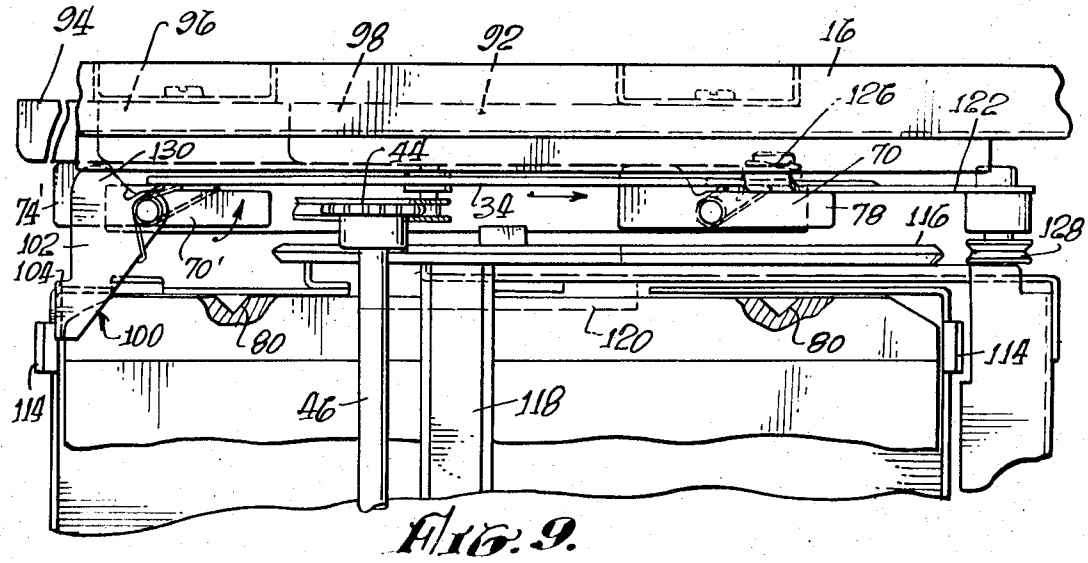


FIG. 9.

XEROGRAPHIC PLATE TRANSPORTING MECHANISM

BACKGROUND OF THE INVENTION

This invention relates to the field of xerography and, more particularly, to a mechanism for transporting a xerographic plate through an automated flat-plate xerographic processing system.

In the xerographic process as described in Carlson U.S. Pat. No. 2,297,691 a base plate of relatively low electrical resistance, such as metal, having a photoconductive insulator layer coated thereon is electrostatically charged in the dark. The charged coating is then exposed to a light image. The charges leak off rapidly to the base plate in proportion to the intensity of light to which any given area is exposed, the charge being substantially retained in non-exposed areas. After such exposure, the coating is contacted with electroscopic marking particles in the dark. When forming a positive image, these particles adhere to the areas where the electrostatic charges remain whereby there is formed a xerographic powder image corresponding to the latent electrostatic image. The powder image can then be transferred to a sheet of transfer material resulting in a positive print having excellent detail and quality. Alternatively, when the base plate is relatively inexpensive, as in the case of paper, it may be desirable to fix the powder image directly to the plate itself and thereby eliminate the image transfer operation.

The art of xerography, as briefly described above, is also amenable to recording X-ray patterns such as might be attained by passing X-rays through a body to be analytically examined. The art of X-ray recording by xerography, generally known as xeroradiography, relates to the recording of X-ray patterns and information by means of materials and devices whose electrical conductivity is altered by the action of X-rays reaching the recording medium. In xeroradiography, the plate or element exposed to the X-ray pattern usually comprises a metallic backing sheet having a photoconductive insulator layer or coating, for example vitreous selenium, on one surface thereof. It is conventional to cover or protect the photoconductive coating from ambient light by a slide plate, usually called a dark slide, spaced from the photoconductive surface. The plate or element is sensitized by applying a uniform electrostatic charge to the coating and thereafter the charged plate is exposed to sensitizing radiation with the object to the examined appropriately interposed between the radiation source and the sensitized plate. Under influence of the X-rays emanating from the source which are differentially absorbed by different areas of the test body, but which readily pass through the dark slide, the photoconductive coating becomes electrically conductive in those portions reached by the sensitizing radiation, thereby permitting portions of the electrostatic charge thereon to be selectively dissipated. Dissipation of the electrostatic charge is proportional to the amount of radiation absorbed by the test body with greater dissipation occurring in those portions of the coating shaded by less absorptive portions of the object being radiographed. In this manner, an electrostatic latent image of the test body is formed on the photoconductive element. The image may then be made visible with an electroscopic marking material which clings to the electrostatically charged portion of the latent image. Reversible, or negative, prints can also be developed by contacting the latent electrostatic image with marking particles of the same polarity. The xeroradiographic process is disclosed, for example, in Schaffert et al. U.S. Pat. No. 2,666,144.

It has previously been recognized that xeroradiography can be applied to the field of medical diagnostics. For example, the xeroradiographic process when utilized to examine extremities, such as hands and feet, has been characterized as being a valuable diagnostic technique since more information is recorded on the xeroradiogram than is recorded on a corresponding radiogram.

In recent years, the xeroradiographic technique has been utilized in the early detection and diagnosis of breast cancer in women. The process, known as xeromammography, has been described as requiring less radiation than non-screen film radiology, and one which gives greater detail in the mammogram to be reviewed by the radiologist. Additionally, a most important advantage is in the increased ease and speed of interpretation of the xeromammogram. Because they are easier to interpret and, accordingly, reduce the fatigue on the examining radiologist thereby increasing his overall effectiveness, the technique is believed to have application in screening techniques for the early detection of breast cancer.

In application Ser. No. 874,747, filed Nov. 7, 1969, and assigned to the assignee of the present invention, there is described an automated flat-plate xerographic processing system including charging means for placing a uniform electrostatic charge on the photoconductive surface of a xerographic plate, means for holding a light-tight cassette into which the xerographic plate can be inserted, means for opening the cassette and for inserting the charged xerographic plate therein without exposing the charged plate to actinic electromagnetic radiation, means for receiving the xerographic plate-holding cassette after imaging exposure, the xerographic plate having thereon a latent electrostatic image suitable for subsequent development, means for opening the cassette and for withdrawing the latent electrostatic image-bearing xerographic plate from the cassette without further exposure of the xerographic plate to actinic electromagnetic radiation, means for developing the latent electrostatic image to form a reproduction thereof suitable for visual examination, and means for advancing the xerographic plate to the developing means without disturbing the latent electrostatic image thereon. In this system, exposure of the uniformly charged xerographic plate takes place outside of the xerographic processing apparatus. This feature enables the radiologist, when considering medical examinations, to selectively position a patient, and particularly those portions of the patient's body being examined, with respect to the radiation source and the xerographic plate. To permit such exposure outside the processing apparatus, the processing system described in the aforementioned co-pending application includes a light-tight cassette into which the uniformly charged xerographic plate is inserted and through which imaging exposure is made. To complete the xerographic processing cycle, the toner image on the photoconductive surface of the xerographic plate is transferred to a suitable support member. This is generally achieved by

withdrawing a single support sheet from a supply tray, transporting it to a point where it is in registration with the xerographic plate having the powder image thereon, transferring the powder image to the support sheet, and transporting the support sheet with the powder image thereon to fuser means from which the xerographic reproduction is advanced into a receiving tray. When using a non-reusable photoconductive element (such as zinc oxide coated paper), the need to transfer the powder image to a further support sheet is eliminated.

In the aforementioned co-pending application, the xerographic plate is advanced through the two processing units by numerous transport mechanisms. With respect to the unit wherein conditioning and electrostatic charging of the xerographic plate takes place, separate mechanisms were provided for withdrawing the xerographic plate from its storage box and for inserting the leading edge of the xerographic plate into the conditioning means, for transporting the xerographic plate through the conditioning means, for withdrawing the xerographic plate from the conditioning means and for depositing the xerographic plate upon the plate carriers in the plate storage magazine, for withdrawing the bottom-most xerographic plate from the storage magazine, for transporting the xerographic plate along a path beneath the electrostatic charging means and for inserting the charged xerographic plate into a cassette.

With respect to the processing unit wherein the latent electrostatic image residing on the photoconductive surface of the xerographic plate is converted into a corresponding powder image which is subsequently transferred to a separate support sheet, distinct mechanisms were provided for withdrawing the latent electrostatic image-bearing xerographic plate from the cassette, for positioning the xerographic plate above the development means, for transporting the xerographic plate, after development, from its position above the developing means to a position where it is in registration with a separate support sheet, for transporting the xerographic plate in registration with the separate support sheet, for transporting the xerographic plate, after the powder image has been transferred therefrom to the support sheet, along a path where a cleaning brush rotates in contact with the photoconductive surface of the xerographic plate, and for inserting the cleaned xerographic plate into a storage box.

While each of the separate plate transporting mechanisms adapted to perform the functions set forth above is, by itself, relatively simple, the overwhelming number of mechanisms initially provided requires that the overall plate transporting mechanisms be reduced in number. Additionally, the mechanisms described in the aforementioned co-pending application, since they do not have positive plate engagement, either horizontally or vertically, permit the plate to exhibit a certain amount of wobble as it is transported along the operative path. As certain clearances must be maintained between the xerographic plate and adjacent surfaces which it passes, it would be desirable to have a plate transporting mechanism which positively assures that the xerographic plate will, at all times, be maintained in the proper horizontal position along the operative paths.

OBJECTS OF THE INVENTION

It is, therefore, the primary object of the present invention to provide an improved mechanism for transporting a flat xerographic plate through an automated xerographic processing system.

It is a further object of the present invention to provide an improved mechanism for transporting a flat member between terminal positions.

It is a further object of the present invention to provide a mechanism for transporting a flat xerographic plate which positively maintains the xerographic plate in proper alignment with the operative path along which the plate is transported.

It is a further object of the present invention to provide an improved flat xerographic plate transporting mechanism wherein the engagement and disengagement of the plate by the mechanism is accomplished without complex structure.

It is a further object of the present invention to provide an improved mechanism for transporting a flat xerographic plate wherein a non-reversing motor is caused to drive the plate transporting mechanism in opposite, reciprocating directions between terminal positions.

It is a further object of the present invention to provide an improved flat xerographic plate transporting mechanism which aligns the xerographic plate with the operative path along which it is to be transported more positively than the corresponding mechanisms set forth in the aforementioned co-pending application.

These and still further objects, features and advantages of the present invention will become apparent upon consideration of the following detailed disclosure.

BRIEF SUMMARY OF THE INVENTION

These and still further objects of the present invention are achieved, in accordance therewith, by providing a flat xerographic plate-transporting mechanism comprising a pair of opposed, vertical shuttle plates, each of the shuttle plates having a substantially vertical slot therein, endless drive chain means passing over sprocket wheels at each of two terminal positions, means to drive the drive chain means in one direction only, a pin securely mounted on each drive chain associated with the drive chain means and adapted to pass through the substantially vertical slot in each shuttle plate, means supported by each shuttle plate to engage the xerographic plate at the first terminal position and means to cause the plate engaging means to become disengaged from the xerographic plate at the second terminal position after the xerographic plate is properly supported by support means associated with the second terminal position.

As indicated above, the chain drive means is adapted to be driven in a single direction only. The pins secured to each drive chain pass through the adjacent slot in the shuttle plates. When the drive means is energized, these pins cause the shuttle plates, which carry the plate-engaging means, to be moved from the first terminal position to the second terminal position. When the shuttle mechanism reaches the second terminal position, the pins engage the outer periphery of the sprocket wheels and, with continued movement of the drive chains, the pins are moved either upwardly or downwardly within each slot and, with further continued motion of the

drive chains, the plate transport mechanism will be caused to return from the second terminal position back to the first terminal position, without need for reversing the direction of the drive means or the drive chains. A similar, but different directional, reversal of direction occurs at the first terminal position as the pins engage, and pass about the periphery, the sprocket wheels thereat. Thus, continuous unidirectional motion of the drive means (and the drive chains) is smoothly translated into two-directional movement of the plate transport mechanism along a single horizontal plane.

For the purposes of this specification, it will be assumed that the xerographic plate will be received by the plate transport mechanism at the first terminal position and transported to, and deposited at, the second terminal position. As the plate transport mechanism returns to the first terminal position, the xerographic plate-engaging means are positioned so they will not engage the waiting xerographic plate as they initially pass those portions of the plate with which they are adapted to engage for plate movement. That is, the waiting xerographic plate is so positioned with respect to the plate transport mechanism, at the first terminal position, that there will be a slight overrun of the plate engaging means with those portions of the xerographic plate with which they are to engage. After the slight overrun has taken place and the plate transport mechanism has reversed its direction, as described above in the preceding paragraph, the plate engaging means are now free to enter into the properly angled slots in the side rails of the xerographic plate whereby the xerographic plate is engaged and moved toward the second terminal position by continued movement of the drive chain means. As the plate transport mechanism reaches the second terminal position, the plate engaging means are automatically disengaged from the xerographic plate without stopping the motion of the transport mechanism, but after the xerographic plate has been positioned on additional support means at the second terminal position. As the plate transport mechanism is reversed in direction to return to the first terminal position, the plate engaging means are caused to remain disengaged from the xerographic plate to prevent any undesirable movement of the plate back toward the first terminal position. With continued movement of the drive chain means, the plate transport mechanism will continue to return to the first terminal position whereupon the plate transporting cycle can be repeated.

To enable the shuttle plates to move freely adjacent the horizontal plane along which the xerographic plate is to be transported, each shuttle plate is rigidly mounted on a movable member which slides in contact with ball bearings supported by a stationary member. Thus, the majority of the support for the xerographic plate being transported is borne by that portion of the frame of the associated automated xerographic processing unit which supports the stationary members.

The plate engaging means, associated with the specific plate transport mechanism described herein, comprises a pair of pawls pivotally mounted on each shuttle plate. Each pawl passes through a corresponding horizontal slot in the shuttle plate such that a portion of each pawl is on the opposite side of the shuttle plate from the area between the plates where the xerographic plate is carried during transportation. The pawls are spring loaded so they will extend into the area between the shuttle plates at an acute angle to the direction of xerographic plate motion between the first and second terminal positions. As the plate transport mechanism reaches each terminal position, the outer portions of the pawls come into contact with cooperating stationary cam means which cause the pawls to rotate out of engagement with the corresponding recesses in the side rails of the xerographic plate being transported (eg, at the second terminal position) or to prevent the pawls from prematurely engaging a xerographic plate to be transported (eg, at the first terminal position). As indicated above, after the slight transport mechanism override at the first terminal position and the reversal of direction of the transport mechanism so it is moving toward the second terminal position, the pawls are permitted to rotate, in the direction in which they are spring-urged, into the cooperating recesses in the side rails of the xerographic plate to be transported, whereby the xerographic plate is removed from the first terminal position and moved in a horizontal plane toward the second terminal position. At the second terminal position, stationary cam means cooperate with the outer portions of the pawls to rotate the pawls so they no longer cooperate with the corresponding recesses in the side rails of the xerographic plate. This occurs after the xerographic plate is at least partially positioned on the plate support means associated with the second terminal position. After reversal of the direction of the plate transport mechanism in the second terminal position, the pawls are prevented, by the stationary cam means and by the angle of the recesses in the side rails of the xerographic plate, from entering the recesses thereby avoiding undesirable movement of the xerographic plate back toward the first terminal position.

Optionally, positioner means can be provided adjacent that portion of the shuttle means which supports the trailing edge of the xerographic plate. The positioner means, in combination with stationary cam means at the second terminal position, serves to properly position the xerographic plate on the plate support means associated with the second terminal position. While not absolutely essential to the operation of the present invention, such positioner means positively assures that the xerographic plate being transported by the transport mechanism will be properly positioned within the second terminal position, for example, on the lowering device described in co-pending application Ser. No. 68,083, filed concurrently herewith and assigned to the assignee of the present invention, and now U.S. Pat. No. 3,640,406, the lowering device being associated with the plate storage magazine described in aforementioned application Ser. No. 874,747.

Where various stations, such as the conditioning station described in application Ser. No. 874,747, are positioned between the first terminal position and the second terminal position, switches can be provided, as needed, to stop the movement of the plate transport mechanism of the present invention at the appropriate position within a particular station. After the operation being performed in the station is completed, the drive means associated with the plate transport mechanism

of the present invention is automatically actuated whereby movement of the xerographic plate toward the second terminal position is reinitiated. Such momentary stops do not, however, change the basic nature of this invention wherein a unidirectionally operated drive means causes reciprocating motion of the plate transport mechanism along a single horizontal path between spaced terminal positions.

BRIEF DESCRIPTION OF THE DRAWINGS

The nature of the invention will be more easily understood when it is considered in conjunction with the accompanying drawings wherein:

FIG. 1 is a top plan view of a xerographic processing unit showing the shuttle mechanism as it is about to withdraw a xerographic plate from a storage box inserted therein and showing, in phantom, the positioning of the pawls as the xerographic plate is transported by the mechanism toward the lowering device at the right-hand side of the unit;

FIG. 2 is a side elevational view of the upper portion of the processing unit of FIG. 1 taken along line 2—2 of FIG. 1;

FIG. 3 is a side view of the right-hand shuttle plate of FIG. 2 showing the cooperation of the pin secured to the drive chain with the vertical slot as the shuttle plate is caused to move from right to left;

FIG. 4 is a side view of the shuttle plate of FIG. 3 showing the downward movement of the pin as it passes about the periphery of the sprocket wheel in the left-hand terminal position;

FIG. 5 is a further side view of the shuttle plate of FIG. 3 showing the cooperation of the pin secured to the drive chain with the vertical slot as the shuttle plate moves from left to right;

FIG. 6 is a side view of stationary cam means suitable for causing the pawls to rotate out of engagement with the xerographic plate in the second terminal position and to cause the positioning means to slightly move the xerographic plate further into the second terminal position;

FIG. 7 is a top view of the pawls, at the upper portion of FIG. 1, showing the positioning thereof at the left-hand terminal position;

FIG. 8 is a top view of the pawls of FIG. 7 showing the positioning of the pawls and the positioning means after the leading pawls and the positioner means have come in contact with the cam means of FIG. 6; and

FIG. 9 is a top view of the pawls of FIG. 7 showing the positioning of the pawls and the positioner means in the right-hand terminal position wherein both pawls and the positioner means have come into full contact with the stationary cam means of FIG. 6.

Referring to FIGS. 1 and 2, there is seen a xerographic unit 10 having a housing 12, a top 14 and side frames 16. At the lefthand side of the unit 10 there is an input station 18 into which a storage box 19 holding one or more xerographic plates can be inserted. Upon insertion, the bottom wall of the storage box rests upon horizontal members 20 and 22 and, when fully inserted, comes into contact with vertically-extending stop 24. Lateral movement of the storage box 19 is prevented by side walls 21 which also guide the storage box as it is inserted into the input station. Supported by the horizontal portion 26 of vertical stop 24 is latch means 28 which will secure the storage box in the input station if it is determined by appropriately positioned magnetic reed switches that at least one xerographic plate is carried by the storage box.

At the righthand side of unit 10, there is a magazine 30 to which the xerographic plates in the storage box will be individually and successively transported by the mechanism of the present invention. For the purposes of this specification, the storage box input station will be regarded as the first terminal position at which the xerographic plate is received by the plate transport mechanism and the magazine will be regarded as the second terminal position to which the xerographic plate will be transported. It should be understood, however, that the terminal positions can take on other forms, for example, the lower portion of the magazine will be a first terminal position when a xerographic plate is being withdrawn therefrom and the cassette receiving station, for example below the storage box input station (but not shown in FIG. 2) can be a second terminal position. In this regard, it will be assumed that the xerographic plate is received by the plate transport mechanism of the present invention at the first terminal position and transported to, and deposited at, the second terminal position.

As can best be seen in FIG. 2, a vertical shuttle plate 34 is positioned in the space between vertical side wall 21 and upper portion 32 of side frame 16 on each side of the storage box input station. Supported on each upper portion 32 is a stationary member 36 carrying a ball bearing supporting member 38. Each shuttle plate 34 is rigidly mounted thereon a member 40 which rides on ball bearings 42 supported between members 38 and 40. In this manner, the shuttle plates are mounted on the side frames of unit 10 for traversing movement between the two terminal positions.

Adjacent the upper portion of shuttle plates 34 are sprocket wheels 44 connected together by drive shaft 46 and having drive chains 48 passing about the periphery thereof. In magazine 30, the drive chains pass about another pair of opposed sprocket wheels 50 connected together by drive shaft 52. The plate transporting mechanism of the present invention is caused to move between the two terminal positions by means of unidirectional motor 54 supported above the plane of xerographic plate travel into magazine 30. Unidirectional motor 54 drives the plate transporting mechanism by means of drive chain 56 passing about sprocket wheels (not shown) mounted on drive shafts 52 and 58.

It will be assumed, for the purposes of this discussion, that unidirectional motor 54 causes drive chain 48 to continuously move in a counter-clockwise direction with regard to the shuttle plate 34 on the righthand side of FIG. 2 when viewed from the interior of the unit. It thus follows that the drive chain connected to the shuttle plate on the lefthand side of FIG. 2 will also be moving in a counter-clockwise direction, though to make this determination the viewing position must be to the outside and the left of the unit as shown in FIG. 2. Counter-clockwise rotation is not critical, however, since the plate transporting mechanism of the present invention can be made, with minor modifications, to operate with the drive chains moving in a clockwise direction.

Each shuttle plate **34** has a vertically extending slot **60** therein. A pin **62**, mounted on one of the links associated with each drive chain, is adapted to extend into slot **60** and be retained therein during traversing movement of the plate transporting mechanism. When pin **62** is adjacent the uppermost portion of slot **60** and the drive chain, as shown in FIG. **3**, is moving in a counter-clockwise direction, shuttle plate **34** on each side of the transporting path will be moved from right to left (e.g., from magazine **30** toward storage box input station **18**). When the shuttle plates reach the first terminal position, pins **62** engage the periphery of sprocket wheels **44** and, with continued rotation of drive chains **48**, are caused to move downwardly within slots **60**. This can best be seen in FIG. **4**. Further rotation of drive chains **48** in the counter-clockwise direction positions the pins at the lowermost portions of slot **60** with the result that shuttle plates **34** are now caused to move from left to right (i.e., from the storage box input station toward the magazine). This can best be seen in FIG. **5**. At the second terminal position (i.e., the magazine) a similar reversal of direction occurs. At the second terminal position, with the particular orientation established in these drawings for purposes of explanation, pins **62** are caused to move about the periphery of sprocket wheels **50** in an upward direction and then in a direction toward the storage box input station. It is in this manner that continuous unidirectional motion of motor **54** and drive chains **48** is smoothly translated into two-directional movement of the plate transport mechanism along a single horizontal plane between the two terminal positions. This enables, for example, the gentle withdrawal of xerographic plates from the storage box, the stable transportation of the xerographic plate from the storage box input station to the magazine, and the smooth deposition of the xerographic plate onto the opposed plate supports in the magazine.

The preceding portion of this specification has been directed to the manner, and means, by which the shuttle plates move between the two terminal positions. This discussion has been without reference to the plate engaging means **64** which are mounted, in the particular embodiment illustrated, on the lower portion of each shuttle plate **34**. Horizontally extending bars **66**, rigidly secured to each shuttle plate **34**, has a pair of vertical shafts **68** mounted thereon adjacent the leading and trailing edges of the shuttle plate. Mounted for rotational movement about each shaft is a pawl **70** or **70'** which is urged by spring **72** to extend into the area between the opposed shuttle plates at an acute angle to the direction of travel of the xerographic plate between the first and second terminal positions. Pawls **70** and **70'** have ends **74** and **74'**, respectively, which extend into the region **75** between the shuttle plate and side frame **16**. Each end **74** extends through a slot **76** in the shuttle plate into region **75**; whereas each end **74'** extends into region **75** merely by virtue of its length and positioning with respect to the trailing edge of the shuttle plate. As the plate transporting mechanism of the present invention moves into and out of the first and second terminal positions, inwardly extending edges **78** and/or ends **74** or **74'** contact stationary cam means whereby the pawls are rotated to a position where they are prevented from prematurely engaging a xerographic plate (eg, at the first terminal position) or are rotated out of engagement with the corresponding recesses in the side rails of the xerographic plate being transported (eg, at the second terminal position).

The stationary cam means can be any object which offers one or more surface portions which cause the desired rotation of the pawls as they come in contact therewith. For example, in the first terminal position, the cam means can be the vertical side walls of the storage box input station, the side rails of the xerographic plate or the side walls of the storage box. As the plate transporting mechanism is advanced toward the storage box input end of the unit, inwardly extending edges **78** slide over the cam surfaces and are rotated, against the action of spring **72**, into non-plate engaging positions. After the plate transporting mechanism reverses direction in the input station, the pawls will remain in the non-plate engaging positions for as long as they remain in contact with the cam surfaces.

The cooperation of the inwardly urged pawls **70** and **70'** with the recesses **80** in the side rails **82** of xerographic plate **84** as the xerographic plate is being withdrawn from the storage box (not shown) is shown in greater detail in FIG. **7**. As previously indicated, the storage box, and the xerographic plate therein, are so positioned, with regard to the extreme terminal position as the shuttle plates move toward the lefthand side of the unit shown in FIG. **1**, that there is a slight override of the pawls, specifically the plate engaging ends **78** of the pawls, with respect to recesses **80** in the side rails of the lowermost xerographic plate held in the storage box. After this slight override (i.e., after the shuttle plates have smoothly reversed direction as described above with reference to FIGS. **3–5**) edges **78** of pawls **70**, on opposed sides of the storage box input station, enter recesses **80** adjacent the leading edge of the xerographic plate, under inward urging of spring **72**. Since, as shown in FIG. **7**, the pawls are urged into the direction in which the xerographic plate is to travel between the first and second terminal positions, edges **78** firmly engage the xerographic plate and move it out of the storage box. Pawls **70'** have been cammed out of plate engaging position by vertical side wall **86** of the storage box input station and, accordingly, are not free, in the position shown in FIG. **7**, to engage the adjacent recesses in the side rails of the xerographic plate. At this time, the trailing edge of the xerographic plate is supported by the bottom wall of the storage box in which the plate now partially resides. With continued movement of the shuttle plates toward magazine **30**, pawls **70'** adjacent the trailing edge of the xerographic plate reach horizontal slots **88** in side walls **86**, slots **88** starting at about point **90**. When this position is reached, pawls **70'** are free to rotate toward the xerographic plate and, as they do so, they engage recesses **80** and, in so doing, support the trailing edge of the xerographic plate. Thus, prior to the time when the xerographic plate is fully withdrawn from the storage box, both pawls adjacent the leading edge of the xerographic plate and both pawls adjacent the trailing edge of the xerographic plate have their inwardly extending edges **78** inserted into the corresponding recesses in the side rails of the xerographic plate. With continued movement of drive chains **48**, the xerographic plate is completely withdrawn from the storage box and, as it is

being transported toward magazine **30**, it is supported by four pawls, one each at each of its four corners, in a manner similar to that shown in the center portion of FIG. **1**.

As the xerographic plate is being transported to magazine **30**, it can pass through intermediate processing stations where, for example, the xerographic plate can be heated, under specific conditions and for specific times, to remove the residual effects from previous exposure of the xerographic plate to X-rays.

An exemplary stationary cam means, suitable for use in magazine **30**, is shown in FIG. **6**. Cam means **92**, positioned on each side of magazine **30**, has a short upper arm **94**, an intermediate arm **96** and a lower arm **98**. The contacting surfaces are horizontally displaced to properly coordinate, as will be described below, the camming action of the various elements supported by the shuttle plates. In addition, the contacting surfaces are vertically aligned to enable different portions of the plate transporting mechanism, specifically, the contacting ends of the pawls and/or the positioner means, to contact only that portion of the stationary cam means which causes the desired functional operation for that particular element.

Optionally, positioner means can be mounted for rotation about vertical shafts **68** most closely adjacent the trailing edge of the xerographic plate as it is being transported between the first and second terminal positions. Each positioner means **100** has a horizontal arm **102** and, at the end thereof remote from the supporting shaft, a downwardly depending leg **104**. Springs **106** normally urge the opposed positioner means into the positions as shown in the center portion of FIG. **1**.

Magazine **30** has side walls **110** parallel to the direction of xerographic plate travel, and side walls **112** perpendicular, and below, the path of xerographic plate travel into the magazine. To assist in the proper channeling of the xerographic plate into the magazine, there are inwardly sloping tabs **114** at each of the four corners of the magazine. Associated with the magazine is a lowering device having cam members **116** positioned on each side of the magazine between side walls **110** and side frame **16**. For structural support, the cam members are connected together by horizontal bar **118** which is above the path of plate travel into the magazine. As each plate is transported into the magazine, it is positioned on horizontal supports **120** which, as the device is lowered, will deposit the xerographic plate on the top plate in a stack of plates already in the magazine or on the bottom wall **122** of the magazine.

A suitable lowering device is shown in co-pending application Ser. No. 68,083 filed concurrently herewith and assigned to the assignee of the present invention. Portions of said co-pending application which are necessary for a complete understanding of the present invention, or to provide sufficient disclosure to understand the functional cooperation of the present invention with the lowering device described therein, are incorporated herein by reference.

As described in said co-pending application, to provide synchronization of the plate transporting mechanism of the present invention with the lowering device described therein, each shuttle plate has, adjacent the leading edge thereof an arm **122** urged upwardly against the vertical surface **124** of shuttle **34** by means of spring **126**. At the end of arm **122** most remote from the shuttle plate is a grooved cam follower **128** mounted for rotational movement as it passes over the upper surfaces of cam means **116**.

When the shuttle plates on opposed sides of the xerographic unit reach the magazine, arms **122** pass beneath cam means **116** at the same time that the xerographic plate is being deposited, in the manner to be described hereinafter, on horizontal supports **120**. After the shuttle plates have reversed direction, grooved cam followers **128** ride over the upper surface of cam means **116** and, since the plate transporting mechanism of the present invention is not free to move vertically, the lowering device is caused to move downwardly. Eventually, the xerographic plate supported thereby is deposited either on the bottom wall of the magazine or on the top plate in a stack of plates within the magazine.

As further described in said co-pending application, cam means **116** are in the form of inverted V-shaped cams. Thus, as cam followers **128** pass over the first legs of the opposed inverted V-shaped cams, the lowering device is lowered toward the bottom of the magazine while, when the cam followers pass over the second legs of the inverted V-shaped cams, the device is permitted to return to its home position under the action of spring return means (not shown).

As the shuttle plates reach magazine **30**, ends **74** of leading pawls **70** contact and ride against lower arms **98** of stationary cam means **92**. This causes the inwardly extending edges **78** of pawls **70** to be rotated out of engagement with the recesses **80** in the xerographic plate. The initial contact by ends **74** with lower arm **98** is so positioned with respect to the initial edges of horizontal supports **120** that, immediately prior to the time when the pawls are rotated out of engagement with the recesses, the leading edge of the xerographic plate is supported by at least a portion of the horizontal supports **120**. Thus, the plate is retained in the horizontal plane in which it was initially traveling between the two terminal positions. When completely rotated, leading pawls assume the position as shown in the righthand portion of FIG. **8**.

As the shuttle plates are advanced further into the second terminal position by uni-directional motor **54**, arm **130** on each positioner means **100** comes into contact with upper leg **94** on stationary cam **92**. This causes the positioner means to start to rotate toward the position shown in FIG. **8**.

Continued movement of the shuttle plates toward the extreme second terminal position brings ends **74'** of pawls **70'** into contact with intermediate arm **96** of stationary cam **92** whereby, as ends **74'** ride against the surface of the stationary cam, the pawls are rotated out of the recesses and into the position as shown in FIG. **9**. At this time, the xerographic plate is supported solely by horizontal supports **120** in the magazine. Further continued movement of the shuttle plates, prior to a reversal of direction, causes leg **104**, and the corresponding leg on the opposite side of the plate transport mechanism, to nudge the trailing edge of the xerographic plate fully into magazine **30**. As indicated above, upon reversal of the direction of the shuttle

plates, cam followers **128** ride over the upper surfaces of opposed cam means **116** and cause the xerographic plate to be lowered within the magazine and the lowering device to be returned to its initial position after depositing the xerographic plate.

Appropriate microswitches can be provided to stop the plate transport mechanism at any desired home position after a single cycle, as described above, after all the xerographic plates have been withdrawn from the storage box and transported to the magazine, or after the magazine is filled with a predetermined number of xerographic plates.

In describing the present invention, it should be understood that, with regard to FIGS. **3–9**, only one-half of the plate transporting mechanism of the present invention has been shown. The corresponding elements on the opposite side of the plate transportation path are, in this particular embodiment, mirror images of the elements more particularly described in the Figures.

Although the plate transporting mechanism of the present invention can be adapted for use in connection with any flat plate xerographic system, it has been particularly designed for use in conjunction with an automated xerographic processing system of the type describe in application Ser. No. 874,834 filed Nov. 7, 1969, and assigned to the assignee of the present invention and now Pat. No. 3650620. Portions of said co-pending application which are necessary for complete understanding of the present invention are incorporated herein by reference. In connection with the automated xerographic processing system described in said co-pending application, the plate transporting mechanism as described herein is also suitable for removing the xerographic plate from the bottom of the magazine, for passing it beneath a corona charging means to place a uniform electrostatic charge on the photoconductive surface of the xerographic plate and for gently inserting the uniformly charged xerographic plate into a cassette for purposes of xeroradiographic exposure outside the processing unit. Since, with such a device, there is no need to synchronize the horizontal movement of the plate transporting mechanism with the vertical movement of a lowering device, arms **122**, and the elements associated therewith, can be eliminated. Further, the plate transporting mechanism of the present invention is also suitable for withdrawing a latent electrostatic image-bearing xerographic plate from the cassette after xeroradiographic exposure and for transporting it to a device for lowering the xerographic plate onto a powder cloud development chamber, and is also suitable for transporting a xerographic powder image-bearing xerographic plate from the top of the development chamber, after xerographic development, to a transfer station and for transporting the xerographic plate, after the xerographic powder image has been transferred therefrom, through a xerographic plate cleaning station and into a storage box. After the desired number of plates have been returned to the storage box, it is withdrawn from its input station in the printer unit and manually transported to its input station in the charging unit, as shown, for example, in FIG. **1**, where the cycle described above is repeated with subsequently withdrawn xerographic plates.

It should be understood that the present invention has been described with reference to one specific embodiment of the invention and that other equivalent embodiments are presently contemplated. For example, the plate engaging pawls can be supported by individual supports as opposed to bar **66**, and can be positioned adjacent the top or middle of the shuttle plate, as opposed to the bottom thereof as shown in FIGS. **2–5**. In such configurations, and depending upon the clearances, etc. available, the means by which the shuttle plates are secured to the side frames of the processing unit may be raised or lowered, in conjunction with the raising or lowering of the vertical slot and the drive chains, etc. Additionally, the positioner means can be eliminated if desired; the outer portions of the pawls can be placed at the same horizontal level to contact the same camming surface in a particular terminal position while the adjacent positioner means contacts a different camming surface; and/or one or more of the shuttle plates can support shaped cam means to cause other components of the xerographic processing system to synchronously function as they are contacted by the shuttle plate-supported cam means during transportation of a xerographic plate between two terminal positions.

While the invention has been described with reference to a specific embodiment thereof, it will be understood by those skilled in the art that various changes in form and detail may be made without departing from the true spirit and scope of the invention. Accordingly, all substitutions, additions, and/or modifications of the present invention, or to which the present invention is readily susceptible without departing from the true spirit and scope of this disclosure, are considered part of the present invention.

WHAT IS CLAIMED IS:

1. A mechanism for transporting an article in a first direction along a horizontal path, said mechanism comprising at least one shuttle plate, each shuttle plate having a slot therein, each slot having spaced ends connected together by an elongated passageway, at least one sprocket wheel at each of two terminal positions, endless drive chain means passing around an engaging said sprocket wheels, means for driving said chain means in one direction only, a pin securely mounted on each endless drive chain associated with said drive chain means, each pin extending into the slot in a shuttle plate adjacent thereto whereby, in each terminal position, each pin engages the periphery of one of said sprocket wheels therein and is caused to move lengthwise within the slot whereby unidirectional motion of the endless drive chain means is smoothly translated into receiprocating, two-directional movement of the plate transport mechanism along a single horizontal plane between the two terminal positions, means supported by each shuttle plate for engaging the article at the first of the two terminal positions and to support the article as the article is transported to the second of the two terminal positions, and means for causing the article-engaging means to become disengaged from the article at the second terminal position.

2. A mechanism for transporting an article in a first direction along a horizontal path, said mechanism comprising a pair of opposed, shuttle plates having vertical portions between which the article is supported as it is transported from a first terminal position to a second terminal position, each of said shuttle plates having a

slot therein, each of said slots having spaced ends connected together by an elongated passageway, sprocket wheels at each of the two terminal positions, endless drive chain means passing around the engaging said sprocket wheels, means for driving said drive chain means in one direction only, a pin securely mounted on each endless drive chain associated with said drive chain means, each of said pins extending into the slot in a shuttle plate adjacent thereto whereby, in each terminal position, the pins engage the periphery of the adjacent sprocket wheels and are caused to move lengthwise within the slots whereby unidirectional motion of the endless drive chain means is smoothly translated into reciprocating, two-directional movement of the plate transport mechanism along a single horizontal plane between the two terminal positions, means supported by each of said shuttle plates for engaging the article at the first terminal position and to support the article as the article is transported to the second terminal position, and means for causing the article-engaging means to become disengaged from the article at the second terminal position.

3. A mechanism for transporting an article in a first direction along a horizontal path, said mechanism comprising a pair of opposed, shuttle plates having vertical portions between which the article is supported as it is transported from a first terminal position to a second terminal position, each of said shuttle plates having a slot therein, each of said slots having spaced ends connected together by an elongated passageway, sprocket wheels at each of the two terminal positions, endless drive chain means passing around and engaging said sprocket wheels, means for driving said drive chain means in one direction only, a pin securely mounted on each endless drive chain associated with said drive chain means, each of said pins extending into the slot in a shuttle plate adjacent thereto whereby, in each terminal position, the pins engage the periphery of the adjacent sprocket wheels and are caused to move lengthwise within the slots whereby unidirectional motion of the endless drive chain means is smoothly translated into reciprocating, two-directional movement of the plate transport mechanism along a single horizontal plane between the two terminal positions, means supported by each of said shuttle plates for engaging the article at the first terminal position and to support the article as the article is transported to the second terminal position, and means for causing the article-engaging means to become disengaged from the article at the second terminal position, said article-engaging means comprising a pair of pawls pivotally mounted on each shuttle plate, each pawl passing through a corresponding horizontal slot in the adjacent shuttle plate such that a portion of each pawl is on the opposite side of the shuttle plate from the area between the plates where the article is carried during transportation.

4. The mechanism of claim 3, wherein said means for causing said article engaging means to become disengaged from the article comprise cam means which contact those portions of said pawls on the opposite side of the shuttle plate from the area between the shuttle plates.

5. A mechanism for transporting an article in a first direction along a horizontal path, said mechanism comprising a pair of opposed, shuttle plates having vertical portions between which the article is supported as it is transported from a first terminal position to a second terminal position, each of said shuttle plates having a slot therein, each of said slots having spaced ends connected together by an elongated passageway, sprocket wheels at each of the two terminal positions, endless driven chain means passing around and engaging said sprocket wheels, means for driving said drive chain means in one direction only, a pin securely mounted on each endless drive chain associated with said drive chain means, each of said pins extending into the slot in a shuttle plate adjacent thereto whereby, in each terminal position, the pins engage the periphery of the adjacent sprocket wheels and are caused to move lengthwise within the slots whereby unidirectional motion of the endless drive chain means is smoothly translated into reciprocating, two-directional movement of the plate transport mechanism along a single horizontal plane between the two terminal positions, means supported by each of said shuttle plates for engaging the article at the first terminal position and to support the article as the article is transported to the second terminal position, and means for causing the article-engaging means to become disengaged from the article at the second terminal position, said article-engaging means comprising a pair of pawls pivotally mounted on each shuttle plate, the pawls being spring-loaded so they will extend into the area between the shuttle plates at an acute angle to the direction of article travel between said first and second terminal positions.

6. A mechanism for transporting an article in a first direction along a horizontal path, said mechanism comprising a pair of opposed, shuttle plates having vertical portions between which the article is supported as it is transported from a first terminal position to a second terminal position, each of said shuttle plates having a slot therein, each of said slots having spaced ends connected together by an elongated passageway, sprocket wheels at each of the two terminal positions, endless drive chain means passing around and engaging said sprocket wheels, means for driving said drive chain means in one direction only, a pin securely mounted on each endless drive chain associated with said drive chain means, each of said pins extending into the slot in a shuttle plate adjacent thereto whereby, in each terminal position, the pins engage the periphery of the adjacent sprocket wheels and are caused to move lengthwise within the slots whereby unidirectional motion of the endless drive chain means is smoothly translated into reciprocating, two-directional movement of the plate transport mechanism along a single horizontal plane between the two terminal positions, means supported by each of said shuttle plates for engaging the article at the first terminal position and to support the article as the article is transported to the second terminal position, and cam means for causing the article-engaging means to become disengaged from the article at the second terminal position.

7. The mechanism of claim 6, wherein said cam means are stationary.

8. A mechanism for transporting an article in a first direction along a horizontal path, said mechanism comprising a pair of opposed, shuttle plates having vertical portions between which the article is supported as it is transported from a first terminal position to a second

terminal position, each of said shuttle plates having a slot therein, each of said slots having spaced ends connected together by an elongated passageway, sprocket wheels at each of the two terminal positions, endless drive chain means passing around and engaging said sprocket wheels, means for driving said drive chain means in one direction only, a pin securely mounted on each endless drive chain associated with said drive chain means, each of said pins extending into the slot in a shuttle plate adjacent thereto whereby, in each terminal position, the pins engage the periphery of the adjacent sprocket wheels and are caused to move lengthwise within the slots whereby unidirectional motion of the endless drive chain means is smoothly translated into reciprocating, two-directional movement of the plate transport mechanism along a single horizontal plane between the two terminal positions, means supported by each of said shuttle plates for engaging the article at the first terminal position and to support the article as the article is transported to the second terminal position, and means for causing the article-engaging means to become disengaged from the article at the second terminal position, said article-engaging means comprising a pair of pawls pivotally mounted on each shuttle plate, said means for causing said pawls to become disengaged from the article comprising a first pair and a second pair of cam means, said first pair of cam means disengaging the pawls most closely adjacent the leading edge of the article and said second pair of cam means disengaging the pawls most closely adjacent the trailing edge of the article.

9. The mechanism of claim 8, wherein said first and said second pairs of cam means are so positioned that the pawls most closely adjacent the leading edge of the article are disengaged by said first pair of cam means before the pawls associated with the trailing edge of the article are disengaged by said second pair of cam means.

10. A mechanism for transporting an article in a first direction along a horizontal path, said mechanism comprising a pair of opposed, shuttle plates having vertical portions between which the article is supported as it is transported from a first terminal position to a second terminal position, each of said shuttle plates having a slot therein, each of said slots having spaced ends connected together by an elongated passageway, sprocket wheels at each of the two terminal positions, endless drive chain means passing around and engaging said sprocket wheels, means for driving said drive chain means in one direction only, a pin securely mounted on each endless drive chain associated with said drive chain means, each of said pins extending into the slot in a shuttle plate adjacent thereto whereby, in each terminal position, the pins engage the periphery of the adjacent sprocket wheels and are caused to move lengthwise within the slots whereby unidirectional motion of the endless drive chain means is smoothly translated into reciprocating, two-directional movement of the plate transport mechanism along a single horizontal plane between the two terminal positions, means supported by each of said shuttle plates for engaging the article at the first terminal position and to support the article as the article is transported to the second terminal position, means for causing the article-engaging means to become disengaged from the article at the second terminal position, spring-loaded positioner means mounted on at least one of said shuttle plates, and cam means positioned adjacent the second terminal position for rotating said positioner means into contact with the trailing edge of the article being transported whereby, after the pawls adjacent the trailing edge of the article are disengaged therefrom, further movement of the shuttle plates into the second terminal position cause said positioner means to urge the article further into the second terminal position.

11. A mechanism for transporting an article in a first direction along a horizontal path, said mechanism comprising a pair of opposed, shuttle plates having vertical portions between which the article is supported as it is transported from a first terminal position to a second terminal position, each of said shuttle plates having a slot therein, each of said slots having spaced ends connected together by an elongated passageway, sprocket wheels at each of the two terminal positions, endless drive chain means passing around and engaging said sprocket wheels, means for driving said drive chain means in one direction only, a pin securely mounted on each endless drive chain associated with said drive chain means, each of said pins extending into the slot in a shuttle plate adjacent thereto whereby, in each terminal position, the pins engage the periphery of the adjacent sprocket wheels and are caused to move lengthwise within the slots whereby unidirectional motion of the endless drive chain means is smoothly translated into reciprocating, two-directional movement of the plate transport mechanism along a single horizontal plane between the two terminal positions, means supported by each of said shuttle plates for engaging the article at the first terminal position and to support the article as the article is transported to the second terminal position, means for causing the article-engaging means to become disengaged from the article at the second terminal position, and cam follower means for synchronizing the horizontal movement of the plate transporting mechanism with means for lowering the article in the second terminal position.

12. The mechanism of claim 11, wherein each cam follower means is mounted adjacent the edge of one of said shuttle plates most closely adjacent the second terminal position.

13. A mechanism for transporting an article in a first direction along a horizontal path, said mechanism comprising a pair of opposed, shuttle plates having vertical portions between which the article is supported as it is transported from a first terminal position to a second terminal position, each of said shuttle plates having a slot therein, each of said slots having spaced ends connected together by an elongated passageway, sprocket wheels at each of the two terminal positions, endless drive chain means passing around and engaging said sprocket wheels, means for driving said drive chain means in one direction only, a pin securely mounted on each endless drive chain associated with said drive chain means, each of said pins extending into the slot in a shuttle plate adjacent thereto whereby, in each terminal position, the pins engage the periphery of the adjacent sprocket wheels and are caused to move lengthwise within the slots whereby undirectional motion of the endless drive chain means is smoothly translated into reciprocating, two-directional movement of

the plate transport mechanism along a single horizontal plane between the two terminal positions, means supported by each of said shuttle plates for engaging the article at the first terminal position and to support the article as the article is transported to the second terminal position, means for causing the article-engaging means to become disengaged from the article at the second terminal position, a frame, a pair of stationary members supported by said frame on opposite sides of the horizontal path between the two terminal positions, a first pair of movable members, one of said movable members being supported by each of said stationary members, a second pair of movable members, one of said opposed shuttle plates being securely mounted on each of said second movable members, and a plurality of ball bearings supported between adjacent ones of said first and second movable members, each of said second pair of movable members sliding in contact with said ball bearings as said opposed shuttle plates move between the two terminal positions.

14. A mechanism for transporting an article in a first direction along a horizontal path, said mechanism comprising a pair of opposed, shuttle plates having vertical portions between which the article is supported as it is transported from a first terminal position to a second terminal position, each of said shuttle plates having a slot therein, each of said slots having spaced ends connected together by an elongated passageway, sprocket wheels at each of the two terminal positions, endless drive chain means passing around and engaging said sprocket wheels, means for driving said drive chain means in one direction only, a pin securely mounted on each endless drive chain associated with said drive chain means, each of said pins extending into the slot in a shuttle plate adjacent thereto whereby, in each terminal position, the pins engage the periphery of the adjacent sprocket wheels and are caused to move lengthwise within the slots whereby unidirectional motion of the endless drive chain means is smoothly translated into reciprocating, two-directional movement of the plate transport mechanism along a single horizontal plane between the two terminal positions, means supported by each of said shuttle plates for engaging the article at the first terminal position and to support the article as the article is transported to the second terminal position, means for causing the article-engaging means to become disengaged from the article at the second terminal position, and a xerographic plate having side rails secured to opposite edge portions thereof, said side rails having a plurality of recesses therein, said article engaging means entering into said recesses for supporting said xerographic plate as it is being transported between the two terminal positions.

15. A mechanism for transporting an article in a first direction along a horizontal path, said mechanism comprising a pair of opposed, shuttle plates having vertical portions between which the article is supported as it is transported from a first terminal position to a second terminal position, each of said shuttle plates having a slot therein, each of said slots having spaced ends connected together by an elongated passageway, sprocket wheels at each of the two terminal positions, endless drive chain means passing around and engaging said sprocket wheels, means for driving said drive chain means in one direction only, a pin securely mounted on each endless drive chain associated with said drive chain means, each of said pins extending into the slot in a shuttle plate adjacent thereto whereby, in each terminal position, the pins engage the periphery of the adjacent sprocket wheels and are caused to move lengthwise within the slots whereby unidirectional motion of the endless drive chain means is smoothly translated into reciprocating, two-directional movement of the plate transport mechanism along a single horizontal plane between the two terminal positions, means supported by each of said shuttle plates for engaging the article at the first terminal position and to support the article as the article is transported to the second terminal position, means for causing the article-engaging means to become disengaged from the article at the second terminal position, and a xerographic plate having side rails having a plurality of recesses therein, said article engaging means slightly overrunning the xerographic plate as the plate is being held stationary in the first terminal position and, after reversal of the direction of travel of the shuttle plates, said article-engaging means becomes operative and rotates into the recesses in the side rails of the xerographic plate whereby, upon continued movement of the transporting mechanism, the xerographic plate is removed from the first terminal position and transported in a direction toward the second terminal position.

16. A mechanism for transporting an article in a first direction along a horizontal path, said mechanism comprising a pair of opposed, shuttle plates having vertical portions between which the article is supported as it is transported from a first terminal position to a second terminal position, each of said shuttle plates having a slot therein, each of said slots having spaced ends connected together by an elongated passageway, sprocket wheels at each of the two terminal positions, endless driven chain means passing around and engaging said sprocket wheels, means for driving said drive chain means in one direction only, a pin securely mounted on each endless drive chain associated with said drive chain means, each of said pins extending into the slot in a shuttle plate adjacent thereto whereby, in each terminal position, the pins engage the periphery of the adjacent sprocket wheels and are caused to move lengthwise within the slots whereby unidirectional motion of the endless drive chain means is smoothly translated into reciprocating, two-directional movement of the plate transport mechanism along a single horizontal plane between the two terminal positions, means supported by each of said shuttle plates for engaging the article at the first terminal position and to support the article as the article is transported to the second terminal position, means for causing the article-engaging means to become disengaged from the article at the second terminal position, and shaped cam means supported by at least one of said shuttle plates, said shaped cam means synchronizing the movement of said mechanism with the operation of means external thereto.

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