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Jordon et al.

[11] **3,818,391**

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[54] **TRACKING ASSEMBLY FOR AN ENDLESS BELT ELECTROSTATOGRAPHIC MACHINE**

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

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[52] **U.S. Cl.** ..... **355/3 R**, 355/16, 198/202, 226/23

[51] **Int. Cl.** **G03g 15/00**, B65g 15/62

[58] **Field of Search** 355/16, 3; 198/202; 226/21, 22, 23, 199

[56] **References Cited**

UNITED STATES PATENTS

3,621,987 11/1971 Sherwood 198/202

3,646,866 3/1972 Baltazzi et al. 355/16

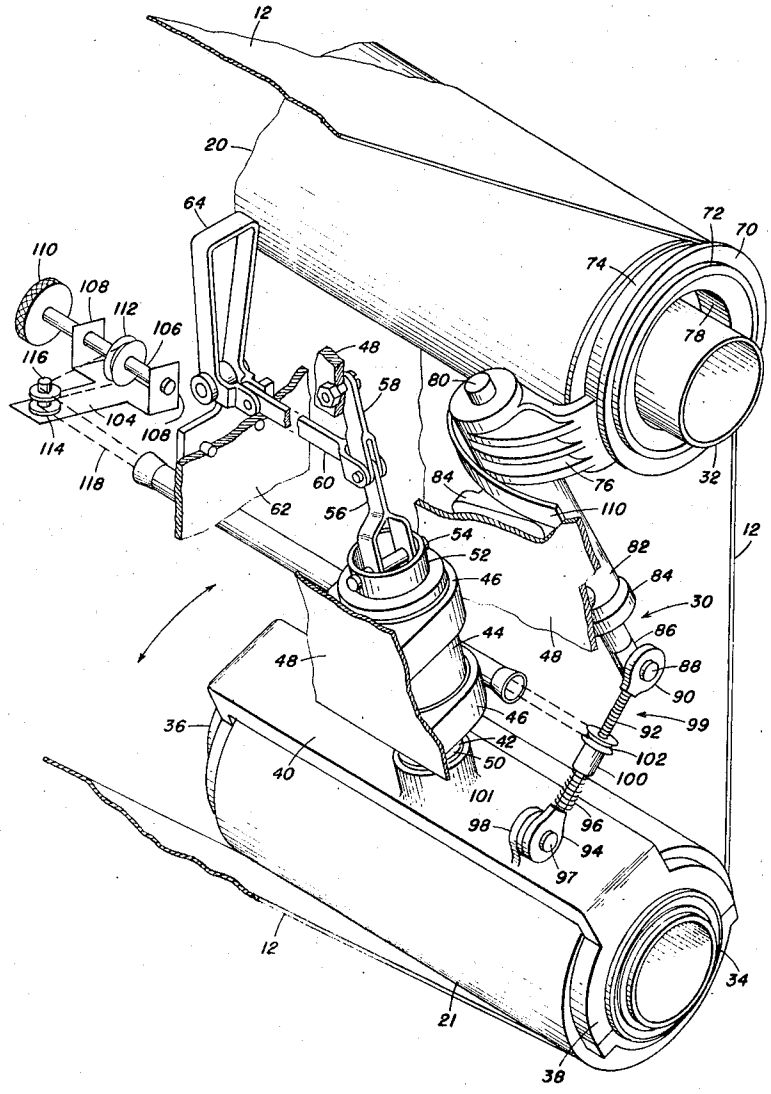
Primary Examiner—Robert P. Greiner

Attorney, Agent, or Firm—Earl T. Reichert

[57] **ABSTRACT**

A tracking assembly for an endless belt assembly of an electrostatograph machine is disclosed comprised of a rotatable yoke assembly having a tracking roller rotatably mounted thereon, and tracking linkage assembly operatively connected to the yoke assembly. Alteration of the linkage setting of the linkage assembly causes the yoke assembly to rotate in either direction on an axis which is in the bisector plane and normal to the roller shaft thereby causing said endless photoconductive belt to be realigned about the belt assembly.

4 Claims, 2 Drawing Figures



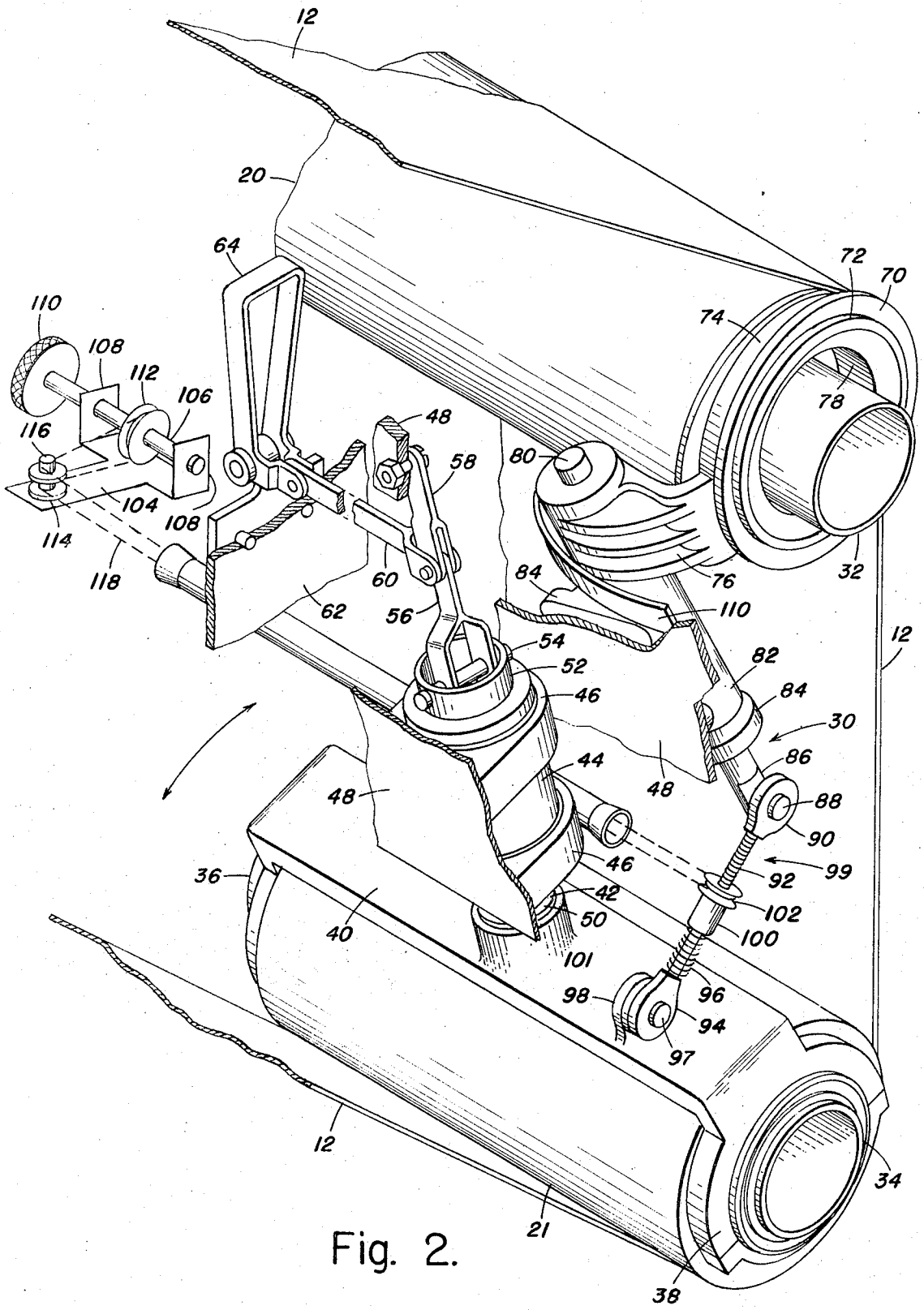

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Fig. 2.

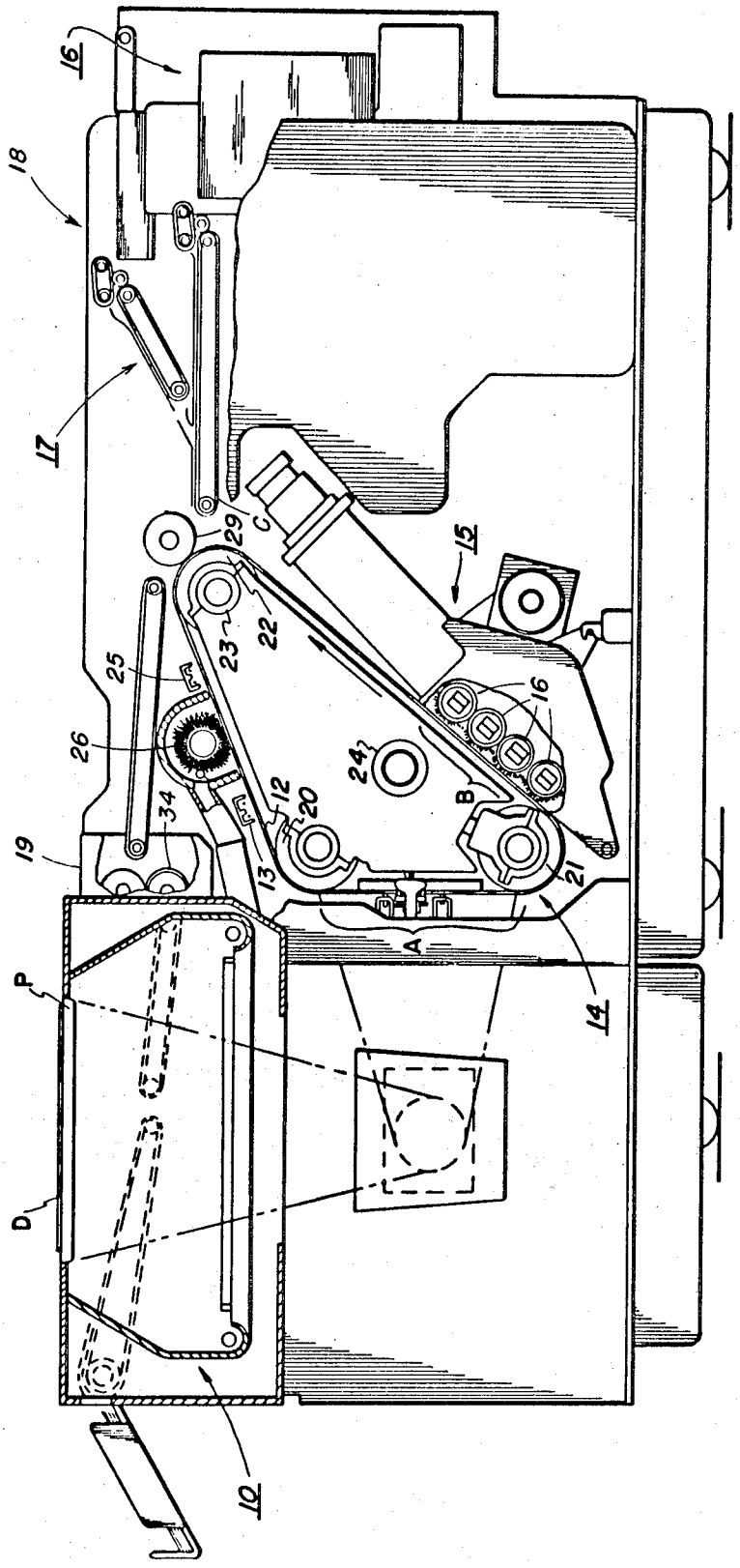

FIG. 1

TRACKING ASSEMBLY FOR AN ENDLESS BELT ELECTROSTATOGRAPHIC MACHINE

BACKGROUND OF THE INVENTION

This invention relates to electrostatography, and more particularly to improvements in a belt tracking system for an endless photoconductor belt. The tracking system in accordance with the present invention is particularly adapted for use with selenium belts for automatic copies/reproducers which are constructed for high speed operation and capable of having their timing sequence varied thereby permitting variable speeds of output.

In the practice of xerography as described in U.S. Pat. No. 2,297,691 to Chester F. Carlson, a xerographic surface comprising a layer of photoconductive insulating material affixed to a conductive backing is used to support electrostatic images. In the usual method of carrying out the process, the xerographic plate is electrostatically charged uniformly over its surface and then exposed to a light pattern of the image being reproduced to thereby discharge the charge in the areas where light strikes the layer. The undischarged areas of the layer thus form an electrostatic charge pattern in conformity with the configuration of the original light pattern.

The latent electrostatic image may then be developed by contacting it with a finely divided electrostatically attractable material, such as a resinous powder. The powder is held in the image areas by the electrostatic fields on the layer. Where the field is greatest, the greatest amount of material is deposited; and where the field is least, little or no material is deposited. Thus, a powder image is produced in conformity with the light image of the copy being reproduced. The powder is subsequently transferred to a sheet of paper or other surface and suitably fixed to thereby form a permanent print.

The latest machine concept for copiers utilizes high speed flash exposure of a document and the arrangement of a moving photoconductor material in the form of an endless belt including the continuously charging thereof together with provisions for solid coverage.

Photoconductor belts are very delicate, are easily damaged, and the movement thereof through processing stations in the reproduction machine must be accomplished with high precision and with as little irregular movement as possible. Additionally, should the tracking of the photoconductive belt become irregular and uncorrectable, the machine must be placed in an inoperative mode as quickly as possible to prevent irreparable damage to the photoconductive belt as well as the machine.

OBJECTS OF THE INVENTION

An object of the present invention is to provide a novel tracking assembly for a photoconductive belt positioned on a belt assembly of an electrostatographic machine.

Another object of the present invention is to provide a novel tracking assembly for a photoconductive belt positioned on a belt assembly whereby the tracking thereof may be manually adjusted.

Still another object of the present invention is to provide a novel tracking assembly to insure lateral stability of a photoconductive belt positioned on a belt assembly.

SUMMARY OF THE INVENTION

These and other objects of the invention are obtained by a tracking assembly for an endless belt assembly of an electrostatograph machine including a rotatable yoke assembly having a tracking roller rotatably mounted thereon, and a tracking linkage assembly operatively connected to the yoke assembly. Alteration of the linkage setting of the linkage assembly causes the yoke assembly to rotate in either direction on an axis which is in the bisector plane and normal to the roller shaft thereby causing said endless photoconductive belt to be re-aligned about the belt assembly.

DESCRIPTION OF THE DRAWINGS

A better understanding of the present invention as well as other objects and further features thereof will become apparent upon consideration of the following detailed disclosure thereof, especially when taken with the accompanying drawings, wherein like numerals designate like parts throughout, and wherein.

FIG. **1** is a schematic sectional view of an electrostatic reproduction machine embodying the principles of the invention; and

FIG. **2** is an isometric view of a portion of the belt assembly as seen from the other side of the machine of FIG. **1.**

For a general understanding of the illustrated copier reproduction machine in which the invention may be incorporated, reference is had to FIG. **1** in which the various system components for the machine are schematically illustrated. A document to be copied is placed upon a transparent support platen P fixedly arranged in an illumination assembly, generally indicated by the reference numeral **10,** positioned at the left end of the machine. Light rays from an illumination system are flashed upon the document to produce image rays corresponding to the informational areas. The image rays are projected by means of an optical system onto the photosensitive surface of a xerographic plate in the form of a flexible photoconductive belt **12** arranged on a belt assembly, generally indicated by the reference numeral **14.**

The belt is comprised of a photoconductive layer of selenium which is the light receiving surface and imaging medium for the apparatus formed on a conductive backing. The surface of the photoconductive belt is made photosensitive by a previous step of uniformly charging the same by means of a corona generating device or corotron **13.**

The belt is journaled for continuous movement upon three rollers **20, 21** and **22** positioned with their axes in parallel. The photoconductive belt assembly **14** is slidably mounted upon two support shafts **23** and **24** with the roller **22** rotatably supported on the shaft **23** which is secured to the frame of the apparatus and is rotatably driven by a suitable motor and drive assembly (not shown) in the direction of the arrow at a constant rate. During exposure of the belt **12,** the portion exposed is that portion of the belt running between rollers **20** and **21.** During movement of the belt **12** the reflected light image of the original document positioned on the platen on the surface of the belt to produce an electrostatic latent image thereon at exposure station A.

As the belt surface continues its movement, the electrostatic image is passed through a developing station B in which there is positioned a developer assembly, generally indicated by the reference numeral **15,** and which effects development of the electrostatic image by means of multiple magnetic brushes **16** as the image moves through the development zone.

The developed electrostatic image is transported by the belt to a transfer station C whereat a sheet of copy paper is moved between a transfer roller of transport roller assembly **29** and the belt at a speed in synchronism with the moving belt in order to accomplish transfer of the developed image by an electrical bias on the transfer roller. There is provided at this station a sheet transport mechanism, generally indicated at **17,** adapted to transport sheets of paper from a paper handling mechanism, generally indicated by the reference numeral **18,** to the developed image on the belt at the station C.

After the sheet is stripped from the belt **12,** it is conveyed into a fuser assembly, generally indicated by **19,** wherein the developed and transferred xerographic powder image on the sheet material is permanently fixed thereto. After fusing, the finished copy is discharged from the apparatus at a suitable point for collection externally of the apparatus. The toner particles remaining as residue on the developed image, background particles and those particles otherwise not transferred are carried by the belt **12** to a clearing apparatus **26** positioned on a course of the belt between rollers **20** and **22** adjacent to charge device **25.**

Further details regarding the structure of the belt assembly **14** and its relationship with the machine and support therefor may be found in the copending Application Ser. No. 102,312 assigned to the same assignee.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to FIG. **2,** there is illustrated a tracking assembly, generally indicated as **30** including the upper roller **20** and the tracking roller **21.** The upper roller **20** is rotatably supported on a hollow shaft **32** journaled for rotation in bearings disposed in side plates (not shown) such as described in corresponding application Ser. No. 102,311 to David Roth Stokes, et al. entitled BELT TRACKING SYSTEM, assigned to the same assignee now U.S. Pat. No. 3,702,131. The tracking roller **21** is secured to a shaft **34** journaled for rotation in bearings (not shown) secured to the ends of parallel legs **36** and **38** of a yoke member **40.**

At the mid point of the yoke member **40** and extending in an opposite direction relative to the legs **36** and **38,** there is provided a shaft, generally indicated as **42,** to support the yoke member **40** for limited rotational movement about the axis of the shaft **42** and to permit slight retraction. The shaft **42** is positioned within a cylinder **44** of relatively large diameter disposed within spaced bearings **46** mounted to a frame **48** and having a coaxial reduced portion **50** secured to the lower portion of the cylinder **44** and disposed within a suitable opening, formed in the blight portion of the yoke member **40.** A relatively heavy coil spring encircles the portion **50** between the yoke member **40** and the lower surface of the lower bearing **46.** The spring **52** imparts a continuous downward force upon the yoke and consequently the roller **21,** when the belt **12** is mounted on its supporting rollers thereby placing belt **12** under slight tension during operation. The structural connection between the yoke member and the portion **50** is slightly loose to allow for limited play between these parts to correct for circumferential variations in manufactured belts.

The upper portion of the cylinder **44** is formed with a tubular sleeve **52** axially aligned therewith. Suitable openings are formed in the sleeve **52** in diametrically opposed positions for supporting a pin **54** which is pivotally connected to one end of a toggle link **56** to the end of the cylinder. The link **56** is pivotally connected at the other end to one end of another toggle link **58** having its opposite end pivotally connected to the frame structure **48.** It will be apparent that the toggle links **56** and **58** and their respective connections form a toggle assembly which when actuated into alignment will cause the cylinder **44** to move downwardly within the bearing **46** and when actuated into a buckled condition will cause the cylinder **44** to be retracted upwardly.

Actuation of the toggle assembly is produced by a drive link **60** which is pivotally connected at one end to the pivot connection between toggle links **56** and **58** extending transverse of the belt assembly **30** through an outer wall **62** and terminating in a pivotal handle **64** which moves drive link **60** axially to actuate toggle links **56** and **58.** In order to remove or to replace a belt photoconductive **12,** the handle **64** is suitably moved to cause buckling of the toggle links **56** and **58** which action draws the cylinder **42** upwardly within the bearings **46** to retract the roller **21.** Sufficient slack is thereby provided to the belt **12** to permit an operator to move a belt relatively easily over the rollers **20, 21** and **22.** After placing a belt over the rollers the handle **64** is moved in an opposite direction to place the toggle links **56** and **58** in an aligned condition thereby forcing the roller **21** against the belt **12** and locking the roller **21** in such position.

A flat sensing ring **70** is mounted for rotation about a bearing **72** disposed on a support plate **74** having a diameter smaller than roller **20** and provided with a curved arm **76.** The sensing ring **70** is preferably made of wear-resistant plastic material which will not become damaged when placed in contact with the relatively sharp edge of the photoconductive belt **12,** and which will not cause fraying or other damage to the coacting edge of the belt **12.** The support plate **74** is provided with a central opening **78** which allows the assembled structure comprising ring **70,** bearing **72** and the plate **74** to accommodate and avoid the adjacent end of the shaft **32** and allow the ring **70** to engage the edge of the belt **12.**

The curved arm **76** of the support plate **74** is provided with an orifice which fixedly receives the upper portion of an inclined shaft **80** mounted for rotation about its longitudinal axis within a fixed cylindrical casting **82** mounted by a spaced bracket **84** to the frame structure **8,** such as by screws (not shown). Suitable bearings (not shown) are utilized within the casting **82** between the same and the shaft **80** in order to facilitate the rotating relationship therebetween. The lower end of the shaft **80** is formed with a reduced portion to which is attached an arm **88** extending perpendicularly relative to the axis of the shaft **80** to swing in either direction upon corresponding rotational movement of the shaft **80.**

The arm **88** is pivotally connected to a link member **90** **112** including an externally threaded portion **92.** Another link member **94** including an externally threaded portion **96** is secured to an arm **97** of ear **98** formed on the upper portion of the yoke member **40.** A cylindrically shaped sleeve **100** including a sprocket **102** threadably engages the threaded portions **92** and **96** of each of the link members **90** and **94,** respectively, thereby providing a turnbuckle assembly, generally indicated as **99,** for altering the distance between the axis of the roller **21** and the axis of the shaft **80** by rotation of the sleeve **100,** as more fully hereinafter described.

A spring **101** is provided over the threaded portion **96** of the member **94** between the sleeve **100** and the end of link member **96** to prevent the unintentional rotation of the sleeve **100,** such as by vibrations. A support assembly **104** is mounted to the frame (not shown) and receives for rotation, a shaft **106** disposed within an opening formed in upturned legs **108** of the support assembly **104.** A dial **110** is fixedly secured to an end of the shaft **106** extending outwardly from the frame. A sprocket **112** is fixedly secured to to a mid portion of the shaft **106** between the legs **108** thereof.

A shoulder bearing assembly **114** is positioned over a shaft **116** mounted on the support assembly **104.** An endless chain **118** is positioned about the sprocket **112** disposed on the shaft **106,** the shouldered bearing assembly **114,** and about the sprocket **102** formed on the sleeve **100.** A tubular member is provided between the shoulder bearing means **114** and the sprocket **102** to guide the chain **118** between the shouldered bearing assembly **114** and the sprocket **102.** It will be readily appreciated that rotation of the dial **110** in either direction will cause the sleeve **100** to rotate thereby varying the distance between the center lines of the arms **88** and **97.**

Minor variations of the tracking of a photoconductive belt **12** about the belt assembly **30** is corrected in the manner described in the aforementioned application Ser. No. 102,311. Thus, movement of the sensing ring **70** in either direction, as shown by the arrows in FIG. **2,** will cause the shaft **80** to rotate about its axis since the shaft is fixedly secured to the arm **76** of the support plate assembly **74.** The corresponding rotation of the shaft **80** will impart a swinging movement to the turnbuckle assembly **99** thereby rotating yoke member **40** about the shaft portion **50** for producing the same motion on the tracking roller **21.** Movement of the sensing ring **70** in either direction will result in the rotation of tracking roller **21** in either direction and thereby causing tracking of the belt **12** in a direction opposite that in which the sensing ring movement occurs when the edge of the belt **12** deviates from a pre-determined portion relative to the guide roller **20.**

For accurate alignment and positioning of electrostatic latent images and then corresponding developed images with respect to the processing stations of the printing machine, it is necessary that the photoreceptor belt maintain a constant and predictable path of movement.

In the event the belt deviates from a prescribed path of movement, say in a direction to the right as viewed in FIG. **2,** the edge of the belt **12** being in engagement with the surface of the sensing ring **70** will cause corresponding movement thereof about the shaft **80,** also to the right. The amount and rate of the movement of the ring **70** is consonant with the amount and rate of deviation of the belt **12.** As described above, with the sensing ring being moved in this manner, the tracking roller **21** will be rotated clockwise to cause a counter tracking of the belt to restore the belt **12** to its original path of movement. It is understood that mistracking to the right would be caused by greater forces being exerted on the under surface of the belt **12** by the rollers about the ends thereof on the side of the sensing ring, and that in order to correct such situation a counter force must be applied to the under surface of the belt **12** on the other side thereof.

Deviation of the belt **12** in the other direction will cause the tracking roller **21** to rotate in a direction which will stop the deviation of the belt **12** and to return it to its predetermined path. A light leaf spring **120** having one end secured to the arm **76** and its other end maintained under slight tension against the frame **48** provides a slight force upon the ring **70** in a direction toward the sensed edge of the belt in order to overcome the frictional forces in the sensing mechanism and to insure that the ring **70** will follow the end thereof.

The sensing arrangement described above provides for correction of belt deviation in either direction by positively actuating countermeasures in either direction, and to accomplish such correction by sensing only one edge of the belt **12.** There is also no need for using two belt sensing mechanisms, one for each belt edge. In addition, the sensing of belt deviation is accomplished at one roller and the actual tracking is produced at another roller, the next roller positioned downstream of belt movement. In this manner, the time lag for correction of belt deviation is almost nil with only a portion of the belt experiencing a deviation. There is no need for a full circumferential movement of the belt before correction is imposed, as is the case wherein sensing and correction occurs at the same roller.

It will be appreciated that a replacement belt may be formed with a minor variation in the circumference thereof as compared with the photoconductive belt being replaced. Such a variation in circumference would result in mistracking and require excessive trial and error adjustment but may be readily compensated for by adjustment of the turnbuckle assembly **99** of the present invention as more fully hereinafter discussed.

If a new photoconductive belt is placed on the belt assembly **14** which results in a deviation not compensatable by the sensing and control mechanism hereinabove described, the deviation may be corrected by rotation of the dial **110** to adjust the distance between the link members **90** and **94** which results in the slight adjustment rotation of the tracking roller **21.** Thus, the photoconductive belt **12** tracked to the right, as seen in FIG. **2,** the dial **110** would be rotated thereby moving the chain clockwise about the sprockets **112** and **102** to cause the sleeve to rotate clockwise. Such clockwise rotation of the sleeve **100** will increase the distance between link members **94** and **90** resulting in a slight clockwise rotation of said tracking roller **21** about the shaft **50.**

Consequently, with the turnbuckle assembly **99** including the drive assembly therefor of the present invention, variations in the circumference of successive photoconductive belts may be readily corrected to pro-

vide for the proper tracking of of such replacement belts.

While the invention has been described in connection with a preferred embodiment thereof, it will be understood that many modifications will be apparent to those of ordinary skill in the art; and that this application is intended to cover any adaptations of variations thereof. Therefore, it is manifestly intended that this invention be only limited by the claims and the equivalents thereof.

What is claimed:

1. An improved electrostatographic machine having a frame, the improvement comprising:

a. a roller assembly disposed on the frame and having a plurality of rollers adapted to support and guide an endless belt having a photosensitive area thereon;

b. means for sensing lateral deviations in the coursing of the belt as the latter is passing over a first of the rollers;

c. means mechanically connecting the sensing means to a second of the rollers so as to cause the second roller to rotate about an axis in response to deviations of the belt; and

d. means for adjusting the mechanical connecting means so as to vary the normal setting of the second roller with respect to said axis.

2. An improved electrostatographic machine having a frame, the improvement comprising:

a. a roller assembly disposed on the frame and having a plurality of rollers adapted to support and guide an endless belt having a photosensitive area thereon; and

b. sensing means disposed at an end of a first of the rollers for sensing lateral deviations of the belt, means connecting the sensing means to a second of the rollers so as to cause the second roller to rotate about an axis in response to deviations of the belt, and means for adjusting the length of the connecting means so as to vary the normal setting of the second roller with respect to said axis.

3. An improved electrostatographic machine according to claim **2** wherein the connecting means is comprised of two threaded sections threadably engaged to opposite ends of a sleeve.

4. An improved electrostatographic machine according to claim **3** which further includes an endless belt means in engagement with the exterior surface of the sleeve, and means for causing the endless belt means to rotate.

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