

[54] **WEB TRACKING SYSTEM**

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[51] Int. Cl. **G03g 15/00, F16h 7/18, B21b 31/32**

[58] Field of Search **355/16, 3; 198/202, 198/184; 226/15, 191; 29/113 R; 74/240, 241, 242, 229; 26/63**

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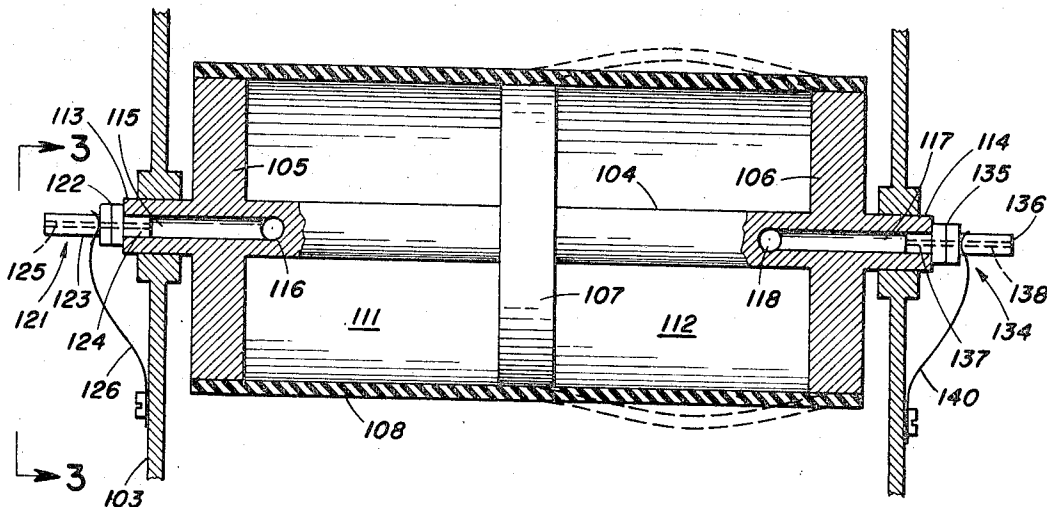
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[57] **ABSTRACT**

A steering roll for a web or belt having two axial chambers and an elastomeric surface on which the web or belt is supported. Fluid pressure is selectively applied through a fluid circuit including fluid amplifiers to the two chambers in response to movement of the web from a predetermined path to cause relative movement between the axial ends of the elastomeric material, thereby tilting the surface of the roll to correct the web alignment. The steering roll can be used to support a recording belt in an electrostatographic apparatus.

10 Claims, 5 Drawing Figures



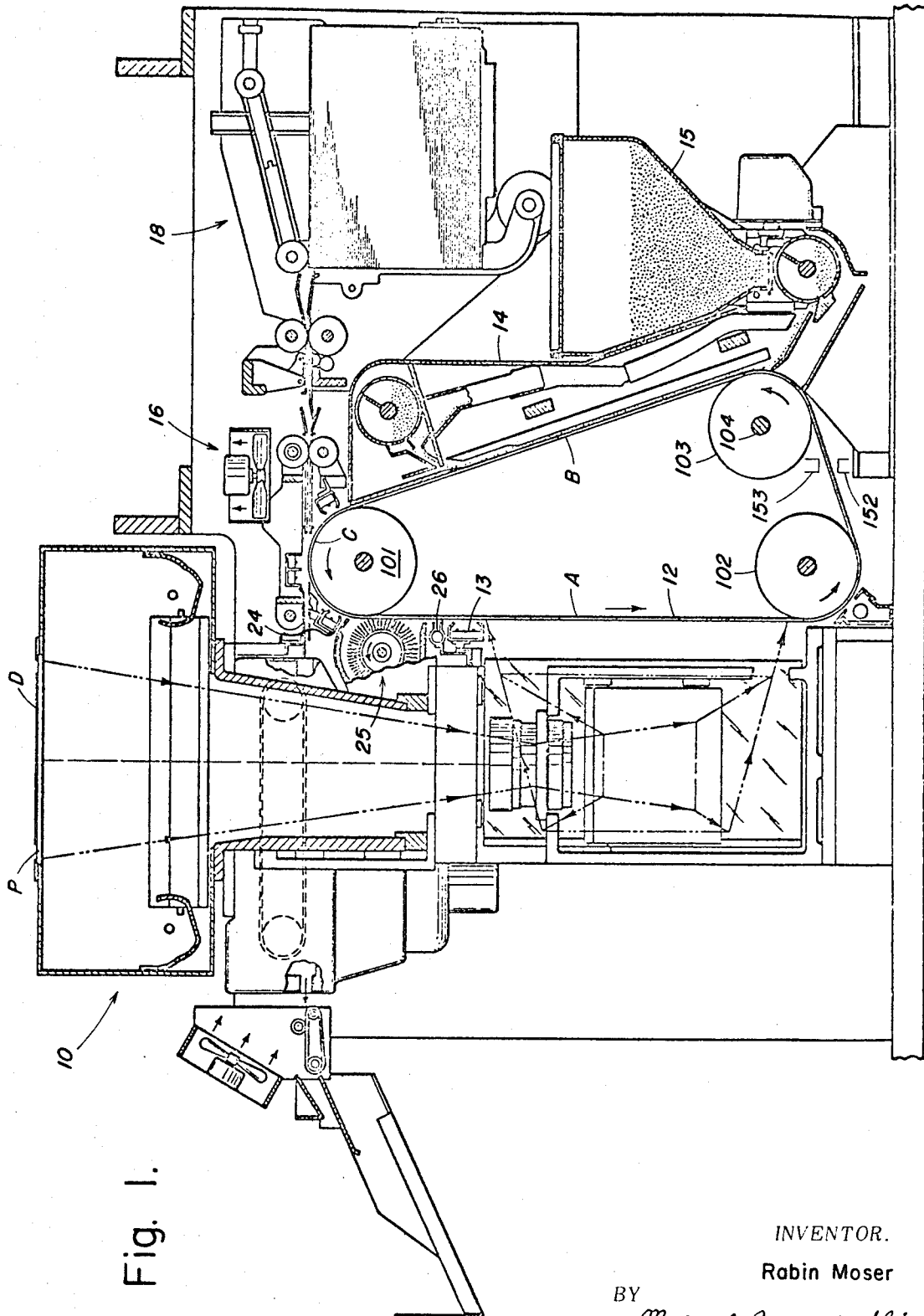


Fig. 1.

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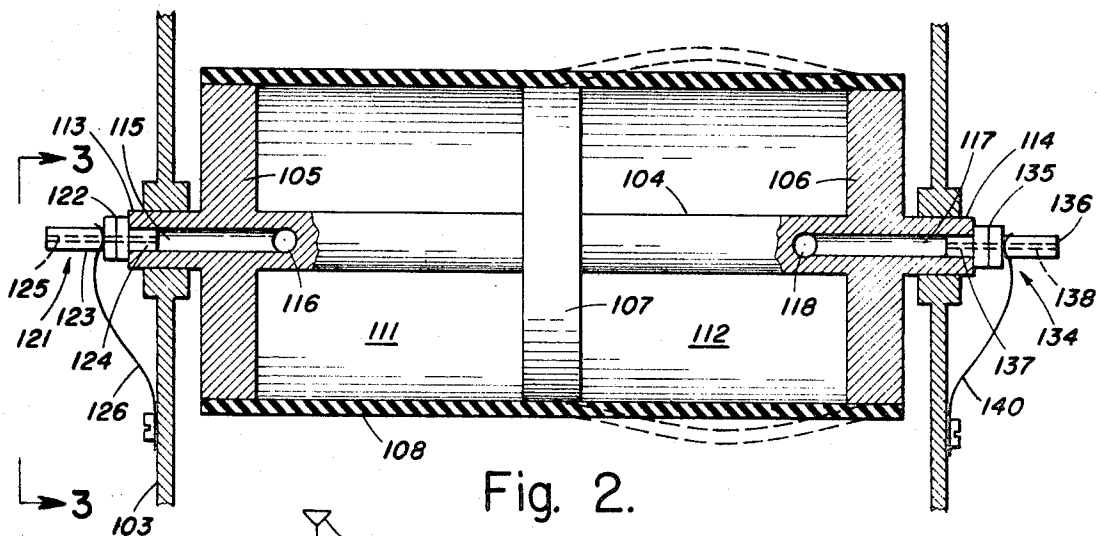


Fig. 2.

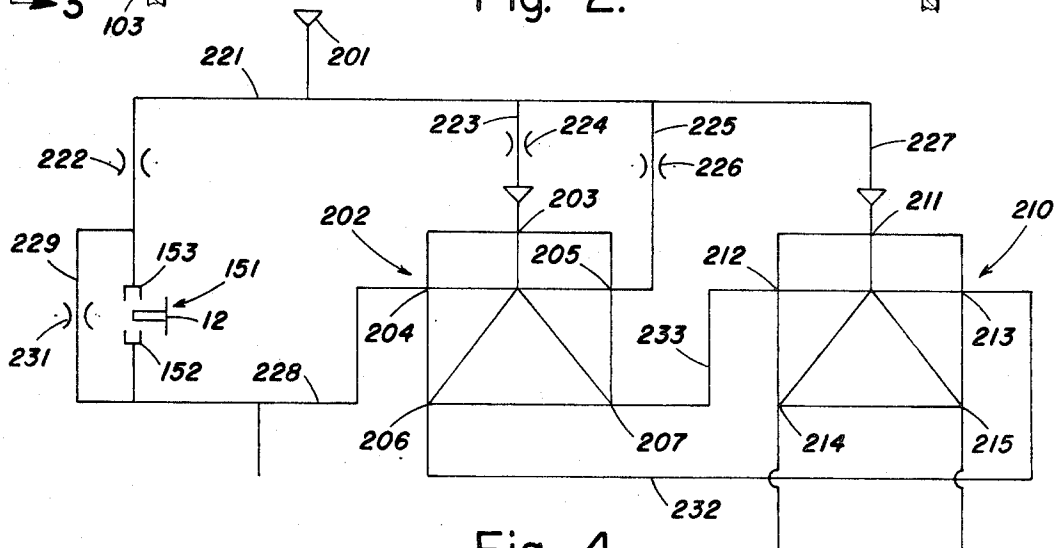
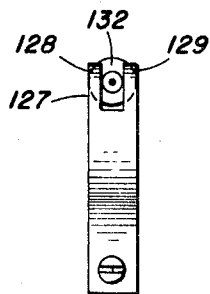


Fig. 4.



WEB TRACKING SYSTEM

This invention relates to maintaining the edgewise alignment of a movable web or belt and to a steering or tracking roll for maintaining the edgewise alignment of a movable web or belt. This invention further relates to an electrostatographic apparatus employing an electrostatographic recording belt and to maintaining the alignment of the belt.

In many system, the flight of a web or belt must be controlled as the web moves from one roll to another to maintain a predetermined alignment of the belt. Thus, for example, in an electrostatographic reproducing apparatus employing an electrostatographic recording surface in the form of a continuous belt, the belt is moved through a plurality of processing stations including: charging of the belt; forming an electrostatic latent image thereon corresponding to the image on the document being reproduced; development of the image on the belt by the use of an electroscopic powder, generally referred to as toner; transfer of the powder image from the belt to a suitable support surface, such as paper; and cleaning of residual toner from the belt. In such systems a high order of belt tracking accuracy is required in order to provide proper belt alignment at the various processing stations.

Many systems have been proposed for the purpose of maintaining proper web or belt alignment but such systems generally require mechanically moving parts for providing movement of a supporting roller to effect edgewise movement of the web supported by the roller to correct the alignment. Consequently, there is a continuing need for more simplified systems for maintaining edgewise alignment of a continuous web or belt.

An object of this invention is to provide for a control system for maintaining the alignment of a moving web or belt.

Another object of this invention is to provide for a new and improved steering roll for maintaining the alignment of a moving web or belt.

A further object of the invention is to provide a control system, including a steering roll, for maintaining the alignment of a moving web or belt without mechanically moving parts.

Still another object of this invention is to maintain the alignment of a recording belt in an electrostatographic apparatus without the use of mechanically moving parts.

These and other objects of the invention should be apparent to those skilled in the art from reading the following description thereof with reference to the accompanying drawings.

The objects of this invention are broadly accomplished, in one aspect, by providing a tracking or steering roll for a continuous non-stretchable web or belt, the steering roll having two axially spaced interior chambers and an expandable elastomeric material as its perimetric surface upon which the web or belt is to be supported. The steering roll is further provided with means to introduce fluidic pressure into the chambers, with the relative pressures between the chambers being changed in response to movement of the web from its predetermined path to cause movement of the portion of the elastomeric material over one of the chambers with respect to the portion of the elastomeric material over the other of the chambers, thereby providing an axial tilting of the perimetric surface of the roll to cor-

rect the alignment of the web. In this manner the alignment of the web or belt is corrected without the use of mechanically moving parts.

The objects of this invention are accomplished in another aspect by using a fluidic circuit including fluid amplifiers to sense the belt edge and vary the pressure in the two chambers of the steering roll to correct the web or belt alignment.

The objects of this invention are accomplished in a further aspect by employing the hereinabove described steering roll in electrostatographic apparatus to maintain the alignment of a movable belt having an electrostatographic recording surface thereon.

The invention will be further described with respect to the embodiments thereof illustrated in the drawings, but it is to be understood that the scope of the invention is not limited to such embodiments.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic sectional view of an electrophotographic reproduction machine employing flash exposure of an image to be reproduced which incorporates the web steering roll of the present invention;

FIG. 2 is an enlarged cross-sectional view of an embodiment of the web steering roll of the present invention;

FIG. 3 is an elevational view taken along the line 3—3 of FIG. 2;

FIG. 4 is a simplified schematic diagram of an embodiment of a fluid control circuit for use with the steering roll of the present invention; and

FIG. 5 is a simplified schematic diagram of another embodiment of a control circuit for use with the steering roll of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings, there is illustrated a machine in which an original D to be copied is placed upon a transparent support platen P fixedly arranged in an illumination assembly generally indicated by the reference number 10, arranged at the left end of the machine. An illumination system within the assembly 10 flashes light rays upon the original, thereby producing image rays corresponding to the informational areas on the original. The image rays are projected by means of an optical system 0 to the photosensitive surface of an electrophotographic member in the form of a flexible photoconductive belt 12 arranged on a belt assembly mounted upon a support bracket secured to the frame of the machine and which is adapted to drive the belt 12 in the direction of the arrow at a constant rate. During this movement of the belt, the reflected light image of an original on the platen is flashed upon the electrophotographic surface of the belt, at an imaging station designated as A. The belt surface that intercepts the light rays comprises a layer of photoconductive material such as selenium on a conductive backing that is sensitized prior to exposure by means of a charging corona generator device indicated at 13.

The flash exposure of the belt surface to the light image discharges the photoconductive layer in the areas struck by light, whereby there remains on the belt an electrostatic latent image in image configuration

corresponding to the light image projected from the original on the supporting platen. As the belt surface continues its movement, the electrostatic image passes through a developing station B in which there is positioned a developer assembly generally indicated by the reference numeral 14 and where the belt is maintained in a flat condition. The developer assembly 14 comprises horizontally and vertically conveying mechanisms which carry developing material to the upper part of the belt assembly whereat the material is dispensed and directed to cascade down over the upwardly moving inclined selenium belt 12 in order to provide development of the electrostatic image.

The developing material comprised of a toner and carrier, of a type known in the art; in which the toner assumes a charge of negative polarity is cascaded over the belt 12 and the negative toner particles are attracted to the positively charged areas, in image configuration, on the belt surface and are deposited thereon to form a powder image. As the toner powder image is formed, additional toner particles are supplied to the developing material in proportion to the amount of toner deposited on the belt during the development step. For this purpose, a toner dispenser generally indicated by reference numeral 15 is used to accurately meter toner to the developer material in the developer assembly 14.

The developed electrostatic image is transported by the belt to a transfer station C whereat a sheet of copy paper is moved at a speed in synchronism with the moving belt in order to accomplish transfer of the developed image. There is provided at this station a sheet transport mechanism generally indicated at 16 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 wherein the developed and transferred powder image on the sheet material is permanently affixed thereto. After fusing, the finished copy is discharged from the apparatus at a suitable point for collection externally of the apparatus.

The next and final station in the device is a belt cleaning station having positioned therein a corona pre-cleaning device 24, similar to the corona charging device 13, to subject the belt 12 and residual toner thereon to a positive charge to reduce the charge of the toner without changing the overall negative charge thereof, thereby facilitating removal of the toner by the belt cleaning assembly generally designated as 25. After removal of the residual toner, the belt 12 is exposed to a source of light in the form of lamp 26, whereby the selenium belt is flooded with light to cause dissipation of any residual electrical charge remaining thereon.

Suitable drive means may be arranged to drive the selenium belt 12 in conjunction with timed flash exposure of an original to be copied, to effect conveying and cascade of toner material, to separate, and feed sheets of paper and to transport the same across the transfer station C and to convey the sheet of paper through the fuser assembly in timed sequence to produce copies of the original.

It is believed that the foregoing description is sufficient for the purposes of this application to show the general operation of a high speed copier utilizing a flash exposure system in which the present invention is particularly suitable. For further details concerning the specific construction of an electrostatic copier of this type reference is made to copending U. S. application Ser. No. 731,934 filed in the name of Hewes et al. and hereby incorporated by reference.

Referring now to the subject matter of the present invention, the belt 12 is supported and guided around three generally parallel rotating rolls 101, 102, and 103 arranged to guide the belt 12 along a generally triangular path to effect the hereinabove described processing steps. The roll 101 is power-rotated to drive the belt 12 at a high speed; the roll 102 is an idler roll to guide the belt 12; and the roll 103 is a steering roll to control edgewise travel of the belt and maintain a predetermined edgewise alignment thereof.

The steering roll 103 is comprised of an axial shaft 104 supporting parallel circular end faces 105 and 106 and a central circular partition 107 parallel to the end faces 105 and 106. A cylindrical sleeve 108 of an elastomeric material, such as rubber is sealingly fitted over the outer perimeters of the end faces 105 and 106 and the partition 107, the elastomeric sleeve 108 defining the outer perimeter of the roll 103 upon which the belt 12 is supported. The end face 105 and partition 107 define a first annular chamber 111 having as its outer perimetric surface the elastomeric sleeve 108, and the end face 106 and partition 107 define a second annular chamber 112 also having as its outer perimetric surface the elastomeric sleeve 108.

The end faces 105 and 106 are each provided with centrally positioned stems 113 and 114 for rotatably supporting the roll 103, the stems 113 and 114 being suitably supported in bearings in the frame of the machine. An axial cylindrical bore 115 extends through the stem 113, face 105 and shaft 104 into the portion of the shaft 104 within chamber 111, and is intersected by a radial cylindrical bore 116 through the shaft 104 which opens into the chamber 111, thereby providing a continuous fluid flow passage between the exterior of the roll 103 and the chamber 111. Similarly, an axial cylindrical bore 117 extends through the stem 114, face 106 and shaft 104 into the portion of the shaft 104 within chamber 112, and is intersected by a radial cylindrical bore 118 through the central shaft 104 which opens into chamber 112, thereby providing a continuous fluid flow passage between the exterior of the roll 103 and the chamber 112.

An adaptor plug 121 comprised of a circular central portion 122 and aligned oppositely extending elongated cylindrical neck portions 123 and 124, is provided with a central bore 125 which extends axially through the neck portion 123, central portion 122 and the neck portion 124. The neck portion 124 of the plug 121 is sealingly positioned within the bore 115 of the roll 103 with the neck portion 124 and the bore 115 being provided with suitable bearing and journal surfaces whereby the roll 103 may be rotated relative to the plug 121. The neck portion 123 of the plug 121 is sealingly inserted within a hose (not shown) attached to a suitable fluid control circuit, as hereinafter described, whereby fluid pressure may be applied to

the chamber 111 from the control circuit through the plug 121. The plug 121 is urged into sealing connection with the roll 103 by a resilient member 126, mounted on the machine frame, the resilient member 126 having a bifurcated end 127, the portions 128 and 129 of which are received in cut-out portion 132 on the face of the central portion 122 of the plug 121 to bias the plug 121 toward the roll 103.

An adaptor plug 134 comprised of a circular central portion 135 and aligned oppositely extending elongated cylindrical neck portions 136 and 137, is provided with a central bore 138 which extends axially through the neck portion 136, central portion 135 and the neck portion 137. The neck portion 137 of the plug 134 is sealingly positioned within the bore 117 of the roll 103 with the neck portion 137 and the bore 117 being provided with suitable bearing and journal surfaces whereby the roll 103 may be rotated relative to the plug 134. The neck portion 136 of the plug 134 is sealingly inserted within a hose (not shown) attached to a suitable fluid control circuit, as hereinafter described, whereby fluid pressure may be applied to the chamber 112 from the control circuit through the plug 134. The plug 134 is urged into sealing connection with the roll 103 by a resilient member 140, mounted on the machine frame, the resilient member 139 having a bifurcated end which is received in cutout portions of the plug 134, as described with respect to the plug 121.

The steering roll 103 is designed to maintain the belt 12 which passes thereover in a predetermined alignment, and such alignment is maintained by increasing the fluid pressure in chamber 112 in response to movement of the belt out of alignment toward the right, such increase in pressure causing expansion of the portion of the elastomeric sleeve 108 over chamber 112, thereby inclining the perimetric surface of the roll 103 downwardly toward the left and causing the belt 12 passing thereover to move to the left. Similarly, movement of the belt out of alignment toward the left is corrected by increasing the pressure in the chamber 111, such increase in pressure causing expansion of the portion of the elastomeric sleeve 108 over chamber 111, thereby inclining the perimetric surface of the roll 103 downwardly toward the right and causing the belt 12 passing thereover to move to the right.

The movement of the belt 12 out of alignment is sensed by a sensing device 151 connected to the frame of the machine including a receiver 152 formed by the open end of a pipe or tube positioned on one side of the plane of the belt 12 adjacent one edge of the belt to be alternately covered and uncovered by the belt as the belt moves laterally back and forth. On the opposite side of the plane of the belt and aligned with the receiver 152 is a nozzle 153 for directing a jet of air into the receiver 152 when the receiver is uncovered or partially covered. The change of pressure within the receiver 152 produced by covering and uncovering thereof by lateral movement of the belt 12 constitutes a pressure signal which is used to select the chamber of the steering roll 103 to which fluid pressure should be applied to correct the alignment of the belt.

Referring now to FIG. 4, which illustrates a representative control circuit for selectively increasing the fluid pressure in chambers 111 and 112 of steering roll 103, which is principally comprised of a pressure source,

schematically indicated as 201; a first proportional fluid amplifier 202 having a supply port 203, control ports 204 and 205 and outlet ports 206 and 207; and a second proportional fluid amplifier 210 having a supply port 211, control ports 212 and 213 and outlet ports 214 and 215. Although two amplifiers are shown, the two amplifiers could be replaced by a single two-stage amplifier.

The pressure source 201 is connected to: the supply nozzle 153 of the sensing device 151 through conduit 221 including a fluidic resistor, schematically indicated as 222, to provide a selected air pressure to the supply nozzle 153; the supply port 203 of fluid amplifier 202 through conduit 223 including a fluidic resistor, schematically indicated as 224, to provide a selected air pressure to the supply port 203; the control port 205 of fluid amplifier 202 through conduit 225 including a fluidic resistor, schematically indicated as 226, to provide a selected pressure to the control port 205; and the supply port 211 of fluid amplifier 210 through conduit 227 to provide air pressure to the supply port 211 at the output pressure of the pressure source 201. It is to be understood, however, that conduit 227 could include a fluidic resistor to provide a pressure to the supply port 211 of fluid amplifier 210 which is other than the output pressure of the pressure source.

The receiver 152 of sensing device 151 is connected to the control port 204 of fluid amplifier 202 through conduit 228, the conduit 228 also being supplied with a selected pressure from the supply pressure source by conduit 229, including a fluid resistor, schematically indicated as 231, which interconnects conduits 221 and 228. The outlet port 206 of fluid amplifier 202 is connected to the control port 213 of fluid amplifier 210 through conduit 232; the outlet port 207 of fluid amplifier 202 is connected to the control port 212 of fluid amplifier 210 through conduit 233; the outlet port 214 of fluid amplifier 210 is connected to the chamber 111 of steering roll 103 through hose 125; and the outlet port 215 of fluid amplifier 210 is connected to the chamber 112 of steering roll 103 through hose 139.

In operation, the sensing device 151 is positioned at an edge of belt 12 adjacent to the steering roll 103 in a manner such that the desired predetermined aligned path of the belt 12 partially covers the receiver 152. Accordingly, movement of the belt 12 to the right, further uncovers the receiver 152, resulting in an increase in air pressure in conduit 228. Similarly, movement of the belt to the left further covers the receiver 152, resulting in a decrease in air pressure in conduit 228.

In the event the belt moves out of alignment to the left, the receiver 152 is further covered and the pressure in conduit 228 is decreased resulting in a corresponding decrease in the pressure signal to the control port 204 of fluid amplifier 202. The decrease in control pressure at control port 204 of fluid amplifier 202 increases the proportion of fluid pressure supplied by supply port 203 of fluid amplifier 202 to the outlet port 206 thereof, thereby increasing the pressure in conduit 232 and decreasing the pressure in conduit 233. The changes in pressures in conduits 232 and 233 result in an increase in the pressure provided to the control port 213 of fluid amplifier 210 with respect to the pressure provided to the control port 212 thereof,

such pressure increase increasing the proportion of fluid pressure supplied by supply port 211 of fluid amplifier 210 to the outlet port 214 thereof. The increase in pressure at outlet port 214 of fluid amplifier 210 increases the pressure provided to chamber 111 of steering roll through hose 125, causing expansion of the portion of the elastomeric sleeve 108 over chamber 111, and thereby downwardly tilting the perimetric surface of the steering roll 103 toward the right, causing the belt 12 to move to the right and thereby correcting the alignment of the belt 12.

In the event the belt moves out of alignment to the right, the receiver 152 is further uncovered and the pressure in conduit 228 is increased resulting in a corresponding increase in the pressure signal to the control port 204 of fluid amplifier 202. The increase in the control pressure at control port 204 of fluid amplifier 202 increases the proportion of fluid pressure supplied by supply port 203 of fluid amplifier 202 to the outlet port 207 thereof, thereby increasing the pressure in conduit 233 and decreasing the pressure in conduit 232. The changes in pressures in conduits 232 and 233 results in an increase in the pressure provided to the control port 212 of fluid amplifier 210 with respect to the pressure provided to the control port 213 thereof, such pressure increase increasing the proportion of fluid pressure supplied by supply port 203 of fluid amplifier 202 to the outlet port 207 thereof, thereby increasing the pressure in conduit 233 and decreasing the pressure in conduit 232. The changes in pressures in conduits 232 and 233 results in an increase in the pressure provided to the control port 212 of fluid amplifier 210 with respect to the pressure provided to the control port 213 thereof, such pressure increase increasing the proportion of fluid pressure supplied by supply port 211 of fluid amplifier 210 to the outlet port 215 thereof. The increase in pressure at outlet port 215 of fluid amplifier 210 increases the pressure provided to chamber 112 of steering roll 103 through hose 139, causing expansion of the portion of the elastomeric sleeve over chamber 112, and thereby downwardly tilting the perimetric surface of the steering roll 103 toward the left, causing the belt 12 to move to the left and thereby correcting the alignment of the belt 12.

Numerous modifications and variations of the hereinabove described embodiment are possible within the teachings of the present invention. Thus, for example, a control circuit other than the control circuit particularly described may be employed for providing appropriate fluidic pressure to the chambers of the steering roll to thereby tilt the perimetric surface thereof by relative expansion and contraction of the axial portions of the elastomeric sleeve. For example, although the invention has been particularly described with respect to a fluidic circuit employing fluidic amplification, such fluidic amplification may be omitted. In general, however, fluidic amplification is preferred in that the employment of fluidic amplification permits the use of low pressures in the sensing device, thereby avoiding the possibility of belt flutter which may occur when using higher pressures.

Referring to FIG. 5, which schematically illustrates a control circuit without fluidic amplification, the left-hand chamber 112' of the steering roll is directly connected to the receiver 152' of the sensing device 151'

through a conduit 301; the left-hand chamber 111' of the steering roll is connected to the pressure supply 201' through a conduit 302, including a fluidic resistor 303; and the nozzle 153' of the sensing device 151' is connected to the pressure source 201' through a conduit 304 including a fluidic resistor 305. The belt 12' is positioned, in the predetermined aligned position, to partially cover the receiver 152' and the pressures provided to chamber 111' and 112' of the steering roll during proper web alignment are selected to maintain the elastomeric sleeve thereof in an expanded condition.

In operation, the pressure in chamber 111' of the steering roll does not vary in that the pressure provided thereto by conduit 302 is not responsive to movement of the web. The pressure in chamber 112' of the steering roll, however, is responsive to edgewise movement of the belt 12' with movement of the belt 12' to the left further covering receiver 152' resulting in a decrease in the pressure provided to chamber 112' through conduit 301. The decrease in pressure in chamber 112' causes contraction of the portion of the elastomeric sleeve over chamber 112' causing downward tilting of the perimetric surface of the steering roll toward the right and correcting alignment of the belt. Similarly, movement of the belt to the right, further uncovers receiver 152' resulting in an increase in the pressure provided to chamber 112' through conduit 301. The increase in pressure in chamber 112' causes expansion of the portion of the elastomeric sleeve over chamber 112' causing downward tilting of the perimetric surface of the steering roll toward the left and correcting alignment of the belt. Consequently, in accordance with this embodiment, the perimetric surface of the roll is tilted to maintain edgewise alignment of a belt by varying the pressure in only one of the chambers of the steering roll.

As still another modification, the roll may be resiliently mounted, instead of rigidly mounted; for example, by spring loading the bearings in which the roll is rotatably supported, whereby a change in the relative pressures between the chambers of the steering roll causes a difference in the amount the springs are compressed to cause the entire roll to tilt and correct the alignment of the belt. In accordance with such a modified embodiment, an imbalance in chamber pressure only slightly affects the belt tension in that correction of the belt is achieved by tilting of the entire roll, rather than by an increase in belt tension which results from the unequal expansion of only the perimetric surface of the roll, as occurs in the above-described embodiment in which the roll is rigidly secured.

Similarly, although the invention has been particularly described with respect to an electrophotographic reproducing apparatus employing flash illumination, the teachings of the invention are equally applicable to other types of electrophotographic reproducing apparatus employing a recording surface in the form of a movable belt. It should also be apparent that the teachings of the invention may also be employed in other types of electrostatographic machines, such as for example, an electrostatographic machine in which the electrostatic latent image is produced by a pulsing electrode.

The present invention has particular applicability to electrostatographic apparatus, but the invention may

also be employed in any apparatus in which a continuous web is to be maintained in a predetermined edgewise alignment, such as, for example, in the paper, textile and laminating industries.

The present invention is particularly advantageous in that proper web alignment is maintained without the use of mechanically moving parts to correct the steering roll. In addition, the use of fluidic amplification permits the use of low sensing pressures.

These and other advantages should be apparent to those skilled in the art from the teachings herein.

Numerous modifications and variations of the present invention are possible in light of the above teachings and, therefore, within the scope of the appended claims the invention may be practised in a manner other than as particularly described.

What is claimed is:

1. A steering roll for a continuous web, comprising:
a roll having an elastomeric material as its outer perimetric surface; partition means dividing the interior of the roll into a pair of axially spaced chambers, said elastomeric material defining a wall of each of said spaced chambers; and first and second inlet means for applying fluid pressure to the interior of each of the pair of chambers to change the relative pressures applied to the axial ends of said elastomeric material to thereby effect tilting of the outer perimetric surface of said wall by relative expansion and contraction between the axial ends of said elastomeric material.
2. The steering roll as defined in claim 1 wherein said roll comprises: an axial shaft; two parallel circular end walls connected to the ends of said shaft; an intermediate circular wall connected to the shaft in a plane parallel to said end walls defining said partition means; a cylindrical sleeve of elastomeric material fitted over the outer peripheries of said end walls and said intermediate wall defining the elastomeric outer perimetric surface, one end wall, said intermediate wall and said cylindrical sleeve defining a first chamber, the second end wall, said intermediate wall and said cylindrical sleeve defining a second chamber; and a pair of stems aligned with said shaft connected to each of said end walls for rotatably supporting said roll.
3. The steering roll as defined in claim 2 wherein said first inlet means comprises: a first bore extending through said one stem, said one end wall and a portion of said shaft within said first chamber and a second intersecting bore in said shaft opening into said first chamber; and said second inlet means comprises a third bore extending through said second stem, said second end wall and a portion of said shaft within said second chamber and a fourth intersecting bore opening into said second chamber.
4. In combination with a continuous web, supporting means supporting said web for movement along a continuous path, said supporting means including a steering roll for inducing inward and outward edgewise travel of said web, said steering roll having an elastomeric material as its outer perimetric surface; partition means dividing the interior of the roll into first and second axially spaced chambers, and means responsive to inward and outward edgewise travel of said web from a predetermined alignment for applying fluid pressure to each of the first and second chambers

to change the relative pressure between the chambers, to produce relative expansion and contraction between the axial ends of said elastomeric material to effect back and forth tilting of the perimetric surface of the roll between oppositely inclined positions and thereby provide the inward and outward edgewise travel of said web to maintain the predetermined alignment.

5. The combination as defined in claim 4 wherein the steering roll is resiliently mounted to permit tilting of the steering roll in response to changes in the relative pressure between said chambers.

6. The combination as defined in claim 4 wherein said means for applying fluid pressure to each of the pair of chambers to change the relative pressure between the pair of chambers comprises: a sensing means including a receiver for receiving a stream of fluid and a nozzle aligned with the receiver for directing a stream of fluid toward said receiver, said nozzle and receiver being positioned at one edge of the web at opposite surfaces thereof for back and forth movement of said one edge of the web between the nozzle and the receiver to increase and decrease the fluid pressure received by said receiver from said nozzle in response to uncovering and covering, respectively, of said receiver; and control means responsive to increases and decreases in pressure in said receiver, said control means increasing the fluid pressure in the first chamber with respect to the second chamber to tilt the perimetric surface of the roll to one of said oppositely inclined positions which causes movement of the web in a direction to cover said receiver, said control means in response to a decrease in pressure in said receiver increasing the fluid pressure in the second chamber with respect to the first chamber to tilt the perimetric surface of the roll to the other of said oppositely inclined positions which causes movement of the web in a direction to uncover said receiver.

7. The combination as defined in claim 6 wherein the control means includes a source of air pressure, first conduit means connecting the source of air pressure to said nozzle; fluid amplification means, including first and second fluid amplifiers; first conduit means for connecting the source of air pressure to a supply port and a first control port of the first fluid amplifier and to a supply port of the second fluid amplifier; second conduit means connecting the receiver to a second control port of the first fluid amplifier; third conduit means connecting a first outlet port of the first fluid amplifier to a first control port of the second fluid amplifier; fourth conduit means connecting a second outlet port of the first fluid amplifier to a second control port of the second fluid amplifier; fifth conduit means connecting a first outlet port of the second fluid amplifier to the first chamber of the roll; and sixth conduit means connecting a second outlet port of the second fluid amplifier to the second chamber of the roll.

8. In an electrophotographic reproduction machine including a casing; a movable electrophotographic recording belt in said casing; a charging station mounted in said casing to provide a positive electrostatic charge on said belt; an imaging station mounted in said casing for illuminating a document to be reproduced onto said belt to provide a positively charged electrostatic latent image corresponding to the document on said belt; a development station mounted

in said casing for rendering the electrostatic latent image on said belt visible by negatively charged toner attracted thereto; a transfer station mounted in said casing for transferring the toner image to a support medium; a cleaning station mounted in said casing for removing residual toner from said belt; and means for supporting the belt for movement in seriatum past the charging station, imaging station, development station, transfer station and cleaning station, the improvement comprising: said supporting means including a steering roll for inducing inward and outward edgewise travel of said web, said steering roll having an elastomeric material as its outer perimetric surface; partition means dividing the interior of the roll into first and second axially spaced chambers, and means responsive to inward and outward edgewise travel of said web from a predetermined alignment for applying fluid pressure to each of the first and second chambers to change the relative pressure between the chambers to produce relative expansion and contraction between the axial ends of said elastomeric material to effect back and forth tilting of the perimetric surface of the roll between oppositely inclined positions and thereby provide the inward and outward edgewise travel of said web to maintain the predetermined alignment.

9. The electrophotographic reproduction machine as defined in claim 8 wherein said means for applying fluid pressure to each of the pair of chambers to change the relative pressure between the pair of chambers comprises: a sensing means including a receiver for receiving a stream of fluid and a nozzle aligned with the receiver for directing a stream of fluid toward said receiver, said nozzle and receiver being positioned at one edge of the web at opposite surfaces thereof for back and forth movement of said one edge of the web between the nozzle and the receiver to increase and

decrease the fluid pressure received by said receiver from said nozzle in response to uncovering and covering, respectively, of said receiver; and control means responsive to increases and decreases in pressure in said receiver, said control means increasing the fluid pressure in the first chamber with respect to the second chamber to tilt the perimetric surface of the roll to one of said oppositely inclined positions which causes movement of the web in a direction to cover said receiver, said control means in response to a decrease in pressure in said receiver increasing the fluid pressure in the second chamber with respect to the first chamber to tilt the perimetric surface of the roll to the other of said oppositely inclined positions which causes movement of the web in a direction to uncover said receiver.

10. The electrophotographic reproduction machine as defined in claim 9 wherein the control means includes a source of air pressure, first conduit means connecting the source of air pressure to said nozzle; fluid amplification means; including first and second fluid amplifiers; first conduit means for connecting the source of air pressure to a supply port and a first control port of the first fluid amplifier and to a supply port of the second fluid amplifier; second conduit means connecting the receiver to a second control port of the first fluid amplifier; third conduit means connecting a first outlet port of the first fluid amplifier to a first control port of the second fluid amplifier; fourth conduit means connecting a second outlet port of the first fluid amplifier to a second control port of the second fluid amplifier; fifth conduit means connecting a first outlet port of the second fluid amplifier to the first chamber of the roll; and sixth conduit means connecting a second outlet port of the second fluid amplifier to the second chamber of the roll.

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