

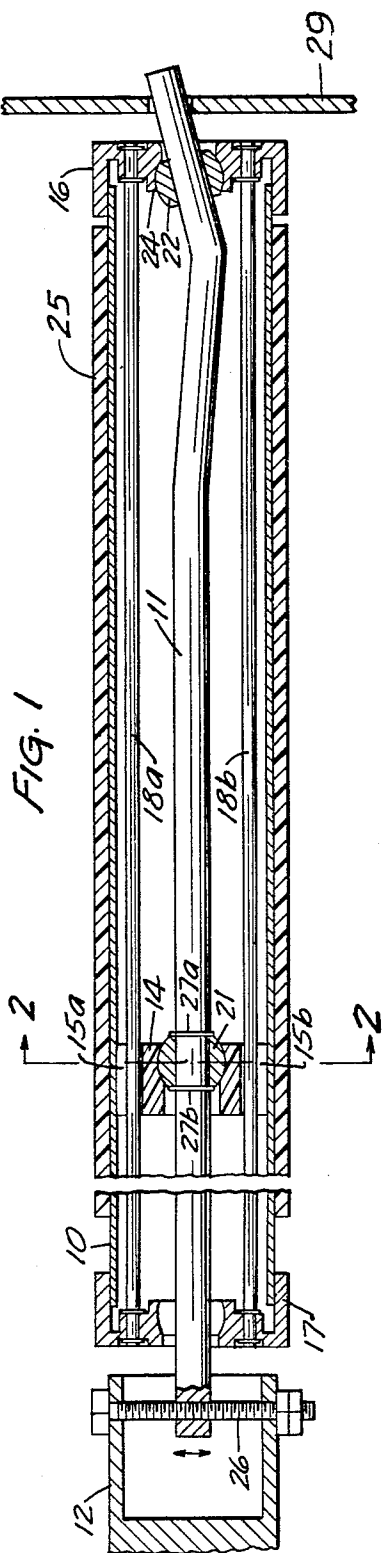
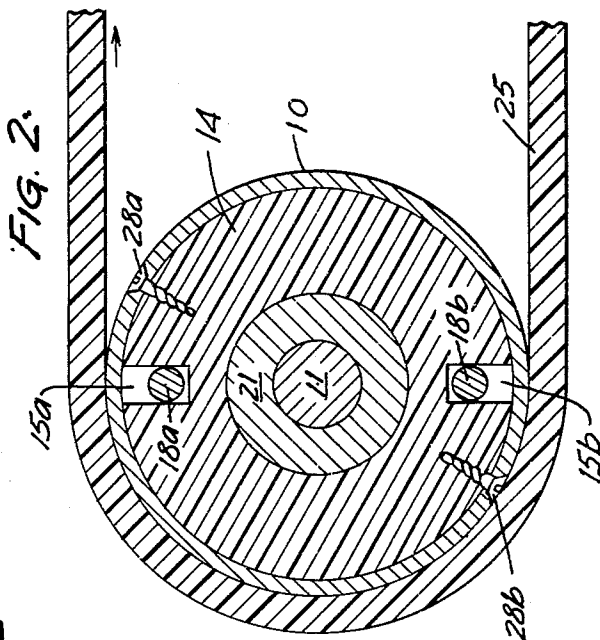
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STEERING ROLLER

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STEERING ROLLER

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This invention relates to the steering of moving belts and strip materials generally, and has particular application in apparatus for mechanically regulating the lateral position of wide flexible conveyor belts within preselected confines without causing deformation of the belt cross-section.

When belting material is conveyed over a path determined by a series of rollers, there is an inherent danger that the strip will drift across and eventually completely off the rollers. This inherent lateral drift is caused by one or a combination of the following factors, each of which is ever present to some degree: misalignment of the rolls; uneven wear along a roller face; and camber and/or lateral curvature of the strip material.

While several steering mechanisms are available in the art for correcting or counteracting the inherent tendency of a conveyor belt to drift laterally, some of them introduce deformities into the belt cross-section. For example, among the better known is a simple crowned roller; however, a wide belt traveling therearound tends to crowd in toward the apex of the roll thus gathering the belt into an unsightly approach bulge. Another well-known steering mechanism is a roller having fixed integral end flanges; however, this type does not effectively control wide flexible belts without deforming the belt or even damaging the edges thereof.

In many installations it is not sufficient merely to steer a belt, but rather the operation must be accomplished without the introduction of deformity-producing stresses into the belt. As a particular example, in certain thermographic copying machines which employ a wide thin transparent flexible conveyor belt to carry a composite of printed page and heat-sensitive copy-sheet past a source of radiation, wrinkling and deformation of the belt must be avoided in order to provide accurate undistorted reproduction of the printed material and to prevent wrinkling or tearing of the original or copy-sheet. These requirements are exemplified in the thermocopying apparatus described in U.S. Patent 2,891,165; in such machines, stresses and deformities of the conveyor belt must be minimized if adequate uniform radiation-conductive contact of the graphic original with the copy-sheet, and desirable copy quality, are to be obtained.

The art has recognized that effective stress-free steering of wide flexible belts should be based upon full-bodied cylindrical rollers having auxiliary means to appropriately tilt either the entire or increments of the belt-bearing roller surface. The following auxiliary tilting means are among those suggested by the art: preloaded sensitive axial springs, electrical circuitry, laterally divided rollers, vacuumatic controls, special motors, etc. While some of these auxiliary tilting means do provide stress-free steering of flexible belts, those that do are complex, and therefore, of substantial expense both in capital outlay and in maintenance.

The present invention provides a simple and inexpensive self-contained tiltable steering roller assembly which, in conjunction with one or more additional supporting or driving rollers, is capable of maintaining the path of a moving belt or strip within narrow limits and without causing wrinkling, stretching, deformation, or edge damage of the belt or strip. The assembly utilizes a smooth-surfaced one-piece cylindrical full-bodied roller which is universally recognized as conducive to stress-free convey-

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ance of a flexible belt. The invention further employs a tilting means of simple mechanical construction, requiring no supplemental electrical circuitry and consequently, is relatively inexpensive and is easily and economically assembled and maintained.

More specifically, the mechanical tilting means for the elongate one-piece cylindrical roller member is based upon two bearings that revolvably support the one-piece cylindrical roller about its longitudinal central axis. The primary support bearing is supported within a journal that is integral with the roller, and is of the circumgyratory type which permits pivotal tilting of the roller about a fixed transverse axis that is perpendicular to the longitudinal axis. The second bearing is slidably carried by a fixed tilted shaft or shaft segment which crosses the longitudinal axis of the roller; it is non-rigidly linked to the roller member a finite distance from the integral primary support bearing. Movement of the slidable bearing along the tilted shaft segment thus causes tilting of the roller member. There are carried by the slidable bearing, means to sense lateral drift or creep of the moving flexible belt. It is desirable that the tilted shaft be substantially coplanar with the roller longitudinal central axis and that this plane be perpendicular to the transverse pivotal axis in order that the tiltable roller be maximally responsive to lateral drift of the conveyor belt.

The invention will now be described in terms of the preferred embodiment shown in the appended drawing in which:

FIGURE 1 is a sectional side elevation of the tiltable steering roller assembly and with a conveyor belt, also shown in section supported thereon; and

FIGURE 2 is a sectional view along line 2-2 of the roller assembly of FIGURE 1.

As shown in the drawing, the tiltable steering roller assembly comprises a hollow cylindrical elongate roller member 10 integrally provided with a socket-type journal 14 that is retained by screws 28a and 28b. The roller member 10 is revolvably and pivotably supported medially on shaft 11 by means of a doubly truncated free-turning spherical bearing 21 laterally positioned along shaft 11 by friction retaining rings 27a and 27b. Shaft 11 has a straight medial portion adjustably supported on adjusting screw 26 fitting within a clevis 12 affixed to an external frame, and a tilted end section that is coplanar and angular with said straight end section. The tilted end section is fixedly supported by frame member 29. The ends of roller member 10 fit within axially slidable cup-shaped end caps 16 and 17 which are rigidly interconnected by rods 18a and 18b passing through the roller and through open channels 15a and 15b in journal 14. The end cap 16 includes a socket-type journal 24 fitting over a doubly truncated spherical bearing 22 which is freely slidable along the tilted end section of the shaft 11. The flexible belt or strip 25 fits between the edges of the end caps and travels around the back surface of the roller member in a clockwise direction as indicated in FIGURE 2.

The operation of the tiltable steering roller assembly is as follows:

When roller member 10 is actuated into motion by the friction of conveyor belt 25, journals 14 and 24 revolve about spherical bearings 21 and 22. If conveyor belt 25 drifts sufficiently toward the left, lateral pressure is exerted against the end cap 17. This lateral pressure is transmitted through rods 18a and 18b to end cap 16, which responds by moving along shaft 11 toward the straight medial portion at the same time pushing downward on roller member 10. Simultaneously, journal 14 swivels pivotably about spherical bearing 21, the net result being an upward tilting movement of the left end of roller member 10. The upward movement of the left end of roller

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member 10 causes the belt to drift rightwardly or toward the cap 16 and thus reverse the previous leftward tendency.

Conversely, if conveyor belt 25 drifts sufficiently toward the right, lateral pressure is exerted against the bearing end cap 16. This lateral pressure causes end cap 16 to move along shaft 11 away from the straight medial portion, and to pull upward on roller member 10. Simultaneously, journal 14 pivots about ball bearing 21, the net result being an upward tilting movement of the right end of roller 10. The right end of roller 10 in being tilted upward causes the belt to drift leftwardly. The frequency of countervailing tilt corrections required to steer the belt can be regulated by normalizing the approach of belt 25 with any imaginary section passing perpendicularly through the central axis of tube 10; this is accomplished by means of adjustment 26.

Thus, it can be seen that when a conveyor belt drifts toward either the left or the right across the novel tiltable steering roller assembly and exerts pressure against the end cap surrounding the roller member, the end so contacted is tilted in the appropriate angular direction so as to provide a countervailing influence by the roller upon the conveyor belt.

What is claimed is as follows:

1. A tiltable roller assembly comprising: a uniplanar fixed bent shaft including a straight medial portion and a tilted end section, said tilted end section being substantially angular to said medial portion; an elongate hollow tube revolvably supported about a symmetrical free-turning arcuate bearing laterally positioned along the shaft medial portion; a spherical bearing slidably mounted along the shaft tilted end section; a pair of end caps slidably fitting over the ends of said hollow tube, said end caps being rigidly tied together internally of said hollow tube, one of said end caps revolvably securing said spherical bearing.

2. The tiltable roller assembly of claim 1 wherein at least one end of the fixed bent shaft is adjustable along an external frame.

3. A tiltable roller assembly mountable on an external frame and suitable for steering a conveyed endless strip comprising: a uniplanar fixed bent shaft including a straight medial portion and tilted end section, said tilted end section being substantially angular to said medial portion; an elongate hollow tube revolvably and tiltably supported about a symmetrical free-turning arcuate bearing laterally positioned along the shaft medial portion; a spherical bearing supporting an end of said tube and slidably mounted along the shaft tilted end section; sensing means for mechanically detecting lateral drift of the end-

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less strip; and linking means connecting said sensing means and said slidable bearing for mechanically translating the lateral movement of said sensing means to sliding movement of said slidable bearing along said tilted end section in a direction opposing said drift.

4. A tiltable roller assembly mountable on an external frame and suitable for steering a conveyed strip comprising: an elongate cylindrical roller with its longitudinal axis located in a plane; support means for rotatably supporting said roller about said axis and for tiltably supporting said roller in said plane, said support means being rigidly mountable on said external frame; a tilted shaft segment disposed near one end of said roller and located in said plane and inclined to said axis, said tilted shaft segment being rigidly mountable on said external frame; a spherical bearing, supporting an end of said roller, slidably mounted along said tilted shaft segment; an end cap slidably fitting over one end of said roller for contacting an edge of said strip and linked to said bearing for translating the lateral drift of said strip to said bearing along said shaft segment in a direction opposing said drift.

5. A tiltable roller assembly mountable on an external frame and suitable for steering a conveyed endless strip making a partial circuit therearound, said roller assembly comprising: roller means for supporting the endless strip; support means for rotatably and tiltably supporting said roller means, said support means being rigidly mountable on said external frame; a shaft segment disposed near one end of said roller means and inclined to the axis of said roller means, said shaft segment being rigidly mountable on said external frame; a slidable bearing carried by said shaft segment on which said roller means is rotatably supported; sensing means disposed adjacent to at least one edge of the endless strip for mechanically detecting lateral drift of the endless strip; and linking means connecting said sensing means and said slidable bearing for mechanically translating the lateral movement of said sensing means to sliding movement of said slidable bearing along said shaft segment in a direction opposing said drift.

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