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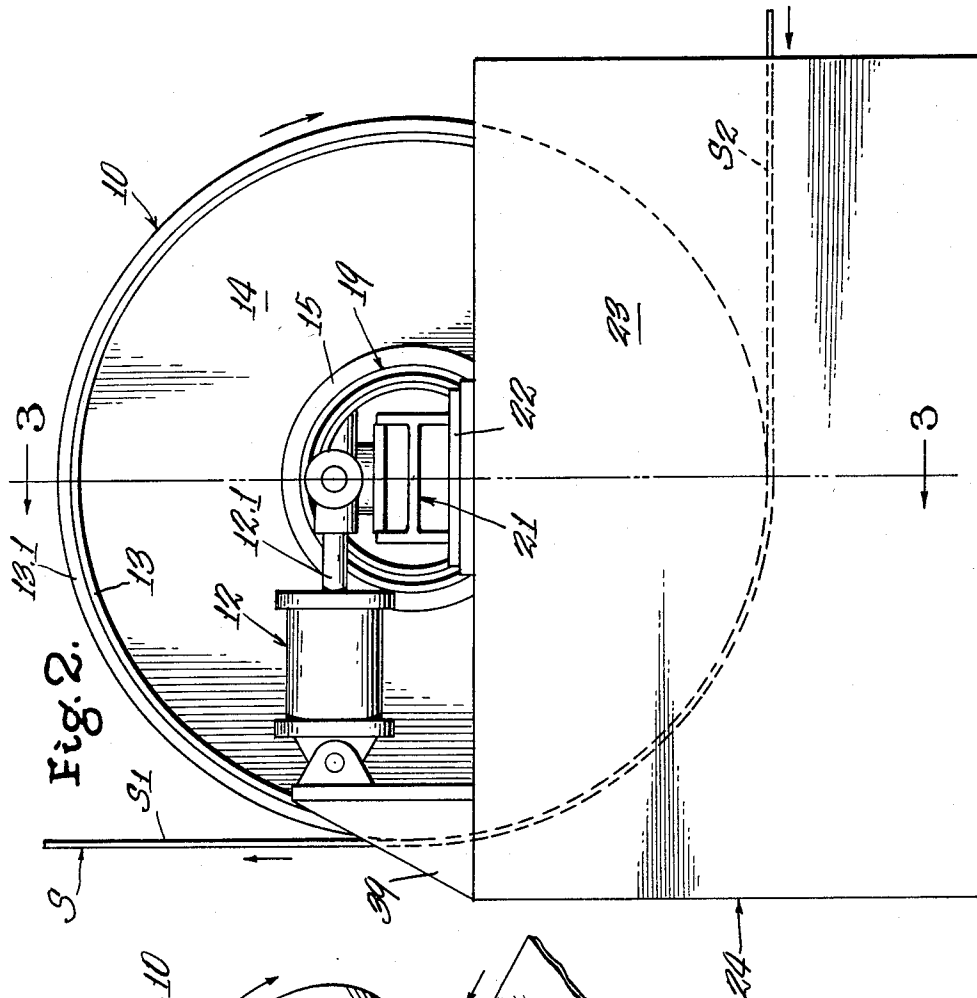
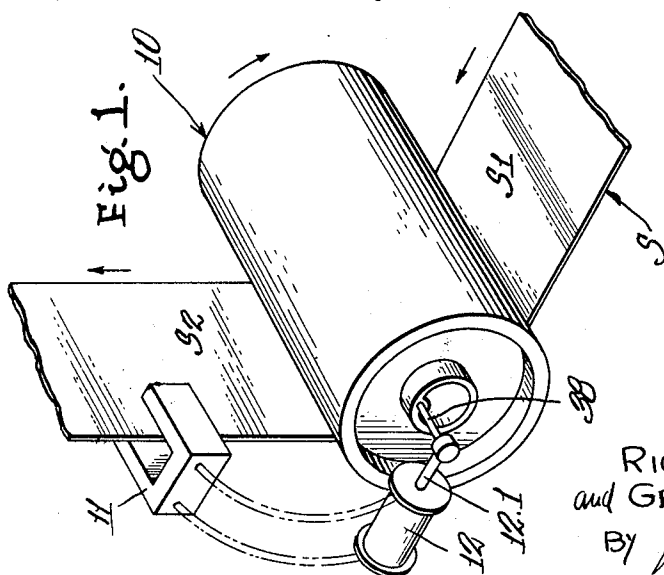
R. F. HERR ETAL

3,145,891

WEB GUIDING

Filed June 4, 1962

3 Sheets-Sheet 1



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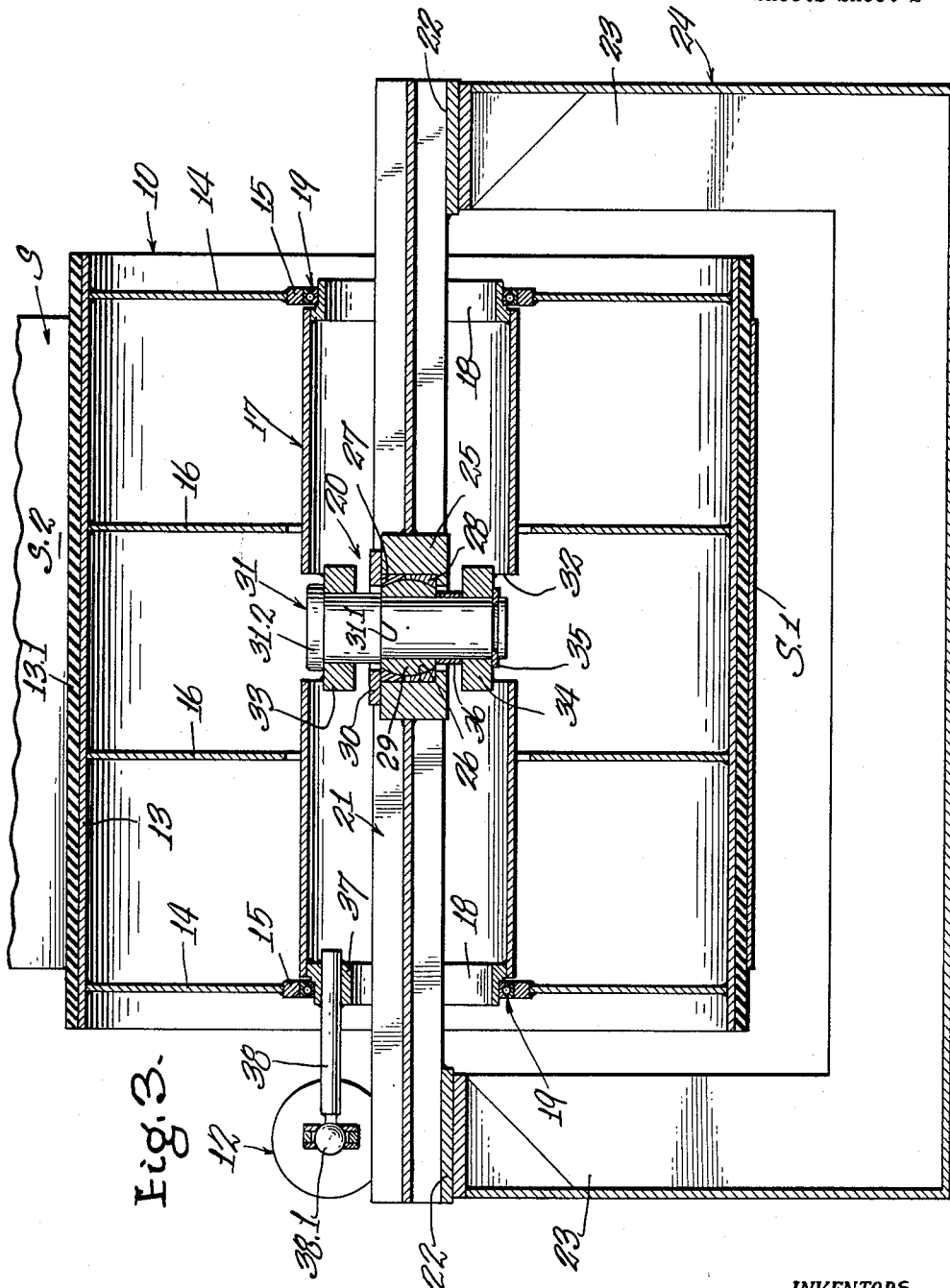
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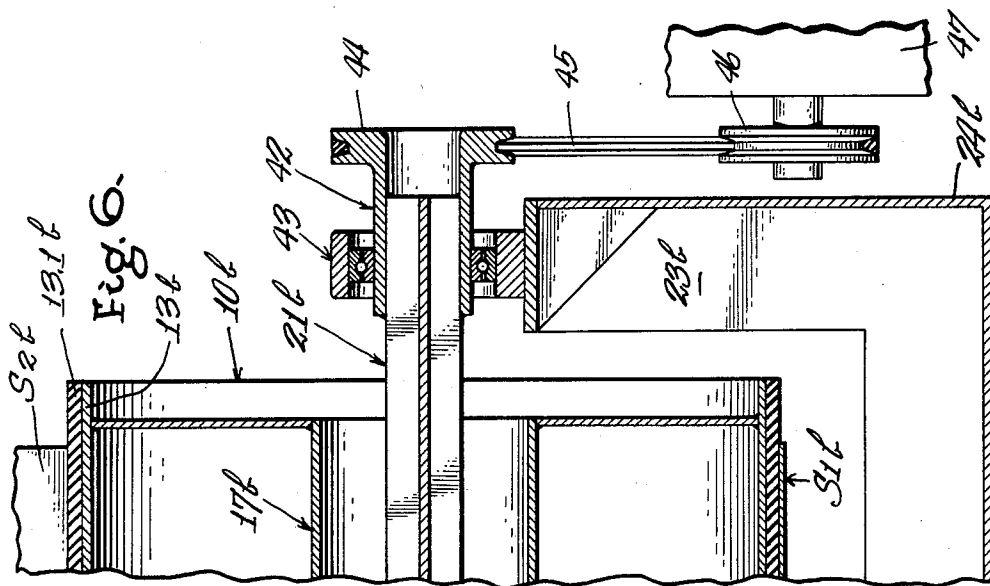
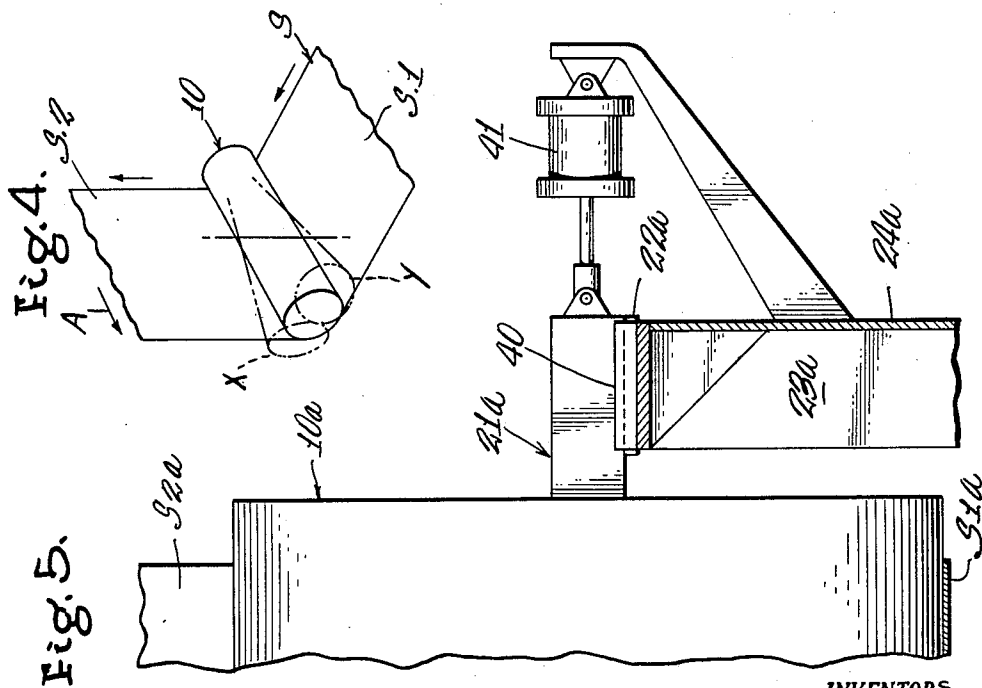
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WEB GUIDING

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WEB GUIDING

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31 Claims. (Cl. 226—21)

The present invention relates to guiding a longitudinally moving web, or strip, and the principal object of the invention is to provide new and improved means of the character described.

It has long been common practice to engage opposed edges of longitudinally traveling strip material with guide members which compelled the material to follow a desired path. This, however, is only possible where the material is relatively rigid and where the speed of the material is relatively low. Where the material is fragile and is traveling at high speed, edge damage can readily occur, particularly when the strip travels under relatively heavy longitudinal tension.

Where engagement of the opposed strip edges is impractical, the strip material has been passed over a shiftable mounted roll. In some cases, the roll mounting has been such that when the strip deviates from its desired path, such deviation causes roll movement in a direction to return the strip to its desired path. In other cases, a sensing device determines when the strip has deviated from its desired path and such device then causes the roll to shift in a direction to return the strip to the path desired.

Heretofore, shiftable mounted roll arrangements have been troublesome, clumsy and space-consuming and, in many instances, have not efficiently guided the strip. In other cases, while guiding may be relatively efficient, roll movement tends to stretch one or the other strip edges. This latter can be a serious problem where the strip is rather fragile.

The present invention, in contrast, provides for accurate strip guiding in a relatively small, compact package with no danger of damaging the strip edges either by engaging them with a guide member or by stretching them by the application of unequal tensions thereon. Other advantages will become apparent from a study of the following description and from the appended drawings.

In the drawings accompanying this specification and forming a part of this application there is shown, for purpose of illustration, embodiments which the invention may assume, and in these drawings:

FIGURE 1 is a diagrammatic perspective view of a preferred embodiment of the invention,

FIGURE 2 is a side elevational view of the invention,

FIGURE 3 is a sectional view generally corresponding to the line 3—3 of FIGURE 2,

FIGURE 4 is a reduced size diagrammatic view of the invention illustrating movement of certain parts, and

FIGURES 5 and 6 are fragmentary views similar to FIGURE 3, but of other embodiments of the invention.

Briefly, and with reference to FIGURE 1, the present invention comprises a roll 10 about which strip material S travels in the direction indicated. In the embodiment first to be described, roll 10 is freely rotatable in the direction indicated, by strip movement. Strip S may conveniently be divided into a roll-approaching portion S1 and a roll-departing portion S2 and as herein disclosed, a strip edge sensing device 11 may be disposed adjacent one edge of the roll-departing strip portion S2.

Device 11 may be of any commercially available type which is responsive to the position of the adjoining strip edge portion S2 and is connected to a roll shifting device,

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such as a fluid cylinder 12. In operation and assuming the strip to be traveling over roll 10 as indicated, the piston rod of cylinder 12 is held immobilized so long as the strip portion S2 is properly positioned. When, however, strip portion S2 becomes displaced in an edge-wise direction from its desired position, device 11 will actuate cylinder 12 to so shift roll 10, in a manner later to be described, that the traveling strip will be returned to its desired position.

For a detailed description of the mounting of roll 10, reference will next be made to FIGURES 2 and 3. As best seen in FIGURE 3, roll 10 is relatively large in diameter and is fabricated to provide maximum strength with minimum weight. To this end, the roll has a tubular peripheral portion 13 closed at each end by centrally apertured walls 14 which may be welded in position. A reinforcing ring 15 is welded within the central aperture of each wall 14 for a purpose to appear. Centrally apertured, intermediate walls 16 may also be welded within the roll portion 13 between the end walls 14 to further strengthen the roll portion 13 and the latter is covered with a layer of rubber or the like 13.1 to insure against marring the strip.

Roll 10 is rotatably mounted on a tubular member 17 which has reduced diameter, ring-like end portions 18 welded thereto. In the present embodiment, a ball bearing assembly 19 is interposed between each portion 18 and each end wall reinforcing ring 15, the parts being held against unintentional disassembly by suitable, well-known retaining members which have not been shown in the interest of avoiding confusion. With the construction thus far described, it will be evident that the roll is freely rotatable on the tubular member 17 through the medium of the anti-friction, ball bearing assemblies 19.

Tubular member 17 is mounted in a novel manner to provide for universal tilting movement of the roll about a ball-joint assembly 20 at the precise center of the roll 10. Extending through the tubular member 17 is a member 21 formed, in the present embodiment, of an H beam section laying on its side as best shown in FIGURE 2. Pads 22 are welded between the member flanges on the underside of the member and at its protruding ends, to facilitate fastening the member rigidly to respective, spaced-apart, upright portions 23 of a supporting frame 24.

Welded into the center of the beam member 21 is a block 25 having an upwardly facing recess 26 for receiving upper and lower ball socket members 27 and 28 respectively. As illustrated, members 27, 28 cooperate to provide a socket for closely receiving a ball 29, a centrally apertured plate 30 being secured by any suitable means to the block 25 and overlying the block recess 26 to retain the ball socket members 27, 28 therein.

A pin 31 extends vertically through the ball 29 and has a shoulder 31.1 against which the latter is abutted. Opposed portions of tubular member 17 are cut away at 32 and welded to such member are respective upper and lower bosses 33, 34 for closely receiving the pin 31. A head 31.2 on such pin abuts the upper boss 33 and a removable locking ring 35 is carried by the lower end of the pin and abuts the lower boss 34 thus locking the pin to the tubular member. A sleeve 36 is interposed between the ball and the lower boss 34 to retain the ball properly positioned on the pin.

With the construction thus far described, it will be evident that the sleeve member 17, together with the roll 10 rotatably carried thereby, is free to tilt in any direction about the ball 29 which is located at the exact center of the roll.

As previously mentioned a fluid cylinder 12 is employed to control tilting of roll 10 and as herein disclosed, one of the tubular member ring-like end portions 18,

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such as the left-hand one seen in FIGURE 3, has an enlarged boss portion 37 in which is anchored a stud 38 which projects axially outwardly of the tubular member. The free end of stud 38 terminates in a ball 38.1 to which the piston rod 12.1 of cylinder 12 is tiltably secured. With reference to FIGURE 2, the portion of cylinder 12 opposite to its piston rod is secured by means of a similar ball and socket to a bracket 39 carried by the adjoining frame upright 23.

With strip S traveling about the roll 10 in the direction indicated and ignoring, for the moment, the operation of cylinder 12, it will be understood that in the event one strip edge for some reason becomes tensioned more than the opposite strip edge, a greater radial inward force will be exerted on one end of the roll than the other. This will tend to tilt the roll about its ball 29 in a direction to equalize the radial inward forces at opposite ends of the roll. Obviously, the roll axis will become stabilized at a position wherein the radial inward forces exerted on the roll by opposite strip edges are equal.

Turning now to the operation of cylinder 12, it will be understood that since each end of the cylinder is mounted on a ball joint for universal tilting action, the roll axis may freely tilt as above outlined in order to equalize the tension in opposite strip edges.

If it now be assumed that the strip portion S2 has deviated from its desired path, such fact will be sensed by the device 11 (FIGURE 1) and the cylinder 12 then actuated, by extending or retracting its piston rod 12.1 to shift the axis of tubular member 17 and thus that of the roll 10. It has been found that best results are obtained if the axis of roll 10 is shifted in a plane generally parallel to the plane of the roll-approaching strip portion S1 as illustrated in FIGURE 4. For this reason, cylinder 12 is so mounted that it exerts a force in a plane generally parallel with that of the roll-approaching strip portion S1 and pin 31 is generally normal to the plane of strip portion S1 to provide an axis about which the roll is pivotable. However, this parallelism is not critical, the apparatus functioning properly, although perhaps somewhat less efficiently, if the planes aforesaid are at an angle with each other of up to 30 degrees.

Still referring to FIGURE 4, if it be assumed that the strip portion S2 has deviated to the left, as indicated by the arrow A, cylinder 12 will be actuated to shift the roll about the axis of pin 31 from its full-line position shown to the phantom-line position indicated at X. This will exert a steering effect on the strip to shift it in the opposite direction to thus return it to its desired running position. It will be noted that shifting the roll in this manner would tend to increase longitudinal tension on the near-side edge of the strip and to correspondingly decrease tension on the far-side edge of the strip; however, since the roll is free to tilt about the ball 29 as previously described, the longitudinal tensions on opposite strip edges will be maintained in balance. Obviously, if the strip is to be steered in the opposite direction, roll 10 will be shifted from its full-line position to its phantom-line position indicated at Y.

Under some circumstances, merely tilting the roll as above described to steer the strip is too slow a process. In such circumstances, the roll may be bodily shifted in an axial direction to immediately shift the strip to its desired position.

With reference to FIGURE 5 wherein another embodiment of the invention is shown and wherein parts similar to those previously described are identified by the same reference characters but with the suffix "a" added, it is to be understood that the pads 22a, instead of being bolted or otherwise fixedly secured to the frame portions 23a, are held on such frame portions by gibs 40 which permit sliding movement of the member 21a in a direction longitudinally thereof. Any suitable means may be provided for reciprocating member 21a, there presently being shown a fluid cylinder 41 which may be connected to a

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sensing device similar to that previously identified by the reference character 11. In other respects, the apparatus shown in FIGURE 5 may be similar to that shown in FIGURES 1 through 4.

In operation of the apparatus illustrated in FIGURE 5, it will be understood that when the sensing device ascertains that the strip has deviated from its desired path, such device will not only tilt the roll axis to steer the strip in the desired direction but will also actuate cylinder 41 to bodily shift the roll 10a in an axial direction and thus the strip traveling thereover in an edgewise direction to the desired path of travel from which the strip has deviated.

The embodiment of the invention seen in FIGURE 6 is similar to that shown in FIGURES 1 through 4; accordingly, similar parts are identified by the same reference characters but with the suffix "b" added. In this embodiment, roll 10b is not rotatably carried by the tubular member 17b but is instead fixedly secured thereto. Thus, tubular member 17b, for all practical purposes, forms a part of the roll 10b.

As presently disclosed member 21b is provided with tubular end portions 42, only one of which is shown, which are rotatably carried by respective bearings 43. Thusly, the member 21b and the roll 10b are unitarily rotatable. Member 42 may have secured thereto a pulley 44 providing a groove for a V belt 45. Belt 45 may cooperate with a pulley 46 driven by a motor unit 47.

Since, in this embodiment, member 17b is rotatable with the roll, a modified arrangement must be employed to connect the roll tilting cylinder thereto. Although not shown, this may be readily be accomplished by substituting for the left-hand, ring-like member 18 seen in FIGURE 3, a similar ring-like member which would, however, be rotatably rather than fixedly secured to the adjoining end of member 17b.

Operation of roll 10b is similar to that of roll 10 previously described; however, instead of roll 10b being an idler which is rotated by the traveling strip, the roll in this case is driven to effect the strip travel.

In view of the foregoing, it will be apparent to those skilled in the art that we have accomplished at least the principal object of our invention and it will also be apparent to those skilled in the art that the embodiments herein described may be variously changed and modified, without departing from the spirit of the invention, and that the invention is capable of uses and has advantages not herein specifically described; hence it will be appreciated that the herein disclosed embodiments are illustrative only, and that our invention is not limited thereto.

We claim:

1. Means for guiding longitudinally moving strip material comprising a tubular member extending transversely of the strip material, a roll concentric with and rotatably mounted on said tubular member and about which said strip material travels, a support member projecting into said tubular member from one end thereof, and means connecting said support member and said tubular member and supporting the latter and said roll for universal tilting movement.

2. The construction of claim 1 wherein said means comprises a pin carried by and extending transversely of said tubular member, a ball carried by said pin, and a socket carried by said support member and closely receiving said ball.

3. The construction of claim 2 wherein said ball is carried by an intermediate portion of said pin and wherein respective ends of the latter are secured to said tubular member.

4. Means for guiding longitudinally moving strip material comprising a pair of spaced-apart frame members, a tubular member extending transversely of the strip material and disposed between said frame members, a roll both concentric and generally coextensive with said tubular member and over which the strip material travels.

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bearing means interposed between said tubular member and said roll adjacent respective ends thereof for rotatably securing said roll to said tubular member, a support member secured to and extending between said frame members and projecting through said tubular member, and means connecting the intermediate portions of said support member and said tubular member and supporting the latter and said roll for universal tilting movement.

5. The construction of claim 4 and further comprising a fluid cylinder extending between said tubular member and one of said frame members for selectively tilting said roll to provide for steering of the moving strip material, the connections between said one frame member and said cylinder and between the latter and said tubular member providing for universal tilting movement therebetween.

6. The construction of claim 5 and further comprising sensing means responsive to the position of a strip material edge and having operable connection with said fluid cylinder for steering the moving strip material in accordance with such edge position.

7. Means for guiding longitudinally moving strip material comprising a rotatably mounted roll about which the strip material travels, means supporting said roll for universal tilting movement to equalize tensions at opposite edges of the strip material, and means for selectively skewing the axis of said roll relative to the longitudinal axis of the traveling strip material for steering the latter.

8. The construction of claim 7 and further comprising sensing means responsive to the position of a strip material edge and having operable connection with said roll axis skewing means for steering the traveling strip material in accordance with such edge position.

9. Means for guiding longitudinally moving strip material comprising a rotatably mounted roll about which the strip material travels, means supporting said roll for universal tilting movement about its center, means providing a pivot axis intersecting the roll center and about which said roll is pivotable, and means for effecting movement of said roll about said pivot axis for steering the strip material traveling thereover.

10. The construction of claim 9 and further comprising sensing means responsive to the position of a strip material edge and having operable connection with said roll movement effecting means for steering the moving strip in accordance with such edge position.

11. The construction of claim 9 wherein said roll supporting means and said axis providing means are disposed within the interior of said roll.

12. Means for guiding longitudinally moving strip material comprising a rotatably mounted roll about which the strip material travels, and means for selectively skewing the axis of said roll relative to the longitudinal axis of the traveling strip material for steering the latter and for shifting said roll axially to bodily move said traveling strip material in an edgewise direction.

13. The construction of claim 12 wherein said roll is skewed to steer said strip material in the same direction as the latter is moved by the axial roll shifting.

14. Means for guiding longitudinally moving strip material comprising a tubular member extending transversely of the strip material, a roll concentric with and rotatably mounted on said tubular member and about which said strip material travels, a support member projecting into said tubular member from one end thereof, means connecting said support member and said tubular member and supporting the latter and said roll for universal tilting movement to equalize tensions at opposite edges of the strip material, and means for selectively skewing the axis of said roll relative to the longitudinal axis of the traveling strip material to steer the latter and for shifting said support member and said roll carried thereby in a direction axially of such roll to bodily move said strip material in an edgewise direction.

15. The construction of claim 14 wherein said support member extends through said tubular member and has

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its ends mounted for longitudinal sliding movement to provide for axial roll movement aforesaid.

16. Means for guiding longitudinally moving strip material comprising a roll, a support member projecting into said roll from one end thereof, means intermediate said support member and said roll and rotatably supporting the latter, and means connecting said support member and said intermediate means and supporting the latter and said roll for universal tilting movement.

17. The construction of claim 16 wherein said connecting means comprises a socket carried by said support member and a ball carried by said intermediate means and closely received within said socket.

18. The construction of claim 16 wherein said last-mentioned means comprises a ball and socket connection.

19. The construction of claim 16 wherein said last-mentioned means comprises a ball carried by said intermediate means and a socket closely receiving said ball and carried by said support member.

20. The construction of claim 16 wherein said intermediate means and said roll are substantially co-extensive and wherein bearing means are interposed between such member and said roll adjacent respective ends thereof.

21. The construction of claim 16 and further comprising force applying means selectively tilting said roll to provide for steering of the moving strip material.

22. The construction of claim 21 wherein the moving strip material approaches said roll along a predetermined plane and wherein said force applying means functions in a plane generally parallel to the plane of the incoming strip.

23. The construction of claim 21 and further comprising sensing means responsive to the position of a strip material edge and having operable connection with said force applying means for steering the moving strip material in accordance with such edge position.

24. The construction of claim 23 wherein said sensing means is spaced from said roll in the direction of strip material travel.

25. The construction of claim 21 wherein said force applying means is connected to said tubular member for the purpose aforesaid.

26. The construction of claim 25 wherein said force applying means comprises a fluid cylinder having a connection with said tubular member which provides for universal tilting movement therebetween.

27. Means for guiding longitudinally moving strip material comprising a rotatable roll over which the strip material travels, a support member for said roll projecting into the latter from one end thereof, means connecting said support member and said roll and supporting the latter for universal tilting movement, and means connected to said roll for selectively tilting the latter to provide for steering of the moving strip material.

28. Means for guiding longitudinally moving strip material comprising a tubular member extending cross-wise of the strip material, a roll generally co-extensive and concentric with said tubular member and about which the strip material travels, bearing means intermediate said roll and said tubular member and adjacent respective ends thereof for rotatably mounting said roll on said member, a transversely apertured support member projecting into said tubular member and of a size to provide radial clearance therebetween, a pin extending transversely of said tubular member and having its ends anchored therein and its intermediate portion extending through the aperture in said support member, a ball carried by the intermediate portion of said pin, a socket for closely receiving said ball and being carried by said support member and at least in part defining the latter's transverse aperture, means carried by and extending axially of said tubular member beyond the adjoining end of said roll, and force applying means having a universal connection with said axially extending means for selectively control-

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ling tilting movement of said tubular member about said ball and consequent tilting movement of said roll.

29. Means for guiding longitudinally moving strip material, comprising a roll about which said strip material travels, an elongated support member within said roll, means upon which said support member is mounted for rotation about a longitudinally disposed axis, and a connection between said roll and said support member and including a universal joint which provides for tilting of said roll in all directions toward and away from concentricity with said support member longitudinal axis and said connection further including means fixedly joining said roll to said support member for unitary rotation at all times.

30. The construction of claim 29 and further compris-

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ing means connected to said support member for rotating the same.

31. The construction of claim 30 and further comprising means for selectively tilting said roll to provide for steering of the moving strip material.

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