Dec. 18, 1956 A. L. LOUCKS 2,774,594

MATERIAL GUIDING APPARATUS

Filed March 10, 1955 2 Sheets-Sheet 1

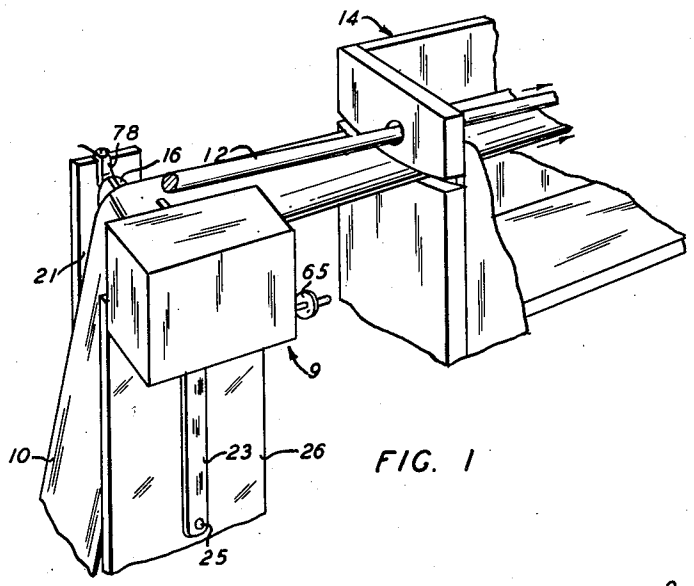


FIG. 1

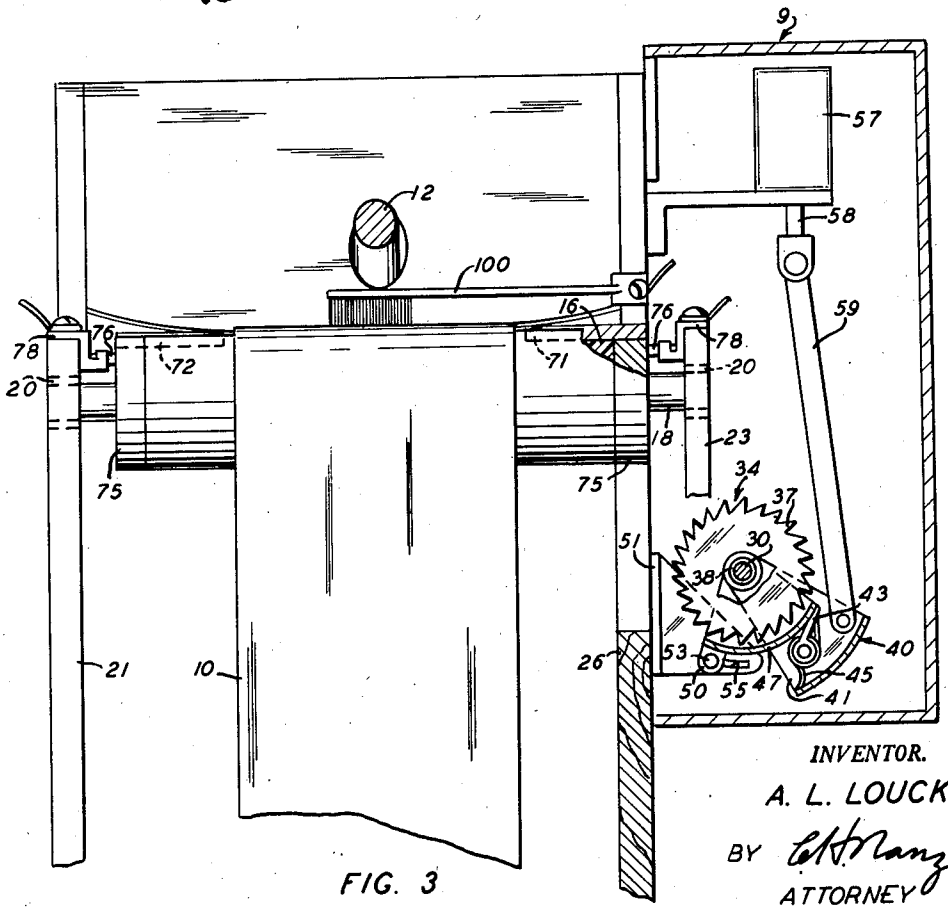


FIG. 3

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MATERIAL GUIDING APPARATUS

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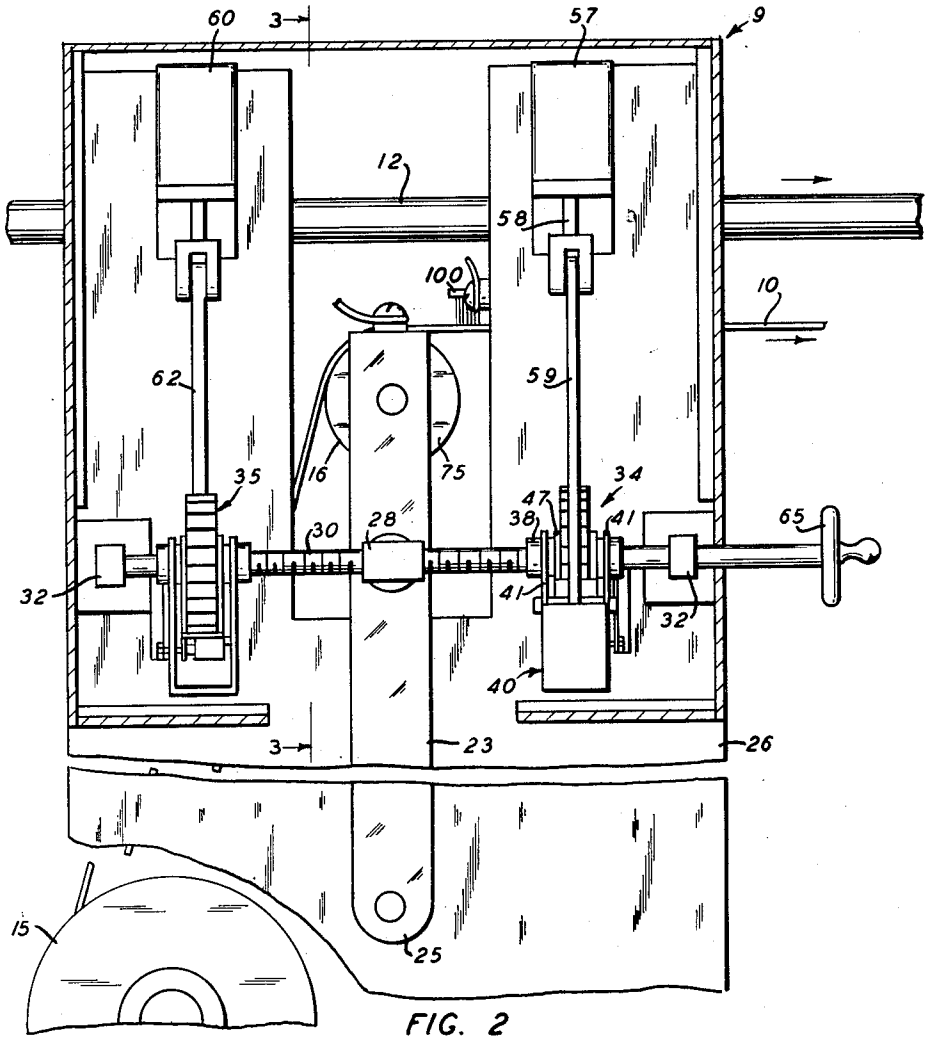


FIG. 2

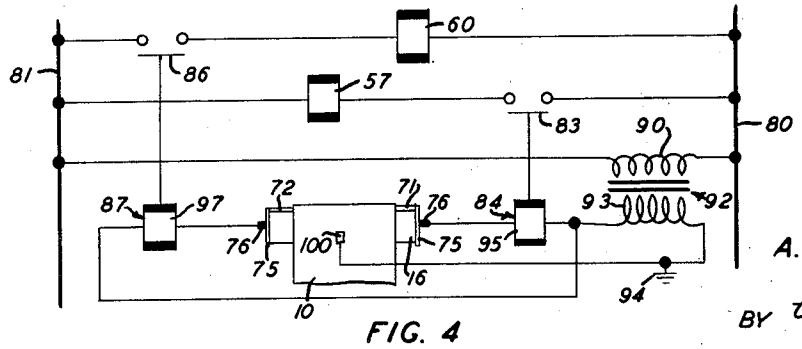


FIG. 4

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MATERIAL GUIDING APPARATUS

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3 Claims. (Cl. 271—2.6)

This invention relates to material guiding apparatus, and more particularly to apparatus for guiding moving strips of material.

This application is a continuation-in-part of my copending application Serial No. 427,958, filed May 6, 1954.

In the manufacture of certain types of composite communication cables, it is desirable to form a thin, flat strip of metal foil, such as aluminum foil, copper foil, or the like, into a continuous tubular sheath about a continuously advancing cable core. It is essential that the finished sheath be free of wrinkles, tears, kinked edges and like defects which would make the cable unsuitable for high frequency transmission purposes. The forming operation is performed by means of a forming unit through which the cable core and the metal foil strip are advanced simultaneously.

To insure the proper alignment of the metal foil strip with respect to the cable core as they advance simultaneously through the forming unit, guide means should be provided for automatically maintaining the alignment of the strip. It has been found that due to the fragile nature of the thin metal foils employed, conventional apparatus for guiding moving strips of material, in which the edges of the strip must of necessity engage and move a detector member, are not satisfactory. Manifestly, such conventional apparatus would cause intolerable damage to thin metal foil.

It is an object of this invention to provide new and improved material guiding apparatus.

It is another object of this invention to provide new and improved apparatus for guiding moving strips of material.

Apparatus embodying certain features of the invention may include a plurality of spaced electrical contacts mounted at either side of the normal path of travel of a continuously advancing strip of electrically conductive material, so that at least one of the contacts is engaged by the strip if it should leave its normal path of travel. Electrically operated means connected to the contacts effect the return of the strip to its normal path of travel when any one of the contacts is engaged.

A complete understanding of the invention may be obtained from the following detailed description of apparatus forming a specific embodiment thereof, when read in conjunction with the appended drawings, in which:

Fig. 1 is a fragmentary, perspective view of apparatus for guiding a strip of metal foil advancing continuously through a sheath forming unit;

Fig. 2 is an enlarged, fragmentary, side elevation of the apparatus shown in Fig. 1, with parts thereof broken away for clarity;

Fig. 3 is an enlarged, fragmentary, vertical section taken along line 3—3 of Fig. 2, with parts thereof broken away for clarity, and

Fig. 4 is a schematic representation of a control circuit forming a part of the apparatus.

Referring now to Fig. 1 of the drawing, there is shown automatic strip aligning apparatus, indicated generally

at 9, for guiding a strip 10 of thin metal foil, such as aluminum or the like, to insure the proper alignment of the strip with respect to a plastic jacketed cable core 12 as the strip and core are advanced simultaneously into and through a tube forming unit, indicated generally at 14. The strip 10 and the cable core 12 are advanced continuously from left to right, as viewed in Fig. 1, by means of a suitable takeup capstan (not shown). The tube forming unit 14 is designed to form the strip 10 into a continuous tubular sheath about the cable core 12 and is described fully in my copending application Serial No. 427,958, filed May 6, 1954.

The strip 10, as it advances to the tube forming unit 14, passes from a supply reel 15 over an idler roller 16. The idler roller 16 is mounted rotatably on a shaft 18, the opposite ends of which are provided with self-aligning ball bearings 20—20. The ball bearing 20 on the left end of the shaft 18, as viewed in Fig. 3, is mounted on a rigid, upright column 21, whereas the ball bearing 20 at the opposite end of the shaft is mounted on an adjustable mounting bracket arm 23.

The bracket arm 23 is pivotally connected by a pin 25 (Fig. 2) to a rigid upright column 26 and is arranged for angular movement in a vertical plane parallel to the longitudinal axis of the forming unit 14. Pivotally attached to the bracket arm 23 at a point immediately below the bearing 20 is an internally threaded, floating nut 28 (Fig. 2), which is threadedly received on a longitudinal extending right hand threaded screw 30. The screw 30 is supported rotatably at its opposite ends by bracket members 32—32 secured fixedly to the upright column 26. Rotation of the screw 30 in either direction is effected by two ratchet and pawl devices 34 and 35 (Fig. 2) positioned on opposite ends of the screw. The ratchet and pawl devices 34 and 35 are substantially identical, but are arranged so as to effect rotation of the screw 30 in opposite directions respectively.

Referring now to Fig. 3, there is shown in detail the ratchet and pawl device 34, which is positioned adjacent to the right hand end of the screw 30 for effecting counterclockwise rotation of the screw, as viewed in Fig. 3. The ratchet and pawl device 34 includes a ratchet wheel 37 having a hub 38 which is mounted on the screw 30 and is keyed thereto for rotation therewith. Mounted loosely on the hub 38 is a U-shaped crank element 40 having two spaced, generally triangular shaped arms 41—41 which straddle the ratchet wheel 37. A pawl 43 is pivotally mounted between the arms 41—41, and is biased resiliently in a counterclockwise direction, as viewed in Fig. 3, by a torsion spring 45.

The pawl 43 is held normally out of engagement with the toothed periphery of the ratchet wheel 37 by an adjustable guard 47 in the form of an arcuate strip of sheet metal. When the crank element 40 is in its normal, inoperative position, as illustrated in Fig. 3, the upper end of the guard 47 prevents the engagement of the pawl 43 with the teeth of the ratchet wheel 37. The lower end of the adjustable guard 47 is secured fixedly to one end of an adjustable support arm 50, the other end of which is mounted loosely on the hub 38. The end of the support arm 50, to which the guard 47 is secured, is attached adjustably to a stationary support bracket 51 by means of a threaded fastener 53. The bracket 51 is secured fixedly to the upright column 26, and is provided with an arcuate slot 55 in which the fastener 53 is received. When the threaded fastener 53 is loosened, the support arm 50 may be moved angularly to adjust the position of the guard 47. The position of the guard 47 establishes the degree of active engagement of the pawl 43 with the ratchet wheel 37.

Angular movement of the crank element 40 in a counterclockwise direction, as viewed in Fig. 3, is accom-

plished by means of a pull type solenoid 57 having a plunger 58 connected eccentrically to the crank element 40 through a pivoted connecting rod 59. Normally, the solenoid 57 is deenergized and the combined weights of the plunger 58, the connecting rod 59 and the crank element 40 hold the crank element in the position shown in Fig. 3, wherein the spring-biased pawl 43 is held out of engagement with the ratchet wheel 37 by the guard 47. However, when the solenoid 57 is energized, the crank element 40 is rotated counterclockwise, as viewed in Fig. 3, through a predetermined angle. As the crank element 40 moves in the counterclockwise direction, the spring-biased pawl 43 slips over the end of the guard 47 and engages a tooth on the ratchet wheel 37 to rotate the screw 30 until the crank element reaches the limit of its counterclockwise movement. Subsequently, when the solenoid 57 is again deenergized, the crank element 40 returns due to gravity to its normal position with the spring-biased pawl 43 disengaged from the ratchet wheel 37.

The ratchet and pawl device 35 (Fig. 2), which is substantially identical to its counterpart described above in detail, is operated by means of a solenoid 60 through a connecting rod 62. The solenoid 60 is identical in construction to the solenoid 57. Energization of the solenoid 60 causes a predetermined clockwise angular rotation of the screw 30, as viewed in Fig. 3, in a manner similar to that described in relation to the solenoid 57. The solenoids 57 and 60 are suitably mounted on the upright column 26, and are positioned above their associated ratchet and pawl devices 34 and 35, respectively. A handwheel 65 is provided on the right hand end of the screw 30 to facilitate manual adjustment of the position of the roller 16.

Referring again to Fig. 2, it may be seen that the rotation of the screw 30 effected by the energization of the solenoid 57 results in a predetermined clockwise angular movement of the pivoted bracket arm 23, which supports the self-aligning ball bearing 20 of the idler roller 16. Conversely energization of the solenoid 60 results in a predetermined counterclockwise movement of the bracket arm 23. The rotational axis of the idler roller 16 always remains substantially in a horizontal plane, but it changes its angular position relative to the longitudinal axis of the forming unit 14 with changes in the angular position of the bracket arm 23. When the bracket arm 23 is positioned vertically, the rotational axis of the idler roller 16 is perpendicular to the longitudinal axis of the forming unit 14.

The idler roller 16, as illustrated in Fig. 3, is made of an insulating material. Partially embedded in the surface of the roller 16 are a pair of metallic contacts 71 and 72. The contacts 71 and 72 are spaced apart a predetermined distance, which is slightly greater than the width of the metal foil strip 10. The contacts 71 and 72 are positioned so that as long as the metal foil strip 10 remains aligned with the longitudinal axis of the forming unit 14 is does not engage either of the contacts. However, if the metal foil strip 10 should move out of alignment, in one direction or the other, one of the contacts 71 or 72 will be engaged by the corresponding edge of the metal foil strip.

The width of each of the contacts 71 and 72 is relatively small in comparison to the circumference of the idler roller 16. Hence, the engagement of the strip 10 with the particular contact 71 or 72, depending upon the direction of the misalignment, is not continuous, but is quickly made and broken once per revolution of the roller. As shown in Fig. 3, the top surfaces of the contacts 71 and 72 are raised slightly above the periphery of the idler roller 16, but not enough to interfere with the smooth running of the metal foil strip 10 over the roller. The contacts 71 and 72 are connected electrically to metallic contact rings 75—75 mounted coaxially on either end of the idler roller 16. As the idler roller 16 rotates the contact rings 75—75 are contacted by spring-pressed carbon brushes 76—76 mounted in conventional brush holders 78—78 supported on upright columns 21 and 26, respectively.

Illustrated in Fig. 4 is a schematic representation of an electrical circuit associated with the contacts 71 and 72 and the solenoids 57 and 60. The circuit includes a pair of power supply lines 80 and 81 connected to a suitable source of A. C. voltage. The solenoid 57 is connected across the lines 80 and 81 through a normally open contact 83 of a solenoid operated relay 84. Similarly, the solenoid 60 is connected across the lines 80 and 81 through a normally open contact 86 of a solenoid operated relay 87. Also connected across the supply lines 80 and 81 is a primary winding 90 of a step-down transformer 92. The secondary winding 93 of the transformer 92 is connected on one side to ground at 94. The ungrounded side of the secondary winding 93 is connected to the contact 71 on the idler roller 16 through a solenoid 95 of the relay 84 and the spring-pressed carbon brush 76. The contact 72 on the idler roller 16 is connected through the spring-pressed carbon brush 76 and a solenoid 97 of the relay 87 to the ungrounded side of the secondary winding 93. The advancing metal foil strip 10 is grounded by means of a metal brush 100 (Fig. 3), which is attached to the column 26 and is in continuous pressing, electrical contact with the surface of the strip.

Operation

Let it be assumed that the apparatus is operating and that the metal foil strip 10, the initial end of which is attached fixedly to the cable core 12 by suitable means, is advanced simultaneously with the cable core through the forming unit 14. In moving toward the forming unit 14 the strip 10 passes over the freely rotatable idler roller 16, which guides it toward the forming unit 14. The automatic strip aligning apparatus 9 functions throughout the operation to insure the alignment of the longitudinal axis of the advancing strip 10 with the longitudinal axis of the forming unit 14.

To illustrate the operation of the strip aligning apparatus 9, let it be assumed, for example, that for some reason or another the strip 10 moves momentarily to the right out of proper alignment, and its right edge, as viewed in Fig. 3, extends into the path of the contact 71 mounted on the periphery of the idler roller 16 near the right end thereof. As long as the strip 10 remains misaligned the contact 17 will engage the metal strip, which is grounded electrically by the metal brush 100, once per revolution of the idler roller 16. Each time the contact 71 engages the metal foil strip 10 momentarily, a low voltage circuit is completed through the secondary winding 93 of the transformer 92 to energize the solenoid 95 of the relay 84, whereby its associated contact 83 is closed momentarily.

When the normally open contact 83 closes momentarily, the solenoid 57 is energized to operate the connecting rod 59 attached to the crank element 40 of the ratchet and pawl device 34. Upon energization of the solenoid 57, the crank element 40 is rotated angularly in the counterclockwise direction, as viewed in Fig. 3, to effect a predetermined angular rotation of the screw 30. This counterclockwise rotation of the screw 30 results in a clockwise angular movement of the bracket arm 23 which supports the self-aligning ball bearing 20 of the idler roller 16.

This predetermined angular movement of the bracket arm 23 displaces the rotational axis of the idler roller 16 from its normal perpendicular orientation with respect to the longitudinal axis of the forming unit 14 in a direction such that the right end of the roller, as viewed in Fig. 3, moves forward a predetermined distance in the direction of travel of the strip 10. The rotational axis of the idler roller 16 remains substantially horizontal, but it assumes an angle of less than 90° with respect to the longitudinal

axis of the forming unit 14. This change in the angular orientation of the idler roller 16 tends to cause the strip to shift laterally from right to left, as viewed in Fig. 3, as it advances, thereby tending to move the strip back into longitudinal alignment with the forming unit 14.

If the correction is not sufficient to move the strip 10 back into alignment before the contact 71 makes another revolution, the electrically grounded strip 10 will again engage the contact 71 to operate the ratchet and pawl device 34 again and cause an additional predetermined angular movement of the idler roller 16 in the manner previously described. It is apparent that if the metal foil strip 10 should move out of alignment in the opposite direction, the contact 72 would be engaged to operate its associated ratchet and pawl device 35 which functions to move the idler roller 16 in the opposite direction to cause the strip to tend to shift toward the right and back into alignment. Thus, the automatic strip aligning apparatus 9 insures proper alignment of the advancing strip 10 with respect to the longitudinal axis of the forming unit 14 and the cable core 12.

It will be understood that metal foil strips employed may be extremely thin. For example, aluminum foil used in making such sheaths may have thicknesses of the order of .003 inch, or less. Heretofore considerable difficulty has been encountered in handling these extremely thin, metal foil strips. However, in spite of their fragile nature, such metal foil strips have been formed into tubular sheaths free of wrinkles, tears, kinded edges and like defects, by employing the above-described apparatus.

Manifestly, it is apparent that by employing additional pair of contacts 71 and 72 spaced around the periphery of the roller, the time required to restore the proper alignment to a misaligned strip would be effectively shortened.

The embodiment of the invention herein disclosed is merely illustrative and may be modified in various ways without departing from the spirit and scope of the invention.

What is claimed is:

1. Apparatus for guiding a thin metal foil strip having a predetermined width, which comprises a guide roller over which such a strip is advanced continuously and normally along a predetermined path of travel, means for mounting the guide roller for rotation on its longitudinal axis, means operable for changing the angular relationship of the longitudinal axis of the roller with respect to the normal path of travel of the strip, a pair of electrical contacts mounted on the roller for rotation therewith and positioned substantially flush with the periphery, said contacts being spaced apart a distance slightly greater than the width of the strip and extending circumferentially only partially around the roller so that when the strip deviates slightly from its normal path of travel, one or the other of said contacts engages and disengages the strip once per revolution of the roller, means for insulating the contacts electrically from the strip so long as the strip maintains said normal path of travel, means for impressing an electrical potential between the strip and the contacts, and solenoid operated means connected to said contacts and designed to be energized, when any one of the contacts is engaged by the strip, to actuate the means for changing the angular relationship of the longitudinal axis of the roller in such a manner as to cause the strip to return to its normal path of travel.

2. Apparatus for guiding a thin metal foil strip having a predetermined width, which comprises a guide roller over which such a strip is advanced continuously and normally along a predetermined path of travel, means for mounting the guide roller for rotation on its longitudinal axis, a rotatable screw operatively connected to said last-mentioned means for changing the angular relationship of the longitudinal axis of the roller with respect to the normal path of travel of the strip, a pair of electrical contacts mounted on the roller for rotation therewith and positioned substantially flush with the periphery, said contacts being spaced apart a distance slightly greater than the width of the strip and extending circumferentially only partially around the roller so that when the strip deviates slightly from its normal path of travel, one or the other of said contacts engages and disengages the strip once per revolution of the roller, means for insulating the contacts electrically from the strip so long as the strip maintains said normal path of travel, means for impressing an electrical potential between the strip and the contacts, solenoid means connected electrically to said contacts and designed to be energized, when any one of the contacts is engaged by the strip, and ratchet and pawl means to actuate the means for operating the screw to change the angular relationship of the roller in such a manner as to cause the strip to return to its normal path of travel.

3. Apparatus for guiding a metal foil strip having a predetermined width, which comprises a guide roller over which such a strip is advanced continuously and normally along a predetermined path of travel, means for mounting the guide roller for rotation on its longitudinal axis, means operable for changing the angular relationship of the longitudinal axis of the roller with respect to the normal path of travel of the strip, a pair of electrical contacts mounted on the roller for rotation therewith and positioned substantially flush with the periphery thereof, said contacts being spaced apart a distance slightly greater than the width of the strip and extending circumferentially only partially around the roller so that when the strip deviates slightly from its normal path of travel one or the other of said contacts engages and disengages the strip once per revolution of the roller, means for insulating the contacts electrically from the strip so long as the strip maintains its normal path of travel, means for impressing an electrical potential between the strip and the contacts, and electrically operated means connected to said contacts and energized when any one of the contacts is engaged by the strip to operate the means for changing the angular relationship of the longitudinal axis of the roller in such a manner as to cause the strip to return to its normal path of travel.

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