

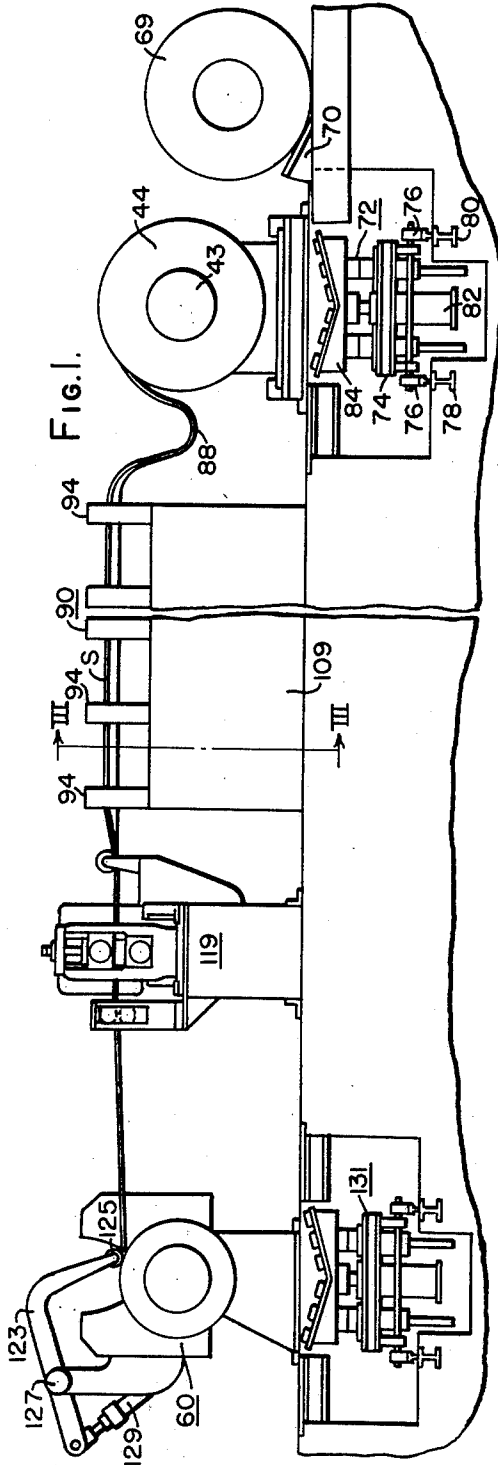
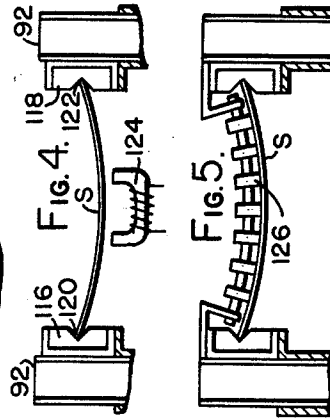
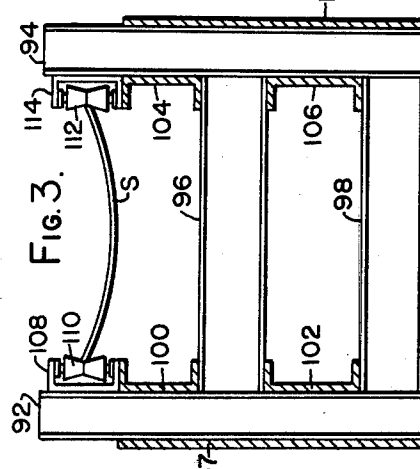
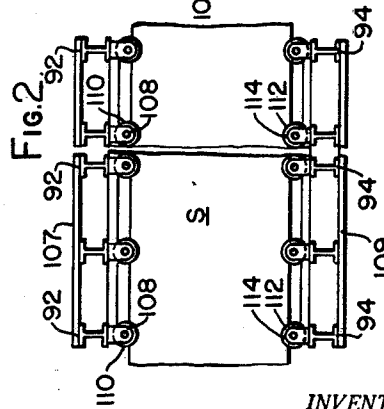
Jan. 8, 1963

J. M. HILL

3,072,309

STRIP GUIDING METHOD AND APPARATUS

Filed April 13, 1960



INVENTOR.
Joseph M. Hill

BY *J. H. Murray*
ATTORNEY

1

3,072,309

STRIP GUIDING METHOD AND APPARATUS
Joseph M. Hill, 8016 Marmion Drive, Pittsburgh, Pa.
Filed Apr. 13, 1960, Ser. No. 21,931
3 Claims. (Cl. 226—88)

This invention relates to a method and apparatus for guiding moving strip material along a predetermined path of travel and more particularly to a method and apparatus of the type described for maintaining the longitudinal center line of moving strip material straight over relatively long lengths.

Metal strip material, as it comes from the mill, is usually cambered, meaning that if the center line of the strip were plotted equally distant from its edges it would assume a curvature in various directions. That is, the strip material is not truly straight and weaves or drifts from side to side along its length. In the usual processing line for strip material, whether it be slitting, painting, plating, cleaning or the like, it is highly desirable that the strip pass through the processing line along a straight path. This is particularly important in a slitting line where the resulting strips of reduced width on the other side of the slitter should be perfectly straight with the slitter serving to shear off any curved or cambered edges. In the usual slitter, however, the strip is guided only by a pair of short blocks which abut the opposite edges of the entering material adjacent the slitting rolls with the result that the blocks do not compensate for a gradually curved center line or camber extending along the length of the strip. This results in the camber appearing in the slit material emanating from the slitter.

Another problem which often arises in processing lines for strip is due to telescoping of the entry coil. Such telescoping causes the strip to drift to one side or the other from a longitudinal axis and, if not corrected, will cause excessive rubbing of the edges of the strip against the sides of the processing line or possibly malfunctioning of the apparatus. In the past, a telescoped condition of the entry coil was usually compensated for by traversing the uncoiling drum on which the entry coil is mounted in a direction perpendicular to strip movement or by passing the strip over a guiding roll having an axis which may be varied with respect to the direction of strip travel to such an extent that the roll guides the strip back to its normal and desired path. In either case, pneumatic or electrical means may be provided for sensing the position of the edge of the strip and for automatically traversing the uncoiling drum or varying the position of the axis of the guiding roll, as the case may be. Both of these methods, although able to alleviate the problem of weaving due to telescoping with some degree of accuracy, are oftentimes costly and troublesome to maintain and in some cases impractical to use.

As an overall object, the present invention seeks to provide a new and improved method and apparatus for maintaining the longitudinal axis of strip material straight over relatively long lengths.

More specifically, an object of the invention is to provide a method and apparatus for eliminating the problem of edge weaving and/or camber in a strip processing line.

Another object of the invention is to provide a system for reducing the effects of telescoped coils on an uncoiler in a strip processing line.

Still another object of the invention resides in the provision of a new and improved slitting line in which the slit material emanating from the slitting rolls will be straight along a longitudinal axis regardless of camber in the material fed into the slitter.

In accordance with the invention, hereinafter described, strip material is first uncoiled from an entry coil and

2

then passed between a pair of parallel guideways which extend along a substantially length of the strip, with the strip being uncoiled at such a rate to produce a loop between the entry coil and the guideways. The parallel guideways are separated by an amount less than the width of the strip so that, as the strip passes between the guideways, it will become curved or bowed between its edges. In this manner, any camber in the strip or variation in its width will be reflected in a change in the radius of curvature of the strip. At the same time, the strip is forced to travel along a true straight line path at all times due to the fact that its edges are confined between the parallel guideways. Thus, after passing between the guideways, the strip may be fed into a slitter, for example, and any camber will be reflected in the edges of the strip which are trimmed off while the desired slit material will be truly straight along its length. By virtue of the loop between the uncoiler and the guideways, sufficient sideways flexibility is given to the strip so that even though the entry coil is telescoped, the strip may be shifted to one side or the other without buckling and will be forced to travel along a straight line path in passing through the aforesaid parallel guideways before being fed to the processing equipment.

The above and other objects and features of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings which form a part of this specification and in which:

FIG. 1 is an illustration of a slitting line incorporating the strip guiding means of the present invention;

FIG. 2 is a top view of the strip guiding apparatus shown in FIG. 1 for the embodiment of the invention wherein parallel rows of rollers are employed to guide the strip along a straight line path;

FIG. 3 is a cross-sectional view taken along line III—III of FIG. 1 for the case where parallel rows of rollers are employed to guide the strip along a straight line path;

FIG. 4 is an illustration of another embodiment of the invention wherein the edges of the strip are guided between notched parallel blocks or runners and wherein a curvature is produced in the strip by means of an electromagnet; and

FIG. 5 is an illustration of still another embodiment of the invention incorporating arched rollers to produce a curvature in the strip across its width during the strip guiding process.

Although the invention is shown herein as applied to a slitting line, it is to be understood that the particular application illustrated is for explanatory purposes only and that the invention may be used for other and different processing lines such as cleaning, plating, levelling or roll forming.

The new and improved apparatus of the present invention for eliminating camber and the effects of telescoping is illustrated in FIGS. 1-5. Referring to FIG. 1, it will be noted that an uncoiler 44 and recoiler 60 are provided. Coils 69 to be slit are located on the floor at the side of the uncoiler and come to rest against a retractable stop member 70 which may be lowered to permit the coil to roll onto a coil car, generally indicated at 72. As shown, the coil car comprises a bed or carriage 74 having wheels 76 thereon adapted to travel over tracks 78 and 80 which extend perpendicular to the path of travel of the strip in traveling through the slitter. That is, the coil car moves into or out of the plane of the drawing. Carried by the bed 74 is a hydraulic cylinder 82 which is adapted to elevate or lower a V-shaped cradle 84 on which the coils are positioned. In a typical loading operation, the stop member 70 will be retracted,

and a coil will roll onto the cradle 34. As was mentioned above, the coil to be loaded is initially located at the side of the uncoiler 44, as is the coil car 72. After the coil rolls onto the cradle 34, the cylinder 32 is pressurized to elevate the cradle until the center line of the coil to be loaded is aligned with the axis of uncoiler 44. Thereafter, the coil car 72 is moved toward the uncoiler (i.e., into the plane of the drawing) whereby the coil to be loaded will slide over the expansible drum 43 of the uncoiler. This drum is collapsed until a coil slides over the drum, whereupon it is expanded to securely abut the inner periphery of the coil in a manner well known in the art.

In accordance with the present invention the strip material is uncoiled at such a rate to maintain a loop therein as at 33 and then passed between a pair of parallel guideways provided in a frame structure 90 which extends along a substantial length of the strip. As is best shown in FIGS. 2 and 3, the frame structure comprises a plurality of spaced I-beams 92 and 94 on opposite sides of the path of the strip, with the I-beams being interconnected by spacing members 96 and 98. As will be understood, the assembly shown in FIG. 3 comprises a single frame section, and in the complete frame structure 90 there are a plurality of such sections mounted in spaced relationship. The various sections are interconnected by means of longitudinally extending channels 100, 102, 104 and 106 and are provided with panels 107 and 109 on the exterior surfaces thereof. Welded or otherwise securely fastened to the upper inside surface of I-beam 92 in each frame section is a generally C-shaped member 103 which supports a roller 110 for rotation about a generally vertical axis. As shown, the roller 110 is of the hour-glass type and has a minimum diameter midway between its ends. The roller 110 in each frame section is one of a complementary pair, the other roller 112 being on the I-beam 94 and supported on a C-shaped member 114 welded or otherwise securely fastened to the upper inside surface of beam 94. As is best shown in FIG. 2, each of the sections is provided with a pair of oppositely disposed rollers to provide a longitudinally extending path between which the strip must pass. The spacing between the rollers 110 and 112 is less than the width of the strip passing therebetween. Consequently, the strip will be bowed or curved between its edges as shown in FIG. 3; however, the curvature must not be great enough to exceed the elastic limit of the material. Although the strip is shown herein as being bowed or arched downwardly, it may alternatively be bowed upwardly with equal effectiveness. It will be understood, of course, that the spacing between rollers 110 and 112 may be made adjustable to accommodate strips of different widths. The rollers are illustrated herein at a fixed width for purposes of simplicity only.

Generally, the length of the parallel paths between which the strip must be guided should be on the order of about five to ten times the width of the strip to give it sufficient sideways rigidity. In some cases it may be necessary to dispose the entire frame structure 90 and the parallel guideways carried thereby at an angle with respect to the normal path of strip travel through the processing equipment. Accordingly, means, not shown, may be provided to rotate the entire frame structure 90 in a horizontal plane about a vertical axis disposed midway between its ends.

With the arrangement described herein, any camber in the strip or other variation in its edges will be reflected by a change in radius in the curvature of the strip. At the same time, however, since the strip must pass between the parallel rows of rollers 110 and 112, it must travel along a straight path regardless of any camber or other edge variations. Similarly, if the entry coil is telescoped, it will cause a certain amount of twisting in the loop 33. However, once the strip enters the path defined between rollers 110 and 112, it must travel along a straight line

path so that when it enters the slit or other processing apparatus it will not weave from side to side. Thus, in the case of a slitter, any camber in the strip, for example, will be reflected in the edge strips or scrap which are sheared off while the resulting slit strips will be straight along their entire lengths due to the fact that the strip, in entering the slitter, was forced to travel along a straight line path. It will be noted in FIG. 1 that the slitter, generally indicated at 119, does not include edge guides such as those used in conventional slitters of the type shown, for example, in U.S. Patent No. 2,275,093. These, of course, become unnecessary due to the fact that the strip has already been aligned in passing through the guideways in frame structure 90. The recoiler 60 in the illustration of FIG. 1 includes a hold-down device for the slit material rather than coil spacers. The hold-down device comprises a lever arm 123 having a roller or rollers 125 at one end which ride on the slit strips wound upon the recoiler. The lever arm 123 is pivotal about point 127 and is connected at its opposite end to a hydraulic cylinder 129, the arrangement being such that the cylinder may be actuated to hold the roller 125 in engagement with the surface of the slit material. This assembly, however, is optional, and may be replaced by separating spacers if desired. After the slit material is wound upon the recoiler 60, it is transferred to a coil car assembly 131 which is identical to the assembly 72 already described in connection with the uncoiler 44.

The center line of the strip material entering the slitter may be curved due to the fact that the edges of the strip are curved. The center lines of the slit strips, however, will be straight since the edges of these strips will be exactly parallel. Furthermore, assuming that the edges of the strip before passing through the slitter are cambered or curved, the center line of the entering strip will shift to one side or the other in passing through the guideway of the present invention; and this variation in the position of the center line of the entering strip will be reflected by differences in the widths of the edges which are discarded as scrap.

Another embodiment of the invention is shown in FIG. 4 wherein the strip passes between wear blocks 116 and 118 having V-shaped notches 120 and 122 therein for the reception of the opposite edges of the strip. As will be understood, the operation of this embodiment is similar to that shown in FIG. 3. In this case, however, the edges of the strip slide in the V-shaped notches 120 and 122 rather than on the periphery of rolls 110 and 112. Again, the beams 92 and 94 are spaced apart whereby the distance between the notches 120 and 122 will be less than the width of the strip to produce a bow or arch in the strip between its edges. To assist in producing this arch magnetic means, such as an electromagnet 124, may be provided below or above the strip to attract the center of the material whereby the bow will be produced.

Still another embodiment of the invention is shown in FIG. 5 wherein a plurality of arched rollers 126 extend across the width of the strip to produce an arch therein. In the embodiment illustrated in FIG. 5, the strip is again positioned between wear block; however, the rollers 110 and 112 of FIG. 3 could be readily used in their place. In all cases, at the point where the strip is to be worked or to continue along its way, the arch or bow is released and the strip comes back to its normal flat condition. By this time, however, it is being positively guided along a straight line path.

The invention thus provides a method and apparatus for maintaining the path of moving strip material straight along great lengths regardless of any camber in the strip, telescoping of the entry coil, or variation in width of the strip. Although the invention has been shown in connection with a certain specific embodiment, it will be readily apparent to those skilled in the art that various changes in form and arrangement of parts may be made to suit requirements without departing from the spirit and

5

scope of the invention. In this respect, it is apparent that in certain cases the strip need not be looped as at 88. Furthermore, means other than the electromagnet 124 in FIG. 4 may be employed to produce an electrically induced force on the strip.

I claim as my invention:

1. Apparatus for maintaining the longitudinal center line of moving strip material straight over long lengths comprising, in combination, a pair of parallel guideways between which the strip is adapted to pass as it moves along a substantially straight line path, said guideways being spaced apart in an amount less than the width of the strip, and members positioned between said guideways in the path of travel of the strip for exerting a pressure at the central portion of the strip whereby the same will become bowed across its width and any camber in the strip or variation in its width will be reflected by a change in radius of the bow in the strip.

2. Apparatus for maintaining the longitudinal center line of moving magnetically permeable strip material straight over long lengths comprising, in combination, a pair of parallel guideways between which the strip is adapted to pass as it moves along a substantially straight line path, said guideways being spaced apart in an amount less than the width of the strip, and magnetic means dis-

6

posed substantially midway between the guideways for exerting an electrically induced force on the strip whereby the strip will become bowed between its edges.

3. A method for maintaining the longitudinal center line of moving rolled metal strip having camber therein straight over long lengths which comprises passing the strip between a pair of parallel guideways extending along the long dimension of the strip with the guideways being spaced apart by an amount less than the width of the strip whereby the strip will be bowed between the guideways and any camber in the strip or variation in its width will be reflected by a change in radius of the bow in the strip, and exerting a force at the center of the strip between said guideways to maintain the bow in the strip.

References Cited in the file of this patent

UNITED STATES PATENTS

255,638	Krueger	Mar. 28, 1882
1,966,684	Pollock	July 17, 1934
2,085,439	Morlock	June 29, 1937
2,275,093	Spangler	Mar. 3, 1942
2,297,525	Anheuser	Sept. 29, 1942
2,608,357	Brearton	Aug. 26, 1952