March 3, 1953 R. B. HEILMAN ET AL 2,630,319

CORRECTING APPARATUS FOR STRIP OPERATIONS

Filed Dec. 7, 1948 2 SHEETS—SHEET 1

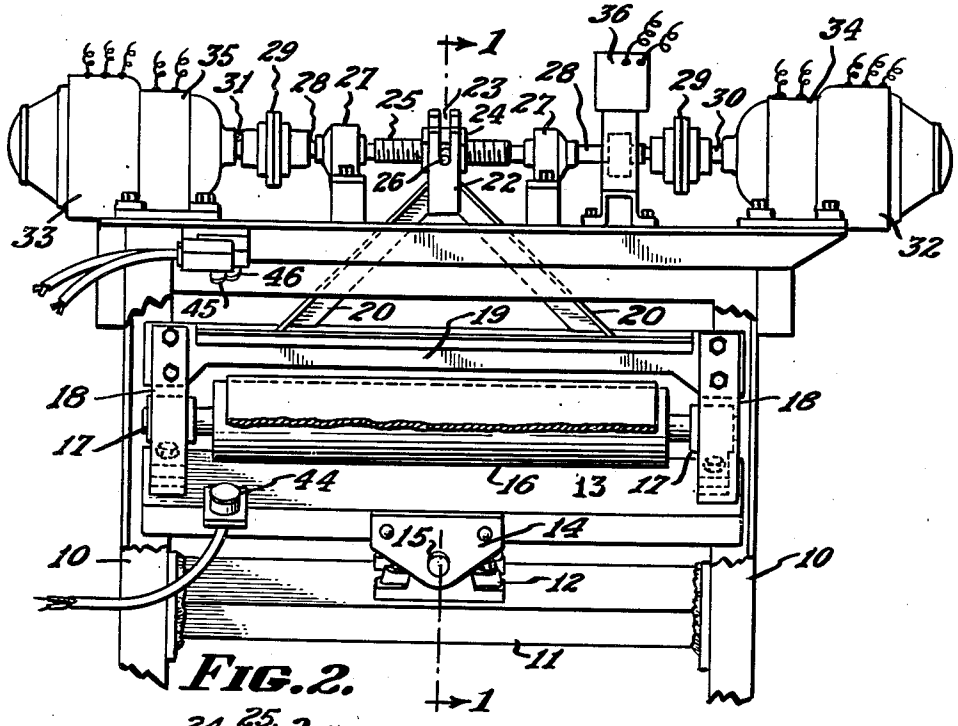


FIG. 2.

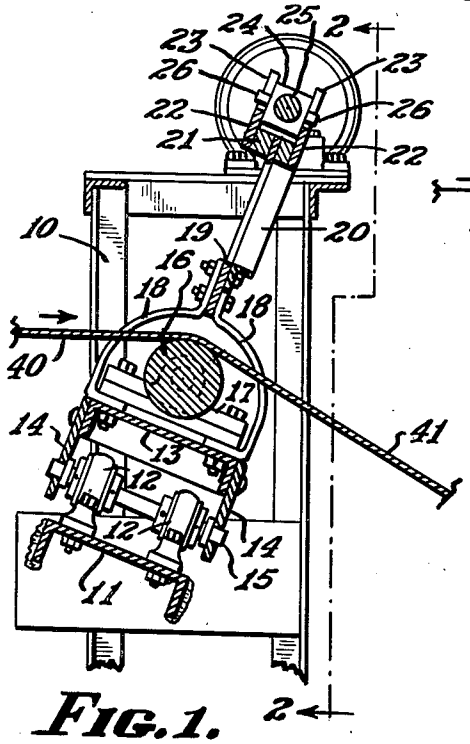


FIG. 1.

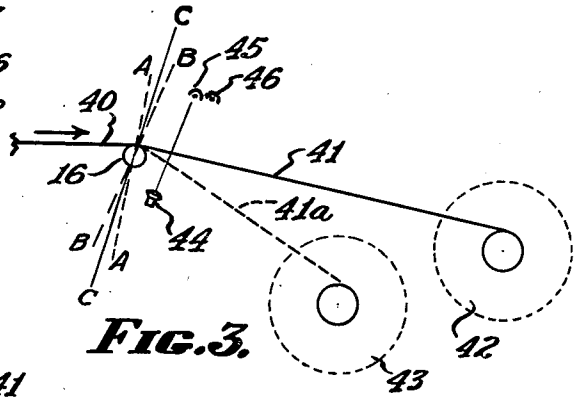


FIG. 3.

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2 SHEETS—SHEET 2

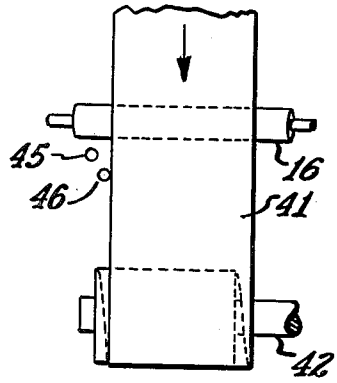


FIG. 4.

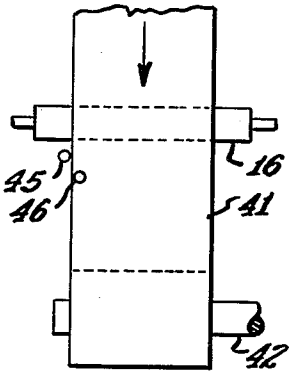


FIG. 5.

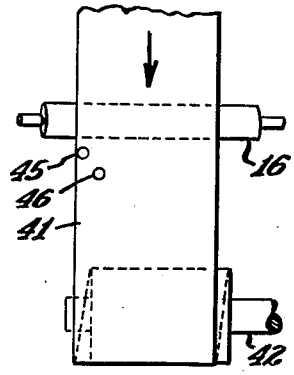


FIG. 6.

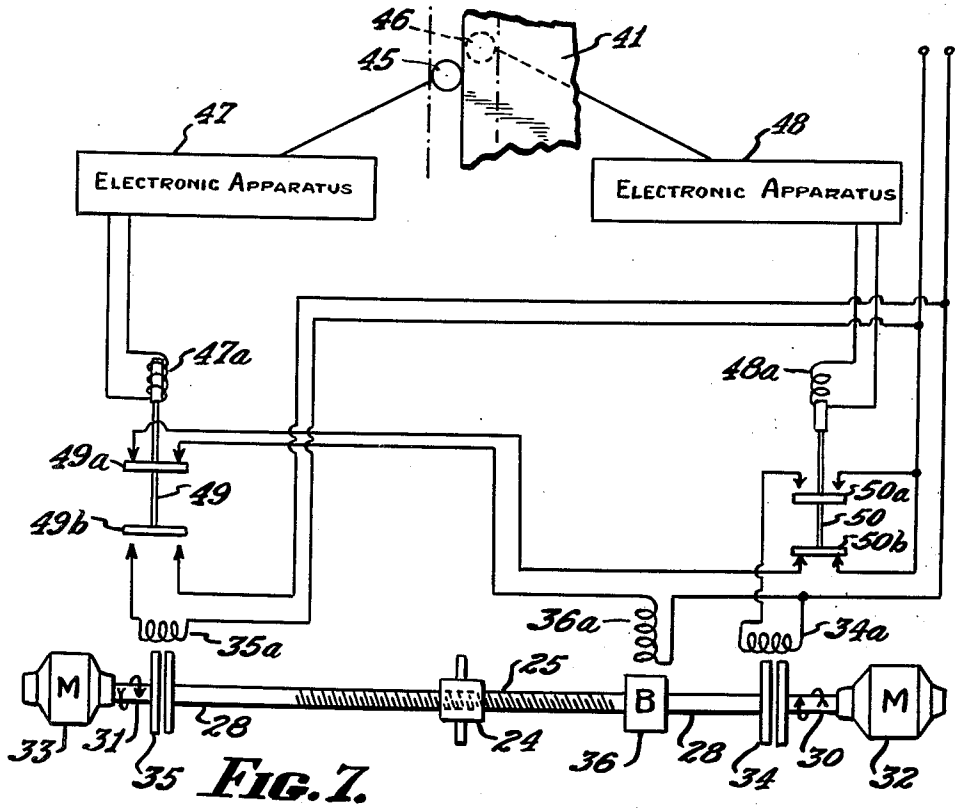


FIG. 7.

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CORRECTING APPARATUS FOR STRIP OPERATIONS

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4 Claims. (Cl. 271—2.6)

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This invention relates to a correcting apparatus for strip operations and more particularly to an apparatus for correcting for lateral movement from its path of travel of a strip during an operation such as coiling.

A number of apparatuses have been proposed and used in the past for the same general purpose. All of these apparatuses in general have fallen into one of two classes. The first class comprises a guide roll which is pivotable in a horizontal or vertical plane either about its center or about one end. The operation of a correcting apparatus of this type is dependent upon creeping of the strip and it has been found from experience that such creeping of the strip over the correcting roll is injurious to a fragile coating material. The other class involves automatically controlled coiler drums which are displaced horizontally in accordance with the path of the oncoming strip whereby the coiler itself moves so that even convolutions are formed.

As pointed out above, the first class of apparatus is objectionable because of the fact that it is damaging to fragile coatings on the strip. The second class is objectionable because of the extreme expense involved in the provisions of this type of coiling apparatus.

With the foregoing considerations in mind it is an object of the present invention to provide a correcting apparatus which will involve no more expense than apparatuses of the first class but which at the same time will avoid the danger of damaging fragile coatings on the strip.

It is another object of the invention to provide a correcting roll which is pivotable not about either end or its center but about a point removed from the roll axis a substantial distance so that the strip will not be caused to creep over the roll during the correcting operation.

In accomplishing the foregoing object it is yet another object of the invention to provide a correcting roll between a strip processing unit and a coiling apparatus above a line connecting the two so that the strip in passing over the connecting roll is caused to change its direction of movement by a relatively small angle. It is a further object of the invention to provide an apparatus in which the plane of rocking of the correcting roll roughly bisects the angle of change of the strip passing over the correcting roll.

Another object of the invention involves the provision of sensing beams in operative relation to one edge or both of the strip in its path to the coiler and to provide operative connections whereby if the strip tends to wander toward one side the correcting roll will be rocked toward the opposite side.

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It is yet another object of the invention to provide rocking means comprising a threaded shaft having a nut thereon connected to the roll mounting and to provide means for selectively clutching said shaft to one of two motors turning in opposite directions so that the starting and stopping of motors is eliminated. In connection with this last mentioned object it is yet another object to provide a brake which will automatically enter into operation when the strip is proceeding in a normal straight path so that the correcting roll rocking apparatus will not function as long as the strip is moving properly.

These and other objects of the invention, which will be pointed out in more detail hereinafter or which will be apparent to one skilled in the art upon reading these specifications we accomplish by that construction and arrangement of parts of which we shall now disclose an exemplary embodiment. Reference is now made to the drawings forming a part hereof and in which:

Figure 1 is a vertical medial cross section through an apparatus embodying the invention.

Figure 2 is an elevational view as seen on the line 2—2 of Figure 1.

Figure 3 is a diagrammatic side elevational view showing the relationship of the strip and the correcting apparatus.

Figures 4, 5 and 6 are diagrammatic plan views showing the operation of the device under different conditions.

Figure 7 is a schematic wiring diagram of the apparatus.

Briefly in the practice of the invention the strip issuing from the final processing unit prior to coiling is caused to pass over a correcting roll in such manner that its path is slightly changed in direction. The change in direction is accomplished by the correcting roll which itself is provided with a rockable mounting. The mounting is disposed at such an angle that the plane of rocking of the correcting roll roughly bisects the angle between the elements of strip approaching and departing from the correcting roll. The correcting roll mounting is rocked in one direction or the other by a screw having a nut connected by an arm to the roll mounting. The screw is turned in one direction or the other by being clutched selectively into a motor turning in one direction or to a motor turning in the other direction. The clutching operations are accomplished by suitable electrical connections with sensing devices placed along the strip

edge to cause motion of the correction roll in one direction or the other in accordance with deviations of the strip from its proper path.

Referring now particularly to Figures 1 and 2, a part of the frame supporting the rocking correcting roll is indicated at **10**. A channel member **11** extends between the two sides of the frame and carries the bearings **12** for the roll pivot. The channel **13** is provided with the pivot plates **14** which engage the pivot shaft **15**. The correcting roll itself is indicated at **16** and is mounted in the bearings **17** which are supported on the channel **13**. Stirrup members **18** are secured to the plate **13** at each end. A bar **19** extends between the stirrups **18** to connect them together. The bar **19** is connected by means of the members **20** to the block **21**. The block **21** is provided with the slotted plates **22** each of which has a slot **23**. The nut **24** which engages with the screw **25** is provided with the pins **26** which extend from both side faces thereof and enter into the slots **23**. The foregoing structure is for the purpose of permitting the parts **22**, **21** and **23** to move in an arcuate path while the nut **24** is moving in a rectilinear path. The pins **26** can ride up and down in the slots **23** to permit this relative movement.

The screw **25** is mounted in bearings **27** secured to the machine frame. The screw **25** is formed with shaft extensions **28** which are secured through the couplings **29** to the motor shafts **30** and **31** respectively. The motors are indicated at **32** and **33**, respectively and each of them has an electric clutch incorporated therein in the portions indicated at **34** and **35**, respectively. The numeral **36** indicates an electrical brake for the shaft **28**.

In Figure 3 there is indicated diagrammatically in side elevation the path of the strip over the correcting roll **16**. The entering strip is indicated at **40** and the strip passing from the correcting roll to the coiler is indicated at **41**. In most installations more than one coiler will be used so that as one coiler is being changed over another coiler may be employed so as to save time. The two coiler stations are indicated respectively at **42** and **43**. It will be observed that the strip in passing over the correcting roll **16** changes direction at **41** by a relatively small angle. When the strip is being coiled onto the coiler station **43** the strip at **41***a* has changed its direction to a slightly greater angle. The line A—A roughly bisects the angle between the elements of strip **40** and **41**. The line B—B roughly bisects the angle between the elements of strip at **40** and **41***a*. The line C—C thus represents substantially a mean bisector of the angle of change of the strip and it is substantially at the angle C—C that the plane of pivoting or rocking of the correcting roll is set.

Beyond the correcting roll toward the coiler there is provided a source of light indicated generally at **44** and two photosensitive units indicated at **45** and **46**.

The disposition of the photosensitive cells **45** and **46** can be better seen by an inspection of Figures 4, 5, and 6. These figures are diagrammatical in nature and they show the strip **41** passing over the correcting roll **16** and onto a coiler indicated generally at **42**. The photo-cells are again indicated at **45** and **46**. It will be clear that the photo-cells are laterally displaced so that there is substantially a common tangent between them. This common tangent will be defined by the strip edge when it is proceeding in its normal path to form a smooth coil as shown in Figure 5. In this situation the photo-cell **45** is energized while the cell **46** is obscured. In this situation the apparatus will be at rest. In Figure 4 if the strip is wandering toward the right the cell **46** will also be energized while if the strip wanders toward the left as in Figure 6 the cell **45** will be obscured. We have therefore a normal situation where one cell is energized and the other is obscured and we have on the one side the situation where both cells are energized and on the other side the situation where neither cell is energized. The operation of the apparatus in response to signals from the photo-cells is best seen by a study of Figure 7 which is a diagram illustrating how the various elements are connected together.

In Figure 7 we have indicated the photo-cells **45** and **46** as being connected respectively to the electronic apparatus indicated generally at **47** and **48**. These apparatuses will be understood to include necessary amplifying apparatus which forms no part of the present invention. It will be observed that the clutches **34** and **35** are actuated respectively by coils **34***a* and **35***a* and that the brake **36** is actuated by a coil **36***a*. Each of the electronic apparatuses **47** and **48** is connected to a coil **47***a* and **48***a* respectively and the coils **47***a* and **48***a* operate the switches indicated generally at **49** and **50**. Each of these switches has two elements indicated respectively at **49***a*, **49***b*, **50***a* and **50***b*.

By tracing through the diagram of Figure 7 it will now be clear that when the strip is following its normal path so that the photo-cell **45** is energized while the photo-cell **46** is obscured the coil **47***a* will be energized throwing the switch **49** to the position shown where the switch **49***a* establishes a contact to energize the coil **36***a* of the brake. The circuit continues through the switch **50***b*. The coil **35***a* and the coil **34***a* will not be energized because the switches **49***b* and **50***a* are open. The motors **32** and **33** will be rotating at synchronous speed in opposite directions and the lead screw **25** will not rotate.

Suppose now that the strip **41** wanders toward the right of Figure 7 so that the cell **46** becomes energized. When this happens the electronic apparatus **48** causes the coil **48***a* to be energized raising the switch **50** so that the switch **50***a* closes its circuit while the circuit previously closed by the switch **50***b* is open. The switch **49** remains in the position shown. In this situation it will be observed that the switch **50***b* in opening breaks the circuit to the brake coil **36***a* and closes the circuit to the clutch coil **34***a*. Therefore the shaft **28** will be coupled to the motor **32** and the lead screw will rotate in the direction of the motor **32**. This will rock the correcting roll in a direction to correct the movement of the strip laterally until the strip returns to the position shown in Figure 7 whereupon the brake will again be applied and the clutch **34** will again be energized.

If now the strip wanders toward the left of Figure 7 so that both photo-cells are obscured, the switch **50** will be in the position shown in Figure 7 while the electronic apparatus **47** will be de-energized thus de-energizing the coil **47***a*. The switch **49** will therefore drop opening the switch **49***a* and closing the switch **49***b*. The opening of the switch **49***a* interrupts the circuit to the brake coil **36***a* thus releasing the brake and energizes the clutch coil **35***a* thus causing the clutch **35** to operate to clutch the shaft **28** to the

motor 33. The shaft 28 will therefore rotate in the direction of the motor 33 rocking the correcting roll in the opposite direction until the strip returns to the position of Figure 7 in relation to the two cells 45 and 46.

It will be clear to one skilled in the art that the details of the control described herein may be modified considerably without departing from the spirit of the invention. The important point of the invention is that the strip in passing to the coiler is caused to brake around a roll at a relatively small angle and that the correcting roll is caused to rock in a plane roughly bisecting that angle. This structure coupled with the fact that the correcting roll does not rock about any point on its own axis but about a point remote from its axis produces a condition where the strip does not creep with respect to the correcting roll during the correcting operation. This feature is of extreme importance in connection with operations on a strip which carries a fragile coating which could be deleteriously affected by slipping contact or creeping contact with a correcting roll.

As we have indicated, it is not necessary that the rocking plane of the correcting roll be on the bisector of the angle of break of the strip, but the nearer it is to the bisector the better the results. We have therefore specified that the rocking plane roughly bisects the angle of break to indicate that preferably it should be in the central region of the angle.

Furthermore the apparatus described will operate without a brake, and we do not limit ourselves to a structure including a brake.

It will thus be seen that we have accomplished the prime objective of the invention without at the same time employing a structure as expensive as one where the coiler itself is laterally displaceable to make up for deviations laterally of the strip in its path of travel. The expense of an installation as outlined herein is but a fraction of expense of such a complex coiler arrangement. Furthermore the present installation exhibits a considerable saving in floor space over the arrangement where the coiler itself is displaceable.

For the foregoing reasons it will be understood that we do not intend to limit ourselves in any manner other than as set forth in the claims which follow.

Having now fully described our invention what we claim as new and desire to secure by Letters Patent is:

1. A correcting roll for use with a coiler for winding a strip of material issuing from a processing unit into a coil, comprising a roll over which said strip passes, said roll being disposed above a line connecting said unit and coiler to cause said strip to change direction through a small angle, a mounting for said roll pivoted at a point remote from the axis of said roll about a pivot roughly normal to a plane bisecting the angle of change of direction of said strip, and substantially centrally disposed with respect to said roll, about which said mounting may rock in a plane roughly bisecting the angle of change of direction of said strip, and means for causing said mounting, and therefore said roll, to be

rocked selectively to one side or the other in accordance with lateral variation in strip travel.

2. An apparatus for use with a coiler to correct any tendency of strip being coiled to deviate laterally, comprising a roll over which said strip passes before entering said coiler, said roll being disposed to cause said strip to change direction through a small angle, said roll being provided with a mounting, said mounting being pivoted at a point remote from the axis of said roll about a pivot roughly normal to a plane bisecting the angle of change of direction of said strip and substantially centrally disposed with respect to said roll, whereby said mounting and roll may rock in a plane roughly bisecting said angle of change of direction, sensing means operatively disposed in relation to an edge of said strip to detect a lateral deviation in strip travel, and means responsive to the action of said sensing means to rock said mounting in one direction or the other in response to said sensings.

3. An apparatus according to claim 2, including a screw, a nut in operative relation with said screw and secured to said mounting so that rotation of said screw produces rocking of said mounting, two continuously running motors for driving said screw respectively in opposite directions, two clutches respectively for clutching said screw to one or the other of said motors, and electric circuits connecting said sensing means with said clutches in such manner that a sensing in one direction energizes one of said clutches, a sensing in the other direction energizes the other of said clutches, and a neutral sensing de-energizes both of said clutches.

4. An apparatus according to claim 2, including a screw, a nut in operative relation with said screw and secured to said mounting so that rotation of said screw produces rocking of said mounting, two continuously running motors for driving said screw respectively in opposite directions, two clutches respectively for clutching said screw to one or the other of said motors, a brake for said screw, and electric circuits connecting said sensing means with said clutches and brake in such manner that a sensing in one direction energizes one of said clutches and de-energizes said brake, a sensing in the other direction energizes the other of said clutches and de-energizes said brake, and a neutral sensing de-energizes both of said clutches and energizes said brake.

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