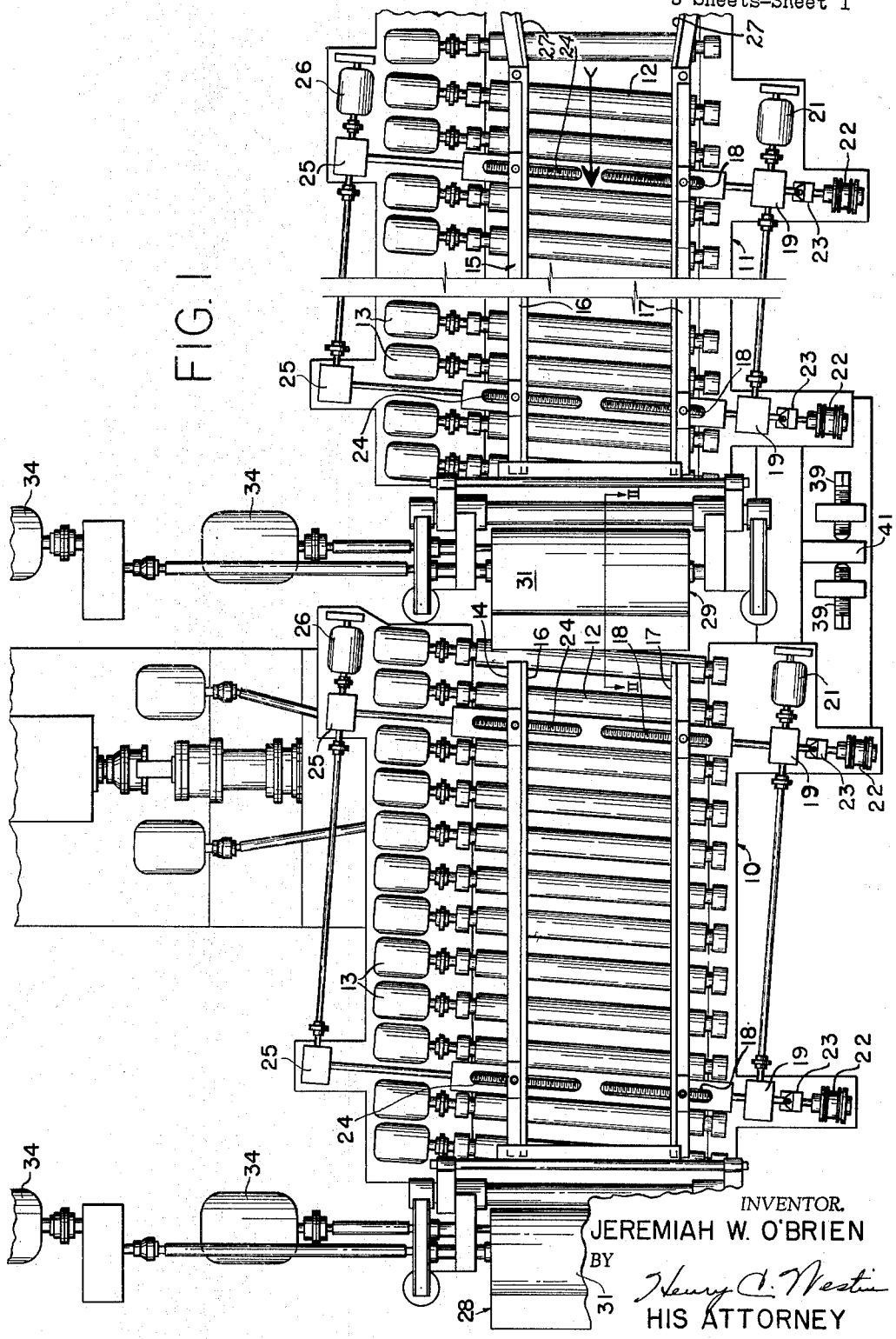
Jan. 4, 1966 J. W. O'BRIEN 3,227,346

STRIP GUIDING APPARATUS

Filed Feb. 28, 1963 3 Sheets-Sheet 1

FIG. 1



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STRIP GUIDING APPARATUS

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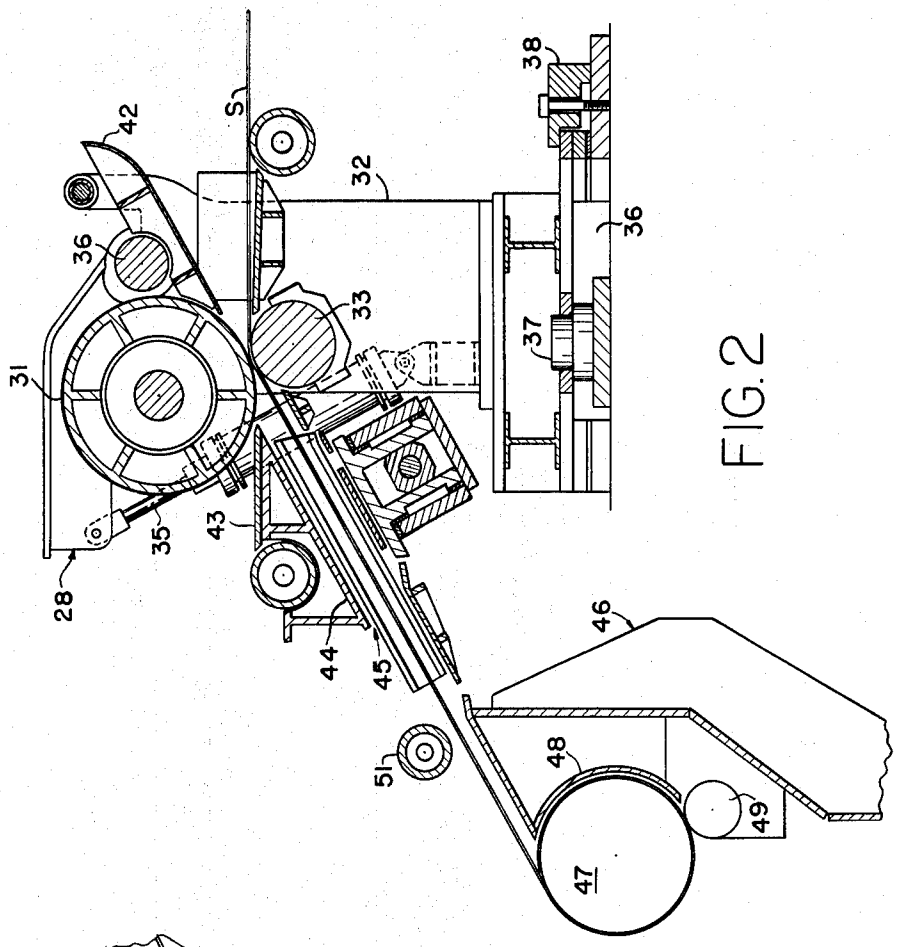

FIG. 2

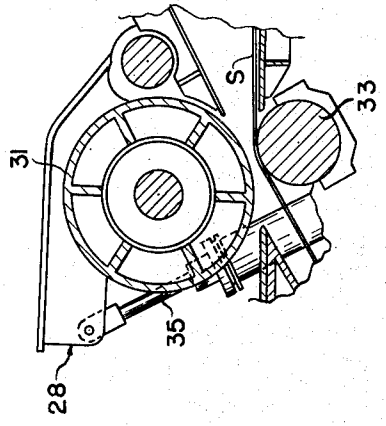

FIG. 5

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STRIP GUIDING APPARATUS

Filed Feb. 28, 1963 3 Sheets-Sheet 3

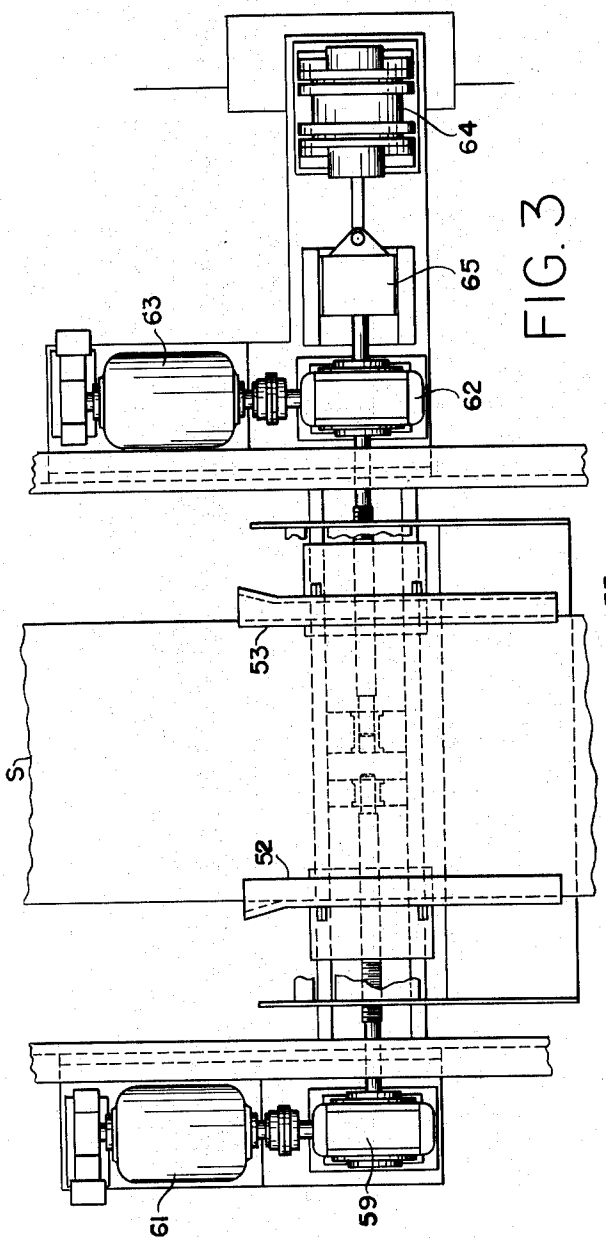

FIG. 3

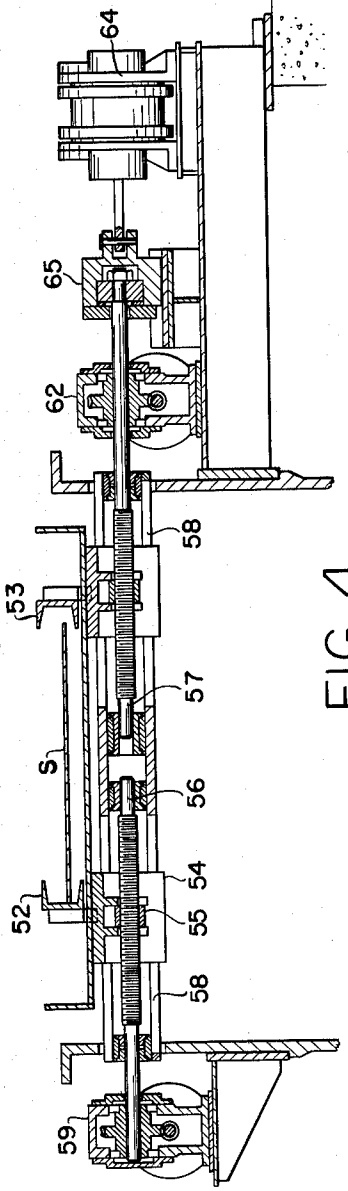

FIG. 4

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3,227,346

STRIP GUIDING APPARATUS

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Claims priority, application Great Britain, Apr. 16, 1962, 14,578/62
4 Claims. (Cl. 226—183)

This invention relates to the handling of strip material and more particularly to feeding strip material to a coiler apparatus.

The leading ends of hot metal strips emerging from a rolling mill are normally wider than the remainder of the strips and may have protruding hooks or cambers. As a result, it is necessary to separate the side guards arranged immediately before the coiler a sufficient distance to allow the ends to pass unrestrictively between the side guards. However, in the absence of the restraining influence of the side guards, the strips are allowed to wander transversely. Only after the front ends are coiled can the guards be closed to the separation required to guide the remainder of the strips.

This means that there is no control against the transverse movement of the leading ends of the strips so that the inner wraps of the coils become telescoped relative to the outer wraps, which result in damage to the edges of the strips during further handling, in addition to causing difficulties in the uncoiling operation of the coils.

Accordingly, the present invention provides in one form an arrangement for feeding strip material to a coiler which comprises a conveyor for delivering strip to a coiling apparatus, and means for biasing the strip toward a side guide previously positioned relative to the coiler. The means provided to cause the strip to be biased toward the one guard may be the rollers of a table which are skewed relative to the normal direction of travel of the strip or the rollers may be tapered or both tapered and skewed.

In another aspect, the invention provides an apparatus for feeding strip material to a coiler comprising a roller table, at least some of the rollers of which are tapered and/or skewed relative to a line drawn perpendicular to the longitudinal axis of the table, a first adjustable guard on one side of the roller table engageable by one of the edges of the strip, a second guard engageable by the other edge of the strip and means operable to move the second guard rapidly toward a predetermined adjustable position adjacent to the other edge of the strip.

The invention also contemplates the employment of a pair of side guards in a throat leading to the coiler, which serve as extensions of the table side guards, and one of which is quickly adjustable relative to the one edge of the strip.

In some forms of the invention it is contemplated to provide a pinch roll unit, one roll of which is arranged to be held out of positive engagement with the leading end of the strip but yet serving to guide the leading end and to be brought into engagement with the trailing end of the strip to impose a drag on the strip after it leaves the mill. The invention also provides for skewing or tapering the pinch rolls.

The invention will be more readily understood from the following description of the preferred embodiment thereof when read in conjunction with the accompanying drawings of which:

FIGURE 1 is a plan view of two tandemly arranged roller tables including a strip side guard arranged which feed strip to a pair of downcoilers,

FIGURE 2 is a sectional view of a part of one of the coilers and pinch roll units,

FIGURE 3 is a plan view looking from the left to the right of FIGURE 1 of one of the strip side guards arranged in the throat of one of the coilers,

FIGURE 4 is a section taken on lines IV—IV of FIGURE 1 through the throat of one of the coilers, and

FIGURE 5 illustrates a modified form of the operational position of the pinch roll unit herein disclosed.

With reference first to FIGURE 1 of the drawings, there is illustrated two identical adjacently arranged elevated coiler tables **10** and **11**, the table **11** being broken to facilitate better illustration of the equipment. The arrow at the right, as one views FIGURE 1, illustrates the direction of travel of the strip as it issues from a hot runout table of a hot strip mill, the mill and table not being shown on the drawings.

For brevity's sake, since many of the elements and machines are identical, a description of only one such element or machine is deemed necessary. Each coiler table comprises a plurality of rollers **12**, which are rotatably received in the end supports of the table and individually driven by electrical motors **13** arranged on a common side of the table. It will be noted in FIGURE 1, that the axes of the rollers **12** are skewed relative to a line drawn perpendicular to the longitudinal axis of the table, the angle of displacement being less than 90° measured in a counterclock wise direction with reference to the longitudinal axis and the upper side of the table. A very acceptable range of angualrity has been found to be between ½° to 2°. It will also be appreciated that the rollers can be adjustable to vary the angle of displacement to obtain the optimum condition.

The tables also comprise a pair of strip side guards **14** and **15**, each guard consisting of opposed strip guard members **16** and **17** which have surfaces arranged perpendicular to the strip supporting surfaces of the rollers **12** and are engageable by the edges of the strip. The side guard member **17** is provided with means for traversing it quickly toward the side guard member **16** and for controlling its innermost position. As shown in FIGURE 1 the side guard member **17** is carried by a pair of parallelly arranged rotatable threaded shafts **18** which are received in non-rotatable nuts secured to the member, thereby on rotation of the threaded shafts, the member **17** is advanced either toward or away from the edge of the strip. The other ends of shafts **18** protrude away from the table **10** or **11** and are secured to the gear wheels of worm-wheel units **19**, the worms being connected to a common electrical motor **21** and through which agency the worms are rotated. The shafts **18** are extended through the worm-wheel units and are connected to piston cylinder assembiles **22** through rotary joints **23**. By this construction, the side guard member **17** is moved by operation of the motor **21** to its operative or closed position after which the piston cylinder assembiles **22** are operated in unison to retract the guard to its open position. When it is desired to bring the strip under the guiding influence of the guiding member **17**, the piston cylinder assemblies **22** are again operated to quickly move the side guard member **17** into the operative or closed position. The mechanism for traversing the guard can be best seen in referring to FIGURE 4, which shows a similar mechanism, although the mechanism shown therein relates to a different side guard yet to be explained.

The opposed side guard **16** is not provided with means for quick motion, but means is provided to predeterminately position it relative to the coiler. This is accomplished by providing a pair of parallelly arranged, rotatable threaded shafts **24** which are received in non-rotatable nuts connected to the side guard member **16**, the shafts being made to extend outward from the table **10** or **11** and their ends connected to gear wheels of gear worm-wheel units **25**. The worms of the gear units are connected together and to an electrical motor **26** through

which agency the worms are rotated and, hence, the side guard **16** is moved toward and away from side guards **17**.

Before leaving the discussion of the tables, it will be noted in FIGURE 1 that in conjunction with the strip side guards **16** and **17** of the table **11** tapering complementary side guards **27** are provided to facilitate the easy entrance of the strip between the side guards **15**.

At the delivery end of each table **10** and **11**, identical pinch roll units **28** and **29** are provided which are best shown in FIGURE 2. Each pinch roll unit comprises an upper roll **31** rotatably mounted in a frame **32**, the roll being arranged above the normal path of the strip which is identified with the reference character S in FIGURES 2 and 3. The pinch roll unit also has a lower roll **33** of considerably smaller diameter as compared with the upper roll **31**. The lower roll is rotatably received in the frame **32** and arranged in an offset relationship relative to the upper roll **31** so that the strip when engaged by the upper roll will be forced in a downward direction out of its normal horizontal line of travel. FIGURE 1 shows the motors **34** provided for driving the pinch rolls **31** and **33**.

It is a feature of this invention to provide means for skewing the pinch rolls **31** and **33**, if such is deemed necessary or desirable, in the same direction and to the same extent that the rollers **12** of the tables **10** and **11** are skewed. To obtain this result and in still referring to FIGURE 2, the frame **32** is rotatably mounted on a base **36** and received into a cylindrical projection **37**. The frame **32** is held against the base and, hence, against rotation by a clamp **38**. The proper skewed position is obtained by adjusting one of two bolts **39**, the inner ends of which engage a projection **41** secured to and projecting from the pinch roll frame **32**, this construction being shown only in FIGURE 1. After the pinch rolls **31** and **33** have been positioned in the desired location, both of the bolts **39** are tightened up to maintain this position.

The upper pinch roll **31** is adjusted relative to the lower roll **33** by a piston cylinder assembly **35** for which purpose the roll is trunnion mounted to a shaft **36**, the shaft being carried by the frame **32**. In FIGURE 5 the upper roll **31** is shown positioned so that while it will still guide the leading end of the strip downwardly, it will not "pinch" the strip against the lower roll **33**. The significance of this arrangement will be explained later.

As shown in FIGURE 2, at the entry side of the pinch roll unit there is provided an inclined guide member **42** which diverges toward the bite of the pinch rolls and as a result assists the leading end of the strip into the bite. At the delivery end of the pinch roll unit an apron **43** is provided having a horizontal surface which serves as an extension of the tables **10** or **11**, which supports the strip issuing horizontally from the pinch roll unit. The lower part of the apron **43** is formed with an inclined guiding surface **44** which constitutes the top of the throat **45** that extend between the bite of the pinch rolls and a coiler **46**.

The coiler may take the form of one of several constructions and in the illustrated form comprise a driven mandrel **47** around which the strip S is coiled. In the coiler illustrated, one of the guiding arrangements that cooperate with the mandrel **47** is shown consisting of a crescent-shaped strip guide **48** which encircles a portion of the mandrel and a driven roll **49**. As shown, the guide **48** in its operative position is held a slight distance away from the mandrel, and strip, whereas, the roll **49** contacts the strip and serves to drive the leading end thereof around the mandrel.

At the lower end of the throat **45**, a non-driven strip deflector roll **51** is provided, the lower surface of which is contacted by the strip after the diameter of the coil has enlarged a given amount.

The present invention also contemplates the embodiment of a side guard in the throat **45**, which guard will function in a manner similar to the guards **14** and **15**. In referring to FIGURES 3 and 4, which illustrate this guard, there is shown a pair of channel-shaped guard members **52** and **53** arranged to present opposed vertical strip guiding surfaces, the channel-shaped guard members **52** and **53** being secured to identical traversable blocks **54**. The blocks are designed to receive nuts **55** through which individual rotatable threaded shafts **56** and **57** are received. The blocks **54** are slidably guided in a carried member **58** which permit the guard members **52** and **53** to be advanced toward and away from the edges of the strip S. With reference now to the means for rotating the shaft **56**, there is provided a worm-wheel unit **59**, the wheel of which is secured to the outer end of the shaft **56**, the worm being connected to an electrical motor **61**.

With reference to the shaft **57**, its outer end also is received in a worm-wheel unit **62**, the wheel being secured to the shaft **57** while the worm is connected to an electrical motor **63**. However, in this case, the end of the shaft **57** protrudes through the worm-wheel unit **62** and is connected to a piston cylinder assembly **64** by means of a rotating joint **65**. In this arrangement, as previously explained with respect to side guards **14** and **15**, the guard **52** is adapted to be predeterminately set in relationship to the side guard **16** and the mandrel **47**, whereas, the side guard **53** will be set with respect to its normal operating or closed position, but may be quickly moved toward and away from the edge of the strip.

A brief description of the operation of the present invention will now be given:

Let it be assumed that the coiler associated with the pinch roll **29** is to be employed to coil an oncoming strip. In this event, prior to the strip being received by the table **11**, the side guard **15** will be adjusted so that the guard members **16** and **17** will be moved to their operative positions. With respect to the side guard member **16**, it will be positioned relative to the mandrel **47**. In the operative position there will exist a slight gap between the edge of the strip and the side guard member **17** so that the opening between the members **16** and **17** is slightly greater than the width of the strip. Once the operative position of the side guard members have been determined, the piston cylinder assemblies **22** are operated to retract the side guard member **17** to its open position.

At the same time the guard members **16** and **17** are being positioned, the guard members **52** and **53** arranged in the throat **45** will also be positioned. The top pinch roll **31** will be lowered in readiness to receive the front end of the strip, it being understood that the pinch rolls will be then rotating at their operative speeds, as will be the rollers **12** of the table **11**. At the same time, the mandrel **47** will be brought to its operative speed and the other operative elements of the coiler **46** brought to their operative positions.

As previously mentioned, because of the condition of the leading end of the strip the guards **17** and **53** will be retracted from their normal guiding positions. As a result of this condition, the strip in prior devices was allowed to wander transversely along the table. This is alleviated in the present invention, since once the leading end of the strip contacts the rollers **12** of the table **11** it will be biased toward the side guard member **16** as a result of the skewed condition of the rollers. This action, of course, will prevent the strip from wandering and maintain its one edge against the side guard member **16**. By virtue of the side guard member **52**, the positioned strip will be further guided into the coiler **46**. Also, should it be found desirable, the pinch rolls if skewed will further assist the proper guiding of the strip. Once the leading end of the strip is received by the mandrel **47** the side guard members **17** and **53** are quickly brought into their operative positions by the operation of the piston cylinder assemblies **22** and **64**, respectively, which

will place their guiding edges closely adjacent the edges of the strip.

As mentioned previously the present invention also contemplates the employment of the pinch roll but in a manner that its top roll is raised away from the lower roll so as not to pinch the strip between the lower pinch roll. In this arrangement, which is illustrated in FIGURE 5, the top roll of the pinch roll unit will have a guiding influence on the leading end of the strip but will not have the effect of driving it down the throat **45**. This operation is particularly advantageous when in actually driving the strip the pinch rolls are found to have a misaligning effect on the strip. Once the strip has left the rolling mill, the pinch rolls are brought down into engagement with the trailing end of the strip to impose a tension between the coiler and the pinch roll unit, thereby assuring that the last convolutions are tightly wound on the coil.

As previously mentioned, various other mechanical means can be employed in place of the illustrated means to accomplish the novel results herein set forth. For example, other means that the skewed or tapered rollers can be provided for urging the strip against a predeterminately set guard member. Moreover, in some applications it may be found unnecessary to provide a second cooperative guard or adjustment of either of the guards. In other applications, depending on the material being processed and speed thereof, the table preceding the coiler table may also be provided with means for urging or maintaining the strip in one direction or at least maintaining the strip against moving traversely of the table. An example of this would be the employment of skewed rollers or tapered rollers.

In accordance with the provisions of the patent statutes, I have explained the principle and operation of my invention and have illustrated and described what I consider to represent the best embodiment thereof. However, I desire to have it understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

1. An apparatus for guiding material in strip form as it travels in a desired direction to a coiling apparatus for coiling thereon, during at least a period of which travel the strip has the tendency to move transversely relative to the desired direction of travel comprising:

a first side guard having a member engageable by one of the edges of the strip to restrain the strip from moving transversely in one direction relative to the desired direction of travel,

said first side guard being positioned so that its member is located in a predetermined relationship relative to said coiling apparatus,

a second side guard arranged opposite to the first having a member engageable by the other edge of the strip to restrain the strip from moving transversely in a second direction relative to the desired direction of travel beyond a certain limit,

a table having a plurality of rotatable rollers that extend between the two side guards for conveying the strip to the coiling apparatus,

said rollers being so constructed and arranged so as to urge the strip transversely relative to the desired direction of travel and against said first side guard,

a pair of pinch rolls arranged at the end of said table between the table and the coiling apparatus,

one of said pinch rolls being arranged so that its strip engaging surface is substantially coplanar with the strip engaging surface of said table rollers, and

means for shifting the pinch rolls horizontally so that their axes are disposed at an angle less than 90° measured in a counter-clockwise direction with reference to the longitudinal axis of said table and the longitudinal side of said table adjacent to said predeterminately positioned side guard.

2. An apparatus according to claim **1**, including

a frame for rotatably receiving said pair of pinch rolls, a base for said frame,

said frame being secured to said base in a manner to allow the frame to move so that the axes of the pinch rolls assume said angular position.

3. An apparatus for guiding material in strip form as it travels in a desired direction to a coiling apparatus for coiling thereon, during at least a period of which travel the strip has the tendency to move transversely relative to the desired direction of travel comprising:

a first side guard having a member engageable by one of the edges of the strip to restrain the strip from moving transversely in one direction relative to the desired direction of travel,

said first side guard being positioned so that its member is located in a predetermined relationship relative to said coiling apparatus,

a second side guard arranged opposite to the first having a member engageable by the other edge of the strip to restrain the strip from moving transversely in a second direction relative to the desired direction of travel beyond a certain limit,

a table having a plurality of rotatable rollers that extend between the two side guards for conveying the strip to the coiling apparatus,

said rollers being so constructed and arranged so as to urge the strip transversely relative to the desired direction of travel and against said predeterminately positioned side guard,

strip guiding throat arranged between the table and the coiling apparatus, comprising:

an additional pair of opposed side guards having members engageable by the opposite edges of the strip to restrain the strip from moving transversely relative to the desired direction of travel beyond a certain limit,

one of said side guards of said additional pair being positioned so that its member is located in a predetermined relationship relative to said coiling apparatus and coplanar with respect to said predeterminately positioned side guard of the other side guard, and

a pair of pinch rolls arranged at the end of the throat into which the strip first enters and adapted to urge the strip into the throat for coiling on said coiling apparatus.

4. An apparatus for guiding material in strip form as it travels in a desired direction to a coiling apparatus for coiling thereon, during at least a period of which travel the strip has the tendency to move transversely relative to the desired direction of travel, comprising:

a first side guard having a member engageable by one of the edges of the strip to restrain the strip from moving transversely in one direction relative to the desired direction of travel,

said first side guard being positioned so that its member is located in a predetermined relationship relative to said coiling apparatus,

a second side guard arranged opposite to the first having a member engageable by the other edge of the strip to restrain the strip from moving transversely in a second direction relative to the desired direction of travel beyond a certain limit,

a table having a plurality of rotatable rollers that extend between the two side guards for conveying the strip to the coiling apparatus,

said rollers being so constructed and arranged so as to urge the strip transversely relative to the desired direction of travel and against said predeterminately positioned side guard,

means for moving said predeterminately positioned first side guards relative to their opposed side guards,

means for determining a closed position of the opposed side guards, and

means for moving the opposed side guards quickly toward and away from the other side guards.

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