

July 20, 1943.

N. B. LANE ET AL

2,324,855

COIL HANDLING SYSTEM AND METHOD

Filed Feb. 3, 1941

2 Sheets-Sheet 1

Fig. 1.

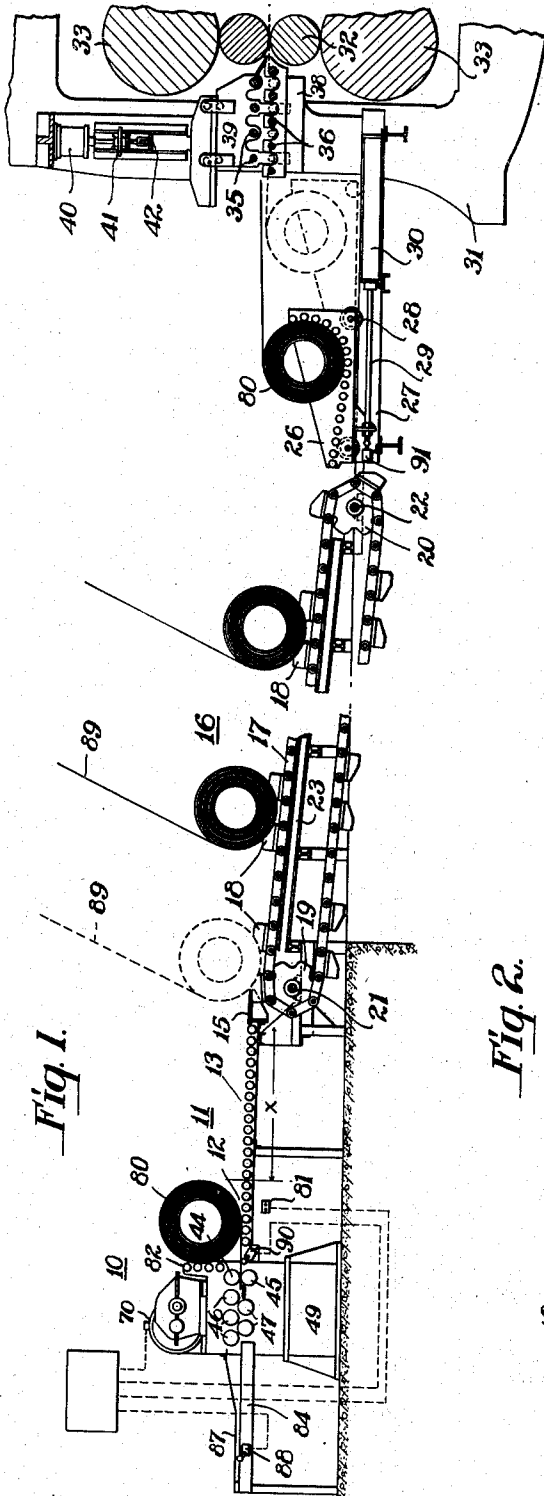
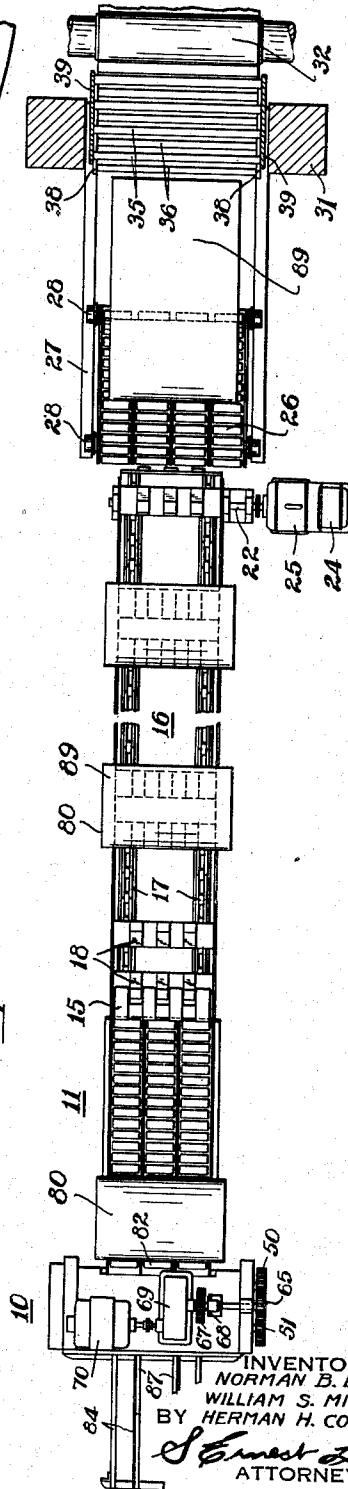


Fig. 2.



INVENTORS
NORMAN B. LANE,
WILLIAM S. MINGLE &
BY HERMAN H. COLSON.
Herman H. Colson
ATTORNEY

July 20, 1943.

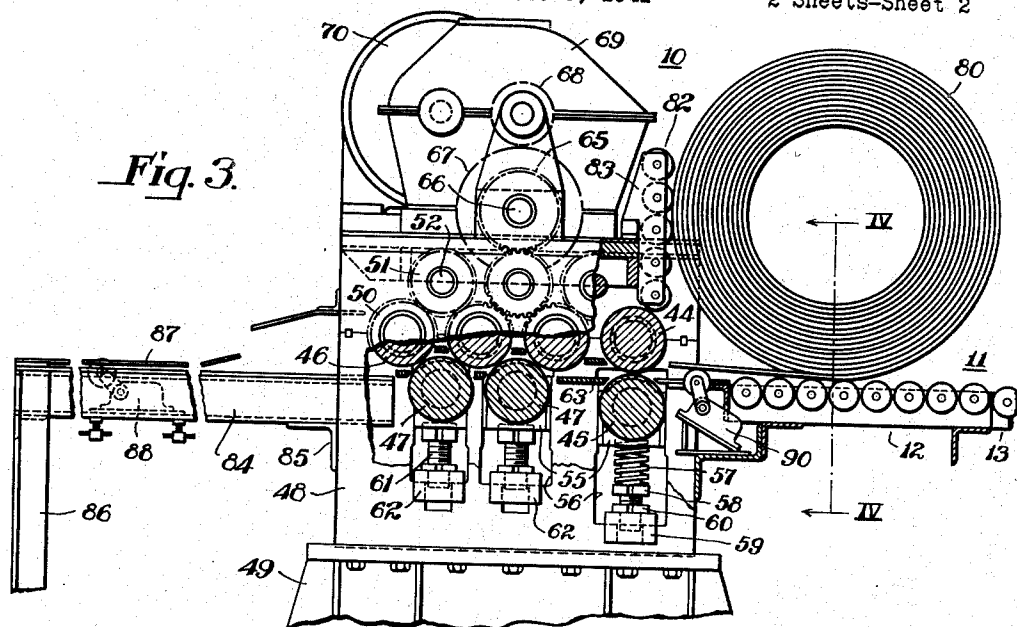
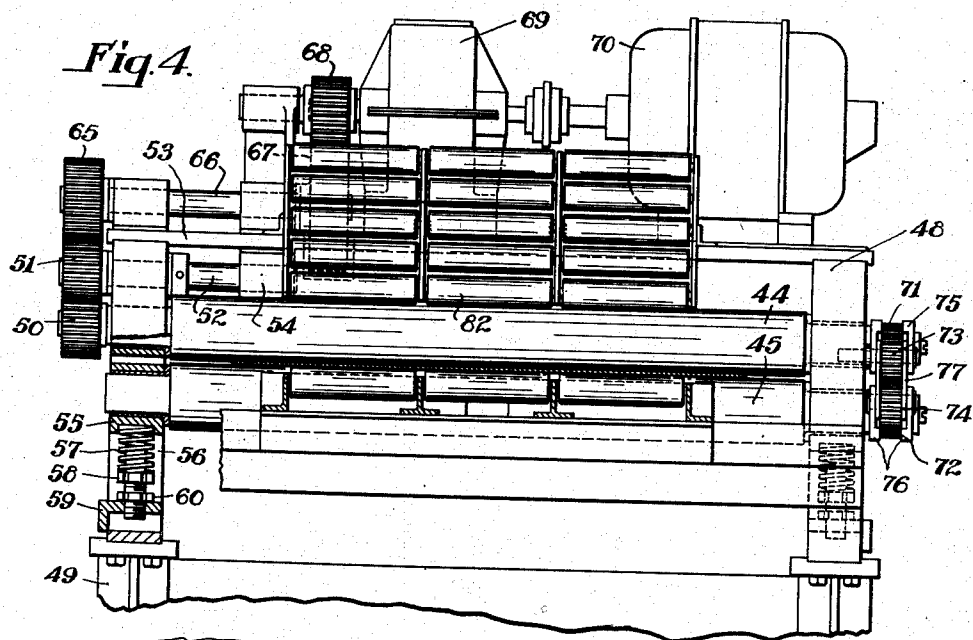
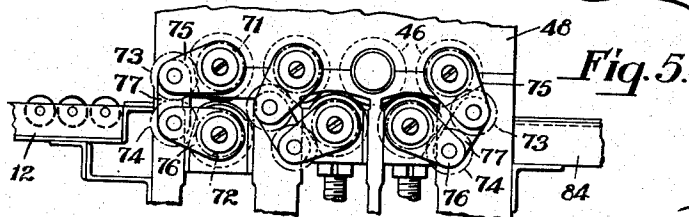
N. B. LANE ET AL

2,324,855

COIL HANDLING SYSTEM AND METHOD

Filed Feb. 3, 1941

2 Sheets-Sheet 2



INVENTORS
NORMAN B. LANE,
WILLIAM S. MINGLE &
BY HERMAN H. COLSON.
H. Ernest Low.
ATTORNEY

UNITED STATES PATENT OFFICE

2,324,855

COIL HANDLING SYSTEM AND METHOD

Norman B. Lane, Englewood, William S. Mingle, Leonia, and Herman H. Colson, Teaneck, N. J., assignors to Aluminum Company of America, Pittsburgh, Pa., a corporation of Pennsylvania

Application February 3, 1941, Serial No. 377,176

18 Claims. (Cl. 80—43)

This invention relates to rolling mills, and more particularly to a coil handling system and method for operating upon the delivering coiled strip metal to a strip mill for rolling therein.

In the operation of strip rolling mills, especially those designed and used for the production of wide cold rolled strip and sheet metal, it is desirable to provide the coiled strip stock with a straight flat end portion or tail prior to its delivery to the mill, the length of such tail being sufficient to reach the mill rolls and enter therebetween when the coil is brought into unwinding position in front of the mill. It is also desirable to deliver the tailed coils to the mill in such a manner that the tail of a coil can be entered into the mill with minimum delay and effort and without marking or damaging the material, in order that the mill may be operated substantially continuously and the cost of rolling the strip be maintained at a minimum.

Under various operating conditions, each coil to be rolled is required to be provided with a tail ranging from about two feet to seven feet or more in length, the long-tailed coils being required for instance when bridling equipment is used for tensioning the strip during rolling. When rolling wide strip stock of various metals and their alloys, particularly in the heavier gauges and in a work hardened condition as where coils of metal are re-rolled without intermediate annealing, with which stock this invention is particularly concerned, it is practically impossible for the operators to pull out and straighten the end of the coiled strip and also to flatten the same in a transverse direction for introduction into the mill without considerably damaging the same, which latter results in scrap loss, and without undue delay, difficulty, and accompanying loss in rolling time. Recourse to auxiliary tail pullers or formers as heretofore used has not been entirely satisfactory because of the extraneous and difficult handling conditions occasioned by the weight and bulk of such large wide coils together with their elongated tails.

In general, therefore, the principal object of the invention is to provide a simplified and improved coil handling method and system whereby coils of strip metal to be rolled are provided with straight flat tails of predetermined length and supplied to the mill without damage, for entry therein with minimum delay and effort in order to expedite the strip rolling process.

In accordance with the invention, it is a further aim to provide a novel coil handling mech-

anism in aligned relation in front of the mill, the mechanism specifically comprising a coil support or carrier for transferring the coils from an intermediate position into unwinding position, a power actuated storage conveyor for delivering the coils one-by-one to the coil support, and a tail former or pulling device for straightening and flattening the outer end of the coil and discharging the same to the storage conveyor. Movement of the coils from the outermost position at the tail puller to the unwinding position in front of the mill is effected in substantially a unidirectional path of travel to prevent delays in feeding the coils and to effect all necessary transfer movements by a rolling action, thereby to prevent damage to the coils and scratching of the surface of the metal. This latter provision is especially essential with the handling and production of highly finished and bright surfaced sheet-strip metal.

The invention further specifically contemplates the provision of a novel tail forming device having driven bending rolls and automatic control means therefor functionally related to a coil receiving support, whereby, after a tail of predetermined length is formed on the coil, automatic discharge movement of the coil along the coil support towards the storage conveyor is effected by reversely operating the tail puller, and means is provided to prevent buckling of the tail. Continued coil movement after its tail is free of the tail puller, is effected by gravity, and simple means is provided to cause the coil to turn on its axis and raise the tail into substantially a vertical position as the coil is received on the storage conveyor. Means is provided on the coil support to permit manual turning of the coil on its axis to bring its tail into a forwardly extending substantially horizontal position in alignment with the roll pass for threading through any bridling equipment and entering into the mill rolls upon delivery movement of the coil into its unwinding position in front of the mill, preferably by reciprocation of the coil support.

The invention has other features of novelty and advantages as will be apparent to one skilled in the art upon a reading of the detailed description thereof taken in conjunction with the accompanying drawings wherein one embodiment of the invention is shown. It will be appreciated that the invention is not limited to the specific details disclosed, that the various component elements may be considerably modified, and that variants may be employed in adapting the invention to various situations. Likewise,

certain features of the invention may be utilized independently of their association with various other elements in the manner specifically disclosed.

In the drawings:

Fig. 1 is a somewhat diagrammatic longitudinal vertical sectional view of the apparatus of this invention;

Fig. 2 is a plan view thereof;

Fig. 3 is a side elevational view partly in section to an enlarged scale of the tail forming device;

Fig. 4 is an end view thereof looking in the direction of the arrows IV—IV of Fig. 3 with a portion of the framework broken away to show the support for one of the rolls of the device; and

Fig. 5 is a fragmentary side elevational view showing the means for driving the lower set of rolls from the upper set.

The cooperative relationship of the apparatus constructed and arranged in accordance with the invention is clearly shown in Figs. 1 and 2. Referring thereto, the reference numeral 10 indicates the tail puller by means of which straight flat tails of predetermined length are formed on the ends of the coils of strip metal that are to be rolled. 11 represents the contiguous coil support on which the coils are supported during the tail pulling operation. The support 11 extends forwardly of the tail puller a distance which is greater than the length of any tail which may be formed on a coil. The forward end of the support is disposed at a lower elevation than that portion of the support adjacent to the tail puller, or in other words the coil support is provided with a substantially level section 12 immediately in front of the tail puller and a downwardly inclined portion 13, the length of which is illustrated by the line X. Preferably, the coil support is of the roller table type, which construction is well known in the art and consists of a plurality of small rollers that are suitably journaled at their ends in longitudinal supporting bars. The purpose of providing the inclined portion 13 will be hereinafter described.

At the end of the roller table coil turning means 15 is provided, which may take the form of an elongated plate disposed at substantially the same level and inclination as the supporting plane of the rollers of the table, across which means each coil rolls as it is discharged from the roller table, the coil moving off such means and coming to rest on a storage conveyor 16. The conveyor 16 comprises parallel endless chains 17 having pairs of transverse coil supporting blocks 18 for receiving a coil thereon. The chains are trained around pairs of sprockets 19 and 20 that are carried by shafts 21 and 22, the shafts being suitably journaled at their ends in suitable framework. The upper chain flights or runs are supported against deflection by suitable longitudinally extending supporting members 23.

The conveyor is adapted to be driven by means of a motor 24 operating through a self-contained speed reducing unit 25 which has driving connection with the shaft 22. Since the coils are deposited on the conveyor and discharged therefrom one-by-one, it is preferred to use a manually actuated means, such as a push button, for initiating operation of the driving motor 24, and a motor control circuit preferably is provided whereby the motor will automatically come to rest after actuating the conveyor through a predetermined distance. Such motor control is well known and is not herein illustrated.

The pairs of coil supporting blocks 18 of the conveyor are spaced apart equal distances, and at each operation of the motor the conveyor will be moved to bring a pair of such blocks into coil receiving position with respect to said plate 15 and also to effect discharge of a coil at the discharge end of the conveyor.

The discharge end of the conveyor is disposed at a lower elevation than its coil receiving end so that the coils not only are advanced toward the rolling mill but are lowered to a level wherein the top of each coil is substantially level with the plane of the roll pass.

As each coil is discharged from the conveyor, it is received by a reciprocable carrier or transfer car 26 that is supported for horizontal movement along tracks 27 disposed in front of the rolling mill. The car 26 is provided at each side with flanged wheels 28 in engagement with the track 27. A power cylinder 30 having a piston working therein is provided for advancing and retracting the car, the piston being connected to a piston rod 29 that has suitable connection with the framework of the car.

While the car may be employed solely for the purpose of receiving each coil from the conveyor 16 and moving the coil into unwinding position in front of the rolling mill, the coil there being transferred to various well known types of coil unwinding apparatus, we prefer to adapt the car for rotatably supporting the coil in unwinding position. To this end the upper side of the car is composed of a series of coil supporting rollers that are journaled in the framework of the car. At the front of the car the series of rollers are curved upwardly so that the front side of the coil will be embraced and supported thereby. In effect, this construction forms a roller cradle for supporting the coil for unwinding movement.

We have here shown a typical strip rolling mill of the 4-high type in which the coiled strip is adapted to be rolled. The mill comprises housings 31, a pair of relatively small work rolls 32, and large back-up rolls 33, the rolls, of course, being journaled in the usual manner and driven by means of the usual drive mechanism not shown herein. Also, the type of mill is not essential to this invention since other types of mills may be used. At the front side of the mill rolls we show somewhat schematically, bridling equipment that may be used to tension the strip during the rolling operation. As here shown, the bridling equipment consists of an upper and a lower series of bridling rolls 35 and 36, respectively, the upper set of rolls 35 being vertically movable and in their lower positions being disposed between adjacent pairs of lower rolls, whereby the strip is caused to take or follow a sinuous path as it is drawn through the bridling equipment by the work rolls 32 in the usual manner.

As here shown, the lower set of bridle rolls is rotatably supported by stationary frame members 38 while the upper set of rolls 35 is supported by side members 39 that are suitably slidably supported in the lower frame members 38 and adapted to be raised and lowered by means of a power cylinder 40 that is secured to a cross beam secured at its ends to the mill housings. The piston of the cylinder 40 is connected through manual screw adjusting means 41 to a cross head 42 which is connected to the side members 39. Adjustment of the adjusting means 41 is provided to control the amount of deflection imparted to the strip by means of the bridling rollers.

Referring now to the tail pulling mechanism 10 which is shown more clearly in Figs. 3, 4, and 5, the device comprises a pair of pinch or feed rolls 44 and 45 and upper and lower sets of bending and straightening rollers 46 and 47. The pinch rolls 44 and 45 are disposed in a common vertical plane while the lower rolls 47 are disposed in vertical planes midway between the axis of the upper rolls 46. The rolls are mounted between suitable end frames or housings 48 that are carried on a stand 49. At one end, all of the rolls 44 and 46 carry gears 50 which mesh with gears 51 that are mounted on stub shafts 52 that are journaled in the adjacent frame 48. The upper ends of the frames or housings 48 are connected by a cross plate 53 on which the driving mechanism for the tail puller is supported. The stub shafts 52 are also provided with end bearings 54 that are secured to the underside of the cross plate 53.

The lower pinch roll 45 and the lower bending rolls 47 are journaled at their ends in bearing blocks 55 mounted for vertical sliding movement in guideways or windows 56 in the side frames 48. The pinch roll 45 is adapted to be pressed against the underside of the upper roll 44 by means of springs 57 that are interposed between the underside of the slide blocks 55, in which the roll 45 is journaled, and the upper face of adjusting screws 58. Each adjusting screw 58 is threaded into a nut member 59 carried by a side housing 48, a jamb nut 60 being provided to lock the screw in adjusted positions. As shown more clearly in Fig. 4, the nut member 59 is of L shape with one leg thereof supported on the bottom edge of the window 56, the side frame 48 beneath the nut member 59 being transversely slotted or cut away in order to accommodate the lower end of the adjusting screw 58. It will be seen that by turning the screws 58 with respect to the nuts 59, the pressure of the pinch roll 45 against the roll 44 can be increased or decreased by controlling the loading of the springs 57.

Vertical adjustment of the lower bending rolls 47 with respect to their upper rollers 46 is accomplished by actuating adjusting screws 61 which have direct bearing engagement with the undersides of the slide blocks 55 and threaded engagement with nut members 62 which correspond to the nut member 59. Normally these bending rolls will be adjusted so that the strip being operated upon will but lightly be engaged by the bending rolls, advancing of the strip through the device being accomplished by the pinch rolls. All the rolls are driven at the same peripheral speeds so that no relative movement between the rolls and the surface of the strip takes place, thus eliminating the possibility of marring or scratching the surface of the strip. Guides or filler members 63 are disposed between the rolls at upper and lower sides of the path of movement of the strip through the device so that the end of the strip will be properly led from one pair of rolls to the succeeding pair of rolls. These guides are supported or secured at their ends to the side frames 48.

One of the gears 51 meshes with a gear 65 secured to a jack shaft 66 that is supported in bearings mounted on the upper side of the plate 53. At its inner end the jack shaft carries a gear 67 in mesh with a drive pinion 68 that is mounted on the output shaft of a gear reducing unit 69, the input shaft of such unit being coupled to a reversible drive motor 70. It will thus be seen that all the upper rolls 44 and 46 are driven. In

order to drive the lower rolls 45 and 47, pinions 71 are mounted on the opposite ends of the upper rolls as shown more clearly in Figs. 4 and 5. Similar pinions 72 are mounted on the adjacent ends of the lower rolls. Pinion 71 and pinion 72 mesh with pinions 73 and 74, respectively, and the latter pinions mesh with each other. The pinions 73 and 74 are journaled between pairs of arms 75 and 76, respectively, that are loosely mounted on the ends of the associated upper and lower rolls, and the ends of the pairs of arms 75 and 76 are joined by links 77. The journal pin for the pinion 73 preferably is fixed to the housing 48 to prevent oscillation of the arms 75, but it will be apparent that each lower roll will be positively driven from its associated upper roll through the pinions just described. Thus, in any adjusted position of the lower bending rolls and during vertical movements of the lower pinch roll, pinions 74 and 72 associated therewith are always maintained in mesh as the distances between their centers are maintained constant by the links 77 and 76. As shown in Fig. 5, it, of course, is unnecessary to provide the upper central bending roll with a drive pinion 71.

In the operation of the system as a whole, coils of heavy gauge strip metal are brought into a position adjacent to the tail puller 10. Such coils may be supplied in batches from an annealing furnace in the usual way. For instance, a loaded annealing tray having a batch of coils stacked on end thereon will be brought into position for removal of the coils one-by-one by suitable lifting means and deposited on the roller table 11 which is disposed at a convenient working level. A coil 80, for example, is deposited on the roller table and is so arranged that the coil must be unwound in a clockwise direction in order to unwind the strip. The end of the coil is cantilevered or bent outwardly from the body of the coil sufficiently to permit entry of such end between the feed rolls 44 and 45. This operation may easily be performed by first bending the end outwardly and then bodily pushing the coil along the level portion of the roller table toward the tail puller. In the meantime, an operator will actuate the start push button 81 which is conveniently located to start the motor 70. The feed rolls 44, 45 and the bending and straightening rolls 46, 47 are driven through the gearing mechanism heretofore described in a direction to pull the strip through the tail puller, a roller stop 82 being mounted on the front edge of the cross plate 53 against which the coil is drawn and supported during the tail pulling operation. The roller support 82 consists of a vertically arranged series of small rollers journaled in supporting brackets 83.

It will be seen that the feed rolls 44, 45 draw the strip from the coil and during passage of the strip past the bending rolls 46, 47, it is bent alternately in opposite directions and thereby straightened and flattened, as will be appreciated. As the end of the strip emerges from the last set of bending rolls, it moves along a horizontal guide 84 which consists of transversely spaced bars that are supported at one end on a cross bar 85 secured to the housings 48 and at their rear ends on vertical legs 86. The tops of the guides 84 along which the strip moves is provided with a suitable material, such as fiber board or the like, so as to prevent scratching of the strip metal. In order to confine the strip to a predetermined path, strap members 87 are disposed in vertically spaced relation to the guides 84, the

inner ends of the straps being inclined upwardly and secured to the frame of the tail puller, whereby the emerging strip is positively guided.

Means are provided to automatically effect reversal of the drive motor 70 after a predetermined length of the strip has been straightened. As here shown, a limit switch 88 is adjustably carried by the guide members 84 in position to be actuated by the end of the strip. The control device 88 is adjusted longitudinally of the guides 84, the position of the device determining the length of the tail formed on the coil. When the limit switch is actuated, the motor 70 is caused to be driven in the opposite direction through usual motor reversing switches. The rolls of the tail puller, therefore, are driven in the reverse direction, whereby the straightened tail is driven out of the machine. Since the tail is pulled out from the lower side of the coil, the weight of the coil is imposed on the drawn out strip, whereupon ejection of the strip from the tail puller causes the coil to be bodily moved along the roller table 11.

The coil moves but a very short distance before it enters upon the inclined portion 13 of the roller table, whereupon coil movement is assisted by gravity, and as the distance between the center of the coil and the feed rollers 44, 45 increases, the liability of the strip buckling by the impelling action of the feed rolls is entirely overcome. This is an important feature of our invention since otherwise with extremely long tails it would be practically impossible to effect automatic movement of the coil away from the tail puller without buckling of the straightened tail.

After the end of the tail clears the feed rolls 44-45, the coil moves onto the stationary plate 15. The rate of travel of the coil is sufficiently low so that the coil will not slide across such plate but will roll thereover, thereby automatically causing the tail 89 to be lifted into substantially a vertical position. The extent of such rolling movement preferably is sufficient to move the tail somewhat past the vertical as shown in Fig. 1. In its horizontal position, the tail 89 holds a stop switch 90 depressed, and when released and elevated, as described, permits the switch to operate and automatically cut off the supply of current to the motor 70. The coil rolls off the plate 15 onto the chock blocks 18 of the conveyor 16.

The motor 24 of the conveyor is initiated to advance the conveyor one step as heretofore described, thereby bringing the succeeding pair of chock blocks 18 into operative position with respect to the plate 15 to receive the next coil. The foregoing operations are repeated until the capacity of the storage conveyor is reached. While the conveyor may be of such length as to accommodate any desired number of coils, the storage of about five or six coils has been found sufficient. The purpose of this conveyor is to enable the mill operators to form a supply of tailed coils for rolling during the time consumed in adjusting the draft of or operating the strip mill so that delay is minimized when rolling operation is initiated or re-initiated.

With the car 26 in retracted position, the conveyor 16 is actuated and the foremost coil 80 discharged therefrom and received by the car. The roller support on the car permits the coil to be manually rotated to bring the tail 89 into substantially horizontal position projecting forwardly toward the rolling mill, whereupon fluid pressure is admitted to the cylinder 30 and the

car advanced to bring the coil into coil unwinding position with respect to the mill, as shown by the broken lines in Fig. 1. Of course, the bridling equipment, if used, will be in open position during this movement so that the horizontal tail is permitted to move between the vertically spaced bridle rolls and enter between the work rolls 32. A limit switch 91 may be provided in the control circuit for the conveyor motor 24 so that, when the car is out of coil receiving position, the conveyor may not be actuated.

Upon completion of the rolling operation upon a coil in unwinding position, the car is retracted and a succeeding coil delivered thereto. The cycle of car movements is, of course, repeated and the succeeding coil entered into the mill with minimum delay and effort. Of course, during the rolling of a coil at the mill, a tail will be formed on another coil at the tail puller and delivered to the conveyor 16, these operations being carried out until all the coils of a given batch have been rolled.

At the discharge side of the rolling mill, the strip metal will, in the usual way, be re-coiled, and if re-rolling to a thinner gauge is desired, the coils may be conveyed to a convenient position adjacent the tail puller and again handled as described.

It is apparent that, by the use of our invention, the time required for introducing the strip into the mill is greatly reduced. The material is not marked nor its end damaged, so that scrap loss is reduced to a minimum and the handling and manipulation of the cumbersome coils greatly expedited. Due to the fact that a number of coils may be provided with straight flat tails of predetermined length during re-adjustment or operation of the mill, substantially continuous operation thereof is effected when rolling procedure is started or again resumed.

While we have described the preferred embodiment of our invention, it will be understood that it is not limited to the apparatus and the details thereof described but that it may be otherwise constructed and embodied without departing from the spirit of the invention or the scope of the appended claims.

We claim:

1. A pre-rolling coil handling method which comprises positioning a coil of strip metal on its side in front of a rolling mill but remotely therefrom, unwinding the strip from the underside of the coil and moving it in a horizontal tangential path away from the mill, reversely bending the unwound strip in planes perpendicular thereto to form a straight tail, advancing the coil bodily toward the mill in substantially a straight line path into an unwinding position adjacent the mill, turning the coil on its axis upon said advancing movement through a distance at least equal to the length of said tail to bring its tail into a forwardly extending substantially horizontal position for entry into the mill during a latter part of said advancing movement, rotatably supporting the coil in said unwinding position to permit the strip to unwind therefrom as it passes through the mill, and handling another coil at said remote position during rolling of the strip.

2. A pre-rolling coil handling method which comprises positioning successive coils of strip metal one-by-one in front of a rolling mill but remotely therefrom, unwinding the strip tangentially from the underside of each successive coil

and moving it in a horizontal path extending away from the mill, bending the unwound strip alternately in opposite directions in planes perpendicular to said path to straighten and flatten a predetermined tail length thereof, reversing the direction of movement imparted to said tail length to move the coil bodily toward the mill in substantially a straight line path a distance equal to said tail length, assisting said bodily movement by the action of gravity, thereafter moving said coil in said path into an unwinding position adjacent the mill, turning the coil on its axis to bring its tail portion into a substantially horizontal forwardly extending position for entry into the mill during the movement of the coil into said unwinding position, rotatably supporting the coil in unwinding position to permit the strip to unwind therefrom as it passes through the mill, and handling a successive coil at said remote position during rolling of the coil described.

3. A pre-rolling coil handling method which comprises positioning a coil of strip metal on its side in front of a rolling mill but remotely therefrom, unwinding the strip from the underside of the coil and moving it in a horizontal tangential path extending away from the mill, reversely bending the unwinding strip to form a straight tail, moving the coil from said remote position to an intermediate storage space, turning said coil as it enters the storage space to raise its tail into a substantially vertical position, intermittently moving the coil through the storage space toward the mill to permit a succeeding coil to enter the storage space, withdrawing the coil in foremost position in the storage space and rotatably supporting the same for movement into unwinding position adjacent the mill, and further turning the coil to bring its tail into substantially horizontal forwardly extending position for entry into the mill when the coil is moved into unwinding position.

4. A coil handling method which comprises supporting a coil with its axis in horizontal position, pulling a tail from the underside of said coil, straightening said tail by reverse bending thereof while pulling the same from the coil, discharging the coil from the position at which it is supported for pulling of the tail by imparting movement to the tail in a direction opposite to that through which it is pulled during reverse bending, thus displacing the coil from its tail pulling support, turning the coil so that the straightened tail points upwardly and beyond over center position, conveying the coil to unwinding position, inserting the tail in a rolling mill, and thereafter rolling the strip metal and thereby unwinding the same from the coil.

5. A coil handling system comprising, in combination, a coil support disposed remotely from a rolling mill, in alignment therewith, a pair of pinch rolls adjacent said coil support for pulling a tail from the underside of a coil disposed thereon, a plurality of reverse bending rolls for straightening the tail pulled by said pinch rolls, roll driving means for driving at least said pinch rolls, a switch adapted to be operated by the end of the tail for reversing said driving means, a conveyor for receiving coils discharged from said coil support upon reversal of said driving means, and coil unwinding means disposed at the end of said conveyor and in alignment with said rolling mill through which the strip material forming the coil is to be rolled.

6. A coil handling system comprising, in com-

bination, a coil support disposed remotely from a rolling mill, in alignment therewith, a pair of pinch rolls adjacent said coil support for pulling a tail from the underside of a coil disposed thereon, a plurality of reverse bending rolls for straightening the tail pulled by said pinch rolls, means for driving the pinch rolls and the bending rolls, means actuated by the end of the tail for reversing said driving means, to move the coil bodily along said support toward the mill, means for receiving the tailed coil and moving it into unwinding position adjacent the mill, the coil being turned on its axis to bring its tail into a forwardly extending substantially horizontal position and being entered into the rolling mill by said movement thereof into unwinding position, and means for rotatably supporting the coil in said unwinding position for unwinding of the strip therefrom.

7. A coil handling system comprising, in combination, a coil support disposed remotely from a rolling mill, in alignment therewith, a pair of pinch rolls adjacent said coil support for pulling a tail from the underside of a coil disposed thereon, a plurality of reverse bending rolls for straightening the tail pulled by said pinch rolls, means for driving the pinch rolls and the bending rolls, means actuated by the end of the tail for reversing said driving means, to move the coil bodily along said support toward the mill, a storage conveyor for receiving the tailed coils discharged from said support, driving means for intermittently actuating said conveyor to discharge the foremost coil therefrom, means for receiving the coil discharged from said conveyor and moving it into unwinding position adjacent the mill, the coil being turned on its axis to bring its tail into a forwardly extending substantially horizontal position and being entered into the rolling mill by said movement thereof into unwinding position, and means for rotatably supporting the coil in said unwinding position for unwinding of the strip therefrom.

8. A coil handling system comprising, in combination, a roller table disposed remotely from a rolling mill, in alignment therewith, a pair of pinch rolls adjacent the rear end of said table for pulling a rearwardly extending tail from the underside of a coil disposed on said table, a plurality of reverse bending rolls for straightening the tail pulled by said pinch rolls, means for driving said pinch rolls and said bending rolls, means actuated by the end of the tail for reversing said driving means to effect movement of said coil bodily along said table toward the front end thereof, means at said front end of the table for automatically effecting rotation of the coil on its axis so as to bring its tail into an upright position, a power driven storage conveyor for receiving the tailed coils from said turning means, means for intermittently actuating said conveyor to discharge the foremost coil therefrom, a carrier cooperating with said conveyor for receiving said discharged coil, means on said carrier for rotatably supporting the coil thereon, said coil being rotated to bring its upright tail into a forwardly extending position for entry into the rolling mill, and means for moving the carrier into a coil unwinding position adjacent to said mill, thereby to effect entry of the tail into the mill.

9. A coil handling system comprising, in combination, a roller table disposed remotely from a rolling mill, in alignment therewith, a pair of pinch rolls adjacent the rear end of said table for pulling a rearwardly extending tail from the

underside of a coil disposed on said table, a plurality of reverse bending rolls for straightening the tail pulled by said pinch rolls, means for driving said pinch rolls and said bending rolls, means actuated by the end of the tail for reversing said driving means to effect movement of said coil bodily along said table toward the front end thereof, means at said front end of the table for automatically effecting rotation of the coil on its axis so as to bring its tail into an upright position, a power driven storage conveyor for receiving the tailed coils from said turning means, means for intermittently actuating said conveyor to discharge the foremost coil therefrom, a carrier cooperating with said conveyor for receiving said discharged coil, means on said carrier for rotatably supporting the coil thereon, said coil being rotated to bring its upright tail into a forwardly extending position for entry into the rolling mill, means for moving the carrier into a coil unwinding position adjacent to said mill, thereby to effect entry of the tail into the mill, said roller table having a substantially level portion adjacent said pinch rolls, on which said coil is supported, and the forward portion being inclined downwardly whereby to prevent buckling of said tail when the coil is moved across said table upon reversal of said driving means.

10. A coil handling system comprising, in combination, a roller table disposed remotely from a rolling mill, in alignment therewith, a pair of pinch rolls adjacent the rear end of said table for pulling a rearwardly extending tail from the underside of a coil disposed on said table, a plurality of reverse bending rolls for straightening the tail pulled by said pinch rolls, means for driving said pinch rolls and said bending rolls, means actuated by the end of the tail for reversing said driving means to effect movement of said coil bodily along said table toward the front end thereof, means at said front end of the table for automatically effecting rotation of the coil on its axis so as to bring its tail into an upright position, a power driven storage conveyor for receiving the tailed coils from said turning means, means for intermittently actuating said conveyor to discharge the foremost coil therefrom, a carrier cooperating with said conveyor for receiving said discharged coil, means on said carrier for rotatably supporting the coil thereon, said coil being rotated to bring its upright tail into a forwardly extending position for entry into the rolling mill, means for moving the carrier into a coil unwinding position adjacent to said mill, thereby to effect entry of the tail into the mill, and means responsive to movement of said carrier out of coil receiving position for preventing actuation of said conveyor driving means.

11. A strip mill system comprising a roll stand, a coil storage conveyor aligned therewith but spaced therefrom, a carrier operable between said conveyor and said stand, for receiving a coil from the conveyor and moving it into an unwinding position in front of said stand, means operable to form a rearwardly extending straight flat tail on the underside of each coil of strip material to be rolled, said tail forming means being arranged at the receiving end of said conveyor for delivery of the tailed coil directly to said conveyor, coil supports on the conveyor in longitudinally spaced relation, and means for actuating the conveyor through a distance equal to the spacing between said coil supports, to bring one of said supports into coil receiving position

and to discharge the foremost coil to said carrier.

12. A strip mill system comprising a roll stand, a coil storage conveyor aligned therewith but spaced therefrom, a carrier operable between said conveyor and said stand, for receiving a coil from the conveyor and moving it into an unwinding position in front of said stand, means operable to form a rearwardly extending straight flat tail on the underside of each coil of strip material to be rolled, said tail forming means being arranged at the receiving end of said conveyor for delivery of the tailed coil directly to said conveyor, coil supports on the conveyor in longitudinally spaced relation, means for actuating said conveyor, and means actuated by said carrier for rendering said conveyor actuating means operative only when said carrier is in coil receiving position.

13. Mechanism for delivering coiled strip metal to a roll stand having work rolls, a roller bridle associated therewith, and provided with upper and lower sets of rollers operable to tension strip material passing between said work rolls, comprising, in combination, a storage conveyor for supporting a plurality of coils to be rolled, the conveyor being aligned with said roll stand but spaced therefrom, a carrier operable between said conveyor and said stand, for receiving a coil from the conveyor and moving it into an unwinding position in front of said stand, means operable to form a rearwardly extending straight flat tail on the underside of each coil of a length sufficient to pass between said sets of rollers and enter between said work rolls, said tail forming means including a roller table in alignment with said conveyor for delivery of the tailed coil directly to said conveyor, coil supports on the conveyor in longitudinally spaced relation, means for actuating the conveyor through a distance equal to the spacing between said coil supports, to bring one of said supports into coil receiving position and to discharge the foremost coil to said carrier, and means on said carrier to rotatably support the coil thereon for movement of its tail into a forwardly extending position, whereby said tail is passed between the rollers of said bridle and entered between said work rolls upon movement of the carrier to said unwinding position.

14. A coil handling apparatus comprising, in combination, a coil support disposed remotely from a coil unwinding position in alignment therewith, a pair of pinch rolls adjacent said coil support for pulling a rearwardly extending tail from the underside of a coil disposed on said support, means for straightening the tail pulled by said pinch rolls, reversible driving means for driving said pinch rolls in a direction to form said tail and in the opposite direction to discharge the coil from said support, and means including rotatable coil supporting members for receiving the discharged coil and moving the same into said unwinding position, said coil being rotated on said supporting members to bring its tail into a substantially horizontal, forwardly extending position prior to said movement into unwinding position.

15. In a coil handling apparatus of the class described, in combination, a coil supporting device incorporating a plurality of rotatable members for receiving a coil of strip metal and supporting the same for unwinding movement, a storage conveyor extending rearwardly from said coil supporting device, a tail puller mechanism incorporating a coil support and driven rolls disposed at the rear end of said conveyor in align-

ment therewith for initially receiving each coil and forming a rearwardly extending tail on the lower side of the coil, means associated with said tail puller mechanism for moving the tailed coil across said support to said conveyor, and means for intermittently actuating said conveyor to deliver the foremost coil thereon to said rotatable members of said coil supporting device.

16. A coil handling apparatus of the class described comprising, in combination, a coil cradle for rotatably supporting a coil of strip metal for unwinding movement, and mounted for substantially horizontal movement from a coil receiving position to a coil unwinding position, means for moving said cradle from one position to the other, a tail puller incorporating a plurality of rolls for forming a rearwardly extending straight flat tail on the underside of each coil prior to delivery thereof to said cradle for unwinding, a coil support associated with said tail puller and spaced from said cradle in alignment therewith, means for bodily moving the coil across said support to remove its tail from between said rolls, and a coil conveying device interposed between said coil support and said cradle for delivering the tailed coil to said cradle in the coil receiving position thereof, said coil traveling in a straight-line path from its tail pulling position to its unwinding position.

17. A coil handling apparatus of the class described comprising, in combination, means incorporating a plurality of rolls for unwinding and straightening the end portion of a coil of strip metal to form a rearwardly extending tail on the underside of the coil, means for rotatably supporting the coil on its side in front of said rolls, reversible driving means for driving said rolls in a direction to form said tail and in the oppo-

site direction to move the coil bodily across said supporting means, said supporting means extending towards a forwardly disposed coil unwinding position, means for receiving and rotatably supporting the tailed coil after its discharge from said supporting means, and means for moving said coil receiving and supporting means and the coil carried thereby forwardly into said unwinding position, said coil being rotated to bring its tail into a substantially horizontal, forwardly extending position for entry between a pair of rotating rolls by said movement thereof into unwinding position.

18. A coil handling apparatus comprising, in combination, a roller table disposed remotely from a coil unwinding position in longitudinal alignment therewith, a pair of pinch rolls adjacent the rear end of said table for pulling a rearwardly extending tail from the underside of a coil disposed on said table, means for straightening the tail pulled by said pinch rolls, means for driving said pinch rolls in a direction to form said tail and in the opposite direction to effect movement of said coil bodily along said table toward the front end thereof, means cooperating with said table to receive the tailed coil and deliver the same into said unwinding position, and means for rotatably supporting the coil in said unwinding position for unwinding movement, said coil being rotated during delivery thereof into unwinding position to bring its tail into a forwardly extending position for entry between a pair of rotating rolls by said delivery movement thereof into unwinding position.

NORMAN B. LANE.
WILLIAM S. MINGLE.
HERMAN H. COLSON.