Sept. 26, 1967 A. F. GROLL 3,343,393

SPACE SAVING STRIP STOCK UNCOILER WITH FEED LOOP

Filed July 17, 1964 3 Sheets-Sheet 1

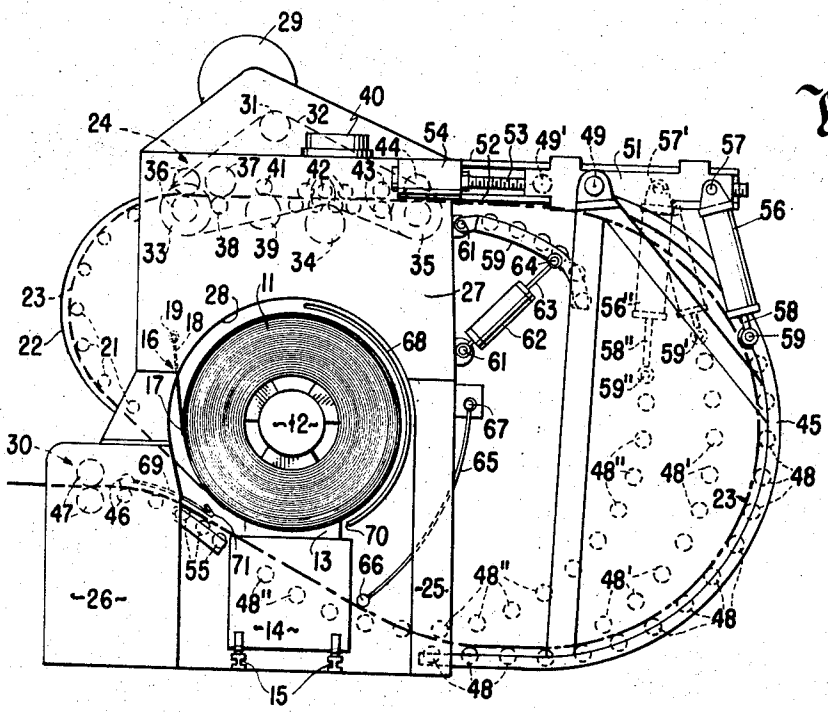


Fig. 1

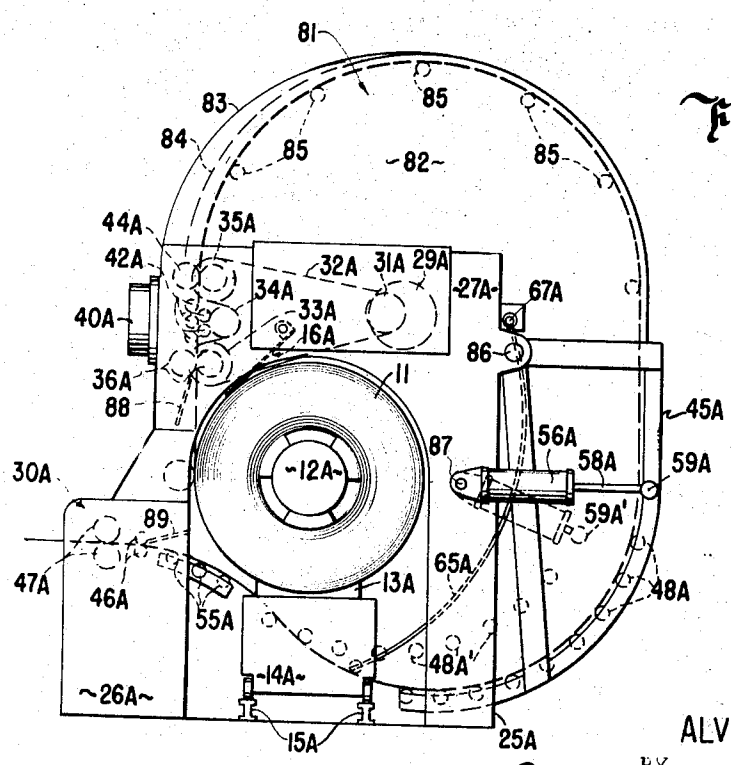


Fig. 2

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Fig. 4

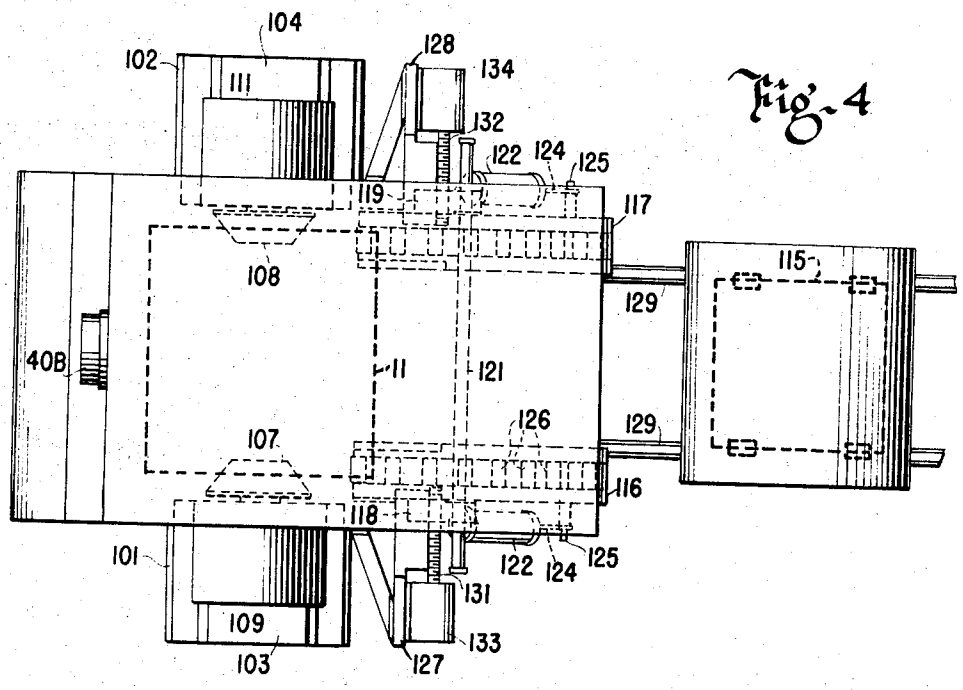
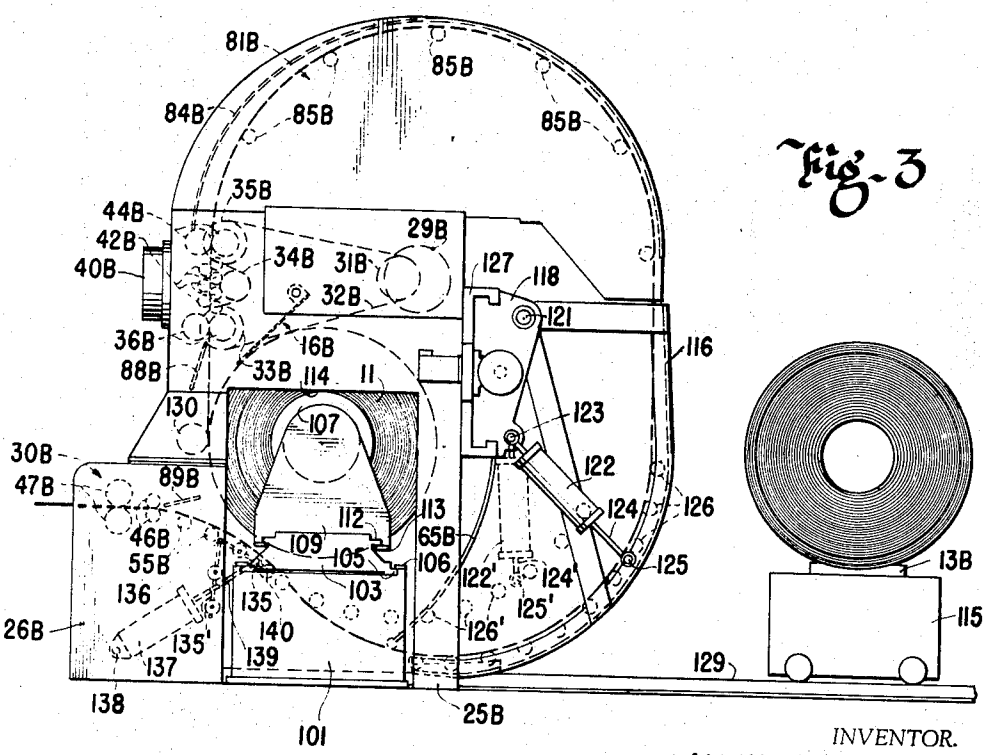


Fig. 3



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SPACE SAVING STRIP STOCK UNCOILER WITH FEED LOOP

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Fig. 6

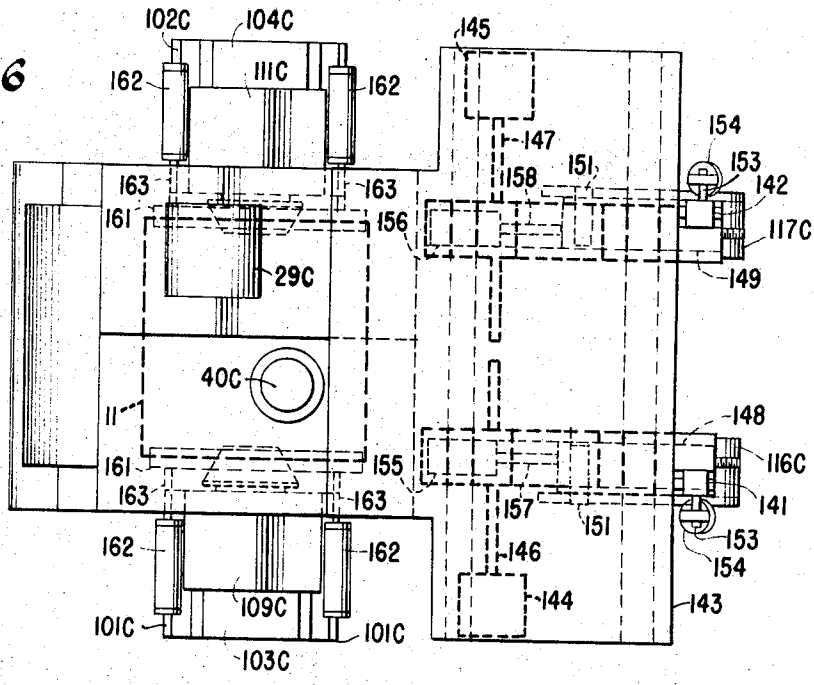
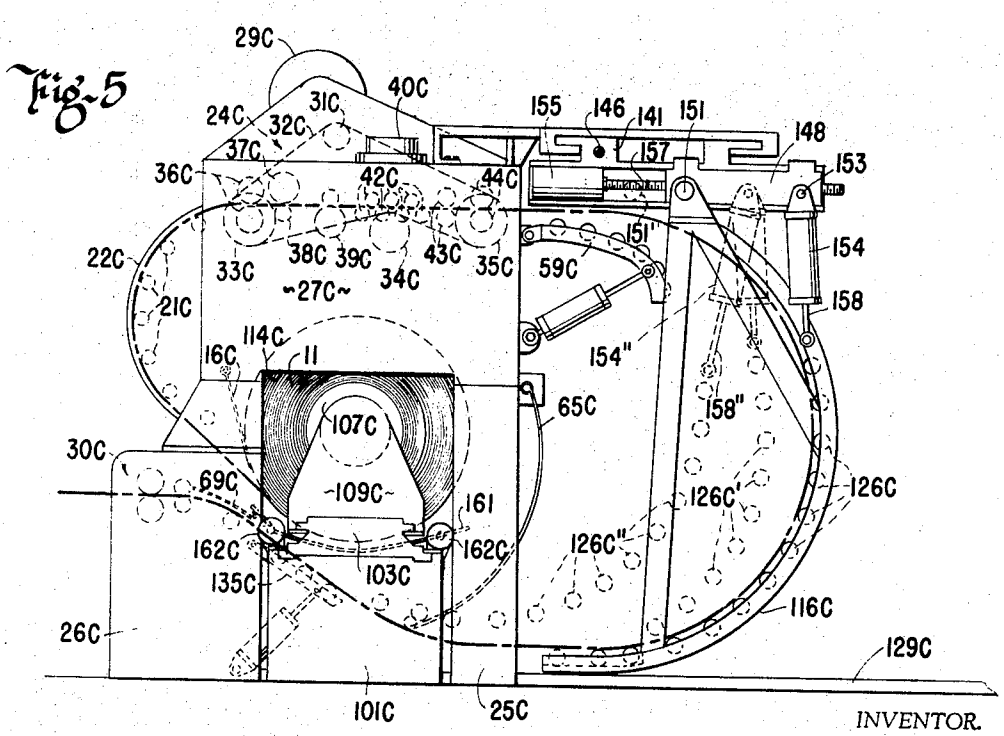


Fig. 5



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3,343,393

SPACE SAVING STRIP STOCK UNCOILER WITH FEED LOOP

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12 Claims. (Cl. 72—183)

This invention relates to strip stock handling equipment and more particularly to equipment for uncoiling and conditioning strip stock to be utilized in devices such as punch presses, shears and stamping machines.

Strips of sheet stock are usually supplied from the mill in tightly wound coils wherein the metal has taken a permanent curvature in the coiling operation. In utilizing coiled strip stock it is first unwound from the coil, and then passed through a straightening mechanism which usually comprises a series of rollers that successively reverse the flexure of the stock over a relatively short radius to reduce and ultimately eliminate the permanent set therein. Such straightened strip stock is then available for further processing by shears, presses or the like which utilize lengths of the stock in step by step motion. The inertia of the coil, uncoiling mechanism and the straightened stock requires relatively smooth withdrawal of the stock from the coil for passage through the straightener. In order to accommodate the continuous feed of the stock from the straightener to the step by step consumption of the stock, prior practice has been to provide a loop of strip stock which is limited in its curvature to avoid the creation of any permanent set in the straightened stock. The usual practice has been to withdraw the strip from the uncoiling mechanism, pass it through a series of rollers constituting a straightener oriented to be essentially tangential to the periphery of the coil and permit the loop to accumulate in line with the uncoiling mechanism and the straightener along a horizontal run. Such an arrangement is illustrated in A. F. Groll Patent No. 3,022,812 which issued Fef. 27, 1962 for Feed Control Means. This type of arrangement requires a great amount of floor space in the shop.

In order to reduce the required shop floor space, it has been proposed that the uncoiling mechanism be placed immediately adjacent the mechanism which processes the strip metal and the intervening loop permitted to expand and contract to accommodate the disparity between the step by step consumption and the continuous feed of the strip in a region above the uncoiling mechanism. In this type of an arrangement a straightener has been provided generally tangential to the outer surface of the coil and inclined upwardly and outwardly therefrom so that the strip stock issues from the straightener along the direction of inclination and is then carried back upon itself and into a feed path beneath the uncoiling mechanism and into the consuming mechanism. In such an arrangement the inclination of the straightener develops a cantilever support for the straightened strip tsock of the loop extending above and around the uncoiling mechanism. This loop cannot be constrained in its radial dimension due to the variations necessary in the step by step take-up of the loop during the operation of the mechanism consuming this strip stock. Therefore, only relatively heavy strip can be processed in such an apparatus because the straightened strip stock is of insufficient strength and elasticity to sustain the weight of free material in the feed loop and the stock tends to collapse or buckle under its own weight thereby stressing it beyond its elastic limit and introducing a permanent set which destroys or seriously impairs its utility. A construction of the type outlined above is disclosed in E. V. Crane et al. U.S. Patent No. 2,246,840 of June 24, 1941.

An object of the present invention is to improve strip stock handling equipment of the type discussed above.

Another object is to reduce the amount of shop floor area required for strip stock handling equipment requiring a variable length loop between the point of removal of the stock from its supply and the stock utilizing apparatus.

Another object is to avoid the introduction of a permanent set into strip stock which has been accumulated for consumption in a utilization mechanism.

Another object is to enable apparatus for uncoiling and preparing strip stock to accommodate a wide range of stock dimensions particularly stock width.

Another object is to facilitate the feeding of strip stock particularly as it is initially taken off the coil and threaded through the processing mechanisms.

In accordance with the one feature of the invention, the above objects are realized by sustaining the variable length loop of strip stock extending between the uncoiling mechanism and the utilization mechanism beneath the uncoiling mechanism. As an adjunct to this feature a conventional straightening mechanism can be positioned closely adjacent the coil from which the stock is drawn and oriented so that the straightened stock issues therefrom vertically. The stock is carried from the straightener over a series of supports and through a turn of essentially 180° and then suspended on its own tension as a free loop between the supports at the end of that turn and the guide mechanisms for introducing the stock into the utilization mechanism. This free loop suspension avoids any requirement for either a column or cantilever type of self-sustaining action by the strip stock and thus avoids the disadvantages of the noted prior art.

Another feature of this invention resides in positioning a washer straightener above the uncoiling mechanism and passing the straightened and the washed strip stock therefrom in a horizontal run which is turned back upon itself into a loop below the coil and coil support.

Another feature involves a pivoted strip stock guide which can be pivoted to thread the end of the strip stock across the region in which the loop expands and contracts and beneath the coil and its supporting mechanism and into the guides which introduces the stock to the feeder of the utilization mechanism. A further adjunct of this feature includes an adjustable positioning of the pivot to facilitate this threading operation and to enable the guide to be moved out of its threading position thereby enlarging the region in which the loop accumulates where long feed lengths and thus large loops are required.

A fourth feature of the invention involves pivoted stock supports to reduce the flexing stress due to the loop weight at the point the stock is introduced to and withdrawn from the loop. These supports follow curves which limit the stock to radii of curvature preventing stress beyond the elastic limit of the material whereby the stock is prevented from attaining a permanent set. In the case of horizontal runs of stock as issued by a washer-straightener for example, if the stock would tend to be unduly stressed if suspended as a cantilever a stock support can be adjusted to support it through a turn toward a vertically descending run from which point the forces imposed primarily would be those of tension.

Another feature resides in shields for the stock to avoid contaminating it as it passes beneath the coil from which it is supplied. This feature of particular advantage in a washer-straightener combination with an uncoiler of the type under consideration since oil, chips and other foreign matter can fall from the coil onto the cleaned strip passing below.

Another feature of the invention is the provision of means to accomodate the aforenoted features in either

a reel type coil supporting mechanism which is loaded by advancement of the coil parallel to the ultimate axis of rotation of that coil and onto the spindle of a reel type clutch mechanism, and for opposed coil clutching elements such as cone type of clutches wherein the loading of a coil into the uncoiling mechanism is accomplished by advancing it into alignment with the axis of rotation by motion transverse of that axis. In the first of these forms of uncoiling mechanism the strip stock guides and, where required, the shields or drip pans utilize to avoid the contamination of the washed strip stock by the superjacent coil of stock, are displaced out of the loading region by pivoting those elements while the guides and drip pans for the second type of uncoiling mechanism are removed from the coil loading path by displacing them transversely of the path on mounting carried on suitable ways in conjunction with driving means for those mountings.

The above and additional objects and features of this invention will be more fully appreciated from the following detailed description when read with reference to the accompanying drawings in which:

FIG. 1 is a side elevation of a reel type uncoiling mechanism associated with a strip stock washer-straightener in accordance with this invention;

FIG. 2 is a side elevation of a reel type uncoiler and strip straightener according to this invention;

FIG. 3 is a side elevation of an uncoiler of the type which engages the opposed ends of the coil as by means of cone-type clutches and is loaded by moving the clutch members outwardly of each other along the axis of rotation and by the advancement of a cart, as illustrated, into the region between the cone-type clutches, said combination including the loop guiding members and arrangement of elements according to this invention;

FIG. 4 is a plan view of the apparatus of FIG. 3;

FIG. 5 is a side elevation of an uncoiler of the type illustrated in FIGS. 3 and 4 associated with a washer-straightener and the guide means utilized therewith all in accordance with this invention; and

FIG. 6 is a top plan view of the apparatus of FIG. 5.

In the reel-type uncoiler of FIG. 1, the coil **11** of strip stock is supported upon an expansible arbor **12**. The arbor **12** is supported as a cantilever on rotatable bearings and has drive means coupled through the cantilever system such that the coil **11** can be mounted thereon by advancing the eye of the coil over the arbor while the coil is supported on a cradle **13** which can be elevated and is carried on a cart **14** which is movable into and out of the region beneath the arbor **12** on rails **15**. The drive for rotating the coil **11** while mounted on the arbor **12** and the means of expanding the arbor **12** are of conventional form and therefore are not shown in this disclosure. A peeler **16** having a knife **17** mounted upon an arm **18** which can be arranged for extension and contraction along its length and is pivoted on the frame of the mechanism as at **19** is provided to strip the coil end from the coil and enable it to be trained around stock suports rolls **21** mounted within the guide housing **22** over an arc approximating the maximum outer curvature of the coil accommodated by the mechanism in order to avoid the introduction of undesired set in the strip supports rolls **21** mounted within the guide housing **22** stock. The stock represented by the dashed line **23**, is fed into the washer-straightener unit **24** supported above the arbor **12** from the stock support rollers **21**.

A framework is provided around the uncoiling mechanism in the form of legs **25** and **26**. The side panel **27** for the washer-straightener is provided with an arcuate cutout **28** to permit the admission of a capacity diameter roll to the arbor of the uncoiler. It also provides the supporting frame for the washer and straightener elements and the drive therefor comprising motor **29** driving through suitable couplings not shown, sprocket **31**, over which is trained drive chain **32**. Leg **26** similarly

forms the housing for a strip stock feeder **30** which intermittently withdraws precisely metered lengths of stock from the suspended loop accumulated between the washer-straightener and the feeder. The feeder can be generally of the type shown in A. F. Groll United States Patent No. 2,728,571 for "Strip Stock Feeders" which issued Dec. 27, 1955, and can be driven mechanically from the utilization device (not shown) or by a separate drive and an electrically actuated clutch synchronized with the utilization device as by means of limit switches (none of which is shown).

Drive chain **32** engages sprockets **33**, **34** and **35**. Sprocket **33** is coupled in driving engagement with pinch rolls **36**, brush roll **37** and backup roll **38**. A gear train also drives brush roll **39** and backup roll **41** from sprocket **33**. Straightener rolls **42** are driven from sprocket **34**. Squeegee rolls **43** and pinch rolls **44** are driven from sprocket **35**. The strip stock is fed from the stock support rollers between the pinch rollers **36**, thence between the respective brush rolls and their backup rolls while being subjected to an appropriate cleaning solution (by means not shown), then passed through the straightener rolls **42**. The squeegee rolls **43** remove the residual solution from the stock which is then issued from the washer-straightener at pinch rolls **44**. It is to be understood that much of the drive mechanism, the troughs for catching the cleaning fluid, the circulating pumps and the means of applying the cleaning fluid are all of conventional form and accordingly have not been included in this disclosure. The offset of the straightener rolls **32** is controlled by motorized straightener roll adjustment **40**. The strip **23** then loops around within the region having outer limits defined by threading chute **45** to a position beneath the coil **11** to anti-backup rolls **46** and feeder pinch rolls **47** journaled on the leg **26** of the frame. When the feed lengths require substantial variations in the dimensions of the loop, the region defined in part by threading chute **45** must be enlarged and therefore means are provided for moving the chute. The chute **45** is depicted in solid lines in its outermost position. It is provided with a series of rollers **48** arranged in an arcuate array and journaled to rotate around axes parallel to the axis of rotation of the coil **11**.

In FIG. 1 the threading chute **45** carrying the guide rollers **48** is shown in phantom in two positions. This range of adjustment is afforded by adjustment of the position of a pivot **49** upon which the chute is mounted and by rotation of the chute around pivot **49**. This pivot is sustained on the slide **51** which is movable in ways **52** along a horizontal path either toward or away the point of issuance of the sheet stock from between rollers **44**. The driving lead screw **53** can be rotated by a suitable motor drive **54** to effect the degree of adjustment of the pivot point which is desired. The purpose of affording this adjustment of the pivot point and thus the position of chute **45** and rollers **48** is twofold. It facilitates the threading of the straightened strip stock by enabling the chute to be pivoted into alignment with the stationary stock support rollers **55** which lead the stock into the anti-backup rollers **46** and the pinch rollers **47**. It also defines the zise of the loop of stock which will be accommodated in the region between rollers **44** and **46**. The pivoting action of the chuts is provided by actuating hydraulic or air cylinder **56** which can also be pivoted from the slide **51** as at pivot **57** to withdraw and extend piston rod **58** pivoted to the side shields of chute **45** at **59**.

Three positions of threading chute **45** are shown. The solid line representation is for that position of full retraction of the chute while the slide **51** is in its outermost position. Two alternate positions are shown in phantom. With the slide moved to its innermost position chute pivot **49** assumes the position **49'** and cylinder pivot is at **57'**. At the innermost position the chute can be retracted to define limits of the region for the feed loop

of strip stock as at roller positions 48' and the piston rod remains retracted as shown in phantom. For threading purposes the chute is pivoted while at its innermost position to orient rollers as at 84'' to define a continuous path with support roller 55 at the point the stock is introduced to feeder 30. In this position cylinder is as at 56'' and the piston rod is extended as at 58''.

A pivoted support 59 having a surface generally following radius of curvature of the stock which will not stress it beyond its elastic limit under the influence of gravity as it issues from pinch rollers 44 is pivoted at the upper portion of the housing side panel 27 as at 61 so that it can be extended to sustain the stock by means of admitting air or hydraulic fluid to cylinder 62 whereby piston rod 63 pivoted at 64 to the guide 59 is extended to raise the guide into stock supporting position. When the stock is of sufficient thickness and rigidity to sustain itself piston rod 63 can be retracted into cylinder 62 to pivot the guide 59 downwardly and out of contact with the bottom surface of the strip stock. It will be noted that the radius of the guide decreases at its outer end and affords support of the stock until it enters a downwardly advancing path which is essentially vertical whereby the stresses imposed on the stock are primarily in tension.

In loading a coil and threading its end through the apparatus of FIG. 1, the coil is mounted on cart 14 alongside of the apparatus. The cart is then advanced along rails 15 to between the legs 25 and 26 of the frame supporting the washer-straightener 24 so that the eye of the coil fits around arbor 12. The arbor is then expanded to grip the inner face of the eye and the coil is rotated either by driving the supporting rollers 13 on the cart 14 or by rotating the arbor 12 by means not shown. This initial rotation is at a slow rate in order to enable the peeler 16 to extend the knife 17 into contact with the outer end of the strip stock whereby that end is pried loose from the coil. This can be done by rotating the coil until the knife blade 17 is in contact with the end and then maintaining the coil stationary while the arm 18 is lengthened through suitable mechanisms not shown. This lifts the end of the coil free and enables it to be passed between the guide shield 22 and the stock support rollers 21 which define a path having a curvature generally of the form of the outer dimension of the maximum coil to be accommodated by the equipment into the pinch rollers 36 and thence through the washer-straightener to issue through pinch rollers 44.

At this time cart 14 is withdrawn from between legs 25 and 26 and the pivot point 49 for the threading chute 45 is displaced to its innermost position with respect to the washer-straightener. Piston rod 58 is extended from cylinder 56 to cause chute 45 to pivot in a clockwise direction such that it defines a path for the stock as shown by phantomed rollers 48''. Thus, the continued rotation of the coil 11 and the driving of the stock through the washer-straightener 24 will carry the stock along the threading chute at 48'' to rollers 54, into the anti-backup rolls 46 and the feeder pinch rolls 47 from which the stock issues to the utilization equipment (not shown). Once the stock has been threaded through the machine, piston rod 58 is retracted into piston 56 to draw the chute outwardly to its position as defined by the phantomed rollers 48' and if the feed length consumed by feeder 30 requires, the loop can be permitted to enlarge beyond the limits defined by the rollers 48' by moving the guide pivot 49 outwardly of the washer-straightener by rotation of screw 53. In this outermost position the stock loop is free to ococupy the region beneath coil 11 and within chute 48.

Ordinarily in operation the loop of stock 23 is permitted to be self-sustaining from the pinch rolls 44 in the area defined by the limits of the path set forth. This ordinarily involves a loop suspended between the pinch rolls 44 and the stationary rolls 55. If, however, the stock is of such a nature to require supplemental support and

a means of limiting the amount of unsupported material depending from the rollers 14 or confining it to a tensile stress support 59 is extended to engage the under surface of the stock and offer further support of its length in the region beyond the pinch rolls 44.

Controls are provided for the drives for the feeder 30 and the washer-straightener 24 to insure that the loop remains within limits. Such control may be of the form shown in A. F. Groll United States Patent No. 3,022,812 of Feb. 27, 1962 for Feed Control Means. Limit switches can be actuated from an operating arm 65 having a roller 66 at its end which follows the inner position of the stock loop. At one extreme the loop might be shortened to draw it against the underside of the coil 11 or its adjacent structures indicating that a greater feed rate from rollers 44 or a slower consumption rate at feeder 30 should be employed. A switch (not shown) actuated by the rotation of shaft 67 mounting arm 65 can effect such alterations. Conversely an oversized loop, as results when washer-straightener 24 issues stock too fast for its consumption at feeder 30, can be sensed from shaft 67 by another switch operated by shaft rotation in the opposite direction to some predetermined limit.

Inasmuch as a washing operation is performed in the washer-straightener, the cleaned strip 23 passing beneath the coil 11 is protected from contamination caused by dirt, oil, chips or the like falling from the coil 11 by means of a drip pan 68. Pan 68 is rotatable about the axis of arbor 12 so that it can be moved into a position clear of the cart 14 during the loading of a coil into the uncoiling mechanism as shown in FIG. 1 and following the withdrawal of the cart 14 from between the legs 25 and 26 of the washer-straightener frame, it can be rotated clockwise to extend beneath and beyond the ends of the coil 11 whereby any matter which might fall from the coil will be caught and carried beyond the region where it might contaminate the cleaned stock passing beneath the coil. The mounting for the drip pan 68 is not shown. However, it can comprise a pivoted cantilever mounting having its pivot point coincident with the axis of rotation of the arbor 12. As a further adjunct to the protection of the cleaned and straightened stock from contamination, a shield 69 overlaps the leading edge 70 of drip pan 68 and is provided with a gutter 71 at its lowermost edge whereby any objects falling from the strip stock as it is drawn from the coil into the shield and guide 22 are caught and prevented from contacting the cleaned strip as it passes over the stationary rollers 54.

In FIG. 2 a reel type uncoiler combined with a straightener in an arrangement whereby the variable length of stock loop extends beneath the coil is shown. This apparatus has many of the features discussed with respect to FIG. 1 and those corresponding features are assigned similar reference characters with the suffix "A". Thus the coil 11 is sustained from an expansible arbor 12A upon which it is loaded by means of a cart 14A traveling on rails 15A. The outer end of the coil is freed of the coil for threading through the apparatus by means of a peeler 16A and that stock is led to pinch rolls 36A and thence straightener rolls 42A wherein the offset of the one set of rolls with respect to the other is controlled by means of a motorized straightener roll adjustment 40A. The stock is then passed through pinch rolls 44A and into casing 81 made up of side panels 82 and end panels 83. The stock is carried by means of a stock deflector 84 over a series of rollers 85 journaled to the casing 81 and arrayed in an arc having a radius of curvature such that no permanent set is imposed upon the straightened stock. Thus the stock loop is suspended between the rollers 85 and a set of stock support rollers 55A and into the antibackup rollers 46A and feeder pinch rollers 47A.

A threading chute 45A is pivoted at 86 to the frame supporting the straightener comprising legs 25A and 26A and side panels 27A. The chute 45A functions as a

threading chute in the manner described with regard to FIG. 1 in that a cylinder **56A** is pivoted at **87** on the straightener support frame and has a piston rod **58A** pivoted at **59A** to the chute **45A** whereby upon retraction of the piston rod **58A** into the cylinder **56A** the chute rollers **48A** define a path aligned with the rollers **55A**. When in the threading position, the chute defines a path tangent to the phantomed rollers **48A'** and the cylinder and piston rod appear as shown in phantom.

The cart is moved on rails **15A** into the region between the legs **25A** and **26A** of the straightener frame while the coil is maintained at a level such that its eye is in alignment with the arbor **12A**. Once the coil is suitably positioned on the arbor, the arbor is expanded and the cart **14A** is withdrawn from between legs **25A** and **26A**. The threading chute **45A** is drawn into a position of alignment with the rollers **55A** by retracting piston rod **58A** into cylinder **56A** so that the chute pivots around its support point **86**. The peeled end of stock is guided along threading guide **88** through the straightener rolls **42A**, over the support rollers **85** to the threading chute rollers **48A** in their displaced position, the stock support rollers **54A**, the threading guide **89**, anti-backup rollers **46A** and feeder pinch rollers **47A**. This advancement of the stock is achieved by rotating the arbor **12A** and driving the straightener rollers by means of motor **29A** rotating sprocket **31A**, driven through a suitable drive train (not shown) to a drive chain **32A** which engages the drive sprockets **33A**, **34A** and **35A** for the straightener rollers.

It will be noted that no columnar or cantilever type of support of the stock loop is relied upon to support that loop, rather the straightener is oriented to issue the straightened strip along a perpendicular path which gradually turns upon itself as defined by the rollers **85** to a point from which the stock is suspended thereby insuring that the stock sustains itself only under tension and therefore has no tendency to buckle or otherwise so distort. This avoids any stresses which might develop a permanent set in the loop area.

The relationship of the elements of FIGURES 1 and 2 significantly reduces the floor space consumed in a shop where a take-up loop of stock is required. Thus in each of the types of devices illustrated arranged to accommodate coils of strip stock weighing up to thirty thousand pounds and a width up to fifty inches. The coils can have outside diameters of from 36 inches to 72 inches and be suitably accommodated in a machine in the case of FIGURE 1, 16 feet high and 20 feet long. In the case of FIGURE 2 the machine illustrated with the stated capacity can be placed in an area 17½ feet high and 16 feet long. This arrangement saves up to 30 feet of length consumed by a horizontal run of the straightener and the loop region, while eliminating the need for a pit into which the loop is permitted to fall.

The two remaining embodiments of the invention illustrated, the straightener uncoiler combination of FIGURES 3 and 4 and the washer straightener uncoiler combination of FIGURES 5 and 6, each utilize a coil support which grasps the eye of the coil on opposite sides thereof and therefore requires loading by movement of the coil into the region between the coil clutches along a path transverse of the axis of rotation of the coil during the uncoiling operation. In the illustrative embodiments the coil support and its loading mechanism illustrated is of the type disclosed in A. F. Groll United States Patent No. 3,107,066 for "Cradle Mechanism With Cone Type Coil Supports" which issued Oct. 15, 1963. However it is to be appreciated that other types of cradle mechanisms utilizing opposed motion of the clutching elements parallel to the common axis about which those elements rotate to uncoil the strip stock can be utilized in accordance with the features of this invention and that this utilization of the equipment disclosed in the aforenoted patent has been chosen as a further means of reducing the amount of floor area required by the apparatus.

The straightener and uncoiler of FIGS. 3 and 4 will be described utilizing, wherever possible, reference characters corresponding to those employed in FIGS. 1 and 2 for corresponding elements and those reference characters will be distinguished from FIGS 1 and 2 by the use of the suffix "B." The coil supporting structure comprises a pair of opposed stationary bases **101** and **102** each having a movable bed **103** and **104** mounted for movement with respect thereto by ways slidably receiving splines **105** which are retained in the ways on the base by gibs **106**. Suitable driving means, not shown, are provided for shifting the beds **103** and **104** toward and away from each other to provide a first means of adjusting the separation of the coil clutch members **107** and **108**. Carriages **109** and **111** are laterally shiftable with respect to the beds **103** and **104** by means of ways receiving the splines **112** and having retaining gibs **113**. The carriages are movable with respect to their supporting beds by driving means (not shown) such as electric motors actuating a screw or hydraulic pistons and cylinders in order to provide freedom of motion inward and outward of the beds **103** and **104**. The straightener supporting frame **81B** is sustained on legs **25B** and **26B** which are cut away at **114** to provide the necessary clearance for the beds and carriages.

The orientation of the strip stock loop in the apparatus of FIGS. 3 and 4 corresponds to that of FIG. 2. However the apparatus must be arranged to afford access of the loading cart **115** so that it can pass through the region normally occupied during threading and operation of the straightener uncoiler combination by the threading chute. Accordingly, the chute and its actuating elements are arranged to be moved aside to permit access of the cart and the coil which it supports. The split chute comprising the frame sections **116** and **117** is displaced transversely of the apparatus (longitudinally of the axis about which the coil is rotated) by means of individual carriages **118** and **119** each of which carries a pivot point **121** for the chute and a drive cylinder **122** pivoted thereto at **123** having a piston rod **124** issuing therefrom to a pivotal connection **125** on the chute. Each split chute section is composed of a frame of the same profile as the chute **45A** of FIG. 2 having rollers **126** journaled thereon and engageable with the edges of the strip stock during the threading of the stock. The drive pivoting means are synchronized such that they are maintained in alignment in their pivotal position around the common axis of the pivot points **121**. Each section is reciprocated transversely of the stock by the movement of carriages **118** and **119** in ways **127** and **128** extending inward to the limits of a coil of maximum width. The carriages can partially extend beyond the limits of the ways when a narrow coil is to be accommodated and the chute is to engage its margins during threading. If desired a double range of adjustment can be utilized as for carriages **109** and **111** by providing intermediate shiftable beds (not shown) between the frame mounted ways **127** and **128** and carriages **118** and **119**.

In operation, a coil is mounted upon the loading cart **115** while that cart is placed outwardly of the uncoiler combination and the carriages **118** and **119** for the threading chute and carriages **109** and **111** for the coil clutches are moved outwardly a distance sufficient to accommodate the overall length of the coil as it is centered upon the cart. The cart is then advanced along its rails **129** between the separated guides **116** and **117** to a region centered between the coil clutches **107** and **108**. As in the case of cart **14A**, its lift mechanism properly orients the coil eye in alignment with the clutches **107** and **108** and those clutches are moved inwardly of each other to engage the coil eye. The elevated coil support **13B** then can be retracted into the cart and the cart withdrawn from the apparatus to the position it is shown in FIGS. 3 and 4. The

carriages **118** and **119** can then be moved toward each other to provide a separation of guides **116** and **117** suitable to accommodate the strip stock. Coil **11** is then rotated while the peeler **16B** is effective to lift the outer end free thereof while the threading roll **130** maintains pressure on the outer surface of the coil at a point tangential to that from which the outer end is separated. The end is threaded past the threading guide **88B** through pinch rolls **36B**, straightener rolls **42B** having an offset as determined by the motorized straightener roll adjustment **40B** to pinch rolls **44B** and thence between the stock deflector **84B** and the stock supporting rolls **85B** within the upper casing of the apparatus. The stock supporting rolls **85B** are disposed in an arc which supports the straightened stock along a path of curvature preventing any development of a permanent set.

During the loading of the coil and while cart **115** is advanced into the apparatus the chute sections **116** and **117** are moved outwardly by rotating drive screws **131** and **132** by means of motors **133** and **134** mounted on the outer portion of ways **127** and **128**. A bidirectional drive is provided by motors **133** and **134** so that carriages **118** and **119** can be driven inward sufficiently to enable the rollers **126** on chute sections **116** and **117** to engage the longitudinal margin of the strip stock during threading.

Since cart **115** advances closely adjacent the housing for feeder **30B**, guide rollers **55B** carrying the stock to anti-backup rolls **46B** are in part carried on a frame **135** pivoted at **136** to leg **26B**. While cart **115** is in the coil loading position frame **135** is pivoted downward to the position **135'**. During threading and normal operation it is extended by means of cylinder **137** pivoted to leg **26B** at **138** and having piston rod **139** connected at pivot **140** to frame **135**.

The chute sections **116** and **117** are shifted transversely to their threading positions and then pivoted by the retraction of piston rod **124** into cylinder **122** to locate the chute in accordance with the phantomed position represented rollers **126'**, cylinder **122'** and piston rod **124'**. Frame **135** is extended, hence the continued advance of the free end of the strip stock permits that end to be carried into the chute and around to a position aligned with the stock support rollers **55B** on the frame **135**. The stock then passes to the threading or baffle plate **89B**, the anti-backup rollers **48B** and the pinch rollers **47B**.

During this advance of the strip stock, the drive for the coil **11** is operated at a low speed as are the straightener rolls. Motor **29B** coupled by a suitable drive train to sprocket **31B** drives chain **32B** for drive sprockets **33B**, **34B** and **35B** to drive straightener rolls **42B** and pinch rolls **36B** and **44B**. Once the threading of the stock is completed, the threading chute can be extended to its loop limiting position by extending the piston rods **124** from cylinders **122** to cause that chute to pivot around point **121**. Thus in the subsequent operation of the uncoiler to feed the intermittent strip consumption at the delivery between pinch rolls **47B**, the limit in the size of the loop accumulated is defined in part by the chute **124** through the engagement of each of sections **116** and **117** with the lateral edge of the strip. Further, as in the preceding threading chutes the limits on the amount of stock accumulated in the loop can be set by means of limit switches (not shown) one of which might be actuated from arm **65B** as the stock loop approaches its maximum dimension and the other of which is actuated as the stock loop approaches its minimum dimension wherein it might be drawn against the underside of the coil **11**.

The washer-straightener uncoiler combination shown in FIGS. 5 and 6 is made up of a composite of the features embodied in the apparatus of FIG. 1 and that of the apparatus of FIGS. 3 and 4. Since the apparatus involves a washer-straightener, it requires means to avoid soiling the cleaned strip as it passes beneath the roll as in FIG. 1. Since the roll is loaded into the uncoiling mechanism from the side rather than axially of its rotational axis, provision is made for the lateral shifting of the clutch members, the stock shields, and the composite threading chute and loop guide wherein the loop guide is split into two sections in the manner of the apparatus of FIGS. 3 and 4. Thus the movable pivot points for both the threading chute and its pivoting cylinder are arranged to be shifted transversely of the coil strip to provide the support for the elements at all positions in the range through which they are shiftable both in the loading operation and in accommodating strip stock narrower than the maximum capacity of the apparatus. As in previous embodiments of the invention, like elements will be assigned like reference characters except that the suffix "C" will be utilized in conjunction with the reference character to identify the elements as utilized in the apparatus of FIGS. 5 and 6. In accordance with this scheme the coil **11** is mounted on clutch members **107C** and **108C** journaled for rotation on the laterally movable carriages **109C** and **111C** which in turn are supported on laterally movable beds **103C** and **104C** supported on the base members **101C** and **102C**. The washer-straightener is sustained by legs **25C** and **26C** of a framework having a side panel **27C** from which is cut an opening **114C** through which the carriages and beds can be extended when the clutches are separated as for either a wide coil or the loading of coils. As in the case of FIG. 1 the strip stock is carried from the coil around a series of stock support rollers **21C** and inside of a stock guide and shield **22C** to pinch rolls **36C**, washer brushes **37C** and **39C** each of which are backed up by a backup roll **38C** and **41C** respectively to straightener rolls **42C**, squeegee rolls **43C** and pinch rolls **44C**. The offset of the straightener rolls is controlled by the motorized straightener rolls adjustment means **40C** and the several rolls in the washer-straightener combination are driven by motor **29C** coupled to driving sprocket **31C** for chain **32C** trained around sprockets **33C**, **34C** and **35C**.

The unitary threading chute and loop guide is split in a manner similar to that of the corresponding elements of FIGS. 3 and 4, and comprise sections **116C** and **117C** on opposite sides of the path along which the strip stock is guided. These guides are provided with short rollers **126C**. The pivots for the split shields **116C** and **117C** are mounted on carriages **141** and **142** hung from a transverse track or way **143** extending across the apparatus above the area through which the coil and loading cart (not shown) pass on tracks **129C**. The carriages are individually driven by reversible electric motors **144** and **145** (shown only in FIG. 6 to avoid obscuring other elements in FIG. 5) rotating drive screws **146** and **147** engaging fixed nuts in the carriages. A slide **148** and **149** is carried on each of carriages **141** and **142**. Pivot **151** for the threading chute and **153** for the chute pivoting cylinder **154** is mounted on each slide. The slides are reciprocated toward and away from the washer-straightener by means of electric motors **155** and **156** driving screws **157** and **158** engaging nuts in the slides.

As shown in solid lines in FIG. 5 the slides are fully extended and the chute is retracted. The retracted position of the slides is phantomed in FIG. 5 for the retracted chute position depicited for rollers **126C'** and the threading position showing rollers **126C''**. When the chute is retracted, piston rod **158** is retracted in cylinder **154**. To position the chute for threading, rod **158** is extending as at **158''** while the cylinder is at **154''** and the chute pivot is at **151''**.

The adjuncts to the apparatus of FIGS. 5 and 6 include the pivoted stock supports **59C** and **135C** at the washer-straightener **24C** and the feeder **30C** and the limit switch controls for the loop sensed by arm **65C**. A stock shield **69C** is provided together with a peeler **16C**. The stock shield **161** beneath the coil **111** is of a form different from shield **68** in FIG. 1 since different loading clearances are required. Shield **161** is split into two sections and extends beneath the edge of coil **11** only since it must be with-

drawn transversely to admit the coil and cart for loading. Each section is supported from a bed **103C** or **104C** by means of a pair of cylinders **162** having piston rods **163** reciprocable parallel to the path of reciprocation of the beds. During loading, the shields **161** are withdrawn from the coil loading region. After the coil has been engaged by the cone clutches **107C** and **108C** the shields **161** are extended beneath the coil ends as shown in FIG. 6 and the coil is threaded as described for the previous examples.

In each of the illustrative embodiments the feed loop of the strip stock is pendent from supporting elements which avoid the imposition of the weight of the loop as a bending moment. Rather in each instance the loop is primarily in tension, particularly at the higher support point which sustains the greater portions of the loop weight. Further since the stock passes above the uncoiler and the straightener or washer-straightener and then below the combination it provides the advantages of combinations requiring a much greater amount of shop space for prior art apparatus of equivalent capacity.

Each embodiment also contemplates a threading chute which initially carries the free end of the strip stock across the region in which the feed loop is subsequently developed. This greatly facilitates the threading of the stock into a feeder or other device consuming it from the loop.

While the features of this invention have been illustrated in specific embodiments it is appreciated that many modifications are available within the spirit and scope of this invention. Accordingly the above description is to be read as illustrative and not in a limiting sense.

Having described the invention, I claim:

1. Apparatus for handling strip stock comprising a strip stock uncoiler; means on said uncoiler for rotatably mounting a coil of strip stock with its axis horizontal; a strip stock straightener above said coil mounting means and located to receive strip stock from a coil mounted on said coil mounting means; a support means for supporting the under surface of the strip stock and defining an arcuate path for straightened strip stock extending from said straightener with a radius of curvature sufficient to avoid developing a set in the straightened stock, said path turning downwardly, said support means having an extreme strip stock support station along said path and defining the point of support by said support means most remote laterally from said coil mounting means on the side of said coil mounting means opposite that from which said stock is withdrawn; means maintaining said extreme stock support station above a first open zone at a height sufficient to accommodate a loop of strip stock pendant from said extreme stock support station; a stock receiving means on the side of said coil mounting means from which the stock is withdrawn; and means maintaining said coil mounting means above a second open zone continuous with said first open zone to form a feed loop zone which is unobstructed to accommodate a range of lengths of feed loop of pendant strip stock between said extreme stock support station and said stock receiving means whereby the strip stock is maintained pendant in an unconstrained feed loop of variable length a portion of which is beneath said coil mounting means.

2. Apparatus for handling strip stock comprising a strip stock uncoiler; means on said uncoiler for sustaining a coil for rotation with its axis horizontal; a strip stock straightener having an upwardly extending path for strip stock which generally is tangential to the coil sustaining means at a greater height than said means; a support means for supporting the under surface of the strip stock and defining an arcuate path for straightened strip stock extending from said straightener upwardly, passing over said uncoiler and turning downwardly, said support means having an extreme strip stock support station along said path and defining the point of support by said support means most remote laterally from said coil sustaining means on the side of said coil sustaining means opposite that from which said stock is withdrawn, said arcuate path having a radius sufficient to avoid developing a set in said stock; means maintaining said extreme stock support station above a first open zone at a height sufficient to accommodate a loop of strip stock pendant from said extreme stock support station; a stock receiving means on the side of said coil sustaining means from which said stock is withdrawn; and means maintaining said coil sustaining means above a second open zone continuous with said first open zone to form a feed loop zone which is unobstructed to accommodate a range of lengths to feed loop of pendant strip stock suspended between said extreme stock support station and said stock receiving means.

3. Apparatus according to claim **2** wherein a curved chute extends from beneath said extreme strip stock support station, a pivoted mounting for said chute to permit motion thereof around an axis extending in a direction transverse of the length of the path assumed by the stock, said chute extending to the vicinity of said receiving means when pivoted to a threading positoin, and defining a portion of said region for receiving said variable length loop when pivoted to a second position, and driving means for moving said chute between said threading and said second position.

4. A combination according to claim **2** wherein said straightener has an essentially vertical run and said stock support extends over an arc of essentially 180°.

5. Apparatus for handling strip stock comprising a strip stock uncoiler; means on said uncoiler for sustaining a coil for rotation with its axis horizontal; a strip stock straightener having an upwardly extending path for strip stock which generally is tangential to the coil sustaining means and at a greater height than said means; a support for supporting the under surface of the strip stock and defining an arcuate path for straightened strip stock extending from said straightener upwardly, passing over said uncoiler and turning downwardly, said support means having an extreme strip stock support station along said path and defining the point of support by said support means most remote laterally from said coil sustaining means on the side of said coil sustaining means opposite that from which said stock is withdrawn, said arcuate path having a radius sufficient to avoid developing a set in said stock; means maintaining said extreme stock support station above a first open zone at a height sufficient to accommodate a loop of strip stock pendant from said extreme stock support station; a stock receiving means on the side of said coil sustaining means from which said stock is withdrawn; means maintaining said coil sustaining means above a second open zone continuous with said first open zone to form a feed loop zone between said extreme stock support station and said stock receiving means and beneath said coil sustaining means which is unobstructed to accommodate a feed loop of strip stock of variable length pendant between said extreme stock support station and said receiving means; and a movable chute having a retracted positoin in which it defines a portion of the outer limit of said feed loop zone and a threading position for guiding stock from said extreme stock support station to said stock receiving means.

6. A combination according to claim **5** wherein said chute comprises two sections seperated parallel to the longitudinal path of the strip stock, and including means to move said guide sections toward and away from each other to align said sections for engagement with the longitudinal margins of the stock.

7. Apparatus according to claim **5** wherein said stock chute is movable in an arc about an axis extending in a direction transverse of the longitudinal path of the stock and adjacent one side of said feed loop zone.

8. Apparatus according to claim 7 wherein said axis is movable along a generally horizontal path, and means for driving said axis along said path.

9. A combination according to claim 5 including a coil loader for moving a coil of strip stock along a path and into a mounting position on said coil sustaining means; and means to drive said movable chute to a position clear of the path of said coil loader.

10. A combination according to claim 9 wherein said coil sustaining means opposed clutches for engaging the opposite ends of the coil and rotatable about a common axis, means for moving said clutches apart for receiving the coil, said coil loader having a path of movement normal to said axis and through the region in which said stock chute aligns said stock with said stock receiving means, said stock chute comprising two sections divided longitudinally and parallel to the stock feed path, first means for moving said chute sections transversely of said stock feed path, said first position being outward of said path, said second position being inward of said path to a position wherein said chute sections each are engageable with a longitudinal margin of said strip stock, and second means for moving said chute sections around

an axis and toward and away from said stock receiving means.

11. A combination according to claim 2 including, a strip stock washer above said coil sustaining means strip stock supporting and guiding means for carrying said stock from said uncoiler to said washer, and a shield above that portion of said feed loop zone beneath said coil sustaining means.

12. A combination according to claim 11 including a coil loader for carrying coils to said coil support, and means to move said shield out of the path of said coil loader.

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