

April 4, 1944.

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Filed Feb. 4, 1941

2,345,656

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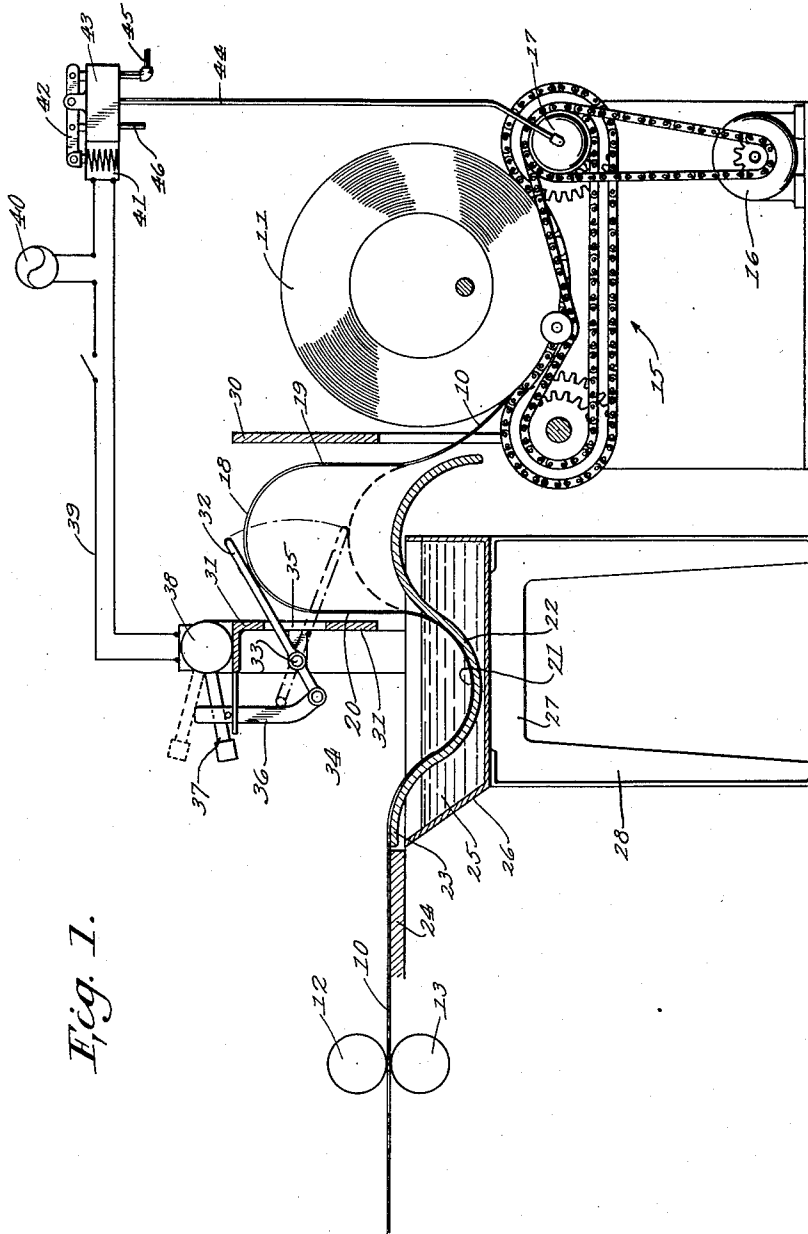


Fig. 1.

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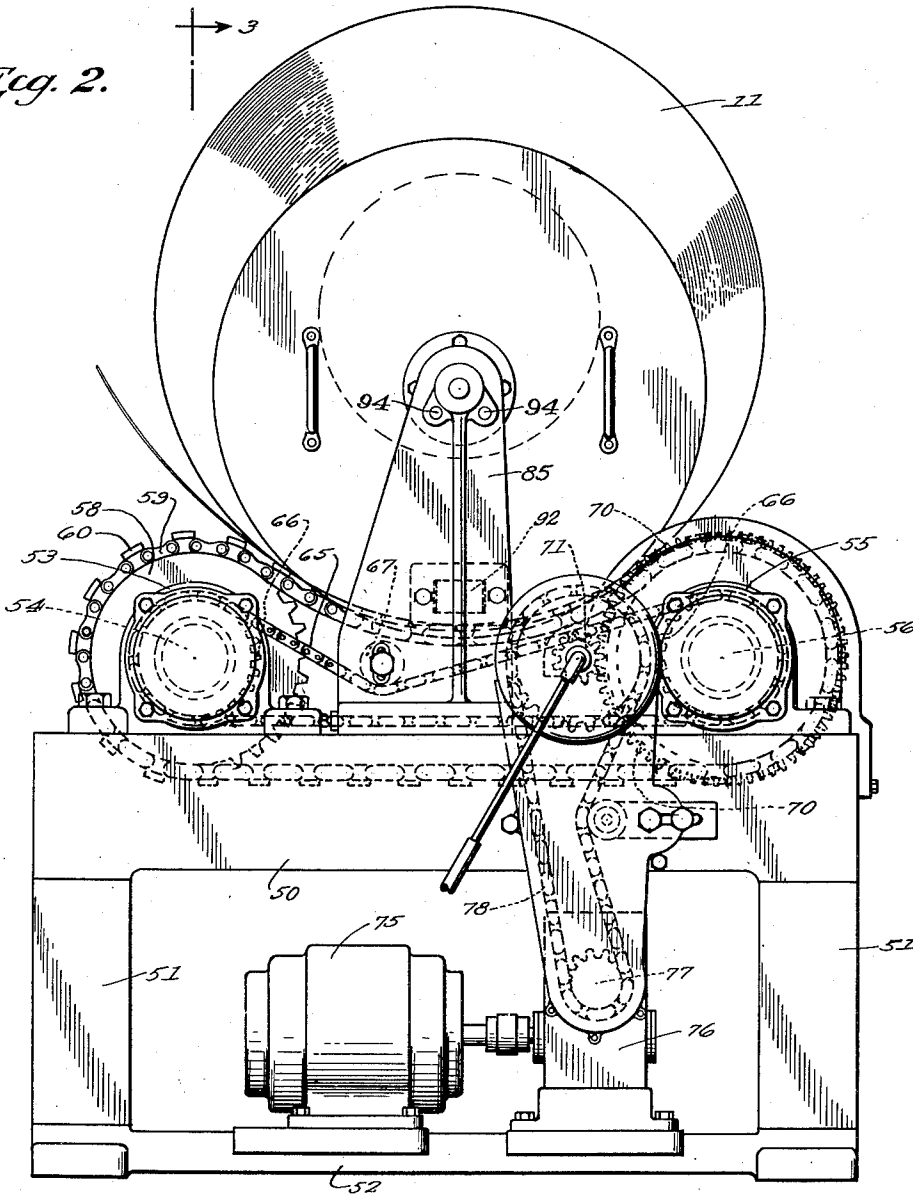
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Fig. 2.



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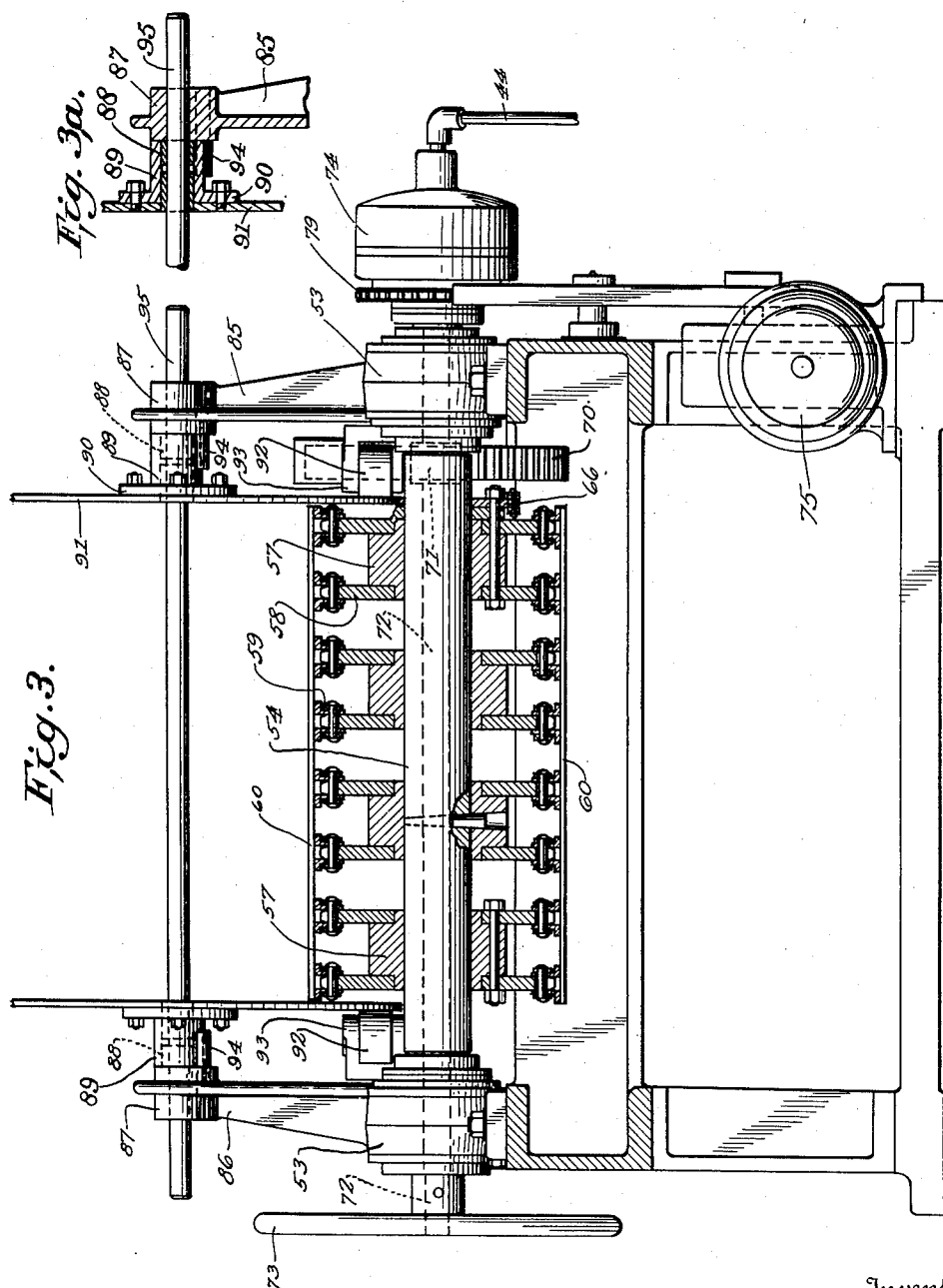
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UNITED STATES PATENT OFFICE

2,345,656

METHOD OF AND APPARATUS FOR DELIVERING SHEET MATERIAL TO PRESSES OR THE LIKE

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Application February 4, 1941, Serial No. 377,370

17 Claims. (Cl. 117—66)

The present invention relates to a method of and apparatus for handling sheet material, such as strip steel and, more particularly, to unwinding strip from a large coil of such material and delivering the same to a strip treating machine, such as a drawing press, in an improved manner.

A primary object of the invention is to provide simplified and improved means for supporting and unwinding a coil. A further object, of equal importance, is to provide improved control means for the coil unwinder, to the end that the strip is unwound at a rate corresponding to the rate of consumption of the strip in the strip treating apparatus.

A further object of the invention is to provide a method of and means for delivering the strip under positive pressure to the feed rolls or equivalent devices of the next machine in the line, such as a drawing press or the like. An important advantage of this phase of the invention is that the drag, back pull and tension upon the press feed rolls are substantially or entirely eliminated, with the result that the feed rolls function primarily as a means for accurately controlling the delivery of strip to the drawing dies or the like.

A further object of the invention is to provide novel means for lubricating or otherwise treating the strip, between the coil of strip and the press feed rolls or the like.

A further object of the invention is to provide a coil unwinder and means for guiding the strip through one or more loops, to provide an excess supply of strip for the drawing press, which, in most instances, receives the strip from intermittent infeed devices. An additional advantage of the provision of an excess supply in loop form in accordance with the present invention, is that the weight of the material in the loop tends constantly to feed the strip by a positive, gravity force to the infeed devices of the drawing press or the like.

A further object of the invention is to provide novel control means for the coil unwinder, actuated and controlled by the position of the strip in the aforementioned loop. To this end, the invention preferably includes an air pressure operated clutch in the driving means and an air valve in the clutch air line, controlled by a feeler or the like associated with the loop of strip steel constituting the excess supply.

A further object of the invention is to provide a novel form of coil supporting cradle, wherein the circumference of the coil is supported upon a concave, flexible supporting surface which is

positively driven to make rolling contact with the coil, to unwind the same. One of the advantages of the invention results from certain novel and improved driving instrumentalities for the coil supporting cradle.

Other and further objects and advantages of the present invention will become apparent to one skilled in the art from a consideration of the following description of the specific embodiments of the invention shown in the accompanying drawings.

In the drawings:

Figure 1 is a somewhat diagrammatic side elevation and vertical longitudinal section of an apparatus in accordance with the present invention.

Figure 2 is an enlarged side elevation of a preferred form of coil unwinder.

Figure 3 is a vertical section taken substantially on line 3—3 of Figure 2, and

Figure 3a is a vertical sectional view of a detail.

The apparatus of the present invention is particularly adapted to deliver strip steel from a large coil to the feed rolls of a drawing press of the type shown in the prior application of Calleson and Calleson, Serial No. 373,028, filed January 3, 1941, although it must be understood that the apparatus may be employed to deliver similar materials to other types of machines, or to deliver different classes of materials to any desired point of consumption or treatment. Thus, although the invention is especially adapted for use with a cupping press of the type shown in that application, it is not confined to operation in that combination.

As shown in Figure 1, the coil is supported upon a chain cradle unwinder, represented generally at 15. The chains upon which the circumference of the coil is supported are positively driven, as hereinafter explained, by driving means including an electric motor 16 and a fluid pressure operated clutch 17. The strip forcefully unwound from the coil is guided through a predetermined path including an upwardly projecting, inverted, U-shaped loop 18 having an ascending leg 19 and a descending leg 20, the latter being extended downwardly into the form of a downwardly projecting loop 21, confined by a curved guide plate 22, aligned at its exit end with the press infeed table 24, where the strip is guided by edge-engaging, hold-down means, not shown, but described in detail in the application mentioned above.

Preferably, the curved guide 22 is, in part, immersed in lubricating oil in a reservoir 26 car-

ried by a table 27 having supporting legs 28. The provision of a lubricating bath between the uncoiling device and the press is advantageous, since it conditions the metal and provides the correct amount of lubricant for the drawing operation performed by the press. Of course, the lubricant bath may be dispensed with, if desired, and the lubricant applied in any other desired manner.

A pair of transverse plates 30, 31 are positioned adjacent the ascending and descending legs of the loop 18, in spaced relation thereto, so that the loop is substantially unconfined. The plates are provided as a safeguard, to prevent the possibility of the loop falling backwardly or forwardly, out of the area where it is desired that the loop remain at all times. A feeler arm 32, pivoted upon a pin 33 carried by the vertical frame member 34, projects through an opening 35 in the plate 31 and overlies and contacts the loop 18, the weight of the arm being sufficient to cause it to follow the loop, as hereinafter explained. The opposite end of the feeler is connected by a link 36 to an arm 37 of an electric switch 38, in a circuit 39 including a source of power 40 and a solenoid 41. The solenoid is connected to the operating lever 42 of an air valve 43, in an air line 44 leading from a source of compressed air by pipe 45 to the air pressure operated clutch 17. The valve assembly 43 includes an exhaust pipe 46, adapted, in one position of the valve, to permit the actuating air in the clutch to exhaust to atmosphere, to release the clutch.

The operation of the apparatus shown somewhat diagrammatically in Figure 1 will now be described. As explained in the aforesaid application of Calleson et al., Serial No. 373,028, the feed rolls 12, 13 operate intermittently. That is, they rotate a predetermined number of times to feed the desired length of strip into position above the drawing dies. Their rotation is then stopped and the rolls remain at rest during the drawing operation. At the conclusion thereof, their rotation is again initiated, to discharge the skeleton scrap and to feed a new length of strip into drawing position. Drawing presses made in accordance with that application actually operate on a cycle of between 60 and 90 or more operations per minute. The driving means for the chain cradle support is set, by a speed reducer as hereinafter explained, to deliver strip from the coil 11 at a rate slightly in excess of the rate of consumption of the cupping press, which corresponds to the rate of delivery of the feed rolls 12, 13, bearing in mind the operative and inoperative portions of their cycle. The strip forcefully delivered from the unwinder is guided upwardly in the form of an upwardly projecting loop 18, as previously explained. The material in the loop, more particularly in the upper, unconfined end thereof and in the descending leg 20, under the influence of gravity tends to force the strip downwardly and forwardly along the guide 22 and through the oil bath. Thus, as long as strip is positively uncoiled and forced upwardly into the loop, the weight of the loop itself exerts a positive force to the strip therebeyond, continually urging the same toward the feed rolls. As a result, the strip does not exert a drag or back-pull on the rolls and the rolls do not have to overcome the weight and frictional resistance to movement of the strip, as was the case in coil unwinders of the prior art. Thus, there is no danger of slippage between the feed rolls and the strip, which, in the past, sometimes caused the

feed rolls to deliver an insufficient length of strip to the press, resulting in spoiled work.

Drawing presses made in accordance with the application mentioned above operate on a cycle of between 60 and 90 or more per minute, each cycle forming four individual drawn cups. It will be appreciated that, with presses operating at such high speed, approaching 400 six inch cups per minute, the accurate feeding of strip steel stock material is a difficult and important problem. This problem is greatly simplified by the method and apparatus of the present invention, wherein the strip is positively and forcefully delivered to the feed rolls, instead of having the feed rolls attempt to draw the strip from a static supply.

A further advantage of the positive delivery of strip to the feed rolls is that the strip may be lubricated before it is engaged by the rolls. Previously, lubrication at this stage was dangerous, because of the increased likelihood of slippage between the rolls and the work.

Since, as previously explained, the uncoiler delivers strip at a faster rate than the feed rolls 12, 13, the unconfined loop 18 tends to increase in height, for instance, from the dotted line position to the full line position, Figure 1. When the feeler 32, in contact with the loop 18, reaches a predetermined position, such as that shown in full lines, the switch 38 is shifted to open position, whereupon the solenoid 41 is de-energized and the valve 43 shifted to a position to close communication between the pressure supply pipe 45 and the line 44 leading to the clutch 17, and to establish communication between the pipe 44 and the exhaust pipe 46. As a result of this shifting of the valve, the actuating air for the clutch is cut off and the air under pressure in the clutch and pipe 44 is exhausted. Hence, the clutch is disengaged and the chain cradle is stopped.

The feed rolls 12, 13 continue to deliver strip intermittently to the press, with the result that the height of the loop 18 decreases. When it has reached a predetermined position, such as that represented by the dotted lines in Figure 1, the feeler 32, which follows the end of the loop, shifts the switch 38 to closed position, with the result that the solenoid 41 is energized and the valve 43 shifted to its other position. Air under pressure then flows from the pipe 45 to the line 44 and the clutch is re-engaged, thereby causing the chain cradle to resume its unwinding action and gradually replenish the supply of strip in the loop 18.

Obviously, instead of having the feeler 32 connected to a switch which controls a solenoid for operating the air valve 43, a similar valve may be connected directly to the feeler, at its pivot or at its rear end, thus entirely eliminating the electric circuit. On the other hand, if a magnetically operated clutch or a mechanically operated clutch be substituted for the clutch 17, it is obvious that the feeler may control suitable actuating circuits or mechanical actuating devices. Hence, the invention is not limited to the particular arrangement diagrammatically shown, for purposes of illustration, in Figure 1.

A preferred form of unwinding apparatus is shown in Figures 2 and 3. Preferably, this apparatus is utilized for the one represented diagrammatically at 15 in Figure 1.

A table 50, carried by legs 51, projecting upwardly from a base 52, carries one pair of bearings 53 for a shaft 54 and another pair of bearings 55 for a similar shaft 56, disposed in parallel

relation thereto. The shafts each carry a plurality of hubs 57, upon which pairs of sprockets 58 are secured, the sprockets on one shaft being aligned with similar sprockets on the other. Sprocket chains 59 are loosely trained about the sprockets 58, so that the upper flights thereof are relatively slack. The several chains are interconnected by a plurality of transversely extending strips 60 connected to alternate links of the chains. If desired, the strips may be faced with rubber or other material that will not mar the sheet metal in the coil 11.

The shafts 54, 56 are maintained in predetermined angular position by a sprocket chain 65, trained about sprockets 66, fast on the shafts, an adjustable idler roller 67 being provided to take up slack in the chain.

The shaft 56 also carries a spur gear 70, in mesh with a pinion 71 fast on a transverse shaft 72 having a handwheel 73 on one end and connected to the driven element of the clutch 74 at the other end. An electric motor 75 drives a speed reducer 76 which has a sprocket 77 connected by a chain 78 to the sprocket 79 of the clutch 74. The sprocket 79 drives one set of plates associated in the clutch 74, while the other set is carried by a member connected to the shaft 72. Air introduced by the line 44 to the clutch operates a diaphragm, in a well known manner, to establish driving connection between the two sets of plates, to rotate the shaft 72. The sprocket 79, therefore, is constantly rotating, and the operations of the chain cradles are controlled by the air clutch.

Guiding means are provided, to retain correct position of a coil on the cradle, as a safety means, to prevent the coil from being inadvertently discharged from the cradle, particularly when nearly all of the strip has been unwound therefrom. The guiding means preferably comprises a pair of upwardly projecting standards 85, 86 having hollow bosses 87 at their upper ends. Hubs 89, having bearing sleeves 88 therein, are provided with disc-like flanges 90 upon which circular end guide plates 91 are bolted. The guide plates engage opposite ends of the coil, as indicated in Figure 3, and prevent inadvertent endwise movement thereof. The lower ends of the guide plates are disposed in substantial engagement with vertically disposed backing-up rollers 92, journaled in brackets 93 carried adjacent the inner faces of the standards 85, 86.

A rod 95 is removably carried by the hollow bosses 87 in the upper ends of the standards. Disc plates 91 rotate on rod 95 whenever contacted by inadvertent side movement of the coil. When a new coil is placed upon the cradle, this rod, of course, is removed, by endwise movement through one of the supporting assemblies. Its extension through the hollow core of the coil is also a safety factor, to prevent displacement of the coil, particularly when substantially all of the strip has been unwound therefrom.

The hubs 89 are supported adjacent the upper ends 87 of the standards 85, when the rod 95 is removed, by forwardly projecting pins 94. When the rod 95 is in position, the hubs 89 are partially supported thereby, to rotate upon the shaft.

It will be understood that the handwheel 73 is rigidly connected to the shaft 72 so that the machine may be turned over by hand when desired.

It is thought that the operation of the uncoiler shown in Figures 2 and 3 will be apparent from

a consideration of the foregoing description.

When a coil is placed upon the flexible endless support, its circumference rests upon a concave, arcuate supporting surface. When actuating air is admitted to the clutch 74, driving connection is established between the motor 75 and shaft 72. The pinion 71, therefore, drives the spur gear 70 and shaft 56. The two shafts are rotated in unison and maintained in the desired relative angular position by the sprocket chain 65, so that the slack in the chains 59 is always positioned in the upper flights thereof. As a result of the movement of the endless flexible support, the coil is unwound by rolling contact with that support and the strip is forcefully delivered along an upwardly directed path to the loop 18, shown in Figure 1. This operation continues until the actuating air for the clutch is cut off and the air under pressure in the clutch exhausted to atmosphere, whereupon the driving connection from the motor to the shaft 72 is temporarily interrupted and the flexible endless support brought to rest. When the height of the loop has been decreased to a predetermined point, as previously explained, the clutch is again rendered operative, and the unwinding continued.

It must be understood that the present invention is not limited to the details of construction or particular method steps shown or described herein, but covers all modifications falling within the scope of the appended claims and their equivalents.

We claim:

1. An apparatus for unwinding strip material from a coil comprising means for supporting the coil, means for positively rotating the coil in a direction to deliver strip from the outer periphery thereof, means for guiding the strip in an upwardly projecting, substantially upright, inverted U-shaped loop which is unconfined and unsupported at its upper end by the guiding means, whereby the weight of the material in the loop urges the material beyond the loop away from the loop and the coil, and means for continuously maintaining a supply of strip material in said loop comprising means controlled by the height of the loop for controlling said coil rotating means.

2. An apparatus for delivering strip material from a coil to a strip treating apparatus, comprising means for unwinding strip from the outer periphery of the coil, means for guiding the strip as it moves away from the unwinding means, first in an upward direction and then in a downward direction, to follow a path including an upwardly projecting loop having substantially upright ascending and descending legs and an unconfined upper end, whereby the weight of the material in the upper end of the loop and in the descending leg imparts a force to the material beyond the loop, means for guiding the material under the influence of said force forwardly toward the material treating apparatus, and means controlled by the height of the loop for controlling said strip unwinding means.

3. An apparatus for delivering strip material from a coil to a strip treating apparatus, comprising means for unwinding strip from the outer periphery of the coil, guiding means causing the strip to follow a path including an upwardly projecting, upright, inverted, U-shaped loop and a downwardly projecting loop or bend immediately therebeyond, whereby the weight of the material in the first-mentioned loop urges the strip downwardly and forwardly through the sec-

ond loop, means for guiding the strip from the second loop or bend toward the material treating apparatus, and means controlled by the position of the material in the upwardly projecting loop for controlling the strip unwinding means.

4. An apparatus for delivering strip material from a coil to a strip treating apparatus, comprising means for rotating the coil in a direction to unwind strip from the outer periphery therefrom, guiding means causing the strip to follow a path including an upwardly projecting, substantially upright, inverted loop which is unconfined at its upper end and a downwardly projecting loop immediately therebeyond which is confined and positively guided at its lower end, whereby the weight of material in the first-mentioned loop tends to urge the strip downwardly and forwardly through the confined and guided downwardly projecting loop, means associated with said strip treating apparatus for receiving the strip so urged forwardly and for controlling the rate of delivery of strip to said apparatus, and means controlled by the position of the material in the upwardly projecting, upwardly unconfined loop for controlling the coil rotating means.

5. An apparatus for delivering strip from a coil to a material treating machine having feed rolls associated therewith adapted to take strip at a predetermined rate, said apparatus comprising means for unwinding strip from the outer periphery of the coil at a rate slightly in excess of the rate of said feed rolls, means for guiding the strip along a path including an upwardly projecting loop having an unconfined upper end and substantially upright ascending and descending legs and a run leading to the feed rolls, whereby an excess of strip is provided in the loop and the weight of the material in the upper end of the loop and in the descending leg urges the material along said run toward said feed rolls, and means controlled by the position of the upper end of the loop for stopping and starting the coil unwinding means.

6. In combination, a pair of feed rolls adapted intermittently to deliver at a predetermined rate, strip material to a material treating apparatus, and means for delivering such material from a coil to the feed rolls, the last-mentioned means comprising means for unwinding strip from the outer periphery of a coil, and means for guiding the strip along a predetermined path including an upwardly projecting loop having an unconfined upper end and ascending and descending legs of substantial length and height, whereby the loop provides an excess supply of strip, the weight of which continuously urges the strip downwardly and forwardly toward said feed rolls and substantially eliminates drag or back pull on the rolls.

7. Apparatus for delivering strip material from a coil to a strip treating apparatus, comprising means for supporting the coil for rotation to deliver strip from the outer periphery thereof, driving means for rotating the coil, including a fluid pressure operated clutch, means for causing the strip to follow a path including an upwardly projecting loop having an unconfined upper end and ascending and descending legs of substantial length and height, whereby the loop provides an excess supply of material, the weight of which urges the material toward the point of consumption, and means actuated by the position of the upper end of the loop for controlling said fluid pressure-operated clutch.

8. An apparatus for delivering strip steel to the feed rolls of a drawing press or the like, comprising means for rotatably supporting a coil of strip, means for rotating the coil to unwind strip from the outer periphery thereof, an oil bath positioned between the coil and the feed rolls, means for guiding the strip along a predetermined path including a substantially upright, upwardly projecting loop of substantial height having an unconfined upper end, an ascending leg and a descending leg leading directly into and through the oil bath, whereby the weight of the strip in the unconfined upper end of the loop and in the descending leg urges the strip through the oil bath to said feed rolls, the movement of the strip being facilitated by the lubricant in the oil bath, and means controlled by the position of the upper end of the loop for controlling the coil rotating means.

9. An apparatus for delivering strip steel to the feed rolls of a drawing press or the like, comprising means for rotatably supporting a coil of strip, means for unwinding strip from the outer periphery thereof, an oil bath positioned between the coil and the feed rolls, means for guiding the strip along a predetermined path including an upwardly projecting loop having an unconfined upper end and ascending and descending legs of substantial length and height and a downwardly projecting confined loop positioned directly therebeyond and in said oil bath, whereby the weight of the strip in the unconfined end of the loop and in the descending leg urges the material forwardly through the confined loop and the oil bath, and means controlled by the position of the upper end of the first-mentioned loop for controlling the strip unwinding means.

10. Apparatus for delivering strip from a coil to a strip treating apparatus comprising means for rotatably supporting a coil for the delivery of strip from the outer periphery thereof, driving means for rotating the coil including an air pressure operated clutch and an air line leading thereto, means for guiding the strip unwound from the outer periphery of the coil through a substantially upright, upwardly projecting loop, an air valve in the clutch air line and means controlled by the height of the loop for shifting the valve, thereby to control the clutch and render the driving means operative or inoperative.

11. Apparatus for delivering strip from a coil to a strip treating apparatus comprising means for rotatably supporting a coil for the delivery of strip from the outer periphery thereof, driving means for rotating the coil including an air pressure operated clutch and an air line leading thereto, means for guiding the strip unwound from the coil through a substantially upright, upwardly projecting loop, an air valve in the clutch air line adapted in one position to deliver actuating air to the clutch to render the driving means operative and in the other position to exhaust air from the clutch to atmosphere to render the driving means inoperative, and means controlled by the height of the loop for shifting the valve from one position to the other.

12. Apparatus for delivering strip from a coil to a strip treating apparatus comprising means for rotatably supporting a coil for the delivery of strip from the outer periphery thereof, driving means for rotating the coil including an air pressure operated clutch and an air line leading thereto, means for guiding the strip unwound from the coil through a substantially upright, upwardly projecting loop, an air valve in the clutch air line,

a feeler positioned to contact the upper end of the loop, and means controlled by the position of the feeler for shifting the air valve, thereby to control the clutch and render the driving means operative or inoperative.

13. Apparatus for delivering strip from a coil to a strip treating apparatus comprising means for rotatably supporting a coil for the delivery of strip from the outer periphery thereof, driving means for rotating the coil including an air pressure operated clutch and an air line leading thereto, means for guiding the strip unwound from the coil through a substantially upright, upwardly projecting loop, an air valve in the clutch air line, a feeler positioned to contact the strip in said loop and to be shifted thereby, an electric switch actuated by the feeler, a solenoid controlled by the switch, and a connection between the solenoid and said air valve, whereby the valve is operated to render the driving means effective or ineffective, according to the position of the strip in the loop.

14. Apparatus for delivering strip from the outer periphery of a coil to a drawing press or the like, comprising coil supporting and unwinding means, strip guiding means adapted to provide a substantially upright loop of substantial height having an unconfined upper end in the strip between the unwinder and the press or the like, driving means for the unwinder, and means controlled by the position of the strip in the upper end of the loop for controlling the driving means, said coil supporting and unwinding means comprising a pair of spaced, parallel shafts, an endless, flexible band trained about the shafts and having a slack upper flight providing a concave, arcuate supporting surface for the circumference of the coil, a relatively tight driving chain interconnecting the shafts to cause the same to rotate in unison, and means associated with one shaft adapted to receive rotation from said driving means.

15. The method of delivering strip steel to the feed rolls of a high speed drawing press or the

like which comprises positively forcing the strip from a source of supply, guiding the strip moving under said force through an upwardly projecting, substantially unconfined loop having ascending and descending legs of substantial length and height, whereby the material in the loop provides an excess supply and the weight thereof in the descending leg forces the strip forwardly, and guiding the strip under the influence of said force to said feed rolls.

16. The method of delivering strip steel to a high speed drawing press or the like which comprises positively forcing the strip from a source of supply, guiding the strip moving under the influence of said force through an upwardly projecting loop which is unconfined and unsupported at its upper end, guiding the strip from said loop directly through a downwardly projecting, confined and supported loop, whereby the weight of the strip in the first-mentioned loop subjects the strip in the second loop and therebeyond to an advancing force, and guiding the strip under the influence of said force to said feed rolls.

17. The method of delivering strip steel to a high speed drawing press or the like which comprises forcefully unwinding strip from the outer periphery of a coil, guiding the strip moving under the influence of said unwinding force through an upwardly projecting loop which is unconfined and unsupported at its upper end, guiding the strip from said loop directly through an oil bath in a downwardly projecting, confined and supported loop, whereby the weight of the strip in the first-mentioned loop subjects the strip in the second loop and therebeyond to an advancing force and whereby the strip is lubricated and the movement of the strip over the support in the downwardly projecting loop is facilitated by the oil bath, and guiding the strip under the influence of said force to said feed rolls.

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