Feb. 9, 1937. E. W. MIKAELSON ET AL 2,070,444

STRIP UNCOILING MACHINE

Filed July 20, 1934 4 Sheets-Sheet 1

FIG. 1.

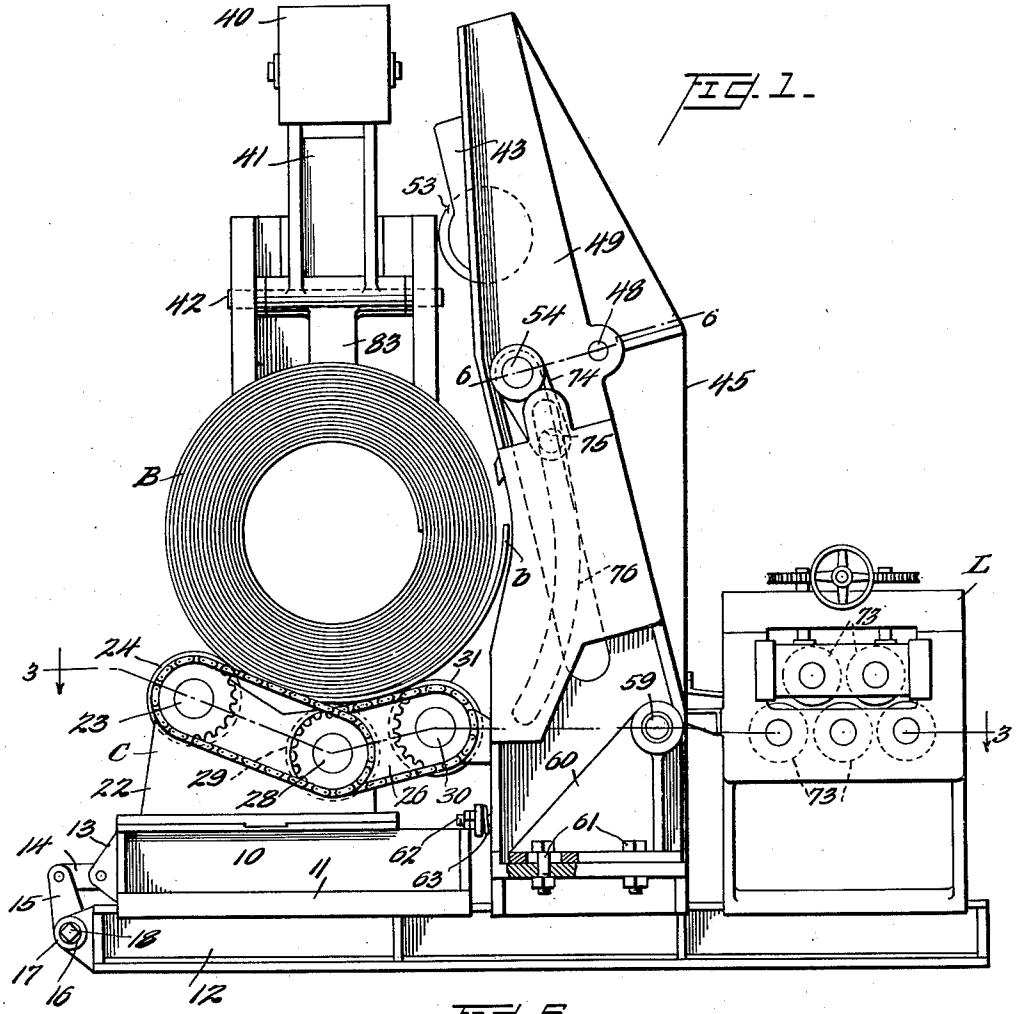
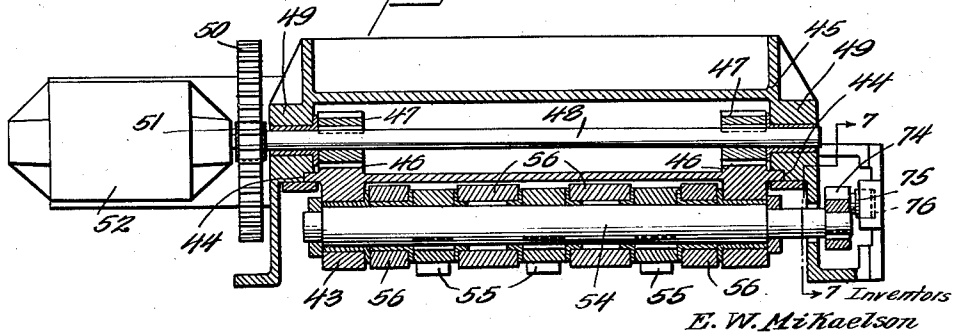


FIG. 6.



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STRIP UNCOILING MACHINE

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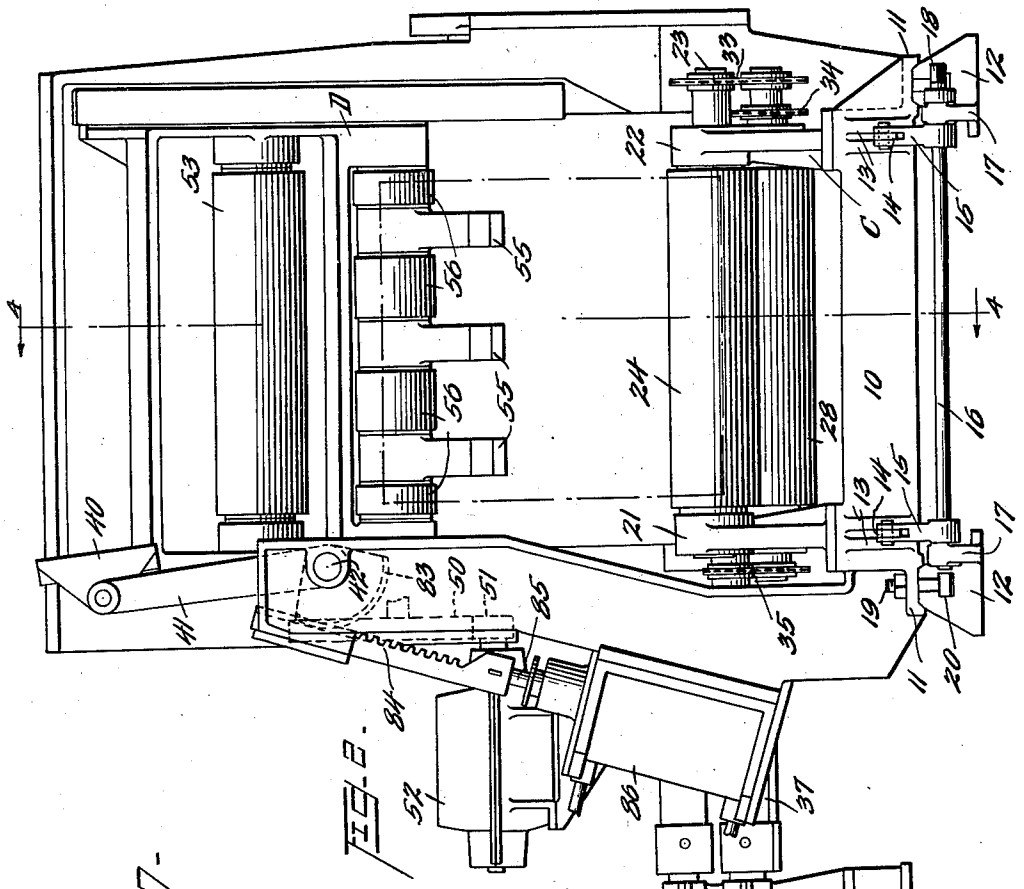

FIG. 2.

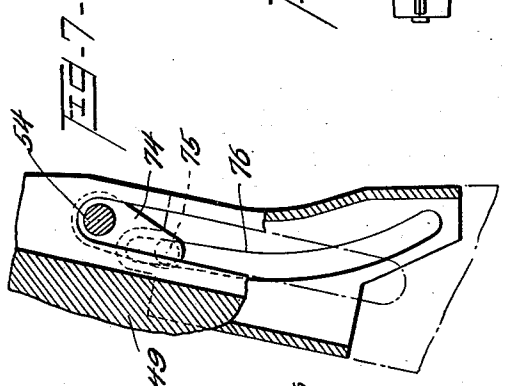

FIG. 7.

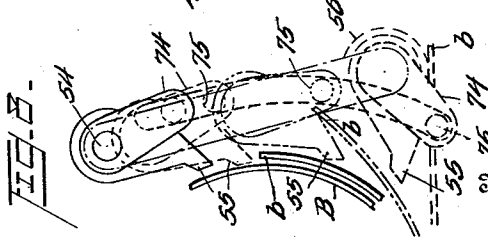

FIG. 8.

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STRIP UNCOILING MACHINE

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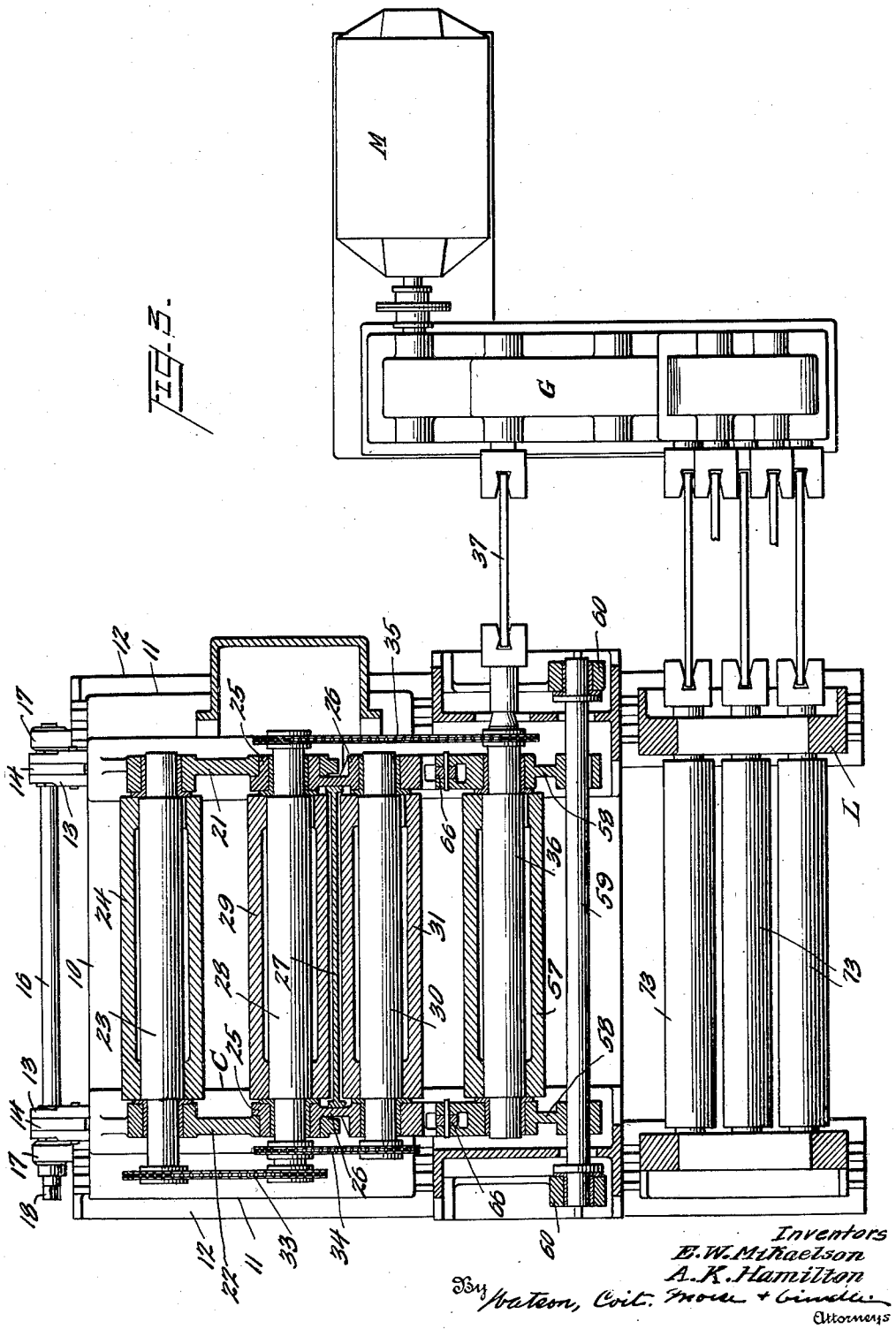
FIG. 3.



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STRIP UNCOILING MACHINE

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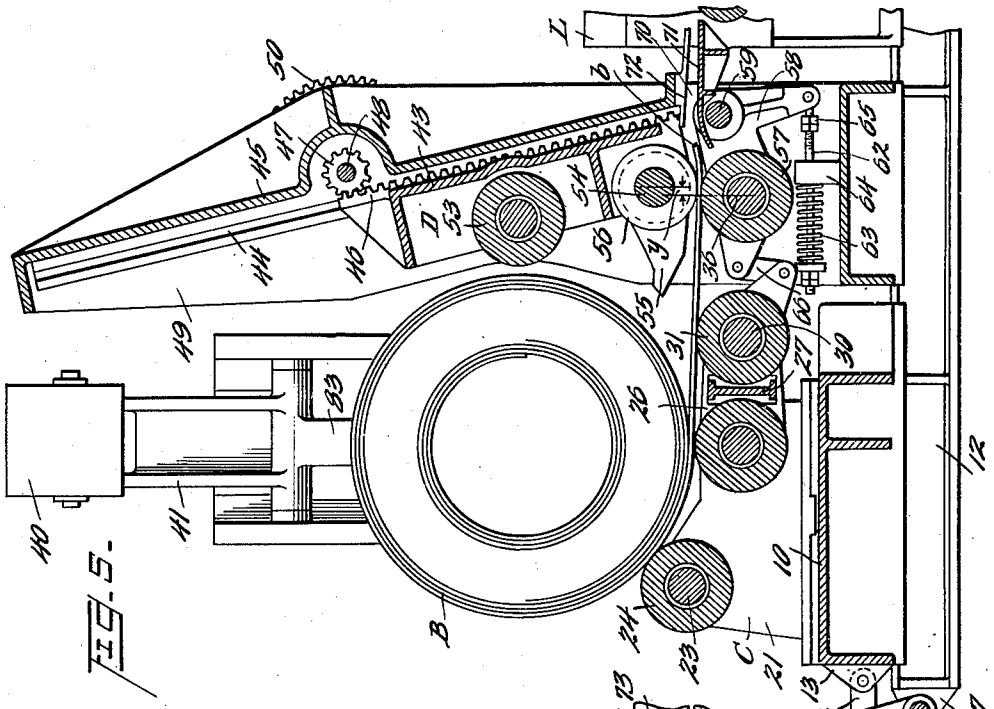

FIG. 5.

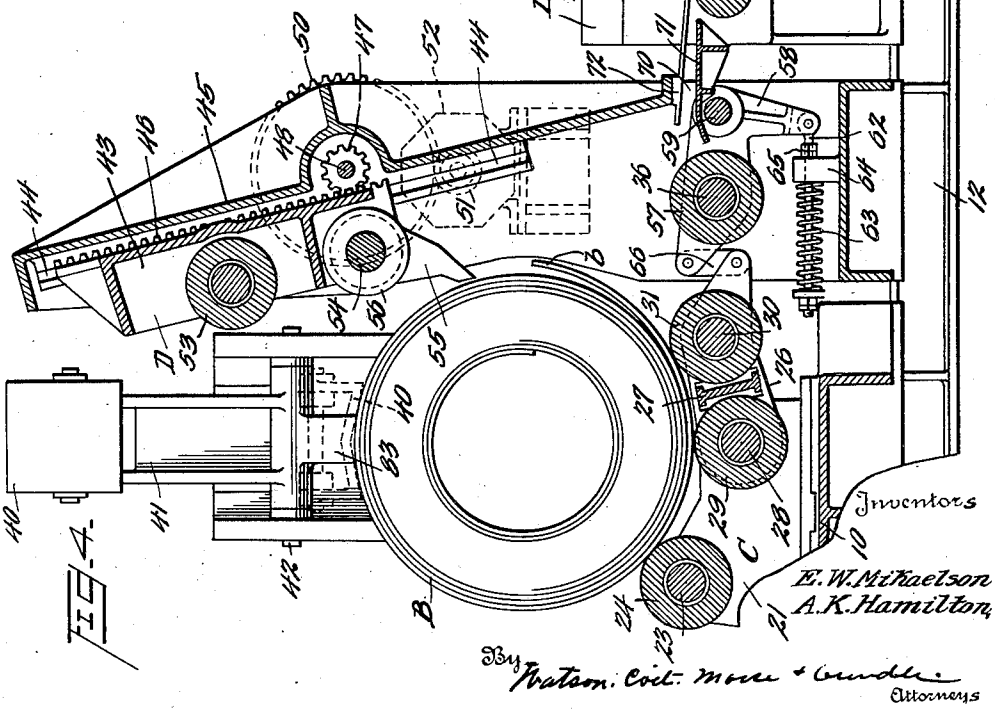

FIG. 4.

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UNITED STATES PATENT OFFICE

2,070,444

STRIP UNCOILING MACHINE

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Application July 20, 1934, Serial No. 736,252

10 Claims. (Cl. 242—78)

A substantial proportion of the sheet metal produced in steel plants is in the form of strips or thin sheet metal members, the lengths of which, as compared with their widths, are relatively great. For the sake of convenience in handling these strips, particularly where they are to be transported from the point of manufacture to the point of further processing, they are usually formed into coils immediately after having been finished in the rolling mill. At the point where such a strip is to be further processed it is necessary to unwind the coil in order that it may be fed through or passed into machines of one kind or another for shaping or fabricating the same into useful articles of manufacture. The present invention contemplates the provision of an uncoiling machine adapted to be used wherever it is necessary to uncoil or unwind a coiled strip and whereby the actual uncoiling operation may be performed more easily and quickly than has heretofore been possible.

One purpose of the invention is to provide a machine of this character having means to engage the free outer end of a coil mounted upon the machine and to deflect this free end from the body of the coil and into such position that it may be gripped by feed mechanism which, when actuated, effects unwinding of the coil. This coil end engaging and deflecting mechanism is power-operated, thereby making it possible to carry out this essential initial step with a minimum expenditure of manual power and delay. It will be appreciated by those skilled in the art that, where a coil is formed of a strip of relatively thick material, it is oftentimes very difficult to separate and deflect the free outer end of the coil from the next convolution of the coil body and to present it properly to feed or pinch rolls which, when operated, are to effect the uncoiling of the entire strip. By means of the present invention a single operator may uncoil with ease a roll of even the stiffest sheet material.

The present invention also contemplates means for automatically positioning the free outer end of the strip thus deflected between feed rolls, and the application of sufficient force to one of the feed rolls to cause it to tightly clamp, in cooperation with a second feed roll, the leading end of a blank so that, when the feed rolls are rotated, sufficient frictional forces are developed between the feed rolls and strip to insure its movement in a direction generally tangential to the coil whereby the coil is unwound. These frictional gripping forces are preferably so great that not only is uncoiling of the blank effected but the blank is positively fed into a second machine, which for instance may be a roller leveler for straightening the same, a single power means therefore effecting both uncoiling of the strip and positive feeding of the same into an adjacent machine.

It is also contemplated by the machine that the strip feeding mechanism shall be of such character as to have straightening functions, that is, that it shall give the strip passing through the same a curvature in a direction opposite to that in which the strip has been curved in the formation of the coil, thus straightening the strip. The straightening function of the feed rolls may be modified to suit conditions, being adjustable to compensate for differences in thickness and physical characteristics of the strip which comprises the coil.

An uncoiling machine such as contemplated by the present invention may be formed in various ways, and one satisfactory embodiment is illustrated in the accompanying drawing by way of example. It will be understood by one skilled in the art that numerous minor details in the design and arrangement of its component elements may be made, without departure from the invention, in adapting the same to various operating conditions.

In the drawings:

Figure 1 is a side elevation of the uncoiling machine, broken away at one point to more clearly show a detail;

Figure 2 is a front elevation of the same;

Figure 3 is a section on line 3—3 of Figure 1;

Figure 4 is a section on line 4—4 of Figure 2;

Figure 5 is a section taken on the same line but showing certain operating parts of the machine in positions different from those in which these same parts are shown in Figure 4;

Figure 6 is a section on line 6—6 of Figure 1;

Figure 7 is a line on section 7—7 of Figure 6; and

Figure 8 is a diagram which shows the coil end engaging and deflecting means in a series of successive positions.

The various operating parts of the machine may be supported upon frames which differ widely in design, but the supporting frame of the machine illustrated is light and substantial and is preferred. The coil carrying or supporting cradle is indicated generally at C, and the mechanism for laterally deflecting the free end of the coil and placing the same between feed rolls is generally indicated at D. The frame which supports this last mentioned mechanism occupies a

fixed position, but the cradle C is horizontally adjustable toward and away from the same in order that coils which vary in diameter may be readily accommodated, it being essential to bring the free outer end of each coil positioned upon the cradle into predetermined relationship with the coil end deflecting mechanism prior to the actuation of this last mentioned mechanism.

The cradle C comprises essentially a base 10 having flanges 11 slidably mounted upon parallel rails 12, and means is provided for effecting sliding movement of base 10 upon rails 12 to adjust the position of the cradle relatively to the coil end engaging mechanism. Thus bracket-like projections 13 of sliding base 10 are connected by links 14 to the ends of arms 15 mounted on cross shaft 16, which shaft is in turn rotatably supported in bearings provided in bracket extensions 17 of the rails 12. One end of shaft 16, indicated at 18, is made polygonal in cross-section for the reception of a suitable tool by means of which the shaft may be rotated and hence the base 10 moved along its supporting rails. Bolts 19, passing through the flanges 11 and having their heads in slots 20 formed in rails 12, are provided for securing the base 10 in any desired position of adjustment.

Rigidly secured to the upper surface of sliding base 10 are parallel pedestals 21 and 22 respectively, these pedestals being provided with aligned bearings within which the ends of shaft 23 are rotatably supported. The coil supporting roll 24 is fixed upon shaft 23. Aligned cylindrical apertures in pedestals 21 and 22 rotatably support the short cylindrical members or hubs 25 which form integral portions, respectively, of the similar side frame members 26 of a rocking frame pivoted for rocking movement about the axis of supporting hub members 25. Members 26 are connected by the cross tying element 27. Within coaxial cylindrical apertures formed in hub members 25 are rotatably mounted the ends of shaft 28 carrying coil supporting roll 29, and members 26 are also provided with aligned bearings for the ends of a second and parallel shaft 30, having coil supporting roll 31 fixed thereon. It is thus seen that, while the axes of rolls 24 and 29 remain fixed with respect to the frame 10 and pedestals 21 and 22, the axis of roll 31 may be rocked upwardly or downwardly about the axis of roll 29 to a limited extent. When a coil such as indicated at B is first positioned upon the cradle, it is intended that it shall be supported by all three of the supporting rolls, as indicated in Figure 4.

Means is provided for rotating the supporting rolls 24, 29, and 31 in the same direction and at equal peripheral speeds in order that the free end of the coil, which is indicated at *b*, may be positoned as shown in Figure 4. To this end shafts 23 and 28 have sprockets mounted upon their ends, which sprockets are connected by a chain 33, and the adjacent ends of shafts 28 and 30 are provided with sprockets connected by chain 34 so that these three shafts with their rolls are operatively interconnected. The opposite end of intermediate shaft 28 is provided with a sprocket which is connected by a chain 35 to a similar sprocket mounted upon a parallel shaft 36, which latter shaft is operatively connected by a spindle 37 and gearing (enclosed within a housing G) to the driving motor M. It will hence be perceived that, when the motor M is energized, the rolls of the coil supporting cradle will be revolved and the coil itself may be rotated until its end *b* is positioned as desired, or the coil may be given a continuous rotation until completely unwound, as will be hereinafter made clear.

Means is provided for frictionally clamping the coil after it has been positioned as shown in Figure 4, this means comprising a clamping member 40 mounted upon the end of an arm 41 fixed upon a shaft 42, which shaft also carries a toothed segment 83. The teeth of segment 83 are in mesh with the teeth of rack 84, the lower end of which is attached to the projecting end of a piston rod 85 extending within the cylinder 86, the inner end of rod 85 being connected to a piston which is not illustrated. Means is provided for conducting to the opposite ends of the cylinder 86 any suitable motive fluid under pressure, for instance air, to effect reciprocation of the piston as desired and hence swinging movement of the clamp 40 about the axis of shaft 42. Thus the clamp may be moved downwardly to engage the top of the coil B and may be thereafter moved upwardly to inoperative position as shown in Figure 2.

After the coil is positioned as shown in Figure 4 and is securely clamped by the clamp 40 (when necessary), the means for engaging and deflecting the free end *b* of the coil and placing this free end between feed rolls is actuated. This mechanism includes the sliding head 43, the lateral edges of which are contained within slots 44 formed in stationary guides located at the sides of the machine, these guides comprising portions of the rigidly formed and mounted frame 45 which is fixed upon the base. Head 43 is shown to have spaced parallel racks 46 formed thereon, the teeth of which mesh with the teeth of pinions 47 fixed upon the horizontally extending shaft 48 rotatably mounted in bearings formed in the side members 49 of frame 45. Upon one end of shaft 48 is fixed a gear 50, the teeth of which mesh with the teeth of a pinion 51 mounted upon the shaft of an electric motor 52 of a type which may be so regulated as to develop a desired torque so that the gripping action of the rolls may be regulated to suit operating conditions. The motor is suitably supported upon a bracket fastened to the side frame member 49 and may be operated through any suitable switching mechanism to raise or lower the head 43 as desired through the gearing just described. Upon head 43 is rotatably mounted a guide roll 53 which, when the head is lowered as shown in Figure 5, limits forward movement of the coil B. The head likewise carries a shaft 54 with horizontally disposed axis, the ends of this shaft being rotatably supported in the head so that it may be freely rocked.

Fixed upon shaft 54 are the spaced bending fingers 55, preferably three in number, and rotatably mounted upon this shaft are four roll sections 56, two such sections being located intermediate the spaced bending fingers and the other two being positioned intermediate the outer bending fingers and the side members of head 43. It is the function of the bending fingers 55 to engage and outwardly deflect the free outer end *b* of the coil when the head 43 is moved downwardly, and it is the function of the roll sections 56 just described to engage this free end after the bending fingers 55 have completed their functions and to further depress the same into contact with lower roll 57, so that the free end of the coil is held in deflected position and is positively gripped between roll sections 56 and roll 57.

The roll 57 just referred to has its ends rotat-

ably supported in the horizontal substantially parallel arms of bell crank levers **58**, which levers are fixed upon a shaft **59**, the ends of which are rotatably supported in bearings formed in the parallel triangular bracket members **60** secured by bolts **61** to a fixed portion of the frame. The lower and vertically extending portion of one of the bell crank levers **58** is connected, through bolt **62** and spring **63**, with the stationary pedestals **64** springing from the fixed frame, the action of the spring being such as to tend to maintain the bell cranks **58** with their horizontal portions elevated as shown in Figure 4, and the tension of the spring being adjustable as by means of adjusting nuts threaded upon the outer end of bolt **62**. Nuts **65** threaded upon the inner end of the bolt limit the upward movement of roll **57** under influence of the spring. The outer ends of the horizontal arms of bell cranks **58** are connected by vertically extending links **66** with the free ends of the side frame members **26** of the frame which carries the vertically movable roll **31** of the coil supporting cradle so that rolls **31** and **57** are constrained to move upwardly and downwardly simultaneously, both being normally held in raised position as shown in Figure 4 by the action of spring **63**.

A horizontal slot or aperture through which the uncoiled strip is drawn or fed is indicated at **70**, the upper and lower surfaces of this slot or discharge aperture being defined by the lower guide plate **71** and the horizontal flange-like guide **72** of frame **45**. Several rolls of a roller leveler are indicated at **73**, the leveler as an entirety being indicated at L in Figure 1.

After the coil B has been positioned as shown in Figure 4 and is frictionally clamped (if necessary), the motor **52** is energized and the head **43** is caused to slowly descend, the bending fingers **55** having their pointed ends disposed closely to the surface of the body of the coil so as to engage the free end *b* of the coil. In the event that the free end *b* too closely engages the next winding of the metal strip, a tool may be inserted between the free end and the body of the coil to facilitate entrance therebetween of the bending fingers. Continued descent of the head after engagement of the bending fingers with the inner surface of the end *b* of the coil results in movement of this end from the position in which it is shown in Figure 4 to the position in which it is shown in Figure 5, lying in this position substantially horizontally and tangentially to the body of the coil.

As the head descends, the bending fingers are caused to rotate in a clockwise direction about the axis of their supporting shaft (Figures 4 and 5) from the position in which they are shown in Figure 4 to the position in which they are shown in Figure 5. A plurality of positions of the bending fingers are illustrated diagrammatically in Figure 8, and in Figures 1, 6, and 7 the means for effecting rotation of shaft **54** and the bending fingers is illustrated. This means includes an arm **74** fixed upon the end of shaft **54** and carrying a roller **75**, which roller is positioned in a groove **76** formed in a plate rigidly attached to the supporting frame. Groove **76** is curved as shown in Figure 7 and as diagrammatically indicated in Figure 8, the lower end of the groove being curved toward the coil B. It will be seen that, while the pointed ends of the bending fingers describe paths which may be said to be generally tangential to the cylindrical surface of the coil B, yet these paths are slightly curved, following to a certain extent the contour of the coil B.

Just before the head **43** reaches its lowermost position, the bending fingers **55** become inoperative; that is, they no longer touch the free end *b* of the coil, having been angularly turned sufficiently to fall behind the lowermost surfaces of the roll which comprises roll sections **56**, also mounted on shaft **54**. Finally, toward the lower limit of movement of travel of the head **43**, the free end of the coil is deflected against and strikes the roll **56** and is gripped between roll **57** and the roll sections **56**. The action of the motor **52** is such, however, as to continue downward movement of the head against the resistance of the cushioning spring **63** until a balance between the force exerted by the motor and the reaction of the cushioning spring is obtained, the bell cranks **58** rocking downwardly in this final movement of the head into the position shown in Figure 5, and the roller **31** being likewise moved downwardly by reason of the interconnection between its supporting frame and bell cranks **58**.

The head comes to rest in the position shown in Figure 5, the leading edge *b* of the blank being tightly gripped between roll **57** and the upper roll which comprises spaced sections **56**. The coil may then be unclamped by the elevation of the clamping member **40** and the uncoiling operation started by energizing the main driving motor M, which in turn drives the lower feed roll **57** as well as the cradle rolls, thus causing the leading end of the blank to move outwardly over the guide plate **71** and into the roller leveler L. The rolls **73** of the roller leveler may be likewise driven from the motor M through the interconnected gearing and spindles shown in Figure 3. The motor M is continued in operation until the coil has been completely unwound and is straightened by reason of the action of the roller leveler.

As has been suggested heretofore, the cooperating feed rolls **57** and **56** may be so adjusted relatively to one another as to give the emerging strip a slight bend in a direction reverse to that in which it was curved during the original coiling operation. From an inspection of Figure 5 it will be perceived that the axis of shaft **54**, carrying the upper roll, lies in a vertical plane to the right of the vertical plane which includes the axis of the lower roll **57**, the distance between these planes being indicated by the letter Y. It is clear, therefore, that the strip will be given a reverse bend by the co-action of these rollers, which not only helps to insure its proper passage between guides **71** and **72** but materially facilitates the subsequent action of the roller leveler. To adjust the distance Y, it is only necessary to shift the supports **60** which carry shaft **59**, bolts **61** passing through slots formed in the lower flanges of these bracket members and hence permitting, when loosened, limited adjustment of the brackets.

It is not necessary in every instance to clamp the coil B by means of the clamping member **40** prior to the actuation of the bending fingers, but in certain instances, particularly where the metal is stiff and comparatively thick, it is essential that the coil be thus clamped. Instead of the roller leveler L some other machine may be positioned adjacent the uncoiling machine, into which the strip may be fed, for instance a shear or punch. After an uncoiling operation has been completed, the head **43** will, of course, be raised to the position in which it is shown in Figure 4

or even slightly above this position, whereupon the rolls 57 and 31 are rocked upwardly under the influence of spring 63 and the machine is in condition to receive a fresh coil.

As may be supposed, the means for engaging the free end of the coil and deflecting it may be modified in design very considerably, and the invention contemplates numerous changes in the design and arrangement of other component elements thereof.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. The combination with a coil support, of a head movable in a fixed path, a shaft mounted on said head, wedge members and rollers mounted on said shaft, and means for moving the head and causing the wedge members and rollers to successively contact with the outer free end of a coil mounted on the support, the rollers being freely rotatable on the shaft.

2. In an uncoiling machine, in combination, a coil support including two spaced parallel rollers upon which a coil may rest, one of said rollers being vertically movable, and means for engaging and deflecting into a path substantially tangential to the coil the outer free end of the coil, said means effecting movement of said movable roller away from the coil during said deflecting operation.

3. In an uncoiling machine, in combination, a coil support including rollers upon which the coil may rest, movable means for engaging and deflecting the free end of a coil, and a guard roller movable with said means into position to limit the lateral movement of the coil as it is unwound.

4. In an uncoiling machine, in combination, a base, means fixed with respect to the base for supporting a coil for rotation about its axis, a pinch roller bodily movable independently of said coil supporting means along a predetermined path, a second pinch roller positioned at one end of the path of movement of said first mentioned pinch roller, a device for engaging and deflecting the end of a coil mounted upon said supporting means into position to be gripped between said rollers, and mechanism for actuating said device and movable roller to cause the end of a coil mounted on said coil supporting means to be first engaged and deflected by said device and thereafter gripped between said rollers.

5. In an uncoiling machine, in combination, a base, means fixed with respect to the base for supporting a coil for rotation about its axis, a pinch roller bodily movable independently of said coil supporting means along a predetermined path, a second pinch roller positioned at one end of the path of movement of said first mentioned pinch roller, a device rotatable about the axis of said first pinch roller for engaging and deflecting the end of a coil mounted upon said supporting means into position to be gripped between said rollers, and mechanism for actuating said device and movable roller to cause the end of a coil mounted on said coil supporting means to be first engaged and deflected by said device and thereafter gripped between said rollers.

6. In an uncoiling machine, in combination, a base, means fixed with respect to the base for supporting a coil for rotation about its axis, a pinch roller bodily movable independently of said coil supporting means along a predetermined path, a second pinch roller positioned at one end of the path of movement of said first mentioned pinch roller, a device mounted for bodily movement relatively to the coil, and for rocking movement about an axis, for engaging and deflecting the end of a coil mounted upon said supporting means into position to be gripped between said rollers, and mechanism for actuating said device and movable roller to cause the said device to engage the end of a coil mounted on said coil supporting means and to deflect the same into position between said rollers, said mechanism also moving said movable roller into position to cooperate with said second roller in gripping the coil end.

7. The combination set forth in claim 6 in which said device is rocked by a stationary cam as it moves relatively to the coil.

8. The combination set forth in claim 6 in which said device and first pinch roller are movable about a common axis.

9. In an uncoiling machine, in combination, means for supporting a coil for rotation about its axis, and mechanism for engaging and deflecting the outer free end of a coil mounted on said means, said mechanism including a movable head, a coil end engaging device rockably mounted on said head, and means independent of the head for rocking said device upon said head, when the head is moved relatively to the coil.

10. In an uncoiling machine, in combination, means for supporting a coil for rotation about its axis, and mechanism for engaging and deflecting the outer free end of a coil mounted on said means, said mechanism including a movable head, means to guide said head for movement in a rectilinear path, a coil end engaging device rockably mounted on said head, and means independent of the head for rocking said device upon said head, toward said coil, when the head is moved in one direction relatively to the coil.

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