Sept. 29, 1953 H. D. MILLER ET AL 2,653,643

APPARATUS FOR UNCOILING SHEET METAL

Filed Sept. 19, 1951 3 Sheets-Sheet 1

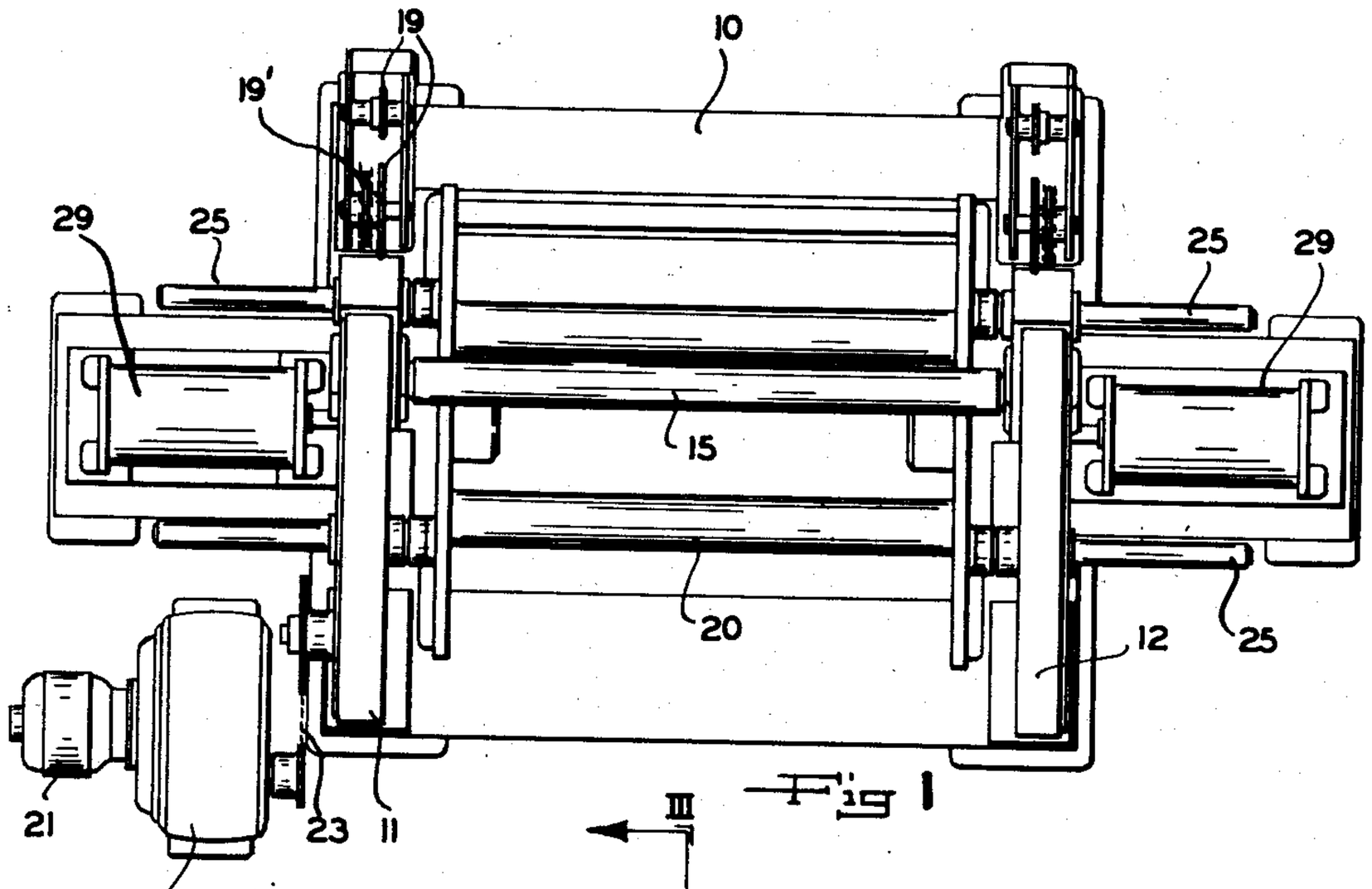

Fig 1

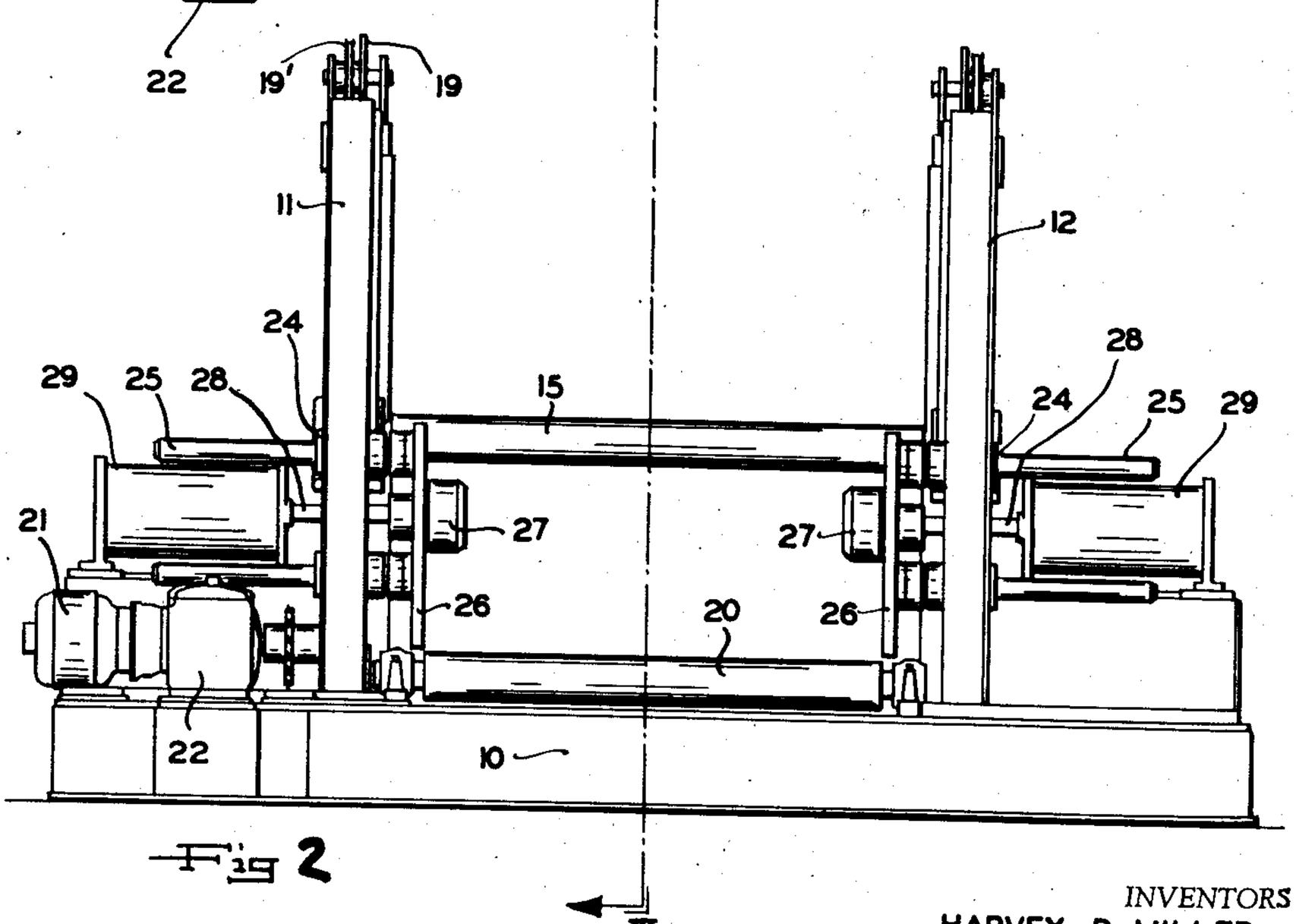

Fig 2

INVENTORS
HARVEY D. MILLER
JOHN C. HOLDGATE

BY Francis J. Klempner

ATTORNEY

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APPARATUS FOR UNCOILING SHEET METAL

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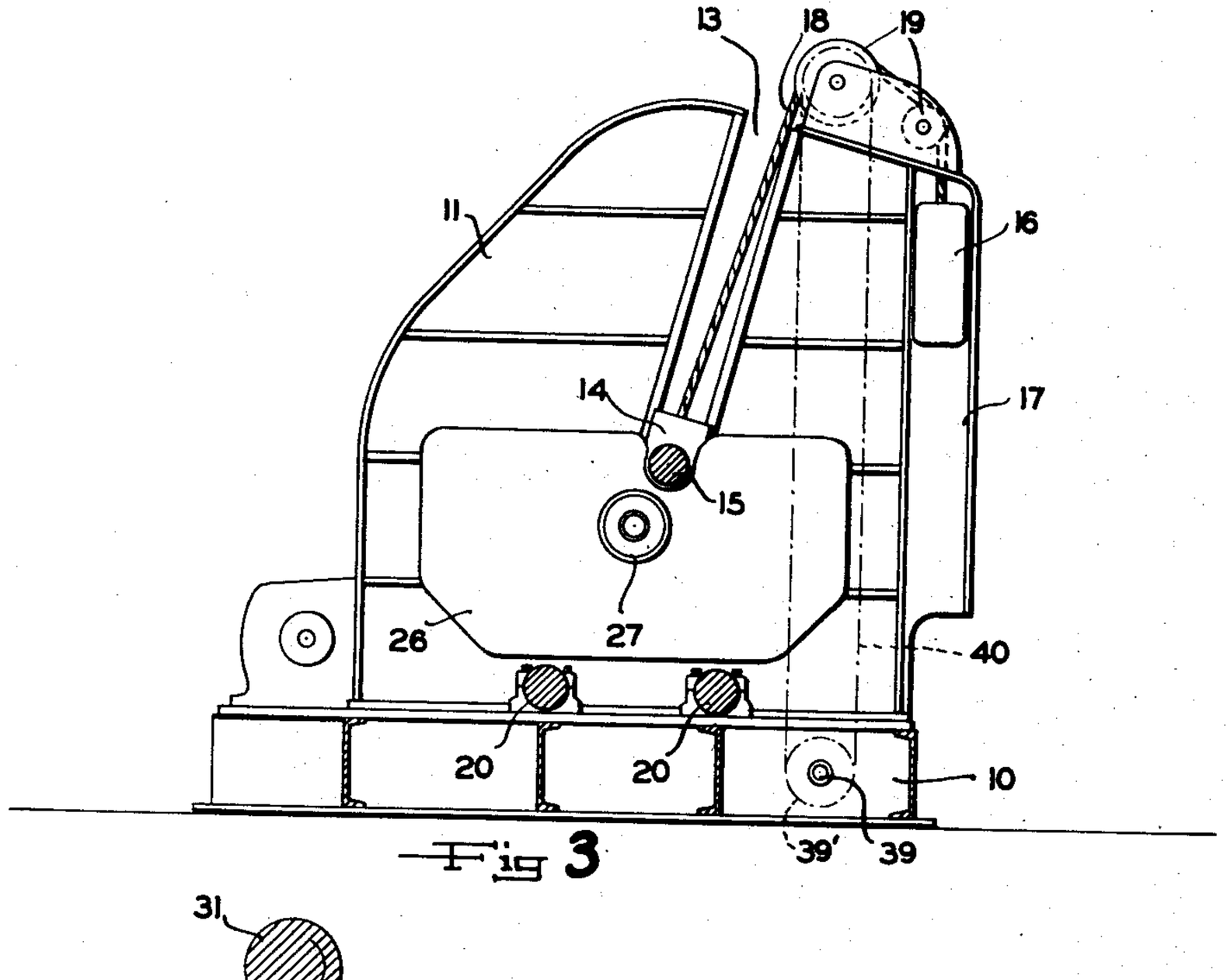

Fig 3

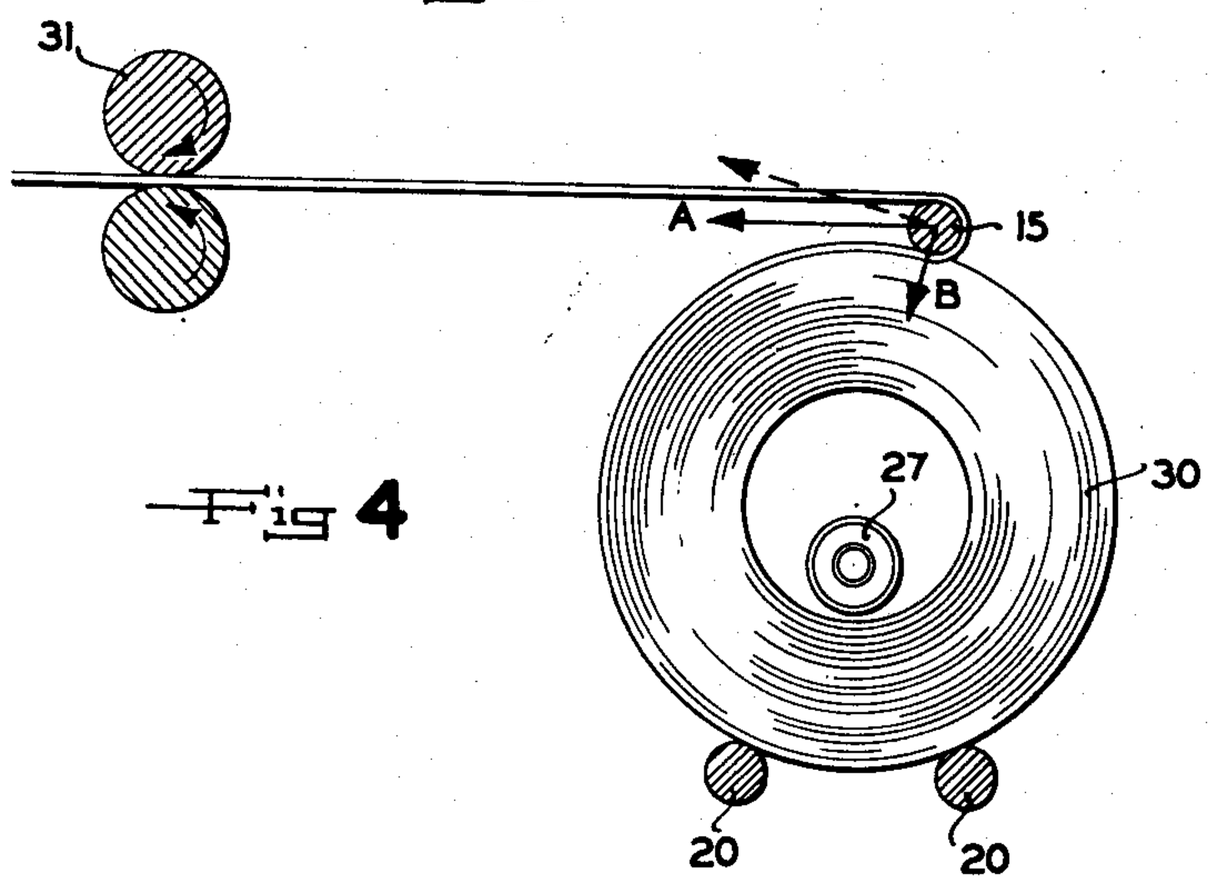

Fig 4

INVENTORS
HARVEY D. MILLER
JOHN C. HOLDGATE

BY Francis J. Kleinday

ATTORNEY

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APPARATUS FOR UNCOILING SHEET METAL

Filed Sept. 19, 1951 3 Sheets-Sheet 3

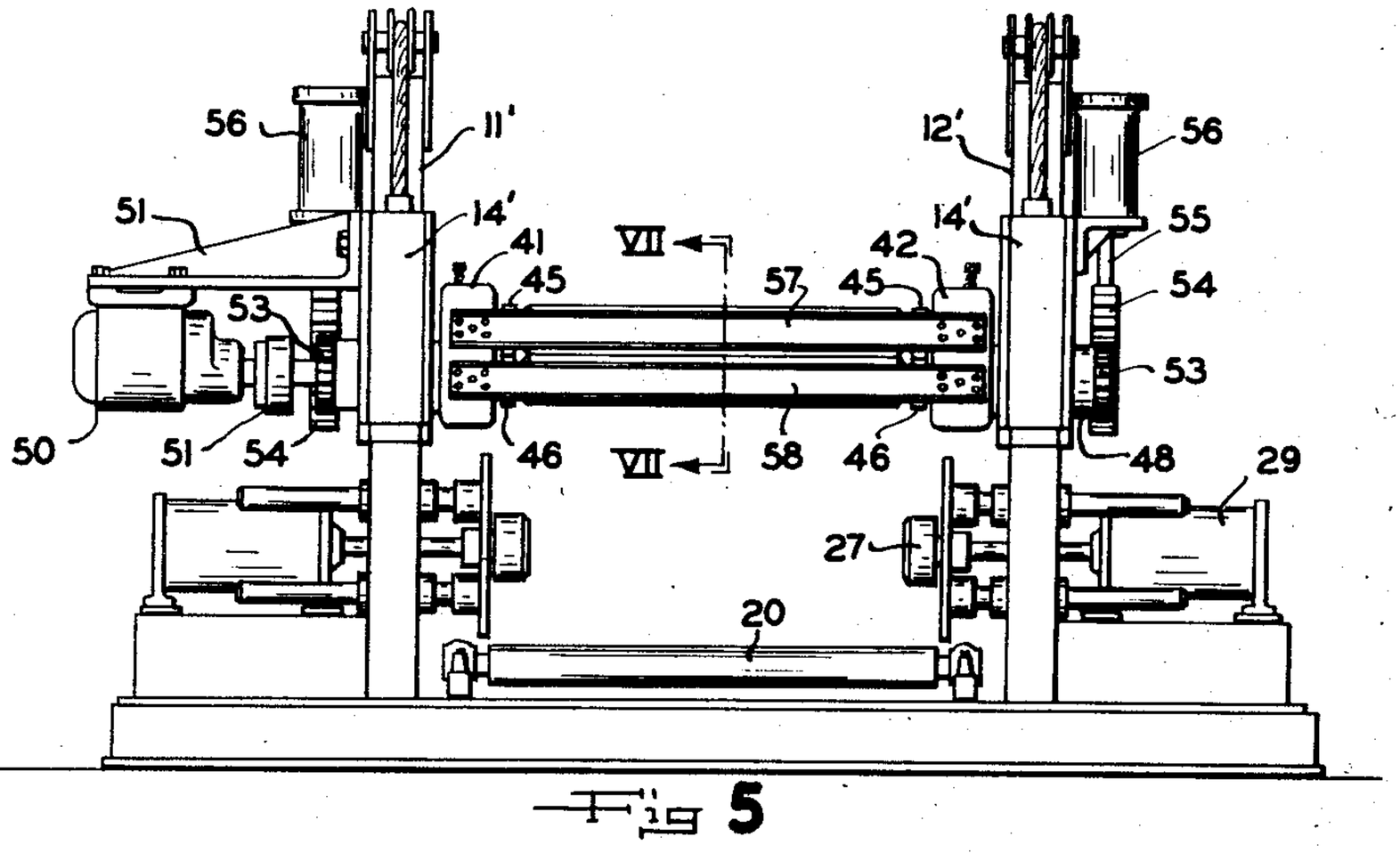

Fig 5

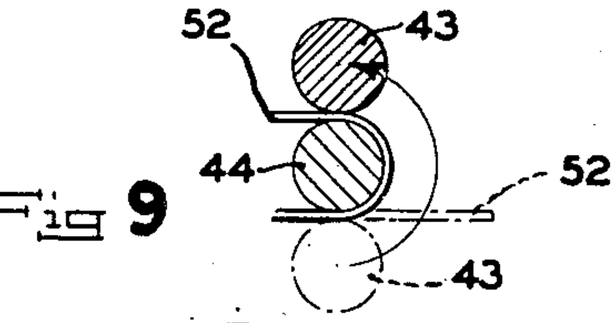

Fig 9

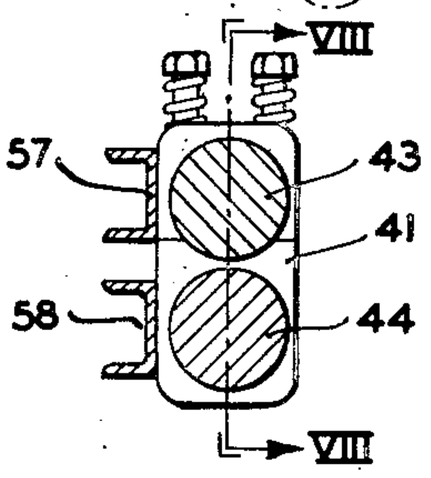

Fig 7

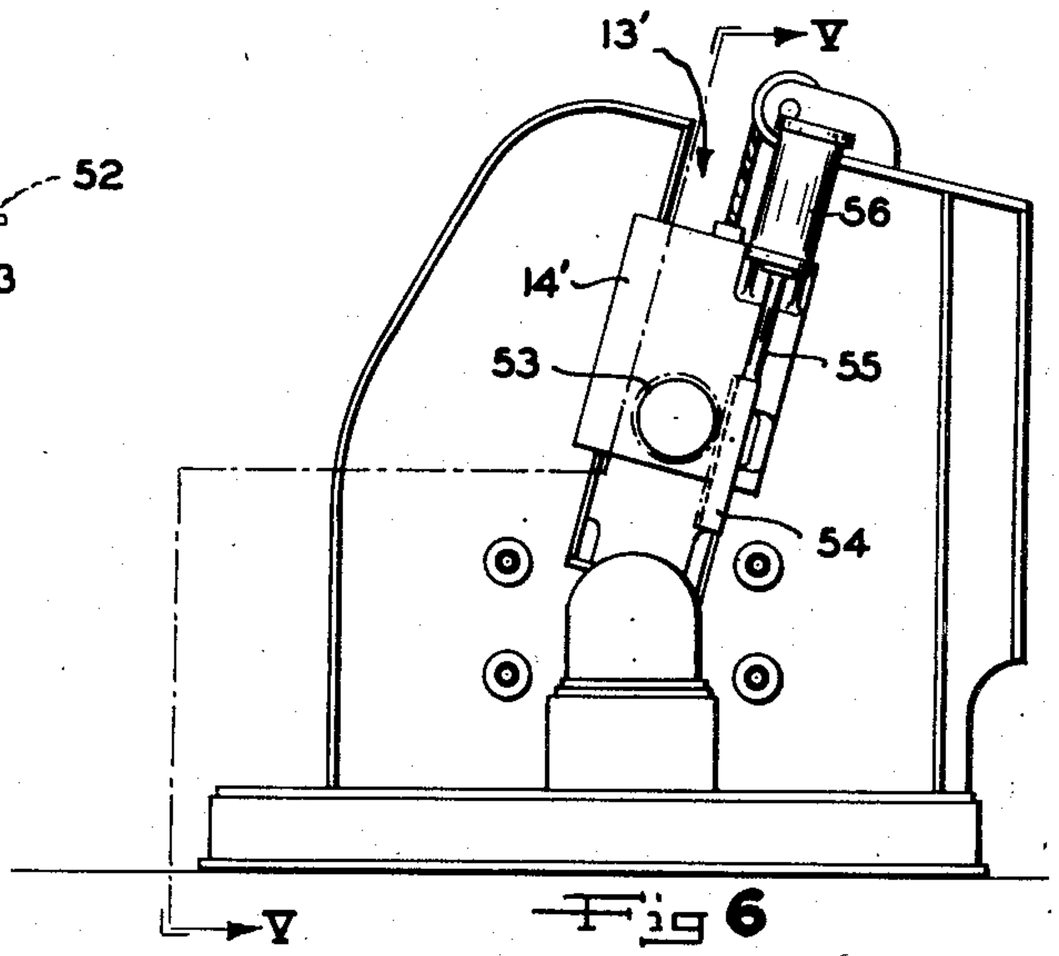

Fig 6

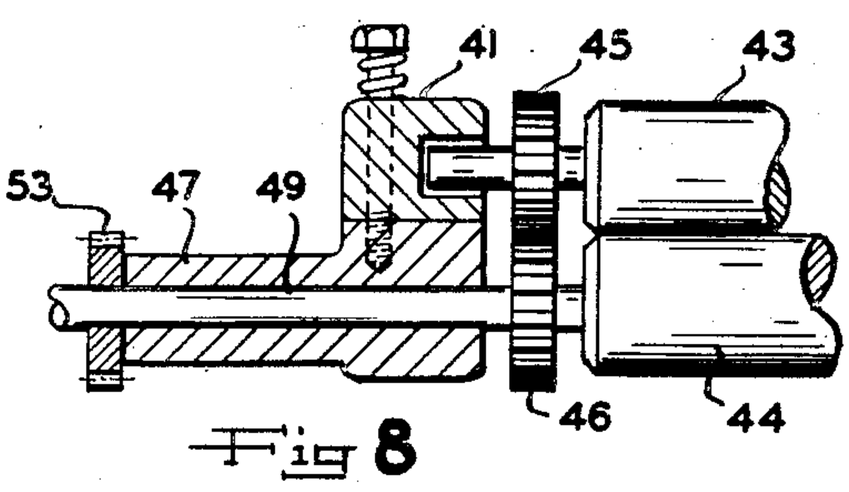

Fig 8

INVENTOR
HARVEY D. MILLER
JOHN C. HOLDGATE

BY Francis J. Klempay

ATTORNEY

Patented Sept. 29, 1953

2,653,643

UNITED STATES PATENT OFFICE

2,653,643

APPARATUS FOR UNCOILING SHEET METAL

Harvey D. Miller, Youngstown, and John C. Holdgate, Cortland, Ohio, assignors to The McKay Machine Company, Youngstown, Ohio, a corporation of Ohio

Application September 19, 1951, Serial No. 247,282

16 Claims. (Cl. 153—54)

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This invention relates to the art of uncoiling metal strip and more particularly to improved apparatus of a simplified nature which is operative to pay off metal strip from coils thereof in such manner that the normal formation of "coil breaks" is effectively avoided.

The primary object of the invention is the provision of vastly simplified yet entirely practical apparatus for advantageously making use of the heretofore known method of avoiding the formation of coil breaks in uncoiling sheet metal which consists of rigidly confining transversely the metal of the strip at the exact point of its departure from the coil proper and of either maintaining the paid-off strip in substantial tension or cold working the strip by flexing it reversely about a working roll before the strip is completely stress relieved as in a roller leveler, for example, before its utilization in a drawing press, for example. To carry out this method of uncoiling it has been heretofore proposed to apply a working roll in pressure engagement with the outer periphery of the coil from which strip is to be extracted, the strip being directed to leave the coil proper along the line of contact of the working roll with the coil, and because of the difficulty of maintaining the leading end portion of the strip piece when lying between the coil and the leveler under tension it is highly desirable to severely stress the strip by severe flexing about the working roll to thus effect a preliminary working of the strip sufficient to destroy its propensity to "coil break" before being fully processed in the roller leveler.

In the apparatus of the present invention the above outlined advantageous method of uncoiling metal strip is retained but the apparatus required possesses, in addition to its simplification, the improved operating characteristics of automatically regulating the pressure applied by the working or take off roll on the outer periphery of the coil in accordance with the needs of the particular material being handled and of insuring the application of sufficient tension to the strip to avoid the formation of coil breaks in the strip during its passage from the coil to the roller leveler or other strip working or utilization equipment.

Another object of the present invention is the provision of an uncoiling machine having the above enumerated advantageous characteristics and which in addition incorporates certain novel features of construction and operation whereby the operation of threading a coil of material into an associated processing machine, for example, is greatly facilitated and hastened.

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The above and other objects and advantages of the invention will become apparent upon consideration of the following detailed specification and accompanying drawing wherein there is disclosed a certain preferred embodiment of the invention.

In the drawing:

Figures 1 and 2 are plan and end views, respectively, of an uncoiler constructed in accordance with the principles of our invention;

Figure 3 is a sectional view taken along the line III—III of Figure 2;

Figure 4 is a schematic showing of the principles of operation of the uncoiler of Figures 1 through 3;

Figure 5 is a front elevation of a second embodiment of our invention with parts broken away generally as is indicated by line V—V of Figure 6;

Figure 6 is a side elevation of the apparatus of Figure 5;

Figure 7 is a fragmentary section view taken along line VII—VII of Figure 5;

Figure 8 is a fragmentary section view of the apparatus of Figure 5 taken generally along line VIII—VIII of Figure 7; and

Figure 9 is a schematic representation of a novel method of threading strip material into an associated processing machine, for example, as is taught by our invention.

As shown in the drawing, the apparatus of our invention may comprise a base structure 10 on which is mounted a pair of spaced, parallel, and upstanding housings 11 and 12 in each of which is formed an inclined slot 13 constituting a guide for the sliding movement of a bearing chock 14. Journaled in the chocks 14 are the end portions or necks of a roll 15 which will be referred to herein as the working roll of the assembly. This roll is normally biased to upper position by a pair of counter weights 16 which slide vertically in recesses 17 formed in the housings 11 and 12 and which are connected to the chocks 14 by means of chains 18 entrained over sprockets 19.

Rotatably supported on the base 10 intermediate the housings 11 and 12 and parallel with respect to each other and to the working roll 15 is a pair of spaced cradle rolls 20 the function of which is to rotatably support a coil of metal strip in the uncoiling structure. To assist in opening a coil and in threading the leading end thereof through pinch rolls (31, for example) or other equipment with which the uncoiler of the invention is associated, we provide for the driven rotation of the cradle rolls 20 and for this purpose we may employ a motor 21 operating through a speed reducer 22 which has its output connected to the

cradle rolls through suitable sprocket and chains **23**. In accordance with usual practice, we may provide an over-running clutch, not shown, in the cradle roll drive to permit the cradle rolls to run freely in a forward direction when the strip is being pulled off the coil by the said pinch rolls, for example, as will be understood by those familiar with the art.

Each of the two housings **11** and **12** have a plurality (preferably four) of spaced horizontally extending and bushed guiding bores **24** therein, and slidably received in each of the bores **24** is a rod **25**. Rigidly secured to the inner ends of the rods **25** is a pair of side guide plates **26**, one of which is shown in plan in Figure 3. On the inner face of each of the side guides **26** is assembled a round projection **27** and by referring to Figure 3 it will be noted that the projections **27** are located substantially above and equidistant from the two cradle rolls **20** and substantially in the common plane of the two guiding slots **13** in the housings **11** and **12**. For moving the side guides **26** in and out to contact a coil if required, to center the coil with other apparatus, or to simply loosely confine the coil during the uncoiling operation each of the side guides **26** is connected to a piston rod **28** of a fluid cylinder **29**. The cylinders **29** are double-acting and it will be understood that during normal operation the side guides **26** can be made to move in and out as desired.

By referring to Figures 1 and 2 it will be noted that there is associated with each of the chain sprockets **19** a second parallel sprocket **19'** and in practice these pairs of sprockets are keyed to common shafts so that both rotate together. Sprockets **19'** are connected by means of endless chains **40** to sprockets **39'** which are keyed to a synchronizing shaft **39** which is journaled in the base structure **10** in spanning relation to the two housings **11** and **12**. This construction insures that the two bearing chocks **14** will slide upwardly and downwardly in unison in the inclined slots **13** to thereby maintain the working roll **15** in parallel relation to the axes of the cradle rolls **20** and other common axes of projections **27** in all positions of the working roll.

In the normal use of the uncoiler above described the same will be positioned in relation to the pinch rolls **31** or other pulling device in the user's plant in the manner shown in Figure 4 whereby the strip will be pulled off the uncoiler in a generally horizontal direction which is normal to the axis of the working roll **15** and which is in the direction of slant of the slots **13**. At the start of a cycle of operation the working roll **15** will be raised to its uppermost position and the side guides **26** will be retracted to allow the coil to be loaded from the front of the machine. The coil is so oriented that the outer end of the strip stock terminates in a rearward direction and either manually or by means of suitable equipment, not shown, the leading end portion of the strip is pulled off the coil and looped over the working roll **15** and threaded into pinch rolls **31**. As the latter begin to apply tension to the strip the strip will assume a tight curvature about the working roll **15** and in doing so will increase the tension required to be applied by the pinch rolls to continue the feeding of the strip. As this tension builds up in a horizontal direction, as represented by vector A in Figure 4, the working roll **15** will be forced downwardly, as represented by vector B, due to the inclined direction of the guide slots **13** and the working roll **15** will thereupon be held in tight pressure engagement with the outer periphery of the coil **30** being paid off. The apparatus thus operates to rigidly confine the metal strip transversely at the point of departure of the strip from the coil proper and to immediately thereafter subject the strip while under tension to cold working by flexure about the working roll **15**. This working of the strip relieves the coil "sets" or stresses inherent in the strip and thereby prevents the formation of coil breaks in the strip regardless of the manner in which the strip is subsequently handled. It is recognized that the propensity of strip material to coil break is influenced by the gauge of the stock, by the analysis and temper of the steel, prior working, etc., but in general it will be found that stiffer material is more prone to develop coil breaks. In the inherent operation of our apparatus stiffer material requires a much larger pulling force for the uncoiling operation and this in turn results in the working roll **15** applying a much heavier radial pressure to the periphery of the coil. Therefore, the apparatus of our invention will automatically apply sufficient working to the strip to avoid the formation of coil breaks regardless of variations in the gauge, temper or other specifications of the coil strip.

During uncoiling, the side guides **26** will be loosely applied to opposite sides of the coil to prevent the respective convolutions of the coil from telescoping due to the combination of the diametric compression exerted between the cradle rolls **20** and the working roll **15**. If irregular action should develop, however, and the pinch rolls are stopped and opened or reversed the resulting collapse of the pull-out tension will, of course, automatically relieve this compression to thereby permit the side guides **26** to re-align the side edges of the convolutions of the coil.

The primary function of the projections **27** is to maintain the coil in substantially proper operating position during preparations for uncoiling and during the uncoiling operation proper, particularly when the coil is down to a few convolutions when the bend of the stock about the working roll **15** tends to kick these few remaining convolutions out the back of the uncoiler.

In Figures 5–9 of the drawing we have shown a modified form of our invention wherein are incorporated certain additional novel features which facilitate the loading and threading of the uncoiling apparatus and of processing apparatus which may be associated therewith. As shown in Figures 5 and 6, housings **11'** and **12'** have been provided with relatively wide guide slots **13'**. Slidably mounted in the slots **13'** for vertically inclined movement are bearing chocks **14'** which are, of course, counterweighted and interconnected for synchronized movement in the manner explained in describing the embodiment shown in Figures 1–4. Mounted in the lower end portions of the chocks **14'** for rotatable movement therein are carrier blocks **41** and **42**. Each of the carrier blocks **41** and **42** journals one end of a pair of cooperating pinch rolls **43** and **44**. In the illustrated embodiment suitable gears **45** and **46** are associated with the pinch rolls **43** and **44** and operate to insure synchronous motion of the rolls at all times.

As may be observed in Figures 5 and 8 the carrier blocks **41** and **42** are mounted in eccentric relation to the shaft sections thereof **47** and **48** which are journaled in chocks **14'**. It will further be noted that the lower pinch roll **44** is axially aligned with the shaft sections **47**

and 48. This arrangement provides that shaft 49, which is connected to and operates to drive the pinch roll 44, may extend directly through the shaft section 47 to an external driving connection. The upper roll 43 is of course driven by the lower roll 44 through gears 45 and 46.

While it will be understood that various well-known types of driving means may be used to operate the pinch roll 44, we have shown for purposes of illustration a conventional gear-head motor 50 which is mounted in depending relation to a bracket 51; the bracket in turn being rigidly secured to the chock 14' at the left hand side of the apparatus. Connecting the motor 50 and the shaft 49 is a conventional over-running clutch 51 which of course permits the pinch rolls 43 and 44 to overrun the driving means as the strip material is payed off by power means external of the uncoiler, as for example, by the drive rolls of a conventional roller leveller or other processing machine, not shown.

As shown in Figure 4, a coil 30 is positioned in the uncoiling apparatus in such manner that the strip pays off the periphery of the coil in a direction away from the rolls 31 of an associated processing machine. Thus it is necessary to bend the material reversely about the working roll 15 in order to thread it into the rolls 31. Considerable effort may be required for this operation, particularly when working with heavy gage material.

In the embodiment shown in Figures 5–9 we have provided a simple yet effective power driven means for obtaining the required reverse bend in the material. As shown in Figure 9 we may, by rotating the carrier blocks 41 and 42 through an angle of 180°, position the normally upper roll 43 below the roll 44. Thus a strip end 52 may be inserted directly between the rolls 43 and 44 in a direction away from an associated processing machine, not shown. The strip end 52 having been thus inserted, as indicated by the broken lines of Figure 9, the carrier blocks 41 and 42 may be pivoted upwardly to return the roll 43 to its normal position. It may be observed that in this operation the strip 52 will be bent reversely about the lower roll 44, which roll thereafter functions as the working roll 15 described in the embodiment of Figures 1–4.

To rotate the carrier blocks 41 and 42 in the manner above described we have mounted a pinion 53 at the outer ends of the shaft sections 47 and 48. Operatively associated with each of the pinions 53 is a rack 54 which is carried by the piston member 55 of a conventional fluid (preferably air) cylinder 56. Preferably the cylinders 56 should be designed so that when the piston member 55 is fully retracted the carriers 41 and 42 will be vertically disposed, with the roll 43 above the roll 44, and when the piston 55 is fully extended the carriers will be vertically disposed with the roll 43 in the lower position as shown by the broken lines of Figure 9.

To insure synchronous rotational motion of the carriers 41 and 42 we have provided channel members 57 and 58 which are rigidly secured to and extend between the carriers. As shown in Figure 5 the channels 57 and 58 are positioned on each side of the line of contact between the rolls 43 and 44. This is necessary, of course, to permit the material to pass freely through the rolls.

In a normal loading and threading operation using the apparatus above described, a coil, not shown, is positioned on the cradle rolls 20 in the usual manner. With the pistons 55 fully extended, placing the roll 43 in the lower position, the leading end 52 of the coiled material may be inserted directly into the pinch rolls 43 and 44. The motor 50 may then be energized to drive the rolls and draw the material therethrough. As soon as a sufficient length of strip has passed through the rolls the pistons 55 may be retracted to rotate the carriers 41 and 42 upwardly, bending the strip about the normally lower roll 44 and directing it toward an associated processing machine, not shown. The motor 50, of course, continues in operation until the material is threaded into the drive rolls, not shown, of the processing machine, whereupon the material will be rapidly payed off from external power means.

It will be understood that the theory of operation (i. e., the utilization of the force required to pay off the material to exert a confining force on the periphery of the coil) is similar in all respects to that of the embodiment shown in Figures 1–4; it being noted that subsequent to the threading operation the lower roll 44 of the latter embodiment becomes a "working roll" and performs the same function as the working roll of the former embodiment.

It should now be apparent that we have provided improved apparatus which accomplishes the objects initially set out above. The apparatus is entirely automatic and foolproof in operation, is simple in design, and may be economically produced. Its practical importance lies in the fact that it provides operative apparatus for furnishing breakfree strip in many smaller fabricating and processing plants which do not require large tonnage capacity and/or further working of the strip as is performed by the expensive and more complicated processing uncoilers, strip processers, and roller levellers.

In the two embodiments described herein we provide the small manufacturer who requires only relatively light gage material with apparatus which may be installed and operated at minimum cost, and further provide, at but slightly greater cost, apparatus which is suited for the manufacturer who must use heavier gage material.

Having thus described our invention what we claim is novel and desire to secure by Letters Patent is:

1. A metal strip uncoiler for use with stock pulling means comprising a base, a pair of horizontally spaced and upwardly extending housings mounted on said base, a pair of spaced parallel coil-supporting cradle rolls journaled on said base between said housings, each of said housings having a plurality of spaced guiding bores therein disposed parallel with the axes of rotation of said rolls, guide rods slidably received in said bores, a pair of side guides rigidly secured to the inner ends of said rods and adapted to engage opposite sides of a coil of strip supported on said rolls, means on said base to move said side guides toward and away from each other, an annular projection on the inner face of each side guide positioned above and substantially equidistant from said rolls and adapted to enter into the center opening of a coil of strip supported on said rolls, each of said housings having a guiding slot extending substantially radially outward of said projections and in normal installations upwardly inclined away from the stock pulling means, a bearing chock slidably received in each of said

slots, and a working roll having its end portions journaled in said chocks, the arrangement being such that upon the strip of a coil supported on said cradle rolls being wrapped around said working roll and pulled outwardly by said stock pulling means said working roll will be forced downwardly into pressure contact with the peripheral surface of said coil.

2. A metal strip uncoiler for use with stock pulling means comprising a base, a pair of horizontally spaced and upwardly extending housings mounted on said base, a pair of spaced parallel coil supporting cradle rolls journaled on said base between said housings, a pair of side guides positioned above said cradle rolls and mounted on said housings for movement toward and away from each other, an annular projection on the inner face of each side guide positioned above and substantially equidistant from said rolls and adapted to enter into the center opening of a coil of strip supported on said rolls, each of said housings having a guiding slot extending substantially radially outward of said projections and in normal installations upwardly inclined away from the stock pulling means, a bearing chock slidably received in each of said slots, a working roll having its end portions journaled in said chocks, each of said housings having a vertically disposed recess for the slidable reception of a counter weight, a counter weight disposed in each of said recesses, a sheave at the upper end of each of said housings, and a flexible connection between the chock and the counter weight on each of said housings, said connections being entrained over said sheaves, the arrangement being such that upon the strip of a coil which is supported on said cradle rolls being wrapped around said working roll and pulled outwardly by said stock pulling means said working roll will be forced downwardly into pressure contact with the peripheral surface of said coil.

3. A metal strip uncoiler for use with stock pulling means comprising a pair of horizontally spaced and upwardly extending housings, a pair of spaced parallel cradle rolls positioned between the roll and portions of said housings in spanning relation thereto, mandrel means mounted for horizontal movement along the axis positioned above and substantially equidistant from said cradle rolls and adapted to enter the center opening of a coil of strip supported on said rolls, each of said housings having a guiding slot extending substantially outward of said axis and in normal installations upwardly inclined away from the stock pulling means, a bearing chock slidably received in each of said slots, and a working roll having its end portions journaled in said chocks, the arrangement being such that upon the strip of a coil supported on said cradle rolls or on said mandrel means being wrapped around said working roll and pulled outwardly by said stock pulling means said working roll will be forced downwardly into pressure contact with the peripheral surface of said coil.

4. Apparatus according to claim 3 further including a sheave at the upper end of each of said slots, a counter weight on each of said housings and guided for vertical movement with respect thereto, and a flexible connector on each of said housings entrained over the sheave thereon and interconnecting the counter weight and chock thereon.

5. Apparatus for uncoiling metal strip and adapted to be used with stock pulling means comprising means to rotatably support a coil of strip

for rotation about a generally fixed axis disposed horizontally, a working roll disposed substantially parallel with said axis, and means mounting said working roll for sliding movement in a direction normal to the axis thereof and upwardly inclined away from said stock pulling means, the arrangement being such that upon the strip of coil which is supported on said coil-supporting means being wrapped around said working roll and pulled outwardly by said stock pulling means said working roll will be forced downwardly into pressure contact with the peripheral surface of said coil.

6. Apparatus according to claim 5 further including means to yieldably bias said working roll to upper position, and means to maintain the axis of said working roll parallel to said first mentioned axis in any position of said working roll.

7. A metal strip uncoiler for use with stock pulling means comprising means to rotatably support a coil of strip for rotation about a generally fixed axis extending horizontally, a pair of housings extending upwardly from sides of a coil of strip when so supported and each having a guiding slot extending substantially radially outward of said axis and upwardly inclined away from said stock pulling means, a bearing chock slidably received in each of said slots, a working roll having its end portions journaled in said chocks, a shaft rotatably mounted on the upper end of each of said housings and each having keyed thereto a pair of spaced parallel sprockets, a counter weight on each of said housings and guided for vertical movement with respect thereto, a chain interconnecting the chock and the counter weight on each of said housings and entrained over the one of said pair of sprockets on each of said housings, a synchronizing shaft spanning said housings and having keyed thereto a pair of widely spaced sprockets, and a pair of endless chains interconnecting the others of said pairs of sprockets on said first mentioned shafts and the said sprockets on said synchronizing shafts.

8. A metal strip uncoiler for use with stock pulling means comprising means to rotatably support a coil of strip for rotation about a generally fixed axis extending horizontally, a pair of side housings extending above said coil, each of said housings having a guiding slot upwardly inclined away from said stock pulling means, a bearing chock slidably mounted in each of said slots, a working roll having its end portions journaled in said chocks, means interconnecting said chocks to synchronize the sliding movement thereof whereby said working roll is held in parallel relation to said axis in any position of said working roll, the arrangement being such that upon the strip of a coil which is mounted on said coil-supporting means being wrapped around said working roll and pulled outwardly by said stock pulling means said working roll will be forced downwardly into pressure contact with the peripheral surface of said coil.

9. Apparatus according to claim 8 further including means to yieldably maintain said working roll in upper position whereby upon completion of the paying off of the strip of one coil the working roll will automatically raise to permit the loading of a next succeeding coil onto said coil-supporting means.

10. A metal strip uncoiled for use with stock pulling means comprising means to rotatably support a coil of strip material, a pair of side

housings extending above said coil, each of said housings having a guiding slot upwardly inclined away from said stock pulling means, a bearing chock slidably mounted in each of said slots, a rotatably mounted working roll supported by said chocks, means interconnecting said chocks to synchronize the sliding movement thereof whereby said working roll is held in parallel relation to said axis in any position of said working roll, the arrangement being such that upon the strip of a coil which is mounted on said coil-supporting means being wrapped around said working roll and pulled outwardly by said stock pulling means said working roll will be forced downwardly into pressure contact with the peripheral surface of said coil.

11. Apparatus according to claim 10 further characterized by a carrier block rotatably mounted in each of said chocks, a pair of pinch rolls rotatably journaled by said carrier blocks, means mounted on at least one of said chocks and operatively associated with at least one of said carrier blocks adapted to rotate said blocks about a horizontal axis extending through both of said blocks, and drive means mounted on at least one of said chocks and operatively associated with at least one of said rolls adapted to rotate said rolls, the arrangement being such that strip material from a coil supported on said coil-supporting means may be inserted into said pinch rolls and drawn therethrough upon energization of said drive means and that upon energization of said means to rotate said blocks, said blocks will be caused to rotate whereby said strip is wrapped about one of said rolls, said last mentioned roll thereafter becoming a working roll.

12. Apparatus according to claim 11 further characterized by said drive means being operatively associated with said rolls through an overrunning clutch, said clutch being adapted to disengage said drive means when said pinch rolls are caused to rotate at a higher speed than that caused by said drive means.

13. Apparatus according to claim 11 further characterized by said carrier blocks being mounted for rotary movement about an axis through one of said pinch rolls, said drive means being connected to the last mentioned of said pinch rolls, and means interconnecting said pinch rolls whereby said rolls are caused to have equal surface velocities at the line of contact therebetween.

14. Apparatus according to claim 11 further characterized by said means to rotate said blocks including a fluid cylinder associated with one of said blocks, said cylinder being operative upon actuation thereof throughout a complete stroke to rotate said block through an angle of substantially 180°.

15. In uncoiling apparatus for use with stock pulling means and of the type wherein strip material being uncoiled is bent reversely about a working roll and wherein the coiled material is confined at the point of departure of the material

from the coil by means of pressure contact between said working roll and the coil; the combination of means to rotatably support a coil, a pair of pinch rolls, carrier blocks rotatably journaling said pinch rolls in parallel relation to the axis of said coil, mounting means for said carrier blocks adapted to permit rotational movement of said blocks about an axis parallel to said pinch rolls and to permit movement of said last mentioned axis toward and away from said coil substantially along a path radiating from the axis of said coil at an angle inclined away from said stock pulling means, and means to rotate said carrier blocks whereby one of said rolls may be moved from a position above the other of said rolls to a position below the other of said rolls, the arrangement being such that strip material may be threaded between said pinch rolls in the direction of inclination of said path and said carrier blocks may be rotated to wrap said strip about the lower of said rolls in a reverse bend, whereby upon said strip being thereafter pulled by said stock pulling means outward of said rolls said strip will exert a force on said lower roll, a component of which force will be directed generally along said path whereby said last mentioned roll is urged into pressure contact with said coil.

16. In uncoiling apparatus for use with stock pulling means and of the type wherein strip material being uncoiled is bent reversely about a working roll and wherein the coiled material is confined at the point of departure of the material from the coil by means of pressure contact between said working roll and the coil; the combination of means to rotatably support a coil, mounting means rotatably mounting said roll in parallel relation to the axis of said coil, said mounting means being adapted to permit movement of said roll toward and away from said coil substantially along a path radiating from the axis of said coil at an angle inclined away from said stock pulling means, the arrangement being such that when strip material from said coil is bent around said roll in a reverse bend and is drawn by said stock pulling means outward of said roll in a direction away from the direction of inclination of said plane said strip will exert a force on said roll, a component of which force will be directed generally along said path whereby said roll is urged into pressure contact with said roll.

HARVEY D. MILLER.
JOHN C. HOLDGATE.

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