

March 5, 1963

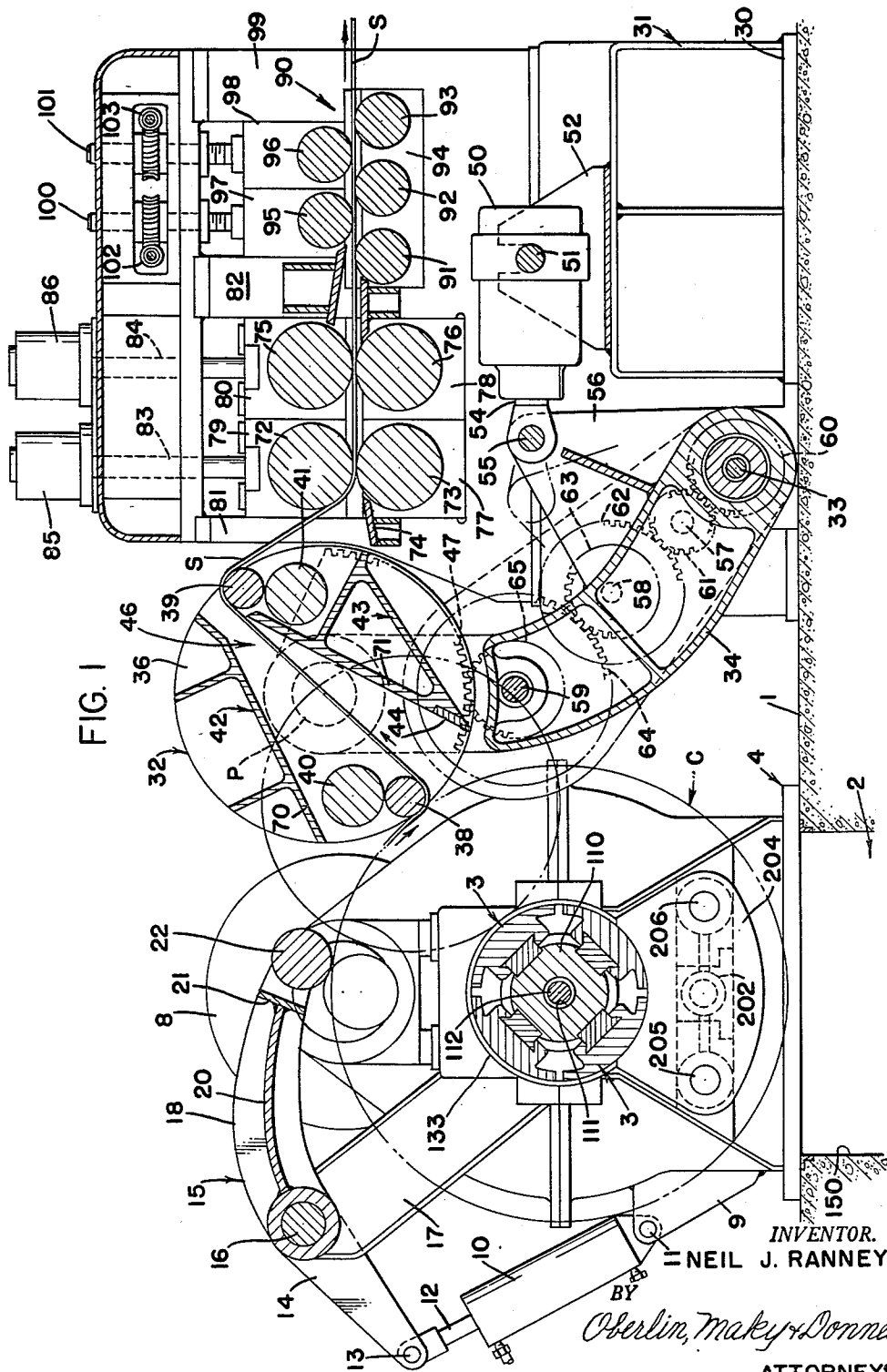
N. J. RANNEY

3,079,976

COIL PROCESSING MECHANISM

Filed Sept. 8, 1959

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COIL PROCESSING MECHANISM

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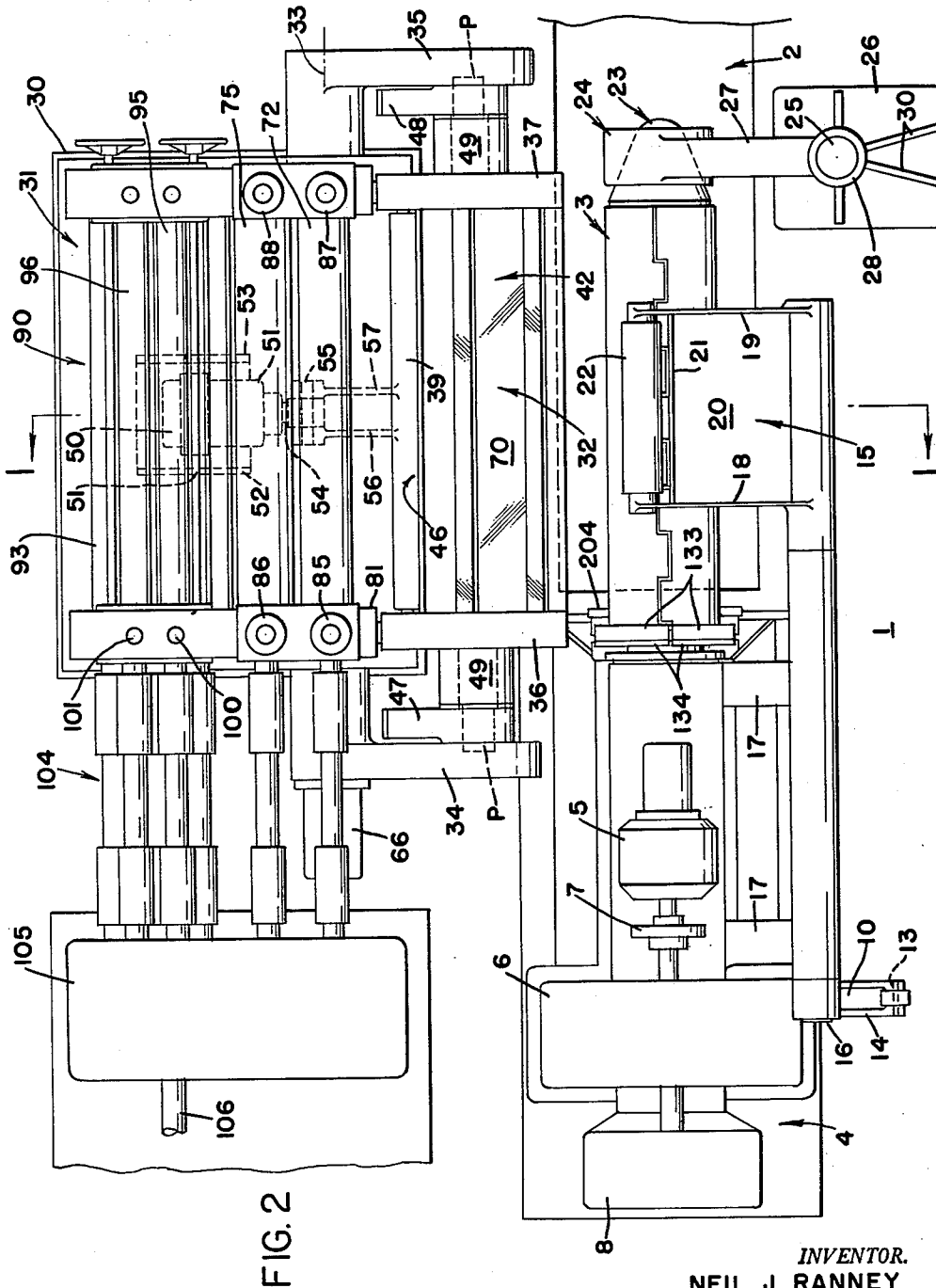


FIG. 2

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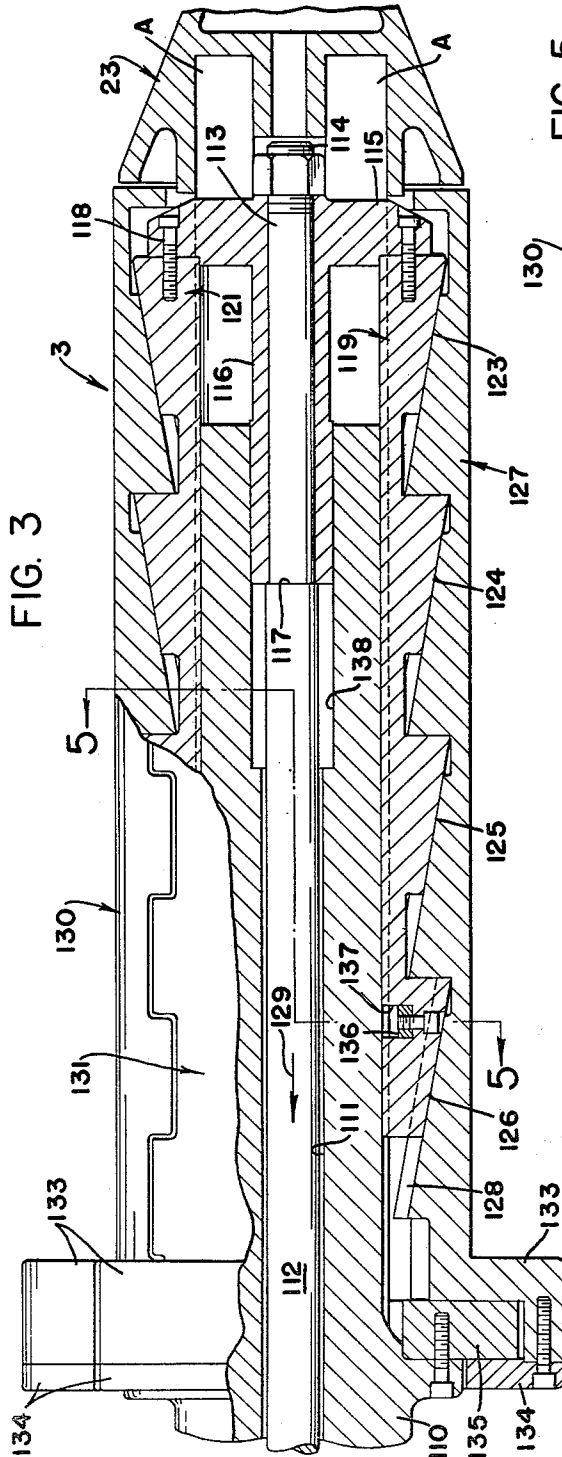
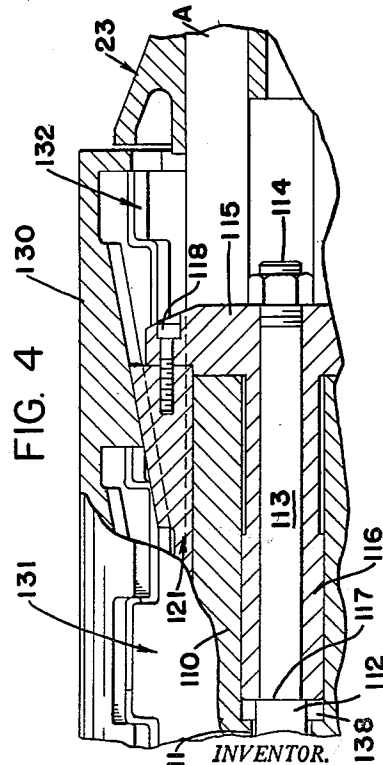
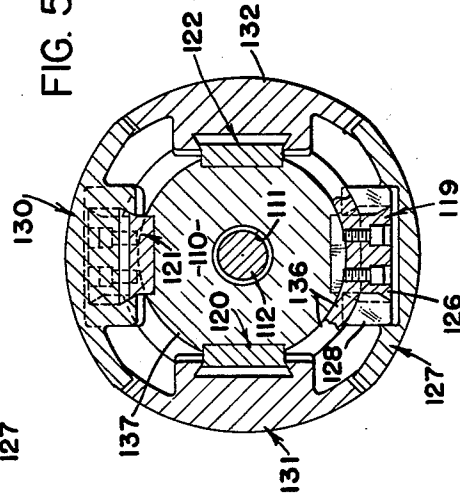


FIG. 5



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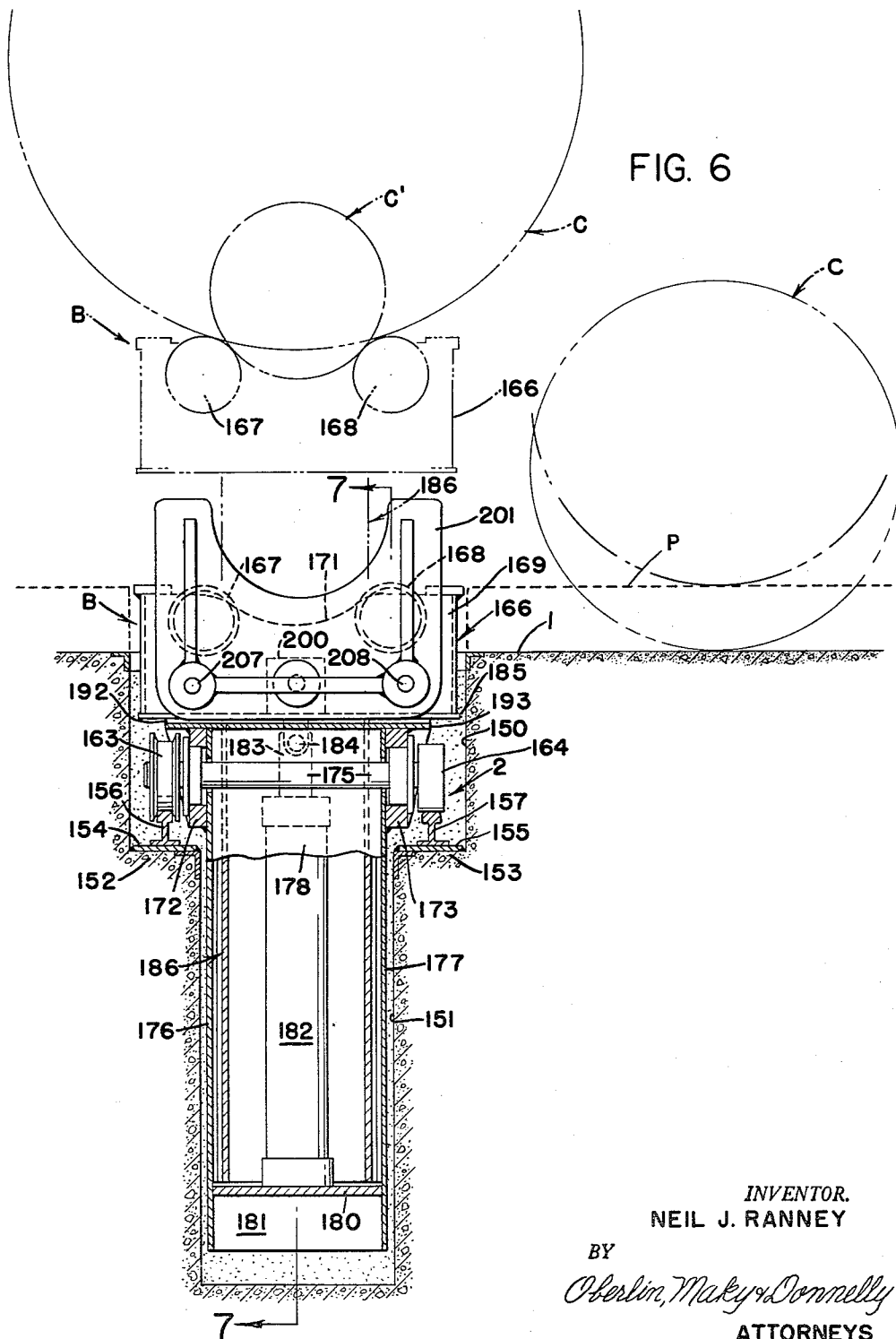
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FIG. 6



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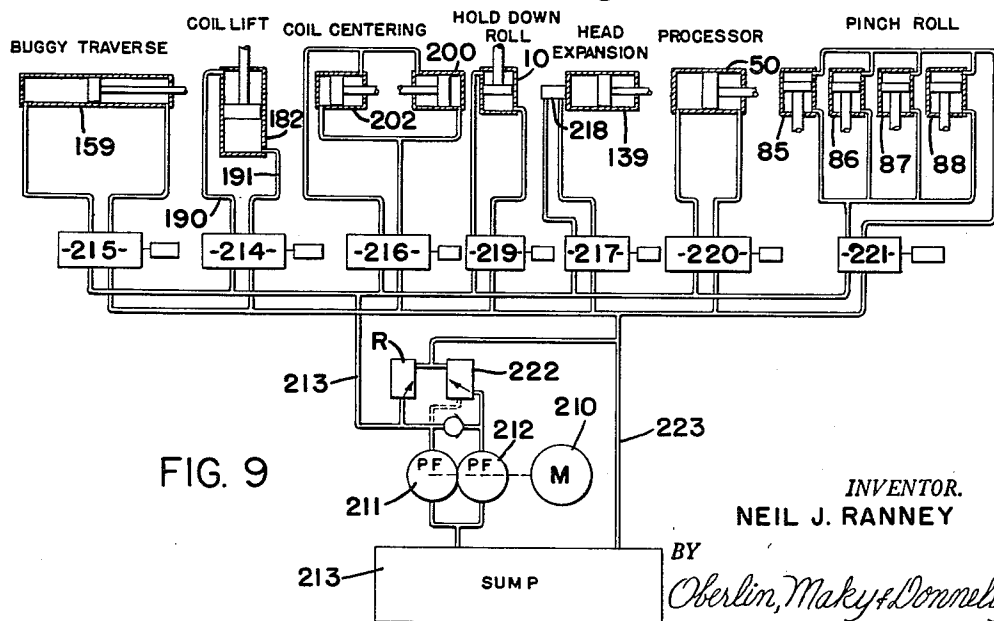
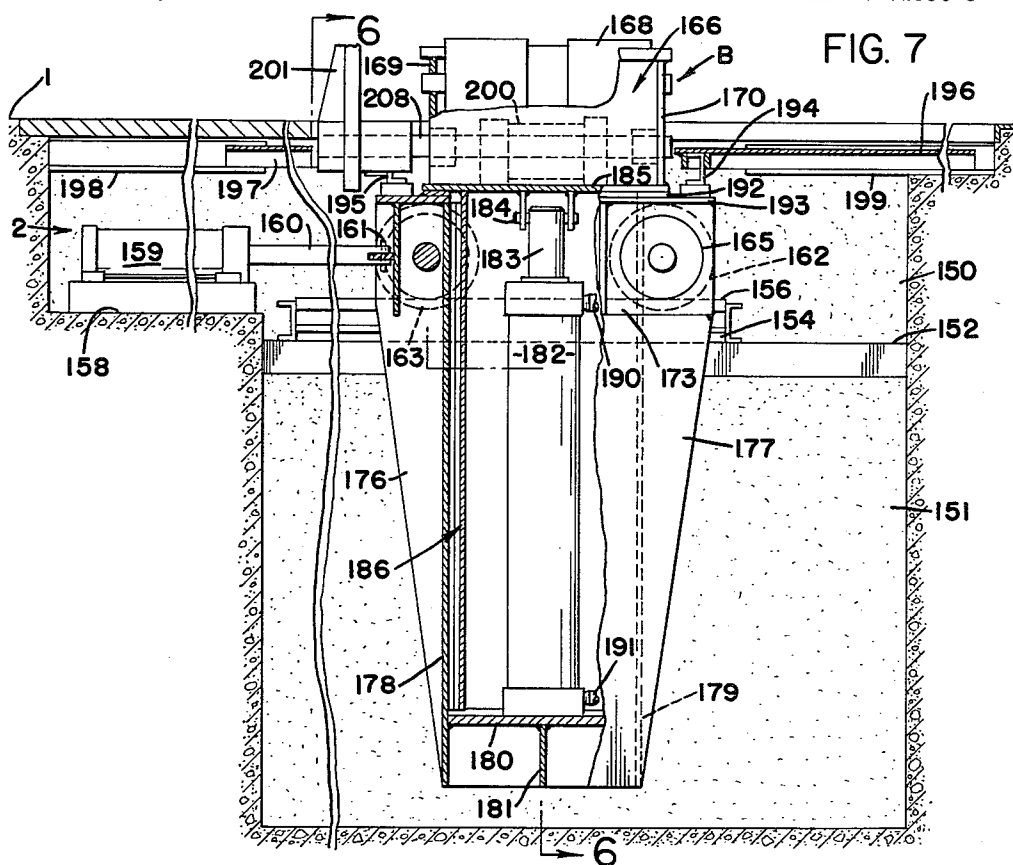
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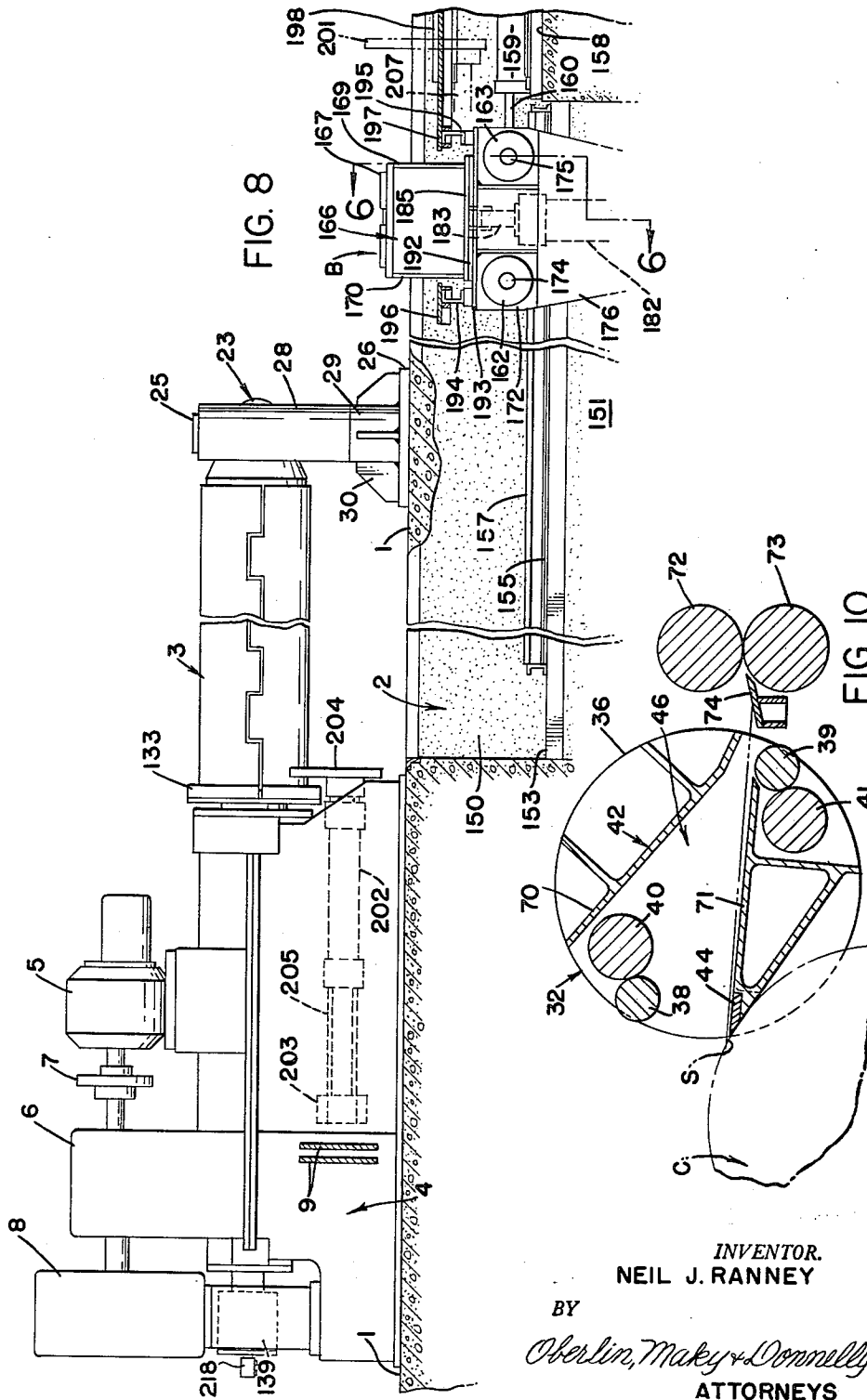
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COIL PROCESSING MECHANISM

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3,079,976

COIL PROCESSING MECHANISM

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Filed Sept. 8, 1959, Ser. No. 838,459
21 Claims. (Cl. 153—36)

This invention relates generally, as indicated, to a coil processing mechanism and more particularly to improvements in metal strip uncoilers whereby metal strip may be uncoiled in a more expeditious manner with substantially less damage for subsequent processing.

One of the principal difficulties encountered in uncoiling of metal strip, particularly hot rolled strip for subsequent further processing, is the formation of transverse ridges or fissures commonly called "coil breaks" which occur in the strip as it is payed off from the outer convolution of the coil in a tangentially extending path. These fissures result from a tendency of the strip to retain its curved or coiled shape.

It has heretofore been proposed, to prevent the occurrence of these fissures, to apply under pressure a small diameter working roll to the outer periphery of the coil in parallelism with the coil mandrel, and then to draw the strip through a sinuous path which includes a portion of the periphery of such working roll. The sinuous path generally cold works the strip into a state of plasticity preventing the formation of "coil breaks" or fissures therein. An expanding mandrel may be employed firmly to grip the inner periphery of the coil as the strip is payed therefrom to act as a backup means for the pressure of the working roll and to enable the application of a back tension to the strip by means of the application of a brake or the like.

Complex mechanisms have been provided to define the aforementioned sinuous path for the strip leaving the coil, such being extremely difficult to rethread whenever the coil stock is exhausted. It is ordinarily difficult to thread the strip through a sinuous path to subsequent working or leveling rolls in that the strip is not readily manually flexed. This, of course, calls for the repositioning of such sinuous path forming rolls whereby the strip may be fed linearly therethrough. Heavy and expensive lifting cylinders or jacks have been employed to position the rolls in their strip working and threading positions, respectively. Moreover, the flexure of the strip along the sinuous path must be maintained under substantially constant conditions for all positions of the rolls forming such sinuous path. The initial or leading roll must also maintain a clamping pressure on the convolutions of the coil against the mandrel. It is, therefore, desirable that the pressures controlling the flexure through such sinuous path be separate or individually controlled relative to the pressure of the leading roll upon the convolutions of the coil.

It is generally an arduous task to rethread conventional coil processing mechanisms in that the strip material is of such a nature that it does not readily lend itself to bending back of the outer wrap from the coil and placing the leading end between the power driven pinch rolls. Often times a separate machine or mechanism called a "coil opener" is provided ahead of the unit to accomplish this threading task. This serves to straighten the lead end of the coil for a few feet and even after this has been done some manual handling is frequently required to get the strip end properly entered between such pulling pinch rolls.

Further, such conventional machines are generally loaded from a path extending longitudinally of the mechanism which requires an extremely long length of floor

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space. This is generally the manner in which the coils are loaded in that it is conventional to bring the coils directly to the end of a processing line. However, such mechanisms require much more space than can be economically utilized and accordingly a mechanism that will load from the side can make more economical use of a considerably smaller layout area.

In machines of the type under consideration, most such machines are built according to specifications for a single intended use only. Consequently, the component units of such machine cannot be utilized separately for slightly different operations and this, accordingly, much increases the cost of the capital outlay necessary for a flexible operation for coil processing. Moreover, spare parts must be stocked for each separate component and it would indeed simplify the spare parts problem if the machine could utilize standard components which may be employed in other mill operations. In connection therewith, it would also be desirable to have a mechanism which would be completely accessible from all sides for maintenance and repair purposes. The use of standard component parts which may be utilized in other mill operations makes the assembly less expensive to build than if it were constructed as one large unitary machine.

Since different gauges of strip require different diameters of processing or flexing rolls for effective scale breaking or "coil break" prevention, a mechanism which would facilitate the ready changing of such rolls would be a tremendous advantage in that it would, of course, markedly reduce the down-time necessary for the change over operation. I have found that an assembly in which the rolls that form the sinusoidal path for the strip as it leaves the coil can be replaced as a cartridge or unit will greatly reduce the necessary down-time for roll changes. Hence, for thinner strip, a cartridge employing smaller diameter working rolls may readily be inserted in such unit in place of larger working rolls for heavier gauge strip.

An example of a conventional type of metal strip uncoiler may be seen in the patent to Todd, No. 2,508,977.

It is accordingly a principal object of my invention to provide a coil processing mechanism in which the roll units may quickly and easily be replaced.

It is a further important object of my invention to provide a coil processing mechanism that can quickly and easily be threaded.

It is yet another object of my invention to provide a coil processing mechanism of simplified design using standard components which may quickly and easily be installed and economically constructed.

It is still another object of my invention to provide a coil processing mechanism that may be loaded from the side thus economically utilizing a smaller layout area for such processing line.

It is a still further object of my invention to provide a strip uncoiler which will considerably reduce the down-time of the strip line for rethreading and roll replacement purposes.

Other objects and advantages of the present invention will become apparent as the following description proceeds.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and the annexed drawings setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principles of the invention may be employed.

In said annexed drawings:

FIG. 1 is a generally vertical section of a coil processing mechanism built in accordance with my invention taken substantially on the line 1—1 of FIG. 2;

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FIG. 2 is a fragmentary top plan view of such coil processing mechanism;

FIG. 3 is a generally vertical fragmentary sectional view of the expansible mandrel for my coil processing mechanism;

FIG. 4 is a fragmentary view similar to FIG. 3 but indicating the mandrel in its expanded condition;

FIG. 5 is a transverse sectional view of such expansible mandrel taken substantially on the line 5—5 of FIG. 3;

FIG. 6 is a fragmentary sectional view of my coil loading buggy as taken generally on the line 6—6 of FIGS. 7 and 8;

FIG. 7 is a fragmentary sectional view of my coil loading buggy as taken on the line 7—7 of FIG. 6;

FIG. 8 is a fragmentary front elevation of my coil processing unit as shown in FIG. 2;

FIG. 9 is a schematic hydraulic circuit indicating the manner in which the various components of my invention may be actuated; and

FIG. 10 is a fragmentary view of the cartridge for my processing rolls with the passageway in the cartridge in a generally horizontal threading position.

Referring now more particularly to FIGS. 1 and 2, I illustrate an embodiment of my new coil processing mechanism which may be mounted on the floor 1 of the plant in which the strip line is operating, such floor having a pit 2 positioned centrally beneath my expansible mandrel 3. The mandrel 3 is mounted on a base or housing 4 to extend out over the pit 2 in a position to be longitudinally centrally aligned therewith. The mandrel is driven by a dynamo-electric motor 5 through a reduction gear unit 6, the motor being connected to the reduction gear through a magnetic disconnect clutch 7. I also provide a braking unit 8 which may, for example, be a water cooled air brake with a pressure compensator for the coil outside diameter. In this manner, the mandrel may either be driven for rotation by means of motor 5 or it can serve as a means to resist the paying out of the strip by use of the braking unit 8. Mounted on the housing 4, I provide a clevis 9 to which is pivoted as at 11 the blind end of cylinder 10. The rod 12 of the cylinder 10 is pivoted at 13 to crank 14 which is rigidly interconnected with my hold-down roll support 15 through rotatable shaft 16 so that such crank 14, shaft 16 and support 15 will rotate as a unit about the axis of shaft 16 which is supported in members 17 projecting from the housing 4 of my expanding mandrel. The support 15 includes two side members 18 and 19 and a central transverse web 20 welded or otherwise secured to a further transverse member 21. The members 18 and 19 extend beyond the member 21 rotatably to support therebetween a hold-down roll 22. This roll is adapted to be forced against the outer periphery of the coil C by the introduction of hydraulic fluid into the cylinder 10.

It will now be seen that the coil of strip is adapted to be loaded on the end of my expansible mandrel 3 by a coil buggy, hereinafter described, such expansible mandrel terminating in a generally conoidal nose 23 adapted to be enclosed by a pivotally mounted outboard bearing 24 when the coil has been properly positioned thereon. The bearing 24 is pivotally mounted about upstanding post 25 mounted on bed plate 26. Such bearing is supported on arm 27 which includes an elongated collar 28 surrounding such post 25, and adapted vertically to pivot thereabout. The lower end of the shaft 25 is enclosed within cylindrical housing 29 supported by ribs 30 on the bed plate 26 to be held in the properly vertically extending position.

The outboard bearing may be manually or hydraulically swung about post 25 into its operative position. In this manner, the mandrel 3 will be supported for rotation at both ends thereof and will thus be more able to withstand the high tension forces of the strip S as it is paid from the coil C. This will, of course, also maintain the

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axis of the mandrel perfectly parallel with the axis of the flexing rolls.

My threading and flexing unit which is positioned adjacent my expansible mandrel may be more clearly seen in FIGS. 1 and 2 and includes a base plate 30 mounted on the floor 1 and supporting a housing 31 to which the various components are attached. My threading and flexing roll cartridge may be generally seen at 32 in FIG. 1, such cartridge being mounted for pivotal bodily movement about pivot 33. The unit 32 is removably mounted on stub shafts P extending within arms 34 and 35 which arms are in turn pivoted about such pivot 33. The unit or cartridge includes two circularly shaped bearing plates 36 and 37 in which are journaled my working or flexing rolls 38 and 39 and my respective backup rolls 40 and 41 for such working rolls. The bearing plates 36 and 37 are interconnected by ribs 42 and 43 of the sectional configuration more clearly shown in FIG. 1. Mounted in the leading edge of rib 43 of the unit 32 is a scraper blade 44 for a purpose hereinafter more clearly defined. The ribs 42 and 43 are of such configuration as to define a passage 46 through my cartridge 32 which enables the strip S to pass therethrough about portions of the peripheries of working rolls 38 and 39. Keyed to shafts P and hence mounted to rotate with the unit 32, I provide two sector gears 47 and 48 interiorly of arms 34 and 35 respectively as shown more clearly in FIG. 2. As is obvious, rotation of the sector gears about such pivots P will rotate the cartridge 32 as a unit. The cartridge is centered between the arms 34 and 35 by means of collar extensions 49 and 49' positioned between the respective sector gears and the bearing plates.

A cylinder 50 is centrally positioned on the housing 31 and is pivoted about pin 51 secured in upstanding retaining plates 52 and 53. The rod 54 of the cylinder 50 is pivotally connected at 55 to two upstanding cranks 56 and 57 secured to a support rigidly connecting the arms 34 and 35 to move the cartridge 32 as a unit toward and away from the coil C positioned on mandrel 3 about the pivot 33.

The arm 34 includes a gear train whereby the unit 32 may be rotated about its central axis. The arm 34 includes pivot shafts 57, 58 and 59. Secured to the shaft 33 to rotate therewith is a gear 60 which meshes with a pinion 61 pivoted on shaft 57 on the arm 34. Pinion 61 meshes with gear 62 to rotate shaft 58 and also rotating smaller gear 63 likewise keyed to shaft 58. Gear 63 rotates gear 64 keyed on shaft 59 which extends between the arms 34 and 35. Secured to the shaft 59 at opposite sides of my cartridge are two pinions, the pinion 65 driving sector gear 47 and the other pinion positioned adjacent arm 35 driving sector gear 48. The gear 60 is driven for rotation by a suitable alternating current motor 66 such that rotation of the gear train 60 through 65 inclusive will simultaneously rotate my sector gears 47 and 48 to rotate my processing cartridge 32 as a unit about the pivot provided by stub shafts P mounted in arms 34 and 35.

In order to define the passageway 46 through my cartridge 32, the ribs 42 and 43 extending between bearing plates 36 and 37 include plates 70 and 71. In this manner, the passageway 46 may be positioned generally horizontally for initial threading purposes or in the inclined position shown during the coil processing operation. The scraper blade 44 which is preferably of a hardened steel material is embedded in the forward or leading edge of the plate 71 of the rib 43 and as will be seen can be utilized to lift and deflect the leading edge of the outer convolution of the coil automatically to force it upwardly and through passageway 46 to extend slightly beyond working roll 39. As soon as the leading edge of the strip has been separated from the coil, the cartridge will be rotated to position such leading edge adjacent the nip of my first two pinch rolls 72 and 73. At

this time, further rotation of the mandrel 3 will automatically force the strip S into such nip. A guide plate 74 is positioned just below the entrance to this nip further to facilitate the positioning of the leading edge of the strip S between the pinch rolls 72 and 73.

I provide two such pairs of pulling or pinch rolls, the second pair 75 and 76 being mounted adjacent the first pair 72 and 73. The lower rolls 73 and 76 of such pairs are rigidly mounted for rotation in the frame 31 in blocks 77 and 78. The upper rolls 72 and 75 are mounted in slidable blocks 79 and 80 positioned vertically to slide between guides 81 and 82. It is noted that the opposite side of my roll assembly is also provided with similar guides and blocks for the raising and lowering of rolls 72 and 75. Rods 83 and 84 of cylinders 85 and 86 are secured in blocks 79 and 80 so that actuation of such cylinders 85 and 86 will force the rolls 72 and 75 against rolls 73 and 76. The opposite side of my roll assembly is also provided with cylinders 87 and 88 controlling the pressure on the opposite sides of rolls 72 and 75 in a similar manner.

Positioned adjacent my pinch roll unit, I provide a smaller roll leveling unit generally shown at 90 which includes three lower rolls 91, 92 and 93 journaled in block 94 rigidly mounted in frame 31, the opposite ends of such rolls being mounted in a similar block in a similar manner. The unit 90 includes two upper or offset rolls 95 and 96 journaled in slidable blocks 97 and 98, respectively, positioned between guides 82 and 99. It will again be understood that the opposite side of my unit 90 is also provided with guides for blocks journaled the opposite ends of rolls 95 and 96. Jacks 100 and 101 driven through worm gearing 102 and 103 may be employed to retract and extend rolls 95 and 96 in a conventional manner to apply pressure to the offset rolls 95 and 96 of my leveling unit 90. My nine rolls 72 through 76 inclusive, 91 through 93 inclusive, and 95 and 96 may be driven through nine flexible spindles generally shown at 104 in FIG. 2. Such spindles are driven by a suitable D.C. motor driving a helical reduction gear unit 105 through shaft 106. In this manner all of my rolls may be driven for rotation and the top rolls 72, 75, 95 and 96 may be retracted to open the pass therethrough.

The Expansible Mandrel (FIGS. 3-5)

My expansible mandrel is mounted on a rotatable core 110 having an elongated central bore 111 therethrough in which the actuating shaft 112 is positioned, such actuating shaft having a reduced portion 113 which terminates in a threaded end portion 114. Secured on the outer end of such shaft is a four armed spider 115 having an annular reduced portion 116 surrounding the reduced portion 113 of my shaft 112. Such annular extension 116 is seated against shoulder 117 formed by the reduced portion 113 of my shaft 112. Bolted or otherwise suitably secured to the arms of member 115, as shown at 118, are four sliding wedges or cam members 119, 120, 121 and 122. The wedge 119, being exemplary of all the wedges 119 through 122, inclusive, has four inclined cam portions 123, 124, 125 and 126 mating with similar grooved inclined portions in the outer segment or chucking member 127 of my mandrel 3. The portions 123 through 126 inclusive are dovetailed within inwardly extending portions 128 of outer casing portion 127. In this manner, movement of the actuating shaft in the direction of the arrow 129 of FIG. 3 will cause the parts to take the relative position shown in FIG. 4. The outer casing segment 130, as well as the other segments 131 and 132, will be caused to move radially outwardly as the wedges are drawn to the left. The outer housing segments may be provided with annular shoulders 133 as shown in FIG. 3 which together with plates 134 enclose annular ring 135 bolted to the core 110. In this manner, the outer segments are held

against axial movement with respect to the core 110. Such plate and shoulder 134 and 133 do not, however, preclude the outer portions or chucking members of the mandrel from moving radially outwardly. The conoidal nose 23 constitutes a continuation of core 110 to be enclosed by the outboard bearing 24 to provide the proper axial rigidity for my expansible mandrel 3. The core may be provided with four slots or elongated apertures A to accommodate the sliding movement of the arms of the spider 115. I may also provide an annular locking ring 136 positioned in annular groove 137 in each of the outer segments 127, 131, 130 and 132. This will further ensure that the wedges 119 through 122 inclusive will move as a unit uniformly to position the outer housing segments radially outwardly from the operating shaft 112. The bore 111 of core 110 is provided with an elongated enlarged portion 138 to accommodate the extension 116 of the spider support 115 as the actuating shaft is drawn to the left as shown in FIG. 3.

The actuating shaft 112 may be operated by a high-speed rotating cylinder 139 which may be positioned rearwardly of the reduction gear unit 6 and employs a special valve fitting or rotary seal extending from the end thereof to which the supply of hydraulic fluid is fed. The fitting seal permits the cylinder to rotate while the supply remains stationary. Such rotating cylinders are, however, generally conventional.

It will now be seen that my mandrel is actuated by means of the actuating shaft being reciprocated within the core 110, the member 115 being secured thereon between the shoulder 117 of the shaft and a nut threaded on the end 114. The wedges 119 through 122 inclusive are secured to the arms of such member 115 to move as a unit radially uniformly to expand and contract the outer segments of my expansible mandrel. It is noted that the radius of curvature of the outer portions is such that the mandrel will be completely circular only in its maximum expanded condition.

The Coil Buggy (FIGS. 6, 7 and 8)

Referring first to FIG. 8, it will be seen that the pit 2 extends outwardly longitudinally of the mandrel 3 and that the pit comprises an upper enlarged portion 150 and a more narrow deeper portion 151. Between such upper and lower portions there are provided shoulders 152 and 153 on which are placed bed plates 154 and 155. These in turn serve as mounting plates for rails 156 and 157 which extend substantially the length of the portion 151 of the pit. At the farthest end of the pit, as shown in FIGS. 7 and 8, I provide a shelf 158 on which is placed an actuating cylinder 159, the rod 160 of which is secured to the coil buggy B at 161.

The buggy B is a four-wheeled carriage riding on rails 156 and 157, the wheels 162 and 163 being flanged on both sides, as shown more clearly in FIG. 6, and the wheels 164 and 165 having no flanges thereon. In this manner, the carriage or buggy B will always be maintained on the rails 156 and 157, perfect rail and wheel alignment not being required. The buggy B includes an upper housing 166 in which are mounted two support rollers 167 and 168. These rollers are journaled in the end plates 169 and 170 of such housing 166 and are positioned to extend slightly beyond the top of such housing, such end plates 169 and 170 having arcuate cutout portions as shown at 171 (FIG. 6) so that the coil C may readily be cradled between the support rollers 167 and 168.

The lower portion of the housing includes two side plates 172 and 173 in which the axles 174 and 175 of the buggy are journaled. Mounted interiorly of these plates are two depending side plates 176 and 177, the configuration of which may more clearly be seen in FIG. 7. Two transverse plates 178 and 179 form with plates 176 and 177 a depending housing extending closely within the deeper more narrow portion 151 of the pit 2.

Secured to the bottom of such housing is a support plate 180 spaced from the bottom thereof by a supporting rib 181. The plate 180 serves as a support for my coil buggy lifting cylinder 182, the rod 183 of which is connected as at 184 to the bottom plate 185 of housing 166. Closely fitting within the depending housing formed by the plates 176 through 179 inclusive, is a similarly shaped housing 186 rigidly secured to the bottom plate 185 of the housing 166. It will now be seen that the housing 186 will slide upwardly and serve as a guide for the support of the rolls 167 and 168 in their extended position as shown in phantom lines in FIG. 6. If necessary, suitable bearing elements may be provided between housing 186 and walls of the external depending housing whereby such housing will rigidly be supported for sliding movement in the proper vertically aligned position. The cylinder 182 will have flexible conduits 190 and 191 connected thereto so that a suitable hydraulic supply of fluid hereinafter described will always operatively be connected thereto.

In its lowermost position, the plate 185 of the housing 166 rests on annular support 192 positioned on shelf 193 secured to the top of plates 176 and 177. The entire buggy may be built of a welded steel construction.

As a safety feature, I may provide each side of my coil buggy with supports 194 and 195 to which are secured sliding plates 196 and 197. These may be secured in guideways 198 and 199 and may be so dimensioned as to slide with my coil buggy always to keep the pit covered, both as a safety precaution and as a means to keep the pit properly free of debris.

With special reference to FIGS. 6 and 8, it may be seen that the coils C may be stored to the right of my mechanism as shown in FIG. 2 and rolled onto the supporting rolls 167 and 168 to be positioned in the proper longitudinal position for placement on the mandrel 3. Suitable ramps or a platform P may be employed to facilitate positioning the coils in the cradle formed by the rolls 167 and 168. If expedient, the buggy may be positioned such that the cradle formed by rollers 167 and 168 is level with the floor. The operator then need only actuate cylinder 182 to raise the cradle with the coil C positioned thereon to align the eye of the coil with the axis of the mandrel 3. Once this has been done, the cylinder 159 is actuated to move the buggy with the coil positioned thereon to the proper position. In this manner, it will be seen that coils may be stored laterally adjacent the strip processing line thus greatly reducing the amount of layout area required for such lines.

It will be seen from FIG. 6 that my buggy can accommodate either large coils C or smaller coils C'. For example, coils having a 64 inch outside diameter may be accommodated as easily as coils having merely a 20 inch outside diameter.

In order properly to center the coil C on the strip line, which means properly centering it on the mandrel 3, I may mount on the lift housing 166 a coil centering cylinder 200, the rod of which is connected to a coil centering plate 201. This cylinder cooperates with cylinder 202 on the housing 4 (FIG. 8), the rod of which is connected to a yoke 203. The yoke is in turn connected to coil centering plate 204 having the configuration more clearly shown in FIG. 1, by means of slidable guide rods 205 and 206. The plate 201 on the buggy housing may also be provided with guide rods 207 and 208 as shown.

Operation

Referring now particularly to FIG. 9, I have illustrated a hydraulic circuit by which the components of my coil processing mechanisms may be actuated. This system may be powered by a suitable electric motor 210 driving two fixed displacement pumps 211 and 212. The intake of both such pumps are connected to a suitable fluid reservoir or sump 213. Pump 211 may, for example, be a large volume, low pressure pump and pump 212 may

be a small volume, high pressure pump. When the pressure system requirements are low, the pressure in outlet line 213 will be sufficiently low that both pumps will be in operation to produce a low pressure and high volume operation for the components of my mechanism now to be described.

The coils, being stored laterally of my coil processing mechanism, are positioned on the cradle formed by the rolls 167 and 168 on my buggy B. The operator initially actuates valve 214 to raise the coil so that the eye is aligned with the axis of the mandrel 3. Then by operation of valve 215, the buggy is traversed toward the mandrel to approximately the end of the stroke of the traverse cylinder 159. The operator then actuates valve 216 simultaneously actuating coil centering cylinders 200 and 202 moving the centering plates 201 and 204 toward each other and in this manner centering the coil with respect to the mandrel and hence the processing unit. These plates will remain in position and act as side guides while the material is being run. These guides will maintain the coil in the form of a right circular cylinder and prevent the convolutions from being laterally displaced. The operator then actuates valve 217 to energize cylinder 139 to expand mandrel 3 firmly to hold coil C thereon, it being noted that this cylinder has the aforementioned special rotary seal 218 permitting such cylinder to rotate as the mandrel revolves. The operator then actuates valve 219 properly to cause the cylinder 10 to position the hold-down roll 22 against the outer convolution of the coil.

My coil processing mechanism is now in position for the strip to be threaded through my coil processing unit. To this end, the operator energizes valve 220 to extend the rod 54 of cylinder 50 to position my unit 32 against the outer convolution of the coil. Energization of the motor 66 will rotate the cartridge 32 as a unit properly to position the blade 44 to lift the leading edge of the coil such that it will be positioned within the passageway 46. The "feed-up" drive on the mandrel (motor 5) will be energized further to cause the strip end to be peeled from the coil and feed forwardly through the threading unit. When the motor 5 is energized, the magnetic clutch 7 engages, and the drag brake 8 releases. As soon as the leading edge of the coil has been removed by the blade 44, the cartridge is rotated about its axis to facilitate the movement of the coil end through the passageway 46. (Note FIG. 10.) It can be seen that by generally horizontally aligning the passageway 46, the leading edge of the coil will readily pass therethrough upon rotation of the mandrel by energization of motor 5. Further simultaneous rotation of the cartridge 32 and the mandrel 3 will position the leading edge on the shelf 74. The operator then energizes valve 221 properly to position the pinch rolls 72 and 75 to receive the leading edge of the strip.

It is noted that the resistance in line 213 will become so great as to actuate unloading valve 222 which will unload the production of pump 211 through conduit 223 to return to the reservoir or sump 213. The unloading valve is designed to unload the production of pump 211 when the pressure in line 213 increases above a certain predetermined amount, as, for example, 750 p.s.i. As soon as the pump 211 is unloaded, the line 213 will be pressurized by pump 212 at a much lower volume and a much higher pressure. In this manner, the proper high pressure may be applied to the various components of my processing unit and yet the cylinders 159 and 182 may be operated at high volume and low pressure.

As soon as the leading edge of the strip S is aligned with the nip of the pairs of pinch rolls, further rotation of the mandrel will feed the strip properly therebetween. As soon as the pinch rolls have been brought down to squeeze the leading edge of the strip firmly therebetween, the processing unit 32 is now reversely rotated by motor 66 so that the working rolls 38 and 39 take generally the

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position shown in FIG. 1 to form the sinuous path for the strip. The valve 220 is further energized to apply the proper pressure of the leading working roll 38 against the outer convolution of the coil C. A conventional relief valve R may be provided in my system to return the fluid to the reservoir through line 223 at the attainment of the predetermined maximum pressure. The valves illustrated in FIG. 9 are shown as manually operated valves but it will, of course, be understood that such valves may be operated properly in sequence by a mechanism to provide a completely automatic operation of my strip uncoiler.

It can now be seen that the strip S has been uncoiled and threaded through the pinch rolls and leveler rolls without the necessity of such strip being handled manually. This ease of threading only results from the compactness of my coil processing cartridge. The passageway 46 being rotatable from a generally vertical to a generally horizontal position in combination with the scraper blade to remove the leading edge of the strip, makes the uncoiling and threading of the strip completely automatic. Once the strip is properly positioned between the roll assemblies, the motor 66 is energized to rotate the unit 32 to provide the proper sinusoidal path for the strip suitably to cold work such strip to eliminate the formation of "coil breaks." It will be seen that as the coil OD becomes smaller and smaller, the pressure of the cylinder 50 will maintain the leading work roll 38 tightly against the outer convolution of the coil. It can now be seen that the expansible mandrel effectively operates as a back-up roll for the leading flexing roll 38 as well as the hold-down roll 22 firmly to grip the coil therebetween. Moreover, the motor 66 will keep the cartridge 32 in its proper position to provide the sinusoidal pass necessary to eliminate the formation of "coil breaks."

The motor driving shaft 106 will rotate the pinch rolls and leveler rolls to draw the strip S therebetween. This drive will cooperate with the brake 8 of the mandrel to keep the strip S under the proper tension. Accordingly, it will require a considerable torque to rotate the unit 32 to produce the sinusoidal path for the strip. With my reduction gear train and motor 66 of the proper power, there is no difficulty in providing this sinuous path.

It is, of course, entirely possible to employ only a single flexing roll in my cartridge 32. This roll, roughly equivalent to roll 39, could be rotated from a lower threading position to a higher working position to provide an offset path for the strip as it passes from the coil to the nip of the pinch rolls. It might then cooperate with the roll 22 as the initial flexing roll. Further, although backup rolls are illustrated in addition to flexing rolls, these are not always required depending on the gauge and width of the strip to be processed.

The use of the small diameter working rolls about which the strip is flexed also serves to benefit the strip, especially hot rolled strip, since hot roll scale is loosened and cracked by the flexing. Some of it flakes off or may readily be mechanically removed as by brushing and, in any event, the job of subsequent scale removal by acid pickling is greatly facilitated.

The compactness of my cartridge 32 makes it extremely easy to change the working rolls 38 and 39 to accommodate different gauge strip. Since both the working rolls and the backup rolls must be changed for different thicknesses of strip, it can be seen that it would markedly reduce the down-time for roll changes in that the time involved for the changing of my cartridge is approximately equivalent to the time involved in changing a single roll. Thus, a mechanism that requires the replacement of four rolls would be subject to four times as much down-time as a unit that requires the changing of only one roll.

Further, the use of my unique coil buggy permits the coils to be stored laterally of the strip line thus greatly reducing the length of such line and permitting such line

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to employ a much smaller layout area. Also, my mechanism utilizes standard components which simplify maintenance and reduce the cost of manufacture. As an example, my expansible mandrel uncoiler is essentially a unit in itself which can be built separately and can duplicate other uncoilers in the mill which are used where a processing unit, as my cartridge 32, is not required, since for some operations, "coil breaks" need not be prevented. This standardization of components also simplifies the spare parts problem which is tremendous for a large operation employing several uncoilers. Moreover, my unit is less expensive to build than if it were one integrated unit. As an example, the leveling and pulling rolls may be built as a separate unit and the drive therefor set up as a separate unit. Also, my mechanism is completely accessible from all sides for maintenance purposes.

It will now be seen that I have provided a method and apparatus for threading strip from a coil through a processing unit essentially characterized by the scraping or prying of the leading edge of the strip into an end of a passage or guideway positioned to facilitate entry of the strip end therein. The guideway is then positioned to align the other end with strip pulling means or a subsequent processing station. The movement of the guideway or passage tends to deflect the strip from its normal path due to its curved set from being in coiled form. The strip is thus automatically guided into engagement with the subsequent strip driving or processing means.

Other modes of applying the principles of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims or the equivalent of such be employed.

I, therefore, particularly point out and distinctly claim as my invention:

1. The method of uncoiling strip material without producing coil breaks comprising the steps of placing a coil of such strip material on a mandrel and passing the leading edge of such strip material through a rotatable unit positioned adjacent such mandrel and having working rolls positioned on opposite sides of such strip, rotating such unit to feed the leading edge of such strip into the nip of pulling rolls, and reversely rotating such unit to provide a sinuous path for such strip about such working rolls.

2. The method of uncoiling strip material without producing coil breaks comprising the steps of placing such coil on an expansible mandrel, placing a rotatable unit with a scraper thereon against the outer convolution of such coil, rotating such unit to scrape the leading edge of such strip therefrom, further rotating such unit to position the leading edge of such strip in line to be fed into the nip of pulling rolls by rotation of such mandrel, and reversely rotating such unit when the leading edge is secured between such pulling rolls to define a sinuous path for such strip to cold work such strip as it passes from the coil to such pulling rolls.

3. The method of threading strip from a coil through a processing unit comprising the steps of placing such coil on a mandrel and forcing the leading edge of such strip into an end of a passageway positioned adjacent to such mandrel to facilitate entry of such strip end therein, aligning the other end of such passageway with strip pulling means and forcing such strip through such passageway to deflect such strip from its normal path due to its curved set and guide it into engagement with such strip pulling means.

4. The method of processing strip material comprising the steps of placing a coil of such strip material on an expansible mandrel, centering such coil on such mandrel to center the strip for a subsequent processing line, forcing the leading edge of such strip from such coil into an end of a strip confining passageway, positioning such passageway to align the other end thereof with strip driving means, forcing such strip through such passageway into driven engagement with such strip driving means,

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further positioning such passageway to define a sinuous path for such strip between such coil and strip driving means, and driving such strip to draw it through such sinuous path.

5. The method of claim 4 including the step of braking such mandrel to place such strip under tension as it is drawn through such sinuous path.

6. A strip uncoiler including a rotatable cartridge positioned adjacent the outer convolution of a coil of strip material, said cartridge having a diametral passageway therethrough, and working rolls positioned on opposite sides of such passageway, means to rotate said cartridge and means bodily to move said cartridge as a unit toward and away from the outer convolution of said coil.

7. In a strip uncoiler, the combination of an expandable mandrel adapted to receive a coil of strip material, a pair of pinch rolls spaced from said mandrel, a rotatable cartridge positioned adjacent said mandrel between said mandrel and said pinch rolls having a generally diametral path therethrough, means to rotate said cartridge to position such path whereby such strip may be fed directly from such coil therethrough to said pinch rolls, said path substantially bridging the outer convolution of such coil and the nip of said pinch rolls when the leading edge of such strip material is initially threaded from such coil, and means reversely to rotate said cartridge to define a sinuous path for such strip directly between such coil and said pinch rolls.

8. A strip uncoiler as set forth in claim 7 including a flexing roll positioned on said cartridge to bear against the outer convolution of such adjacent coil whereby such strip will be flexed thereabout when said cartridge defines such sinuous path between such coil and said pinch rolls.

9. A strip uncoiler as set forth in claim 8 wherein said cartridge has flexing rolls on opposite sides of such path wherein such strip will be reversely flexed thereabout when said cartridge defines such sinuous path between such coil and said pinch rolls.

10. A strip uncoiler as set forth in claim 9 including means to position a coil on said mandrel, means to expand said mandrel and means to rotate said mandrel.

11. An uncoiler as set forth in claim 10 including means to drive said pinch rolls to pull such strip through said cartridge.

12. A metal strip uncoiler comprising a mandrel for the placement of a coil of strip material thereon, a pair of pulling rolls the nip of which is laterally spaced from said mandrel; laterally spaced flexing rolls positioned intermediate said mandrel and said pulling rolls, and means coaxially bodily to rotate each said flexing roll through an arcuate path to position said flexing rolls alternately in either a generally horizontal position for threading purposes or in a generally vertical position to define a sinuous path for such strip as it passes from said mandrel to the nip of said pulling rolls, means to expand said mandrel, and means operative to force the leading flexing roll against the outer convolution of such coil, said flexing rolls being mounted in a rotatable cartridge, said cartridge including a scraper blade forcibly to remove the leading edge of said strip whereby it will be forced through said cartridge by rotation of said mandrel.

13. A metal strip uncoiler comprising a mandrel for the placement of a coil of strip material thereon, a pair of pulling rolls, the nip of which is axially spaced from said mandrel; axially spaced flexing rolls positioned directly intermediate said mandrel and said pulling rolls, means coaxially bodily to rotate each of said flexing rolls through an arcuate path to position said flexing rolls alternately in either a position for threading purposes or in a position to define a sinuous path for such strip as it passes directly from said mandrel to the nip of said pulling rolls, means to expand said mandrel, and means operative to force the leading flexing roll against the outer convolution of such coil held by said thus expanded mandrel.

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14. An uncoiler as set forth in claim 13 including a buggy means to position such coil on said mandrel, said buggy means including centering means cooperating with similar means on said mandrel to center such coil on said mandrel and guide the lateral edges thereof as such strip is payed therefrom.

15. An uncoiler as set forth in claim 14 wherein said buggy means includes lift means to position the eye of such coil in alignment with the axis of said mandrel.

16. An uncoiler as set forth in claim 15 including traversing means for said buggy to position said buggy beneath said mandrel when the eye of such coil is aligned with the axis of said mandrel.

17. A flexing roll unit for an uncoiler comprising spaced coaxially rotatable bearing members spaced from each other by rib assemblies to provide a path through said unit, working rolls journaled in said members on opposite sides of said path, and pivotally mounted arm means to move said unit toward and away from the outer convolution of a juxtaposed coil of strip material including a pair of pivotally mounted arms with said unit being rotatably mounted between the distal ends thereof.

18. A flexing roll unit for an uncoiler comprising spaced coaxially rotatable bearing members spaced from each other by rib assemblies to provide a path through said unit, working rolls journaled in said members on opposite sides of said path, pivotally mounted arm means to move said unit toward and away from the outer convolution of a juxtaposed coil of strip material, and means to rotate said unit to change the position of such path.

19. A flexing roll unit for an uncoiler comprising spaced coaxially rotatable bearing members spaced from each other by rib assemblies to provide a path through said unit, working rolls journaled in said members on opposite sides of said path, pivotally mounted arm means to move said unit toward and away from the outer convolution of a juxtaposed coil of strip material including a pair of pivotally mounted arms with said unit being rotatably mounted between the distal ends thereof, and drive means on at least one of said arms to rotate said unit to change the position of such path.

20. A flexing roll unit for an uncoiler comprising spaced coaxially rotatable bearing members spaced from each other by rib assemblies to provide a path through said unit, working rolls journaled in said members on opposite sides of said path, pivotally mounted arm means to move said unit toward and away from the outer convolution of a juxtaposed coil of strip material including a pair of pivotally mounted arms with said unit being rotatably mounted between the distal ends thereof, and means operative to pivot said unit through an arcuate path about the pivot provided by the proximal ends of said arms.

21. A flexing roll unit for an uncoiler comprising coaxially rotatable bearing members spaced from each other by rib assemblies to provide a path through said unit, working rolls journaled in said members on opposite sides of said path, a pair of arms supporting said unit at the distal ends thereof, and means operative to pivot said arms to move said arms to move said unit bodily toward and away from the outer convolution of a juxtaposed coil of strip material.

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