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Keyser

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[54] **VARIABLE WIDTH STRIP CONDITIONER**

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[52] **U.S. Cl.** **226/198;** 226/199; 72/164

[51] **Int. Cl.** **B65h 23/26**

[58] **Field of Search** 72/160, 162, 163, 164, 72/165; 226/18, 19, 198, 199; 271/248, 250, 253, 254, 255, 171

[56] **References Cited**

UNITED STATES PATENTS

273,353	3/1883	Frichette	72/162
2,827,809	3/1958	Beam	226/19
2,984,285	5/1961	Simich et al.	72/165
3,114,489	12/1963	Legler	226/198
3,777,532	12/1973	Noe	72/160

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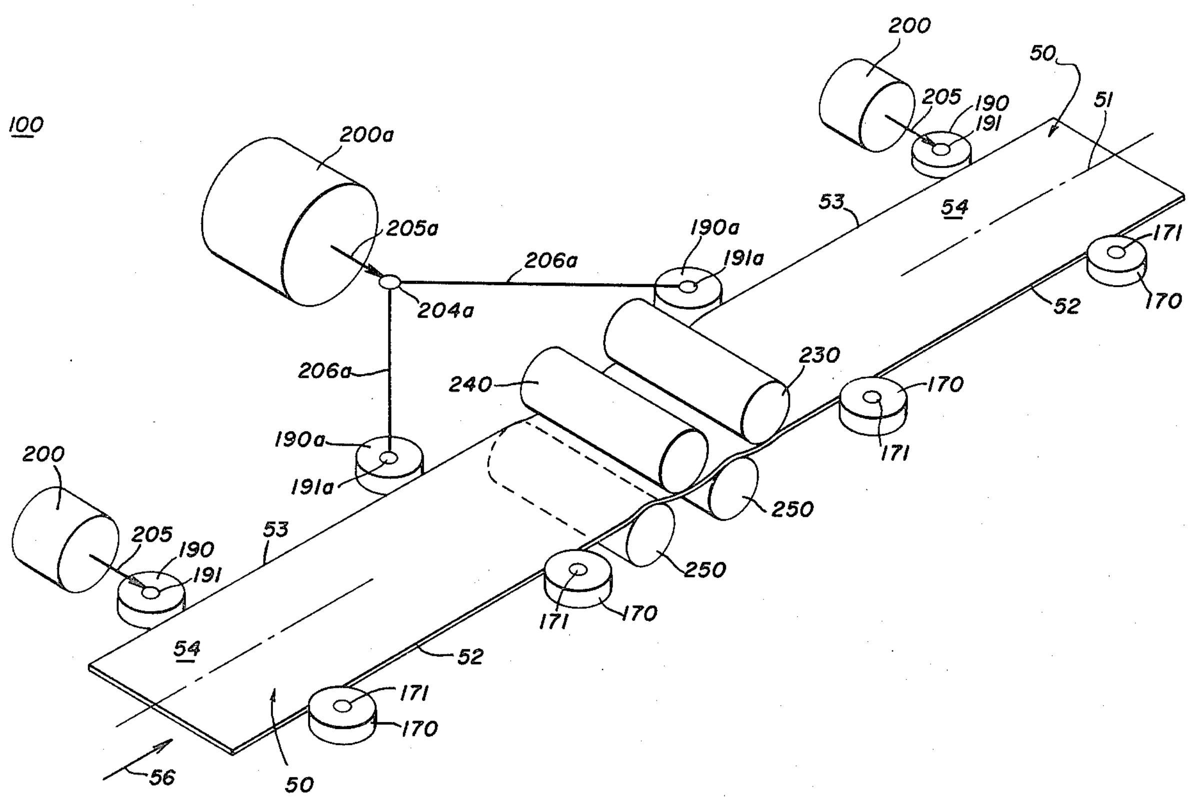
[57] **ABSTRACT**

Apparatus for conditioning elongated metal strips of different widths including feed rolls to support the strip for longitudinal movement along a predetermined planar datum path, work rolls contacting the opposite surfaces of the strip and extending the entire width thereof to work the strip into and out of the predetermined path, a first set of edge rolls movable to different adjusted fixed positions with respect to the center line of the predetermined path for engaging one edge of the strip, and a second set of edge rolls movable by pneumatic motors to engage the other edge of the strip and to urge the strip against the fixed first set of edge rolls.

7 Claims, 5 Drawing Figures



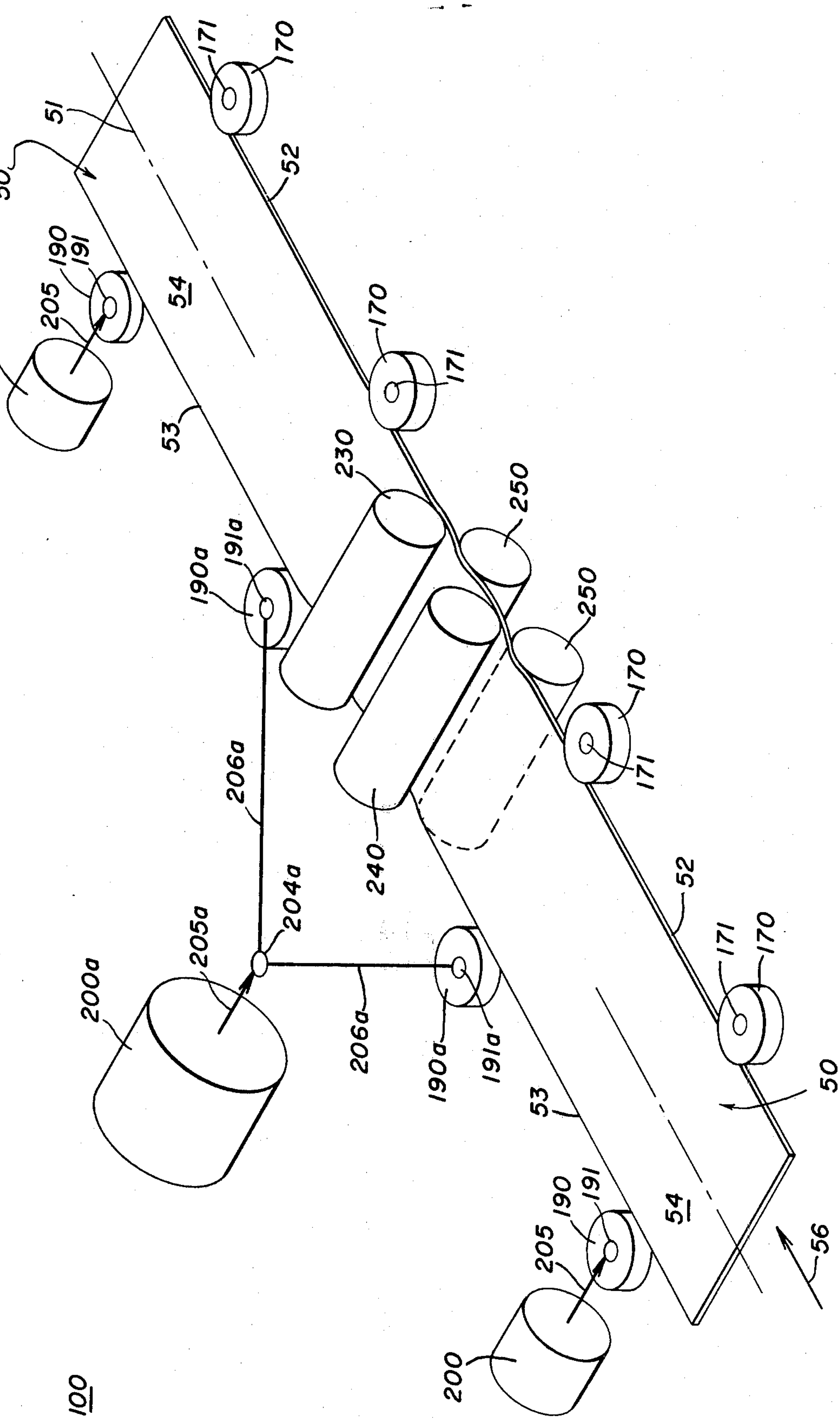

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FIG. 1

100

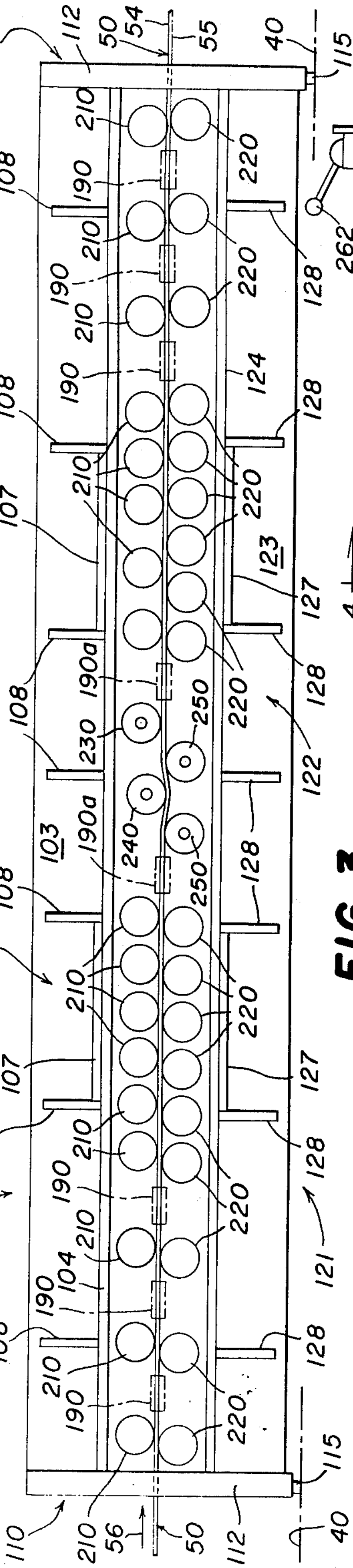


FIG. 2

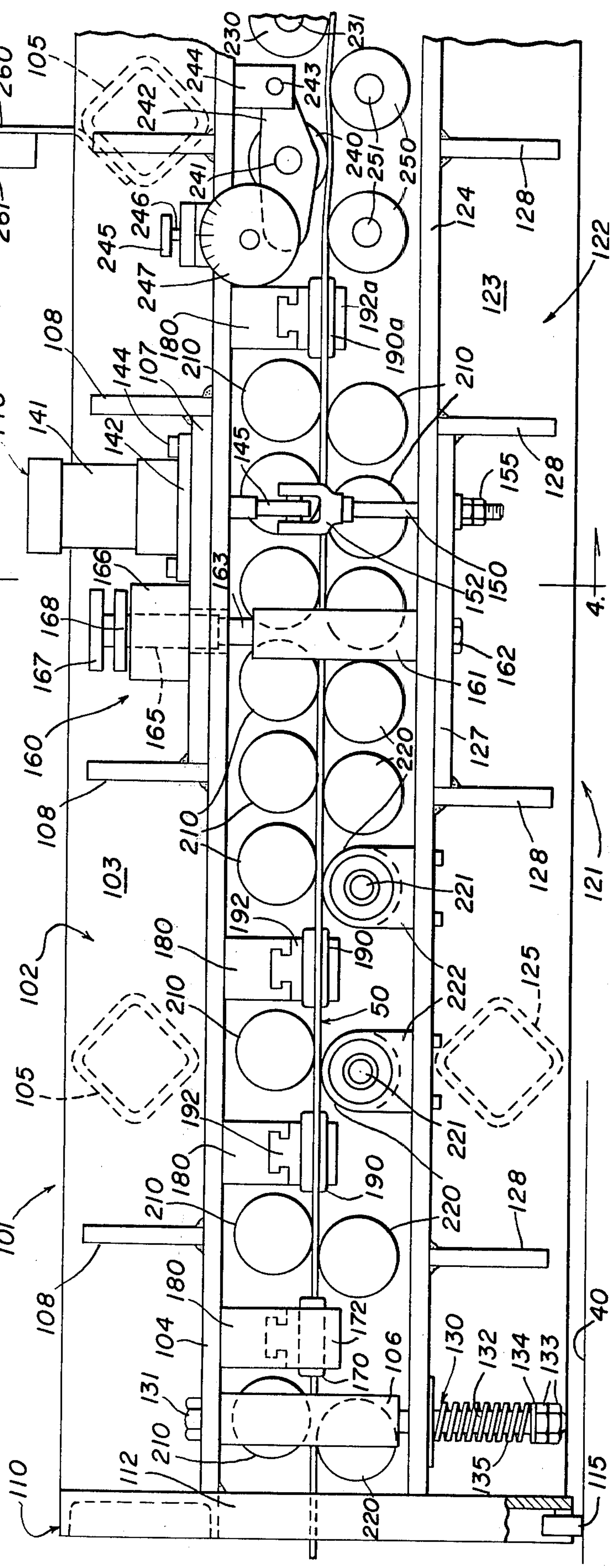
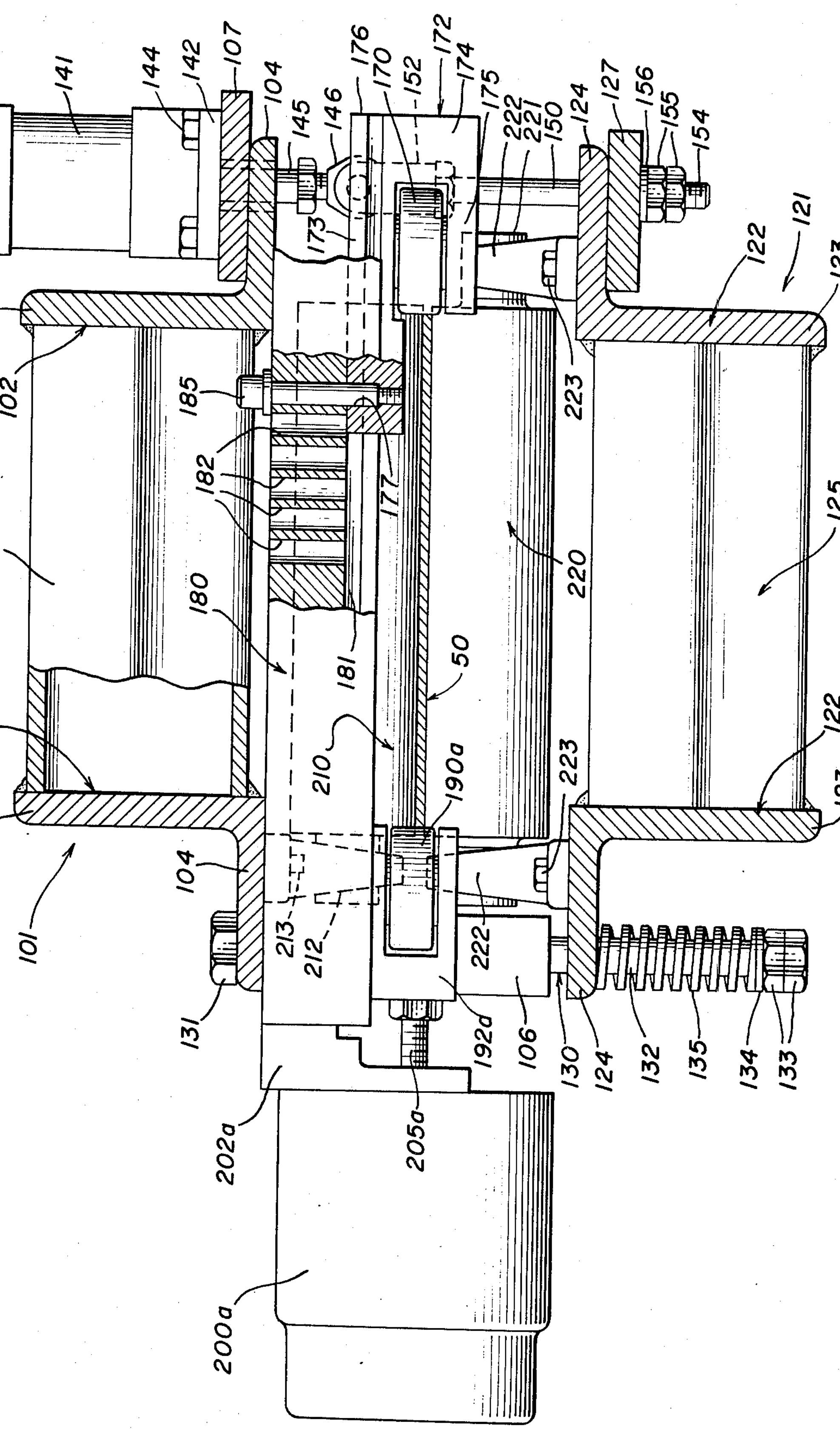


FIG. 3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125
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190a
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205a
200a

FIG. 4

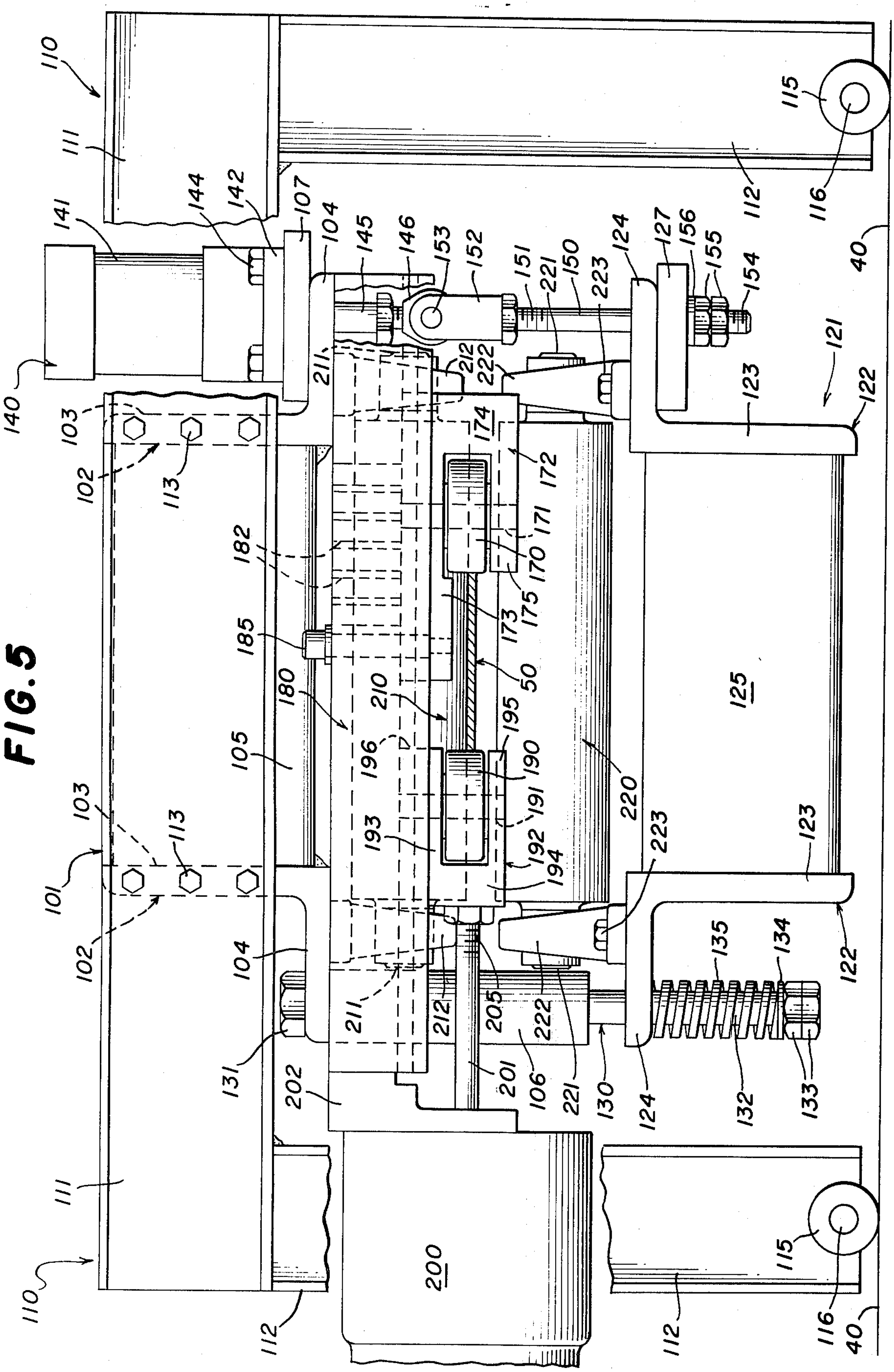

FIG. 5

VARIABLE WIDTH STRIP CONDITIONER

BACKGROUND OF THE INVENTION

The present invention relates generally to improvements in apparatus for conditioning elongated metal strips, and specifically to conditioners that can accommodate different widths of metal strips therethrough.

Standard practice heretofore is exemplified by the apparatus illustrated in U.S. Pat. No. 2,984,285 granted May 16, 1961 to Simich et al and U.S letters Pat. No. 3,006,401 granted Oct. 31, 1961 to Wognum et al. In both these prior patents, relatively narrow skate-type work rolls are utilized to work the metal strip as it passes through the conditioner. The conditioners are constructed and arranged to accommodate only a single width of metal strip therethrough.

SUMMARY OF THE INVENTION

The present invention provides a conditioner for elongated metal strips that can accommodate a plurality of different widths of strip, the machine being adjustable with a minimum of operator effort to accommodate such different widths of metal strips.

The accommodation of the different widths of metal strips is accomplished by providing long work rolls that extend the entire width of the widest strip to be treated and by providing edge guide rolls, one set engaging one edge of the strip being movable to one of a plurality of selected fixed positions with respect to the center line of the path of the strip, and the other set of edge guide rolls being urged by pneumatic motors into resilient engagement with the other edge of the strip.

This is accomplished in the present invention, and it is an object of the present invention to accomplish these desired results, by providing apparatus for conditioning elongated metal strips of different widths including means supporting the strip for longitudinal movement along a predetermined planar datum path, a pair of work rolls contacting the opposite surfaces of the strip and extending the entire width thereof in a direction transverse to the direction of movement thereof, one of the work rolls being displaced out of the path in one direction and the other of the work rolls being displaced out of the path in the other direction, the work rolls deflecting the strip across the entire width thereof out of the path in one direction and then in the other direction to work the entire width of the strip plastically substantially throughout the thickness thereof, the length of the work rolls being sufficient to accommodate a plurality of different widths of metal strip to be conditioned, and edge guides engaging the longitudinally extending side edges of the strip to guide the strip in a predetermined direction through the support means and the work rollers for all widths of strip to be conditioned.

Another object of the invention is to provide a strip conditioning apparatus of the type set forth wherein at least two pairs of work rolls are provided contacting the opposite surfaces of the strip.

In connection with the foregoing object, another object of the invention is to provide a conditioning apparatus of the type set forth, wherein at least one of the work rolls is readily manually adjustable with respect to the predetermined planar datum path to adjust the amount of working imparted to the strip during the conditioning thereof.

Still another object of the invention is to provide a strip conditioning apparatus of the type set forth, wherein the edge guides are rollers, one set of edge guide rollers engaging one longitudinally extending side edge of the strip and being adjustable to one or a plurality of selected fixed positions displaced different distances away from the center line of the predetermined path to accommodate corresponding different widths of strips, and the second set of edge guide rollers being mounted on pneumatic motors urging the second set of edge guide rolls against the other longitudinal extending edge of the strip.

Further features of the invention pertain to the particular arrangement of the strip conditioning apparatus, whereby the above outlined and additional operating features thereof are attained.

The invention, both as to its organization and method of operation, together with further features and advantages thereof will best be understood with reference to the following specification taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic perspective view illustrating the principles of the present invention;

FIG. 2 is a simplified side elevational view of a machine made in accordance with the present invention and incorporating therein the principles of the invention as diagrammatically illustrated in FIG. 1;

FIG. 3 is an enlarged side elevational view of the left hand portion of the machine of FIG. 2;

FIG. 4 is an enlarged view in vertical section along the line 4—4 of FIG. 3; and

FIG. 5 is an enlarged end view, with certain portions broken away, of the machine of FIG. 2 as viewed from the left hand end thereof.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1 of the drawings, there is diagrammatically illustrated a preferred embodiment of the invention, the apparatus being shown in diagrammatic and schematic form, and being illustrated as a variable width strip conditioner generally designated by the numeral **100**. The strip conditioner **100** is shown operating upon a metal strip **50** which has been fed from a source thereof (not shown), such as a large coil, to the strip conditioner **100**, the metal strip **50** having a longitudinally extending center line **51**, a pair of longitudinally extending side edges **52** and **53**, an upper surface **54** and a lower surface **55** (see FIG. **2** also). In order to guide the metal strip **50** through the strip conditioner **100**, a set of stationary edge guide rolls **170** is provided engaging the longitudinal edge **52**. Each of the rolls **170** is mounted upon an axle **171** for rotation thereabout, the axes of the axles **171** being disposed substantially normal to the surfaces **54–55** of the metal strip **50**. The axles **171** are further positioned stationary or immovable with respect to the center line **51**, whereby the edge guide rolls **170** are in turn stationary, although free to rotate about the axes of the axles **171**.

A second set of movable edge guide rolls **190** is provided including two such guide rolls **190** engaging the longitudinal edge **53** of the metal strip **50** at the extreme ends thereof as viewed in FIG. **1** and a pair of guide rolls **190a** engaging the longitudinal edge **53** near the midpoint thereof. The guide rolls **190** are mounted to rotate upon axles **191**, while the guide rolls **190***a* are mounted to rotate upon axles **191**a, the axis of the axles **191** and **191***a* being disposed substantially normal to the surfaces **54–55** of the metal strip **50**. The guide rolls **190** are urged toward and against the adjacent strip edge **53** by pneumatic motors **200**, the motors **200** having connections **205** respectively to the axles **191**, and the guide rolls **190**a are likewise urged against the strip edge **53** by a pneumatic motor **200***a* acting through a connection **205***a* against a pivot **204***a* that in turn acts against connections **206***a* to the axles **191***a*.

Two bottom work rolls **250** are provided engaging the lower surface **55** of the strip **50** to deflect the same upwardly out of the predetermined path established by the feed rolls for the strip **50**. The upper surface **54** of the strip **50** is engaged by a top work roll **230** and an adjustable top work roll **240**, the work rolls **230** and **240** deflecting the strip **50** downwardly out of the predetermined path thereof. As illustrated, all the work rolls **230–240–250** are disposed between the movable edge guide rolls **190***a* and a cooperating pair of stationary edge guide rolls **170**, whereby the edge guide rolls **170** and **190***a* can be moved inwardly to engage strips **50** having widths substantially less than lengths of the work rolls **230–240–250**. The work rolls **230–240–250** also extend the entire width of the strip **50** so as to work the metal of the strip across the entire width of the strip **51** as the strip **50** moves across the various work rolls **230–240–250**. By utilizing elongated work rolls **230–240–250** that extend the entire width of the strip **50**, various widths of strip **50** can be conditioned therethrough from widths only slightly less than the longitudinal extend of the work rolls **230–240–250** down to very narrow widths thereof.

The strip conditioner **100** by means of the work rolls **230, 240** and **250**, applies combined stresses to the strip **50** in the area being worked that exceed the elastic limit of the material so that plastic working takes place. From FIG. **1**, it will be seen that the forces applied to each area of the strip **50** being worked is the result of (a) the stress produced by bending or flexing the strip about the surfaces of the work rolls **230, 240** and **250**, (b) the stress produced by deflecting the area being worked out of the datum path of the strip **50**, and (c) the tension produced in the strip **50** by the relatively small pulling force provided by any suitable device (not shown) for pulling or advancing the strip **50** through the strip conditioner **100** in the direction of the arrow **56**.

The amount of force required to advance the strip **50** through the strip conditioner **100** is relatively small so that the tensional force referred to above as item (c) is small. On the other hand the working of the strip **50** is primarily produced by the forces of items (a) and (b). The diameters of the work rolls **230, 240** and **250** are proportioned to the thickness of the strip **50** being worked and the physical properties thereof so that the flexure of the metal about the surfaces of the rolls will alone produce stresses exceeding the elastic limit of the material of the strip. Thus, the addition thereto of any tensional stress greater than zero will produce substantial plastic stretching of the area being worked, and in the present invention, that additional force is provided primarily by item (b) above, that is, by deflection of the work area out of the datum path.

During working of the strip **50**, the portion thereof not in engagement with the work rolls **230, 240** and **250** is held in a predetermined path by various surface engaging feed rolls to be described more fully hereinafter and also by the edge engaging rolls **170, 190** and **190***a*. As a result, any camber initially in the strip **50** will be relieved and removed.

There is shown in FIGS. **2** through **5** of the drawings a strip conditioner **100** which specifically embodies the principles of the invention which have been discussed above with respect to FIG. **1**. For purposes of clarity, the numerals utilized in FIG. **1** have also been utilized in FIGS. **2** through **5** to identify like parts. As illustrated, the strip conditioner **100** includes a top frame **101** supported upon a pair of end frames **110** and having in turn supported therefrom a bottom frame **121**. The top frame **101** is formed of two longitudinally extending angle irons **102** substantially parallel to each other and each having a vertical member **103** and a horizontal and outwardly extending member **104**. The angle irons **102** are interconnected at spaced points with cross members **105**, there also being provided four laterally extending plates **107** and a plurality of triangular shaped reinforcements **108** along the angle irons **102** (see particularly FIG. **2**).

The end frames **110** each includes a cross beam **111** supported by a pair of spaced apart vertical legs **112** extending downwardly therefrom. The cross beams **111** are secured to the adjacent ends of the top frame **101** by suitable bolts **113** extending through apertures in the cross beam **111** and into threaded openings in the adjacent ends of the vertical members **103** of the angle irons **102**. The lower ends of the legs **112** each carry a wheel **115** that is free to rotate upon an axle **116** mounted in the leg **112** adjacent to the lower end thereof. The axes of the axles **116** are arranged parallel to the longitudinal axes of the angle irons **102** and also parallel to the path of movement of the strip **50** through the strip conditioner **100**, i.e., parallel to the center line **51** of the strip **50**. As a consequence, the strip conditioner **100** is able to align itself automatically in a direction transverse to the direction of movement of the strip **50** therethrough, thereby always to keep the strip conditioner **100** automatically aligned with the strip **50** as it is pulled from a source thereof (typically a coil) through the strip conditioner **100** and to a subsequent processing station.

Mounted in each of the four corners of the top frame **101** and extending downwardly therefrom are guides **106** including integral bolts **130** shiftably to connect the bottom frame **121** beneath the top frame **101**. As illustrated, the bottom frame **121** also is formed of two longitudinally extending angle irons **122** that are substantially parallel to each other and disposed below corresponding angle irons **102** in the top frame **101**. Each angle iron **122** includes a vertical member **123** and an outwardly extending horizontal member **124**, the angle irons **122** being connected at suitable points with cross members **125**. Four plates **127** are disposed on the bottom frame **121** at spaced points therealong, and a plurality of triangular reinforcements **128** are provided along the length thereof between the angle iron members **123** and **124**.

The four bolts **130** have shanks **132** that extend below the guides **106** on the top frame **101** and through openings in the horizontal members **124**, the upper ends of the guides **106** being provided with a threaded shank (not shown) receiving hexagonal nuts **131** and the lower ends being threaded to receive a pair of hexagonal nuts 133 thereon (see FIGS. 4 and 5). A washer 134 is provided about the shank 132 and rests upon the top nut 133 and a compression spring 135 is disposed between the washer 134 and the adjacent surface of the associated horizontal member 124, the springs 135 being disposed about the associated shanks 132 and acting resiliently to support the bottom frame 121 below the top frame 101.

The bottom frame 121 can be moved upwardly toward and downwardly away from the top frame 101 under the control of four hydraulic motors 140 (see FIGS. 3, 4 and 5). Each of the hydraulic motors 140 includes a housing or cylinder 141 having an integral flange 142 which is used to mount the hydraulic motor 140 upon one of the plates 107 by means of bolts 144. Disposed in the cylinder 141 is a piston (not shown) to which is connected a piston rod 145 that carries at the bottom end thereof an eye 146 that is adjustable with respect to the piston rod 145. Four bolts 150 are provided and extend downwardly through openings in the adjacent horizontal member 124 and one of the plates 127. The upper end of each bolt 150 is threaded as at 151 and threadedly receives a U-shaped bracket 152 that carries a pin 153 extending through the eye 146 to interconnect the upper end of the bolt 150 to one of the piston rods 145. The lower end of the bolt 150 is also threaded as at 154 and receives a pair of nuts 155 and a washer 156 so as to support the adjacent part of the bottom frame 121. Suitable control mechanism (only partially illustrated) is provided for simultaneously actuating the hydraulic motors 140 so as to raise and lower the bottom frame 121 with respect to the top frame 101 as required.

There are provided four adjustable stops 160, each associated with one of the hydraulic motors 140, so as precisely to control the raised position of the bottom frame 121 with respect to the top frame 101 (see FIG. 3). As illustrated, a lower block 161 is provided for each adjustable stop 160 that extends upwardly from the adjacent horizontal member 124 and is fixedly mounted thereon by a bolt 162 extending through aligned openings in one of the plates 127 and the associated horizontal member 124. The upper end of the block 161 carries a reduced end 163 that serves as a fixed stop member for the adjustable stop 160. A block 166 is provided on the associated plate 107 and has a threaded opening therein in alignment with enlarged openings in the adjacent horizontal member 104 and plate 107. The block 166 threadedly receives a threaded adjustable stop member 165 that extends downwardly and in position to abut against the upper end of the fixed stop member 163. The vertical position of the lower end of the adjustable stop member 165 can be adjusted by turning an adjusting knob 167 fixedly secured thereto, and the adjusted position of the stop member 165 can be secured and fixed by means of a lock nut 168. It will be appreciated that the four adjustable stops 160 can be adjusted so as accurately to position the bottom frame member 121 with respect to the top frame member 101 upon actuation of the hydraulic motors 140.

The stationary edge guide rolls 170 described above with respect to FIG. 1 are in the machine of FIGS. 2 to 5 mounted upon the top frame 101 (see FIGS. 3, 4 and 5). The axle 171 for each of the rolls 170 is mounted in a J-shaped block including a top member 173, a side member 174 and a bottom member 175 spaced from but substantially parallel to the top member 173. The top member 173 carries a T-shaped key for engagement with a mounting block 180 positioned upon the top frame 101. More specifically, the mounting block 180 is secured beneath the angle irons 102 and has a T-shaped transverse opening therein that receives the T-shaped key on the associated J-shaped block 172. Referring specifically to FIG. 5, it will be seen that the axle 171 is vertically mounted in a block 172 with the upper end disposed in the top member 173 and the bottom end in the bottom member 175 with the roll 170 mounted for rotation about the axis of the axle 171. The block 172 has a vertically arranged opening 177 therein (see FIG. 4) which can be placed in alignment with one of six vertically arranged adjusting openings 182 in the block 180. As illustrated, the block 172 can be slid transversely with respect to the conditioner 100 and into registration with any selected one of the adjusting openings 182 in the block 180; a pin 185 is provided to hold the block 172 in the adjusted position with respect to the mounting block 180. It will be appreciated that with the pin 185 in place, and extending through aligned openings 182 and 177, the block 172 and its associated stationary edge guide roll 170 is fixedly positioned with respect to the center line of the strip conditioner 100.

Each of the stationary edge guide rolls 170 is mounted in the manner described above so that each of the edge guide rolls 170 can be adjusted toward and away from the center line of the strip conditioner 100. The parts in FIG. 4 are illustrated with the edge guide roll 170 disposed in its outermost position with respect to the center line 51 of the associated strip 50 to be conditioned. On the other hand, the parts in FIG. 5 are illustrated with the edge guide roll 170 positioned in its innermost position with respect to the center line of the strip conditioner 100, i.e., with respect to the center line 51 of the associated strip 50. It will be appreciated that by adjusting the edge guide rolls 170 toward or away from the center line of the conditioner 100, strips 50 of different widths can be conditioned using the strip conditioner 100. In order to accommodate this inward adjustment of the edge guide rolls 170 from the position of FIG. 4 to the position of FIG. 5, the edge guide rolls 170 are longitudinally positioned between the transversely extending rolls (to be described hereinafter) so as not to interfere therewith or require changing thereof in order to adjust the positions of the edge guide rolls 170. In fact the edge guide rolls 170 can be easily and quickly moved to the desired selected position by simply lifting out the pins 185, pushing the blocks 172 to the new desired selected position with respect to the blocks 180, and then reinserting the pins 185, this operation being quickly and conveniently accomplished without any disassembly of the strip conditioner 100 other than removal of the pins 185.

Referring now to FIGS. 3 and 5, the construction and mounting of the movable edge guide rolls 190 will be described. A J-shaped block 192 is provided for each of the rolls 190, the block 192 including a top member 193, a side member 194 and a bottom member 195 spaced from but generally parallel with the top member 193. The axle 191 is arranged vertically in the U-shaped block 192 and mounts the roll 190 thereon between the top member 193 and the bottom member 195 of the block 192. The top of the block 192 carries a T-shaped key that fits into the T-shaped transverse opening **181** in the associated mounting block **180** so that the block **192** is guided as it moves toward and away from the center line of the strip conditioner **100**, such movement being guided by the mounting block **180** and the cooperating T-shaped key **196** and T-shaped opening **181**.

The position of the movable roll is under the control of the air motor **200** described above, and to this end the air motor **200** is provided with a shaft **201** that is connected by the connection **205** to the block **192**. The air motor **200** is itself mounted upon the top frame **101** by means of a bracket **202**.

Referring to FIG. 4, the mounting of the movable edge guide roll **190a** is illustrated, it being pointed out that the mounting thereof is identical to the mounting of the movable edge guide roll **190** described above, whereby like numerals have been applied to like numbers for like parts with the addition of the suffix "*a*". It will be understood that suitable pneumatic controls (not shown) are provided so as to control the air motors **200** and **200***a* in such a manner as continually to press the movable rolls **190** and **190***a* against the adjacent edge **53** of the strip **50**, this action in turn pressing the other edge **52** of the strip **50** against the stationary guide rolls **170** described above. The air motors **200** and **200***a* are constructed and arranged so that they can bring the movable rolls **190** and **190***a* into engagement with the adjacent edge **53** of the strip **50** in any and all adjusted positioned of the stationary guide rolls **170** described above.

The top frame **101** has mounted thereon a plurality of top feed rolls **210** which serve to guide the strip **50** through the strip conditioner **100** and past the edge rolls **170, 190** and **190***a* and through the work rolls **230**, 240 and **250**. The rolls **210** are essentially cylindrical in shape and are mounted upon a cylindrical shaft **211** that in turn has the ends thereof mounted in bearings **212** that are attached to the associated horizontal members **104** by means of bolts **213**. Bottom feed rolls **220** that function in cooperation with the top feed rolls **210** are also provided, the bottom feed rolls **220** being mounted upon the bottom frame **121**. The feed rolls **220** are also cylindrical in shape and are provided with a central shaft **221** supported in bearings **222** that are secured to the associated horizontal members **124** by means of bolts **223**.

The lengths of the top feed rolls **210** are essentially equal one to each other and are also essentially equal to the lengths of the bottom feed rolls **220**, the axes of the feed rolls **210** and **220** being arranged transverse of the direction of movement of the strip **50** through the strip conditioner **100**. The maximum width of the strip **50** that can be handled by the strip conditioner **100** is limited by the length of the feed rolls **210** and **220**, the feed rolls **210** and **220** having lengths slightly greater than the maximum width of the strip **50** to be treated, see FIG. **4** for an illustration of the maximum width of strip **50** to be treated. As has been explained hereinabove, the edge rolls **170, 190** and **190***a* are disposed between the feed rolls **210** and **220** so that the edge guide rolls **170, 190** and **190***a* can be adjusted inwardly toward each other to handle narrow strips **50** as illustrated in FIG. **5**.

Four work rolls have been provided as illustrated and described with respect to FIG. **1**. The first work roll is a top work roll **230** having its axis of rotation essentially fixedly mounted upon the top frame **101** and more particularly the roll **230** is arranged to rotate with respect to the longitudinal axis of the central shaft **231** mounting the work roll **230**, the shaft **231** being in turn mounted by bearings (not shown) on the top frame **101**. Essentially the position of the work roll **230** is fixed and is such that it deflects the strip **50** downwardly with respect to a predetermined datum path established by the feed rolls **210–220**.

The bottom work rolls **250** are both mounted upon the bottom frame **121**, and more specifically are provided with shafts **251** that are mounted by means of bearings (not shown) on the bottom frame **121**. The axes of rotation of the work rolls **250** are essentially fixed with respect to the bottom frame **121** and in use the work rolls **250** serve to deflect the strip **50** upwardly with respect to the predetermined datum path established by the feed rolls **210–220**.

Finally, the adjustable top work roll **240** is provided mounted upon the top frame **101** and adjustable with respect thereto. More specifically, the adjustable work roll **240** is mounted upon a shaft **241** that in turn is journalled in a pair of plates **242**. One end of the plates **242** is pivoted as at **243** on blocks **244** fixedly secured to the top frame **101**. The other ends of the plates **242** can be adjusted toward and away from the predetermined datum path for the strip **50** determined by the feed rolls **210–220** by an adjusting knob **245** which acts through a shaft **246** to serve to move the left hand end of the plates **242** as viewed in FIG. 3 toward and away from the strip **50**. A dial **247** is also provided so as to indicate the distance that the surface of the adjustable roll **240** is depressed below the predetermined datum path established for the strip **50** by the feed rolls **210–220**. It will be appreciated that by turning the adjusting knob **245**, the amount of working imparted to the strip **50** by the adjustable work roll **240** can be adjusted, thereby to impart more or less working to the strip **50** as it passes through the work rolls **230–240–250**.

Finally there is provided a valve panel **260** (see FIG. 3) on which are mounted a valve **261** having a valve handle **262**, these parts diagrammatically illustrating the controls for the hydraulic motors **140** and the penumatic motors **200** and **200***a*.

In using the strip conditioner **100** to condition a metal strip **50**, the hydraulic motors **140** are operated to lower the bottom frame **121** to its lower position (as illustrated in FIG. **5**), wherein the bottom frame **121** and the parts supported thereon are resiliently supported upon the four springs **135**. The air motors **200** and **200***a* are also actuated to withdraw the movable edge guide rolls **190** and **190***a* to a retracted position. The width of the strip **50** to be conditioned is then ascertained and the positions of the stationary guide rolls **170** are adjusted so that the inner surfaces thereof lie along a straight line disposed from the center line of the conditioner **100** a distance equal to half the width of the strip **50** to be conditioned. This is accomplished by removing the pins **185** and shifting the blocks **172** with respect to the mounting blocks **180** until the appropriate adjusting opening **182** in the block **180** is in alignment with the opening **177** in the block **172**. The pins **185** are the reinserted. The adjustable stops **160** are adjusted for the thickness of the strip **50** to be processed and the adjustable work roll **240** has its position adjusted by means of the knob **245** in accordance with the work to be imparted to the strip **50**.

The leading end of the strip **50** is then passed through the conditioner **100** in the direction of the arrow **56** in FIGS. **1** and **2** and the leading end of the strip **50** is connected to the suitable next processing apparatus. The hydraulic motors **140** and the air motors **200-200***a* are then actuated to cause the feed rolls **210** and **220** to engage the surfaces **54** and **55**, respectively, of the strip **50** and to cause the edge guide rolls **170** to engage the edge **52** and to cause the edge guide rolls **190** and **190***a* to engage the edge **53.**

The feed rolls **210–220** support the strip **50** for longitudinal movement in the direction of the arrow **56** along a predetermined essentially planar datum path. The stationary edge rolls **170** engage the associated edge **52**, the edge **52** being pressed thereagainst through the action of the motors **200-200***a* pressing the movable guide rolls **190-190***a* against the opposite edge **53.** This action in connection with the operation of the work rolls also tends to eliminate camber from the strip **50** as it passes through the conditioner **100.**

The work rolls **230** and **240** contact the upper surface **54** and bend the strip **50** along the entire width thereof downwardly out of the predetermined datum path established by the feed rolls **210–220.** The work rolls **250** on the other hand bend the strip **50** upwardly out of the predetermined planar datum path established by the said rolls **210–220.** As a result, the work rollers **230–240–250** deflect the strip **50** across the entire width thereof out of the predetermined planar datum path in one direction and then in the other direction, then again in the one direction and again in the other direction so as to work the entire width of the strip plastically substantially throughout the thickness thereof.

When it is desired to condition a different width of strip **50**, the hydraulic motors **140** are actuated to lower the bottom frame **121** and the pneumatic motors **200-200***a* are actuated to retract the movable edge guide rolls **190-190***a*. After removal of any strip **50** left therein from the prior operation, the stationary edge guide rolls **170** can be adjusted to a new position by removing the pins **185** and sliding the blocks **172** to the new position and reinserting the pins **185**, so as to accommodate a different width of strip **50** for conditioning. The adjustable stops **160** and the adjustable top work roll **240** can also be adjusted as desired to accommodate the new strip **50.** Thereafter the hydraulic motors **140** are actuated to raise the bottom frame **121** and the air motors **200-200***a* are actuated to engage the adjacent edge of the new strip **50** now in position for feeding through the conditioner **100.**

From the above description it will be appreciated that the conditioner **100** can be used to condition a number of different widths of strip **50**, and that the conditioner **100** can be quickly changed to accommodate the different widths of strip **50.**

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it is intended to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. Apparatus for conditioning elongated metal strips of different widths without affecting the thickness thereof comprising means supporting the strip for longitudinal movement along a predetermined planar datum path without substantial tension being imparted to the strip, a pair of work rolls contacting the opposite surfaces of the strip and extending the entire width thereof in a direction transverse to the direction of movement thereof, one of said work rolls being displaced out of the predetermined planar datum path in one direction and the other of said work rolls being displaced out of the predetermined planar datum path in the other direction, said work rolls deflecting the strip across the entire width thereof out of the datum path in one direction and then in the other direction to work the entire width of the strip plastically substantially throughout the thickness thereof, the length of said work rolls being sufficient to accommodate a plurality of different widths of metal strip to be conditioned, a first set of edge guides engaging one longitudinally extending side edge of the strip to guide the said one edge of the strip in a predetermined direction through said supporting means and said work rolls, mounting structure for said first set of edge guides to mount the same at one of a plurality of selected distances away from the center line of the predetermined planar datum path to accommodate corresponding different widths of strips to be guided thereby, a second set of edge guides engaging the other longitudinally extending side edge of the strip to guide the other side edge of the strip in a predetermined direction through said supporting means and said work rolls, and mounting structure for said second set of edge guides to mount the same for movement of individual ones of said second set of edge guides toward and away from said first set of edge guides and continually to urge said second set of edge guides resiliently against the associated other side edge of the strip and thus to urge the one edge of the strip into firm guiding engagement with said first set of edge guides.

2. The apparatus set forth in claim **1**, wherein at least one of said work rolls is adjustable toward and away from the predetermined planar datum path for adjusting the amount of work imparted to the strip.

3. The apparatus set forth in claim **1**, wherein said edge guides are rolls mounted to rotate about axes disposed substantially normal to the predetermined planar datum path of the associated strip.

4. The apparatus set forth in claim **1**, wherein said edge guides are longitudinally spaced with respect to said work rolls, whereby said edge guides can be positioned inwardly with respect to the ends of said work rolls towards the center line of the predetermined planar datum path, thereby to accommodate relatively narrow strips therethrough.

5. Apparatus for conditioning elongated metal strips of different widths comprising means supporting the strip for longitudinal movement along a predetermined planar datum path, a pair of work rolls contacting the opposite surfaces of the strip and extending the entire width thereof in a direction transverse to the direction of movement thereof, one of said work rolls being displaced out of the predetermined planar datum path in one direction and the other of said work rolls being displaced out of the predetermined planar datum path in the other direction, said work rolls deflecting the strip across the entire width thereof out of the datum path in one direction and then in the other direction to work the entire width of the strip plastically substantially throughout the thickness thereof, the length of said work rolls being sufficient to accommodate a plurality of different widths of metal strip to be conditioned, a first set of edge guides engaging one longitudinally extending side edge of the strip to guide the said one edge of the strip in a predetermined direction through said supporting means and said work rolls, mounting structure for said first set of edge guides to mount the same at one of a plurality of selected distances away from the center line of the predetermined planar datum path to accommodate corresponding different widths of strips to be guided thereby, the individual ones of said edge guides in said first set of edge guides being mounted at a plurality of selected positions each disposed a predetermined distance from the center line of the predetermined planar datum path and being fixedly held in the selected position by readily changeable securing structures, a second set of edge guides engaging the other longitudinally extending side edge of the strip to guide the other side edge of the strip in a predetermined direction through said supporting means and said work rolls, and mounting structure for said second set of edge guides to mount the same for movement toward and away from said first set of edge guides and continually to urge said second set of edge guides against the associated other side edge of the strip and thus to urge the one edge of the strip into firm guiding engagement with said first set of edge guides.

6. Apparatus for conditioning elongated metal strip of different widths comprising means supporting the strip for longitudinal movement along a predetermined planar datum path, a pair of work rolls contacting the opposite surfaces of the strip and extending the entire width thereof in a direction transverse to the direction of movement thereof, one of said work rolls being displaced out of the predetermined planar datum path in one direction and the other of said work rolls being displaced out of the predetermined planar datum path in the other direction, said work rolls deflecting the strip across the entire width thereof out of the datum path in one direction and then in the other direction to work the entire width of the strip plastically substantially throughout the thickness thereof, the length of said work rolls being sufficient to accommodate a plurality of different widths of metal strip to be conditioned, a first set of edge guides engaging one longitudinally extending side edge of the strip to guide the said one edge of the strip in a predetermined direction through said supporting means and said work rolls, mounting structure for said first set of edge guides to mount the same at one of a plurality of selected distances away from the center line of the predetermined planar datum path to accommodate corresponding different widths of strips to be guided thereby, said mounting structure for said first set of edge guides including a mounting block disposed above and overlying the predetermined planar datum path and a guide block for each of said first edge guides slidably engaging the associated mounting block for movement toward and away from the center line of the predetermined planar datum path and a plurality of aligned openings in said blocks for receiving pins fixedly to position said first set of edge guides with respect to the center line of the predetermined planar datum path, a second set of edge guides engaging the other longitudinally extending side edge of the strip to guide the other side edge of the strip in a predetermined direction through said supporting means and said work rolls, and mounting structure for said second set of edge guides to mount the same for movement toward and away from said first set of edge guides and continually to urge said second set of edge guides against the associated other side edge of the strip and thus to urge the one edge of the strip into firm guiding engagement with said first set of edge guides.

7. Apparatus for conditioning elongated metal strips of different widths comprising means supporting the strip for longitudinal movement along a predetermined planar datum path, a pair of work rolls contacting the opposite surfaces of the strip and extending the entire width thereof in a direction transverse to the direction of movement thereof, one of said work rolls being displaced out of the predetermined planar datum path in one direction and the other of said work rolls being displaced out of the predetermined planar datum path in the other direction, said work rolls deflecting the strip across the entire width thereof out of the datum path in one direction and then in the other direction to work the entire width of the strip plastically substantially throughout the thickness thereof, the length of said work rolls being sufficient to accommodate a plurality of different widths of metal strip to be conditioned, a first set of edge guides engaging one longitudinally extending side edge of the strip to guide the said one edge of the strip in a predetermined direction through said supporting means and said work rolls, mounting structure for said first set of edge guides to mount the same at one of a plurality of selected distances away from the center line of the predetermined planar datum path to accommodate corresponding different widths of strips to be guided thereby, a second set of edge guides engaging the other longitudinally extending side edge of the strip to guide the other side edge of the strip in a predetermined direction through said supporting means and said work rolls, and mounting structure for said second set of edge guides to mount the same for movement toward and away from said first set of edge guides and continually to urge said second set of edge guides against the associated other side edge of the strip and thus to urge the one edge of the strip into firm guiding engagement with said first set of edge guides, said mounting structure for said second set of edge guides including a mounting block disposed above and overlying the predetermined planar datum path and a guide block for each of said second edge guides slidably engaging the associated mounting block for movement toward and away from the center line of the predetermined planar datum path and pneumatic motors connected to said guide blocks and continually urging the associated second set of second edge guides against the associated other side edge of the strip.

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