

Dec. 20, 1932.

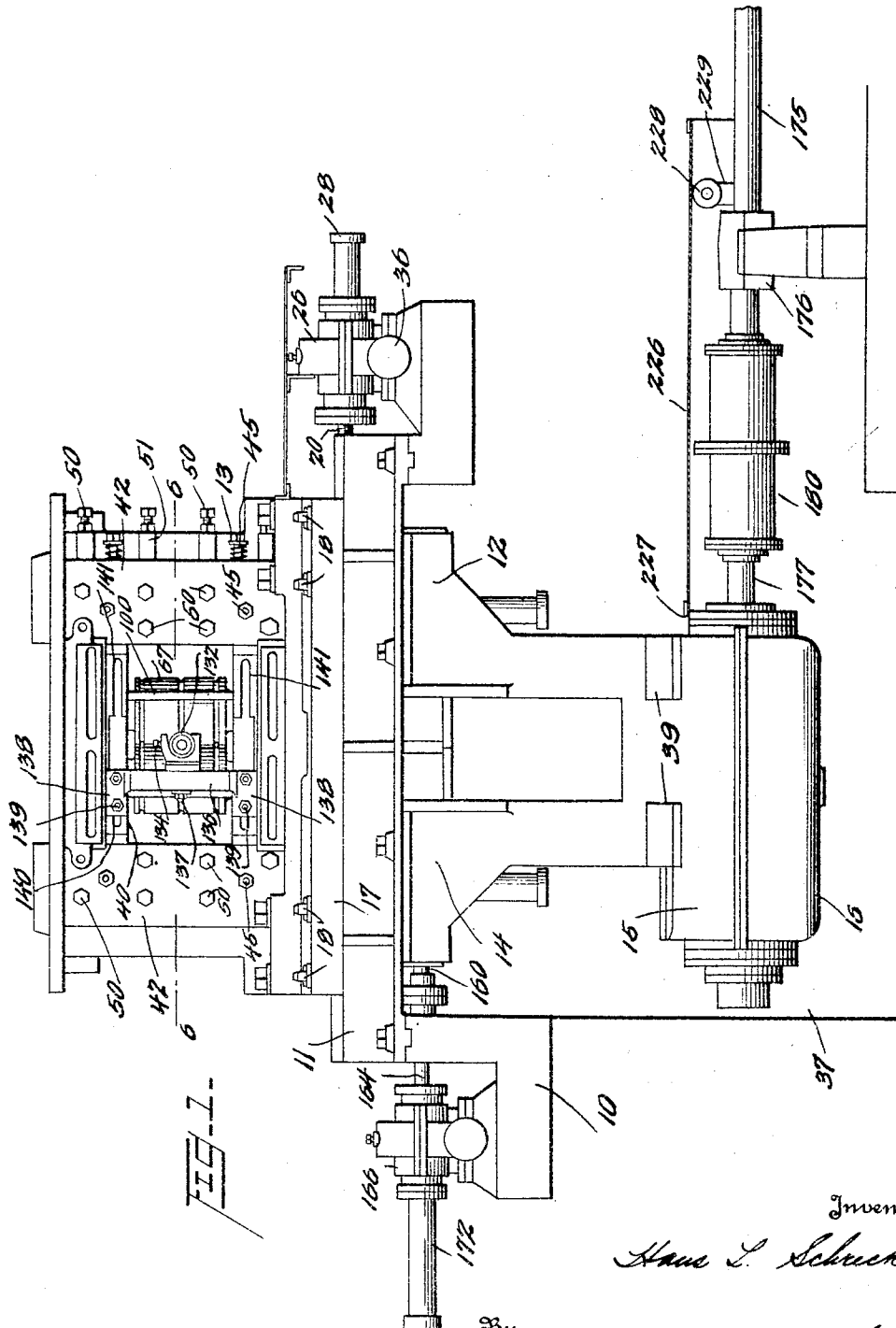
H. L. SCHRECK

1,891,579

ROLLING MILL

Filed March 22, 1930

9 Sheets-Sheet 1



Inventor

Hans L. Schreck,

Whitton, Critt, Morse & Brindle
Attorneys

Dec. 20, 1932.

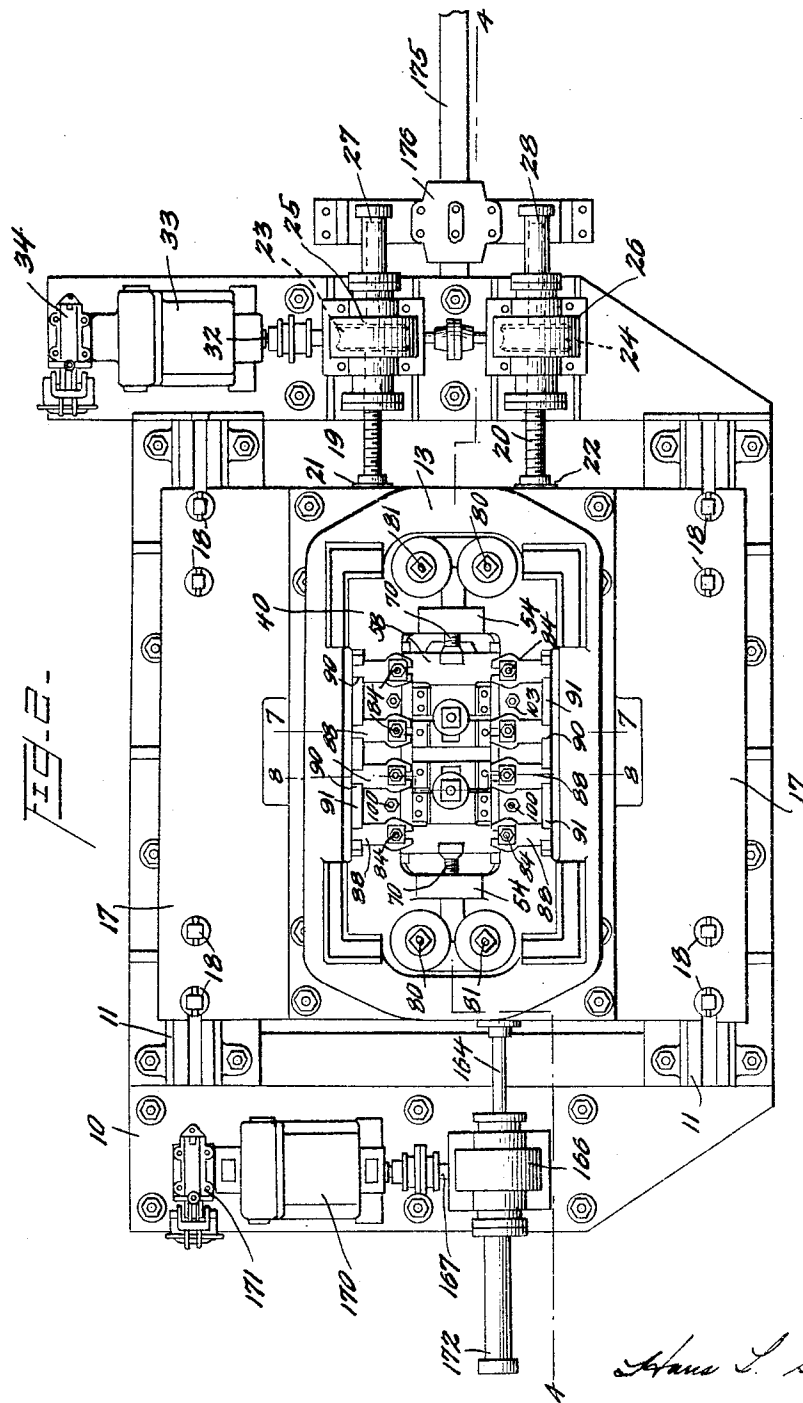
H. L. SCHRECK

1,891,579

ROLLING MILL

Filed March 22, 1930

9 Sheets-Sheet 2



Inventor

Hans L. Schreck

284

Whitton, Crit, Morse & Grindle
Attorneys

Dec. 20, 1932.

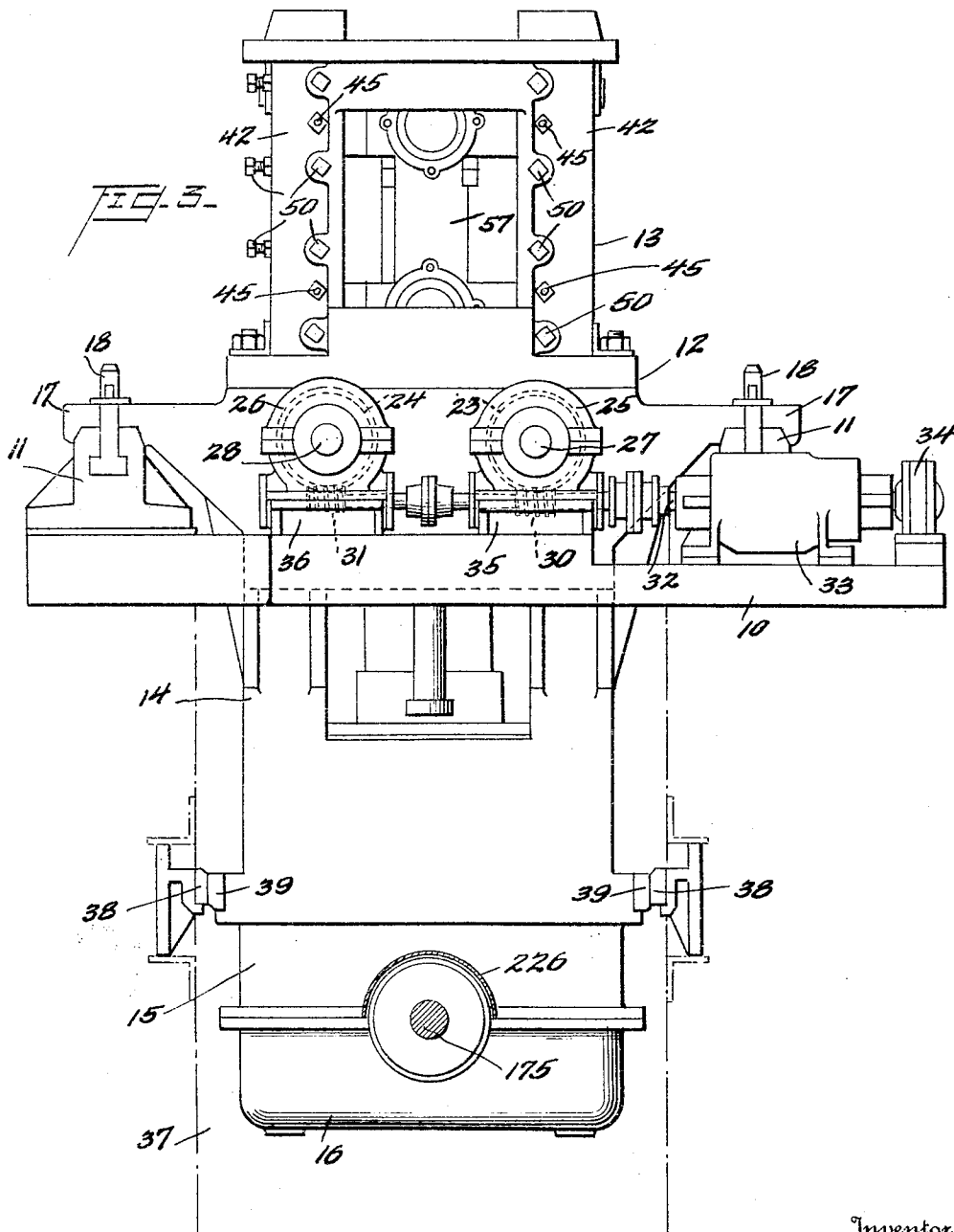
H. L. SCHRECK

1,891,579

ROLLING MILL

Filed March 22, 1930

9 Sheets-Sheet 3



Inventor

Hans L. Schreck,

By *Whitton, Coit, Morse & Brindle*
Attorneys

Dec. 20, 1932.

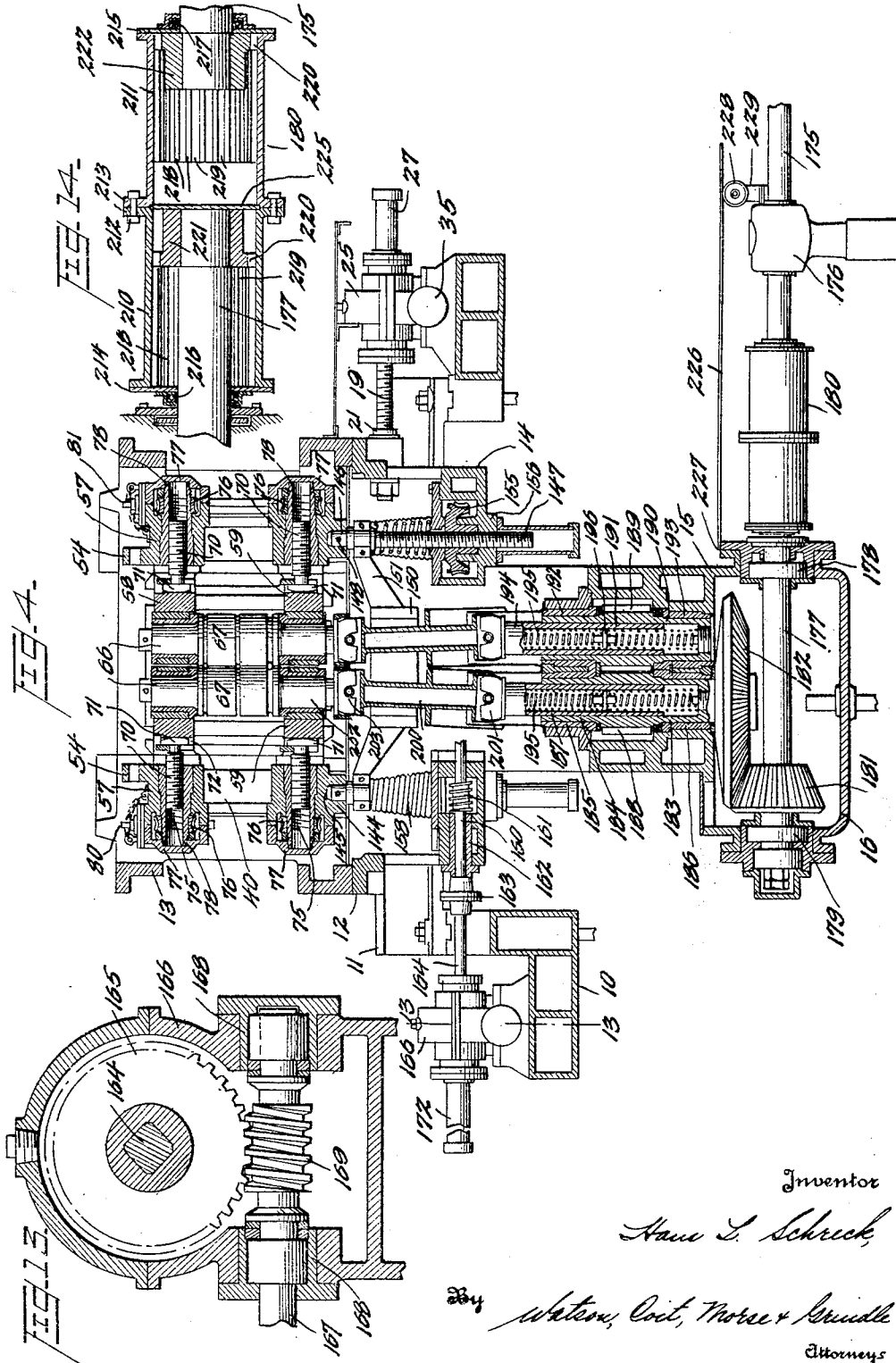
H. L. SCHRECK

1,891,579

ROLLING MILL

Filed March 22, 1930

9 Sheets-Sheet 4



Inventor

H. L. Schreck

Watson, Coit, Morse & Brundage
Attorneys

Dec. 20, 1932.

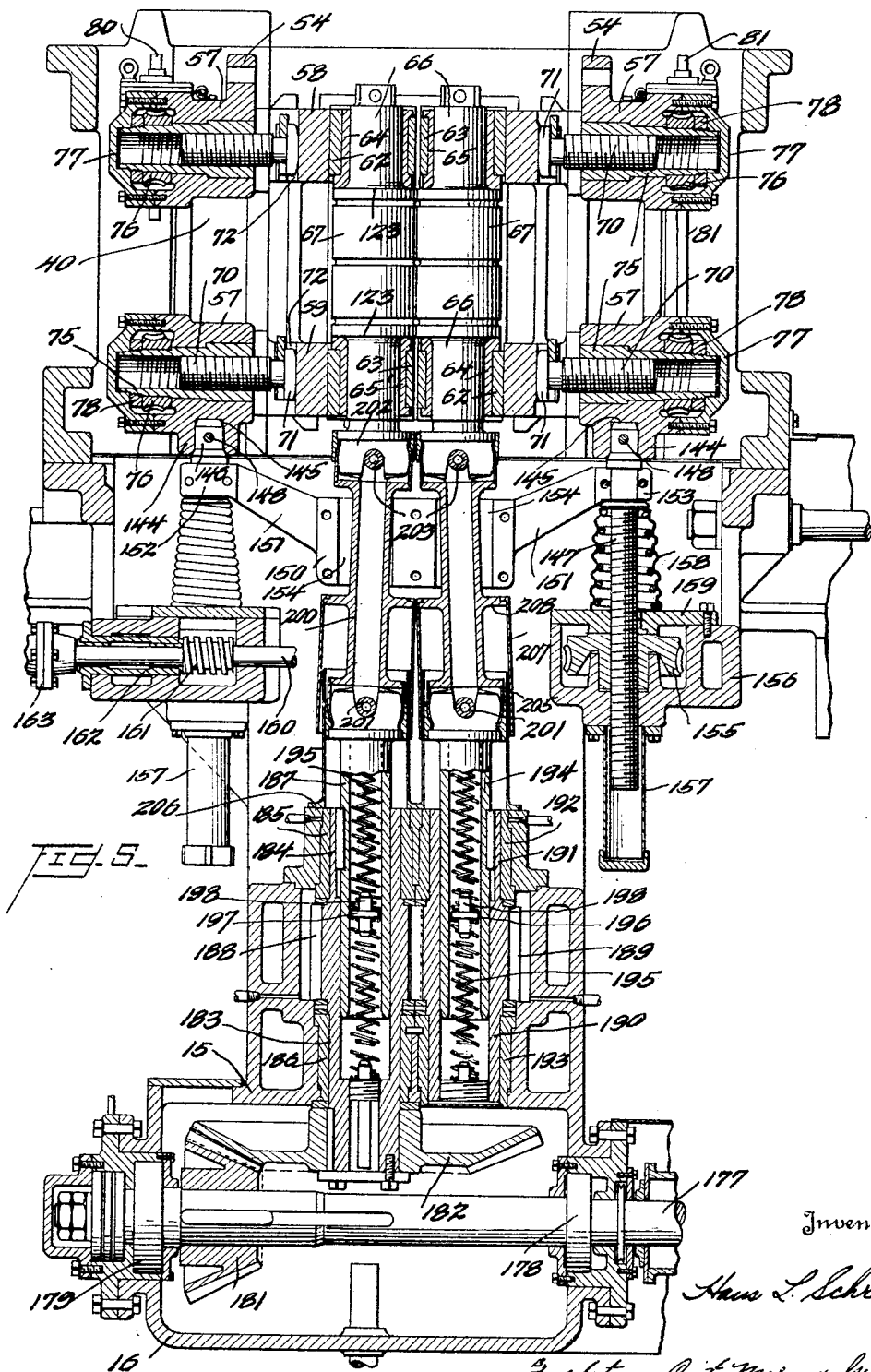
H. L. SCHRECK

1,891,579

ROLLING MILL

Filed March 22, 1930

9 Sheets-Sheet 5



Inventor

Hans L. Schreck,

Watson, Coit, Morse & Grundt
Attorneys

Dec. 20, 1932.

H. L. SCHRECK

1,891,579

ROLLING MILL

Filed March 22, 1930

9 Sheets-Sheet 6

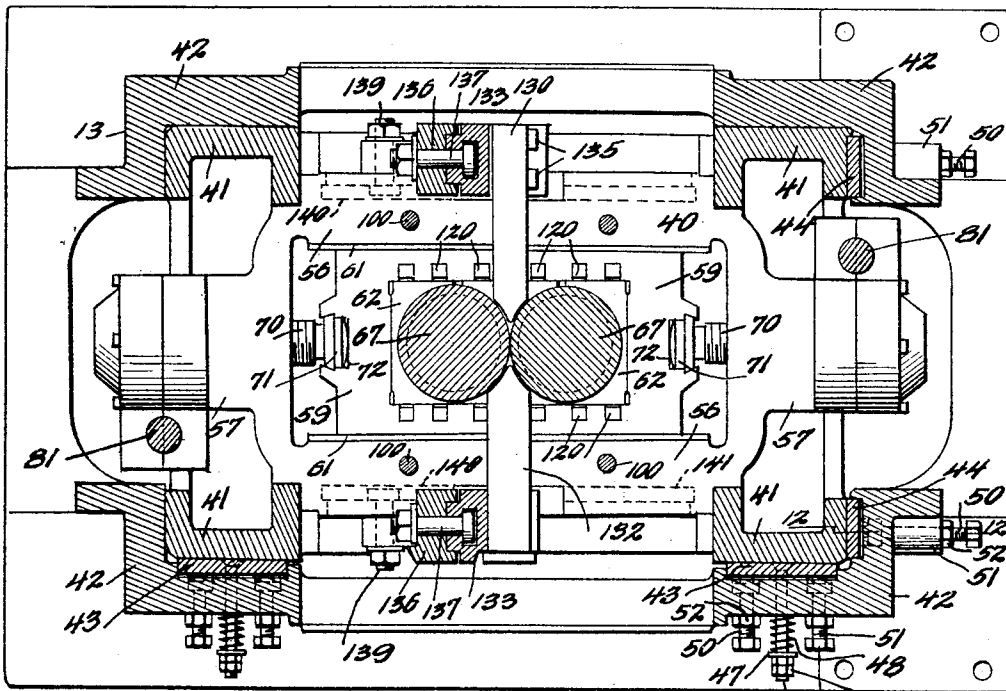
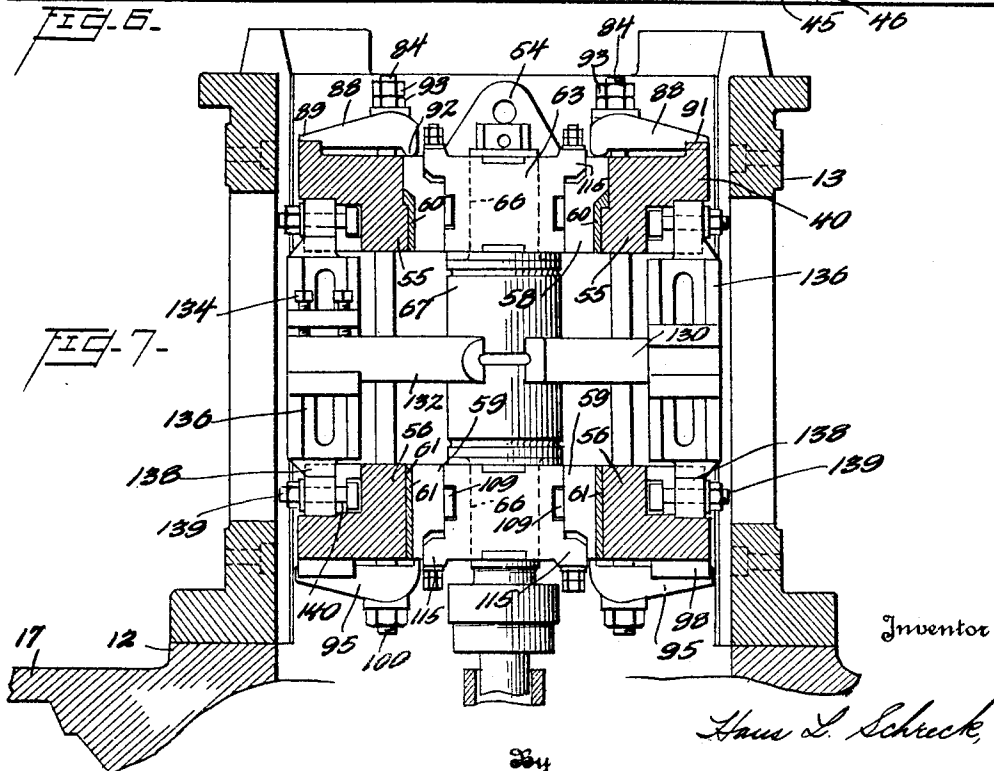


Fig. 6.



Inventor

Hans L. Schreck,

Watson, Coit, Morse & Grindle
Attorneys

Dec. 20, 1932.

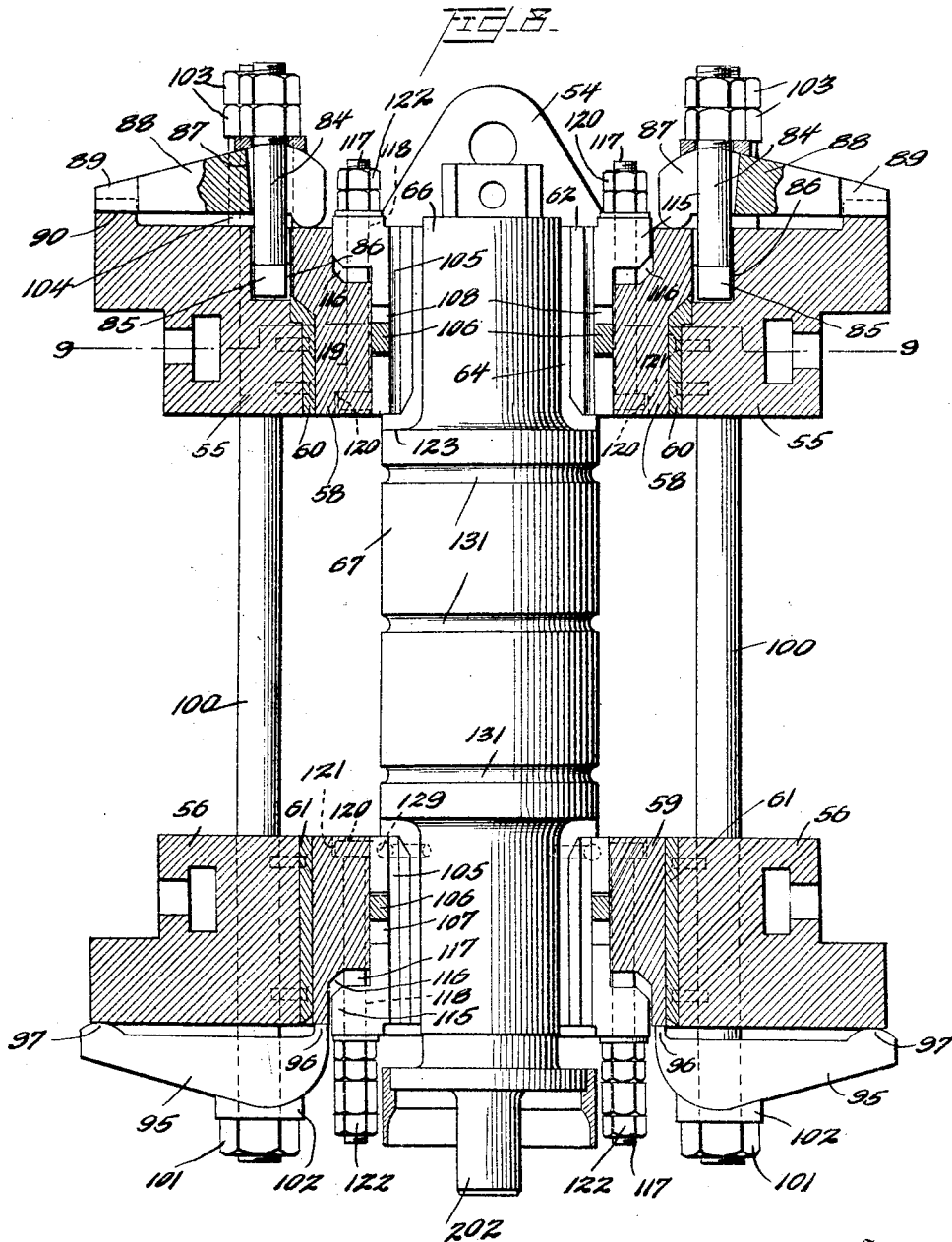
H. L. SCHRECK

1,891,579

ROLLING MILL

Filed March 22, 1930

9 Sheets-Sheet 7

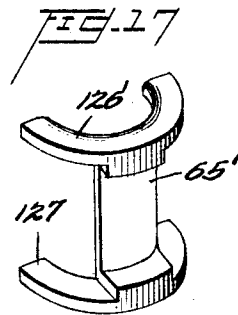
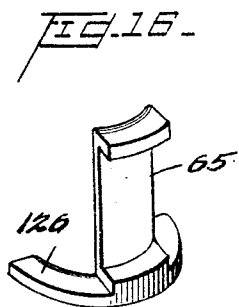
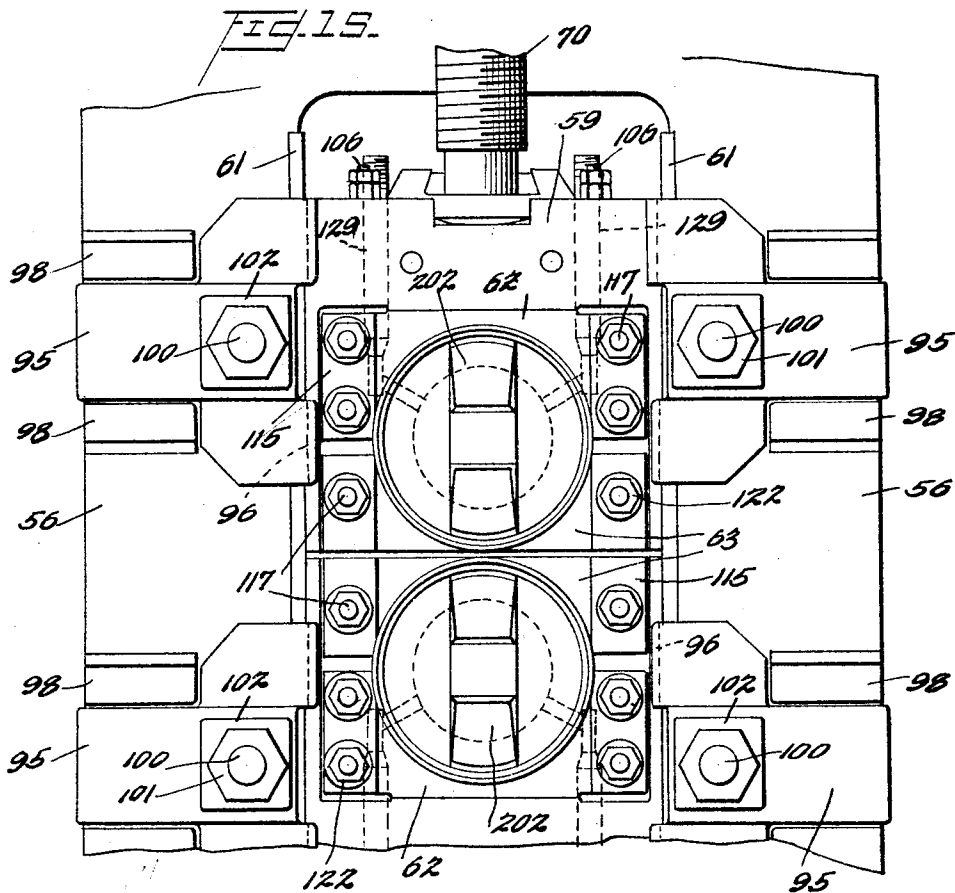


Inventor

Haus L. Schreck,

By

Water, Coit, Morse & Grindle
Attorneys



Inventor

Hans L. Schreck

By

Watson, Coit, Morse & Brindle
Attorneys

UNITED STATES PATENT OFFICE

HANS L. SCHRECK, OF EASTON, PENNSYLVANIA, ASSIGNOR TO TREADWELL ENGINEERING COMPANY, OF EASTON, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA

ROLLING MILL

Application filed March 22, 1930. Serial No. 438,098.

This invention relates to rolling mills and particularly to vertical mills adapted to be employed in rolling bars or like articles, and to be used either alone or in conjunction with an adjacent mill having horizontal rolls.

The principal object of this invention is the provision of a rolling mill of this type, wherein the parts requiring replacement, interchange or renewal may be readily removed from the mill housing and readily adjusted and secured therein.

More specifically, there is provided by means of this invention a unitary assembly of roll supporting elements, conveniently termed a cage, which is adapted to be removed from the housing as a unit, being slidably received therein and detachably connected with the adjusting and driving mechanism. Provision is also made for adjustably positioning a work rest or support on the cage for removal and adjustment therewith.

Another object is to provide novel means for laterally and vertically positioning the passes of the rolls by appropriate bodily movements of the mill housing and the roll supporting cage. Novel means are also provided for individually adjusting the roll bearings for the proper spacing of the rolls or for the reception of rolls of various diameters.

A further object is to provide in connection with the roll bearings, novel means for taking up wear and supplying lubricant thereto.

Still another object of the invention is to provide, in a rolling mill of this type, a power transmission mechanism for the rolls, which includes among other novel features extensible spindles arranged in a novel manner with respect to the position adjusting mechanisms and provided with dust guards.

Other objects and purposes will be apparent from the following specification when read in connection with the accompanying drawings in which one embodiment of my invention is set forth by way of example.

In the drawings,

Figure 1 is a front elevation of a rolling mill embodying the principles of my invention;

Figure 2 is a top plan view of the same;

Figure 3 is a side elevation of the mill;

Figure 4 is a transverse vertical cross-sectional view of the mill taken on line 4—4 of Figure 2 with certain parts thereof shown in elevation;

Figure 5 shows a portion of the mechanism shown in Figure 4 upon an enlarged scale;

Figure 6 is a horizontal cross-sectional view of the upper portion of the mill taken on line 6—6 of Figure 1;

Figure 7 is a vertical sectional view taken on line 7—7 of Figure 2;

Figure 8 is a vertical sectional view taken on line 8—8 of Figure 2;

Figure 9 is a fragmentary horizontal sectional view taken on line 9—9 of Figure 8;

Figure 10 is a fragmentary sectional view taken on line 10—10 of Figure 9;

Figure 11 is a similar view of the lower roll bearing;

Figure 12 is a vertical sectional view taken on line 12—12 of Figure 6;

Figure 13 is a vertical cross-sectional view taken on line 13—13 of Figure 4;

Figure 14 is a vertical, longitudinal, sectional view of the extensible main shaft coupling shown in elevation in the lower portion of Figure 4;

Figure 15 is a bottom plan view of the lower roll bearings; and

Figures 16 and 17 are perspective views of the upper and lower brasses respectively.

As best shown in Figures 1, 2, and 3, the numeral 10 designates generally a foundation member or pedestal which is provided with the shoes or guides 11 upon which is mounted for lateral sliding movement the housing designated generally by the numeral 12. The housing 12 comprises an upper portion 13 which is adapted to enclose the rolls, the intermediate portion 14 adapted to contain the greater portion of the transmission mechanism, and the lower portion 15 which is provided with a cover 16 and which is adapted to enclose the gearing which connects the main drive shaft with the transmission mechanism. The entire housing 12 is slung from the brackets 17 which are adjustable along the shoes 11, being securable there-

to when in adjusted position by means of the fastening elements 18.

Power driven means for moving the housing 12 along the shoes 11 are provided and comprise the two screw shafts 19 and 20, each of which is secured at one of its ends to the housing 13 as at 21 and 22 and is threaded axially through the worm wheels 23 and 24 contained in housing 25 and 26. The opposite ends of screw shafts 19 and 20 are adapted to reciprocate in the protective casings or guards 27 and 28. The worm wheels 23 and 24 are driven in unison by means of worms 30 and 31 carried by the shaft 32 which in turn is driven by the motor 33 and is further controlled by the magnetic brake 34 of any suitable type. The worms 30 and 31 are enclosed in housing and bearing members 35 and 36 respectively.

The intermediate portion 14 and lowermost portion 15 of the housing 12 are adapted to extend downwardly into a well or pit 37, the side walls of which are provided with cooperating guiding and centering elements 38 and 39, as shown in Figure 3. Mounted upon the foundation platform 10 on the opposite side of the mill from the lateral adjusting mechanism are disposed means for adjusting the rolls vertically which will be described hereinafter.

The upper housing portion 13 is provided with a substantially rectangular opening for the reception of the roll supporting frame or cage 40. The cage 40 is provided with corner frames 41 adapted to slidingly contact with the inner surfaces of corresponding corner members 42 of the upper housing 13. The corresponding surfaces of the frames at the opposite side of the housing are provided with the adjustable liners 43. Similar adjustable liners 44 are provided between the corner members 41 and 42 of the cage and housing respectively at one side of the mill. These liners 43 and 44 are resiliently urged toward the inner face of the housing corner frames 42 by means of the bolts 45 which are secured thereto and are adapted to pass loosely through perforations in the walls of the housing. The outer ends of these bolts 45 are provided with nuts 46 and washer 47, and a coiled compression spring 48 is disposed between the washer 47 and the outer surface of the housing wall. Bolts 50 are threaded through bosses 51 in the end wall of the corner frames 42 in the case of the liners 44 and through the front wall of the member 42 in the case of the liners 43. The inner ends of the bolts 50 are adapted to contact with the liners 43 and 44 and upon rotation of the bolts the liners may be moved inwardly toward the cage 40 or permitted to be retracted therefrom under the influence of the springs 48. Nuts 52 are provided for locking the bolts 50 in adjusted positions. Since the liners 43 are wider than the liners 44 they are

provided with two rows of adjusting bolts 50, whereas the liners 44 are provided with but a single row. Enlargements 53 are provided near the inner ends of the bolts 50 which act as stop members for preventing the complete withdrawal of the bolts from the frame member 42. It will be readily seen that by means of the arrangement just described the cage 40 may be rigidly clamped within the housing 13 after it is adjusted to the proper vertical position therein.

Lugs 54 are formed on the upper side frame member 57 of the cage 40 which are adapted to be engaged by suitable grapples whereby the cage may be lifted out of the housing 13.

As best shown in Figures 6 and 7 the cage 40 is provided with upper and lower transverse frame members 55 and 56 respectively, which, along with the end frame portions 57, enclose rectangular openings for the reception of bearing supporting frames 58. Wear plates or guides 60 are provided between the frames 55 of the cage 40 and the upper roll bearing frames 58 and similar plates or guides 61 are provided between the lower frame members 56 and the lower bearing frames 59. The bearing supporting frames 58 and 59 are generally U-shaped and the arms thereof are adapted to enclose the split bearing members 62 and 63 which carry the brasses 64 and 65 which are adapted to receive the reduced necks 66 of the rolls 67.

Means for adjusting the roll bearings laterally toward and from the center of the cage 40 are provided which include the screws 70 provided with heads 71 adapted to be received within the slotted portion 72 of the roll bearing frames 58 and 59. The screw shafts 70 are threaded within the tubular members 75 which are rotatably received within the upper and lower portions of the end members 57 of the cage 40. Rigidly secured to the tubular members 75 are the worm wheels 76 which are spaced from the cover members 77 attached to the portions 57 by means of the sleeves 78. The upper and lower worm wheels 76 on each side of the cage 40 are disposed one above the other and are rotated by means of separate operating shafts 80 and 81, to the upper ends of which a suitable tool may be applied for effecting this rotation. Shafts 80 are vertically disposed on one side of the upper worm wheels 76 and are provided with worms for meshing therewith and the shafts 81 are disposed on the opposite sides of the worm wheels and extend downwardly to the lower wheels 76 where they are operatively connected therewith by means of similar worms. It will thus be seen that independent lateral adjustments are provided for each upper and lower roll bearing.

For securing the upper roll bearing supporting frames 58 in adjusted position along the guides 60 there are provided the rela-

tively short rods or bolts 84 which are provided with T-shaped heads 85 adapted to occupy the slots 86 in the upper side frame members 55 of the cage. The shanks of these bolts or rods 84 are adapted to pass through the slots 87 of the forked cam levers 88, one of the ends 89 of each of which is adapted to be positioned in slots 90 cut in the raised edge 91 of the upper frame members 55 of the cage 40. The opposite forked end levers 88 are provided with cam portions 92 which are adapted to bear upon the upper surface of the side portions of the roll bearing supporting frames 58. Pressure is applied to the levers 88 for obtaining this clamping action upon the frames 58 by means of tightening the nuts 93 upon the upper ends of the shafts 84.

As shown in Figures 8 and 15, a somewhat similar arrangement for retaining the lower bearing supporting frames 59 is provided. Substantially Y-shaped levers 95 are provided with raised portions 96 adapted to bear against the lower exposed surfaces of the frames 59 and the cam portions 97 at the opposite ends of these levers which are adapted to bear against the lower surfaces of the side portions 56 of the cage 40, between the raised spacing portions 98. Tie rods 100 are adapted to pass through the levers 95, the lower cage frame members 56 and the upper cage frame members 55, their upper ends emerging at points between each pair of upper levers 88. Nuts 101 and washers 102 serve to retain the lower levers 95 upon the lower ends of the rods 100 and the nuts 103 are adapted to be tightened upon the upper ends of the shafts 100 to apply pressure to the lower roll bearing frames 59 in order to clamp them securely within the cage. The nuts 103 may be spaced from the upper surface of the upper cage frame member 55 by means of the sleeves 104. By means of the construction just described the upper and lower roll supporting frames 58 and 59 may be firmly secured in adjusted positions from readily accessible points at the top of the cage.

The bearing halves 62 and 63 are provided with tongue and groove connections shown at 105 and provision is made for contracting the bearings for taking up the wear on the brasses 64 and 65. This means includes the tie rods 106 which are adapted to pass through perforations 107 in the roll bearing supporting frames 58 and 59 and also through the marginal slots 108 formed in the side walls of the bearings 62 and 63. The slots 108 are made deeper than the width of the rods 106 to allow for the vertical movement of the bearings 62 and 63 provided by the wear take-up to be described. The tie rods 106 are provided with T-heads 109 which serve to retain the bearing halves 63, and at their other ends they are provided with washers 110 and nuts

111 which serve to retain the coiled compression springs 112 within the socket 113 formed in the supporting frames 58 and 59. It will be readily understood that the nuts 110 may be tightened to adjust the compression of the springs 112 to exert the proper force upon the rods 106 to retain the bearing halves in place.

In order to secure the bearing halves 62 and 63 in their proper vertical positions longitudinally of the rolls 67 they are provided with overhanging portions 115 which are adapted to occupy the space 116 at the edges of the members 58 and 59. Relatively short tie rods or bolts 117 are adapted to pass through the perforations 118 in these overhanging portions 115 and also through the slots 119 cut in the inner surfaces of the walls of the bearing supporting frames 58 and 59. These rods 117 are provided with enlarged heads 120 adapted to occupy the space 121 cut in the lower faces of the members 58 and in the upper faces of the members 59. By tightening the nuts 122 on the outer ends of the rods 117 the bearings and brasses may be drawn inwardly to take up any wear which might occur between the brasses and the roll shoulders 123. It will be noted that there are two rods 117 on each side of the bearing halves 62 and one on each side of the bearing halves 63 but any desired or appropriate number of these tightening devices may be provided.

It will be noted that the bearing brasses 64 are semicircular but that the opposite brasses 65 occupy but a small portion of the other half of the circumference of the bearing. The bearing members 63 are also cut-away as at 124 so that there are provided, on either side of each brass 65, chambers 125 for retaining oil, grease or other lubricant. As shown in Figures 10, 11, 16, and 17, the brass 65 which is disposed at the upper ends of the rolls is provided with a semicircular portion 126 which is adapted to occupy the space between the roll shoulders 123 and the lower surfaces of the upper bearing halves 63. A corresponding lower brass is designated 65' and in addition to being provided with a semicircular portion 126' is also provided with the lower semicircular portion 127 which is adapted to retain the lubricant within the bearing. It is of course not necessary to provide such a portion in connection with the upper brass 65 since the lubricant will be retained in the upper chambers by means of the lower portion 126. The lubricant may be supplied to the upper chambers through the orifice 128 and is adapted to be supplied to the lower chamber through the passage-ways 129 formed in the lower bearings and brasses as shown in Figures 8 and 9.

Referring particularly to Figures 1, 6, and 7, the numeral 130 designates a guide by which the rods or other articles to be rolled

are positioned so as to be carried through the passes provided in the grooves 131 of the rolls. As the rods issue from the passes they are adapted to be guided from the rolls by means of guides 132. These guides 130 and 132 are adapted to be clamped in the brackets 133 by any suitable means such as the set screw 134 in the case of the front or delivery guide 132 or the bolts 135 in the case of the rear or feed guide 130. The brackets 133 are adapted for vertical adjustment along the rest bars 136 to which they may be secured when in adjusted position by means of the bolts 137. The rest bars 136 are provided with upper and lower flanges 138 which are laterally adjustably secured to the upper and lower cage frame members 55 and 56 by means of the fastening elements 139, the heads of which are disposed in the slots 140. Similar slots 141 are provided on the other side of the vertical center line of the mill for the alternative reception of the rest bar and guides. Besides being vertically and horizontally adjustable with respect to the cage 40 and the rolls 67 these guides 130 and 132 are also adapted to partake of the lateral adjustment of the entire mill housing 12, and also of the vertical adjustment of the cage 40 which will now be described.

Upon the under surface of the end frame portions 57 of the cage 40 are formed bosses 144 provided with the sockets 145 which are adapted to receive the upper ends 146 of the vertical screw shafts 147. Pins 148 are adapted to be passed through the bosses 144 and the ends of the shaft for detachably securing the cage 40 to the shafts. A transversely and vertically split yoke 150 is provided with arms 151, the ends of which are adapted to be rigidly clamped around the shafts 147 near their upper ends between the collars 152 and 153. The body portion of the yoke 150 is provided with the openings 154 for the purpose to be later described.

The lower portions of the shafts 147 are adapted to be threaded axially through the worm wheels 155 which are carried by bearings in the portion 156 of the housing 14. The downwardly extending lower ends of the shafts 147 are adapted to protrude through the housing portion 156 and are protected by the casings or guards 157. In order to protect the upper part of the threaded portion of the shafts 147 during their vertical reciprocation in adjusting the cage 40, there are provided the bellows-like casings or guards 158, formed of helical springs which are preferably frusto-conical and covered with canvas or other suitable flexible material. The casings 158 in their fully extended positions are of greater height than the maximum exposed lengths of the threaded portions of the shafts 147 and are adapted to be compressed between the ends of yoke arms

151 and the cover plate 159 associated with the housing portion 156.

For the purpose of rotating the worm wheels 155 a shaft 160 is provided which is adapted to carry worm portions 161 which mesh with the worm wheels 155. The shaft 160 is mounted in bearings 162 carried by mill housing. A coupling member 163 is provided to connect the outer end of the shaft 160 with the squared shaft 164. The shaft 164 is adapted to pass axially through the worm wheel 165 in the housing 166 and is adapted to be rotated thereby but at the same time being capable of reciprocation there-through. The worm wheel 165 is driven by means of the shaft 167 mounted in bearings 168 within the housing 166 and provided with the worm portion 169. Shaft 167 is adapted to be rotated by means of the motor 170 and its starting and stopping to be further controlled by a suitable magnetic brake 171. In its movement through the worm wheel 165, the shaft 164 is adapted to protrude through the housing 166 and when it is thus extended it is protected by means of the guard 172. It will thus be seen that there is provided by the mechanism just described a means for raising and lowering the roll cage 40 within the upper portion 13 of the mill housing to secure the desired elevation of the passes 131 of the rolls so as to align these passes with the passes of an adjacent mill or for any other desired purpose, and at the same time to provide the necessary flexibility or extensibility of this elevating means to provide for its efficient operation at any laterally adjusted position of the mill housing 12 as effected by mechanism already described.

For the purpose of driving the rolls, there is provided a main drive shaft 175 which is adapted to be rotated by means of a suitable motor (not shown) adapted to be disposed to the right of Figures 1, 2, and 4. The shaft 175 is supported by the bearing 176 and is adapted to be connected to the shaft 177 carried by the bearings 178 and 179 disposed in the lower housing portion 15, by means of the extensible shaft coupling 180. This coupling is shown in detail in Figure 14 and will be described hereafter. Shaft 177 carries the bevel gear 181 which is adapted to mesh with the horizontally disposed bevel gear 182 secured to the lower end of the extensible spindle 183. Spindle 183 comprises the hollow lower portion 184, which is adapted to rotate in bearings 185 and 186 carried by the housing 15, and the member 187 which is telescopically received within the member 184. Members 184 and 187 are keyed together to rotate as a unit. Intermediate the two bearings 185 and 186 there is formed upon the spindle element 184 the gear teeth 188 which are adapted to mesh with the corresponding teeth 189 on the lower member 190 of the adjacent extensible spindle 191. Spindle 191 is rotatably mounted

in the bearings 192 and 193 and is adapted to receive the telescoping spindle member 194 similarly to the other spindle member 184. Members 191 and 194 are also keyed together
5 for unitary rotation.

The spindle members 194 and 187, and the corresponding members 191 and 194, are urged apart by means of the inner and outer pairs of coiled springs 195 contained within
10 the hollow interiors of these spindles. The upper and lower groups of springs within each spindle are spaced and centered by the followers 196 which comprise the disks 197 having projecting portions 198 on either side
15 thereof. The upper ends of the spindle members 187 and 194 are operatively connected with the lower ends of spindles 200 by means of the universal joints 201. Spindles 200 are adapted to pass through the openings 154 in
20 the yoke 150 and are operatively connected at their upper ends to the gudgeons 202 of the rolls 67 by means of the universal joints 203. As the rolls 67 are moved apart laterally by means of the adjusting shaft 70, it will be
25 seen that the spindles 200 will tilt laterally within the openings 154 and upon vertical adjustment of the cage 40 carrying the rolls, the universal joints 201 and 203 between the spindles and the rolls will be maintained by means of the extensibility of the spindles 183
30 and 190, the springs 195 therein tending continually to urge the upper portions 187 and 194 of the spindles upwardly toward the rolls.

In order to protect the universal joints 201 and the extensible spindle connections there are provided the upwardly extending guards 205 which are secured at their lower ends to
35 the portions 206 of the housing 15 and which extend upwardly closely adjacent to the universal joints 201. Guards 207 secured at their upper ends to the flanges 208 carried by the spindles 200 are adapted to extend downwardly and surround the upper ends of the
40 guards 205. Just sufficient clearance between the adjacent ends of the stationary guards 205 and the rotatable guards 207 is provided to permit the limited sliding, tilting, and rotating movement of the guard 207.

The extensible coupling 180 between the main shaft members 175 and 177 shown in cross-section in Figure 14, will now be described in detail. The coupling member 180
45 comprises essentially the two tubular members 210 and 211 which are connected by a series of bolts 212 which join the flanges 213 at the center of the coupling member 180. The ends of the tubular members 210 and 211 are closed by the plates 214 and 215 respectively, which carry packing devices 216
50 and 217 respectively through which shafts 177 and 175 are adapted to reciprocate. The walls of the members 210 and 211 are interiorly provided with ribs 218 between which are formed the grooves 219 within which the

teeth 220 of the members 221 and 222 are adapted to slide. The member 221 is keyed to the end of the shaft 177 and the member 222 is correspondingly keyed to the end of
70 the main shaft 175. It will be seen that, upon lateral movement of the housing 12 the coupling 180 will permit a driving connection to be maintained by the shafts 175 and 177 while the shaft 177 is moved along with the
75 housing 12 toward and from the shaft 175. However, a centrally disposed partition member 225 is provided between the halves 210 and 211 of the coupling 180 which is adapted to confine the ends of the shafts 175
80 and 177 to their respective coupling members 210 and 211 during lateral movement of the housing. The coupling member 180 may be supplied with a suitable lubricant which will be retained therein during the axial
85 movement of the shaft 177, by means of the packed end plates.

Above the shaft 175 and the coupling member 180 is disposed the cover 226, one end of which is secured to the housing portion
90 15 as at 227 and the other end is adapted to travel, during lateral adjustment of the housing, on the roller 228 carried by the bracket 229 which is supported by some stationary member such as bearing 176.

Although a preferred embodiment of my invention has been illustrated and described,
95 it is obvious that various changes and modifications may be made therein within the scope of the invention as defined by the following claims.

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

1. A rolling mill comprising in combination, a stationary support provided with a
105 horizontal trackway, a housing arranged for limited travel relative to said support, rolls and transmission mechanism enclosed within said housing, means mounted on said support for effecting said travel, means mounted
110 on said support and having an extensible connection with said rolls for effecting vertical adjustment thereof, a source of power for said rolls, and extensible means operatively connecting said source of power with
115 said transmission mechanism.

2. A rolling mill comprising in combination, a stationary support provided with a
120 vertical opening disposed over a well, a trackway along each side of said opening, a plurality of rolls and a transmission system therefor, an underslung housing for said rolls and transmission arranged for limited travel
125 along said trackway relatively to said support, a pair of guides mounted on the walls of the well below said support and adapted to contact with the lower part of said housing, means for driving the rolls, and means
130 for effecting said travel of the housing.

3. A rolling mill comprising in combination, a stationary support, guides on said support, a housing arranged for limited travel upon said guides, a motor on said support, a drive shaft on said support adapted to be driven by said motor and disposed at one end of said guides and at right angles thereto, worms on said shaft, a worm-wheel adapted to mesh with said worms, a screw shaft threaded axially through said wheel and adapted to be moved in either direction therethrough upon rotation of said wheel, one end of said screw shaft being secured to said housing, whereby lateral adjustment of said housing may be obtained, and rolls and transmission mechanism enclosed by said housing.

4. A rolling mill comprising in combination, a stationary support, guides on said support, a housing arranged for limited travel upon said guides, a motor on said support, a drive shaft on said support adapted to be driven by said motor and disposed at one end of said guides and at right angles thereto, worms on said shaft, a pair of spaced worm wheels adapted to mesh with said worms, screw shafts threaded axially through said wheels and adapted to be moved in either direction therethrough upon rotation of said wheels, one end of each of said screw shafts being secured to said housing whereby lateral adjustment of said housing may be obtained, and rolls and transmission mechanism enclosed by said housing.

5. The combination as set forth in claim 3, in which said drive shaft is provided with a magnetic brake.

6. In a rolling mill in combination, a stationary support, guides on said support, a housing mounted on said guides, rolls and transmission mechanism contained in said housing, means for effecting limited travel of said housing along said guides, a main roll driving shaft, a source of power for rotating said shaft, a shaft operatively connected with said transmission mechanism and projecting from said housing, and means for connecting the adjacent ends of said shafts comprising a coupling element slidingly and nonrotatably mounted thereon.

7. In a rolling mill, in combination, a plurality of rolls, a stationary foundation, a roll housing movable relatively thereto, means on said foundation for driving said rolls, means on said foundation for moving said housing, a cover plate having one portion thereof secured to said housing and movably supported at another portion by anti-friction means carried by said foundation.

8. In a rolling mill, in combination, a plurality of rolls and power transmission mechanism therefor, a housing adapted to contain and support said rolls, a roll supporting cage removably disposed in the upper part of said housing, a support for said cage

mounted on the lower portion of said housing and having a readily detachable connection with said cage, whereby said cage and the rolls carried thereby may be removed from said housing without disturbing said support.

9. In a rolling mill, in combination, a plurality of rolls and power transmission mechanism therefor, a housing adapted to contain and support said rolls, a roll supporting cage vertically adjustably and removably disposed in the upper part of said housing, a vertically adjustable support for said cage mounted on the lower portion of said housing and having a readily detachable connection with said cage, whereby said cage and the rolls carried thereby may be removed from said housing without disturbing said support.

10. In a rolling mill, in combination, a plurality of rolls and power transmission mechanism therefor, a housing adapted to contain and support said rolls, a series of vertically disposed rolls, a cage for supporting said rolls, said cage being vertically removable from the upper portion of said housing, a support for said cage and power transmission mechanism for said rolls carried by the lower portion of said housing, and readily detachable connections between said cage and support and between said rolls and said transmission mechanism, whereby said cage and rolls may be lifted from said housing without disturbing said support or said transmission mechanism.

11. In a rolling mill, in combination, a plurality of rolls and power transmission mechanism therefor, a housing adapted to contain and support said rolls and power transmission mechanism, a series of vertically disposed rolls, a cage for supporting said rolls, said cage being vertically adjustable within and vertically removable from the upper portion of said housing, a vertically adjustable support for said cage and vertically extensible power transmission mechanism for said rolls carried by the lower portion of said housing, and readily detachable connections between said cage and support and between said rolls and said transmission mechanism, whereby said cage and rolls may be lifted from said housing without disturbing said support or said transmission mechanism.

12. In a rolling mill, in combination, a plurality of rolls and power transmission mechanism therefor, a housing to contain and support said rolls, a roll supporting cage vertically adjustably disposed within the upper portion of said housing, a pair of worm wheels rotatably mounted on a portion of said housing, a pair of screw shafts threaded axially through said worm wheels, the upper ends of said shafts being connected to said cage, a worm shaft operatively

connected with said worm wheels, and means for driving said worm shaft, whereby said screw shafts may be moved vertically to secure vertical adjustment of said cage and rolls.

13. In a rolling mill, in combination, a plurality of rolls and power transmission mechanism therefor, a housing to contain and support said rolls, a roll supporting cage vertically adjustably disposed within the upper portion of said housing, a pair of worm wheels rotatably mounted on a portion of said housing, a pair of screw shafts threaded axially through said worm wheels, the upper ends of said shafts being connected to said cage, a worm shaft operatively connected with said worm wheels, means for driving said worm shaft, another worm wheel mounted on said worm shaft for rotation therewith, a second worm shaft meshing with said last named worm wheel, a motor, and a magnetic brake associated with said second shaft to control the rotation thereof.

14. In a rolling mill in combination, a stationary support, a roll housing horizontally movable relatively to said support, a roll supporting cage mounted for vertical adjustment in said housing, a worm wheel rotatably mounted in said housing, a screw shaft secured at one end to said cage and threaded axially through said worm wheel, a worm shaft rotatably carried by said housing and adapted to mesh with said worm wheel, a second worm shaft which is rotatably mounted upon said stationary support and is adapted to be driven by a motor and mesh with a second worm wheel which is also rotatably mounted upon said support, said first mentioned worm shaft being adapted to extend axially through said second worm wheel, and being longitudinally movable therethrough but constrained to rotate therewith.

15. In a rolling mill in combination, a housing adapted to contain and support the rolls and power transmission mechanism therefor, a roll supporting cage vertically adjustably disposed within said housing, a rotatable member mounted on said housing, a screw shaft threaded axially through said member for vertical reciprocation as said member is rotated in either direction, one end of said shaft being connected to said cage, means for rotating said member, and a dust guard for the exposed threaded portion of said screw shaft.

16. In a rolling mill in combination, a housing adapted to contain and support the rolls and power transmission mechanism therefor, a roll supporting cage vertically adjustably disposed within said housing, a rotatable member mounted on said housing, a screw shaft threaded axially through said member for vertical reciprocation as said member is rotated in either direction, one end

of said shaft being connected to said cage, means for rotating said member, and a deformable dust guard surrounding the threaded portion of said screw shaft between said rotatable member and said cage and adapted to expand and contract as said threaded portion increases and diminishes upon reciprocation of said shaft.

17. The construction set forth in claim 12 in which the screw shafts are connected near their upper ends by means of a rigid yoke.

18. In a rolling mill in combination, a housing adapted to contain and support the rolls and power transmission mechanism therefor, a plurality of vertically disposed rolls, a roll supporting cage vertically adjustably disposed within the upper portion of said housing, a pair of vertically movable shafts adapted to support said cage upon their upper ends, a transversely extending yoke rigidly connecting said shafts, a plurality of vertical spindles operatively connected to the transmission mechanism for driving said rolls, said yoke being provided with apertures through which said spindles are adapted to pass.

19. The construction set forth in claim 18 in which the rolls are laterally adjustable, the spindles are adapted to move laterally upon lateral displacement of said rolls, and the apertures in said yoke are laterally enlarged to provide clearance for the spindles in their lateral movement.

20. In a rolling mill, in combination, a roll mounted for axial adjustment, a relatively stationary source of power for driving said roll, transmission mechanism between said roll and said source of power including an extensible spindle, said spindle comprising hollow telescoping members within which is disposed a resilient compression element, whereby said spindle is rendered automatically extensible to maintain the driving connection with said roll when said roll is adjusted axially.

21. In a rolling mill, an extensible spindle adapted to transmit motion to a roll, comprising in combination, a pair of hollow telescoping members, the remote ends of which are closed, whereby a spring chamber of variable length is formed within said spindle and a coiled compression spring disposed in said chamber.

22. In a rolling mill, an extensible spindle adapted to transmit motion to a roll, comprising in combination, a pair of hollow telescoping members, the remote ends of which are closed, whereby a spring chamber of variable length is formed within said spindle, a plurality of compression spring coils disposed in said chamber, and a spring follower disposed between adjacent ends of said coils to space and center said coils.

23. In a rolling mill, a pair of extensible spindles adapted to transmit motion to a pair

of rolls, each comprising a pair of hollow telescoping members, the remote ends of which are closed, whereby a chamber of variable length is formed within said spindle, resilient means in said chamber to urge said members toward extended positions, the inner ones of each pair of telescoping members having an operative connection with said rolls and the outer ones being provided with intermeshing gears, and a gear mounted on the end of one of said outer members adapted to be operatively connected with a source of power.

24. In a rolling mill in combination, a housing, a roll supporting cage mounted in said housing for adjustment axially of the rolls, a pair of rolls mounted in said cage for adjustment toward and from each other, axially movable shafts for effecting the adjustment of said cage, a pair of extensible spindles rotatably carried by said housing in fixed spaced positions, said spindles being geared together and one of them operatively connected with a source of power, a second pair of spindles each having its respective ends operatively connected to an end of one of the rolls and an end of one of said extensible spindles, said second pair of spindles being adapted to tilt upon adjustment of said rolls, and a rigid yoke having its ends secured to said cage adjusting shafts and provided with intermediate bowed portions adapted to loosely embrace said tiltable spindles.

25. In a device of the class described, in combination, a transmission housing, an extensible spindle comprising a plurality of telescoping sections, the section at one end of said spindle being rotatably mounted in said housing, another spindle, one end of which is operatively connected to the other end section of said extensible spindle by means of a universal joint, a stationary tubular dust guard secured to and extending from said housing and adapted to surround portions of said spindles, another tubular dust guard secured to said second named spindle for rotation therewith and adapted to surround portions of said spindles and to telescope with and move angularly with respect to said first named dust guard.

26. In a device of the class described, in combination, an extensible spindle comprising a relatively fixed section and an axially movable section having a sliding connection therewith, a second spindle having one of its ends operatively connected with the adjacent end of said movable section of said extensible spindle by means of a universal joint, an extensible dust guard having one end secured to said second spindle and adapted to surround said sliding connection and said universal joint.

27. In a rolling mill in combination, a housing, a roll supporting cage adjustably

mounted in said housing, a guide for aligning the article being rolled with the grooves of the rolls, said guide being carried by and adjustable with said cage.

28. In a rolling mill in combination, a housing, a roll supporting cage slidably mounted for adjustment and ready removal from said housing, an adjustable rest bar carried by said cage and adjustable and removable therewith, and a guide adjustably mounted on said rest bar for aligning the article being rolled with the grooves of the roll.

29. In a rolling mill in combination, a housing, a roll supporting cage adjustably mounted in said housing, guide surfaces on said housing, corresponding guide surfaces on said cage and liners adjustably secured to one of said surfaces for rigidly clamping said cage within said housing.

30. In a rolling mill in combination, a housing, a substantially rectangular roll supporting cage slidably adjustably and removably mounted in said housing, cooperating guide surfaces on said cage and said housing near the corners of said cage, certain of said cooperating surfaces being provided with liners therebetween, said liners being resiliently urged toward one of said surfaces and adjustably movable away from said surface whereby said cage may be rigidly retained within said housing.

31. In a rolling mill provided with a housing having a slidably mounted roll supporting cage disposed therein, a liner adapted to be disposed between adjacent surfaces of said housing and said cage, said liner being resiliently retained by said housing by means of a plurality of headed bolts passing loosely through perforations in said housing and surrounded by coiled compression springs disposed between the outer surface of said housing and said heads, said liner adapted to be urged toward said cage surface by means of set bolts adjustably threaded through the wall of said housing and contacting with said liner.

32. In a rolling mill, a roll supporting cage, an upper and a lower roll bearing supporting frame laterally adjustably supported in said cage, and means for independently adjusting said frames, comprising screw shafts connected to said frames, hollow internally threaded members for actuating said screw shafts, and worm gearing for rotating said members.

33. In a rolling mill, a roll supporting cage, provided with a pair of upper horizontal ways and a pair of lower horizontal ways, a pair of upper roll bearing frames adjustable along said upper ways and a pair of lower roll bearing frames adjustable along said lower ways, a vertical roll mounted in bearings carried by each pair of corresponding upper and lower frames, a plu-

5 reality of cam levers fulcrumed on the upper and lower portions of said cage on each side of said frames and having cam surfaces adapted to bear upon said frames to retain them in fixed position after adjustment.

10 34. In a rolling mill in combination, a cage, upper and lower roll bearing supporting frames mounted in said cage for lateral adjustment, split bearings disposed in said frames, spring retracted tie rods for retaining said split bearings in said frames.

15 35. In a rolling mill in combination, a cylindrical roll having a neck portion and a shoulder portion at each end, a roll bearing supporting frame disposed at each end of said roll, a roll bearing at each end of said roll adapted to bear against said shoulders, said roll bearings being mounted in said frames so that they may be adjusted axially of said rolls to take up the wear on said bearing surfaces.

20 36. In a rolling mill in combination, a cylindrical roll having a neck portion and a shoulder portion at each end thereof, a roll bearing supporting frame at each end of said roll, a split bearing carried by each of said frames and surrounding each neck portion of the roll and adapted also to bear against said shoulders, means for resiliently and laterally adjustably retaining said split bearing within said frame, said means also serving to urge the halves of said split bearing toward each other to take up wear between said bearings and said necks, and means associated with said frames and bearings adjustable axially of said roll to take up wear between said bearings and said shoulder.

25 37. In a rolling mill, a roll bearing comprising a pair of bearing members, each provided with a brass adapted to contact with a portion of the roll, and lubricant reservoirs formed between said roll, said brasses, and said bearing members.

30 38. In a rolling mill, a roll provided with neck portions and shoulders between said neck portions and the body portion of the roll, a bearing for said roll comprising in combination, a pair of interfitting bearing members adapted to receive between them one of the neck portions of said roll, one of said bearing members being provided with a semicircular brass, and the other being provided with a brass which is adapted to contact with the roll neck for only a portion of its semicircumference, lubricant reservoirs formed between the ends of said brasses, the roll neck and one of said bearing members, said brasses being provided with flanges which provide bearing surfaces for the shoulders of the roll.

35 39. In a rolling mill, a roll bearing, comprising a pair of complementary bearing members, one of said bearing members being fitted with a semicircular brass adapted to bear against the roll neck, the other of said bearing members being provided with a brass,

the body portion of which is narrower than the semicircumference of the roll neck and is provided with upper and lower semicircular extensions whereby oil pockets are formed between said extensions on either side of said body portion.

40. A rolling mill comprising, in combination, a stationary support, guides on said support, a housing arranged for limited travel on said guides, a motor on said support, an internally threaded member rotatably mounted upon said support, means for preventing axial movement of said member, a driving connection between said motor and said member, a screw shaft threaded axially through said member and adapted to be moved in either direction therethrough upon rotation of said member, one end of said screw shaft being secured to said housing, whereby lateral adjustment of said housing may be effected, and rolls and transmission mechanism enclosed by said housing.

41. In a rolling mill, in combination, a plurality of rolls and power transmission elements, a support, a roll carrying frame vertically adjustably mounted in said support, an internally threaded member rotatably carried by said support, means for preventing axial movement of said member, a vertically disposed screw shaft threaded axially through said member, one end of said shaft being connected to said frame, and means for rotating said member whereby said screw shaft may be moved vertically to effect the vertical adjustment of said frames and rolls.

42. In a rolling mill or the like, in combination, a support, a member adjustably mounted on said support, mechanism for adjusting the position of said member comprising an extensible portion, and a dust guard for said extensible portion comprising a deformable sleeve adapted to be contracted and expanded in accordance with the position of said portion and provided with a resilient reinforcing member adapted to continually urge said sleeve toward its fully expanded position.

43. In a rolling mill, in combination, a plurality of rolls and a power transmission system therefor, a support, a roll carrying frame vertically adjustably mounted on said support, a pair of vertically axially movable shafts connected to said frame for effecting the adjustment thereof, a rigid yoke connecting said shafts and provided with apertures intermediate the length thereof, a plurality of vertical spindles operatively connected to the transmission mechanism for driving said rolls, each of said spindles being adapted to pass through one of said apertures.

44. In a rolling mill, in combination, a housing, a roll supporting cage slidably mounted for adjustment and ready removal

from said housing, an adjustable guide carried by said cage and being adjustable and removable therewith.

45. In a rolling mill, in combination, a roll, a support provided with a pair of ways, a roll bearing frame adjustable along said ways, and means for securing said frame in adjusted positions comprising a cam lever fulcrumed upon said support and having a portion adapted to bear upon said frame, and adjustable means for applying pressure to said lever comprising a bolt adapted to pass through said lever and having a head adapted to interlock with a portion of said support.

46. In a rolling mill, a roll supporting cage, provided with a pair of upper horizontal ways and a pair of lower horizontal ways, a pair of upper roll bearing frames adjustable along said upper ways and a pair of lower roll bearing frames adjustable along said lower ways, a vertical roll mounted in bearings carried by each pair of corresponding upper and lower frames, a plurality of cam levers fulcrumed on the upper and lower portions of said cage on each side of said frames and having cam surfaces adapted to bear upon said frames to retain them in fixed position after adjustment, means for applying pressure to certain of said levers comprising tie rods adapted to pass through the upper and lower portions of said cage, and means for applying pressure to other of said levers comprising bolts having T-shaped heads adapted to interlock with portions of said cage.

47. A rolling mill comprising, in combination, a stationary support or foundation, a housing arranged for limited travel in a horizontal direction relative to said support, rolls and transmission mechanism enclosed within said housing, means mounted upon said support and operatively connected with said housing for effecting said horizontal travel, and further means also mounted on said support and operatively associated with said rolls for effecting vertical adjustment thereof within said housing, and driving means for said rolls.

48. In a rolling mill, in combination, a plurality of vertical rolls, a cage provided with bearings for supporting said rolls, a housing provided with an opening in the top thereof through which said cage together with the rolls and bearings may be bodily lifted, means for adjusting the position of said cage within said housing, and vertically arranged extensible driving means for said rolls disposed beneath said cage.

49. In a rolling mill, in combination, a plurality of vertical rolls, a cage provided with bearings for supporting said rolls, a housing provided with an opening at the top thereof through which said cage together with the rolls and bearings may be bodily lift-

ed, means for adjusting the position of said cage within said housing, means for laterally adjusting said bearings relatively to said cage, whereby the size of roll used and the distance between said rolls may be varied, and flexible driving means for said rolls disposed beneath said cage and adapted to automatically accommodate themselves to the adjustments of said cage and of said bearings.

In testimony whereof I hereunto affix my signature.

HANS L. SCHRECK.

70

75

80

85

90

95

100

105

110

115

120

125

130