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Eibe et al.

[11] **3,864,954**

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[54] **ROLL CHANGERS**

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[52] **U.S. Cl.** **72/238,** 72/239

[51] **Int. Cl.** **B21b 31/08**

[58] **Field of Search** 72/238, 239

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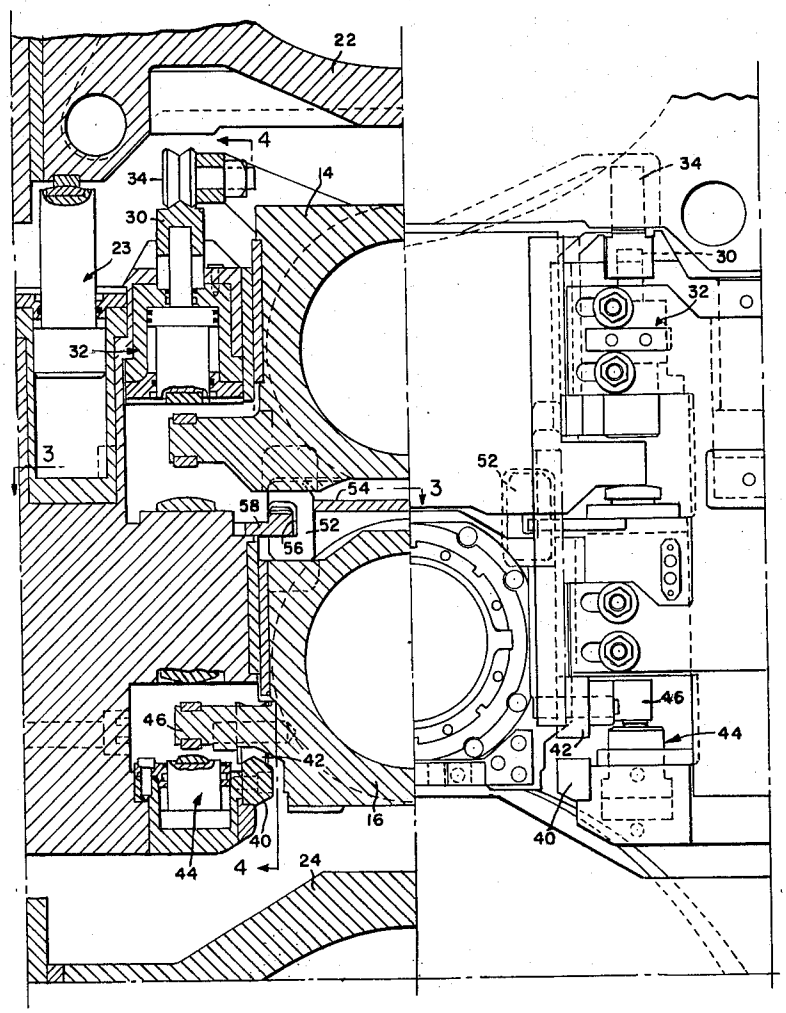
Attorney, Agent, or Firm—Smith, Harding, Earley & Follmer

[57] **ABSTRACT**

An automatic work roll changer for a continuous rolling mill in which stools are located on the operator side so that they can be positioned between the operator side work roll chocks and the drive work roll chocks as the work rolls are changed.

17 Claims, 8 Drawing Figures



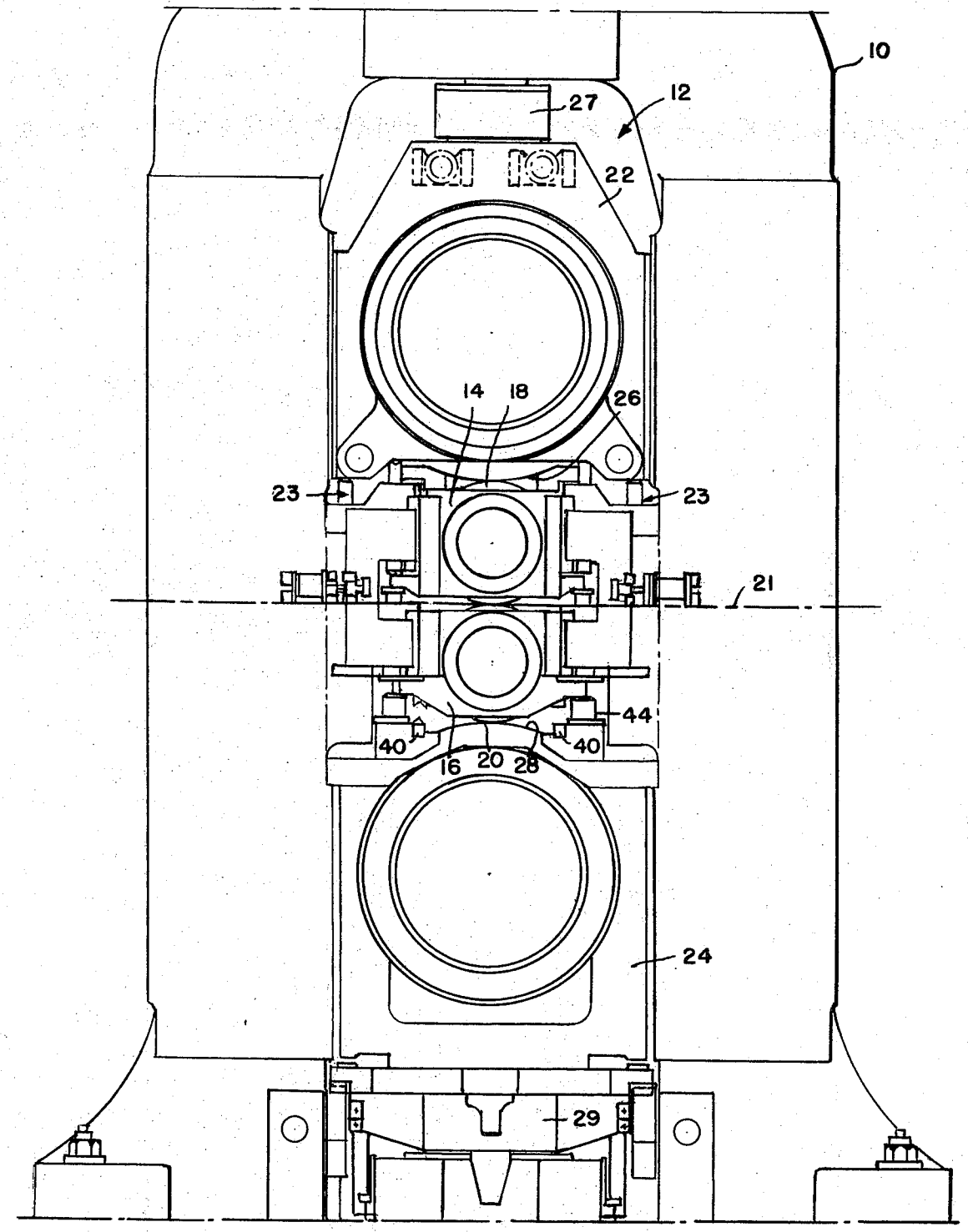
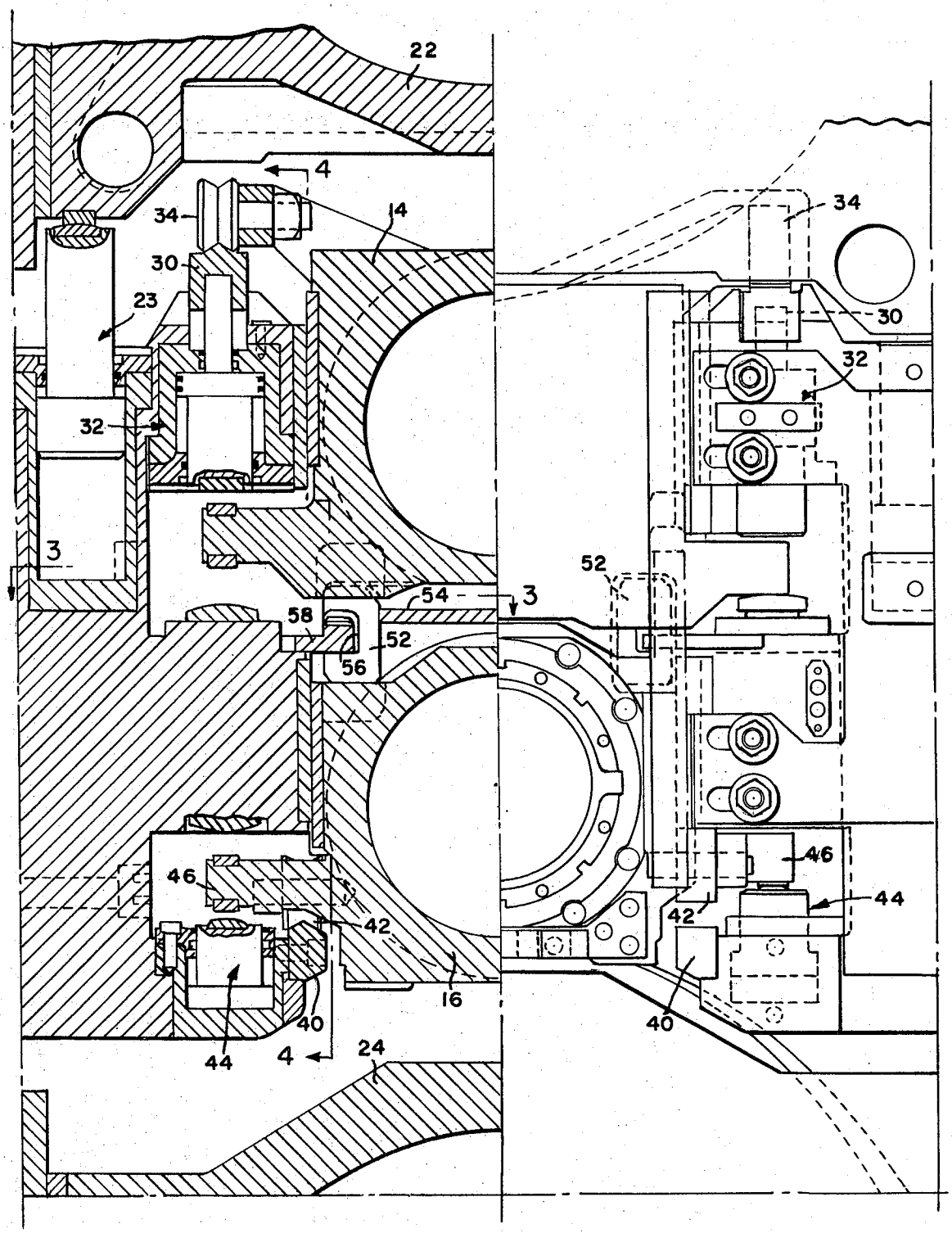


FIG. 1.


22
4
34
14
30
23
32
3
58
56
52
54
3
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34
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32
46
42
40
44
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24
16
46
44
42
40

FIG. 2.

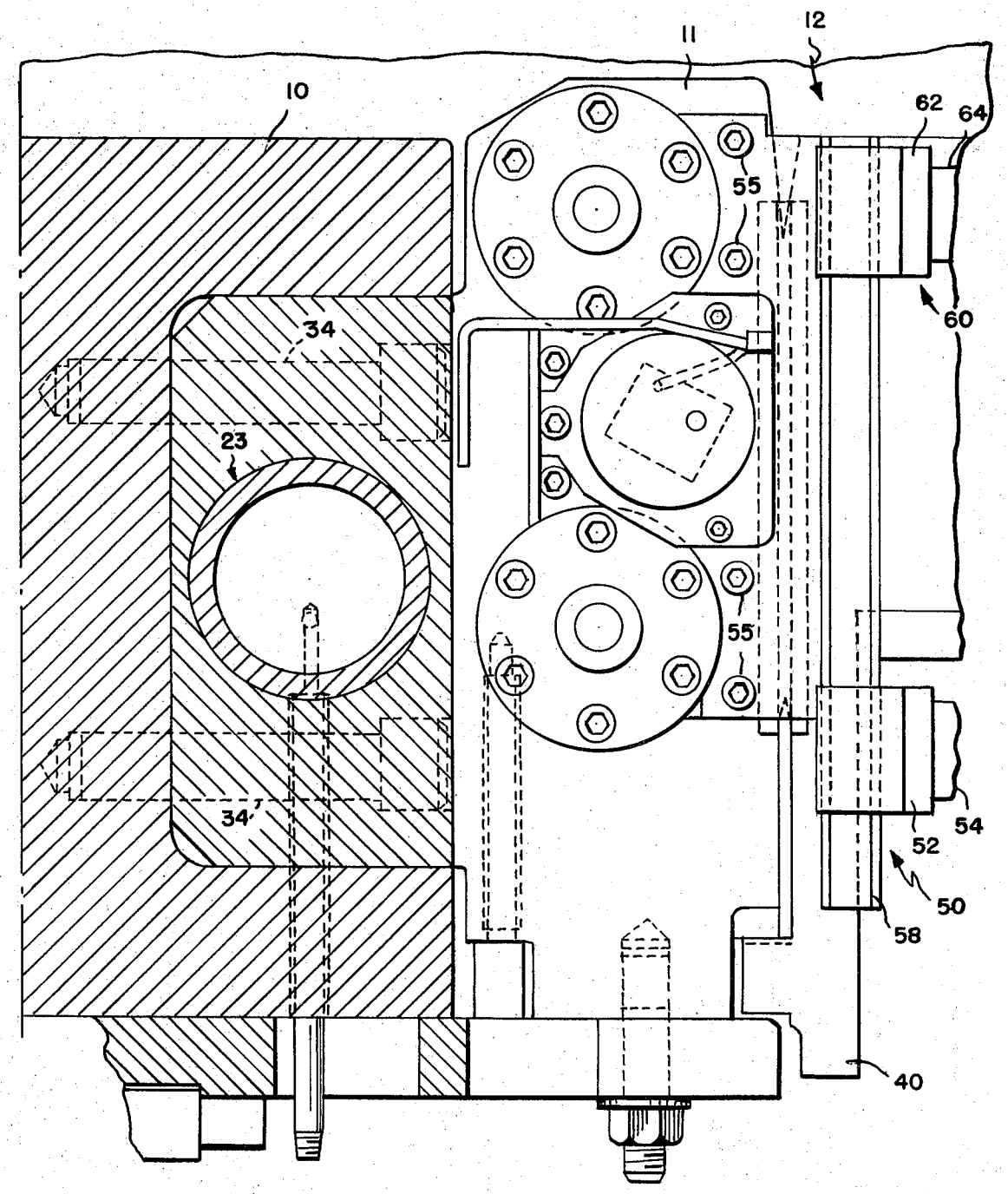

FIG. 3

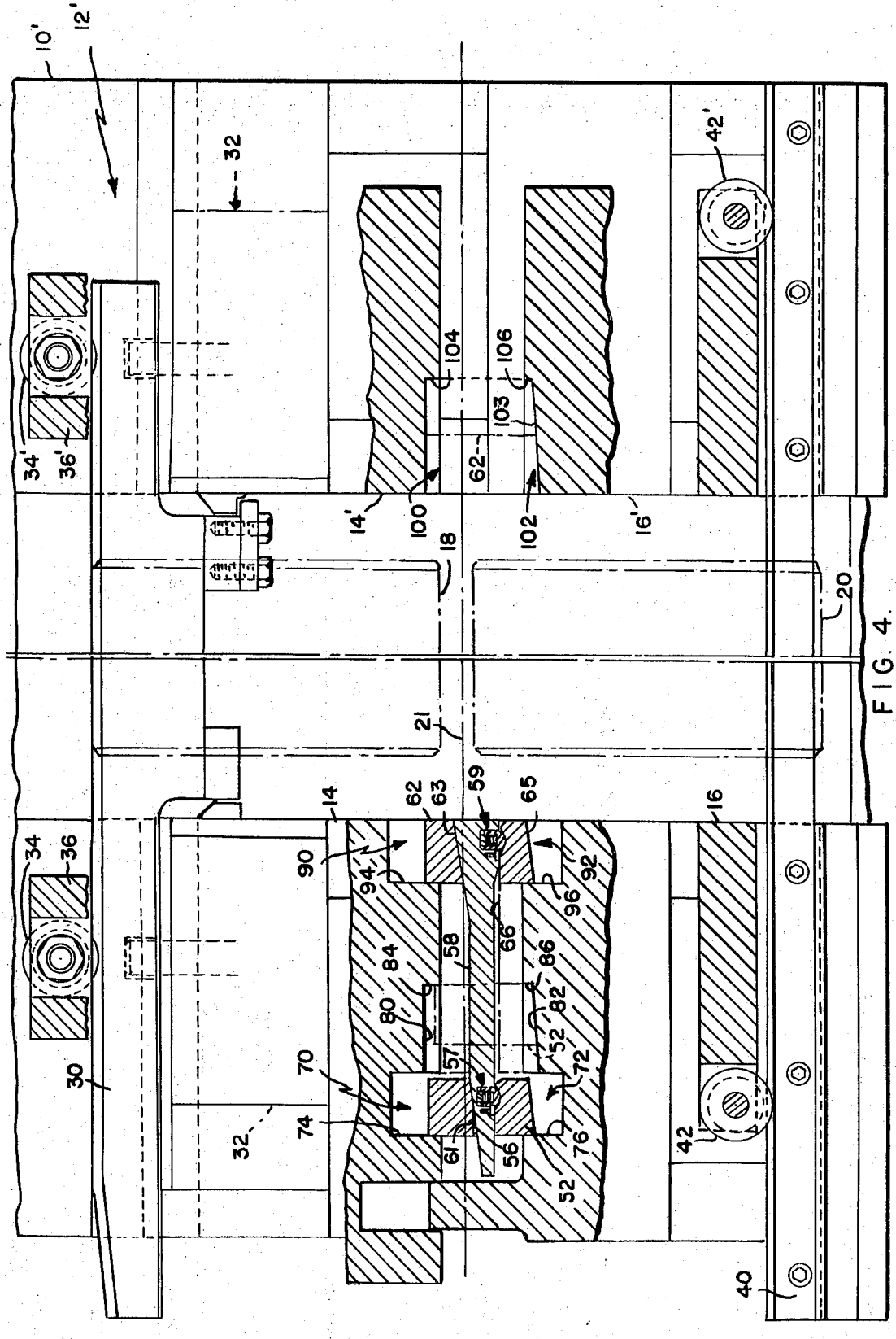
10'
12'
32
42'
34'
36'
104
106
103
62
14'
100
102
16'
18
20
21
14
62
63
59
65
16
34
36
90
94
92
96
66
58
84
86
82
80
52
57
72
70
74
61
56
76
52
30
32
42
40

FIG. 4.

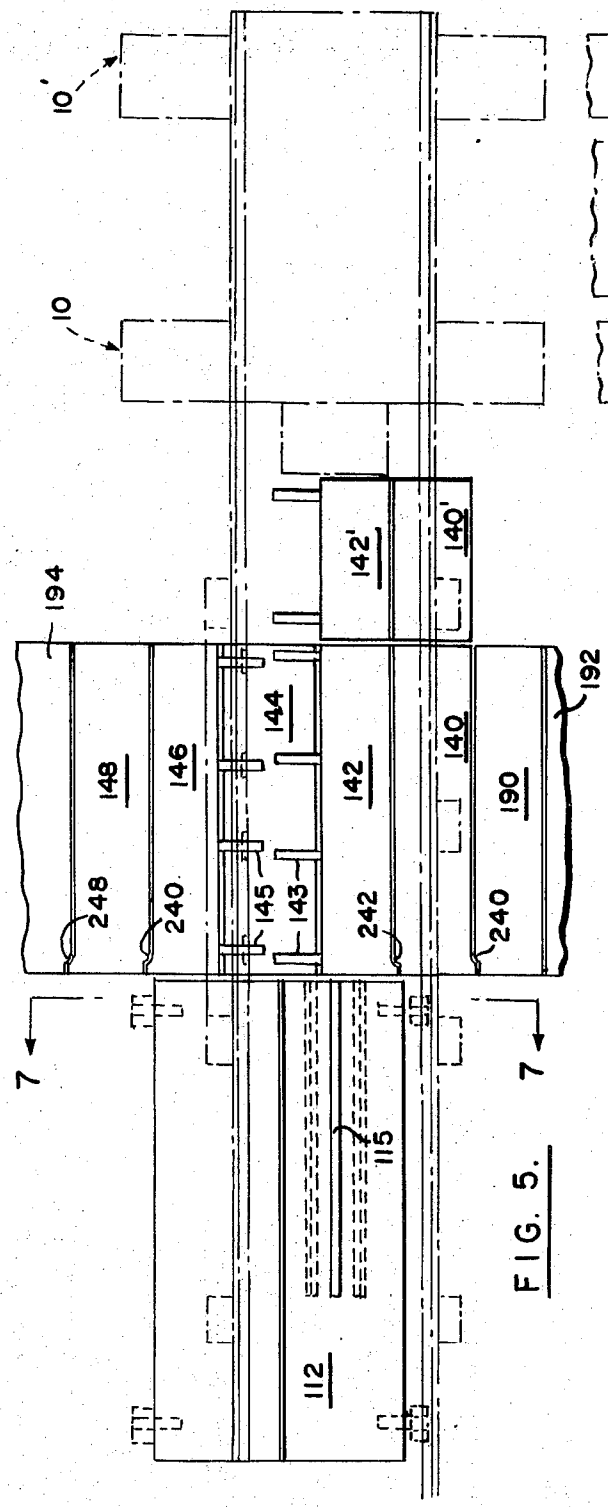
10'
10
194
148
146
144
142
140
190
192
142'
140'
248
240
145
143
242
240
7
7
112
115

FIG. 5.

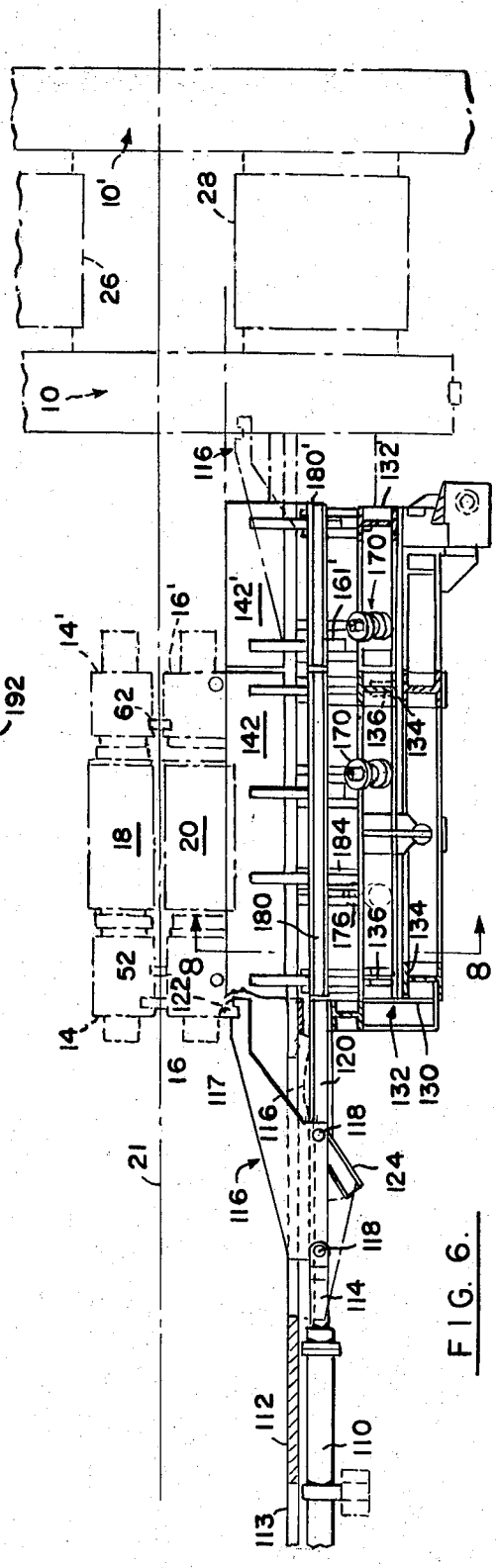
10'
10
28
26
116
180'
132
170
161'
142'
16'
14'
62
142
136
134
18
20
184
180
176
52
122
8
8
14
16
120
117
132
130
116
118
124
21
116
118
114
112
110
113

FIG. 6.

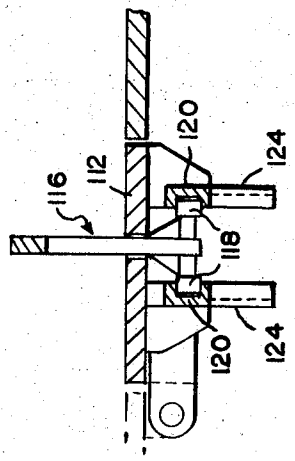
116
112
120
124
118
120
124

FIG. 7.

192
190
140
160
340
150
174
139
140
142
161
180
182
142
162
144
152
170
184
138
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156
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172
181
176
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167
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158
178
168
186
130
148
132

FIG. 8.

ROLL CHANGERS

BACKGROUND OF THE INVENTION

This invention relates generally to roll changers and particularly to apparatus for automatically changing the work rolls of a continuous rolling mill.

The problem of changing the work rolls of a rolling mill has become a manner of increasing importance in the efficient operation of modern rolling mills. With modern high speed rolling mills it is frequenly necessary to change work rolls several times each shift because of the changing nature of the orders available, because of steel analysis, or for any of a variety of reasons recognized in the trade. In the past, rolls were changed by overhead cranes using counterweighted yokes or cradles for individually handling a roll into and out of the rolling mill housing. Such methods were excessively wasteful of time and manpower. More recently, automatic work roll changers have been provided such as, for example, the roll changers shown in U.S. Pat. Nos. 3,698,226 and 3,699,796. However, such work roll changers cannot be used with continuous rolling mills since such mills always have some strip in the mill and it is necessary to move the work rolls and work roll chocks across the strip into and out of the mill without interferring with the strip.

Another problem in work roll changers is that the the location of a roll changing car on the floor of the mill in a roll changing position adjacent the mill makes this entire area inaccessible to workmen.

SUMMARY OF THE INVENTION

The present invention provides a roll changer design particularly adapted for the rapid automatic work roll changing of a continuous rolling mill. The roll changer in accordance with the invention has provision for supporting the work roll chocks and the work rolls supported thereby in a separated condition as it moves across the strip in the mill to avoid interference therewith and means for inserting stools between the operator side work roll chocks and between the drive work roll chock to maintain this separated condition as the work rolls are moved out of the mill for transfer to a roll changing car outside of the mill.

Briefly stated, the design in accordance with the invention comprises a rolling mill having upper and lower work rolls defining a passline for the strip to be rolled therebetween, an operator side mill housing defining a window, upper and lower work roll chocks for rotatably supporting the upper and lower work rolls and adapted to be removably mounted in said operator side housing, a mill housing on the drive side of the mill defining a window, an upper and lower work roll chock for rotatably supporting the upper and lower work rolls on the drive side of the mill and adapted to be removably mounted in said drive side housing window, means for supporting said work roll chock and said work rolls supported thereby in a separated condition during movement thereof inside of the mill housing, and means for supporting said work roll chocks and the work roll supported thereby in separated condition during movement outside of the mill housing, said last-named means comprising first stool means positioned within said operator side housing and adapted to be positioned between said operator side work roll chocks and second stool means positioned within said operator side housing and adapted to be positioned between said drive side work roll chocks.

In order to provide access to the mill during rolling in the roll changing area adjacent thereto, there is provided a roll changing car which is maintained under the floor of the mill during rolling and which includes floor plates providing the floor area. The roll changing car can be opened up to a roll changing position with the floor plates forming the rails on which the work rolls are supported outside the mill during the changing operation.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a fragmentary elevational view of the operator side housing of a rolling mill provided with the roll changer changing apparatus in accordance with the invention;

FIG. **2** is a vertical section of the work roll region of the rolling mill shown in FIG. **1**;

FIG. **3** is a sectional view taken generally on line **3—3** of FIG. **2**;

FIG. **4** is a sectional view taken generally on line **4—4** of FIG. **2**;

FIG. **5** is a plan view of the roll changing area;

FIG. **6** is a vertical section of the roller changing area;

FIG. **7** is a section taken generally on line **7—7** of FIG. **5**;

FIG. **8** is a sectional view taken generally on line **8—8** of FIG. **6**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. **1**, there is shown a mill housing **10** which is located on the operator side of the mill. Housing **10** provides a window **12** adapted to contain an upper work roll chock **14** and a lower work roll chock **16** which conventionally support an upper work roll **18** and a lower work roll **20**, respectively, which define a pass line **21**. Window **12** is also adapted to contain an upper back-up roll chock **22** and a lower back-up roll chock **24** which conventionally support an upper back-up roll **26** and a lower back-up roll **28**, respectively. As is conventional in the art, there is provided a screw-down means **27** at the upper end of the mill engaging the upper back-up roll chock **22** and a hydraulic force applicator **29** at the lower end of the mill engaging the lower back-up roll chock **24**.

At the drive side of the mill there is provided a mill housing **10'** which is similar to the housing **10**. As is shown in FIG. **4**, housing **10'** provides a window **12'** adapted to contain an upper work roll chock **14'** and a lower work roll chock **16'** which conventionally supports the upper work roll **18** and the lower work roll **20**, respectively. Window **12'** also contains upper and lower back-up roll chocks (not shown) as is conventional in the art.

A pair of spaced apart upper inside rails **30** are positioned within windows **12** and **12'** to extend from the drive side housing **10'** to the operator side housing **10**. Upper rails **30** are supported on a pair of hydraulic cylinder means **32** positioned in each of the housing **10** and **10'**, the rails **30** being supported on the upper end of the actuator rod of such cylinder means as is best shown in FIG. **2**. The upper work roll chocks **14** and **14'** are supported on the upper rails **30** by means of wheel means **34, 34'** carried on outwardly extending arms **36, 36'** of the work roll chocks **14** and **14'** extend-

ing arms 36, 36' of the work roll chocks 14 and 14' respectively.

The hydraulic cylinder means 32 serve to raise and lower the upper rails 30, and in turn the upper work roll chocks supported thereon, the raised position of the rails 30 being shown in the left side of FIG. 2 (the roll changing position) and the lower position of the rails 30 being shown in the right side of FIG. 2 (the normal rolling position). The hydraulic cylinder means 32 also serve as a "crown out" force applicator means for the upper work roll.

A pair of spaced apart lower inside rails 40 are positioned within the windows 12 and 12' to extend from the drive side housing 10' to operator side housing 10. Lower rails 40 are mounted, by means of bolts, on the housing means 10 and 10' directly below wheel means 42, 42' mounted on the lower work roll chocks 16 and 16'. A pair of hydraulic cylinder means 44 mounted in each of the housing members 10 and 10' are raised to engage outwardly extending ears 46 on the lower chocks 16 and 16' to raise and lower the chocks between the lower position shown on the left side of FIG. 2 and the upper position shown on the right side of FIG. 2. At the left side of this figure the wheel means 42 rest on the lower rails 40 whereas at the right side the wheel means 42 are spaced above the rails 40 during the rolling of the mill. The cylinder means 44 also serves as the "crown-out" cylinders for the lower work rolls 20, such cylinder means applying a force to the work rolls to reduce the crown thereof.

By means of the above-described construction, the inside rails 30 and 40 in cooperation with the wheel means associated with the work roll chocks serve to support the upper and lower work rolls 18 and 20 for movement into and out of the mill in the region between the mill housings 10 and 10'. Moreover, such arrangement provides that the work roll chocks are maintained in a separated condition whereby the chocks 14' and 16' at the drive side of the mill can be moved passed the strip extending along the pass line 21 which would be the case in a continuous rolling mill.

In accordance with the invention, novel means are provided from maintaining the work rolls in this separated condition when they are outside of the mill to permit an automatic work roll change. To this end, there are provided an operator side stool means 50 comprising a pair of stools 52 interconnected by a rod 54, each stool having a cutout 56 formed therein to fit around a pair of stool supporting rails 58 mounted by bolts 55 on an insert 11 in housing 10. Rails 58 are located within the window 12 at a location between the work roll chocks 14 and 16.

There is also provided a drive side stool means 60 essentially the same as operator side stool means 50 and comprising a pair of stools 62 interconnected by a rod 64, each stool 62 having a cutout portion 66 formed therein so as to fit around the rails 58.

Operator side work roll chocks 14 and 16 are provided with opposed cavities 70 and 72, respectively adapted to receive operator side stools 52. The stools 52 would be contained within the cavities 70 and 72 during a rolling operation. As shown in FIG. 4, in the roll changing condition of the work roll chocks 14 and 16, the vertically extending outer walls 74 and 76 of cavities 70 and 72 serve to limit the movement of the stools 52 relative to the chocks 14 and 16 in the direction toward the ouside of the mill.

Chocks 14 and 16 are provided with opposed cavities 80 and 82 respectively, which join with cavities 70 and 72 respectively and extend therefrom in the direction toward the inside of the mill. Cavities 80 and 82 are constructed to permit relative movement between chocks 14 and 16 and the stools 52 between the solid line position and the dashed line position shown in FIG. 4. Cavities 80 and 82 are provided with vertically extending walls 84 and 86, respectively, which serve to limit such relative movement at the dashed line position. Each cavity 82 is provided with an inclined bottom wall which contacts a similar inclined bottom wall on each stool 52 during the relative movement.

A spring biased latch means 57 is mounted on each rail 58 and is arranged to engage a latch cavity in each stool 52 for holding the same on the rail 58 at the solid line position shown in FIG. 4. The rails 58 are provided with an inclined top surface portion 61 which cooperates with a similar poriton of the cutout 56 to limit the movement of the stools 52 along the rails 58 in the direction toward the inside of the mill at the solid line position shown in FIG. 4.

The operator side work roll chocks 14 and 16 are also provided with opposed cavities 90 and 92 respectively, adapted to receive the drive side stools 62, such stools being adapted to be contained within the cavities 90 and 92 during a rolling operation. As shown in FIG. 4, in the roll changing position of the work roll chocks 14 and 16, vertically extending walls 94 and 96 of cavities 90 and 92 respectively serve to limit movement of the stools 62 relative to chocks 14 and 16 in the direction toward the outside of the mill. Cavities 90 and 92 are open in the side facing the inside of the mill.

Spring biased latch means 59 are mounted on each of the rails 58 and arranged to engage an associated latch cavity in each stool 62 for holding the same on an associated rail 58 at the solid position shown in FIG. 4. Each of the rails 58 is also provided with an inclined top surface portion 63 above the latch means 59 which cooperates with an associated cutout 66 of an associated stool 62 to limit the relative movement of the stool 62 on the rail 58 at the solid line position shown in FIG. 4.

The drive side work roll chocks 14' and 16' are provided with a pair of opposed cavities 100 and 102, respectively, which are aligned with cavities 90 and 92 and are open on the side facing those cavities, i.e., the inside of the mill. Cavities 100 and 102 have vertical walls 104 and 106 respectively which are adapted to engage a vertical wall of the stools 62 and an inclined bottom wall 103 adapted to contact an inclined bottom wall 65 of each stool 62. By this arrangement as the drive side work roll chocks 14' and 16' are moved toward the outside of the mill (to the left as viewed in FIG. 4), each stool 62 is moved into the cavities 100 and 102 to come to rest at the position indicated by the dashed line showing of stool 62 in FIG. 4. The manner in which this is accomplished and the purpose thereof during a work roll changing operation will appear hereafter.

Work roll changing means is provided for pulling the separated work rolls from an opened mill and for pushing a new set of work rolls back into the mill. Such means is best illustrated in FIG. 5 to 8 and comprises a long stroke roll changing cylinder means 110 supported on the underside of a movable floor plate structure 112, the floor line of the mill being indicated at

113 in FIG. 6. Connected to the extended end of the actuator rod 114 of cylinder means 110 is a hook means 116 provided with a plurality of rollers 118 arranged to ride in horizontally extending channel tracks 120 beneath the floor 112. At the end of the hook means 116 there is provided a hook 117 adapted to engage a cooperating hook portion 122 formed in the lower work roll chock 16. The rollers 118 closest to the mill are adapted to ride in a downwardly extending pair of channel tracks 124 so as to guide the hook means 116 as it moves between the raised solid line position and the dashed lower position shown at the left end in FIG. 6. In its upper position, the hook means 116 is engagable with the work roll chocks so as to cause the movement thereof into or out of the mill. In its lower position, hook means are located below the floor line 113. The floor 112 is provided with a slot 115 adapted to permit the hook means 116 to move therethrough as it is moved between the upper and lower positions thereof.

Located between the floor 112 and the mill is roll transfer bed 130 adapted to support a side shift car 132. Bed 130 is constructed of a plurality of beam members connected together and supported below the floor line 114 on the foundation. The side shift car 132 is movable back and forth in the direction of strip movement through the mill on a plurality of rails 134 on the bed 130, the shift car 132 having wheels 136 arranged to ride on rails 134 as best shown in FIG. 6. The back and forth shifting movement of the car 132 is caused by a hydraulic cylinder means 138 which has its actuator arm connected to the side shift car 132 at the connection 139.

The side shift car 132 also comprises means for providing the floor area in the region adjacent the mill, such means comprising five floor plates 140, 142, 144, 146 and 148. As shown in FIG. 8, floor plates 140, 142, 146 and 148 are pivotally mounted for movement on pivot bars 150, 152, 156 and 158, respectively, for movement between an upright solid line position and a horizontally extending dashed line position. In the solid line position, the floor plates 140, 142, 146 and 148 are adapted to serve as rails for supporting the movement of the work rolls into and cout of the mill, wherefore the upper ends thereof are adapted to be aligned with the rails 140 inside the mill. The rail portions of floor plates 140, 142, 146 and 148 are provided with wheel stops 240, 242, 246 and 248, respectively, best shown in FIG. 5. In the horizontal position, the floor plates 140, 142, 146 and 148 serve to provide the floor portion in the region adjacent the mill as is best illustrated in FIG. 5. Since the floor area is now clear of any roll changing car the operators of the mill can move around in this area during the rolling operation and at other times.

The pivotal mounting for each of the floor plates 140, 142, 146 and 148 is similar. Floor plate 140 is mounted at its underside on a plurality of vertically extending plates secured to and spaced along horizontally extending pivot bar 150. Floor plate 142 is mounted at its underside on a plurality of vertical plates 162 secured to and spaced along pivot bar 152. Floor plate 146 is mounted at its underside on a plurality of vertical plates 166 secured to and spaced along pivot bar 156. Floor plate 148 is mounted at its underside on a plurality of vertical plates 168 secured to and spaced along pivot bar 158. One of the plates 160 is interconnected with an associated plate 162 by a link 161. Also one of the plates 166 is innerconnected with a generally aligned plate 168 by a link 167.

Means are provided for actuating the pivoted floor plates between the upright and horizontal positions thereof. Such means comprises a hydraulic cylinder means 170 pivoted on the side care at pivot 172 at one end and having its actuator rod 174 pivotally connected to one of the plates 160. By this arrangement, cylinder means 170 is operable to actuate the floor plates 140 and 142 between the upright and horizontal position thereof shown in FIG. 8. Thus, when the actuator rod 174 is extended as is shown in solid lines in FIG. 8, the floor plates 140 and 142 will be in the upright position thereof. When cylinder means 170 is actuated to retract the actuator rod 174, the floor plates 140 and 142 will be moved to the dashed line horizontal position thereof defining the floor. It will be apparent that the link 161 maintains a conjoint movement of the floor plates 140 and 142. Floor plates 146 and 148 are similarly aactuated between their upright and horizontal positions by means of a hydraulic cylinder means 176 pivoted at one end on the shift car 132 at pivot 172 and having its actuator rod 178 connected to one of the plates 168. The conjoint movement between the floor plates 146 and 148 is achieved by means of the link 167.

Side car 132 comprises two pairs of spaced apart track channels 180 and 181 which are adapted to be aligned with the track channels 120 by the side shifting movement of the car. The track channels 180 and 181 also conform to track channels 120 and thus provide a track guide means for the rollers 118 of the hook means 116 as it moves toward or away from the mill. As is shown in FIG. 8, the trace channels 180 are centered with respect to the upper rail forming ends of the floor plates 140 and 142 in their upright position while the track channels 181 are centered with respect to the upper rail forming ends of the floor plates 146 and 148.

The track channels 180 are supported on a plurality of vertically extending supports 182, 184 and 186 spaced along the tracks. Supports 184 also serve to support the non-pivoting floor plate 144. The floor plate 144 is provided with a plurality of slots 143 adapted to permit the movement therethrough of the vertical plates 162 and slots 145 to permit the movement therethrough of vertical plates 166 as the floor plates move between the upright and horizontal positions thereof.

Located adjacent the side of floor plate 140 is a pivotally supported floor plate 190 which has located adjacent thereto a fixed floor plate 192. Located adjacent the side of floor plate 148 is a fixed floor plate 194.

Located between the floor plates 140 and 142 and the mill are a pair of walkway doors 140' and 142'. The walkway doors 140' and 142' are constructed and arranged in essentially the same manner as the floor plates 140 and 142 wherefore corresponding parts have been given like reference numerals with primes added. Thus, the walkway doors 140' and 142' are actuated between a horizontal position providing a floor area as shown in FIG. 5 and an upright position providing vertically extending rails in continuation of the rails defined by plates 140 and 142 as shown in FIG. 6. This movement is achieved by a hydraulic cylinder means 170' which is connected to vertical plates mounted on a pivot means and secured to the underside of the plates 140' and 142'. The cylinder means 170' is supported

on a stationary framework 132'. There are provided interconnecting links 161' and track channels 180' which are aligned with the channels 180 as is best shown in FIG. 6. The channels 180' provide a guide means for the rollers 118 of the hook means 116. Since the walkway doors 140' and 142' are supported on a framework 132' which is fixedly supported on the bed 130, these doors are not actuated through a side shifting movement along with the doors 140 and 142 mounted on the side shift car 132.

The operation of the roll changer in accordance with the invention in automatically changing a worn set of work rolls and replacing them with a new set of work rolls will now be described. In describing this procedure let it be assumed that the roll changing apparatus is in the position illustrated in FIG. 5 with the floor plates 140, 142, 146 and 148 in their horizontal position and the hook means 116 is positioned below the floor line as is indicated by the dashed line showing of FIG. 6. The first step is to actuate the cylinder means 176 to extend its actuator rod 178 to move the floor plates 146 and 148 from the horizontal position to the upright position as is illustrated in FIG. 8. The new rolls are then placed on the rails 146 and 148 as shown in dashed lines in FIG. 8 by suitable means known in the art. The work rolls will be positioned one above the other in a separated condition which is maintained by a set of stool means 50 and 60. Thus, the stool means 50 are positioned between the work roll chocks 14 and 16 and the stool means 60 are positioned between the work roll chocks 14' and 16'. The general location of the stool means 50 and 60 is illustrated by the dashed line showings of the stool members 52 and 62 in FIG. 4 which are located respectively in the cavities 80 and 82 of chocks 14 and 16 and in the cavities 100 and 102 in the drive side work roll chocks 14' and 16'.

The next few steps involve getting as many parts as possible prepared before the mill is stopped. This involves opening the other set of rails provided by the floor plates 140 and 142 by actuating hydraulic cylinder means 170 to extend its actuator rod 174 to place plates 140 and 142 in the position shown in FIG. 8. Also, the cylinder means 170' is actuated to place the floor plates 140' and 142' in the upright position aligned with the floor plates 140 and 142. Also, long stroke cylinder means 110 is actuated to extend its actuator rod 114 toward the mill to position the hook means 116 immediately adjacent the mill. During this movement the hook means 116 is first moved from the dotted line position to the solid line position shown at the left end in FIG. 6 and then is further advanced to the dashed line position shown adjacent the mill. During this movement the rollers 118 move through channel portions 120, 180 and 180' in that order.

The next step is to stop the rolling operation of the mill and to then open the mill, i.e., move the backup rolls and the work roll chocks from the rolling position to the separated position shown in the left side of FIG. 2. This is achieved by the actuation of the hydraulic cylinder means shown in FIGS. 1 and 2 and is conventional. FIG. 4 also illustrates the condition of the work rolls and work roll chocks and other parts at this stage in the work roll changing operation. The step involves raising the upper backup roll chocks 22 by hydraulic cylinder means 23, raising the upper work roll chocks by hydraulic cylinder means 32 acting through upper rails 30, and lowering the lower work roll chocks onto rails 40 by retracting hydraulic cylinder means 44.

It will be noted that the work rolls 18 and 20 and the work roll chocks supporting the same are spaced above and below the pass line 21 of the mill whereat the strip is located in the case of a continuous rolling mill. Also the wheels 42 on the lower work roll chocks are supported on the lower rails 40 and the wheels 34 on the upper work roll chocks are supported on the upper rails 30.

The chock clamps on the side are now opened as is conventional in the art.

The hook means 116 is then engaged in the hook member 122 on the lower work roll chock 16 and the long stroke cylinder 110 is actuated to retract the rolls to the position shown in FIG. 6. At this point the wheels 42 on the lower work roll chock 16 come into contact with stops 240 and 242 on the rails 140 and 142. The movement of the rolls is arrested when the wheels 42 come into contact with the stops. About two inches prior to this position, the track supporting rollers 118 drop downwardly into the inclined tracks 124 to release their engagement with the hook member 122. The hook means 116 then returns to the lower position shown in dashed lines in FIG. 6. During this retracting movement the rollers 118 move in order through track channels 180' and 180 and 120. The worn work rolls which have been pulled from the mill now rest on the upper rail portion of plates 140 and 142 with the wheels 42 of the lower work roll chocks being supported at the upper ends of these floor plates 140 and 142 and against stops 240 and 242.

Cylinder means 138 is then actuated to extend its actuator rod and cause a side shifting movement of the side shift car 132. This places the floor plates 146 and 148 at the position where the floor plates 140 and 142 were and places the new work rolls in line with the mill. This also places the hook means 116 in engagement with the hook portion 122 of the work roll chocks for the new work rolls.

It is noted that the floor plate 140 is provided with two curved ribs 340 which are arranged to come in contact with the edge of the floor plate 190 during the last portion of the side shifting movement of the side shift car 132 to cause the floor plate 190 to pivot upwardly. This movement serves to lift the floor plate 190 out of the way to avoid obstruction with the side shifting car 132 during the side shift movement.

The long stroke cylinder 110 is then actuated to extend its actuator rod 114 to thereby push the new work rolls into the open mill. During this movement the rollers 118 pass through track channels 120, 181 (which have now been moved to the position formally occupied by track channels 180) and track channels 180'.

The mill is now closed in accordance with conventional procedures by the actuation of the cylinder means in the mill and the hook means is withdrawn to the dashed line showing at the left end of FIG. 6. The worn work rolls are then removed for repair, the side shift car 132 is returned to the left position shown in FIG. 8 and the floor plates 140, 142, 146 and 148 are returned to the horizontal position providing a flat floor. Hinged floor portion 190 is then also returned to the horizontal position shown in FIGS. 5 and 8.

It will be evident that in the above description as the work roll chocks are moved out of the mill (to the left as viewed in FIG. 4), the chocks are initially carried by

the rails 30 and 40 in the mill. As the operator side work roll chocks 14 and 16 move to the left from the position shown in FIG. 4 they will initially pick up, in the cavities 80 and 82, the operator side stool members 52 which will be located in essentially the dashed line position shown in this figure. This will occur before the wheels 34 and 42 move off the rail means 30 and 40 so that when this move off occurs the stools 52 will serve to keep the rolls in the separated condition. It will be noted that the outside end of each rail 30 has a slight inclination which allows the upper chock 14 to be set easily onto the top of stools 52. The lower wheels 42 will move onto the upper ends of the plates 140' and 142' as they pass from rails 40.

Continued movement of the work rolls out of the mill will bring the drive side chocks 14' and 16' into engagement with the drive side stools 62. The stools 62 thus move into the cavities 100 and 102 to the position illustrated by the dashed line showing of stools 62 in FIG. 4. Thus, when the drive side chocks 14' and 16' move off the rails 30 and 40 within the mill, the stools 62 serve to maintain them in the separated condition.

When the new set of rolls is inserted into the mill an action occurs which is essentially the reverse of that described above during the removal of the work roll chocks. In other words, the drive side stools 62 will be picked up by the stool supporting rails 58 at the solid line position shown in FIG. 4. Thus, the stools 62 are held in this position by reason of the latch means 59 and the limiting action of the inclined portion 63. Continued movement of the work roll chocks into the mill will subsequently cause the operator side stools 52 to be picked up by the stool support rails 58 at the solid line position shown in FIG. 4. Again this occurs by reason of the latch means 59 and the limitng action of the inclined portion 61.

By reason of the above described arrangement it will only be necessary to have two sets of stool means 50 and 60 for each mill. One set of stool means is to be retained in the mill during rolling while the other set of stool means will be used in the preparation of the new work rolls which are to be inserted into the mill to replace the worn work rolls.

It will be apparent that various changes may be made in the construction and arrangement of parts without departing from the scope of the invention.

We claim:

1. In a rolling mill having upper and lower work rolls defining a pass line for the strip to be rolled therebetween, an operator side mill housing defining a window, upper and lower work roll chocks for rotatably supporting the upper and lower work rolls and adapted to be removably mounted in said operator side housing, a mill housing on the drive side of the mill defining a window, an upper and lower work roll chock for rotatably supporting the upper and lower work rolls on the drive side of the mill and adapted to be removably mounted in said drive side housing window, means for supporting said work roll chocks and said work rolls supported thereby in a separated condition during movement thereof inside of the mill housing, means for supporting said work roll chocks and the work roll supported thereby in separated condition during movement outside of the mill housing, said last-named means comprising first stool means positioned within said operator side housing and adapted to be positiond between said operator side work roll chocks and second stool means positioned within said operator side housing and adapted to be positioned between said drive side work roll chocks, and means for supporting said first and second stool means in said operator side housing window at a location between said upper and lower work roll chocks.

2. In a rolling mill according to claim 1 wherein said operator side work roll chocks have opposed cavities adapted to contain said first and second stool means during a rolling operation.

3. A rolling mill according to claim 2 wherein said operator side work roll chocks contain cavities adapted to receive and pick up said first stool means as the work rolls are moved toward the outside of the mill during a work roll changing operation.

4. A rolling mill according to claim 3 wherein said drive side work roll chocks comprise opposed cavity portions adapted to receive and pick up said second stool means as the work rolls are moved toward the outside of the mill during a work roll changing operation.

5. A rolling mill according to claim 1 wherein said supporting means for said first and second stool means comprises horizontally extending rail means.

6. A rolling mill according to claim 5 including a pair of latch means holding said first and second stool means at a desired position on said rail means and limiting movement thereof in the direction toward the inside of the mill whereby as work rolls are moved into the mill during a work roll changing operation said first and second stool means will be deposited onto said rail means at said limiting positions.

7. A rolling mill according to claim 1 including a side shift car adjacent said operator side housing and having means providing two pairs of rails adapted to receive and support said work roll chocks outside of the mill.

8. A rolling mill according to claim 7 wherein said means for providing said rails on said side shift car comprises floor plates adapted to be moved from a horizontal position providing a floor area and an upright position whereat the upper ends thereof provide said rails for supporting said work roll chocks.

9. A rolling mill according to claim 1 wherein said means for supporting said work roll chocks during movement inside the mill includes rails extending between said drive side mill housing and said operator side mill housing.

10. A rolling mill according to claim 9 wherein said supporting means for said first and second stool means comprises horizontally extending rail means.

11. A rolling mill according to claim 10 including a pair of latch means holding said first and second stool means at a desired position on said rail means and limiting movement thereof in the direction toward the inside of the mill whereby as work rolls are moved into the mill during a work roll changing operation said first and second stool means will be deposited onto said rail means at said limiting positions.

12. A side shift car for use in automatic changing of the work rolls of a mill stand of a rolling mill comprising a frame located adjacent the mill stand below the floor line of the mill and adapted to be shifted between a pair of roll changing positions, power operated means for actuating said frame between said pair of roll changing positions, and means mounted on said frame providing two pair of rails adapted to support two sets

of work rolls at a location adjacent the rolling mill stand, said rail providing means comprising a plurality of floor plates mounted for movement between a horizontal position in which said floor plates provide a floor area adjacent the rolling mill and an upright position in which the upper ends of said floor plates provide horizontally extending rails adapted to support said work roll, the floor plates providing each pair of rails being positioned in edge-to-edge relationship in said horizontal position thereof to provide a closed floor area, one of said pair of rails in said upright position thereof being aligned with said mill stand when said frame is in one of said pair of roll changing positions, the other of said pair of rails in said upright position thereof being aligned with said mill stand when said frame is in the other of said pair of roll changing positions.

13. A side shift car according to claim **12** in which said floor plates are pivotally mounted on horizontally extending pivots and including link means associated with each pair of rail forming floor plates for interconnecting the same for conjoint movement.

14. A side shift car according to claim **13** including power operated means associated with each pair of linked floor plates for actuating the same between said horizontal and upright positions thereof.

15. In a rolling mill having upper and lower work rolls defining a pass line for the strip to be rolled therebetween, an operator side mill housing defining a window, upper and lower work roll chocks for rotatably supporting the upper and lower work rolls and adapted to be removably mounted in said operator side housing, a mill housing on the drive side of the mill defining a window, and upper and lower work roll chock for rotatably supporting the upper and lower work rolls on the drive side of the mill and adapted to be removably mounted in said drive side housing window, means for supporting said work roll chocks and said work rolls supported thereby in a separated condition during movement thereof inside of the mill housing, and means for supporting said work roll chocks and the work roll supported thereby in separated condition during movement outside of the mill housing, said last-named means comprising first stool means positioned within said operator side housing and second stool means positioned within said operator side housing, said operator side work roll chocks having opposed recessed cavities adapted to receive and contain said first and second stool means during a rolling operation with said work rolls in a closed condition.

16. A rolling mill according to claim **15** wherein said operator side work roll chocks contain cavities adapted to receive and pick up said first stool means as the work rolls are moved toward the outside of the mill during a work roll changing operation.

17. A rolling mill according to claim **16** wherein said drive side work roll chocks comprise opposed cavity portions adapted to receive and pick up said second stool means as the work rolls are moved toward the outside of the mill during a work roll changing operation.

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